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May 1980 75p

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Many months ago mention was made on this page of the impact of music recording techniques and video into the world of film sound track recording and dubbing. Even today, most of the music and almost all the tracks required for film dubbing are recorded on perforated magnetic film which is similar to normal light sensitive film stock, but with a magnetic coating. Since each frame of the film is identified by a perforation, maintaining synchronism between the many sources of sound and pictures that comprise a finished production is simply a case of counting sprocket holes (well more or less). Even in the area of sprocketed film transports, there are several recent developments (most principally for television film, rather than features) including the removal of the sprockets themselves from drives that use sprocketed film, and high speed transports (up to 30x normal speed) which, in addition to shortening the time taken while spooling in dubbing, are able to operate with telecines (the machines that allow film to be shown on television) and video tape recorders (dubbing has always been a problem), both of which have high spooling speeds. Tim Amyes' article 'Current trends in film dubbing' on page 40 takes a look at these developments in conventional film dubbing and the latest hardware available. But the recent availability of synchronisers using timecode has allowed film to be transferred on to video cassette, and taken away from the dubbing theatre into a conventional recording studio where a multitrack can be locked to the pictures and sound recording and dubbing achieved in this manner, without the necessity for the work to be carried out in a conventional perforated film dubbing theatre, and this area will see many developments in the coming year.

Having had a peaceful few months without any major exhibitions, the season has now started again with the London AES Convention held in late February. This was also the first of three pro-audio shows in London within six months and a great deal of effort was put in by the British AES Committee into organising a successful convention that attracted 2,780 visitors (50% up on last year in Brussels). I have never understood why the AES does not move its Conventions into proper convention centres (of which there are dozens around although one often has to leave major cities to find them), rather than holding them in dozens of separate rooms and floors in hotels which were not designed to accommodate such exhibitions. The Park Lane hotel used at the London AES (together with the London Hilton, several streets away) was possibly the worst hotel the organisers could have selected in Mayfair, and many exhibitors were unhappy that visitors simply couldn't find their stands which were often situated in dead ends or floors away from the main exhibition. Even the organisers had to use transeivers to communicate between the various sites, since no telephones were allowed in the exhibition (with resulting queues for the few payphones). Visitors found themselves walking through restaurants to find some exhibition stands (although many simply didn't find them). And then on the final day when the show closed at 1pm, exhibitors at Park Lane discovered that they weren't allowed to park trucks outside the hotel until evening, rather making a mockery of closing early. But then it was a successful show . . . Next London show is the APRS, whose regular venue needs no further discussion.

Cover of UREI Model 200 plotter by Adrian Mott and Ray Hyden

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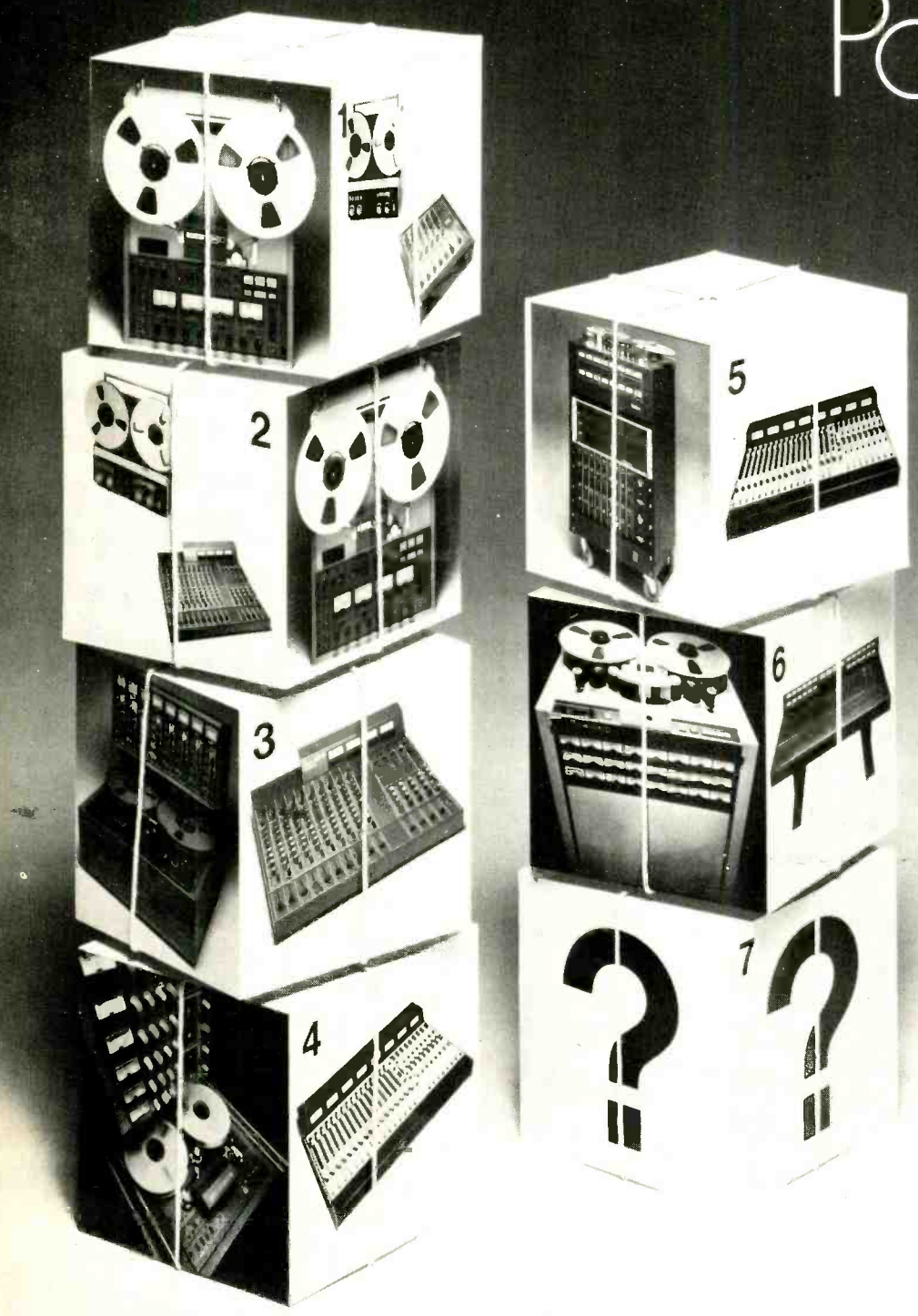

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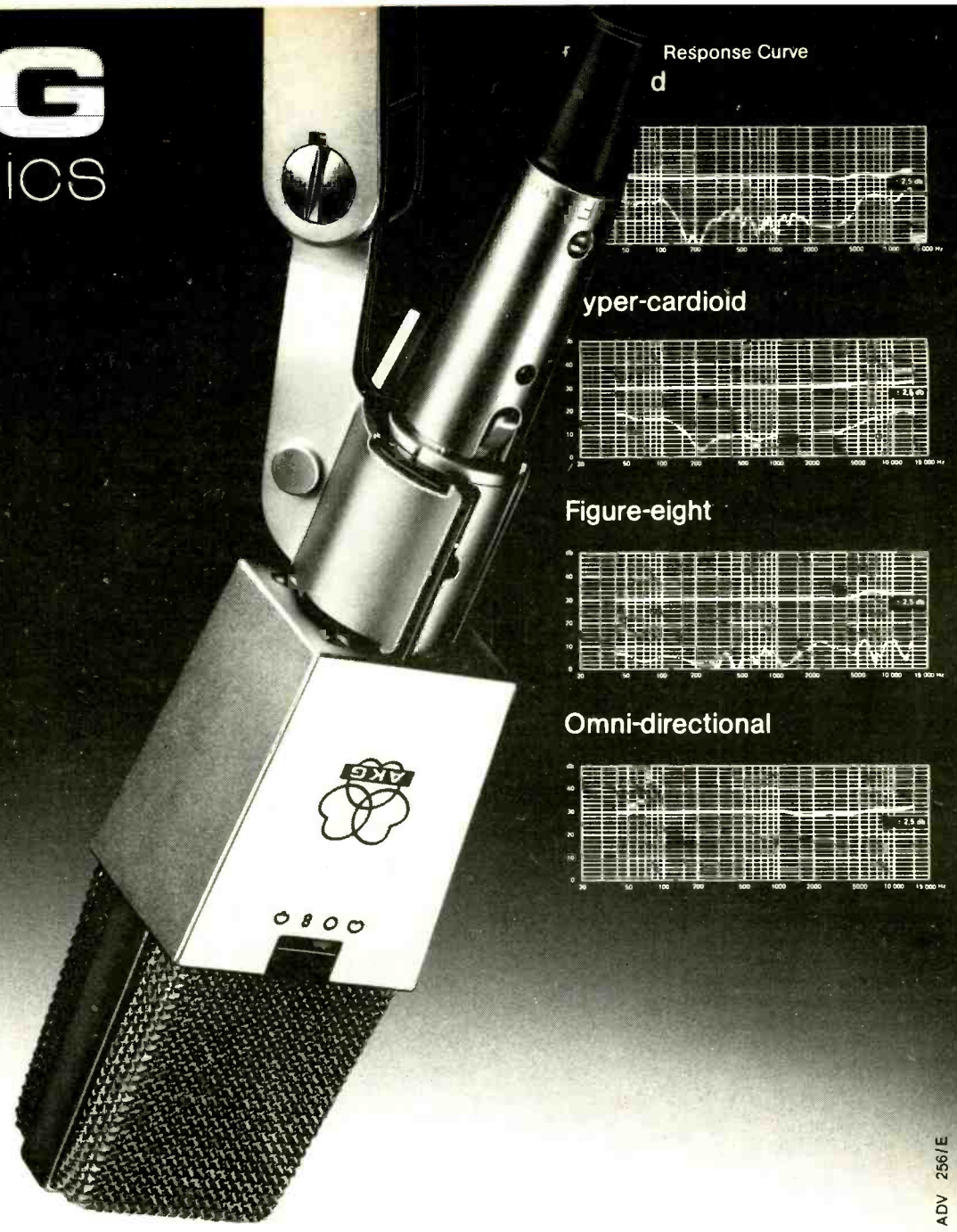

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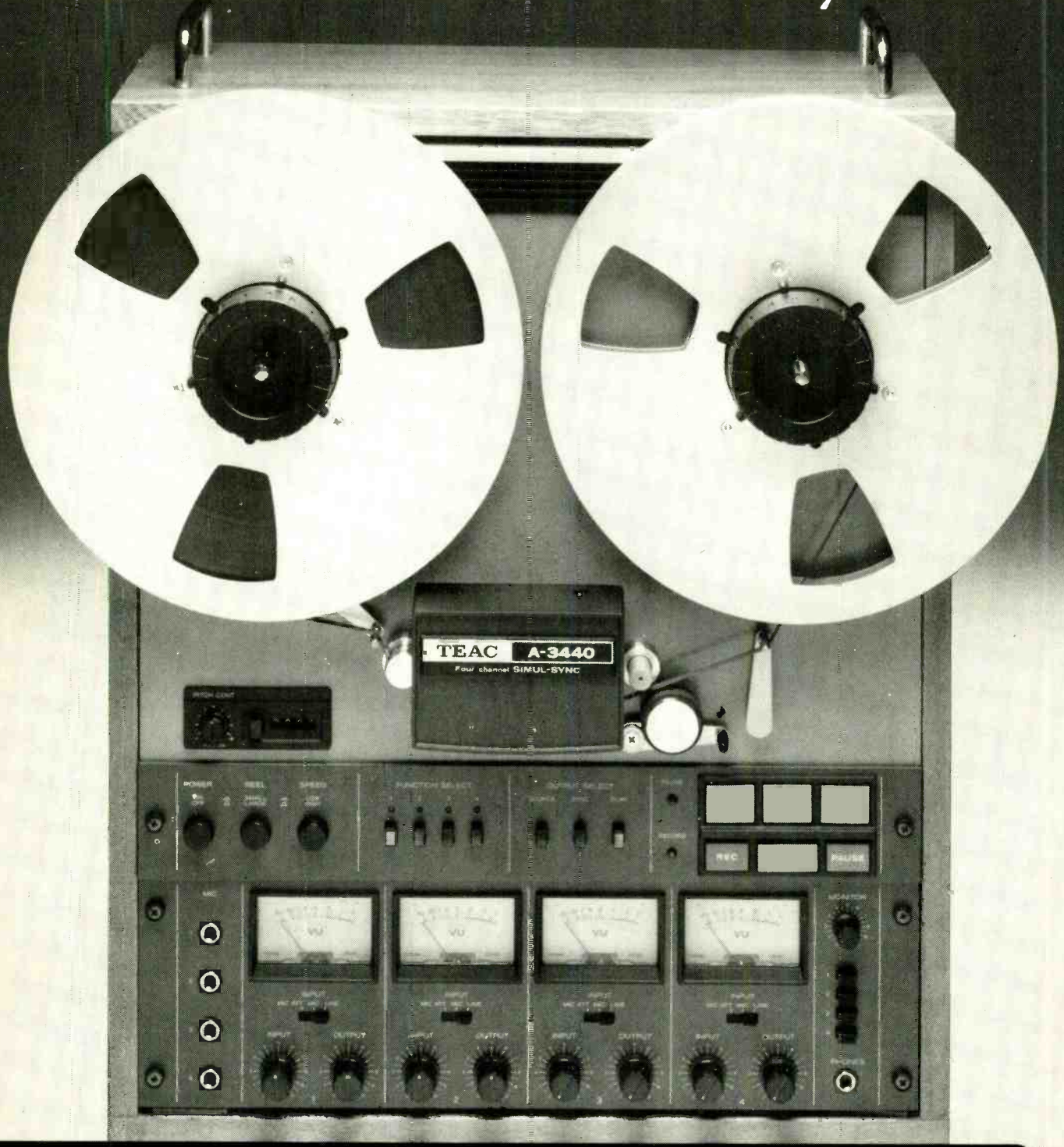

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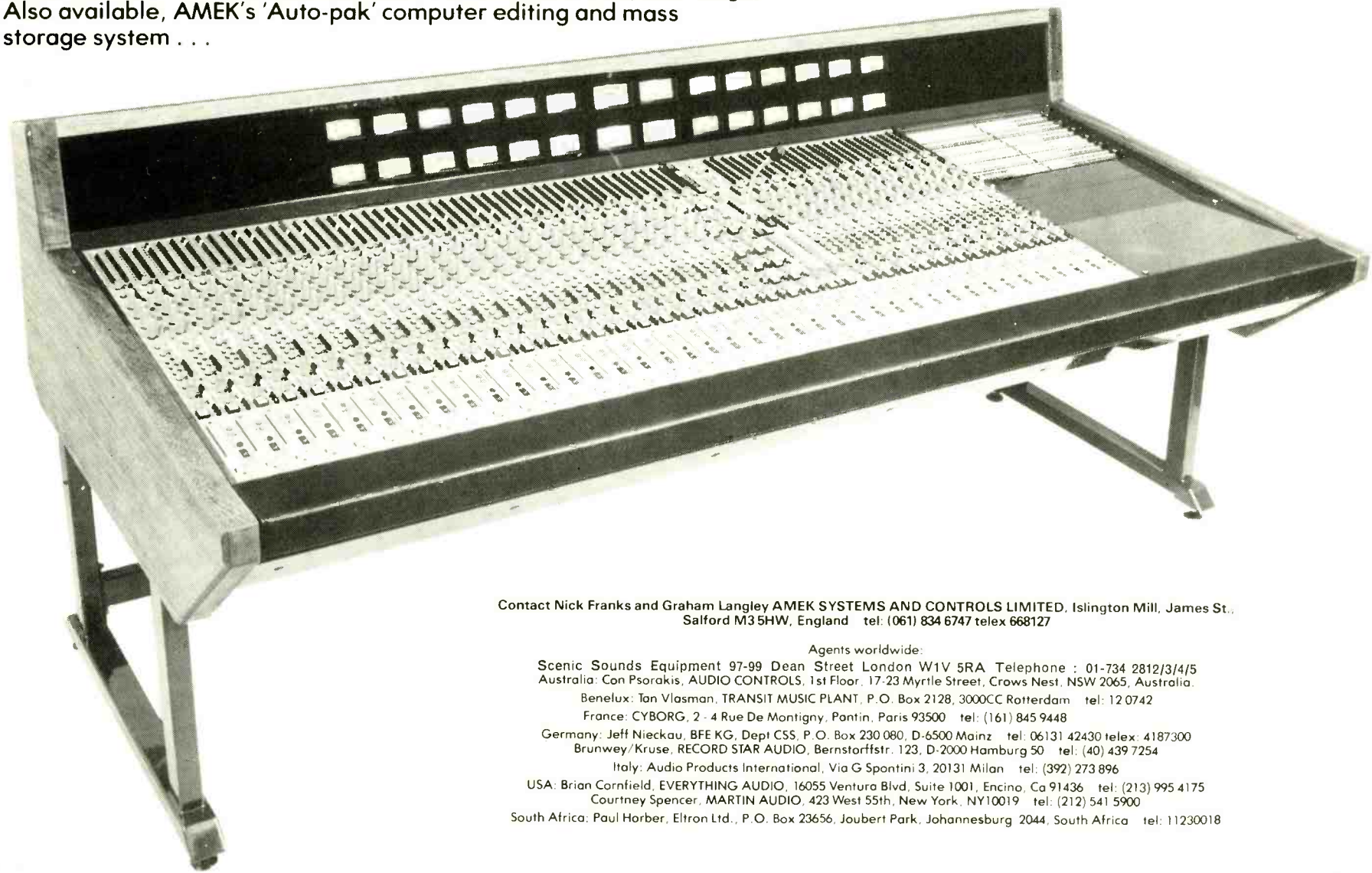

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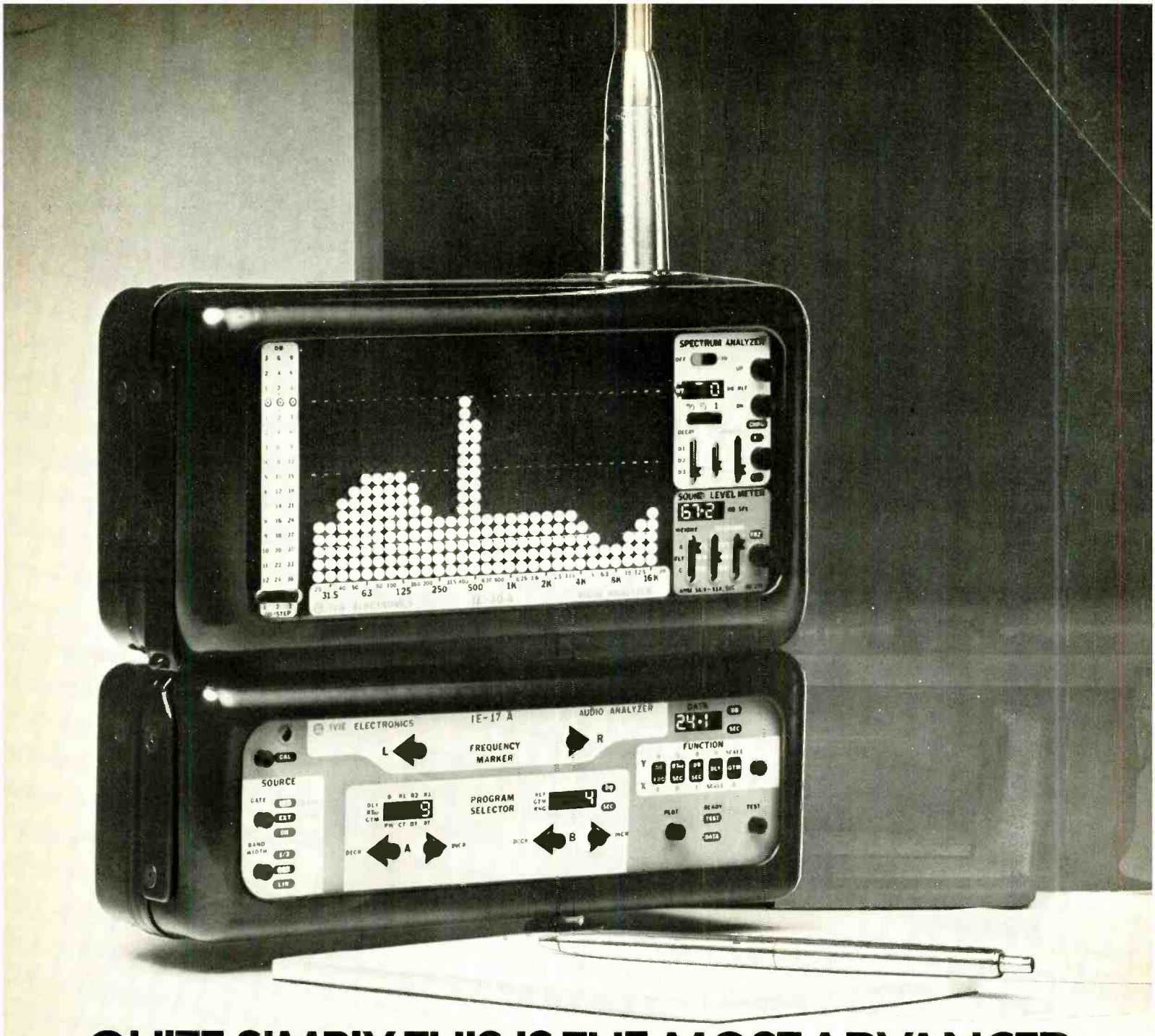

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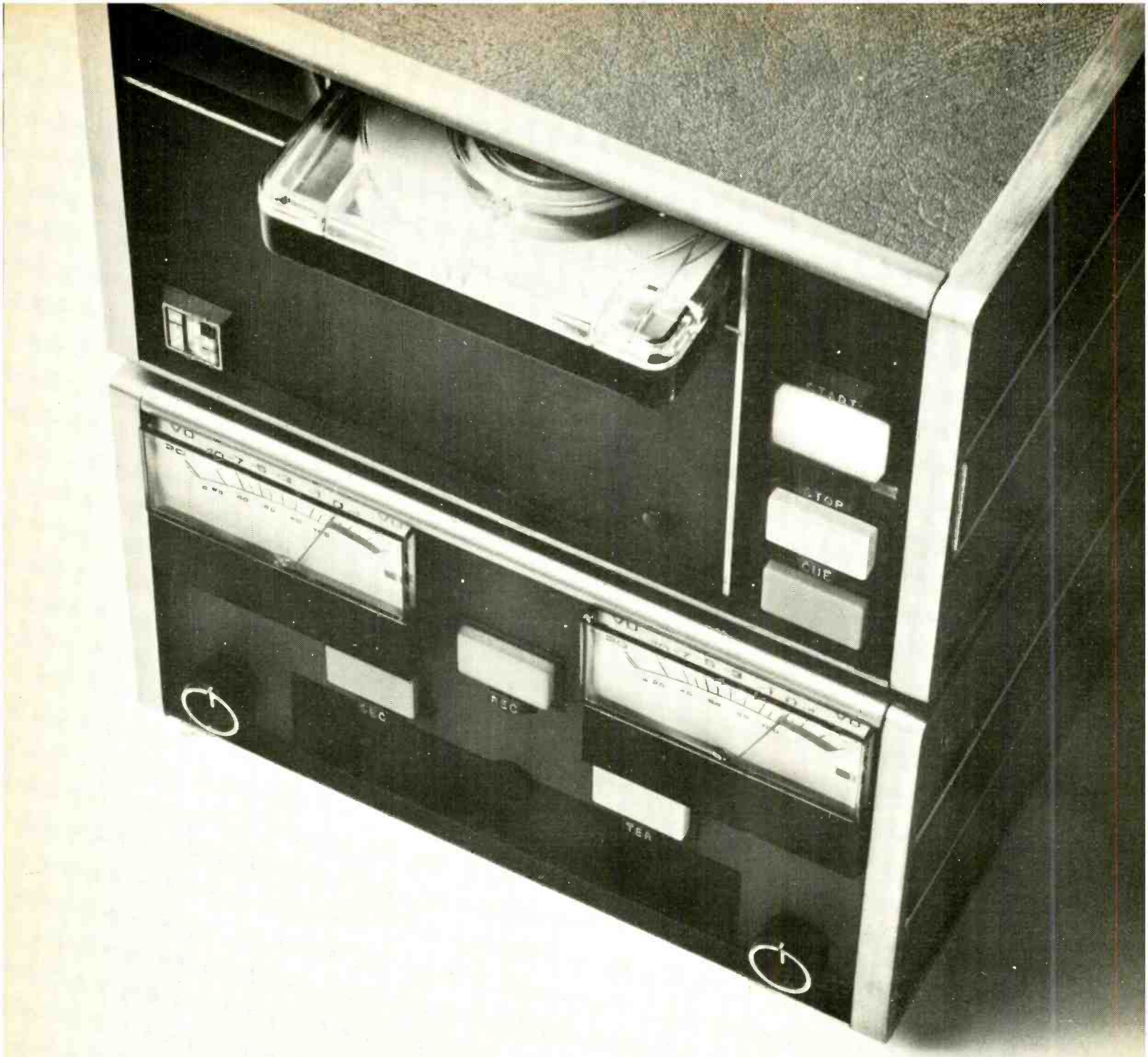

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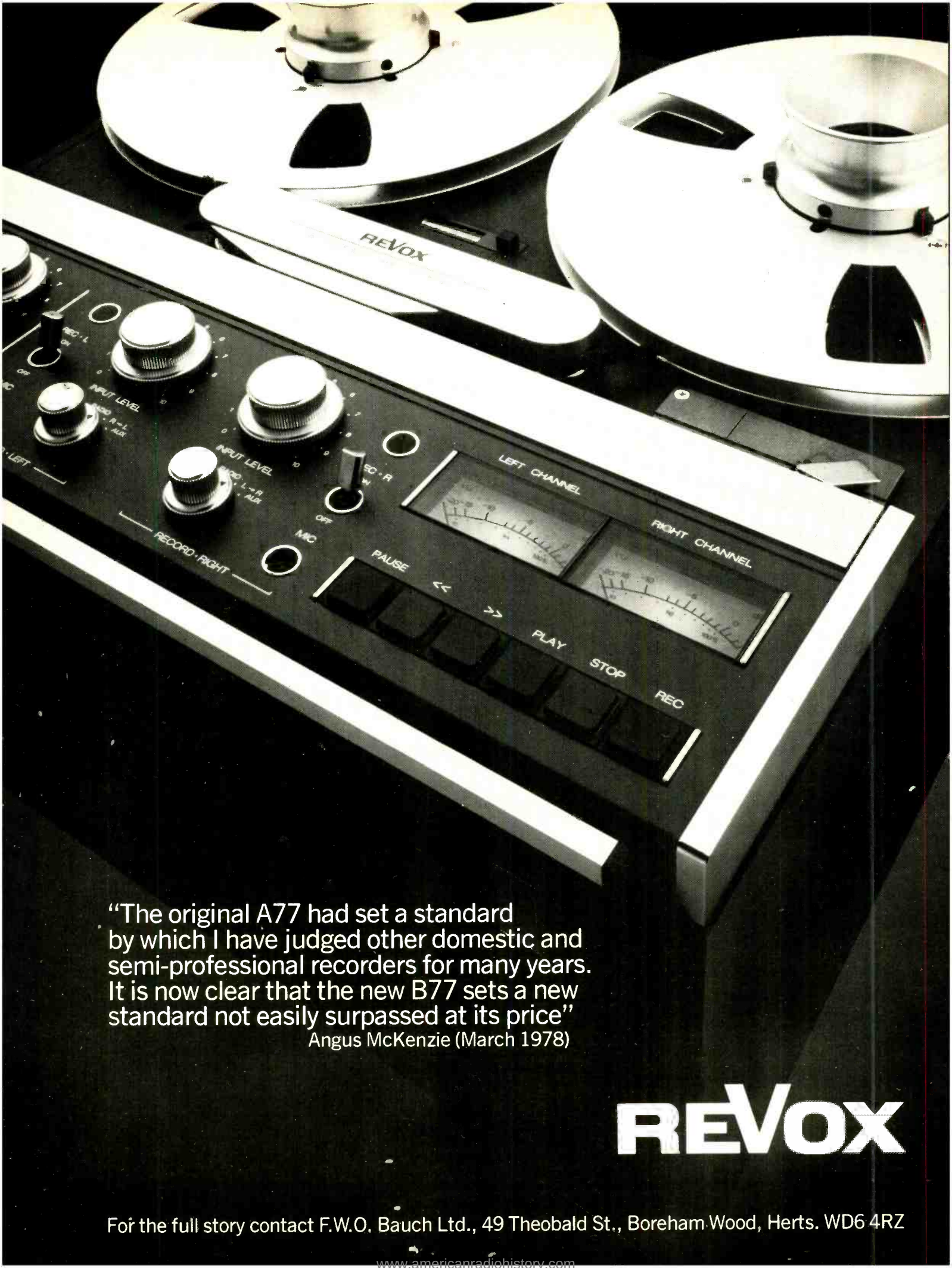

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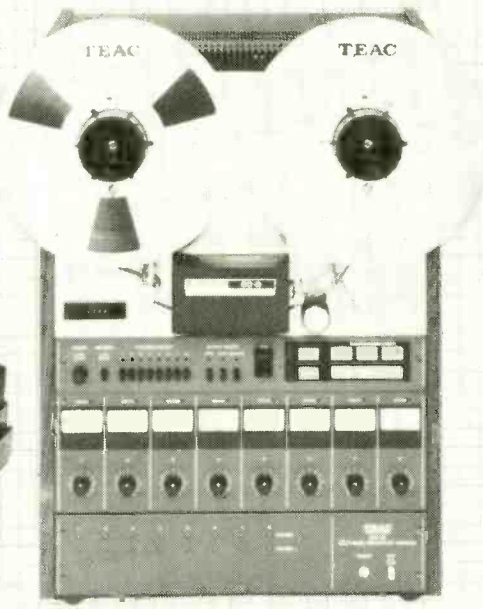

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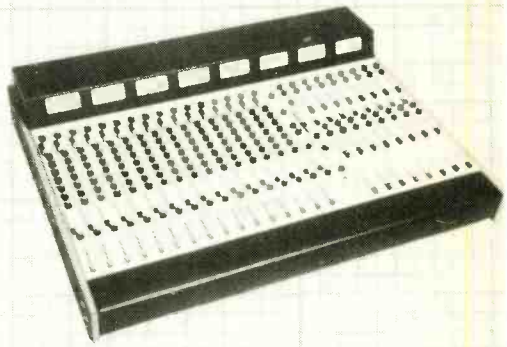

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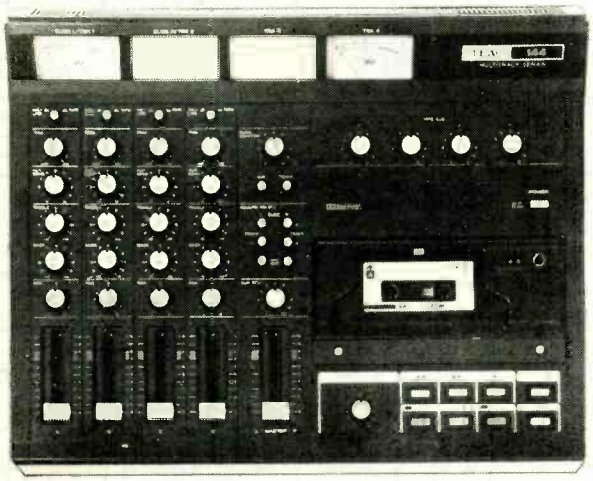


Now you can have the essential functions and flexibility of multitrack recording in one compact, self contained unit. It's called the Model 144 Porta-Studio and it lets you record basic tracks, overdub in sync and remix to stereo. On standard cassette tape.

TEAC engineers created a totally unique format for Porta-Studio. Four tracks in sync on cassette tape at 3¾ ips. It's fast, simple, reliable and economical. Rehearse on it. Learn on it. Create on it. Just plug in a microphone or instrument and go to work on it.

Porta-Studio's versatile 4X2 mixer section gives you mic/line/tape switching, trim control, high and low EQ, fader, pan and Aux Send for each input. The failsafe group switching matrix lets you record on up to two tracks at the same time. And there's a master fader that gives you overall level control during recording and mixdown.

The full-logic cue system in Porta-Studio lets you hear everything you're doing all the time. Input and tape cueing, monitoring for recording or mixdown are all available. And every signal can be metered. Coming or going.

Porta-Studio's drive system is built specifically for the rugged needs of multitrack recording. Transport controls are all soleniod-operated for faster, easier switching. And you get a built-in variable speed control that lets you add special effects, fix a flat note or solve timing and cueing problems.

You can work with Porta-Studio using nothing more than headphones. Or send the output through your home audio system. You'll also find the patch points and controls that let you use Porta-Studio with equipment like echo or delay units, equalizers and additional mixers.

Come in to REW for a demonstration of the very affordable Porta-Studio. Nothing else in the world puts so much multitrack function into a small package.

REW Professional Audio 114/116 Charing Cross Road, London WC2. Tel: 01-836 2372/7851

CANFORD AUDIO

STARGATE WORKS, RYTON, TYNE and WEAR. NE40 3EX
Tel: RYTON (089422) 4515

★ **AUTOMATIC CABLE TESTER Mk. 2**
— tests for all possible faults, if none present gives OK indication, otherwise indicates exact nature of fault
— accepts XLR, PO or Bantam jack
— Mk. 2 version enables detection of intermittent faults

★ **STUDIO ACOUSTIC TABLES**
— purpose-built for radio, production or TV
— hexagonal or rectangular

★ **ACOUSTIC SCRIPT LECTERNS**

★ **OTHER SPECIALIST JOINERY**
— consoles, studio fittings, etc.

★ **BATTERY MICROPHONE PREAMPLIFIER**
— XLR connectors
— balanced input
— variable gain, low noise

★ **EMO DIRECT INJECTION BOXES**
— 10% off list price

POWER AMPLIFICATION BY MUSTANG

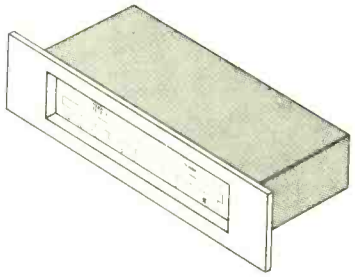
Our SS.100 and SS.50 are economical amplifiers with outputs of up to 175 and 100 Watts RMS into 4-16 ohms, typical THD figures being 0.1%, slewing rate > 10v/μs, noise > 90dB down, zero level input, and full electronic protection. Considering these points with their proven reliability and robust construction, plug in output transistors and driver board, optional balanced input and 100V line output, and virtually ex stock despatches we reckon we take some beating! Contact us now for the full technical specifications.

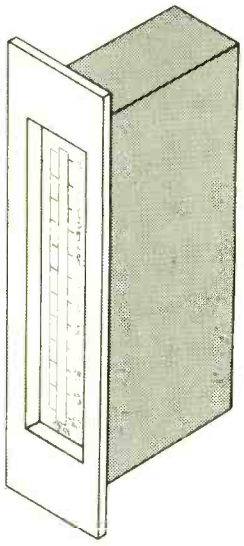
Manufacturers of mixers, integrated mixer amplifiers and slave amplifiers, studio power amplifiers, transformers, lighting control equipment and cabinets for the home and export markets.
Contact us for full illustrated technical brochures.

MUSTANG COMMUNICATIONS

Nelson Street, Scarborough, North Yorkshire YO12 7SZ England
Telephone 0723-63298

ONIK d.B.m. VISUAL DISPLAY





of Bargraph visual displays which
's and the most up to date logic
very accurate and versatile with a
namic range. Available with vertical or horizontal scales which can be illuminated and comes in an attractive moulded case with an elegant matt black finish.

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

Brief Specification

Input sensitivity	770 m.v. (adj.)
Input impedance	10K
Rise Time VU	35 M.S.
Decay Time VU	300 M.S. (adj.)
Rise Time PPM	3 M.S.
Decay Time PPM	3 s. (adj.)

Supply voltage 12 Volts D.C.
Tolerance within one D.B.
Frequency response 10 Hz-100kHz
Connections via a multiwave connector

Also available a range of inexpensive mono and stereo displays in a very attractive case with an acrylic facia. Ideal for level or VU monitoring. Prices on application. For further information please contact U.K. marketing agents.

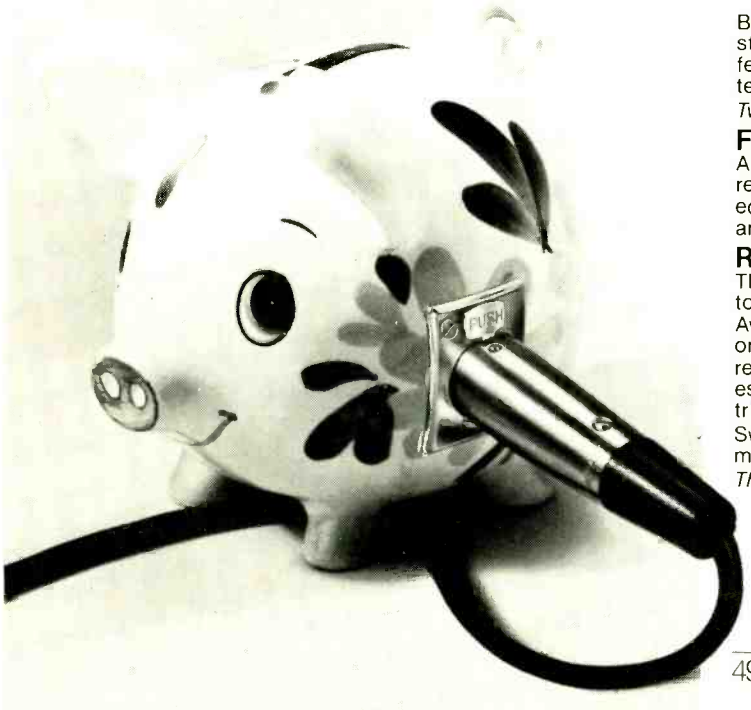
CLIFF ELECTRONICS LTD.

97 COULSDON ROAD, CATERHAM, SURREY

Telephone: Caterham 47713 Telex 8813346

Manufactured in U.K. by CAPITAL COMPONENTS, 28 East Street, Rochford, Essex.
For technical informaton please ring Les Hamilton (0702) 547252

Penny Dropped?



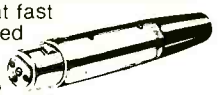
Switchcraft QG Connectors are money savers

Because we have introduced an attractive new quantity discount structure. Switchcraft are still the same high quality, with unique features such as captive design screws and shell ground terminals.

Two new additions to the range are —

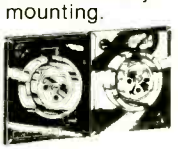
FAS-DISCONNECT

A new non-locking feature allowing immediate disconnection that requires only a 4 lb (1.8 kg) force. Great for that fast equipment take-down in hard to reach, darkened areas. Stage hands never had it so good!



REAR MOUNTED RECEPTACLES

The new Y series QG receptacles permit a complete sub assembly to be soldered, cleaned and tested prior to chassis mounting. Available with PC or solder terminals with lock or Fas-disconnect latching, the Y series offers real savings in production costs. Extra colour trim escutcheons provide functional panel trimming and colour coding.



Switchcraft QG Connectors are just right for audio mixers consoles, PA systems and in computer applications.

The professionals choose Switchcraft QG and save the pennies!

SWITCHCRAFT INC Q·G

F.W.O. Bauch Limited

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

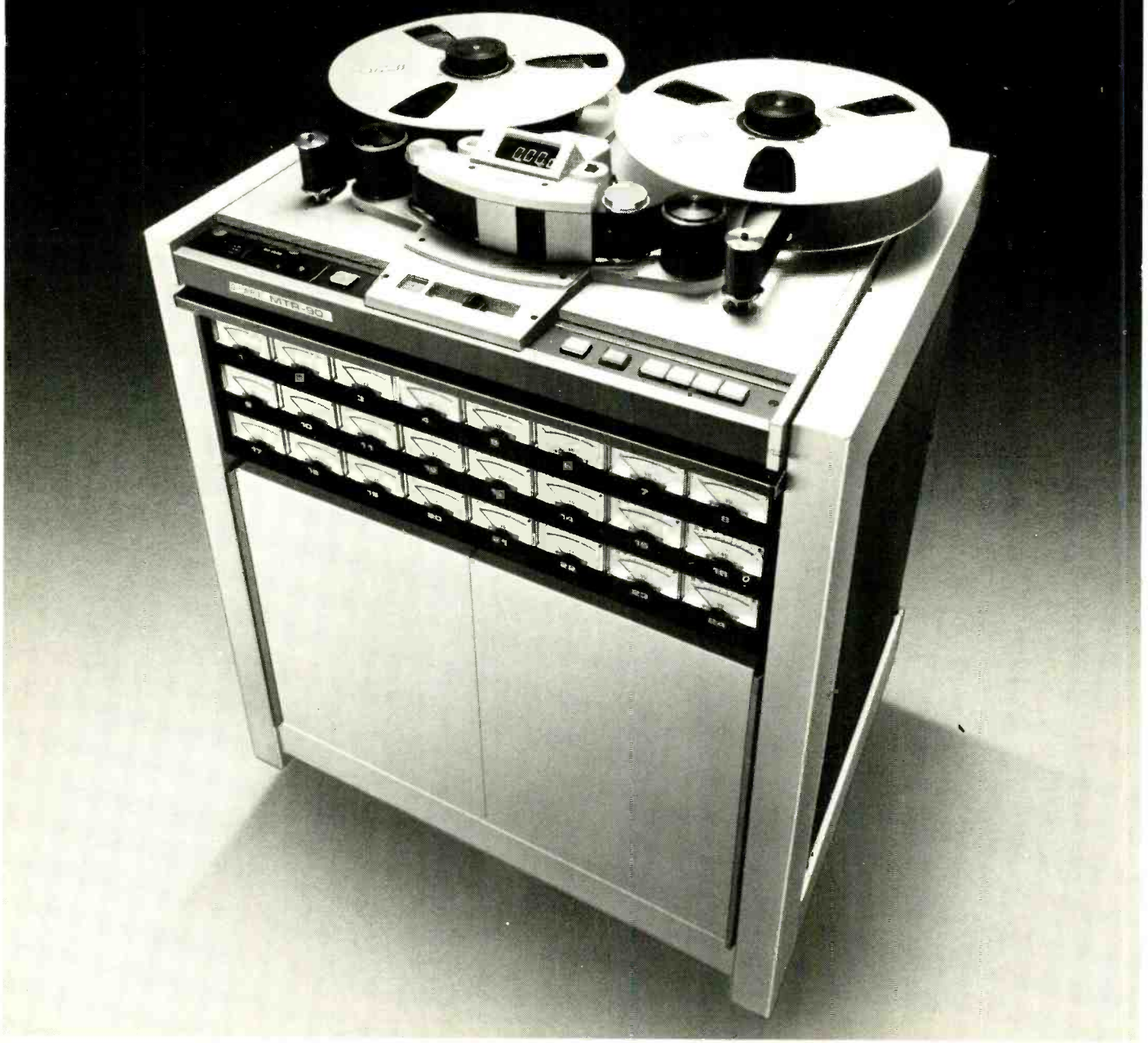
Designed for the 1980's, the MTR-90 is a synthesis of the most up-to-date technology and innovation currently available. The new generation tape transport incorporates a pinch-roller-free direct drive capstan with the PLL DC-servo circuitry. Other features include gapless, noise-free punches, digitally 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.

OTARI

Industrial Tape Applications
1-7 Harewood Avenue, Marylebone Road,
London NW1 Phone: 01-724 2497, Telex: 21879

Otari Electric Co., Ltd.
4-29-18 Minami Ogikubo, Suginami-ku,
Tokyo 167 Phone: (03) 333-9631,
Telex: OTRDENKI J26604

The most advanced 24-track available. OTARI MTR-90.



news

Eventide Instant Phaser ▶

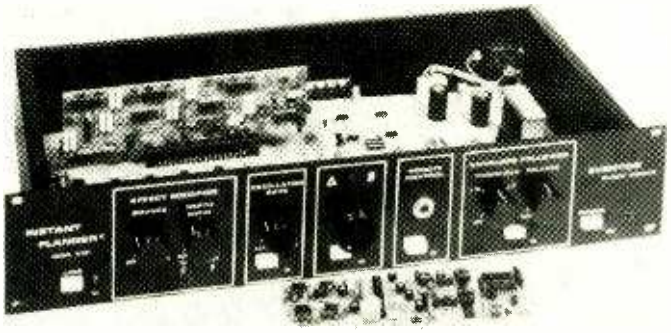
Eventide informs us that it has received numerous requests to bring back its Instant Phaser unit, and in response has introduced a plug-in card for its Instant Flanger which turns the unit into an Instant Phaser. The *BPC101* phaser card is interchangeable with the *SDC-1* flanger card in the *Model FL201* Instant Flanger, and uses electronic phase-shift networks to generate frequency cancellations in the audio signal, rather than the bucket brigade devices used in the Instant Flanger. The phaser card has 12 identical stages with the auxiliary output tapped from the eighth stage. Phase-shift control is by PWM transmission gates acting as variable resistors in low noise all-pass op-amp circuits, while a 100kHz sampling frequency avoids any aliasing. Frequency response of the phaser is limited primarily by the lowpass filter preceding it in the *FL201* main frame (15kHz cutoff) and the card has input and output lowpass filters set at 15kHz. Quoted specifications of the phaser are: distortion typically better than 0.5% at 1kHz; and dynamic range greater than 90dB from clipping to noise floor. The phaser card requires only simple calibration to operate with the individual flanger, and thereafter the phaser and flanger cards may be interchanged with no further adjustments. Cost of the *BPC101* phaser card is $233. The *FL201* Instant Flanger may be purchased with either the *SDC-1* flanger card or the *BPC101* phaser card for $615, or with both for $848. Other options for the Instant Flanger remain the same.

Eventide Clockworks, 265 West 54th Street, New York, NY 10019, USA.
Phone: (212) 581-9290.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1.
Phone: 01-580 4314.

Bandridge FE5 equaliser

Bandridge has introduced a low priced 2-channel graphic equaliser, the model *FE5*, retailing at less than £80. The *FE5* has five centre frequencies at 60Hz, 240Hz, 1kHz, 3.5kHz and 10kHz, with a range of ±12dB. Noise is quoted as −70dB ref 2.45V input, while IM and harmonic distortion is quoted as 0.05% ref 1V output. Controls include a tape monitor switch, a bypass switch and a level meter.

Bandridge Ltd, 1 York Road, London SW19, UK.
Phone: 01-543 3633.



Ruslang tape recorder console ▼

The Ruslang Corporation has developed a table-top transport console, the *RL300*, and a rack base the *RL350* designed to accept various tape transports. The *RL300* will accept any 19in x 15¾in tape transport and its standard instrumentation overbridge which is 19in wide will accept whatever instrumentation height is required. The deck of the *RL300* is canted at a 12° angle for operator convenience and an easy-service, tilt-up feature makes the electronics totally accessible as maintenance can be performed without removing the tape transport or going in through the back of the unit. The *RL350* is mounted on castors for portability and converts the two units into a roll-around console when the units are used in tandem. Although marketed as a package each unit is also available individually. The console is ideally suited to table-top use or with the *RL350* it may house additional electronics. The *RL350* will accept Scully, Ampex, MCI, Otari, and many other units.

Ruslang Corp, 247 Ash Street, Bridgeport, Conn 06605, USA.
Phone: (203) 384-1266.

Canadian training course

We have received details of a new Canadian training course run by the Trebas Institute of Recording Arts, a non-profit making national institution established to provide training for the recording industry. The recording arts and sciences is a 2-year course, which accepts either part-time or full-time students. The course has a common first year which provides a grounding in all aspects of the recording industry, while in the second year students specialise in one of three programme areas: record producing; sound engineering; or management. Further details are available from: The Director, Trebas Institute of Recording Arts, 1 Place Ville Marie, Suite 3235, Montreal, Quebec, Canada H3B 3M7.
Phone: (514) 871-1067.

Ortofon/SME 30H

SME Ltd and Ortofon have jointly produced an integrated low mass pick-up arm/cartridge which utilises the technology of both companies. Termed the *Ortofon/SME 30H*, the unit consists of a special version of the detachable arm tube of the *SME Series III* low mass tonearm and an Ortofon low mass pick-up cartridge based on the company's *VMS* principle. The total effective mass of the system measured at the stylus tip is a mere 4.5g—less than the mass of practically any other pick-up cartridge alone—while the system resonance is a very desirable 13Hz.

Ortofon Manufacturing A/S, 11B Mosedalvej, DK-2500 Copenhagen-Valby, Denmark. Phone: 01-462422.
UK: Harman (Audio) UK Ltd, St John's Road, Tylers Green, High Wycombe, Bucks HP10 8HR. Phone: 049481 5331.

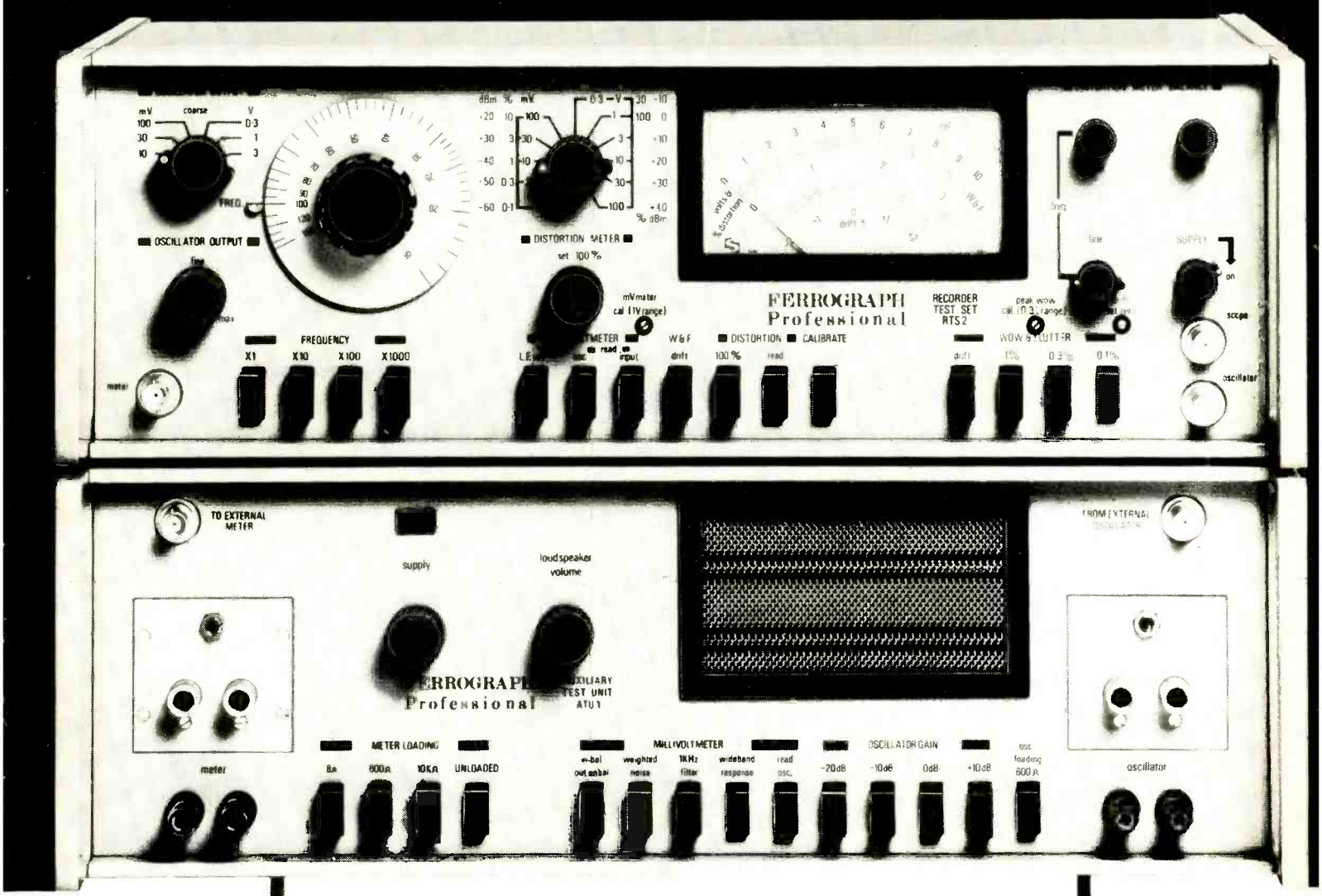
New Future Film cables

Future Film Developments has introduced several new cables. In its range of multiple-pair audio and instrumentation cables, new additions include a range of five cables containing from 1-10 individually screened and jacketed twisted pairs. Each pair is identified by numbers —printed every inch—on the pair jacket, and has its own aluminium-foil screen (100% screen coverage) and 'drain wire' for rapid and effective screen connection. These cables are an alternative to individual signal leads run between common points in audio and electronics installations—either fixed or 'trailing lead'—and complement FFD's range of multipair individually-screened cables. Another new cable is a low impedance, 2-conductor (12AWG) cable specially designed for use as loudspeaker leads. This cable has a characteristic impedance of 8Ω, and features high-purity tinned-copper conductors wound concentrically on a high K core. The angle of the concentrically-wound conductor system is designed to minimise coupling and skin-effect losses. The cable has a low series inductance of 0.038μH per metre, a rise-time of 0.38μs, and a phase shift of 1° at 20kHz. Comparable figures for standard loudspeaker cable are: risetime 3.1μs and phase shift 6°.

Future Film Developments, 36/38 Lexington Street, London W1R 3HR, UK.
Phone: 01-437 1892.

28 ▶

Check'em in
Check'em out



All-in-one test units mean faster, cheaper servicing.

Stands to reason.

Take the Ferrograph Recorder Test Set, RTS2.

It saves you from the need for time wasting connections to separate instrumentation....and from the creation of hum-loop. Instead, just a single input and output lead, connections that remain unchanged throughout the test series.

Then—push-button answers.

The RTS2 is considerably cheaper than the usual collection of separate instruments too!

Link it with a Ferrograph Auxiliary Test Unit, ATU1, and you extend its use to include measurement on professional equipment.

Versatile, sure, easy to operate, portable. And long lasting, thanks to the in-built quality and attention to detail that you find in all Neal-Ferrograph equipment. Your answer for efficient servicing turnround.

Please send me your illustrated leaflets with specifications of the equipment I have ticked.

Recorder Test Set ☐
Auxiliary Test Unit ☐

Name

Address

NEAL FERROGRAPH RECORD

Simonside Works, South Shields, Tyne and Wear, NE34 9NX. Tel: 0632 566321.

Dutch consoles

We have received details of a range of consoles from Dutch manufacturer D & R Electronica. Top of the range is the *ST1600* in line console available in 24 or 32-channel configurations. The input/output modules are in 8-channel groups and contain the following features: input selection for mic/line/remix; mic input gain control with phase and -20dB attenuation switches; line gain active only on line and remix; 4-band equalisation; channel/group selection; 3-way sync switch with LED indication; stereo cue send with pan; four aux sends all pre/mute/post switchable; and two rotary routing switches. The master section includes eight stereo monitor inputs, a master sync switch, cue master pots with program switch and four aux master pots, all with solo switches. Prices of the *ST1600* consoles are approximately £72,000 for a 24-channel console and £84,000 for a 32-channel console.

The next series of consoles are the *MT840* consoles available in 8, 16 and 24-channel configurations, designed primarily with semi-professional usage in mind. Features include transformer balanced mic input stage and 3-band equalisation. Prices are approximately £17,000 for the 16-channel version and £22,000 for the 24-channel console. Next are the *PA820* consoles for PA and theatre usage with similar features to the *MT840*. The *PA820* is also available in 8, 16 and 24-channel formats and prices are approximately £14,000 for the 16-channel console and £19,000 for the 24-channel configuration. The final range of consoles are the *MR600* consoles available in 6, 12 and 18-channel versions, designed particularly with small, budget conscious studios in mind. Price of the 18-channel version is approximately £7,500.

Finally, D & R Electronica also manufacture a range of ancillary equipment including an LED bar, a noise gate, a compressor/limiter, a parametric equaliser, a single channel compander, and its 100W *MPA150* power amplifier.

D & R Electronica, keizersgracht 284,1016 EW Amsterdam, Netherlands.
Phone: 020-250130.

ITAM 1610

ITAM has introduced the *ITAM 1610* 16-track tape recorder using 1in tape. The recorder features an ITAM-designed direct drive capstan motor and servo system and has three tape speeds (7½/15/30in/s) plus varispeed. Wow and flutter is quoted at 0.05% or better at 15in/s. Spooling is by dc print motors and electronic braking is utilised, while rotating guides act as tape lifters during fast wind and also ensure tape alignment in the record or play modes. The recorder has modular electronics and features a plug-in eq card with comprehensive line-up facilities and electronic FET switching for click free operation. The *1610* is a console mounted unit and is extremely compact, measuring only 36 x 20 x 16in. A full function remote control unit is available and another option is a digital counter. The recorder can be interfaced with any noise reduction system. The *1610* is also available in ½in or 1in (export only) 8-track format and prices are as follows: *ITAM 1610* 16-track 1in £5,750; *ITAM 810* 8-track 1in (export model) £4,480; and *ITAM 807* 8-track ½in £4,450.

ITAM, 1-7 Harewood Avenue, Marylebone Road, London NW1 6LE, UK. Phone: 01-724 2497.
Europe: Son Professionnel, 171 rue D'Aguesseau, 92100 Boulogne, Paris, France. Phone: 604.70.70.

ILR Music Limited

A new company, ILR Music Limited, has been set up to service commercial radio stations with various types of programming material from classical through to rock music. Formed in November 1979, the company will be asking individual ILR stations which type of music they require and how they would like it presented, ie studio recorded or as a concert. Generally London based studios and musicians will be used but if ILR stations prefer to use local acts the company is willing to set up sessions outside London. General Manager of ILR Music is David Tucker, formerly a cutting engineer with RCA in London, from whom full details of the service can be obtained.

ILR Music Ltd, Suite 12-16, 175 Piccadilly, London W1V 9DB, UK. Phone: 01-493 2613.

Agencies

● The Audicon plate reverberation system previously distributed in the UK by Cue Communications is now being marketed by TRAD Electronic Sales Ltd, 149b St Albans Road, Watford, Herts WD2 5BB. Phone: 0923 47988.

● The Sescom range and QSC audio products are now being distributed in the Netherlands by Special Audio Products BV, Scheldeplein 18, Amsterdam, The Netherlands. Phone: 020-79 70 55.

Technicord Limited

Technicord has been appointed UK distributor for the *Audio-Line* range of jacks and jack panels manufactured by Audio Accessories Inc in the USA. The *Audio-Line* range comprises ¼in and 0.175in jacks and jack panels. The jack panels are machined to individual customer requirements and are guaranteed for life against breakage. The jacks are chrome plated and the mini-jacks feature a U-shaped frame rather than the usual L-shape, increased spring tension (utilising a nylon buffer) and splayed wiring terminals. Technicord will also continue to manufacture and market its own range of ¼in and 0.175in patchcords.

Technicord Limited, Melbourn House, 2 Black Bank Road, Little Downham, Ely, Cambs CB6 2TZ, UK.
Phone: 035387 721.

Trident Agencies

Console manufacturer Trident Audio Developments has recently strengthened its overseas agency representation with a number of new agency appointments. In the USA in addition to its present agents (Studio Maintenance Services in California and Empirical Audio on the east coast), Trident has appointed Harris Audio Systems as its agent in Florida and Wilson & Associates as its agents for Tennessee, Alabama, Georgia, North and South Carolina, Arkansas and Louisiana. Harris Audio Systems are at: 1962 NE 149th Street, North Miami, Florida 33181; Phone: (305) 944-4448. Wilson & Associates are at: Rt 3 Barrel Springs Hollow Road, Franklin, Tennessee 37064; Phone: (615) 794-0155; Telex: 555-177. Outside the USA Trident has appointed agents in Canada, Japan, New Zealand, Australia, Sweden and Norway. Canadian agents are Radio Services Inc, 2500 Bates Road, Montreal, Quebec; Phone: (514) 342-2511. Japanese agents are Nissho Electronics Corp, Konwa Building, 1-12-22 Tsukiji Chuo-Ku, Tokyo; Phone: 03 544-8400. Trident agent in New Zealand is Mandrill Recording Studios, Vacation House, 60 Parnell Road, PO Box 3924, Auckland 1; Phone: 09 793222. Australian agents are the John Barry Group, 105 Reserve Road, Artarmon, PO Box 199, Sydney, New South Wales 2064; Phone: 02 439-6955. In Scandinavia Swedish agent is Stage & Studio KB, Box 257, S 442 01 Kungalv; Phone: 0303 5.03.48. Finally, Trident's new Norwegian agent is Protechnic AS, Lyder Sagens Gate 19, Oslo 3; Phone: 02 46.05.54.

Telex Audiocom intercom system

Telex has introduced the new *Audiocom* closed circuit headset intercom system comprising a switchboard, intercom stations and loudspeaker stations plus a variety of accessories. The system may be a single or multiple line intercom and is suitable for a wide range of applications. The system may be used for distances up to five miles with minimal system noise and has excellent RFI and EMI rejection. The *Audiocom* system requires only 2-conductor shielded or 3-conductor wiring and readily interfaces with other intercoms including telephone circuits. Features of the system include low power consumption at a nominal 24V dc; immunity to damage resulting from inadvertent phase reversal, a shorted line or if a headset is connected directly to the line; constant gain levels as stations are added or deleted; and automatic pre-amplifier shut off to prevent line noise when a mic or headset is disconnected. An additional feature is a controlled frequency response (voice shaped 200Hz to 5kHz) which limits the affect of ambient noise and enhances maximum transmission of information.

Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, Minn 55420, USA.
Phone: (612) 884-4051.

Institute of Sound & Communications Engineers

Following two years of planning and development by a committee of experts drawn from the professional engineer section of the Association of Sound and Communications Engineers (ASCE) and educationalists—The Institute of Sound and Communications Engineers was officially launched at an inaugural meeting held at the Royal Festival Hall in late 1979. The Institute, operating under the umbrella of the ASCE, will cater for the needs of engineers engaged in the field of sound and communications and a prime aim of the Institute's future programming will be the raising of technical standards, the dissemination of technical and management information, education and training, and the establishment of a code of conduct. Entrance to the Institute is by examination, although exemption from all or part of this is provided for those suitably qualified and experienced. Further details may be obtained from: The Secretary, The Institute of Sound & Communications Engineers, 47 Windsor Road, Slough, Berks SL1 2EE, UK.
Phone: 0753 39455.

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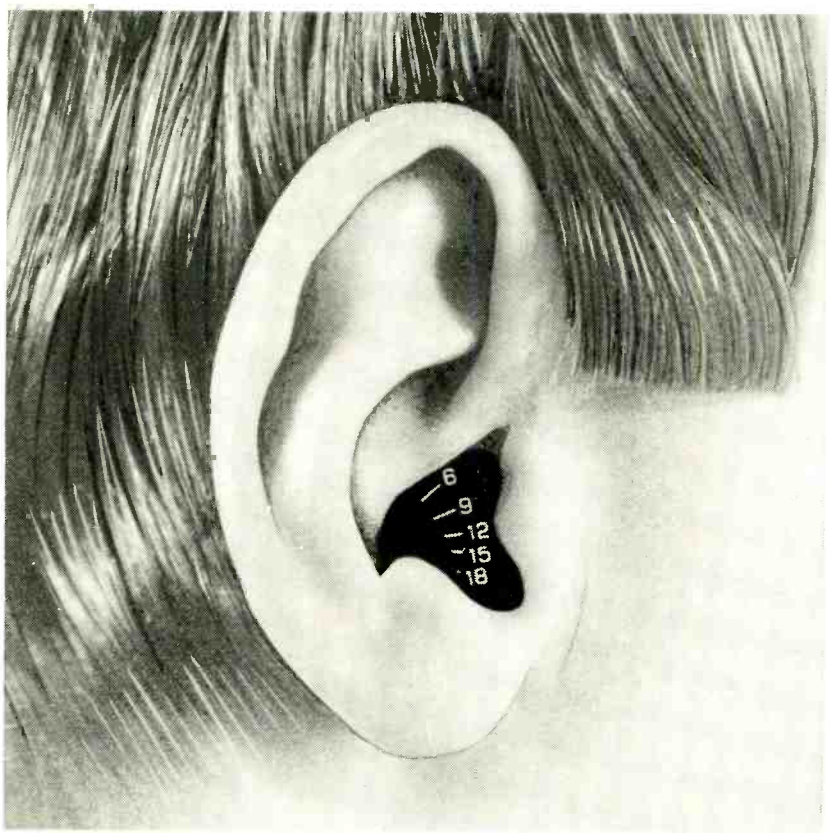
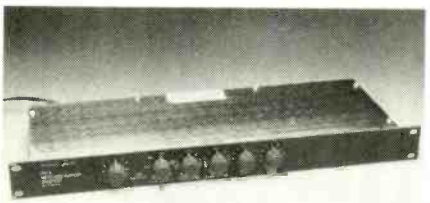
One of our best customers



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

Zuma Disc Mastering Computer

Zumaudio Inc has introduced the Zuma disc mastering computer, a microprocessor - based digital system allowing users of Neumann *VMS Series* lathes to make more efficient use of disc space without requiring mechanical modifications to the lathe. Zumaudio claim that in comparison to the Neumann lathe's internal pitch-depth system, the Zuma computer's greater efficiency permits an increase in cutting level of up to 2dB, depending on the programme material. This efficiency is accounted for by the system's digital control which it is claimed features improved pitch and depth control algorithms. In operation, the Neumann pitch-depth computer is bypassed and the signals from the preview tape machine are fed to the Zuma computer. It samples and digitises these signals and constructs in its memory a numerical picture of the groove being cut. One turntable revolution later the computer recalls this information and compares it to the numerical picture of the current groove section being cut. If the two adjacent groove profiles permit, the computer nestles them together rather than allowing for the absolute value of the peak excursions as with conventional systems. Additionally, the computer seeks to maintain a constant land value between grooves by monitoring the space it creates. After determining the pitch and depth values digitally the computer converts these numerical values to analogue form for use by the Neumann lathe's existing servo pitch motor and depth control. Since no mechanical modifications are made to the lathe, the lathe's existent system can be restored to operation at any time by means of a jumper plug. The computer features an integral diagnostic routine and additionally one Zuma computer can electronically lock two lathes in tandem for the cutting of multiple lacquer sets. Price of the Zuma computer including installation is $7,000. To date three Zuma disc mastering computers have been installed—at Capitol Records and K-Disc in Hollywood and at Masterdisk in New York.
Zumaudio Inc, 4150 W. Gelding, Phoenix, Arizona 85023, USA.

AKG D130 microphone

AKG has introduced a new microphone primarily for use by broadcast journalists and interviewers. The new mic, the *D130*, is a dynamic type with an omnidirectional polar pattern. Features include sturdy shockproof construction, a sintered-bronze windshield, and a hum-bucking coil to cancel the effects of stray magnetic fields induced by power cables, lighting, etc. The mic's transducer element is cushioned within a compliant impact-absorbing suspension making it virtually immune to handling noise and mechanical shocks and vibrations. Frequency response of the *D130* is 50Hz to 13kHz ±2.5dB, and it costs £45.
AKG Acoustics Ltd, 191 The Vale, London W3 7QS, UK.
Phone: 01-749 2042.

Cambridge Electronic Workshop Music Processor

CEW has introduced a small mixer designed for club and mobile disco use, but which is also a full broadcast specification mixer. Called the *Music Processor*, the mixer is built in standard 19in rack units and is of modular construction. The *Music Processor* features transformer coupled inputs with phantom powering and mic limiters, Penny & Giles faders with remote starts for decks, and separate equalisation for two record decks, two line inputs and each of the two mic inputs. The outputs have a stereo limiter, voice over, adjustable voice switch from the DJ's mic, and a 9-band graphic equaliser. The mixer includes a built-in comprehensive lighting control unit which is compatible with Pulsar equipment and contains a 6-channel sound-light/chaser, strobe drive and four independently controlled mains sockets.
Cambridge Electronic Workshop, 4 Water Lane, Oakington, Cambridge CB4 5AL, UK.
Phone: 022023 3737.

New Genelec monitor loudspeaker

Genelec has introduced a new monitor loudspeaker which is especially suitable for broadcasting use eg small and medium-sized music and speech studios and control rooms. The *Triamp S30* is a 3-way system with a 210mm bass driver, 80mm midrange driver and a ribbon tweeter, driven by three integrated power amplifiers and an active crossover network with individual calibrated attenuators for each channel. Frequency response of the loudspeaker is 40Hz to 20kHz ±3dB and the maximum spl at 1m is 105dB.
Genelec Oy, Satamakatu 7, SF-74100, Iisalmi, Finland.
Phone: 35877-24942.

Hiwatt products

We have details of the current range of products from Hiwatt, who are notable for being one of the few companies still producing valve amplifiers. Ever since the company's inception in 1964 Hiwatt has been renowned for its all-purpose valve amplifiers, and the present range of products includes several models covering a power range from 50 to 400W (*Models 504, 103, 201,* and *405*). Other products include a graphic eq/solid state amplifier, *Model NCA 108*; tuned reflex loudspeaker columns; combined loudspeaker/valve amplifiers; stage foldback monitors; slave power amplifiers; and a 3-way stereo electronic crossover. The products of greatest interest, however, are the Hiwatt *Type D* mixer and the *Tube State STA 200R* and *Tube State STA 200R-D* valve power amplifiers. The *Type D* mixer is a quasi-modular PA mixer which features a master output section and input sections each of which has four input channels, allowing input configurations to be formed in multiples of four. The input channels feature variable input attenuation; 3-position amplifier gain adjustment; ±20dB boost or cut at 18kHz, 30Hz and over a variable frequency range between 250Hz and 5kHz; PFL switching; VU metering; LED overload indication; pan and aux controls; echo and foldback sends; and channel output group switching. The *STA 200s* are respectively mono and stereo 19in rack mount valve power amplifiers capable of delivering 200W (*STA 200R-D*, 200W per channel) into 4Ω, 8Ω and 16Ω impedances. The amplifiers use ECC81/ECC83 valves in the pre-amplifier stage and EL34 valves in the power stage. The control panels are simply laid out and feature input/output XLR sockets, adjustable gain, output impedance selection, and power/standby illuminated switches.
Hiwatt Equipment Ltd, Park Works, 16 Park Road, Kingston-on-Thames, Surrey, UK.
Phone: 01-549 0252.

Contracts

●Sierra Audio has begun reconstruction of the Soundmixers Studio B in New York. Later this year Studio C will be redesigned and rebuilt, and it is likely that Sierra will also be responsible for the design and construction of the new Soundmixers audio/video level to contain Studios E and F. In addition Sierra has commenced construction of three studios at the new site for Bias Recording in Arlington, Virginia. The new complex will replace two studios and the main studio will contain three levels with a large volume isolation pit.

●Neve is to supply the new Bournemouth ILR station, Two Counties Radio, with a turnkey equipment package for the station's two broadcast studios, a 750 sq ft recording studio, and a news booth, plus ancillary equipment. The broadcast studios are to be equipped with Neve *5402B* consoles with six stereo and three mic channels, while the recording studio is to have a Neve *8066* 20/16 console.

●Trident has supplied A & M Records, Hollywood, and Automatt, San Francisco with customised 40/24/32 *TSM* consoles. In addition Sound Mixers, New York has also received a *TSM* console. In the UK, Matrix and Chipping Norton Studios have received *TSM* consoles and Rockfield Studios has ordered a customised *TSM*.

●MCI has supplied Sound Recorders, a new 24-track studio in Kansas City, with a *600 Series* automated console.

●Dell Technical Vehicles Ltd of Southampton has received a contract from Denmark Radio to build one of the largest and most sophisticated sound vehicles so far undertaken in Europe. The vehicle is to be equipped with a custom-built Solid State Logic 48/32 console, and the interior acoustics are to be prepared by Eastlake Audio. Dell are undertaking the design and construction of the vehicle and will also be responsible for electronics installation.

People

●Graham Moon has been appointed managing director of Severn Sound, the new Gloucestershire ILR station.

●Aerco Productions has appointed Derek Sticklen, formerly of Utopia Studios, Pye Studios and FWO Bauch, as service manager for its contract studio maintenance service.

●Tannoy has appointed David Bissett-Powell as its professional products manager with sole responsibility for the marketing of its monitor loudspeakers and electronic dividing network.

●John Klett has joined Empirical Audio, New York as sales engineer.

●Monterey Sound Studios, Glendale, California has appointed Richard Tilles as studio manager and Marvin Hall as chief engineer.

●Richard Kelley, formerly with Britannia Row and Aphex UK, has moved to FWO Bauch Ltd to look after the recently appointed Harrison agency. ■

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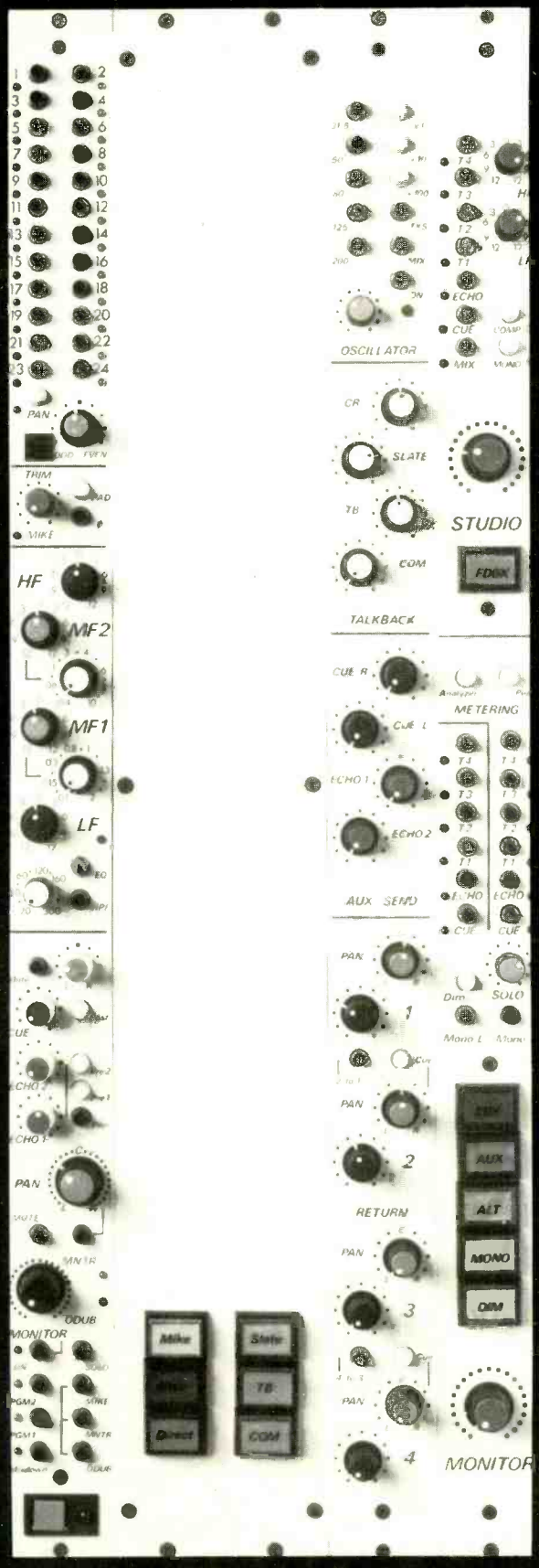

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studio diary

Village Recorders, Los Angeles

Village built Studio D for Fleetwood Mac initially, who occupied it for over a year while recording their new album *Tusk*; and they are now busy rebuilding Studio B to incorporate suggestions made by Supertramp.

That tells you quite a lot about the Village, their kind of clients, their relationship with them and their approach to running their business. The Village has impeccable credentials as a heavy duty studio, but there's no resting on laurels; innovation and updates are a continuous process.

"It's not unusual to change things for artists here, in fact it happens quite a bit," says studio manager Gary Starr recalling a number of precedents, including tearing down a wall for Sly Stone. However that was a minor adjustment compared to what happened in Studio D. Studio owner Geordie Hormel and Gary discussed the proposed project with Ken Caillat and Richard Dashut, production and engineering people with Fleetwood. "We got the group's input through Ken and Richard. They figured if we did certain things then the group would record their new album here," says Gary. Considering the sales of *Rumours* and what was expected of the follow-up album, the room in which it was to be recorded had to be extraspecially good.

Acoustic design was a joint affair between Geordie Hormel, Gary and Rudi Bruer. The resultant studio is 1,100sq ft, not including the two isolation chambers and echo room. First stage of the construction was to build completely floating floors and walls, and a suspended ceiling. This makes the studio completely isolated from the existing structure, and by definition completely impervious to extraneous noises. The next step was to create as pleasant an ambience as possible in the studio with the decor. This was especially important because of the block bookings envisaged by the studio, like Fleetwood Mac's 13-month stay for *Tusk*.

Oak panelling and antiques make for a beautiful and pleasant room. The combination of this and stained glass windows (depicting palm trees) even make for a new style of decoration, 'Hawaiian Gothic'. Clever use of mirrors, particularly in the lounge adjoining the studio, makes the whole place look much bigger than it is. The studio itself has ample room for a fair number of players and instruments, as well as a moped, punchbag and shop window mannequins, which are obviously such an essential part of the 'Mac' sound.

The main studio is 'pretty bright', has bass traps in the walls, and part of the ceiling is louvred for further adjustment. There is an overdub room lined with hard wood and glass for a more live sound, and the Hawaiian Gothic isolation booth for pianos or drums. It has mid-range trapping making it, "a real tight midranging room" according to Gary. The large echo chamber has a sloping roof and plastered walls and can be used on its own or, with its door left open, miked from the studio.

There is a lightweight video setup which has already been used with Olivia Newton John and will shortly be expanded. There's also a video tie-up facility, not only between the control room and studio, but also for example, to the hard bathroom-type chamber. Each room connects with feed through points, even the lounge; and dingle mics enable panels to be set up for talkback without adding any extra mics. There are 6×2 independent monitoring channels available for headphone foldback at various points in the studio and in all the side rooms, as well as ample 40-input mic panels.

The control room itself is fairly large; again designed with atmosphere and the occupants in mind, and offering a high degree of 'electronic comfort'. The rhomboid shape gives good visibility to all parts of the studio. "That was our aim in building it and I think with the three large windows we succeeded pretty well," says Gary.

The Neve console with *Necam* has Dolby on all tracks, so it doesn't have to be patched in. There are 40 inputs and 24 channels, although the room is wired for 32, the first eight could then rate 25 for 32. SMPTE synchronised time code allows two 24-tracks to be synchronised to achieve 46-tracks. Synthesiser accessory panels set up in a special housing conveniently located in front of a couch some distance behind the control panel allows the setting up of three or four inputs to do a mix or synthesising without disturbing anyone else. There are Urei and *Kepex* limiters, and Eventide *Harmonizers* and delay units. All racks are on wheels and can be unplugged and moved where needed. Recording is with two Studer *A80s* and an Ampex *ATR100*. Fleetwood Mac mixed down to a Soundstream digital recorder. (Accolade for the first all digital recording however, goes to Ry Cooder with his new album.) As one would expect with a studio of this class, there is a wide range of outboard equipment and instruments, Moogs, grands etc, which can be brought into any of the studios as the clients desire.

Monitoring is generally with JBLs physically time aligned, by placing the components rather than doing it electronically. "This room is rated at 2,000W, so you can play real loud. We also use Urei *604 8G* time aligned speakers, using them as near field monitors. We also have Auratones and Visonic David *100s*. There are six EMT *140* plates, one *240* gold foil and a new Lexicon *224* digital reverb unit. In fact there are a total of four spread throughout the studios. "You can synthesise the character, change the reverb time and delay. You can hit anything, even synthesise Grand Central Station if you like. Actually, it's basically a simulated echo room with four rooms," according to Gary.

Studio A, which is 17 by 30ft has a Harrison 32/32 console and again there is a Lexicon *224*. There are Roger Meyer noise gates and an ADR *Vocal Stresser*, Gary calls an 'incredible device'. The control room is equipped with a custom JBL system, but there were a pair of Urei's in place for monitoring. "It's a growing trend for clients to carry these around for near monitoring since they depend less on the room." Also present were another

34 ▶

Studio D, Village Recorders, Los Angeles *Photos: Steven Finestone*

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pair of Visonik David *100s*. "They don't have a real good bottom end, but the top imaging is good." The studio was designed by Geordie Hormel and Dr Rittinger. The whole room has an 18in concrete shell, one wall is half mirrored, but the other forms a Helmholz resonator. The wall is covered with wood strips of varying widths set at varying distances. "The whole wall is, in effect, a broad band resonator, you can put a vocalist 5ft from the drum kit and the room is still manageable," says Gary. The room also has a soloist booth and is particularly good for strings.

Studio C was the first Quad room in the world, it has a Quad-Eight *2084* Quad mixdown console. Again there is *604 8G* time-align near monitoring. The Quad facility has been used by Jethro Tull. "We want to tie this in with our video room and use the console for video mixdowns. This room also had the first Stephens tape machine. We also have an Ampex *1200* tape machine. Dolby or dbx is available here or anywhere in the studio. We also have three complete BTX synchronising systems with which you can slave one tape machine."

Studio B, which Supertramp occupied for eight months doing their *Breakfast in America* album, should be completely rebuilt by the end of 1980. It will be a small room with a symmetrical, wedge shaped control room in the middle of the studio for best utilisation of space. And to allow for better drum trapping, there will be a sunken drum trap, possibly with hydraulic control. Once again particular attention is being paid to complete isolation of the floor, walls and ceilings. The desk will probably be a big Neve. Art Nouveau is being considered for the decor. "The studio will have a large area and will also be used for overdubs, but primarily remixing because of the space. But the main aim of the room is to get a good drum sound, so the studio has to have lots of volume. Once again we're building for acoustics and comfort," he said.

The largest room in the building which has in the past been a Masonic lodge as well as the home of the Moody Bible Institute, is the auditorium. Currently rented out to the Transcendental Meditation people which possibly accounts for the good vibes. "We actually talked one band into doing their drums here in the auditorium because of the height of the ceiling,' but it was so loud outside that the police came in and stopped it. So we are intending to decouple the walls and floor and float the ceiling, as we're going to turn this into a plush screen room with 70mm film facilities and tie-ins to the studios. (The studio already has a video room and staff.) The logical step from there is a complete scoring studio and dubbing studio. The size of the auditorium approximates that of a film theatre, so it should work out fine. There's a big move into video anyway. A video SMPTE tie-up would also be a good idea for us. We are also thinking of installing a computer," he concluded.

Excellence of equipment and housing are not the sole priority at Village Recorders, as general manager Dick La Palme points out. "This is the kind of operation where the artist and the music always come first. And for that you not only need state of the art equipment, but state of the art people who are knowledgeable and keep themselves up to date on things which can be done to improve things. Plus everyone here is sensitive to the artist and their needs. We don't want anything coming out of here that is bad. I'd rather tell a customer to forget a session if he isn't happy with the outcome. We go after the pros, people who are interested in making good records first and foremost, rather than people who just want to make records that sell. Our pride is that groups like Fleetwood, Steely Dan and Supertramp do their work here. We have something that attracts people of that calibre, and we are one of the few studios that really care about the music. I used to handle the Cadet series for Leonard and Phil Chess, I also handled artists like Andy Williams, plus I used to be a musician myself. So I have a real concept of what happens to a record after the artist has completed it. We can offer artists help and consultation in the direction a record should or shouldn't go and an understanding of the problems they may run into once they leave the studio.

"Everyone here has a pride in their craft. And when we assign an engineer to a session we make sure he is into that particular kind of music. Certain engineers should do Sonny James, other engineers should do Etta James. It's like a doctor, if you have ear-ache you go to an ear, nose and throat specialist. I don't think all engineers and producers can do everything. I had a guy come in for a job once. He had great credentials, but when I asked which radio station he listened to he told me KFAC, which is a classical station. So I asked him if he liked rock. He admitted that he didn't but would record it. I advised him to look for a job where he could record classical music. There's no way I could assign an engineer who didn't like rock to work with a band like Fleetwood Mac. Our whole purpose, our desire is wanting an excellent product, and to get it you have to pay attention to the smallest things. Someone will walk into a control room and you can feel the tension. That person is giving off bad vibes in the form of electrical current. Those vibes get on the tape. And I or we, will do anything to cure that; change the engineer, change the tape op, change the studio.

"We don't buy advertising space to promote this place, word of mouth is enough. We have worked hard to earn the reputation that we enjoy. We have state of the art people and equipment, sensitivity and we are frank. Music has given me a lot in 25 years and I want to give as much back as I can. When you get a group coming in from way left of the field like Steely Dan whom no one had ever heard of and then they come out with the beautiful sounds they made on *Can't Buy A Thrill*, it's still a buzz. It's a privilege to be there while the seed is being planted and we want the seeds planted in our garden."

Bill Third

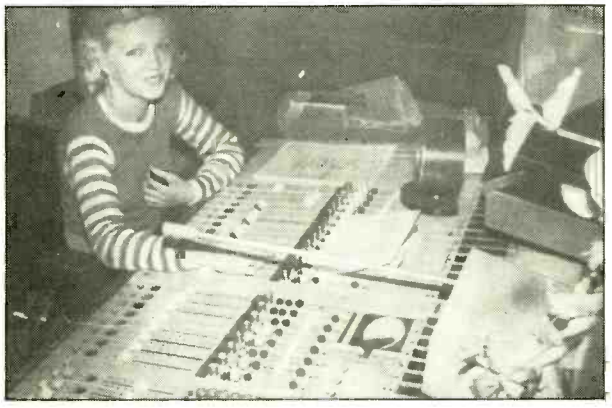
The Village Recorder, 1616 Butler Avenue, West Los Angeles, Cal 90025, USA. Phone: (213) 478-8227.

Radio Tallinn, USSR

Tallinn is the capital of the Estonian SSR which is a part of the federal union of the Soviet. In Estonia they have their own language, close to Finnish, their own culture, history and radio.

As a listener in Tallinn you can choose between eight different programmes, three Estonian, three distributed from Moscow and two (one in Finnish and one in Swedish) from Helsinki, Finland, which is situated just 100km north of Tallinn, just opposite the gulf of Finland.

Radio Tallinn transmits in 4-channel stereo and has a small following of amateurs some of whom are supported with special listening receivers. As far as I know the station is the only one in the world to transmit quadraphonic programmes frequently. The fact that special knowledge and technical equipment was required in the development of quadraphonic radioplays, music etc, has helped them enormously in straightforward stereo radio.



All the music transmitted on Estonian Radio is via tape and each title is on a separate AEG-bobbin. You might wonder why this is? It's simply because the technicians dislike the plastic used on records. So if they haven't made a recording on tape themselves they order a master tape and copy it.

Most of Estonia's consoles are manufactured by Tesla in Czechoslovakia and their tape recorders, even one of their 4-channels, are Hungarian. They are allowed little foreign currency to spend outside their country, but the little they have, has been spent on: a Studer *A80* 8-track, an EMT *250* digital delay, Agfa PER *525* magnetic tape, IC's and the original Dolby equipment.

Recently, as there was a shortage of chips from the Silicon Valley, California, according to the trade embargo from Washington, our skilled technicians were forced to construct new'black boxes'and push the present equipment to its limit.

Most of the technical operators are women. Their salary is about 140rbl(£98.50)/month, the sound directors, who are all men, about 170rbl(£119)/month, and by way of a comparison a toffee boiler at Tallinn's sweet factory earns 150rbl (£105)/month! **Gosta Dahlgren**

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MXR Professional Products Group

Photos: Ralph Denyer

Mention the name RAK to any reasonably well informed person in the music business and one thought immediately springs to mind—Mickie Most's studios and record company. Such simplification while it gives due regard to the flair, success and business acumen of Mickie suggests that everything at RAK revolves around the man himself. Although there is some truth in this viewpoint, for Mickie retains overall control of the affairs of the recording studios and the RAK Records Mobile, management of the studios and mobile lies in the more than capable hands of studio manager, Doug Hopkins.

One rainy morning in late October I called on Doug to see for myself the facilities which produce so many of the UK's top 20 singles and albums. I must admit that as I entered the impressive 19th-century building, which houses the studios and record company, I wondered how I always seem to arrange studio visits on days when the heavens decide to downpour, but decided that *Studio Sound* staff obviously are not immune to Sod's Law. However, I digress. Once inside the warmth of RAK and suitably dried out I set about discovering the history of the studios.

While the recording studios in Charlbert Street (in the St John's Wood area of NW London) date from 1977, the recording activities of RAK go back to the days when Doug Hopkins was independent of the company. Six years ago Doug had started Team Recording, a mobile studio which has now become the RAK Records Mobile. Mickie Most was one of the mobile's most frequent users and two years after Team Recording was set up Doug suggested to Mickie that it would be more economic for him to take over the mobile than to be continually spending money booking it for his RAK Records productions. Mickie agreed and so began the partnership which has seen RAK's recording activities grow from ownership of a mobile to ownership of a studio complex.

With 18 months successful mobile operation behind him, the next logical step was to find a permanent studio home, and in 1976 Mickie asked Doug to obtain suitable premises in London. Doug's search led him to Charlbert Street where he found a building which had previously been used by ATV as outside television rehearsal rooms. This building was built around 1890 and had originally been a church institute, but had been refurbished in the 1950's. Situated in a residential area, there was local opposition to the idea of the building becoming recording studios, so obtaining planning permission was not easy. The question of potential sound leakage and the requirement that the building's exterior appearance and charm be retained were the principal problem areas. However, in conjunction with its surveyors and expert technical consultants, RAK overcame the local objections. Work then commenced on gutting the building and refurbishing it so that when it was completed it contained two studios plus offices for RAK Records.

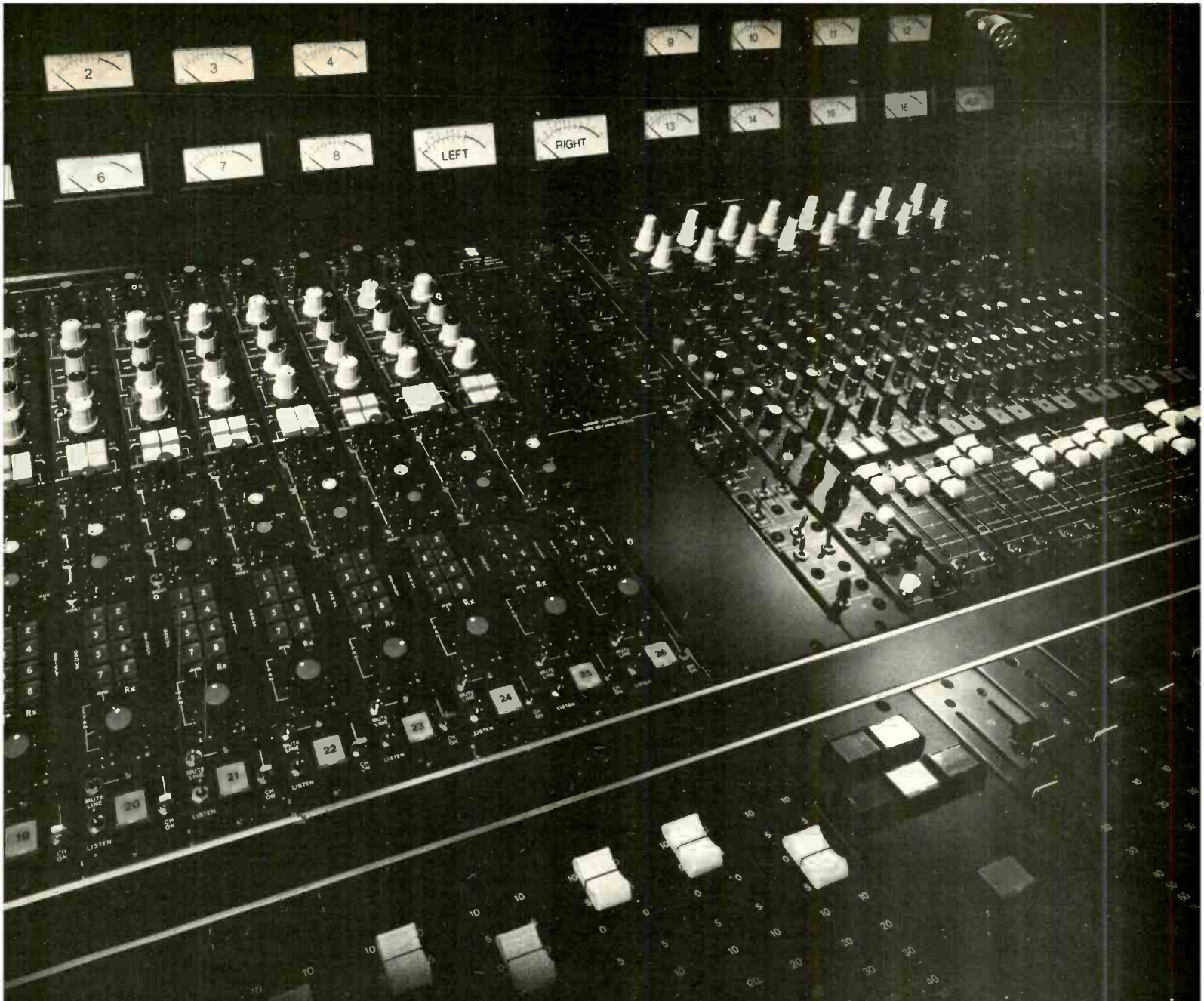
That brings us up to date on the current position; however, further developments are in train. RAK recently purchased the building alongside its Charlbert Street headquarters which will have a four-bedroomed apartment available to select clients, the remainder to form the basis of RAK Studio Three. This new studio will be as large as the present Studio One, but with a higher ceiling, the control room being similar to that of Studio One. The control room will require totally new construction alongside the area earmarked for the studio. It is also possible that the new studio will have video production facilities. At the time of my visit, the financial climate and recession within the music industry were such that Mickie and Doug were debating whether it would be better to commence construction of the new studio immediately or to wait until the business climate improved. As Doug put it: "There's no sense in investing in and building a new studio if when it's completed the business isn't there for it".

In addition to the planned expansion in London they are also building a studio in the South of France, near Cannes. This studio, in a residential villa, has eight luxurious bedrooms and construction work is apparently well under way. Doug informed me that the studio will have the same basic equipment as London, although there's a possibility of a different console being used.

However, enough of RAK's history and future intentions, what about the facilities? Doug and I started our tour of the London studios with the largest—Studio One. This is 27 x 40ft and may be partitioned across the middle with screening, which when not in use can be folded back into the side wall. This allows the whole studio area to be used for orchestral work but with the option of closing off the rear for smaller group usage. Other features of the studio are a slightly raised ceiling in the rear half, a suspended polished wooden floor (originally a wooden dance floor—it has been restored and refinished), and two areas supported by concrete suitable for use with the studio's Audio Kinetics isolation screens as drum booths, or alternatively as a bass player's plinth. Permanently resident in Studio One are a Yamaha grand piano and a sophisticated Yamaha *GX1* synthesiser. The studio itself has a reputation for giving a good string and orchestral sound and is also capable of a good firm rhythm sound.

The control room of Studio One which lies at the front of the building is large, ie 16 x 25ft. Three tall windows looking out on to Charlbert Street dominate the wall behind the console and these are a legacy from the decision to maintain the building's facade. Because of the obvious need to avoid sound leakage, these windows are fitted with 1in thick plate glass in mock frames, with a ¼in layer of laminated glass on the interior side. In between the two layers of glass are curtains which may be electronically closed for those engineers who prefer to work in the half-light conditions prevalent in most studios. Personally I prefer the light and airy feeling which the control room has with the curtains open, which I would imagine allows (in conjunction with the room's spaciousness) engineers to work in

38 ▶



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Netherlands & Belgium Pieter Bollen, Geluidstechniek bv,
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Hillbrow, Johannesburg 2001,
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a relaxed atmosphere without rapidly becoming tired. The decision to keep the outside windows also influenced the ceiling height, such that it now slopes down from the top of the windows to the opposite wall. This ceiling is false, and two tons of lead have been placed above it to halt vertical sound leakage, but there's enough space available for air conditioning equipment.

As previously mentioned the Studio One control room is large and spacious. Centrally placed opposite the window to the studio, on an elevated base area, is an L-shaped API 48/48 console with a 32-track monitoring sub-console. This is fully automated and has the capability to carry out 46-track recording, hence the rather large size of the console. However, although large, the console is still compact and is sensibly laid out for ease of operation. For 46-track recording the studio uses the Maglink synchronisation system in conjunction with two of the studio's standard multitracks, the Lyrec *TR532* 24-track. RAK was the first studio in the UK to use the Lyrec and while there were a few teething problems in the early days RAK are now more than happy with them. The studios currently have three Lyrecs, one permanently resident in each studio and the third machine available for either studio as required. In addition to the Lyrecs RAK's other standard tape machine is the Studer *B67*.

Monitoring and ancillary equipment in both studios is identical, so to save duplication I will detail that available in Studio One only. Monitors are Tannoy *HPD*s in Lockwood cabinets, driven by Amcron *DC300*s, and in Studio One these are suspended from the control room ceiling on anti-vibration mounts. In addition to the Tannoy / Lockwoods both studios also have *Auratones* driven by Amcron *D60*s. Ancillary equipment comprises an Audio & Design *Scamp* rack with various modules; a pair of Urei *1176LN* peak limiters; BEL flanger; and Eventide *Harmonizer*, *Omnipressor* and DDL. The delay units are to be replaced by AMS units soon. Dolby A noise reduction is standard in the studios (dbx noise reduction can be catered for), and Doug informed me that they are using Dolby less frequently, preferring to record at 30in/s instead. Other standard miscellaneous units are EMT turntables and Tandberg *TCD330* cassette decks for cassette copies.

RAK's Studio Two is situated on the opposite side of the building, with the same problem windows, and is much smaller than Studio One. Studio floor area is approximately 17 x 17ft and is decorated in a rather 'cold' black and white colour scheme. This studio is almost totally used for group sessions, has an overhead control room, and comes complete with a Yamaha piano and a selection of acoustic screens. The overhead arrangement cuts down the amount of direct vision from the control room and also gives a slightly closed-in feel to the studio which is obviated by the use of mirror tiles on the undersurface of the elevated control room and studio wall beneath. While this gives the impression of a larger room the studio could really have done with being slightly larger, but unfortunately space was not available. Incidentally, access to and from the studio from the control room is via an open staircase. Doug explained that originally this was intended to be a mixdown studio with facilities for overdubbing, but eventually they decided to make it suitable for group recording. It certainly appears to be successful in this role as Hot Chocolate, for example, have recorded many of their hit singles in this studio.

The control room of Studio Two is more or less L-shaped. Space is limited with the console at the front above the studio and tape machines housed in a side annexe. The console in Studio Two is again an API automated desk; in basic format it is a 32-input remix console which doubles as a 32-track monitor console for an auxiliary API 24-track recording console. As with Studio One the console may be used for 46-track recording. Also as previously mentioned the ancillary equipment and monitors are the same as Studio One.

That completes the tour of the Charlbert Street studios which house the RAK Records offices on the upper level of the building. Prior to turning my attention to the RAK Records Mobile I asked Doug out of interest what percentage of studio time is taken up by RAK's own productions. Doug estimated this at approximately 20%, but said it obviously fluctuated up and down from this figure depending upon the projects underway. Incidentally, artists who have used the studios include Hot Chocolate, The Who, Yes, Wings, Gallagher and Lyle, and The Jam.

The RAK Records Mobile has been in existence for six years, the last four years having been within the RAK organisation. At the time of my visit the mobile was on location at St Paul's Cathedral, London and unfortunately I was unable to visit it; however, Doug filled me in on its history and facilities. The mobile is probably best known as the unit used by Paul McCartney to record *Mull of Kintyre* and Doug informed me that Wings had just completed recording the group's new album on location at Lympne Castle, Folkestone using the mobile. Other well known users have included The Three Degrees, Yes, Rick Wakeman and Ella Fitzgerald. The mobile does not confine its recording activities to popular album projects alone though, as the BBC is a regular user, particularly for its television programmes *The Old Grey Whistle Test* and *Rock Goes To College*. Another regular booking, presently in its fifth year, is a month in each year booked by RCA to record opera at the Walthamstow Assembly Hall in Walthamstow Town Hall. This has produced many well respected opera recordings, particularly notable for the excellently caught acoustics of the recording venue.

If from the above, readers obtain the impression that the mobile spends all its time in the UK, this would be an incorrect assumption. The mobile regularly crosses the English Channel to record in Europe, sometimes for live concert recording and occasionally for album projects. A regular port-of-call is France where the mobile has recorded Charles Aznavour, The Shadows, Hot Chocolate, Suzy Quatro and Donovan. The mobile was also used to record Kate Bush live in Mannheim, West Germany and a European album project was recording Bonnie Tyler in Portugal.

This all proves that the mobile can cater for a wide range of work. When Doug first put together the mobile it was 32-track using Maglink synchronisation to lock two 16-track machines together, but this was subsequently expanded to synchronisation of two 24-track machines. The two 24-tracks currently in use are 3M *M79*s and the mobile also has a pair of ¼in Studer *B62*s, one of which is portable. The Maglink synchroniser is used to do 46-track recording and may be used to link the machines to film or videotape. The console in the mobile is yet another API desk and has 54 mic inputs, 24 outputs and 24-track monitoring. Monitors are JBL *4310*s driven by an Amcron power amplifier, while ancillary equipment includes Dolby A noise reduction; EMT *240* plate reverb; Urei limiter; and Eventide phaser, *Harmonizer*, *Omnipresser*, and DDL. There is a wide range of mics including models from AKG, Beyer, Neumann, Schoeps and Shure, all with phantom powering. Communications equipment comprises an intercom system and walkie-talkie facilities, and the mobile also has a Shibaden CCTV system for video monitoring. The mobile is a custom-built truck on a Ford chassis and it is fully air conditioned. A feature of its design is that all the equipment is connected by multi-pin plugs so everything can be de-rigged if required and taken out through the mobile's side doors so that control can be set up anywhere. This in fact is the procedure for the RCA opera recordings and apparently Paul McCartney also likes to work this way.

So there we have it, a full review of RAK's recording facilities. It only remains for the French studio to be finished (completion due in 1980) and for Studio Three to make its appearance and yet another phase in RAK's successful expansion will be completed. What the future holds is almost anybody's guess, but it wouldn't surprise me if Doug and Mickie have further studio projects up their sleeves.

Noel Bell

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Irish 24-track recording

Due to a brainstorm by the assistant editor we incorrectly stated in *Studio Diary*, February 1980, that Windmill Lane Studios, Dublin was Ireland's first 24-track studio. In fact Ireland's first 24-track studio dates from 1976 when Lombard Sound, Dublin became operational. Our apologies to Lombard Sound for the error.

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Trends in 16mm film dubbing

Tim Amyes (Scottish TV)

Two-thirds of film production in Britain is still shot on 16mm film and of this, television is the major user. With the publicity and interest that electronic field production and electronic newsgathering using portable television cameras is receiving at the moment, it might seem that there would be a reduction in film making. But television's investment in film dubbing equipment does not demonstrate this.

A FILM DUBBING theatre can cost in excess of £100,000, the equivalent of equipping three film crews. Why this heavy investment in what might be considered an outmoded method of producing programmes? Obviously some re-equipping is to replace obsolete equipment, and here is a possible key to all this investment. It would seem sensible to run down the main capital investment of film production, the dubbing theatre, with the film process itself. The dubbing theatres at present being installed will become obsolete at a time when a more realistic appraisal can be made of the need for film. By then it should be discovered whether electronic equipment of compatible size, weight, reliability, flexibility and cost can be manufactured. Therefore, in the next few years there may be an upsurge of electronic production at the expense of film, or as appears at present to be happening a division of production methods into film or electronic. To understand the requirements of film dubbing it is obviously important to understand the complete process of film sound recording and the various related operations. Some of these production methods are peculiar to the use of film in television.

Films are usually shot in a discontinuous manner with one camera shooting all the material needed; action is filmed, the camera stopped and moved, the action continues. The various shots are then edited together after processing and copying to make a complete sequence. Sound is recorded at the same time as the picture is filmed, but the sound recording is far from complete after the picture has been shot.

Film recording almost always takes place away from the ideal situation of the studio and control room. The sound recordist has only his headphones and experience to monitor the quality of the sound, so he tries to produce the best quality from, frequently, the most unsuitable locations. To produce the cleanest sound possible he may record separately each sound that makes up a scene. A simple scene may, for example, consist of two people walking, meeting, walking, talking and each driving away in separate cars. This scene will consist of many separate sounds. The feet of the two characters meeting needs to be recorded in close-up, the talk between the two will consist of the recording of each, the walks to the car are recorded, the door slamming is part of the sound scene, and so is the noise of the two cars starting. In addition, the general background noise of the complete scene is needed. It may be cars going by and birds singing, street vendors or a harbour. The sound scene is more than just one picture following another (as are the visual pictures), it consists of sounds that geographically and in time knit the whole scene together. To combine all the sounds of a scene into one necessitates the use of a dubbing theatre for re-recording and mixing and sprocketed magnetic film is used to interlock the various sounds synchronously.

Original recordings in the field are recorded on ¼in tape with a reference pulse derived from the speed of a camera recorded on a tape. The tape is then copied onto fully coated magnetic film with the pulses derived from the camera motor driving the sprocket motor of the film recorder so that the sound film (called Sepmag) is now interlocked with the original camera film. The film and sound track can now be edited and when completed will consist of one reel of picture, a few rolls of sound and a cue chart to indicate to the mixer where the various sounds come in. A simple mix will consist of two sound tracks, a complicated one of, perhaps, 10.

The unique part of any 16mm dubbing theatre are the magnetic film transports. Their development is not entirely related to the needs of film dubbing since television has for some time been the major market for film equipment manufacturers. Its needs are diverse, the sound film transport has uses in telecine and VTR as well as dubbing. Indeed a new generation of high speed telecine machines (for transferring film onto television) has opened up a lucrative market for the film transport manufacturer.

All television stations need to show film since it is still a universally accepted method of selling and interchanging programme material. Unlike video tape with its varying standards, film has universally accepted standards, both of picture and sound. A television station may not have a dubbing theatre but it will need at least one telecine machine to show film, and probably a magnetic film

transport to play off sound tracks. Thus, as telecine machines have developed, so have magnetic film transports—or sound followers, and both product manufacturers have needed to keep in step.

To maintain synchronisation between separate picture and sound films it is necessary to have a reliable system of interlock. The basic principles date back to the earliest talking pictures where a three phase ac generator was used to drive all the dubbing equipment. As the generator was driven up to speed, it fed ac to the synchronous motors of the transports thus running them up to speed together (interlock). Dubs were rehearsed and then shot onto the optical recorder (a film camera that records optical sound tracks) and there could be no mistakes since lengths of up to 1000ft (10 minutes) were recorded in one go.

This system was later adapted to allow the equipment to be run backwards and forwards in interlock for which it was necessary to add switching to the slave motors to command them to change direction. It was now possible to 'rock and roll' difficult sections before the final take. With the introduction of magnetic recording, the 'rock and roll' system could be fully exploited and using the silent insert record switch, sections could be rehearsed and recorded scene by scene.

The upsurge of television production in the late fifties resulted in the need for more film sound transports while the demand for film sound equipment for cinema use declined. Complex interlock systems were marketed as mains-driven interlock generators were not entirely suitable for television. Now film transports followed their respective telecine machine rather than being driven by a central generator. Thus the term sound follower came into use. Here the shaft of the telecine machine (usually 1500rpm) was fitted with a miniature low voltage generator which feeds the sound follower's drive motor. These generators deliver a 5V TTL square wave with direction sensing information which is the current standard interlock system. High speed and instantaneous start are the latest facilities to be offered by the telecine manufacturer and film transports follow and sometimes lead these developments. The British Rank Cintel Mk111 telecine runs at up to 10x normal speed, and modern film dubbing equipment offers all the facilities that are found in telecine and VTR areas. Not only do they have instantaneous start and high speed interlock spooling, but they may also have logic controlled pinchwheel drives, programmer facilities, and interlock speeds of up to 30 times. But it must be pointed out that the latest research into film transports is geared to sound follower use rather than the limited dubbing market.

FIG. 1 TIGHT LOOP DRIVE SYSTEM WITH FILM HELD IN CONTACT WITH SPROCKET AT TWO POINTS

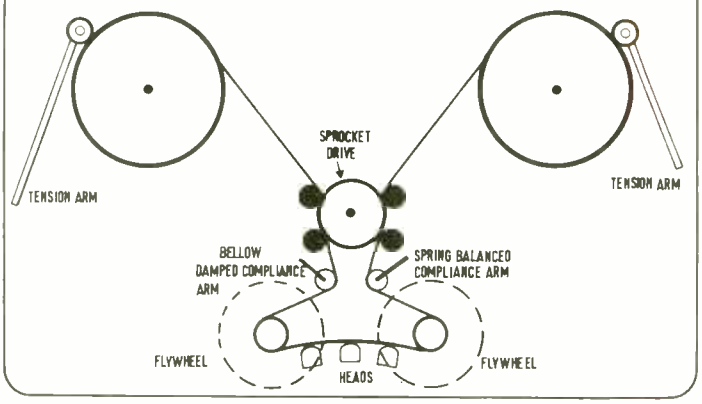
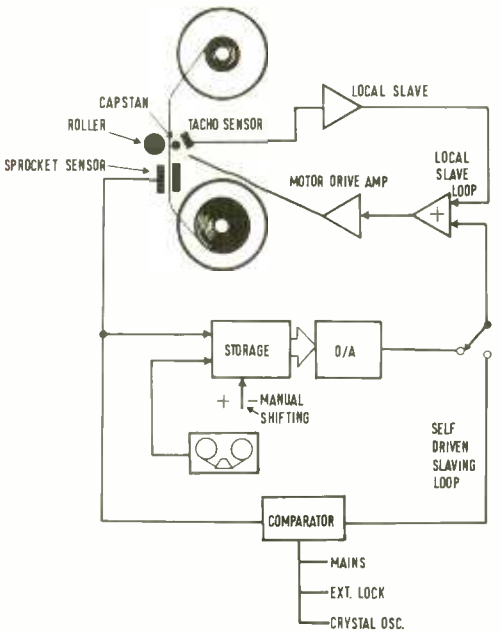
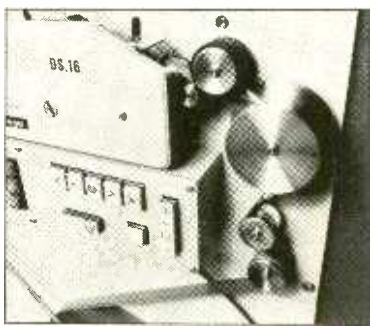


FIG. 2 ENERTEC CAPSTAN DRIVE SCHEMATIC



Right, Enertec DS16 film transport with capstan and pinch wheel rather than a sprocketed wheel



Title photo, Dubbing theatre at Anglia Television with Neve console, EMT record deck, ITC cart machines and Ferrograph tape recorder

One of the major drawbacks to the design of any film recorder is the problems caused by the sprockets which are, of course, the most proven audio synchronising system. If a film is transported by its sprockets, it is necessary to introduce certain mechanical filters to reduce speed variations. The usual film drive is via a tight loop system (**fig 1**), which requires sprung compliance arms to maintain tension over the heads, with flywheels and dashpots to reduce wow and flutter. Every effort is needed to reduce sprocket modulation—the flutter caused by the sprockets engaging or leaving the sprocket teeth. If the system is driven by a stepping motor (Sondor *OMA3*), further damping will be required to reduce the inherent pulses of the motor. One recent design from Westrex has eliminated the need for any type of mechanical filtering since it uses timebase compensating circuitry for electronic wow and flutter suppression which incidentally gives remarkably short run-up times to and from high speed. Each transports manufacturer has over the years developed its own particular drive system, these obviously being expensive to research and produce, particularly considering the cost of high quality fine tolerance sprocket manufacture and the precision required in the damping mechanisms. Despite this, figures as low as 0.04% weighted rms wow and flutter can be obtained at speeds of 25 frames/s (7½in/s). But it should be noted that most of the tight loop designs on the market are over 10 years old. They are of high versatility and have been adapted to higher speed usage, but have limited development potential left. It will only be a matter of time before sprocket-driven machines give way to capstan drive.

To transport film entirely successfully at speed must mean eliminating the sprocket feed or drive from the transport. Sound tracks used in dubbing must, by definition, consist of many splices of film, and one poorly-made join could, on entering a sprocket wheel and contact shoe at 30x (225in/s) destroy a large section of a sound track, despite careful guiding to the entry point by rollers. The elimination of the sprocket on modern telecine machines points the way, **fig 2.** At present only two capstan drive pinchwheel machines are available on the market, the Sondor *Libra* and the Enertec *DS16*, while two capstan designs without pinch wheels are also made, the Picot *2000* and the Enertec *DPS1635*. All but the Sondor operate with drive systems similar to the new generation of telecine machines they partner. These machines are driven by a capstan control system that resolves to the speed of a free running sprocket against a reference signal and hence adjusts the capstan motor drive. The reference signal can be an interlock generated signal, mains, or an internal quartz crystal. Since dubbing machines and telecine followers are operated only with continuous film on spools, the capstan pinch wheel can be eliminated, which allows even better film handling. As these machines are not used for editing, the lack of a pinch wheel is no disadvantage. There are, however, certain disadvantages in using sprocketless drives. To maintain head contact with the inflexible film in the capstan drive it is

42 ▶

necessary to have strong back tension on spools. In the tight loop system, this tension is restricted to the length of the film passing through the tight loop. A break, if it occurs in the tight loop system, will not mean a loss of sync since the film is physically held in the sprocket drive, at two points. But a capstan drive machine, however, will probably lose sync on a break, the film running uncontrolled over the frame - counting sprocket — which will continue to turn through momentum. Fortunately, film breaks are rare and high speed interlock rewind will reduce the delay caused by re-syncing at the start.

Undoubtedly the major advantage of the capstan drive machine is its ability to handle film at speed and to reach speed quickly with no possible film damage. To operate at high speed and maintain synchronisation with perfect accuracy, it has been necessary to store frame-counting digitally (Rapimag, Picot, Enertec, Albrecht) on both capstan and sprocket-driven machines so that the film transport does not have to follow the master frame by frame, but follows as closely as its own run-up and run-down times will allow. The remaining frames are stored and added or subtracted as speed is reached. These additions or subtractions have to take place with as little change in speed stability as possible. Here a mechanical analogy with the stabilising dash pots and arm compliance of the tight loop system can be drawn. Most machines with digital stores reach speed, stabilise wow and flutter and clear the store, all within the same time as movement ceases in the tight loop damping system. This should happen even from high to normal speed in two or three seconds.

The use of frame storage allows interlock with any type of sound or video transport. Manufacturers hope that this might open the video tape recorder market to them. The quality of sound from video tape recorders is not entirely suitable for multiple copying since the recording tape is orientated for video rather than audio use. Sound followers have been coupled to VTR's by decoding the timecode from the video tape and using this to drive the sprocket of the film transport (it is not necessary to timecode the film). This gives audio flexibility and reduces the need to couple VTR's for sound processing.

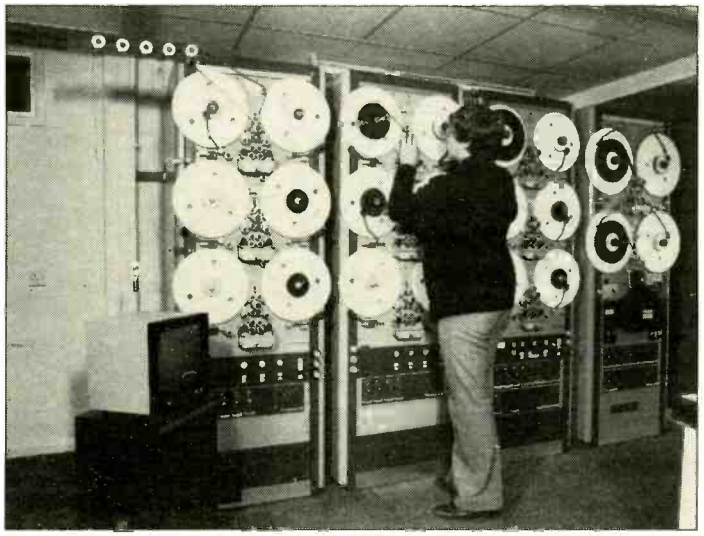
The most popular transport in use in British TV dubbing theatres today is the *Transultra* produced by Perfectone. This machine runs at up to four times normal speed so it is not suitable for high-speed telecine coupling. When designed in the late sixties, it was a general-purpose machine with the unusual option available as a location recorder, but it is now primarily a dubbing machine with restricted speed.

Sondor of Switzerland have recently added a machine designed particularly for dubbing to their range, the *Libra*, which is of flat bed design but can be used in normal rack mounting. It uses a unique capstan *and* sprocket drive transport. A sensor arm is placed between the two drives which adjusts the speed of the capstan motor to follow the sprocket. Drive is synchronous but of very low torque.

One further consideration that must be taken into account when examining film transports for dubbing is their ability to run loops. Sound effects in dubbing theatres are often kept on loops of magnetic film and since these possess no tension from being wound on spools, it is difficult to run loops on capstan machines which require back tension for head contact. However, the increasing use of cartridges in effects libraries has reduced the requirements for loops.

The flatbed machine has found particular favour in transfer areas where it has operational compatibility when used next to a standard flatbed ¼in tape recorder. One of the more unusual transfer machines available is the Stellavox *TD88* which will run both ¼in tape and 16mm film. Two of these machines would allow the ultimate in transfer flexibility. Enertec also produce a 16mm flatbed machine which is an adaption of their ¼in tape deck. This capstan drive recorder does not count sprockets with a sprocket roller, but with a photo-electric device and may only be used successfully with uncut opaque film—any clear film will upset the photo-cell count.

Until a few years ago only two recording configurations were available for transfer on 16mm film. Recent EBU deliberations have produced a new three-track format with two equal size tracks for audio and a third for timecode, **fig 3.**



Perfectone Transultra transports at Harlech Television in Bristol, with right hand unit including a video scanner to provide a television picture (rather than a projector). The pulleys on the left allow film loops to be run.

FIG. 3 16mm MAGNETIC FILM TRACKS

It has become practice in some organisations to transfer mono material onto both tracks. In the editing stage only one is played off, the other remaining untouched and when the film is dubbed, the editing track is disregarded. A substantial improvement on roughly-handled tracks is claimed. If timecode is used on location, it too will be transferred with the audio tracks. Since it carries the exact time that both picture and sound were recorded, it allows the separate sound and picture to be automatically linked up in editing. This eliminates the need to sync up by hand, or the use of visual and aural identification marks (the clapper board) on location. By the time the edited timecode material reaches the dubbing theatre, the sprockets will have become the synchronising system while timecode remains as an ultimate check. It has incidentally been claimed that timecoding saves up to 50% of production time by simplifying location and editing work but it has not found wide acceptance.

For this discussion we can draw up a list of requirements that are unique to modern sprocketed film transports.

The machines must be capable of: 1) easy viewing of the heads to allow lining up for the start marks (within one frame of sync). 2) inching of the film to allow the above. 3) high speed interlock operation with no loss of sync (to at least $\frac{1}{25}$s) particularly when shut down for a long stop period. 4) not stretching film when standing in a ready position. 5) passing poor joins and badly handled film, especially at high speed. 6) Immediate stabilisation to speed from standstill or fast speed interlock. 7) not losing sync on film breakage. 8) running loops. 9) running thick polyester stock (in current use) and acetate stock (now going out of usage). 10) withdrawing heads to reduce headwear (a particular problem with thick stock at high speed). 11) recording and replaying EBU track configurations (with the option of timecode). 12) movement independent of other transports with memory (operated from a remote position). This requires individual motors on each transport and can be of considerable cost. 13) recording standards, at present in excess of, at 25 frames/s (7½in/s), wow and flutter 0.06%, frequency response 40Hz to 15kHz, +1.5 −2.5dB, noise to −55dB peak weighted.

Projectors

One other piece of equipment is essential in the dubbing theatre—the projector. Various methods can be used to project film for dubbing; optical viewing and close-circuit television viewing are often both available from one machine. Pictures can be projected by a mechanically induced intermittent movement on the film or by a series of prisms or mirrors which appear to halt the image but use a continually-moving piece of film. In the dubbing theatre the mechanical intermittent method of projection is not particularly successful. Great strain is placed on film if it is moved backwards and forwards intermittently in a projector. This means speed has to be severely restricted although image quality is unsurpassed. Films in poor condition are particularly susceptible to damage and as yet speeds of up to

44 ▶

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film dubbing

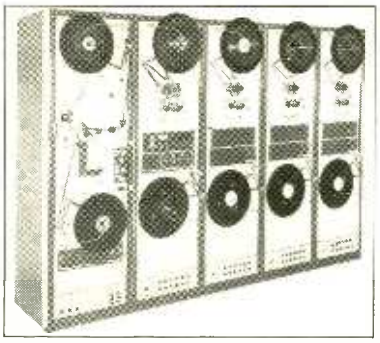
about 4x are only possible with intermittent movements.

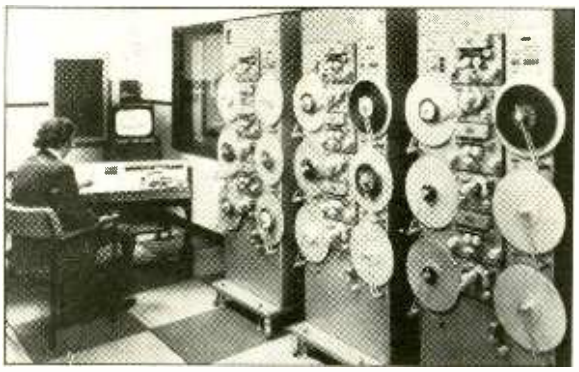
The most successful method of transporting picture for dubbing is by continuous motion, in the same manner that the sound is transported. This system lends itself to changing sound transports into projectors. It is merely necessary to place a prismatic device (called a holoscope) in the path of the film (a hollow prism with 24 facets). The pictures projected cannot be as steady or sharp as in intermittent projection, but the film will not be damaged. For TV this is particularly important, for example in the case of news and current affairs programmes where original film is transmitted. This practice is almost unknown outside broadcasting.

Recently one further continuous dubbing projector design has been marketed, the Perfectone *Comitor*. Here a series of four moving mirrors produce an intermittent picture. Mechanical restrictions mean that the picture can only be projected at up to four times speed and above this there is no image, but interlock is still maintained to 30x. The mirror system is claimed to be free from the inherent design problems of holoscopes in terms of flare, contrast, focus and evenness of illumination. But despite the image problems of the holoscope device it is an ample and completely reliable device that has no complicated mechanical moving parts. The holoscope is a useful method for a sound transport manufacturer, not wishing to become involved in projection research, to adapt his standard transport to picture use since the market for dubbing theatre projectors is small and restricted.

Dubbing projectors must possess certain additional requirements beyond that of the sound transport. They must: 1) be compatible with the sound transports in terms of fast interlock rewind speeds and interlock control system. (It should be pointed out that it is difficult to design a holoscope transport that will reach speeds in excess of 15x without film damage.) 2) not scratch or damage film even at high speed. 3) have a still frame facility with image. 4) be capable of showing an image at the highest speeds. 5) produce the sharpest, brightest, flicker-free image possible. But since these criteria cannot be met entirely, it is up to the individual to decide which machine provides the most important image characteristics.

Projectors and sound transports are specific requirements for dubbing theatres, but their operational layout will depend on the type of theatre and space available. In the television dubbing theatre load and programme requirements will determine layout. In addition to the machine room and mixing area, television film operations require a commentary area in the form of a studio or booth. It may also be necessary to have a separate room devoted to the transfer to tapes that are recorded in the field. In operations with a bigger load, a central machine room serving two or more mixing rooms might be necessary.





Left, High speed (30x) Perfectone Comitor projector with matching Rapimag transports, and Below, Albrecht transports at Thames Television

In constructing a dubbing complex, the most important area to be considered is the mixing room. It is here that the sounds will be monitored, equalised and balanced. Since it is in the living room that the final sound is to be heard, the mixing room should simulate the average viewer's television viewing room. Recent research has shown the average living room to have an average volume of between 2,000 and 2,500 cubic metres (15 x 18 x 9ft), there are little or no self-resonances caused by furniture and the reverberation time is in the region of 0.5s. The modern dubbing theatre in television will fulfil these specifications, although, of course, reverberation should be shorter (because it is additive). This is against a previous trend of designing large preview type theatres or control room type areas. It is also important to consider the listening level in the theatre.

The frequency response of the ear varies with sound intensity as Fletcher's curves demonstrate and research can help us judge the correct level to monitor at. The average living room's TV listening level is determined by the ambient background noise and the maximum noise socially acceptable. Most people live in large cities where traffic determines the ambient noise (40 to 50dB) and consideration of the neighbours fixes how loud the TV set can be. The possible range that can be heard from the set in a living room is between 35 and 40dB, thus this is the limit to recording range, with a maximum monitoring level of 70dB.

In constructing a dubbing complex it is necessary to first consider where to position the dubbing mixing room and this will determine the size of the remaining areas. Obviously the machine room will need sufficient space to carry projector and sound transports. If the machines are grouped two or three in a rack, less space is needed than if standard one machine per rack configurations are used. In a traditional theatre a projector rather than a closed circuit television system is used, and here the machine room will need to be adjacent to the theatre. The remaining adjacent area is then available for a studio and, if space allows, a transfer area. The size of the studio will be determined by the commitment and if only voice overs are recorded, a booth may be all that is necessary, although satisfactory acoustic treatment of a small booth is difficult and if loops, effects and music are recorded, a studio will be needed.

Closed circuit television allows the studio, machine room and mixing room to be independent while the transfer area does not have to be situated locally. Most modern projectors have outlets for CCTV monitors while projection takes place. The requirements for mixing desks for dubbing are very dependent on the type of use they will be put to. However, certain criteria have always been considered important: ease of operation, accessibility and flexibility. Every control must be quickly and easily available. It may be necessary to change equalisation or effects during a shot and instantaneously return to it. It is unusual to leave set-ups unchanged for long periods. Unfortunately the accepted desk layout does not follow broadcast or record practice and customised desks are often constructed.

Two recent dubbing desks show some common features. The larger desk is for TV feature use while the other is for general purpose use in a regional television station. Both have the equalisation immediately above the faders with switching above this. Both have the output groups placed out of the way. Module size is as large as space will allow. Control panels are immediately to the right. Meters are directly in line with the mixer's eye to the screen. Two main meters are provided, a send to the recorder and a return from the recorder. Full jacking facilities are immediately to hand. Both desks allow two-man operation, with a maximum of ten faders per operator. The smaller desk has facilities for cart and gram operation from its submixer (which would be separate in the larger installation). This is particularly useful for hastily prepared news or current affairs programmes where often the editor will not have time to lay the necessary tracks and these must be layed in 'live' and possibly recorded onto a spare track for future use. The larger desk has the facility to record on six tracks, the smaller on four (three or two twin-track machines in interlock)—obviously multitrack recording allows greater flexibility. Final mixes can be divided down into music, dialogue and effects ready to remix for foreign versions and this facility extended for recording various commentary tracks, post sync dialogue tracks and rehearsals of final mixes. It can help to eliminate the need for computer mixing, for mixes can be stored on spare tracks allowing the correct take to be chosen later. The spare track on the final can also be used for carrying verbal information such as caption cues if these are to be added electronically rather than in the processing laboratory. Twin track allows stereo operation at a later date.

To assist the mixer in correctly taking track cues, large character footage or time counters are usually provided under the screen, with auxiliary displays provided in the desk—the counters can be switched to stopwatch use if necessary.

Another cue device commonly in use is the pre-read display. As the modulation on the track reaches a pre-read head ahead on the sound transport, a series of lights under the screen are triggered that count down the arrival of the modulation to the replay head.

Automation of the dubbing process can be easily controlled using film which does not necessarily need to be timecoded for programmed operation. Indeed, there have been some problems using the 16mm EBU timecode system on its designated track and it has been found that in rough studio conditions, the code is difficult to record and successfully reproduce. Sprocket holes, however, provide a cheap and accurate form of coding for automatic operation.

This has found particular application in the dubbing of foreign films. Once loops of film were made of the lines to be re-recorded in another language and the actor matched the new dialogue to the continually looping mouth movements of the picture—when re-voiced dialogue and picture matched the take was recorded. 'Automatic looping' by continuous shuttling between two points to be dubbed saved the laborious cutting of loops. Unfortunately, efficiency is so great that some independent theatres are resisting change with the reduction in income it brings! Dubbing is not commonly practised in British and American television stations: the major international output of programme material is in English, and the traditions of dubbing (re-voicing) tend to be found in non-English speaking countries.

What functions can one expect present programmers to perform? Most commercially available units will perform looping and automatic insert. Additional facilities available include: 1) inching each machine individually from the desk with memory. 2) moving tracks for any distance within their length, and the ability to dub in this interlock with automatic return. 3) automatic return to the last stop point with insert record if required, the record insert to activate at correct speed. 4) automatic start and stopping of a number of carts, grams, tapes, etc. 5) automatic changing from one fader to another and cutting of faders. (These last three functions could be available from a keyboard or by an automatic address activated at a still frame cue after a visual search.) 6) security anti-run off, stopping film running off the end of reels in high-speed mode.

Having considered the various aspects of a modern film dubbing complex, let us now consider the size of the installation. There is a certain minimum level of sound transports that are required for any system. Projectors, mixing desks and control systems are, of course, essential. At present modern television installations in Britain are generally being equipped with at least eight machines, but this number is obviously dependent on commitment. If a transfer operation is being continuously used this will reduce the number of machines available for interlock mixing. For complete flexibility the transfer area needs to be able to transfer 16mm to 16mm as well as 16mm to ¼in. Cost may dictate that these machines are used in interlock for dubbing when required, but cost may not be the only consideration in determining the type of machines purchased. In a confined space, three transports in a rack may be all that can be housed, meaning that machines cannot have separate motoring for each transport—this brings restrictions on programmer operations.

The cost of machines varies considerably and most manufacturers give discounts on large purchases. Generally speaking a twin-track reproducer will cost between £6,000 and £10,000, and a recorder between £7,000 and £12,000—the cheaper models are sold in multiples in a bay. At present capstan drive (store) machines fall in the middle range, but these are mostly one to a bay. Price does not seem particularly dependent on fast rewind interlock speed. The time saved between running in interlock at 30x and 10 is minimal—especially if one considers the run-up times and short roll back distances. For example, a fast run-up 10x system will be far quicker in operation than a 30x system with a run-up five times slower. The 30x high speed interlock is a step forward, but it is really aimed at other markets.

The equipping of a film complex is expensive especially if there is any uncertainty to the future of film. To give full flexibility in the future, some manufacturers provide reproducers fully pre-wired, complete with switching to turn into recorders. It is merely necessary to add record amplifiers and head blocks. Programmers are now being supplied with VTR interlock as standard. Thus a modern twin-track, eight-machine film dubbing theatre is capable of 16-track recording with video tape recorder interlock. It may have additional programmer facilities and instantaneous track shift.

It will be interesting to see if these facilities are taken up in the next few years. ■

business

ADRIAN HOPE

Music trade bodies

IT IS presumably safe to assume that everyone involved in *legitimate* record production abhors piracy, bootlegging and counterfeiting because all these are parasitic activities which feed off someone else's hard work and investment. (If you're in this kind of business for profit, please do everyone else a favour and shoot yourself.) What the industry needs most of all in its fight against parasites is sympathy from the retail trade, press and public, but after several years of trying to deal with the three record industry trade bodies which are most concerned with such problems (the BPI, MCPS and IFPI), I am frankly not surprised that there is so little sympathy going spare. Not to put too fine a point on it, dealing with these bodies is rather like swimming through treacle. And the unexplained about-turns of policy would do credit to a politician. For example, the BPI is apparently at long last abandoning the expensive wild goose chase for a spoiler system which somehow magically prevents anyone from making an illegal tape copy. But the BPI's decision to stop financing spoiler research work at Southampton University was announced by BPI Director General John Deacon just four months after he had 'strenuously denied' suggestions that research was being abandoned. 'International research has proved that this is a possibility' and 'there is obviously no question of us abandoning the search' continued a report in the music press.

With spoilers now apparently acknowledged as a dead duck, the BPI is pushing for a tax or levy on blank cassettes. Clearly, to cover the cost of administration and show a profit, the tax will have to be heavy. Some people believe that the levy hoped for will bring the price of a cassette up to the price of a gramophone record. The BPI now says this idea is 'quite ridiculous'. But why can the BPI point to no similar denial when the *Guardian* last year published a similar suggestion? Perhaps the sudden denial is not entirely unconnected with the recent moves by the European Tape Industry Association who are now starting to lobby against the tape levy. Incidentally, this has meant crunch time for EMI, who make both tapes and discs. The latest news is that EMI is siding with the BPI and will quit the ETIA.

The idea of a levy raises all manner of other questions, all so far unanswered by those advocating its implementation. For starters, what will happen about blank tapes sold for legitimate purposes, for instance for talking books for the blind? And how will the levy profits be distributed? Will they go to boost the income of artists like Paul McCartney who are already somewhat successful? Or will they somehow be donated to lesser known artists who have been unable to record because of industry cut-backs but might have been successful if only they had been able to record?

The MCPS has a mandate from the BPI to sell licences which authorise home taping. These cost £1.50 plus VAT and although there is, of course, no way of compelling home tapers to buy these around 10,000 honest people do so, the resulting proceeds of which, in theory at least, are split 50:50 between music publishers and record companies. But now there have been undenied reports of plans to raise the licence fee to nearer £10. This seems calculated to deter even those honest people from volunteering to buy them. And if the BPI levy scheme goes through, will MCPS licence holders still have to pay the tax on blank tape?

I've honestly never been quite sure where the IFPI fits into all this. But a year or so ago they appointed John Hall QC as director of anti-piracy operations, so I wrote to him. In fact I wrote several times and the last I heard was in July 1979 when he promised to 'get in touch . . . to arrange a meeting later'. I'm still waiting. And I only ever received an acknowledgement to a similar letter sent to Gerry Oord who was also reported to have taken up an anti-piracy post with the IFPI.

Meanwhile from the MCPS I am still waiting in vain for some kind of clarification over what exactly the home taping licence authorises those honest people to do. In an almost incomprehensible guide to the legality of taping, the MCPS contradicts the working of its own licence in a crucial respect. Whereas the licence authorises the public to copy a *borrowed* record, the guide suggests that licence holders are only able to tape their own record collection.

As you will by now gather, I am the proud possessor of a file full of copy letters sent to the BPI *et al* which dates back to the spoiler saga and comes right up to date with a whole range of questions, for instance on the proposed levy. I was not therefore enamoured to see recently, on the front page of a music paper, the bald statement that the BPI 'was not approached for information' on an article which I had written about the industry. But by a happy coincidence I was already due that week to meet John Deacon, along with BPI PR man Richard Robson and BPI manager Peter Scaping. Outnumbered three-to-one and on my guard after reading that I had 'not approached' the BPI for information, I asked to discuss the little matter of the large backlog of unanswered questions with the witness of a tape recorder. To cut a long story short all three BPI spokesmen flatly refused to speak on the subject while the tape was running. So I'll make an offer through the pages of *Studio Sound*. If the executives of any record companies which are contributing members of the BPI are interested in an insight into what it is like for a journalist to try and seek information from the BPI, I'll make available to them copies of all the correspondence. And if they wish I'll throw in an unedited copy of the BPI's taped refusal to discuss the matter in front of a tape recorder.

Sooner or later the record industry and its trade bodies, of which there seem to be an uncommon number, are going to have to face up to a hard fact of reality. For years they've had it easy. Sycophants in the music press have been ready and willing to regurgitate the industry's proclamations and wails, virtually verbatim and without criticism or question. But in this respect the industry's publicity machine is a victim of its own success. These proclamations and wails have now been so widely publicised that they have stimulated awkward questions from the less gullible. And if one thing in this world is certain it is that awkward questions from less gullible people cannot be made to disappear simply by ignoring them. The sooner the industry's spokesmen wake up to this fact the better for the industry as a whole. The time has now passed when the record industry could think of talking to the trade, press and public as doing them a favour.

TV on Radio

IT'S NICE to see video and TV being taken seriously by BBC Sound Radio. At Bush House, from whence the BBC external services originate, and wherein there is a gaggle of broadcasters working in 38 different language sections, they have now installed a massive video distribution centre for current affair and news stories. News items are written into a computer system from any of 64 video terminals dotted around Bush House and stored on magnetic discs. The stored stories can be called up by a journalist using any of 137 display screens available in the building. In other words, wherever you are in Bush House, you can refer to all the available news stories from the moment they are typed into the central computer. It used to take up to two hours to distribute typescript stories by messenger. It isn't widely recognised that it was Radio London who pioneered the use of video in BBC radio. The station was loaned a simple computer system into which information can be typed to appear on a remote display. Radio London put the computer alongside the switchboard operator handling incoming calls for phone-in programmes and put the remote display unit in the studio in front of the broadcaster talking to the callers on the air. So the broadcaster's screen can carry a continually updated list of callers who have phoned in. It displays information such as their names, what they want to talk about and what line they are on.

Most radio stations, for instance Radio London's closest rival LBC, must rely on little scraps of paper carried backwards and forwards by messenger from the phone-in switchboard operator. Ironically Radio London only got their hands on the computer in the first place because another BBC department had it lying around and couldn't think of a use for it. "Here play with this," they told Radio London, who did more than play with it; they came up with an idea which must surely very soon become standard in all radio stations that handle phone-ins. ■

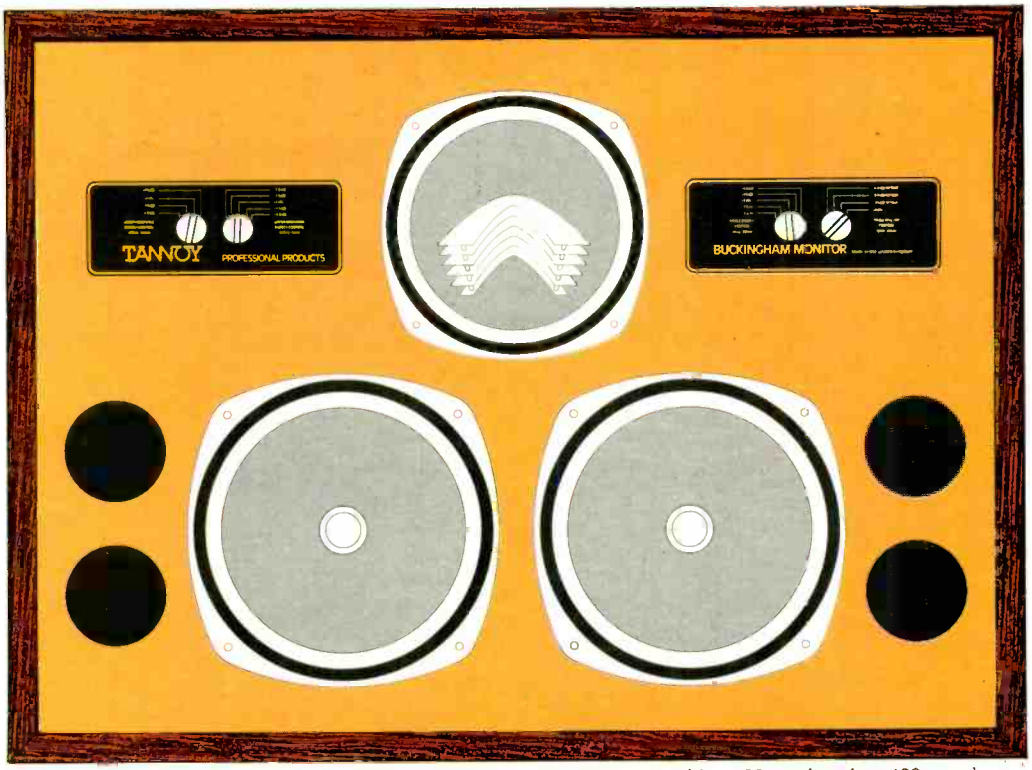
Our back room boys are out in front.

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

Survey: handheld sound level meters

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.

2215
Type: precision sound level meter and octave analyser.
Conforms with IEC, DIN and ANSI standards, linear, A and C weighting, 10-octave filters from 31.5Hz to 16kHz, built-in microphone, dynamic range from 26 to 140dBA, meter indicates true rms, on a 30dB linear scale, overload warning, scales displayed in meter face, linear 60dB output for recorder.
Price: £1,314.

2206
Type: precision sound level meter.
Conforms with IEC, DIN and ANSI standards, linear, A and C weighting, built-in microphone, frequency range from 20Hz to 18kHz, dynamic range from 39 to 135dBA, indication of attenuator setting in meter scale.
Price: £660.

2219
Type: sound level meter.
Conforms with lower IEC, DIN and ANSI standards, A-weighting, frequency range from 5Hz to 12.5kHz, dynamic range from 35 to 130dBA, indication of attenuator setting in meter scale.
Price: £285.

2210
Type: impulse precision sound level meter.
Conforms to consolidated revision of IEC 123 and 179, and provides digital readout of sound level with the detector featuring standardised impulse fast, slow and peak modes. AGC provides 90dBA dynamic range, frequency range 20Hz to 20kHz. A, B, C and D-weighting built in, accepts ½in microphones directly, others via adaptors.
Price: £2,970.

2218
Type: precision integrating sound level meter.
Provides digital readout of L eq and a precision sound level meter with analogue readout. Measures single event noise exposure level, while the sound level meter meets IEC, DIN and ANSI standards, with rms detector, impulse, fast, slow and peak responses, measuring range 25 to 145dB, 50dB linearly-scaled meter, linear or A weighting.
Price: £1,659.

2225
Type: integrating sound level meter.
Miniature instrument measuring L eq for a fixed period of 60s and peak with a 30µs rise time. 25dBA to 140dBA in four ranges, LED column display with 0.5dB resolution, built-in mic.
Price: on application.

B & K 2215

DOHM (UK)

Dohm London Ltd, Dohm House, 130 Gipsy Hill London SE19 1PL.
Phone: 01-670 5883. Telex: 261588.

Noise Level Indicator
Type: simple noise level meter.
Measures sound level using A-weighting, provides meter readout with 40 to 120dBA scale, battery operated.
Price: £69.

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.

1933
Type: precision sound level meter and analyser.
Measures impulse sound, sound level and octave band analyser, measures true rms volts, with impact (true peak) facility, flat, A, B and C-weighting, response 5Hz to 100kHz, fast and slow meter functions, meter has 20dB linear scale with actual attenuator setting shown as meter scale, two microphone sensitivity presets, one supplied ½in measuring mic, numerous accessories.
Price: about £2,500.

1982
Type: precision sound level meter and analyser.
Basically similar to the *1933*, but provides both analogue meter (with 50dB scale) and four-digit display, four ranges.
Price: about £1,500.

1981-B
Type: precision sound level meter.
Basically similar to *1982*, but only two ranges.
Price: £915.

1565-B
Type: sound level meter.
Very compact sound level meter and analogue display, measures from 40 to 140dB, meter scaling non-linear, fast or slow response, A, B or C-weighting, built-in rugged ceramic microphone.
Price: £320.

1565-D
Type: sound level meter.
Similar to *1565-B*, but range from 30 to 130dB.
Price: £320.

1983
Type: sound level meter.
Basic sound level meter, A-weighted, single range from 70 to 120dBA, internal adjustment for slow or fast response, built-in ceramic microphone, linear scale.
Price: £422.

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, Borehamwood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

IE-30A
Type: ⅓-octave realtime spectrum analyser using LED matrix display, and precision sound level meter. While this product is primarily a realtime spectrum analyser, it also includes digital readout of precision sound level with 0.1dB resolution of dB spl and dBV, digital hold, fast or slow response, impulse and peak reading, A, C and flat weightings, supplied with measuring microphone.
Price: £2,263.

LEM (France)

LEM, F-92320 Chatillon, France.
Phone: (1) 253.77.60. Telex: 680461.

Sonometre Digital P1443
Type: sound level meter using LED display.
Provides sound level measurement using LED step display with ranges of 34 to 84dB and 64 to 114dB, built-in microphone, A-weighting.
Price: on application. ■

Hot off the drawing board

SERIES 80

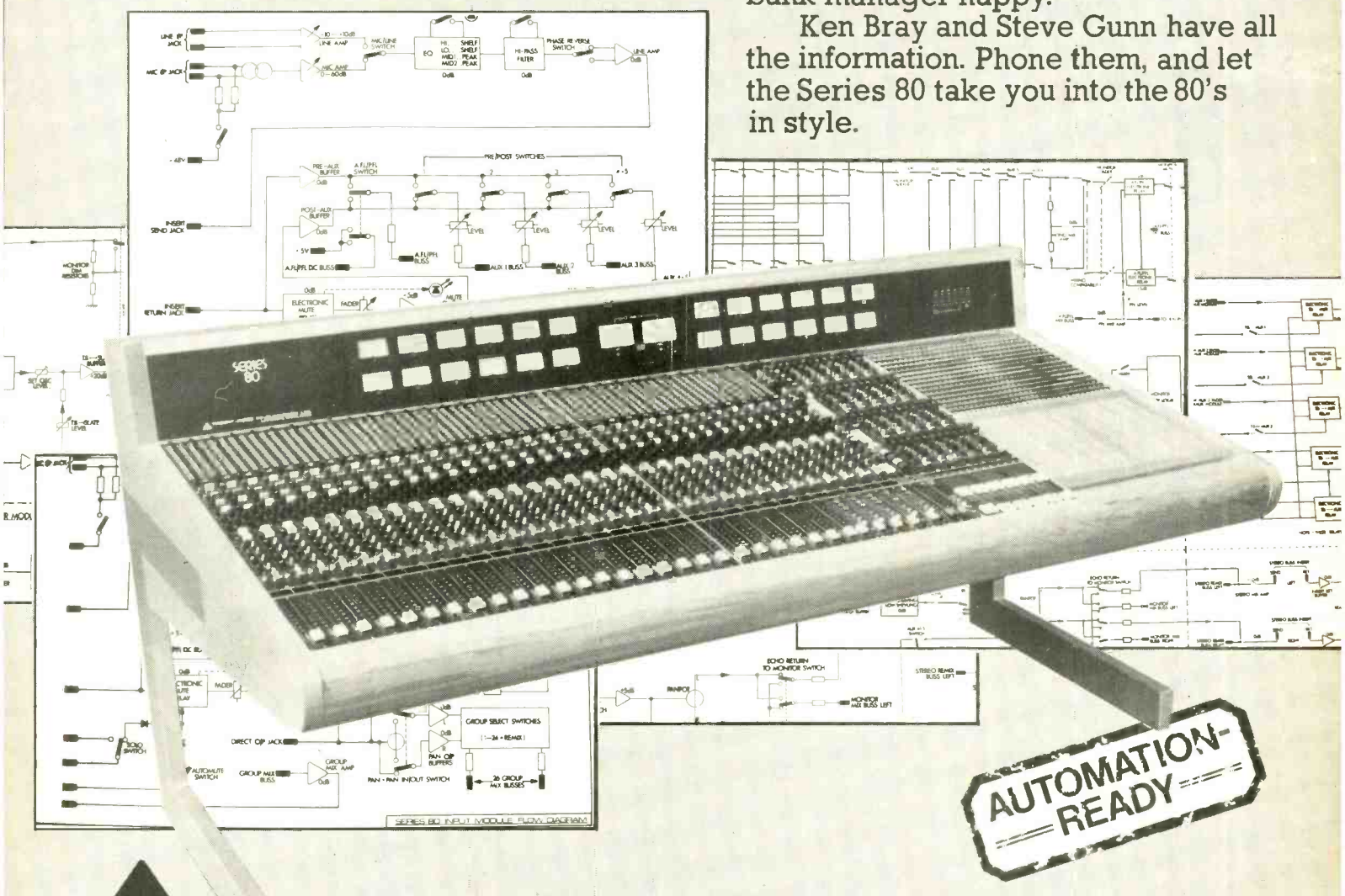
Trident's new console that has designs on all 16 and 24-track studios.

At last — the mixing console specially developed for 16 and 24-track studios, bearing the Trident stamp of quality and expertise.

This latest addition to Trident's range of mixers spans the area between the superb TSM consoles and the adaptable Fleximix system — taking the TSM's facilities and tailoring them to a surprisingly compact 16 or 24-track format.

But the best surprise of all is its competitive price: £17-22,000 (depending on format), so now you'll be able to keep both your studio engineer and bank manager happy.

Ken Bray and Steve Gunn have all the information. Phone them, and let the Series 80 take you into the 80's in style.



TRIDENT

Trident Audio Developments Limited
Shepperton Studio Centre, Squires Bridge Road, Shepperton, Middlesex, England.
Telephone: Chertsey (09328) 60241 Telex: 8813982

America Area 1 Studio Maintenance Services, California Tel: 213-877-3311 **America Area 2** Empirical Audio, New York Tel: 914-762-3089 **America Area 3** Phil Reddish Stereo Inc., Ohio. Tel: 216-885-1222 **America Area 4** Wilson Audio Sales, Tennessee. Tel: 615-794-0155 **America Area 5** Harris Audio Systems Inc. Florida. Tel 305-944-4448 **Australia** John Barry Group, Sydney. Tel: 61-2-439-6955 **Belgium** Naybies, Brussels. Tel 32-2-734-31-38 **Canada** Radio Services Inc., Montreal. Tel: 514-342-2511 **Finland** Intro OY, Helsinki. Tel: 90-742-133 **France** Lazare Electronics, Paris Tel 33-1-878-62-10 **Italy** Audio Products International, Milan. Tel: 392-27-29-51 **Japan** Nissho Electronics Corporation, Tokyo. Tel. 03-544-8400 **New Zealand** Mandrill Recording Studios, Auckland Tel: 793222 **Norway** Protechnic AS, Oslo. Tel 02-46-05-54 **South Africa** Leephy (Pty) Ltd., Johannesburg. Tel: 27-11-48-3821 **Spain** Neotechnica S A E., Madrid. Tel: 34-1-242-09-00 **Sweden** Stage & Studio KB, Kungalv. Tel 0303-503 48

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

Survey: test discs

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.

QR2009
Stereophonic gliding frequency records, 12in 45rpm, programme consisting of frequency sweeps from 20Hz to 20kHz, with 16 bands divided into groups of four with left, right, left + right, left — right.
Price: £60 for five, £14 each.

QR2010
Stereo test records, 12in 33rpm, programme including 15 different bands with signals for measurement of frequency response (20Hz to 45kHz), tracking, wow and flutter, polarity, crosstalk, rumble and arm resonances.
Price: £60 for five, £14 each.

QR2011
Pink noise test record, 12in 33rpm, for listening room investigations, programme consists of $\frac{1}{3}$–octave filtered pink noise.
Price: £60 for five, £14 each.

CBS (USA)

CBS Technology Center, 227 High Ridge Road, Stamford, Conn 06905, USA.
Phone: (203) 327-2000.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1.
Phone: 01–580 4314.

STR 151
Broadcast test record to RIAA standard.

STR 100
Stereo frequency test record.

STR 101
Seven steps to better listening; lining up record for domestic equipment.

STR 112
Squarewave, tracking and intermodulation test record.

STR 120
Extended frequency test record; 10 to 500Hz, 500 to 50kHz glide tones

STR 130
RIAA frequency response test record for calibration of professional replay equipment.

STR 140
Pink noise tests for acoustical testing of systems and loudspeakers and for psychoacoustic tests of reproduction equipment.

STR 170
This record employs a 3180μs equalisation characteristic with constant amplitude recording below 500Hz and constant velocity above this point.

SQT 1100
Quadraphonic test record for calibration, verification and adjustment of SQ replay systems.

DGG (West Germany)

Beuth-Vertreib GmbH, 1000 Berlin 30, Burggrafenstrasse 7, Germany. Also **5000 Koln, Friesenplatz 16, Germany.**
UK: Lennard Developments Ltd, 206 Chase Side, Enfield, Middlesex EN2 0QX.
Phone: 01–363 8238.

Deutsche Grammophon Gesellschaft manufacture a family of test discs to calibrate replay equipment to the following DIN standards:
45541 frequency response
45542 distortion
45543 crosstalk
45544 rumble
45545 wow and flutter
Price: £6.50 each.

EMI (UK)

EMI Records Ltd, Manchester Square, London W1.
Phone: 01-486 4488.

TCS 101
A stereo frequency response disc with a recorded equalisation characteristic to British Standard 1928/1960, except that the level of frequency bands above 10kHz has been dropped by 6dB. Spot frequencies and reference tones.

TCS 102
A series of glide tones for detecting resonances.

TCS 104
As *TCS101* but in mono only (lateral modulation).

TCS 105
As *TCS104* but with vertical modulation.

These test discs are available through normal EMI record retail outlets at standard LP cost.

JVC (USA)

JVC Cutting Center Inc, RCA Bldg, Suite 500, 6363 Sunset Boulevard, Hollywood, California, 90028, USA.
UK: JVC (UK) Ltd, Eldonwall Trading Estate, Staples Corner, 6–8 Priestly Way, London NW2 7AF.
Phone: 01–450 2621.

TRS 1001
Mono disc for checking frequency response, mechanical resonances, etc.

TRS 1002
Stereo disc for checking frequency response, wow and flutter, etc.

TRS 1003
Stereo frequency response record for testing the high frequency response of CD–4 pickup cartridges.

TRS 1004
A record cut for undertaking quick checks of high frequency response, crosstalk, and phase of CD–4 cartridges. Primarily intended for checks during production.

TRS 1005
Record for high frequency response and crosstalk checks on CD–4 cartridges using level recorders such as the B & K *2305/2307*.

TRS 1007 Mk II
Stereo disc for checking frequency response, separation and crosstalk, equalised to IEC A weighted and RIAA curves.

SHURE (USA)

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204, USA.
Phone: (312) 328-9000.
UK: Shure Electronics Ltd, Eccleston Road, Maidstone ME15 6AU
Phone: 0622 59881.

TTR103
Cartridge trackability test record, requires lab instrumentation.
Price: £6.30.

TTR109
Cartridge level, channel balance and separation test record, requires lab instrumentation.
Price: £5.10.

TTR115
Audio obstacle course. Tests cartridge and arm trackability, plus resonances, phasing, etc, needs no instrumentation
Price: £3.90. ■

Survey: test tapes

AGFA (West Germany)

Agfa-Gevaert AG, Vertrieb Magnetband, D-509 Leverkusen, West Germany.
USA: Agfa-Gevaert Inc, 275 North Street, Peterborough, New Jersey 07608.
Phone: (201) 288-4100.
UK: Agfa-Gevaert Ltd, 27 Great West Road, Brentford, Middlesex TW8 9AX.
Phone: 01-560 2131.

The company manufactures a range of recording test tapes in a variety of widths and speeds to the DIN/IEC format only.

AMPEX (USA)

Ampex Corporation, Audio - Video Systems Division, 401 Broadway, Redwood City, Cal 94063, USA.
UK: Ampex Great Britain Ltd, Acre Road, Reading, Berks RG2 0QR.
Phone: 0734 85200.

The company manufactures a range of test tapes in all size formats between ¼ and 2in; these are available both in full and separate tracking. Speed standards are 30, 15, 7½ and 3¾in/s (the last speed is available only in ¼in size).

Equalisation standards are to either DIN or IEC (30in/s uses AES).

Tapes are available in three groups: reproduce alignment tapes, flutter test tapes and level set tapes.

The first group offers operating level tones at 11 spot frequencies at operating level (15 and 30in/s only). The lower speed tapes use —10dB tones at appropriately reduced frequencies. They also incorporate extended azimuth and 700Hz reference tones recorded at operating level (lower speeds —10dB).

Flutter tapes use tones of either 3000 or 3150Hz recorded at —2dB below operating level. These are guaranteed to have less than 0.03% rms unweighted wow and flutter.

Level set tapes comprise long sections of 700Hz at various standard flux levels resulting in approximately 1% total harmonic distortion.

BASF (West Germany)

BASF AG, 67 Ludwigshafen-am-Rhein, West Germany.
Phone: 0621 40081.
USA: BASF Systems Inc, Crosly Drive, Bedford, Mass 01730.
Phone: (617) 271-4000.
UK: BASF United Kingdom Ltd, Haddon House, 2-4 Fitzroy Street, London W1P 5AD.
Phone: 01-637 8971. Telex: 28649.

The company manufactures a range of test tapes in all size formats to the IEC/DIN specification only.

MRL (USA)

Magnetic Reference Laboratory Inc, 229 Polaris Avenue, Suite 4, Mountain View, Cal 94043, USA.
Phone: (415) 965-8187.
UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

Wide range of test tapes, each supplied with a calibration graph. Each reproducer alignment tape is recorded with the following: 1kHz at 0dB for 30s, 20s each of 500Hz, 8kHz and 16kHz at —10dB, series of frequencies 31.5, 63, 125, 250, 500Hz, 1, 2, 4, 8, 10, 12.5, 16 and 20kHz at —10dB, finally 1kHz at 0dB for 30s. Most tapes are available in ¼in, ½in, 1in and 2in widths, and at 7½, 15 and 30in/s speeds (with three tapes at 3¾in/s). The following equalisations and levels are available: NAB, IEC and AES at 200nWb/m, NAB and AES at 250nWb/m, IEC at 320nWb/m (AES at 30in/s only). In addition to standard spot frequency tapes, a range of rapid sweep tapes are produced which sweep from 500Hz to 20kHz for display on an oscilloscope using a special graticle. Only available in NAB and AES at 200nWb/m, and IEC at 320nWb/m. Finally, there is a ¼in only azimuth adjustment tape using the difference method (alternating medium frequency tones recorded with opposingly displaced azimuth offsets, so that steady level indicates aligned azimuth), multispeed use.
Prices: apart from azimuth which costs £28.76, all other types are similarly priced apart from tape width, ¼in £21.57, ½in £44.94, 1in £119.85, 2in £231.

NEAL-FERROGRAPH (UK)

North East Audio Ltd, Simonside Works, South Shields, Tyne &Wear NE34 9NX.
Phone: 0632 566321. Telex: 537227.
USA: Neal-Ferrograph (USA) Ltd, 652 Glenbrook Road, Stamford, Conn 06906.
Phone: (203) 348-1045. Telex: 643678.

Neal-Ferrograph produce a series of test tapes in ¼in format only, including 0VU (£10.20), DIN + 70μs (£40.80), quarter track alignment (£10.20), NAB/DIN and IEC/CCIR (£25.50) all at 7½in/s, IEC/CCIR/DIN at 15in/s (£25.50), IEC/CCIR/DIN at 3¾in/s (£25.50).

STL (USA)

Standard Tape Laboratory Inc, 26120 Eden Landing Road, Hayward, Cal 94545, USA.
Phone: (415) 786-3546.

Complete range of frequency alignment, pink noise, sweep, speed and flutter tapes, all available in reel-to-reel, cassette and cartridge.

WEBBER (UK)

Webber Tapes Ltd, Ipswich, UK.
UK: Trad Electronic Sales Ltd, 149b St Albans Road, Watford WD2 5BB.
Phone: 0923 47988. Telex: 262741.

Range of test with 'format and tone durations convenient and speedy for day to day machine alignment', but not specified. Three ranges: recorded to 200nWb/m level with NAB or IEC eq, or to 320nWb/m with IEC eq. All available in ¼, ½, 1 and 2in widths, variously at 7½, 15 and 30in/s depending upon range and width.
Prices: ¼in £18, ½in £32, 1in £92, 2in about £170. ■

agony

Stan Kenton used to run a big band which played long, complicated arrangements which had the trumpet section screaming in an exhausting, stratospheric register. For many years that trumpet section included a gentleman who was, well how can you say it, a very good trumpet player but rather slow in other areas. At one recording session the band was nearly at the end of an especially demanding chart. Suddenly the rather slow trumpet player started waving his arms and brought the band to a halt. "Is this F or F sharp?" he queried. "F sharp," said Stan Kenton irritably and counted the red-lipped brass section into another take. Five minutes later, with the trumpets screaming towards the coda, the same thing happened. The player again waved the band to a halt. "What the hell is it now?" demanded Stan the Man. "That sure sounds better as an F sharp," drawled a voice from the trumpet section.

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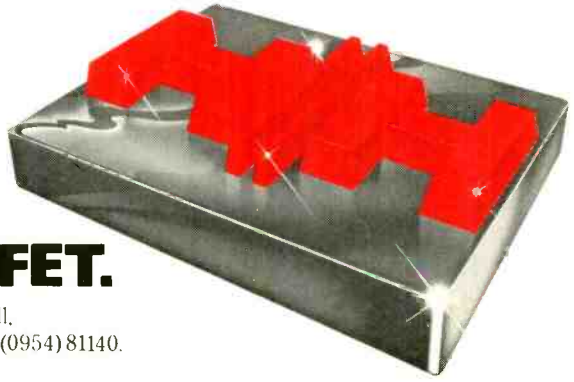

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AES 65th Convention and Sound 80, London-A Report

Angus Robertson and Noel Bell

The 65th Convention of the Audio Engineering Society took place in London, from February 22 to 28. Angus Robertson reports on the exhibition, while Noel Bell reports on the Convention.

WHILE THE AES Conventions in the United States are held each year at the same venue, the practice in Europe is for the Convention to visit different countries each year. Unfortunately, or perhaps fortunately for the AES, the Convention has grown to such a size that finding suitable venues each year is becoming rather a problem, and after suggestions that the Convention be held in Vienna and Monte Carlo (where many of us were looking forward to spending a week), the AES eventually decided to bring the Convention back to London, after an absence of four years. It is perhaps unfortunate that there are currently no suitably large Convention venues in London, and the AES felt unable to move outside London to one of the purpose-built venues, so the Convention was split between two hotels (the London Hilton and Park Lane) which were a few minutes walk (or run in the rain!) apart. Exhibitors in the Park Lane (where the sessions took place) were split between six different floors in the hotel, while only two floors of the London Hilton were occupied by exhibitors, although technical forums took place in the rooftop restaurant. The annual British Sound 80 exhibition organised by the Association of Sound and Communication Engineers was held from February 26 to 28, and a coach ran hourly between venues enabling visitors to London to take in both exhibitions.

Organisation was generally very good, despite the widely separated exhibition areas, although security was far below American standards, and a couple of exhibitors experienced problems in this area. But the organisers must be applauded for introducing that most revered institution of an exhibition, the press office (but then journalists are totally biased!), ably run by Basil Lane who provided invaluable assistance to journalists attending the Convention.

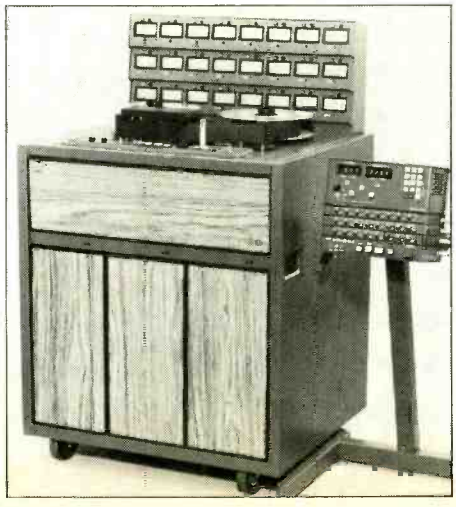
In addition to the 120-odd exhibitors and the usual technical meetings, a number of organised visits were made to the BBC, IBA, local recording studios and so on, three lunchtime recitals were given by various classical and jazz musicians, and three technical forums organised: 'Experiences in automated mixing' brought together designers of automation systems and users from London studios for a lively discussion; 'Digital recording in audio' with those involved in the use and development of digital recording (with the exception of EMI) and 'Experiences in subjective testing' included a number of researchers and technical consultants discussing an objective approach to subjective testing.

Once again, there was little new to rush to see at the exhibition, although many companies were showing new products.

Recording

One company that has not yet made its digital intentions clear is **Ampex** (although tape is produced for digital recorders), who are for the present concentrating on analogue recording and demonstrated the latest *ATR-124* multitrack and ½in stereo *ATR-100*. A convincing demonstration was held with the *ADD-1* digital disc mastering preview delay being switched in and out from the ½in stereo *ATR-100* and replayed through JBL monitors, the delay being totally inaudible. What wasn't mentioned at the Convention was that Ampex Corp is being purchased by The Signal Companies Inc for around $357m, subject to various approvals, and this acquisition should provide greater stability for Ampex whose profits are not high considering the corporation's turnover.

MCI JH-24 multitrack



In addition to the established *Proline 1000* and *2000*, **Leevers-Rich** demonstrated a logger to IBA specifications which records 4-tracks at $\frac{15}{16}$in/s with auto changeover to a second machine.

MCI introduced a new multitrack recorder, the *JH-24*, which replaces the existing *JH-16* series. Using a dc servo-controlled *JH-114* type transport equipped for spools from 6 to 14in, the *JH-24* incorporates electronics similar to those in the *JH-110B* series (reviewed in January *Studio Sound*)which provide headroom increased 10dB to 30dB (at 1kHz referenced to 250nWb/m) and frequency response increased from 20kHz to 26kHz. NAB or CCIR operation is channel selectable for both record and repro, while the audio circuitry is totally transformerless with differential inputs, outputs and head coupling, separate preamps and equalisers for repro and sync and depth of erasure (full track) of –80dB at 1kHz. Available in 8, 16 or 24-track versions, the new *JH-24* costs $18,032, $25,200 and $37,464 respectively, upgradable models also being available. The *JH-24* interfaces directly to the established *JH-45 Autolock* synchroniser and *AutoLocator III*.

56 ▶

APRS 80

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Trident Audio
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Tickets: **APRS, 23 CHESTNUT AVENUE, CHORLEYWOOD WD3 4HA ENGLAND**

AES Report

3M Digital Mastering System with editor (foreground), Martin Rex and Ron Ensminger (UK and USA digital field engineers) and John Prigmore (3M UK)

Eela Audio mixers with Bill Dyer and Franz Vann Enbergen

3M Mincom provided the first demonstrations in Europe of their *Digital Mastering System* which has been in use in America for several months. Just before the exhibition 3M announced that the first digital recorders were being installed in London at the end of the show, these being a full Mastering system for Roundhouse Studios in London,comprising a 32-track, 4-track and Digital Editor (the simple non-screen type), while Town House studios are taking delivery of a digital 4-track with disc cutting preview unit allowing both digital mastering (from analogue multitrack) and disc cutting. These three digital recorders were also the first off the full production line to final specifications, while those delivered in the States have primarily been preproduction models with many inherent problems which have now been resolved for the production line. Due to the current strength of the pound against the dollar, prices of the 3M Mincom digital products are now rather lower than shown in the January survey, being as follows: 32-track £67,000, 16-track £42,000, 4-track £20,000, 16/32 update £29,000, editor £4,500, 1.3s disc cutting delay £3,200, 1.9s delay £4,300. 3M point out that by the time one has acquired Dolby's for a pair of 16-tracks and a synchroniser, the price is becoming comparable with that of the digital 32-track.

Neal-Ferrograph produce a wide range of tape and cassette recorders for a number of applications, ranging from the top of the line *Studio 8* professional recorder which is now also available as the *Penthouse Studio 8* for broadcasters with three-position stand, console, transportable or rack-mounting versions. The lower end *SP7* is available in a multitude of versions and options including line in/out in mono or stereo in various track formats, balanced inputs, 4-channel IBA spec logging recorder, *Edit 7* replay only with easy head access for editing, and finally the consumer-oriented *Logic 7* variants.

Sony is the only company apart from 3M actually marketing digital recording products, and ironically the BBC has purchased a Sony 2-channel system rather than that of 3M (which it helped develop). Sony has published an excellent guide to the current situation in digital recording called 'Digital Audio Technology' which although presented in non-technical fashion, does include all relevant technical information for the understanding of digital recording including a comparison of 19 different digital formats variously stationary or rotary head. Sony is currently developing digital recording along three separate paths: *PCM-3200* series digital multitrack using 50.4 or 44.056kHz sampling and 16-bits for 4 to 48 channels on 2in tape using stationary heads and which should be available in Britain during 1981; the *PCM-1600* (which the BBC are using) which has a sampling rate of 40.056kHz using 16-bits providing two channels and recording on a *BVU-200A* NTSC format video cassette recorder to provide 90dB dynamic range for professional and broadcast applications; and the consumer system comprising the *PCM-100* (pro model), *PCM-10* (consumer model) and *PCM-P10* (replay only) all of which use 44.056kHz sampling and 14-bits to give 85dB dynamic range when used with NTSC format consumer video cassette recorders such as *Betamax* or *VHS*, again all models being available in Britain and meeting the new EIAJ digital specification which is also being used by Hitachi,Technics and Mitsubishi.

In addition to these recording products, Sony has the DEC-100 digital-editing controller for the *PCM-1600*-based system, the *DAD-1X* digital audio disc system providing five hours playing time on a 12in disc (but definitely not yet available), the *DRX-2000* digital reverberator, *DSX-87* digital sampling rate converter and *DQP-6040* digital quantisation processor. The latter two products indicate the problems that are beginning to arise with various standards, although most people now believe that the requirements for recording studios are markedly higher than that of broadcasters or consumer systems and so the split between 14- and 16-bit will remain—after all, BBC Radio has been using 13-bit PCM distribution systems for several years, a fact few people outside the BBC seem to appreciate.

Coming down to cassettes and cartridges, ITC were demonstrating their latest *Series 99* deck, but there was no news of the awaited triple stack *Series 99*.

Fitch Tape Mechanisms were showing (at Sound 80) the *T250* NAB cartridge player and recorder series which use indirect capstan drive, pre-lift pinch roller system, adjustable damped solenoid, and numerous other facilities ranging in price from £374 to £760.

Certainly not professional but still of interest were OEM cassette mechanisms from A Liebl GmbH being shown by **Canford Audio.** The *LW104* is a very simple and compact type for a continuous loop *Compact* cassette available with a variety of options, costing from £17.48 for the basic mechanism. *LW604* is an electronically controlled two-motor cassette mechanism with solenoid control, front or top-loading versions, optional logic control, motion sensing, counter, many other functions from £53.20 for the basic mechanism, about £80 including logic control card.

Synchronisers were demonstrated by a number of companies, including **Audio Kinetics** showing the *Q-Lock*, **Ampex** with the ECCO *MQS-100*, BTX *4500* from **Scenic Sounds Equipment,** and **Telefunken** *MTS15A-2* audio editing system.

Mixing consoles

Amek were showing examples from its range of consoles which includes the *M1000* sound reinforcement and production consoles which are compatible with modules from another company, Total Audio Concepts, which have simpler facilities for on-stage monitoring. The *M2000A/2500* series consoles are master recording types using the Allison automation system.

CA Audio Systems were showing modules from a Cadac *In-Line* console that may be provided with CARE automation which is microprocessor-based using floppy disc storage.

Eela Audio (Pieter Bollen Geluidtechniek BV) is already known for its *Concord S2000* console which is available in 12, 20 or 28-channel input/output versions (from £4,568 to £7,770), but also the *S100* and *S200* modular

58 ▶

SYNCON

Logic and Music in Harmony

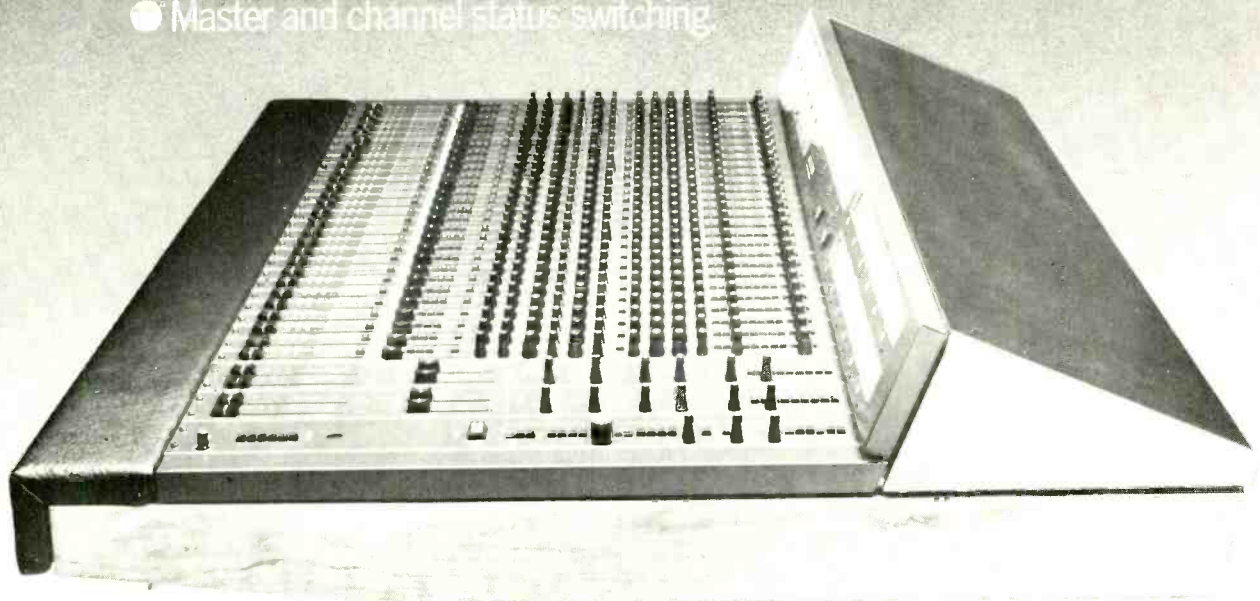
It is a fact that many medium priced consoles use ungraded VCAs and ICs resulting in signal degradation and unpredictable performance. Syncon uses top quality discrete circuitry on interchangeable cards which allow not only instant replacement but future upgrading.

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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mixer ranges. The *S100* is a stereo mixer which is made up from either blocks containing four mic/line inputs or four stereo line inputs, and a stereo output block with echo returns, limiters, VU meters (optional PPMs), headphone outputs, talkback mic and line-up oscillator. It is available in frames for 4 to 16 channels, with an optional 8-track interface unit providing routing from 10 channels and left and right, to eight outputs, and an eight into two monitor mix, with machine remote controls. The *S200* is a modular mixer with input modules with four or eight outputs, and two or four aux sends, standard chassis being available for 12 to 28 modules, with output modules, aux/osc/talkback module, monitor module and power supplies. Finally Eela Audio offer a small ENG mixer for television and film applications with four channels, recessed faders to prevent accidental knocks, balanced inputs and outputs on XLRs, VU meter and LED indicators, headphone output, limiter, hi pass filters on each input, max +20dBm output.

Clive Green & Co introduced, in co-operation with **Enertec** of France, a totally new multitrack in-line console that is available in versions for recording or broadcasting. It is built around an input/output/monitor module that includes an electronically balanced input (no transformer), channel couple facility taking mic amp output to monitor input on the same module, allowing both multitrack recording and stereo output, six-section eq with four bands of parametric eq and two filters, solo post eq, multitrack mix trim, four monitor mixdown groups. Other modules include the mixdown and monitor groups module, control room listen selection and playback to studio module, echo send masters module, cue send master module, talkback, solo and oscillators module, master controls, and echo/effects return module; the console is automation ready.

While a single module had been shown at the last AES Convention, **Harrison** introduced a complete *MR1* console, the design and operation of which has become so complex that it uses a microprocessor in each channel input/output module, entailing that a typical 56-channel console has 60 microprocessors to look after the complex routing and facilities offered, and the full automation system. The mic amp is transformerless, there are two line inputs, two insert patch points with transformer coupled drivers, shaping equaliser with four bands (either continuously variable or stepped), cut off filters; the fader is conductive plastic but provides a digital output which is manipulated by the processor to allow other functions (panning, automated echo, sub-grouping etc) via VCAs, mute button which also operates as solo, monitor pot (also used with a digital output), automated and manual cue sends, insertion and phase switches, pre-listen, auto listen, return, ping (for reversing selected sources); optional machine remotes to control two Studer *A800* 24-track tape recorders with ready, input and reproduce buttons and five LEDs to indicate status adjacent to each channel fader with master control buttons in the quad master module; main pan is automated with switchable cinema pan (left, centre and right), there are 15 subgroups; communica-

Andy Munro (centre) of Allen & Heath with Syncon console

Clive Green of Clive Green & Co with the new In-Line console

New Harrison MR1 console with Michael Bauch (FWO Bauch), Paul Ford (Audio International) and David Harrison (president)

Graham Blyth and Phil Dudderidge of Soundcraft

tions module, group master module, quad master module, speaker monitor module, main processor module (with two more microprocessors), and of course the optional *Auto-Set II* automatic system.

Midas introduced its latest console, the *TR System* for theatre sound mixing applications, to complement the *PR System* used for live sound reinforcement. Standard formats are 24, 30 or 36 into eight subgroups and eight output groups with six auxiliary busses, two inputs to each channel switchable mic or line, stereo monitoring from the sub-group and group outputs, comprehensive communications facilities, P & G faders, 3-band eq with hi pass filter, peak indicator or six LED −15 to +20dBV column to indicate prefader level, oscillator, talkback and intercom, console or remote mounted jackfield and multi-way connector for all inputs and outputs.

Neve is now producing the *8108* range of consoles off the production line and live demonstrations were provided during the Convention at the Nova Suite on a console fitted with Necam automation. While the console was fully described in the last LA AES report, the three points that stand out are the easy to access monitor (secondary) slider faders which are not hidden in amongst a pile of knobs but uncluttered, the dual 200 segment bargraph meters that display VU and PPM side by side on each channel, and the comprehensive microprocessor - controlled assignment panel and monitor and facilities panel using touch sensitive switching with separate channel located interrogate switches. Neve were also showing the **Neve-Chromatec** multichannel monitor and spectrum analyser which uses a colour TV display to provide monitoring for up to 56 channels of spectrum analysis from 31Hz to 16kHz in $\frac{1}{3}$-octaves. Monitoring bargraphs may be grouped in fours or eights and colour coded for channel identification with colour change to red at a preset height, in addition to which there is an electronically generated graticle.

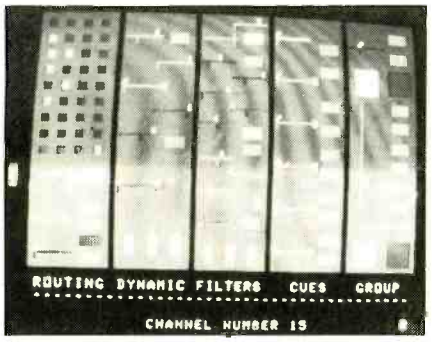
Siemens, from Austria, were showing a number of sound desks including a 24 input to four or eight output version for broadcasting or theatres, and which uses the *C8* module system and stereo modules with adjoining faders, while the *C4* console is portable with 10 inputs and four outputs.

Solid State Logic attracted large crowds to its stand to see the *SL4000E* series automated console which now has the unique distinction of being controlled by not one but two mini-computers. While the standard computer provides dynamic automation of 56 faders and mutes, eight group faders and mutes and pretimes the quad master fader, in addition to title and cue listing (with both VDT screen and printer built into the console, and synchronisation of up to three audio or video transports, and remote control of effects such as delay lines, echo plate motors, synthesisers etc; the second computer (to be replaced by a microprocessor) provides *Total Recall* of every last console function with $\frac{1}{4}$dB accuracy. The position of every switch and variable control is continuously monitored by the computer which is able to display positions in a variety of display formats on a television screen, and stores every change made to the settings of the console which may then be displayed on the monitor and compared with the position of

60 ▶

AES Report

the controls as set on the console. As yet, it won't actually set the console controls to the stored position, but it does indicate which way pots should be turned, and when they are



accurately set to the stored position, enabling existing mixes to be recreated precisely (the problem of automating all the eq pots, pans, filters, comp/limiter/expander functions, cue sends and so on is at present impossible while providing sensible feedback so that the operator can see the settings—note Neve's motorised faders).

Trident Audio Developments were showing examples of each of its three ranges of consoles from the modular *Fleximix*, through the *TSM series* to the *Series 80* console.

Tweed Audio produce both broadcast and music recording consoles, and specialise in producing custom consoles. Latest introduction to the range is the *RP1601* radio presentation console which includes eight hi level stereo inputs, four mic channels (with optional limiters), two mono inputs for telephones balancing, two remote selectors for outside sources, full talkback and intercom facilities, digital clock and timer that starts whenever a stereo selected fader is raised to start a turntable, or when the turntable or cart is remotely started, and all for £6,500.

Cassette duplication

A number of companies were showing cassette duplication equipment including **Crowmay Ltd** (marketed by Cassette Duplicating Supplies) who produce loop bin master playback machines accepting $\frac{1}{4}$, $\frac{1}{2}$ and 1in wide tape with up to eight tracks, replaying onto slaves accepting either $\frac{1}{4}$" or cassette tape and recording at 120, 60 or 30in/s for 64, 32 or 16 times duplication ratios. An automatic cassette winder is also produced which loads recorded tapes into empty cassette shells.

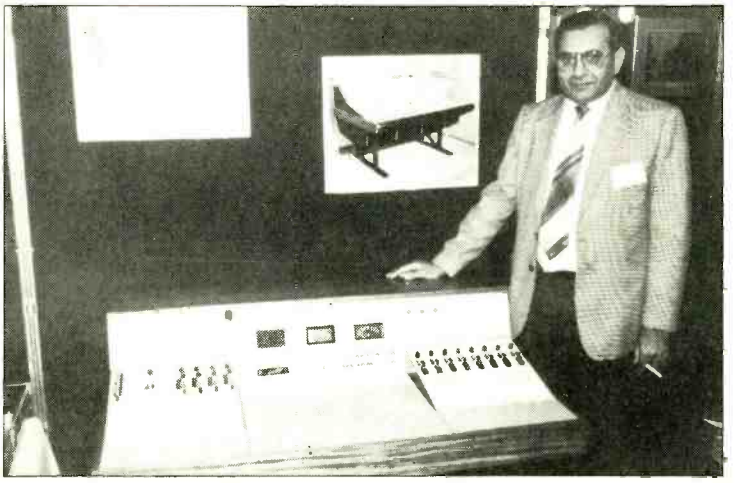
Electro Sound Inc produce a range of duplicating equipment including a master recorder/reproducer, *System 8000* high speed tape duplicating system for 64 and 32 times duplicating ratios with loop bin and 240in/s tape speed max, slave duplicators for $\frac{1}{4}$in or cassette tape, automatic cassette loaders with leader, cassette and cartridge tape winders and automatic splicers.

Cetec were showing Gauss duplicators which operate at duplication ratios up to 64 times for 8-track carts, $\frac{1}{4}$in or cassettes using loop bin master for up to 1in tape, running at max 240in/s, while slaves run at max 120in/s.

King Instrument Corp manufacturers a range of cassette loaders from a manual model, through semi-auto and fully auto with models for 45 or 200 cassettes storage, and a video

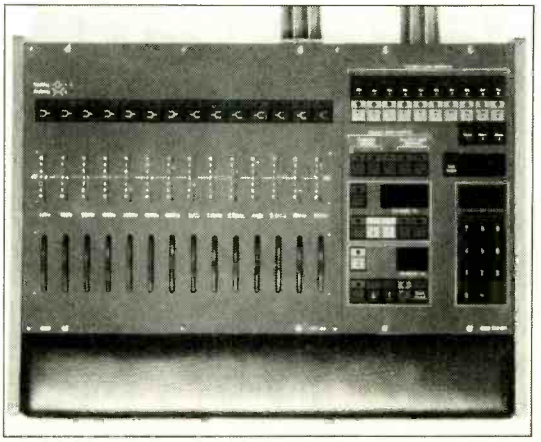
Malcolm Toft and Ken Bray of Trident Audio Developments

Kirsh Mustafa of Tweed with the RP1601 radio console



David Scott of Atlantex Music (MXR) serving Pauline Cook of Turnkey from the MXR 'Ice Cream Parlour' which proved very popular with visitors

NTP programmable graphic equaliser (below), EMT 251 digital reverberation unit (right)



cassette hub loader for both *VHS* and *Beta* cassettes.

Otari produce both duplicating and copying equipment ranging from the *DP-7000* duplication system operating at 64 times with a 1in loop bin master, and the rather smaller *DP4050* system copying loaded cassettes at eight times with slaves taking three or six cassettes.

Signal processing

Not strictly a processor since it ideally shouldn't introduce any effect, is the latest product from **Advanced Music Systems**, the disc mastering delay system *DM-DDS/A*. Using 16-bit encoding for 96dB dynamic range, the delay provides a bandwidth of 22kHz or 27kHz, analogue or digital inputs and outputs, two phase matched channels, three preset delay times or keyboard enterable time for special application, auto calibration of 0dB, twin LED column meters, 1.6s or 1.3s maximum delay, and remote drive capability.

NTP Elektronik showed a wide range of audio processing units but the focal point of their stand was the *Model 582* programmable remote controlled 14-band graphic equaliser, which comprised a central control and programming unit fed by a motherboard with 4 eq channels (or multiples thereof) and the facility to store and recall settings from a floppy disc memory.

Scamp has become an established signal processing system from **Audio & Design Recording**, but has until now only been a 19in rack system, and rather difficult to take onto the road, so the *Scamp Mini-Rack* has been introduced. Self contained with an *S26* power module (which drives up to five processing modules), the rack is mounted in a sturdy flight case with pack-flat handles and lid locker for all connectors and mains cables. When used with the *SO2* pre-amp module, it can be used directly with instruments to create most effects.

EMT introduced a new digital reverberation system, the *EMT-251*, which is a slightly smaller but similar model to the *EMT-250*. A free-standing unit, the *251* uses 16-bit processing and 34kHz sampling for 15kHz response with a 256 kbit RAM and 32 kbit ROM. Reverberation is controllable in 16 steps from 0.4s to 4.5s with initial delay of 0 to 80ms or 40 to 120ms. There are three distinct reflections with one reflection cluster. Other programs include delay to 440ms with four programmable taps, non-lin program for increasing sound concentration, chorus for sound multiplication, space 1 and 2 for 15s reverb times, and echo with repeated reflections with attenuation. EMT also showed the new *EMT-266* transient limiter which includes an initial delay of 0.3ms and optional variable pre-emphasis after limiting. All controls are set under a panel, and the unit is suitable for FM broadcasting or disc cutting.

Feldon Audio were showing the new *Eventide JJ193* delay line (which I appear to have missed at New York), which has four outputs each with up to 510ms of delay switchable by front panel DIP switches in 2ms steps (extra delay optional to max 2.046s), frequency response 12kHz, dynamic range 90dB, and only £598.82 basic, £700.75 with 1s and £914.79 with 2s delay. There is also the *CD254* which has simplified delay adjustment and costs only about £500.

62 ▶

AES Report

Klark-Teknik provided preliminary information on the new *DN80* (which will be shown at APRS) and which is a 16-bit realtime audio computer using bit slice techniques to provide reverberation (3rd generation), multi-tap echo, glitch free multiple harmonising, flanging, ADT and interface with automated mix down systems for automated control.

Scenic Sounds Equipment was showing the *360 Systems* programmable equaliser that stores and recalls 28 sets of eq curves and level settings from its own internal memory.

UREI introduced the new *Model 546* dual parametric equaliser which includes four selections of independent processing with variable bandwidth, frequency and boost/cut; the *Model 1178* dual peak limiter which is a 2-channel version of the successful *1176LN* peak limiter; and the *Model 562* feedback suppressor which includes five active notch filters with max 20dB depth and variable from 60Hz to 6kHz, and also lo and hi pass filters.

Microphones

Designed for broadcasters, the new **AKG** *D130* microphone is an omnidirectional dynamic type with hum bucking coil to cancel the effects of stray magnetic fields and built-in sintered bronze cap which works as a pop and wind shield.

EDC manufactures a range of radio microphones including the *Cygnus* handheld transmitter, and the *Minkom* pocket transmitter. The latest *Sirius* handheld model has a number of interesting features including an aerial built inside the mic casing, although an external aerial can be added for greater range, and the decorative sleeve may be easily changed, there being five colours available as standard, with others to order—certainly simplifies multi-microphone operation.

Electro-Voice introduced two new microphones, the *Variable-D RE18* which has the capsule completely shock isolated from the outer steel case and also includes a low profile blast filter. The *Variable-D* design has very low proximity bass effect when used at less than 1in, enabling consistent quality over a range of working distances with super cardioid response. The *DO56* omni-directional mic also includes a shock isolated dynamic element with a response shaped for close vocal pick-up. Electro-Voice also introduced a new electronic crossover/equaliser, the *XEQ-1*, for reinforcement applications, and sister company Tapco several new products including the *C-12* mixer with 12 inputs, four sub-groups, stereo and mono outputs, and may be expanded to 20 or 28 inputs by eight channel expander units.

While Italian company **RCF** is well known for its ⅓-octave realtime spectrum analyser, it also produces a vast range of equipment primarily designed for PA applications ranging from microphones, stands and adaptors, sound column loudspeakers, wall-mounted speakers, horns, mobile systems, amplifiers and mixers, disco desks and hifi loudspeakers—UK agent is **Covemain Ltd.**

One name that used to be very common in Britain was Reslo, and although the company no longer makes microphones, a new range of radio microphones has been introduced under the **Rello** name. The range includes a ball-top handheld transmitter microphone, a pocket pack transmitter that may be used with tie-clip microphones, and a radio guitar system. Receivers are available either free standing with audio output or built into either a small handheld PA radio amplifier or a large column loudspeaker for PA applications.

While **Sony** has gained worldwide acceptance with its *ECM50* microphone (which is familiar to television viewers in every civilised country of the world), Sony also produces a wide range of other microphones for further applications including the new *C48* studio capacitor microphone selectable to omni, uni or bi-directional and intended for instrument pick-up, the *C37P* which is the 'workhorse' of the Sony range, the *F-115A* all-weather dynamic microphone which even works in wind and drizzle, and the *C74* which is a hyper cardioid gun microphone.

Monitors

As usual, a number of companies were demonstrating and exhibiting monitor loudspeakers at the Convention, although fortunately in a rather more subdued fashion than certain other exhibitions I have had the misfortune to visit recently.

B & W Loudspeakers were showing the culmination of their latest design project, the B & W *801* monitor which is a three-way acoustic suspension system with specially developed drivers and a 4th order crossover network and which includes electronic overload protection to prevent thermal damage to the drivers. B & W also manufacture the *DM12* which is a small enclosure monitor.

Canford Audio market a range of speakers primarily for PA applications including the *Star Loudspeaker Unit* which provides a long range concentrated sound cone for use in difficult acoustic conditions, and also column and baffle speakers.

Genelec from Finland, distributed by **Future Film,** were showing their range of monitors including the *Triamp 0124A* which is a 3-way system with three integrated power amplifiers and active crossover network, while the *Biamp 1019A* is a mini monitor with 2-way bi-amplified system.

Red Acoustics is a new company that has developed an interesting monitor, the *Red Professional.* This is a self-powered unit with twin 8in lf drivers separately driven by 100W amps and a pair of 1in direct hf radiators driven by a 50W amp. To overcome bass resonances in the 32-litre cabinet, the lf drivers are electronically equalised, and there is a Tristar front-mounted acoustical device to improve dispersion.

Tannoy Products were showing their established range of professional monitors including the *M1000 Super Red* monitor with a single point sound source with a 15in dual concentric drive unit, the *M2000 Buckingham* monitor which uses dual 12in drivers for lf, and a dual concentric drive unit for mid and hi frequencies. Finally the *M3000 Classic* monitor has 500W peak handling capability using a 15in dual concentric drive unit. Tannoy also produce the *XO5000* dividing network which is a stereo unit with each channel incorporating a single point parametric equaliser with selectable time delay, 3-position hi pass filter, hi pass and channel inversion. In addition Tannoy also showed two new *Super Red* monitors which should become available in mid 1980. Smaller counterparts to their big brothers, the *SRM12X* and *SRM12B* both use dual concentric drivers and will handle 100W inputs.

Test equipment

Various new products were introduced by **Bruel & Kjaer,** including the *2225* integrating sound level meter, the *4428* and *4439* noise dose meters, *4374* and *4375* miniature accelerometers, a luminance contrast meter (B & K's first excursion into light!), *2811* 8-channel multiplexer for multi mic measurements, the *2116* auto test station with combined generator, analyser and recorder with range from 100Hz to 10kHz, primarily for operation with the new *4222* anechoic test chamber designed for testing small microphones and hearing aids; the *2610* measuring amplifier; and the *2033* high resolution signal analyser.

Consilium Industri were showing the *GNA11M* sweeping generator and network analyser which sweeps from 0.2Hz to 200kHz.

Inovonics, imported by Feldon Audio, has introduced an accessory assembly (the *153000*) for the established *Model 500* realtime spectrum analyser that provides an X-Y recorder interface which accepts digital data from the analyser digital interface socket, and converts it into analogue signals to feed an X-Y plotter.

Klark-Teknik has ventured into a new field with the *DN60* realtime spectrum analyser which covers 25Hz to 20kHz on ISO frequencies in 30 ⅓-octaves, with a 16-step LED display calibrated for 1 or 2dB per step. Other features include peak hold, three memories, weighting facility, internal noise source, selectable time constants and optional RT_{60} reverb analysis card. One option that deserves consideration was the exhibition display where the LED

64 ▶

David Leake (right) and Terry Clarke (who had just returned from skiing, and thus the stick), with the new Klark Teknik DN60 spectrum analyser

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.

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AES Report

matrix was being used to scroll graphics and words promoting the product. One can imagine its use in the studio welcoming the band or producer!

RE Instruments is a Danish company manufacturing a range of test instruments which are imported into Britain by Danbridge (UK) Ltd (something the survey missed last month). The range includes modulation meters, wow and flutter meters and analysers, signal generators, FM carrier unit, stereo generator, automatic distortion analyser, servograph and wattmeter.

Turntables and accessories

Cetec International produce the *G12* instant start turntable for broadcast and disco applications and which is complemented by the *ST220* and *AT1005* tone arms, the latter being high precision.

Consilium Industri exhibited the *HA-1B* head amplifier which is designed for low impedance moving coil pick-up cartridges and which claims 1.4nV full bandwidth equiv input noise with 20dB gain and 0.02% distortion.

EMT introduced the *948* broadcast turntable which provides direct drive with fast cue, stop and reverse cue. It may be remote controlled and the tone arm is motor lifted, and is designed for minimum width. Speed may be either fixed at 33⅓, 45 and 78rpm, or continuously varied.

Stanton were exhibiting the *Model 310* professional phono preamplifier and equaliser which provides 30 to 60dB gain with max +20dBm output and −70dB noise. There are controls for level, rumble filter, variable hf gain and switchable flat or NAB post emphasis curves.

Intercoms and talkback

Communications is a very general area, but over the past few years a number of companies have become specifically involved in marketing products in this area.

Minicom is distributed in Britain by Rank Strand Sound and comprises belt packs that link with a central power supply, and use headsets with dynamic boom mics. The system is three wire, and may be used with up to 12 stations in parallel.

A microprocessor-controlled audio matrix switch was introduced by **Calrec Audio,** and comprises a 16x16 matrix which can handle mono or stereo, and provides routing for mixer inputs, talkback and mixer outputs, and is ideally suited to local radio stations where selection of a number of OB circuits is required.

RTS Systems is now distributed in Britain by Future Film Developments and manufactures a wide range of intercom products using a 2-wire system, and may be interfaced with most other types of intercom systems including 3 and 4-wire, and telephone networks. Available with 2-channel capability, user stations are available as belt pack, rack mount, speaker unit, wall mount, camera mount, console mount, and power supplies can handle up to 10 or 50 user stations. Numerous accessories are available. RTS Systems also manufactures a series of audio products including a 2-channel phono preamp, monitor and distribution amplifiers.

Strand Sound also manufacture an intercom system that comprises a master station providing 2-channels, and which will power up to 40 belt packs which include an illuminating call light, adjustable side tone and are used with headsets.

Other lines

Keith Monks (Audio) was showing a number of new products including a special microphone shock mount, an extending fishpole for hand-held boom microphone use, and the *LS1-8XMB* mains or battery-operated self-contained monitor speaker and power amplifier (10W) which may be used for general purpose monitoring applications.

Prophon Sound was showing what could be described as a mini snake system, which provides two stage boxes each with eight jack sockets, but which are interconnected by up to 200m of standard coax cable rather than multicore cable. Input impedance of the system is 50kΩ and it will cope with signals to 500mV, technique being eight carrier frequencies on the wide bandwidth cable.

Pulse Designs Ltd, distributed by Feldon Audio, exhibited two *Metrotone Tempo-Check* products, one designed for the studio, the other for the musician. *Tempo-Check Studio 100* is rack mounting and may be programmed to give up to 12 main beats and 12 cross rhythm beats per bar, with over 120 different combinations, which is rather easier to follow than an ordinary metronome, and also includes 12 crystal controlled tuning notes; it also provides display of frames/beat and beats/min. The *Metrone Tempo-Check* is similar, but very much smaller and nicad battery operated, for performers.

Costronics Electronics and **Tim Orr Design Consultants** were showing a rather unusual product called *Microspeech.* This is a card that plugs into SWTP and MSI *6800* microcomputers, and generates speech when programmed using either straight alphanumerics from a keyboard, or even better when programmed with phonetics.

Bulgin Electronics Soundex displayed their range of metering products including a new *Audio Multimeter AMM100* which uses PPM display to measure signal levels down to −72dB in switched dB ranges (£185), the *Twin PPM 404* which has two movements side by side, freestanding, with decibel scales (£95), and the *Studio PPM 100* which is again freestanding, mains powered and uses a Sifam illuminated movement and XLR connectors.

Tunkey now offer, in addition to a wide range of pro- and semi-pro audio products, an increasing range of useful goodies, such as a freestanding console to mount Teac tape recorders, a Teac 64-way bay with phono connectors back and front, a range of *Accessit* black boxes, low cost (£9.90) ear muff headphones ideal for foldback, rack strips allowing one to construct one's own racks, gaffer tape and *Fospro* spray which 'has been known to cure everything from noisy faders to broken bicycles. It dispels moisture, lubricates and deposits a protective film that prevents condensation.'

Finally, **Trad** is now importing the range of Xedit precision splicing blocks which are available in sizes from cassette, ¼ and ½in with standard or long cuts, and 1, 2 and 3in blocks; all blocks having two or three different cutting angles and varying in price from £6 to £38 for 2in.

66 ▶

A whole page of sound advice from ADR.

F690 Music-Voice Ratio Limiter

This is an F 600 Broadcast Limiter fitted with a voice operated threshold switching circuit. In use it gives an accurate method of controlling the voice-music ratios, and prevents over-attenuation of the music level. The F 690 is a stereo unit but can be used in mono with one channel for voice and the other for music voice-over control.

E500 Selective Band Processor

Use it for treating any part of the audio bandwidth. Particularly useful when transferring a recording from tape to disc when treatment of selected troublesome areas of the signal prevent degrading the whole signal. The E 500 can be used with any standard limiters, compressors or expanders that operate at normal time levels and is a stereo unit.

E560 Selective Limiter

A versatile unit which combines three functions; overall programme limiting, selective limiting and parametric equalising. The E 560 combines the notch section of the E 500 and the F 600 Limiter. A monitor switch means that notch areas for limiting are easily defined and the limiter also operates when peaking or notching in the Equaliser mode.

E900 Sweep Equaliser

Instant, uncomplicated audio frequency correction without the fuss of a parametric equaliser. Up to 20 dB of Peak or Dip can be selected and used instantaneously. To prevent unwanted clicks all controls are D.C. decoupled and the front panel lay-out is designed for operational simplicity.

E950 Paragraphic Equaliser

All the functions of a conventional graphic-equaliser combined with the flexibility of parametric equalisation. It can be set up as a straight forward graphic unit in either stereo 6-section format, or a 12-section mono system outputting on the unit's RH output connectors. The E 950 is ideal for both Broadcasting and Recording applications.

All are manufactured to ADR's highest technical standards and are normally available from stock. Make sure by ordering yours now, we re as near as your telephone.

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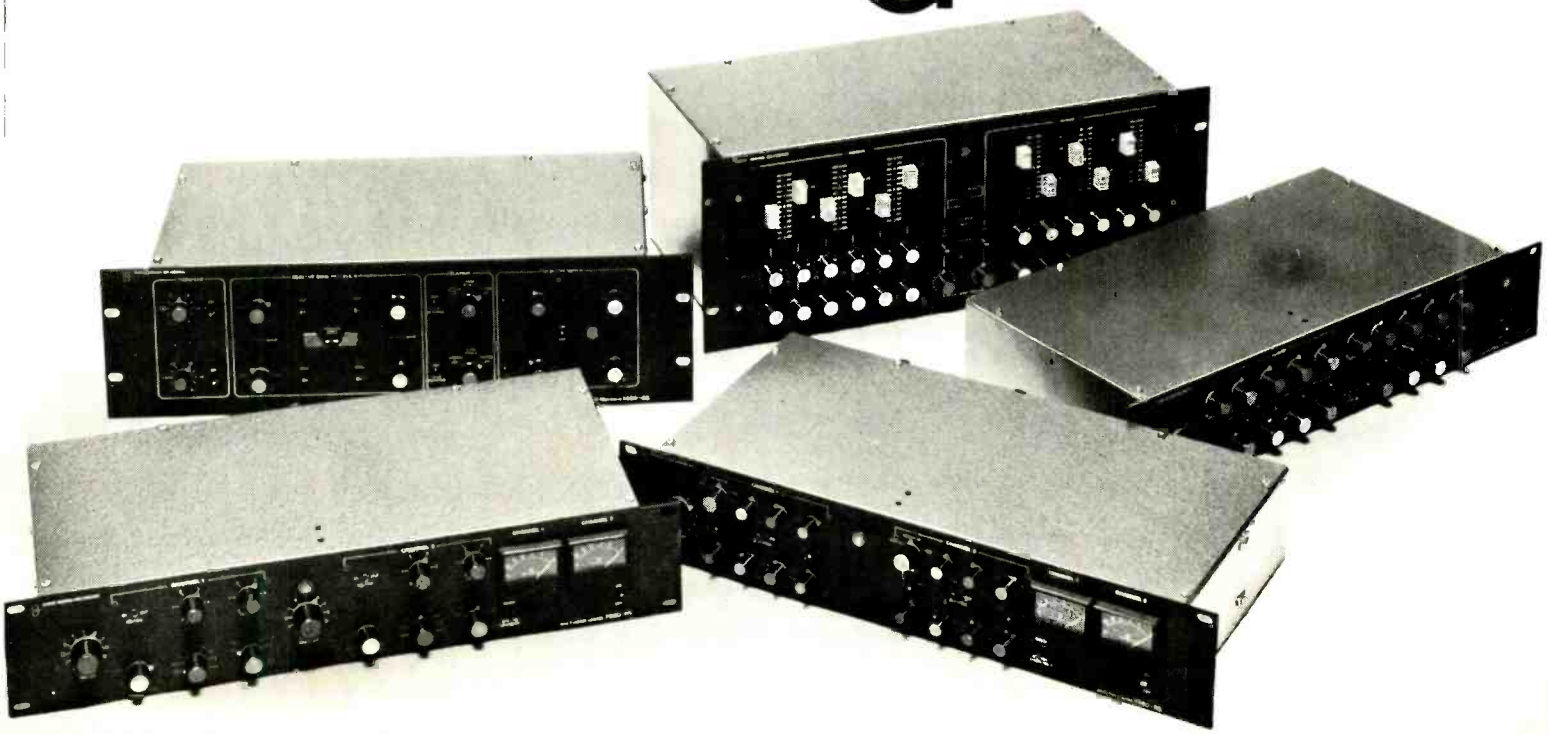

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AES Report

Convention

The technical sessions at this year's AES European Convention saw the presentation of a wide range of papers covering all aspects of the audio industry. The standard of the papers was to a very high level and the organisers and authors must be congratulated on collectively presenting a varied and stimulating programme. An interesting adjunct to the technical sessions was the provision of a room exclusively devoted to subjective listening tests. Designed and equipped by engineers from Kef Electronics, but sponsored by the AES, this facility acquainted audio engineers with some of the problems of subjective evaluation techniques. Results of the tests conducted with Convention delegates (and members of the Press) indicated a surprising degree of consistency in the results with a few 'Golden Ears' being capable of accurately picking out such effects as soft and hard clipping in amplifiers and the audibility of the upper cut-off frequency of filters used for anti-aliasing in digital systems.

One of the main subject areas at the Convention was that of digital audio. Dr Toshi Doi and his colleagues from the Sony Audio Technology Centre proposed a digital I/O format as a standard for universal digital audio communication between digital equipment. Working from the premise that in the future recording studios will be using digital signal processing for audio and video recording, editing, mixing, reverberation and delay, effects, equalisation, musical instruments, disc cutting, and sampling rate conversion; and in the more distant future that these will be supplemented by digital microphones and loudspeakers; Dr Doi proposed that to avoid any possibility of signal degradation a standard I/O format for all digital audio equipment should be established. Dr Doi's proposed format has the following characteristics: 2's compliment bit-serial treatment of data with NRZ modulation; word sync bits prepared as a 3-bit cell with transition in the middle of the central bit cell giving a large jitter margin and a transmission distance of over 200m; 20 or 24 information bits per word using linear quantisation and initial MSB; a bit clock rate of 32 x fs (if fs=50.4kHz, it is 1.6128Mb/s); 256 words per block; 29-bits per word with the 29th bit prepared as a block flag; 4 control bits per word for the initial 4 words of a block; 4 or 8 user bits per word (4 or 8 x 252 bits per block) depending on the number of information bits; and the possibility of including error correction.

F A Griffiths of Decca described the design and operational characteristics of the Decca digital recording system which in its initial six months of operation has resulted in the release of five LP recordings. Mr Griffiths informed delegates that Decca currently has six digital recorders in operational use. Design of the Decca system was commenced in early 1978 and at an early stage it was decided to utilise a video tape recorder as the basis for the system rather than to develop a special audio machine. Decca's recorder is an open reel video instrumentation recorder with a bandwidth of 5.5MHz and this type of recorder was chosen because the conventional analogue audio tracks of the machine allow fast spool and search facilities which are particularly useful for editing and session playback applications. Decca's recording format employs a 48kHz sampling frequency and records two 18-bit audio signals together with an equal number of parity bits to provide error detection and correction. The data is interleaved so as to cause burst errors to appear as random errors, and the correction system employed allows correction of two errors in any 18-bit word and will detect three errors. 18-bit words were chosen such that a wider dynamic range than the finished record was recorded thereby allowing the possibility of dynamic range and equalisation adjustment following the initial recording. A feature of the data format is the provision for recording time code and alpha numeric data in addition to audio data, so that details of the recording may be 'written on the tape'. Although the data format is based on a television field, a television waveform is not used for recording. The recorder operates as a data recorder, recording blocks of data which happen to have a repetition rate of 50Hz with an interblock gap similar to television field blanking. The television

MCI showed the JH-600. Mr and Mrs Lutz Meyer right

Martin Morcom of Sony with the latest PCM adaptors

Martin Jackson (left) was offering a wide range of equipment including the Maison Rouge mobile parked outside

The sole importer for Crown/Amron, HHB Hire & Sales, with James Beattie (Amcron), Ian K. Jones (HHB), Clyde Moore (Amcron) and Peter Christensen (Nilesco Europe)

synchronising signals are replaced with digital synchronising words occurring frequently throughout the data block.

In the Decca system the digital sync system occupies three line periods in which a number of selected 8-bit code words are evenly distributed and to ensure synchronisation identification of only four consecutive 8-bit words is required. This allows for almost three lines of burst error. The data period which follows the sync signal is also interspersed with 8-bit sync codes to maintain fine synchronisation in the presence of burst errors and these codes are placed at half-line intervals throughout the data field. Because of this feature the sync system is therefore capable of correctly decoding each frame of data without reference to other data blocks on the tape.

Operational features of the Decca recorder include monitoring of the system's performance using LED indicators. Green LEDs are used to monitor errors in the left or right audio data channels, the signals being derived from the error correction system. In addition as Decca use a Miller code for the recorded signal, a Miller decoder detects errors and a red LED is flashed when these errors are detected. Decca's error correction system doesn't use error concealment and if errors do occur which are uncorrectable a click may be heard and a red LED flashes for 0.5s as a warning. On session recording two Decca machines are always used for safety purposes to obviate this problem; however, in practice Mr Griffiths informed us that such errors are encountered very infrequently. The error indicators may also be coupled to an automatic monitoring system allowing copy tapes to be produced and checked without the need for critical listening to the copy process. Another operational feature is the provision of level indication designed to react instantaneously to increases in signal level enabling the instantaneous peak signal to be monitored. This level indication is specifically used to overcome input signal overloading and to set the system's headroom. With regard to maintenance of the Decca recorder a diagnostic switching system is utilised which progressively removes from the input/output paths of the machine the memories, the error coder/decoder and the sync system until finally the A/D converter is directly connected to the D/A converter. Via this system any faults are traced to specific pcb's which are immediately field replaceable.

Decca's electronic editing system is based on normal video editing technology and techniques. Two digital recorders are used, one to playback tapes and one to record the edited result, operating in the Assemble Edit Mode. During a typical editing sequence the recordings are monitored in turn until an approximate edit point is reached. Then, using the analogue audio track on the VTR final adjustment is made by the operator moving the tapes forward and back by hand. The machine then runs back automatically for about 5s and a 10s rehearsal is then possible. The two digital audio signals are automatically crossfaded at the chosen point and the audible result checked. During this stage the block of data from the editing machine following the edit point is stored in a memory. Adjustment of the edit point on either or both of the machines is then possible and another rehearsal may be carried out When satisfactory the edit is achieved by the edit machine automatically switching into record during the inter-block gap at the edit point. The stored block of data is then crossfaded with the new data and fed to the recorder input. The crossfade can be varied in duration from 6 to 50ms by means of a multiposition switch, and timecode recorded with the audio data controls the complete operation in the rehearse and perform edit modes. The edit point may be moved in increments of one frame (about 20ms increments) and Mr Griffiths explained that in practice relative timing errors at the edit point of up to about 10ms were unnoticeable. The result of an edit on the tape is a butt join of the signal to itself immediately followed by the crossfade to the new data. To assist in determining edit points, the audio envelope for a period ± 0.25s from the selected edit position is displayed on a cathode ray tube.

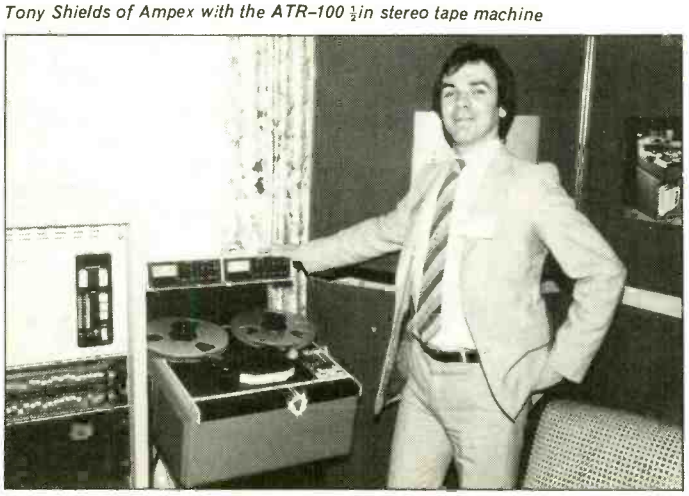
Decca's electronic editing system has the ability to change the level of one of the signals via digital gain adjustment at the edit point. Also looking to the future Mr Griffiths informed delegates that Decca intend incorporating some form of simple equalisation adjustment and artificial reverberation at the editing stage.

68 ▶

Les Lewis and John Pedre of Neve with the latest 8108

Ray Dolby and Stephen Temmer on the Gotham Audio stand

Tony Shields of Ampex with the ATR-100 ½in stereo tape machine



Stuart Nevison demonstrating the Advanced Music Systems digital delay and effects processor to an interested crowd

AES Report

Continuing in the same vein, Bob Youngquist presented a paper describing the 3M digital editing system which comprises an edit module that controls the tape movement of two 3M digital mastering machines and offers special function buttons for determining exact edit points. Editing is accomplished by a copying process with the two tape machines being synchronised together by timecode on one track on each recorder. This timecode track doesn't use SMPTE code but uses a special 3M timecode formed of 24-bit words and using a 3,125Hz block rate. The timecode is used in conjunction with tape time (with readout in minutes and seconds derived from $\frac{1}{16}$s output pulses from the tachometer) to control exact tape positions. Editing positions are initially determined aurally and when a suitable edit point has been found the editor stores the timecode number and tape time of the chosen tape position. At this stage the tapes can be moved forward and backward electronically while the music is being continuously monitored. Once an edit point has been selected use of a 'shuttle' function which operates in conjunction with 'pre-audition' and 'post audition' functions allows rehearsal of the edit point with tape rewind to a position 2s before the edit point, the relevant audio muting being controlled by the 'pre-audition' and 'post-audition' functions. To adjust the position of the edit point 'earlier' and 'later' functions are provided which in conjunction with increment timing buttons adjust the position by either 1, 3, 10, 30 or 100ms. The edit point is determined in the editor by the timecode; however, the 'shuttle' function is operated by tape time. Changing the edit point obviously alters the tape time and to ensure that tape time doesn't become out of step the editor automatically compensates the tape time position readout. An additional feature of the 3M system is the ability to preview the edit using a 'preview edit' function. This function rewinds both tape machines to 10s prior to the edit point, both machines go into play, the play machine synchronises to the record machine, the edit is previewed at the chosen edit point, and about 2s after the edit the machines shuttle back and recycle. To make an actual edit the audio tracks are assigned into a sync record mode, the edit button is pressed, the tape machines rewind to 10s prior to the edit point, both machines sync and at the edit point the record machine automatically goes into record.

Another paper on digital audio was a description by the JVC development team of the company's *Series 90* digital recording system using $\frac{1}{2}$in U-type VTRs. The system is based on the *BP-90* signal processor, a 2-channel PCM processor using 16-bit linear 2's complement quantisation and operating on the NTSC signal format. The processor has a sampling frequency of 44.056kHz, a transmission rate of 3.084Mbits/s, a dynamic range of over 90dB, harmonic distortion of less than 0.02%, and a frequency response of dc to 20kHz ±0.5dB. The system incorporates an error detection and correction system (38-bit check, triple error correction) and tape address using a 6-digit BCD system counting V-units (a field of video signal) which approximates the time. The editing system consists of an editing console, the signal processor and a pair of U-type VTRs. The *AE-90* editing console has an editing accuracy of within approximately 45μs; a rehearsal memory time of 5.92s (maximum); a 'search' function to locate the edit point with variable tape edit location speed; memory recall of the edit point; variable crossfade time at the edit point of either 0, 10, 17 or 40ms increments; level adjustment between +12dB and −∞ of the signal level allowing for fade-in/out; and a 'shift' function which allows the edit point to be moved forward or backward in steps of 2ms. Editing at the chosen edit point is by crossfading. For disc cutting applications JVC has also produced the *CD-90* digital audio delay unit which acts as the preview unit delaying the signal driving a disc cutter head with analogue pitch/depth control signals. This unit has an adjustable delay time (1.1s for 33$\frac{1}{3}$rpm, 0.8s for 45rpm) up to a maximum of 1.5s in 6ms increments. Delay times for 33$\frac{1}{3}$rpm and 45rpm are preset for a sampling frequency of 44.056kHz, while any other sampling frequency is catered for by the adjustable delay time facility. Digital input to the delay unit is in the form of 16-bit serial/parallel data signals, and while the unit's internal sampling frequency is 44.056kHz, external sampling frequencies of between 30kHz and 60kHz may be used.

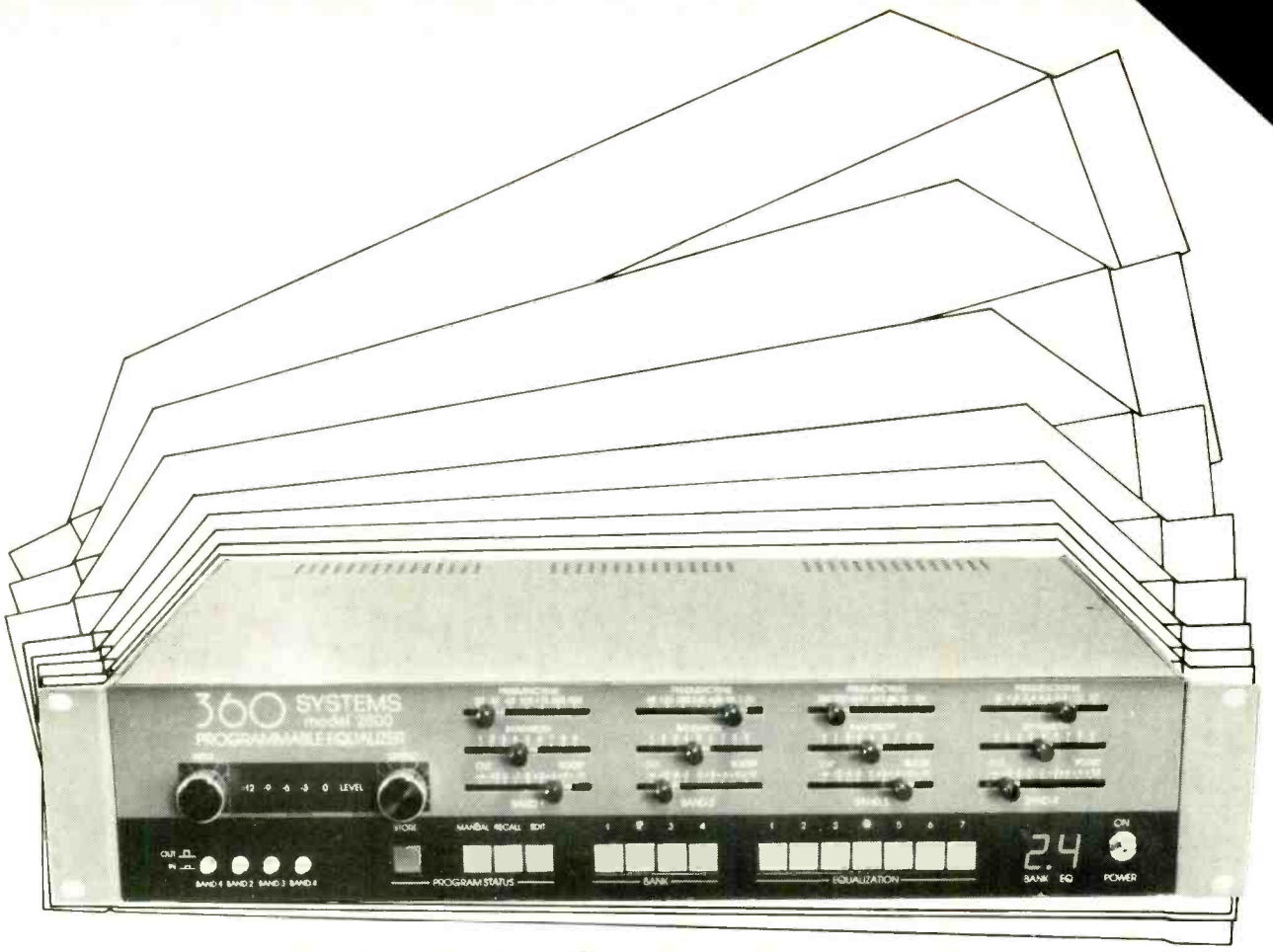
In a paper covering the design of A/D and D/A converters, N H C Gilchrist of the BBC Research Department briefly covered the historical development of the BBC's high resolution ramp-counter type converters as used in the BBC 10-bit and 13-bit PCM distribution systems, and then went on to describe the BBC's development work on 16-bit A/D and D/A converters of the floating-point type, embodying a commercial successive-approximation A/D converter and ladder-network D/A converter with relatively low resolution. Mr Gilchrist described the use of 12-bit D/A converters for 16-bit word coding and explained that depending on the gain adjustment, resolution is effectively 16-bits/sample for low-level signals, reducing ultimately to 12-bits/sample for high-level signals. The reduced resolution occurring on high-level signals causes these signals to be accompanied by an increased level of quantising noise; however, Mr Gilchrist stated that in listening tests the higher sound level masked this programme-modulated noise such that it was undetectable. To avoid overloading the 12-bit A/D converter it was found that the programmable gain amplifier must act instantaneously to audio input level increases; however, it was also found that a delay of about 100ms was needed on decreasing input level signals especially to cater for situations where low-level samples are encountered between high-amplitude peaks, as otherwise the cyclic gain changes would cause audible distortion. Similarly the D/A converter has a delay introduced into the gain changing operation when the input signal amplitude is falling. Concluding his paper Mr Gilchrist indicated that good dynamic range, overload margin and s/n ratio can be obtained from 16/12-bit converters and

70 ▶

Douglas Leighton, president of RTS Systems who produce a wide range of intercoms, now distributed by Future Film Developments

Len Lewis of Audio and Design Recording attempting to sell a jackplug (and the new Scamp Mini-Rack)

Mr and Mrs Howard Smith on the Calrec Audio stand



THE EQUALIZER WITH A MEMORY

360 Systems' new Programmable Parametric stores and recalls 28 sets of EQ curves and level settings from its own internal memory. It gives instant access to the special sounds you've stored away, and lets you organize them into sequences for mixdown. You won't have to buy a whole automation system to use the 2800 EQ. It's a completely self contained system, using a Z-80 Microcomputer to manage the affairs of an analog equalizer. Now you can pull the plug and take your sound from the studio to the cutting room. Or get repeatable special effects on the road with a stage act. It won't forget, either – a lithium cell keeps memory up whenever AC power is down.

The 2800 is a **broadband** constant-Q parametric. Listen to it – it sounds better. Broad, easy curves come just as easily as its narrow 60 dB notches – great for fixing problems like hum and camera noise. The output level's programmable too. When you change EQ, you'll often want a level shift to preserve the same "apparent loudness" level. Now you've got it. And there's an optional interface connector to tie in with feet/frames or time code cue decoders. Or with anybody else's console automation.

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h Pichler and Paul Skritek presented a paper on the design principles of sample and hold circuits for digital audio systems. As is common knowledge high resolution A/D and D/A conversion modules require sample and hold circuits for track-and-hold and for deglitching; however, these circuits can cause various types of degradation of the audio signal. Examples given in the paper included amplitude errors caused by time error (clock jitter) and too short a sampling interval; errors caused by input to output and control to output crosstalk; frequency dependent transfer characteristic errors caused by finite sampling pulse duration effects in conjunction with the order of hold circuit; and non-linearity of aperture time due to residual charge in the hold circuit. In most of these circuits MOSFETs are used for the sampling gate and the input stage of the hold amplifier which limits the large signal characteristic and causes temperature-induced errors. The authors of the paper then described a dynamic model and an improved equivalent circuit of the MOS part (sampling gate, hold capacitor, hold amplifier) of sample and hold circuitry working with sinusoid and transient signals and gave an estimation of such a circuit's possible degradation and transfer characteristics.

Moving into the high fidelity field, Dr Hawksworth and Mr Wood of Essex University described methods of obtaining A/D and D/A conversion using low-cost components. Basis of the paper was the authors' research into data reduction schemes. The authors stated that their examination of the quality requirements needed for hi-fi digital audio conversion implied that it is possible to mimic a 14 to 15-bit system for about £350 per channel using a 12-bit A/D converter and two 14-bit D/A converters and a little op-amp based circuitry. The system's encoder is band-limited to attenuate unwanted noise and frequencies above 15kHz and samples at a 38kHz rate, while the sample and hold circuitry operates with signals of up to 10V peak at its output and is accurate to 15 bits with the exception of very high level hf inputs. The A/D converter is a 14-bit floating point type with a 13-bit mantissa and single gain bit. Because the gain is scaled after sampling the attack is instantaneous and gain scaling is on a sample by sample basis. The 13-bit A/D converter is of the sign magnitude type and the scaled samples pass through a near unity gain voltage follower and an inverting amplifier of identical gain, the output taken being decided by a polarity detector which drives a JFET multiplexer. In order to cancel the offset errors associated with JFET op-amps the system can handle six variable offsets associated with gain scaling or polarity change once aligned within a wide 'tolerance zone' necessary for unambiguous operation. In addition a method for inaudibly recalibrating the whole system is incorporated in the logic based upon techniques used in record scratch eliminators. Input latch decoding is via a 15-bit linear D/A converter and deglitcher, which uses two 14-bit D/A converters, one being fed with a positive reference voltage, and the other being fed with a negative reference voltage of equal magnitude, the output currents being summed and converted to an output voltage. This technique performs the subtraction required for the cancelling of the applied offset, and also undoes the rectification action because 'positive' samples are multiplied by the positive reference and 'negative' samples multiplied by the negative reference.

Don Keele of JBL presented a paper describing an automatic loudspeaker polar response measurement and analysis system controlled by a 'high-end' microcomputer. Primarily designed to be used as a time-saving method of designing loudspeaker horns, the measurement and analysis system comprises a Z80 micro-processor-based S100 buss computer (a Cromemco System 3) interfaced with a $\frac{1}{3}$-octave realtime analyser and remote controlled turntable. This system is used to gather response spectra at different angles and the disc-stored spectral data is subsequently analysed to generate polar/frequency response curves and beamwidth/directivity data. Most of the system's hardware comprises standard test equipment, with the exception of the turntable which was custom-built. The system's software was programmed by a JBL developed program and results are available either as digital printout or as data curves on a digital plotter and graphics display (the latter still being under development).

Andy Munro, the designer of the MBI *Series 24* broadcast console, presented a paper describing the design parameters behind this 'self-op' console specifically aimed at the ILR market. Prime consideration was given to the requirement that the console be totally modular with modules being capable of removal or retrofitting without any wiring or interface modifications. The only exception to this design criteria being the two master modules which contain stereo master outputs, aux master outputs, interface for 'mic open' circuitry and 'clean feed' output, master ducking (voice-over), PFL master circuitry, and all other master interfacing. The console has a 24-module capacity mainframe (also extendable in 8-module units) in order to accommodate as many ILR studio roles as possible, including normal DJ presentation; news; 'phone-ins'; OB broadcast control; pre-production work; advertising production; and straightforward programme monitoring. Flexibility of module choice is accordingly paramount and modules were therefore designed for metering, mic-line inputs, stereo line select input, telephone interface, monitoring, talk-back and independent inter-studio communication.

A new simplified pictorial method of representing the properties of 2-channel directional reproduction systems was described and illustrated by Michael Gerzon. Termed a 'PQ' diagram, the method shows a graph of the real part P and the imaginary part Q of the ratio $(L - R)/(L + R)$ of the ratio of complex difference gain to the complex sum gain of a stereo signal L and R. P is drawn along the x-axis and Q along the y-axis. The curve traced out by a sound varying in direction, called the 'pan locus', representing the directional encoding system. The PQ diagram has a number of interesting geometrical properties, since it can be shown to be a stereographic projection of the 'energy' or Scheiber sphere picture. Using the PQ method Mr Gerzon then went on to illustrate and compare the properties of 2-channel directional reproduction systems including conventional stereo; BMX; BBC matrix H; System UHJ and the various SQ encoding systems; dummy head stereo; and the Orban technique of mono-compatible pseudo stereo.

Michael Gerzon also presented a paper on practical periphony, ie the recording and reproduction of sound via loudspeakers from a full sphere of directions including both all horizontal directions and all elevated and depressed directions also; in other words, 3-dimensional recording and reproduction. Periphonically encoded recordings have become a practical proposition with the development of the Calrec *Soundfield* mic; however, it is only now that corresponding developments in psychoacoustically optimised Ambisonic directional decoding techniques have permitted the design of Ambisonic full-sphere decoders using irregular loudspeaker layouts. Mr Gerzon's written paper gave details of the mathematical design theory for irregular-layout periphonic decoders, including the choice of psychoacoustic shelf filtering (which differs from that used in the Ambisonic horizontal-only reproduction system) and speaker-feed matrixing. In practice three loudspeaker layouts fulfil the necessary requirements for reproduction of periphony, these being the 'cuboid', the 'octahedron' and the 'birectangle' layout configurations. The latter also has the advantage that it provides a conventional stereo loudspeaker pair. Alongside Mr Gerzon's paper, practical demonstration of NRDC Ambisonic periphony was being demonstrated in a room in the Park Lane Hotel. Here periphonic recordings were replayed, together with horizontal-only recordings made at the same time, to show the possibilities of the system. The results were quite remarkable, with a distinct improvement being noticable with periphony. The sound stage was extremely well defined with no phase or frequency-dependent nasties, and was very stable. The added facility of height information gave a definite feeling of actually being in the recording location. Interestingly, close listening at various points within the large central listening area showed that as long as the listener was more than 1m away from the closest loudspeaker the perceived effect was the re-creation of a full and stable 3-dimensional image.

Finally, Jurg Jecklin of Radiostudio Basel, described a classical music recording technique using two pressure mics. The technique is based on three assumptions, namely: the sound source is musically and acoustically balanced; the orchestra or chamber music group is playing in the correct acoustical environment; and there is one point in the recording venue where optimal balance between instruments, direct sound and diffuse sound is present. At this acoustically balanced point a special mic configuration is placed comprising two pressure mics spaced apart by a distance of 16.5cm. The two mics are acoustically separated by a disc with a diameter of 30cm. This disc is acoustically damped on both sides. The stereo signal received by these mics is composed of time delay and intensity differences between the two channels, the intensity differences being frequency response dependent. ■

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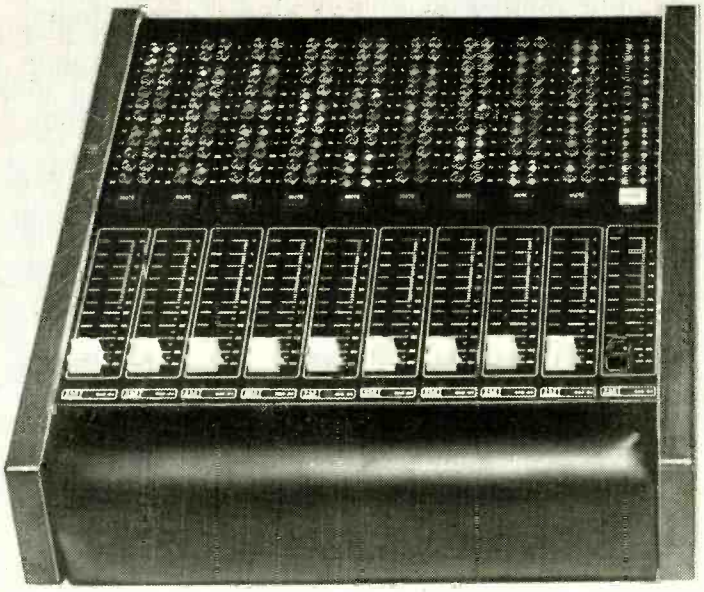
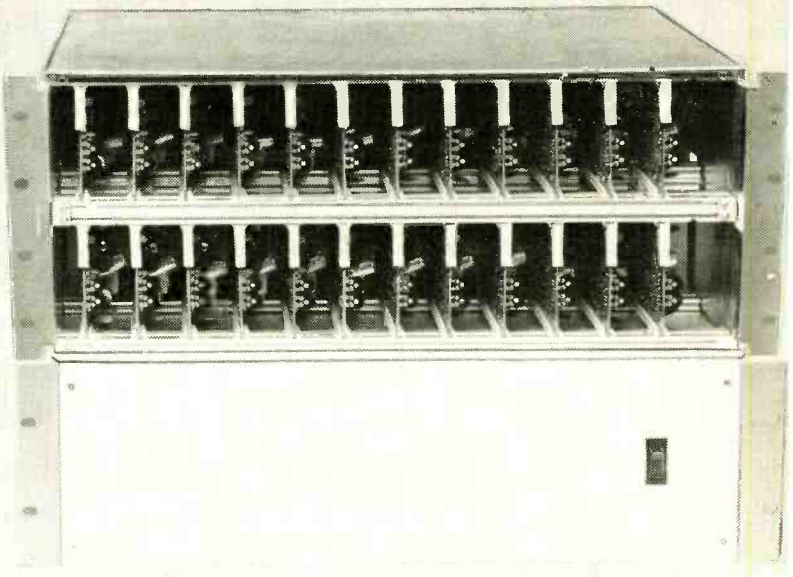
OAS-24 Grouping and Automation System
It provides up to 10 subgroups from 24 audio channels, using B&B voltage controlled attenuators.
The system comes in 3 parts; Control console, with 9 group modules each containing grouping switches, mute switch and fader, and one master module; VCA case with appropriate number of VCA cards; and power supply.

You can use it to extend the life of your console at a fraction of the cost of a new board, or move it from one studio to another any time you want, therefore taking extra capability only where you need it.





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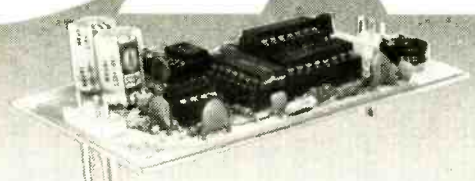
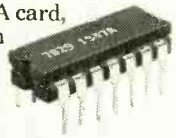


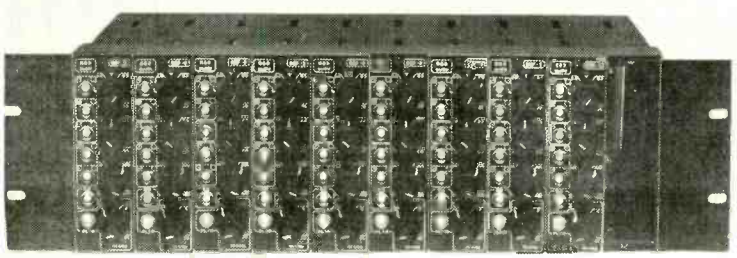
B&B VCA 500A Card

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.

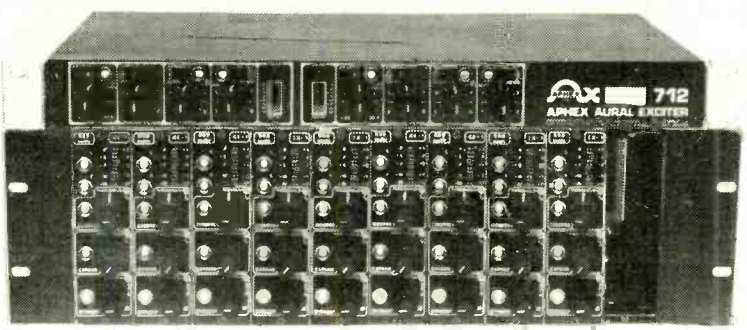


Model 712 Aural Exciter

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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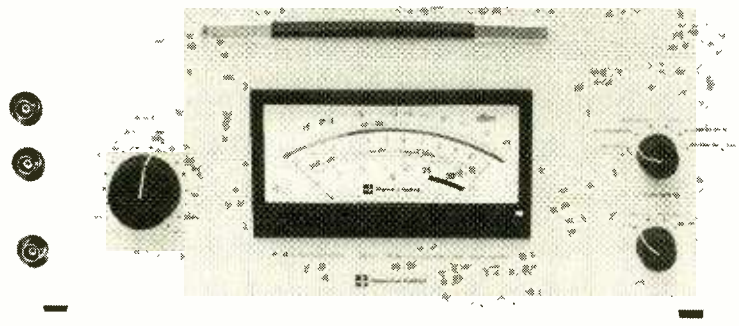
reviews

Wayne Kerr Radford ANM3 noise meter



MANUFACTURER'S SPECIFICATION

Amplitude range: 10μV to 300V fsd (—100dBm to +50dBm), 16 ranges in 10dB steps.

Range to range correlation: better than 1%.

Frequency response (wideband): 100μV to 300V ranges 4Hz to 500kHz ±3dB, 4Hz to 250kHz ±0.5dB, 30μV range 6Hz to 150kHz ±0.5dB, 10μV range 16Hz to 70kHz ±0.5dB.

Noisemeter weighting networks: 'Audio Band' sensibly flat over audio band with —3dB points at 22Hz and 22kHz. Rolls off at 6dB/octave at 22Hz and 18dB/octave at 22kHz, IEC/DIN 'Curve A' ±0.5dB of IEC recommendation, CCIR ±0.5dB of CCIR Recommendation 468.

Input impedance: 10mV to 300V ranges—1MΩ shunted by less than 30pF, 30μV to 3mV ranges—820kΩ shunted by less than 75pF, 10μV range—600kΩ shunted by less than 75pF.

Accuracy: meter scale linearity is better than 1% from 20% to 100% fsd (typically better than 0.5%).

Calibration: 0.25% fsd 1V range.

Rms conversion accuracy: to 1% of reading accuracy for crest factor of 6, up to 100kHz.

Quasi-peak characteristics: to DIN 45 405, CCIR Recommendation 468-1. Inherent noise (with input short circuited): wideband less than 1.2μV (—120dBm), DIN 'audio band' less than 0.4μV (—130dBm), IEC/DIN 'Curve A' less than 0.3μV (—132dBm), CCIR less than 0.3μV (—132dBm).

Ac output: 1V ±20% (sic) corresponding to 1V nominal fsd.

Dc output: 1V ±0.5% corresponding to 1V nominal fsd.

Power source: two PP9 batteries, a socket is provided on the rear of the instrument to accommodate an external regulated ±9V supply if required.

Dimensions and weight: (wdh) 440 x 210 x 150mm, (front panel controls add 20mm to the depth), 9kg packed weight.

Price: £350.

Manufacturer: Wayne Kerr Radford, Wilmot Breedon Electronics Ltd, Durban Road, Bognor Regis, West Sussex.

THE Wayne Kerr Radford *ANM3* audio noise meter is one of a series of instruments manufactured by that company for measuring noise, but it is perhaps the most interesting of the series for readers as it is one of the relatively few instruments on the market which measure noise to the CCIR quasi-peak standard.

The instrument is specifically designed to meet the requirements of the latest CCIR Recommendation 468-2 which is more difficult to meet than the earlier CCIR 468 recommendations.

Large for what it does, the instrument is 440mm wide to align with other Wayne Kerr Radford instruments with the centre of the front panel being occupied by a 150mm-wide mirror scale meter calibrated clearly in volts and dBm, plus a green battery check arc. The dBm scale extends from +3 to zero in 0.1dBm increments and down to −6dBm in 0.2dBm increments where the scale extends to −15dBm. These scales operate in conjunction with the range switch to the meter's left with ranges from 300V (+50dBm) down to 10μV (−100 dBm) which is an unusually high sensitivity. The 10dB steps of the range switch are marked in black for voltage and red for dBm, but all front panel markings are rather small and not all that easy to read. My eyesight isn't that bad, but I found it hard work to read the legends without glasses.

Remaining front panel controls are two rotary switches to the right of the meter. The upper switch selects the weighting (or frequency response) with a choice of 'wide band', 'DIN audio band', 'IEC curve A', CCIR plus a choice of two external filters which plug in at the rear panel. The lower switch turns the instrument on and selects either a true rms rectifier characteristic, the CCIR quasi-peak characteristic and also has a battery check position. The front panel signal input is a BNC socket with two further BNC sockets providing nominal 1V outputs corresponding to full scale deflection of the meter, one output being ac and the other dc.

Turning to the rear panel the centre section, which can be removed with a Philips screwdriver, gives access to two PP9 batteries and also bears clear markings relating to the other rear panel features. It would have been nice not to have to use tools to change batteries and as there is no clear indication that the instrument is switched on, battery changing could be a tiresome and expensive hobby.

It is understood that the manufacturer will release a mains power unit to fit into the battery compartment, but in the meantime an external ±9V dc supply may be used via a 5-pin 180° DIN socket on the rear panel. This is switched in or out of action by a nearby slide switch while diodes protect against incorrect polarity.

The final feature is a 4-pin DIN socket which provides the two external filter inputs and outputs; it is rather inconvenient that both pairs are on single connectors and clearly BNC connections would have been an advantage, but at a cost of course.

Within the instrument the layout and wiring was tidy with good quality components being mainly mounted on four glass fibre printed circuit boards interconnected by means of pin connectors. Access for servicing was good, but no component identifications are provided and at the time of writing only a preliminary user's manual was available including circuits but no layout diagrams.

The sheet metal construction provided a solid case painted light grey with a separate thick alloy front panel which in the review sample had not been securely fixed to the case and nor was one of the printed circuit boards properly secured to its mounting pillars. Whilst the case is provided with good feet at the time of writing no tilting foot was fitted, but it is understood that future production will be fitted with a tilting foot/carrying handle which will be a great advantage when using the instrument on a flat bench.

Frequency response and noise

Fig 1 gives an overall picture of the response curves available at all input gain settings with the wideband performance depending upon gain as stated in the specification. The A-weighting and the CCIR-weighting curves were found to be well within the IEC A and the CCIR specifications, but the DIN audio band curve does not comply with DIN 45 405 in the bass and it is understood that the manufacturer is going to change this curve.

In the wide band mode the frequency response depends at high sensitivities upon the voltage range selected and the performance in **Table 1** was measured.

TABLE 1

Range	—0.5dB	—1.0dB	—3.0dB
10μV	39.6kHz	57.6kHz	93.7kHz
30μV	97kHz	154kHz	over 200kHz
100μV	300kHz		

On higher voltage ranges, the response was effectively flat to in excess of 250kHz with the low frequency roll-off being satisfactory on all ranges.

With the input shorted the noise performance was close to the voltages specified by the manufacturer, but it will be noted that the specified decibel values fail to correspond with the specified voltages, the residual noise in **Table 2** being measured.

76 ▶

TABLE 2

Wide band	1.25μV rms	1.0μV quasi-peak
DIN audio band	0.6μV rms	0.75μV quasi-peak
A-weighted	0.3uV rms	0.35μV quasi-peak
CCIR-weighted	0.8μV rms	1.3μV quasi-peak

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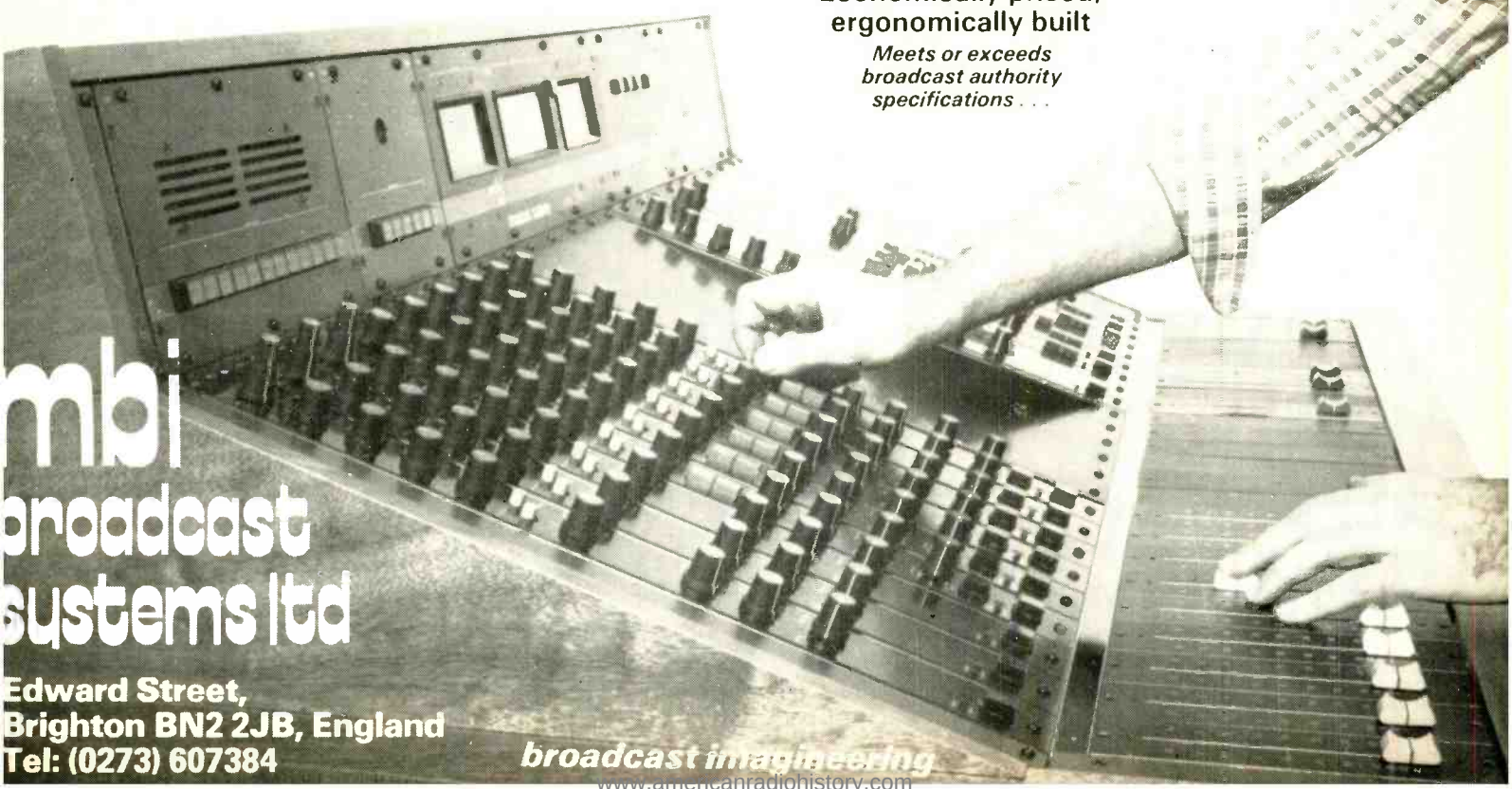

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Clearly this is an unusually quiet instrument with noise contributing little error to the most sensitive range of only 10μV full scale deflection.

Measuring accuracy

The alignment of the weighting networks at 1kHz was found to be very accurate with the A-weighting being −0.1dB and the CCIR-weighting −0.05dB of the unweighted sensitivity. Furthermore the rms and the quasi-peak readings were identical.

Using a 1kHz signal on the 1V range, an indication of 1V was found to correspond to an input of 0.997V rms sinewave—excellent calibration—and checking the attenuator step accuracy showed that the total error overall was within ±0.05dB.

The meter linearity was also carefully checked and found to be within a pointer's width down to an indication of −8dB with errors of only 0.1dB at indications of −10dB and −11dB, excellent accuracy again.

The Quasi-peak metering

The dynamic characteristics of the quasi-peak rectifier are closely defined in the recent CCIR recommendation 468-2 and the instrument was tested in terms of these standard requirements.

The first test consists of applying bursts of 5kHz tone to the instrument and observing the peak deflection of the meter for various lengths of tone burst when the amplitude of the continuous level would give 80% full scale deflection. The results in **Table 3** were obtained which as can be seen are well within specification.

The next test again consists of applying bursts of 5kHz tone of the same amplitude and 5ms duration, the repetition rate being altered to three values, the instrument was again well within specification, **Table 4.**

TABLE 4

Burst rate (bursts per second)	2	10	100
Indication (dB)	−7.0	−2.6	−0.3
Standard requirement	−7.3/5.5	−2.8/1.7	−0.5/0.0

Further tests for the overload margin (which is now 20dB), reversibility error and overswing, all gave results which are within the standards and the only minor way in which the instrument did not comply was the scale calibration. The standard requires a calibrated range of 20dB whilst this instrument only has calibrations over the +3dB to −15dB range. Personally I cannot see the point of the recommended 20dB range as there is nothing to be gained by adding closely-spaced calibrations well below full scale deflection.

Inputs and outputs

The measuring input was found to have an input impedance of 1.01MΩ in parallel with 12pF on ranges above and including 10mV, and following the manufacturer's specification at higher sensitivities—all adequately high impedances.

External filter inputs required 100mV rms sinewave for '10' meter indication into an input impedance of 10kΩ in parallel with 36pF with the external filter output having a sensitivity of 0.987V for an input which would give '10' meter indication from a source impedance of 1kΩ, this arrangement allowing for 20dB maximum loss in external filters.

FIG.1 WAYNE KERR AN M3 VARIOUS RESPONSES

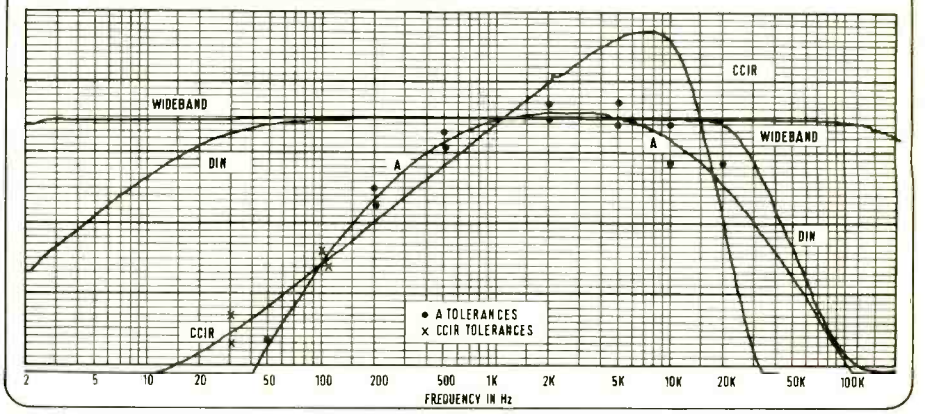


TABLE 3

Burst length	1ms	2ms	5ms	10ms	20ms	50ms	100ms	200ms
Measured deflection	18%	28%	41%	48%	53%	60%	65%	76%
Standard requirement	13.5/21.4%	22.4/31.6%	34%/46%	41/55%	44/60%	50/68%	58/78%	68/92%

Turning to the ac and dc front panel outputs it was initially found that these BNC connections did not have the shield grounded and if the meter was used on the two most sensitive ranges, the unit burst into oscillation. It was later found that the manufacturer had omitted the grounding wire and inserting this solved the oscillation problem. It was then found that the output levels for '10' meter indication were 0.994V dc and 0.997V ac from a source impedance of 992Ω for the dc output and 2,730Ω for the ac output—useful and accurate levels but an impedance on the high side.

Summary

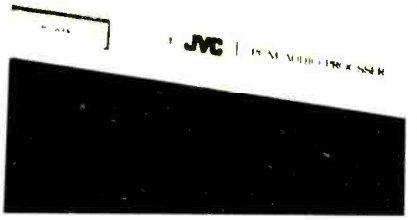
This battery-operated instrument proved to have excellent accuracy in all respects and generally had a good performance in terms of standard requirements. In other respects the noise performance was good and it has the advantage of having a very high sensitivity.

In many instances the use of an external power supply will be considered as the battery consumption at just over 40mA is quite high for PP9 batteries which are none too cheap nowadays. It is however understood that an internal mains adaptor will be available.

On the minus side it was unfortunate that a grounding wire was missing, a printed circuit board was loose, and the front panel securing nuts not properly tightened. Clearly the quality control can be improved, but this is a very useful instrument at a not unreasonable price.

Hugh Ford

agony



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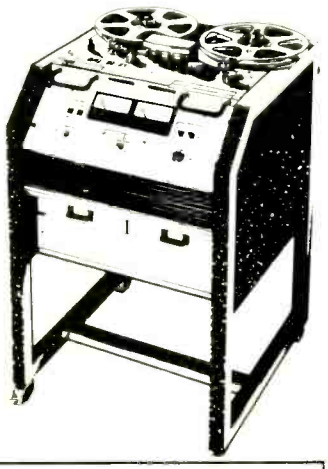

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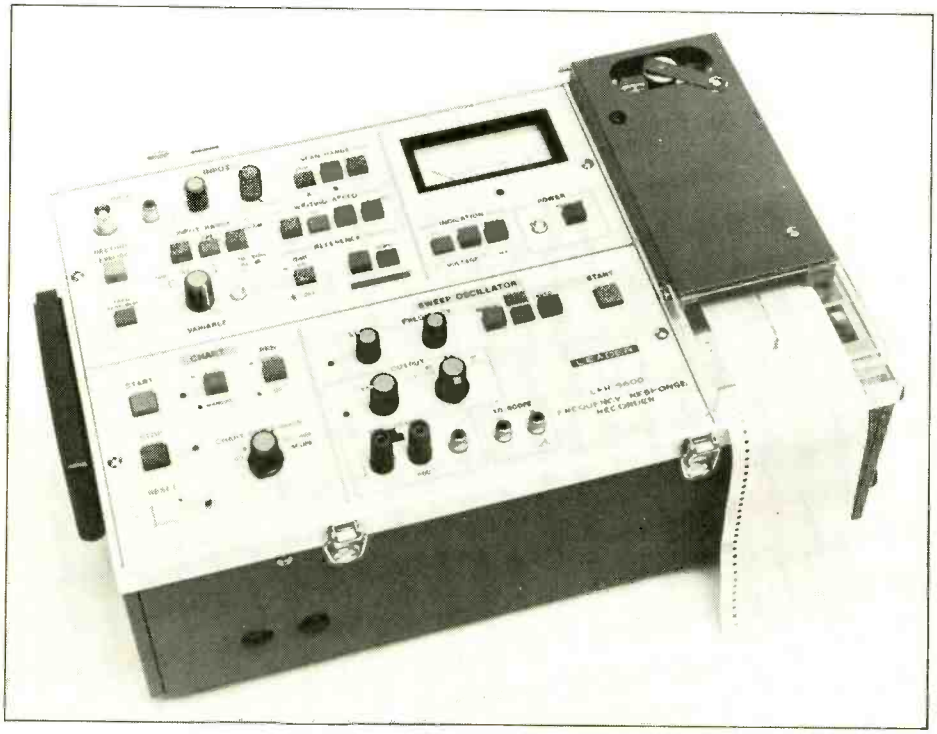


MANUFACTURER'S SPECIFICATION

Input section

Frequency range: 20Hz to 30kHz.

Input impedance: 500kΩ in parallel with less than 50pF.

Voltage ranges: three ac and dc ranges. Ac range 10V (+20dB) 100mV to 316V, 1V (0dB) 10mV to 31.6V, 0.1V (—20dB) 1mV to 3.16V. Dc ranges 1V/cm, 100mV/cm and 10mV/cm.

Recording accuracy: logarithmic scales ±0.5dB reference 0dB at 1kHz. Linear scale ±2% of full scale reference 0dB at 1kHz. At indications of +10dB to —10dB ±0.5dB 20Hz to 30kHz. At —20dB indication ±0.5dB 20Hz to 20kHz, ±1dB to 30kHz. At —30dB indication ±1dB 20Hz to 20kHz, ±1.5dB to 30kHz. At —40dB indication ±1.5dB 20Hz to 20kHz, ±2dB to 30kHz. All reference 0dB at 1kHz.

Frequency scale: ±3% ±2Hz full scale.

Scales: 25dB, 50dB and linear.

Detection: average rectifier.

Response speed: four ranges of 0.1s, 0.2s, 0.5s and 1s.

Standard signal: 1kHz or 333Hz with distortion less than 1%.

Sweep operation: manual, auto-start, chart stop and reset.

Signal processing time: five seconds for pilot signal, 54s for sweep signal at 3mm/s chart speed, signal to noise measurement 8.5s at 3mm/s chart speed.

Attenuator: output impedance 600Ω ±10%. Three ranges, 0, —20dB, —40dB accurate to ±2%.

Indicating meter: indicates sweep frequency, input voltage or output voltage. Frequency scale 20Hz to 30kHz. Voltage 3V (+10dB) full scale. Accuracy 5% of full scale deflection for voltage and frequency.

Oscilloscope output: vertical output 3V peak to peak ±10% for full scale voltage. Horizontal output 3V ±10% of full scale for 30kHz. Output impedances 10kΩ ±10%. Automatic 0dB circuit: standard frequency 1kHz for reel-to-reel or 333Hz for cassette. Pull in range ±10dB against 0dB.

Recording section

Chart speeds: 0.1, 0.3, 1, 3mm/s and 'to scope'.

Writing: ink pen.

Paper: total width 73mm (approximately 3in), effective width 50mm (approximately 2in), length 60m (approximately 200ft).

Paper carrier: start (automatic or manual), stop and reset.

Automatic start: by 1kHz or 333Hz pilot signal.

Sweep oscillator section

Frequency range: 20Hz to 30kHz.

Pilot frequency: 1kHz or 333Hz.

Output voltage: greater than 3V rms into 600Ω.

Output flatness: 20Hz to 10kHz±0.2dB, 10kHz to 30kHz ±0.5dB.

Distortion: less than 0.5% 100Hz to 1kHz, 0.6% to 5kHz, 0.7% to 10kHz, 0.9% 20Hz to 100Hz, 1.0% 10kHz to 20kHz then 1.4% to 30kHz.

Temperature range: 0 to 40°C.

Power supply: Ac 115V, 50/60Hz at 28VA. European version available.

Size: 400mm wide x 250mm deep x 150mm high (16 x 10 x 6in).

Weight: 9.5kg (21lb).

Price: £1,350.

Manufacturer: Leader Electronics Corporation, 2-6-33 Tsunashima Higashi, Kohoku-ku, Yokahama, Japan.

UK Agents: Martron Limited, 20 Park Street, Princes Risborough, Buckinghamshire, and Cybervox Ltd, 105/109 Oyster Lane, Byfleet, Surrey KT14 7JH.

THE Leader *LFR-5600* frequency response recorder consists basically of two sections, a linear or logarithmic variable speed pen recorder and a sweep oscillator which may either be driven in synchronism with the recorder or alternatively manually tuned. In addition there is a moving coil meter which can be switched to monitor input level, output level or tuned frequency.

Housed in a metal case with a removable lid (which has plenty of storage space for leads and oddments), the recorder has a good carrying handle and is equipped with feet both on its base and end so that it can be safely put down vertically when being carried, or horizontally on the bench for normal use.

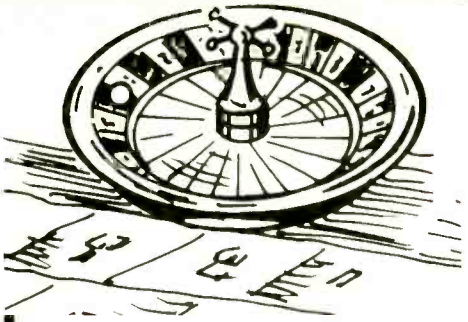
The front panel divides logically into five sections, the galvanometer chart recorder, the metering section, chart movement control, the sweep oscillator, and input and recording control.

Starting with the sweep oscillator, this has terminal/banana socket outputs on standard ¾in centres plus a phono socket in parallel, the output being an unbalanced 600Ω output with an inbuilt terminating resistor which can be inserted by means of a slide switch. Near the outputs are a variable potentiometer level control and a voltage range switch providing nominal maximum outputs of 3V, 0.3V or 0.03V rms into 600Ω or twice these voltages into a high load impedance. It is felt that the maximum output capability is rather low for some professional applications, but there is a useful output range.

Three interlocked pushbuttons control the oscillator's mode of operation. If the 'manual' button is depressed the oscillator frequency is controlled by a nearby potentiometer, 'auto' transfers control to either the start button of the oscillator or the recorder section whereupon the oscillator is swept from 20Hz to 30kHz at a speed controlled by the position of the chart speed switch in the chart movement control section. Thirdly there is a button labelled 'pilot signal' which, when depressed, passes a special signal of either 333Hz or 1kHz to the oscillator's output terminals at a level controlled by a separate level control, the frequency being controlled by two pushbuttons in the metering section. The purpose of this pilot signal is to provide an automatic start function in the recorder which is very useful when working with single head tape machines and some test discs. When making the recording in the pilot signal mode, a burst of pilot signal is automatically recorded and the normal sweep started at the end of the pilot signal. When the recording is replayed in the pilot signal mode, the chart recorder waits for the 333Hz or 1kHz pilot signal and automatically starts at the end of the pilot signal, thus maintaining synchronism with the recorded frequency sweep. The idea of having both 333Hz and 1kHz is that these are standard reference frequencies for low and high speed tape recording reference fluxivities.

The chart movement control section has a

80 ▶



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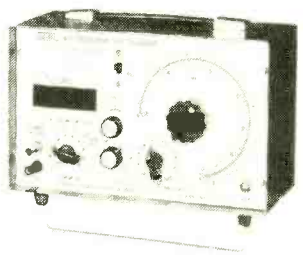

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SQUARE OUTPUT	TG200D, DM & DMP only, 7V peak down to <200μV, Rise time <150nS.	**£125**
SYNC. OUTPUT	>1V r.m.s. sine in phase with output.	TG200DM
SYNC. INPUT	±1% freq. lock range per volt r.m.s.	**£130**
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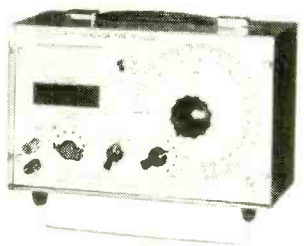

TG152 SERIES

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five-position rotary switch for the control of chart speed from 0.1mm/s (incorrectly identified on the panel as mm/S) through 0.3mm/s, 1mm/s to 3mm/s with the fifth position identified as 'scope'. In practice the chart speed setting controls the oscillator sweep rate whether the recorder is in use or not, and the fifth position provides a 10s sweep which may be used to plot frequency response on a long persistence oscilloscope via two phono sockets in the sweep oscillator section. One of these provides a vertical output proportional to the pen position on the chart and the other a sawtooth waveform to replace the oscilloscope's timebase.

A stop button stops the sweep (with or without chart drive) at any frequency, while the reset button sets the sweep frequency to 20Hz and rearms the chart drive logic. In addition to a pen up/down button, there are two further controls in the chart movement control section. Finally, there is an auto/manual switch which in the auto position initiates the chart drive from a pilot signal with the start button arming the pilot sensor, or alternatively starts the chart drive in the manual condition.

The metering section contains a single moving coil meter calibrated from 20Hz to 40kHz on a logarithmic scale with calibration points within each decade at 1, 2 and 5 beneath a dBV scale covering ±10dBV, and a voltage scale from zero to three volts. These three scales work in conjunction with three interlocked pushbuttons which select frequency, input voltage or output voltage, the ranges of which are selected by the oscillator output level switch or the input attenuator switch in the input and recording control section. Within this section two sets of interlocked pushbuttons effect the recorder, four control the writing speeds of 0.1, 0.2, 0.5 or 1s for the chart width, with the other three buttons providing 25dB, 50dB or linear ranges.

The input to the recorder is via a BNC socket in parallel with a phono socket after which the signal path divides depending upon whether dc recording or ac frequency response recording has been selected. In the former case potentiometers are provided to set the pen to zero before recording and to fine adjust the sensitivity which is controlled for both ac and dc recording by three range pushbuttons. In the case of dc recording, they give full chart width sensitivities of nominal 0.05V, 0.5V and 5V with the fine control having an infinite range with a calibration point when fully clockwise.

In the ac recording mode there is a separate similar sensitivity control with the range pushbuttons providing zero decibel reference line sensitivities of 0.1V, 1V or 10V rms, and voltmeter ranges for full scale deflection of 0.3V, 3V or 30V.

The remaining features of this section consist of pushbuttons for selecting the 333Hz or 1kHz pilot frequency and a rather useful feature for automatically setting the zero decibel reference point on the chart. If the zero decibel reference feature is selected, the recording section senses the level of the pilot tone when it is replayed and automatically adjusts the input gain to the recorder so that the pilot tone level corresponds to the zero decibel reference line on the chart. The gain is then held constant whilst the frequency response curve is plotted and held until a further pilot tone is encountered. This feature has approximately a ±10dB range within which a small light illuminates to tell the operator that the level is within the range of automatic operation—all a very ingenious and potentially useful feature which would save time in production line work in particular.

The galvanometer recorder is a simple ink-fed device with a large ink reservoir feeding a felt writing pen via a miniature tube with paper drive by means of a single sprocket. The paper roll is very simple to replace and contains charts 250mm long by 150mm wide, frequency calibrated from 10Hz to 40kHz and with adequate space for notes—the basic recorder settings have pre-printed annotations.

The recorder is contained in a solid metal frame with the base largely being covered with a printed circuit board housing the control electronics. Two further assemblies plug into this board to form the operating surface, one assembly being the input and metering section and the other the oscillator and chart control section. Each has printed circuits to which the front panel controls are attached, and overall access for servicing is good with the components and boards being to a good 'domestic standard'. However no component identifications are provided and the instruction book only includes circuits — no layout diagrams.

All front panel controls are clear labelled and grouped by grey markings on the light grey front panels with coloured knobs being used to ease operation. In addition there are a number of LED indicators to tell the operator the status of the instrument, and after a little practise it is simple to use.

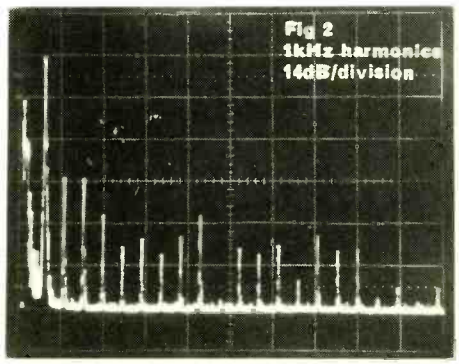
The oscillator

Initial attention was directed at the pilot oscillator. This may be kept in action by pressing the pilot button or it gives a five-second burst of tone when the start button is pressed, after which the sweep begins. The frequency of the pilot was found to be 334.2Hz or 1003.9Hz, which is more than adequate with maximum output voltages of 3.47V and 3.485V respectively into 600Ω or approximately twice this voltage unloaded. Distortion of the pilot tones was very low with less than 0.03% second harmonic and less than 0.01% third harmonic.

Checking the accuracy of the output attenuator showed this to be excellent, with the 20dB nominal steps being 20.02dB and 19.98dB, with a maximum output at 1kHz from the sweep oscillator of 3.58V loaded into 600Ω or twice this into an open circuit. It is felt that whilst this maximum level is enough for measurements on domestic equipment, it is a little restricted for some measurements upon professional equipment. It is however a nice feature that the level of the pilot tone may be set higher than the level from the sweep oscillator.

The flatness of the oscillator output was excellent, being within ±0.1dB throughout its measured frequency range from 20Hz to 35kHz in the automatic sweep mode, and extending to 50kHz in the manual mode.

Measuring the sweep oscillator harmonic distortion showed that this was higher than specification, **fig 1,** which shows the level of the second and third harmonic plus the fourth and ninth harmonics which also predominate. Whilst the distortion is relatively constant with frequency, it is felt that the levels of distortion at lower frequencies make the oscillator unsuitable for subjective testing. The levels of other harmonics are demonstrated in **fig 2**



which is a spectrum analysis of the output at 1kHz and shows many high harmonics typical of function generator type oscillators. It is however understood that there are internal adjustments for distortion and the review instrument may not be typical of production.

Checking the frequency accuracy against chart position showed that this was very good with no significant difference between the chart calibrations and the actual frequency.

The metering section

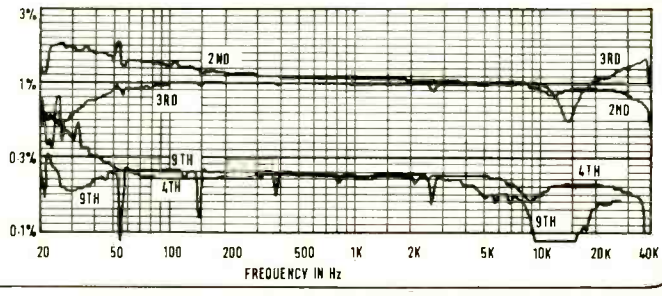
Table 1 shows the accuracy of the meter in

82 ▶

TABLE 1

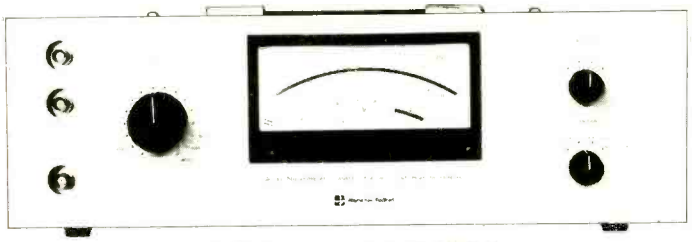
Reading	20Hz	50Hz	100Hz	500Hz	1kHz	5kHz	10kHz	20kHz	30kHz
Actual frequency	20.6Hz	51.7Hz	102.7Hz	518.6Hz	1.038kHz	5.194kHz	10.31kHz	20.54kHz	29.86kHz

FIG.1
LEADER LFR-5600
HARMONIC
DISTORTION



NOISE

If noise is a problem in your design these instruments are essential for diagnosis



ANM3
- Switchable quasi peak/true r.m.s.
- CCIR weighting filter
- IEC weighting filter
- DIN weighting filter
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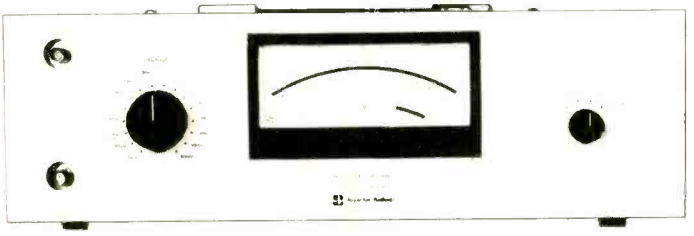

ANM4
- Average responding meter
- 16 measurement ranges
- High sensitivity, low noise (<1μV)
- Modified CCIR filter
- Conforms to Dolby recommendations

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the frequency measuring mode where it clearly performs a useful function when the chart recorder is not in use, as there is no other way of determining frequency.

In the input or output voltage measuring mode, the meter was checked at three points on each range and found to be within 1% of full scale deflection, which is a very good performance.

The recorder and input section

The unbalanced input had an input impedance of 495kΩ in parallel with 34/28.5/45pF depending upon the input attenuator setting, with the accuracy of the attenuator being with the readability of the instrument. So far as the meter is concerned, the full scale ranges are 30V, 3V and 0.3V rms sinewave with an average rectifier characteristic. In the case of the recorder, the instrument is calibrated for the zero decibel line which is four fifths full scale deflection (ie 10dB below full scale on the 50dB range or 5dB below full scale on the 25dB range).

The available sensitivities for the zero dB line on the recorder are nominally 10V, 1V and 0.1V with the measured sensitivities corresponding to 9.86V, 0.986V and 0.0986V in the logarithmic modes or these values for full scale deflection in the linear mode. For higher input voltages, the variable level control provided an infinite range and when dc recording the sensitivity was constant 5.00V for full scale deflection with the separate input level control also having an infinite range.

Fig 3 shows the linearity of the recorder with 10dB steps being recorded on the 50dB range and 5dB steps on the 25dB range while a similar good degree of linearity was experienced when recording dc. Checking the automatic level setting circuit showed that this could be used up to 26dB below full scale chart reading on the 50dB range, and that it was extremely effective with the resetting of the level only being possible with the chart stopped so that the level control cannot reset itself with a pilot tone frequency during a sweep.

The acceptable frequency of the automatic starting pilot tone was found to be from 320Hz to 350Hz for the nominal 333Hz tone or 800Hz to 1.1kHz for the nominal 1kHz tone, thus allowing for reasonable speed errors when using pre-recorded test tapes or discs, but eliminating accidental starting with other frequencies.

As can be seen from **fig 4,** the overall frequency response of the recorder is within +0 −0.5dB from 10Hz to 40kHz and effectively flat from 20Hz to 30kHz. Checking the pen speeds showed that the pen tended to have an exponential rise with the rise and fall times differing significantly, **Table 2.**

TABLE 2

Nominal speed	Rise time	Fall time
1s	0.95s	0.3s
0.5s	0.65s	0.25s
0.2s	0.12s	0.1s
0.1s	0.085s	0.06s

For frequency response recording, these errors are not of significance but they could be important for some applications. Checking the chart speeds showed that at 0.1mm/s and 0.3mm/s the recorder ran 1.6% slow increasing to 0.6% slow at the fastest speed of 3mm/s nominal.

The nominal 10s oscilloscope sweep was found to take 10.2s with a 3V p-p sawtooth output as the timebase and an output of 2.5V corresponding to full scale deflection on the pen recorder both from a satisfactory source impedance of 10kΩ.

Summary

The Leader frequency response recorder is a versatile instrument at a most realistic price. Overall the accuracy is more than adequate for general measurement purposes in the workshop, or for production line use, and the instrument is compatible with various pre-recorded discs so far as chart timing and the auto start facility is concerned.

Particularly in the review sample, the sweep oscillator distortion is on the high side for subjective testing of, for instance, loudspeakers, and also the pen speed has its errors, but neither of these matters effects the instrument for frequency response recording.

One minor snag is the ink used has a rather long drying time, so the recording can be accidentally smudged for quite a long time after it has been made, but in all other respects this is an easy instrument to use and is lightweight and portable. **Hugh Ford**

FIG. 3
LEADER LFR-5600 PEN LINEARITY

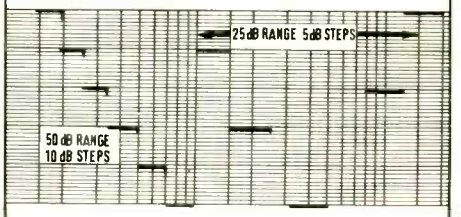
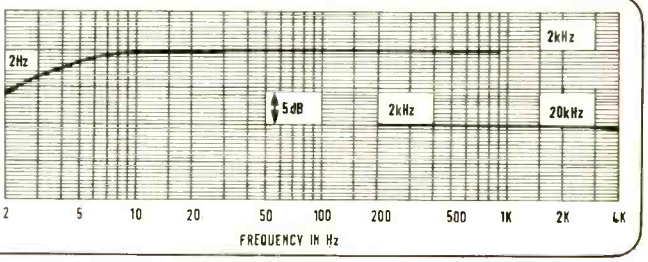


FIG. 4
LEADER LFR-5600
OVERALL FREQUENCY
RESPONSE



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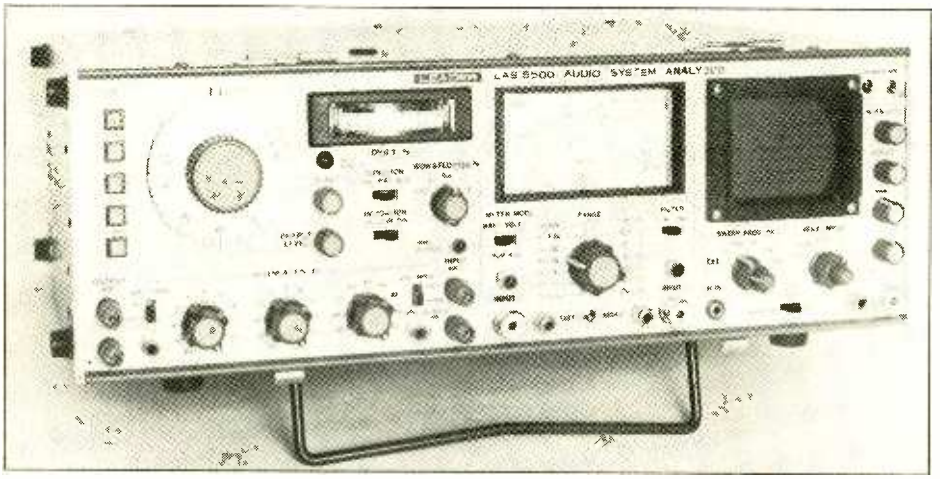
reviews

Leader LAS-5500 audio system analyser



MANUFACTURER'S SPECIFICATION

Audio oscillator

Frequency range: 10Hz to 1MHz in five decade ranges.

Calibration accuracy: ±5% below 100Hz, ±3% above 100Hz.

Output waveform: sine wave.

Output voltage: greater than 3V into 600Ω.

Distortion: less than 0.05% 500Hz to 20kHz, 0.1% 100Hz to 100kHz, 0.55% 50Hz to 500kHz, 1% 10Hz to 1MHz.

Output levelling: within ±0.3dB (600Ω load).

Output impedance: 600Ω.

Output control: direct or through attenuator.

Attenuator

Input/output impedance: 600Ω unbalanced.

Attenuation range: 0–101dB in 0.1dB steps.

Frequency response: ±2% to —70dB dc to 200kHz, ±2% to —101dB dc to 100kHz.

Maximum input: 0.5W (17V rms, or +27dBm).

Output load resistor: 600Ω (switchable in or out).

Ac millivoltmeter

Voltage range: 30μV to 100V rms in 12 ranges, 0.3, 1, 3, 10, 30, 100mV rms, 0.3, 1, 3, 10, 30, 100V rms.

Decibel ranges: —90 to +42dBm (0dB=0.775V), —90 to +40dBV (0dB=1V).

Accuracy: ±3% of full scale referred to 1kHz.

Frequency response: ±10% 5Hz to 500kHz. ±5% 10Hz to 200kHz. ±3% 20Hz to 100kHz.

Input impedance: 10MΩ in parallel with less than 65pF at each range.

Weighting filter: according to JIS 'A' curve (same as NAB) switchable in or out.

Input connections: UHF type and pin jacks for left and right, switch selectable.

Measuring modes: direct, attenuator output and wow and flutter.

Oscilloscope

Display area: 8 x 10 divisions (one division=6mm).

Vertical sensitivity: 10mV/div adjustable in four steps x1, x10, x100, x1000 with continuous fine adjustment, 10mV to 100V/div.

Bandwidth: dc or 2Hz to 5MHz (—3dB) vertical, rise time 70ns.

Vertical input: impedance 1MΩ in parallel with 40pF via UHF type connector (SO-239), maximum input voltage 600V (dc+ac peak).

Horizontal sensitivity: approximately 200mV/division with input control range of 200mV to 10V/division, maximum input voltage 100V (dc+ac peak).

Horizontal bandwidth: dc to 250kHz (—3dB).

Horizontal input impedance: 100kΩ.

Time base: 10Hz to 100kHz sweep frequency in four ranges with continuous fine adjustment, internal positive synchronisation only.

Wow and flutter meter

Measuring frequencies: JIS, CCIR 3kHz, DIN 3150Hz ±10%.

Input voltage range: 15mV to 10V rms with automatic levelling.

Input impedance: greater than 300kΩ.

Wow and flutter ranges: five ranges—0.03%, 0.1%, 0.3%, 1%, 3% at full scale, accuracy within ±5% of full scale.

Frequency response: within —3dB ±1dB (sic), JIS 0.5 to 200Hz, CCIR 0.3 to 200Hz, DIN 0.3 to 300Hz.

Weighting characteristics: applicable to JIS, CCIR and DIN standards.

Indication: JIS—effective value, 95% of input (referred tp 100%) within 3.5 ±1s, CCIR/DIN—peak value in accordance with relevant standards.

Indicating method: uses % scales of millivoltmeter.

Test frequency source: 3kHz ±0.03% output 0.3V rms, output impedance approximately 5kΩ, distortion less than 2%.

General

Power supply: 100, 115, 200 or 230V, as specified, 50/60Hz, approximately 36VA with all sections in use.

Size: approximately 150 x 450 x 430mm (hwd).

Weight: approximately 11.5kg (25lb) including accessories.

Accessories: dummy load comprising two 8Ω 50W resistors in case, low capacitance probe, plugs and adaptors.

Price: £950.

Manufacturer: Leader Electronics Corporation, 2-6-33 Tsunashima-Higashi, Khoku-Ku, Yokohama, Japan.

UK agents: Martron Limited, 20 Park Street, Princes Risborough, Buckinghamshire and Cybervox Ltd, 105/109 Oyster Lane, Byfleet, Surrey KT14 7JH.

THE Leader audio analyser combines a number of test instruments into a single portable case complete with a stout carrying handle and feet on one side and also on the bottom so that it can be put down vertically, or horizontally on the bench when a tilting foot may also be used. Unlike so many instruments there is an apartment at the rear for stowing the mains lead (even with a 13A UK plug!), test leads etc.

As supplied, the instrument is accompanied by a resistive load box containing two 8Ω 50W non-inductive resistors terminated in banana sockets/binding posts and also a probe which can be switched between 1:1 and 10:1 division. The resistors may of course be used in series or parallel to form 4Ω or 16Ω loads rated at 100W.

Within the analyser there is a sinewave oscillator covering 10Hz to 1MHz, a 0 to 101dB 600Ω attenuator with 0.1dB steps over the full range, a millivolt-meter covering 100V to 300μV full scale ranges, a small oscilloscope and a wow and flutter meter (with a separate 3kHz oscillator) working to either the IEC peak weighted standard, the CCIR standard or the JIS standard plus an unweighted setting, and including a drift meter.

Clearly this is a most versatile instrument for many audio alignment and servicing tasks and is particularly useful for aligning tape recorders. However, it seems a shame that some form of distortion measurement was not included but maybe this is asking too much of a single portable combination.

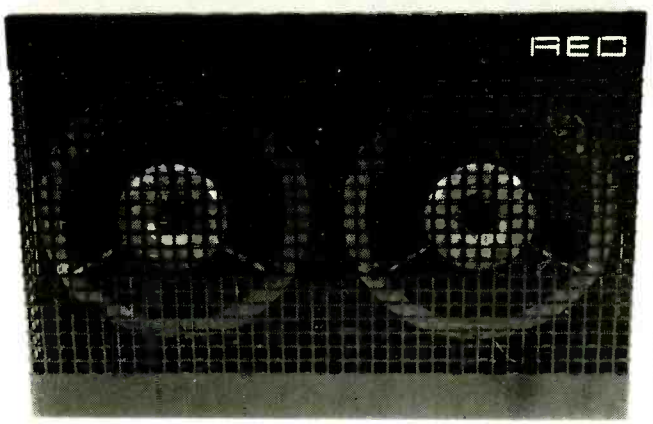
To the left of the instrument is the oscillator with a large calibrated tuning dial with extremely clear calibrations from one to ten operating in conjunction with five interlocked pushbuttons which select the frequency decade from x1 to x100K. A potentiometer level control feeds the oscillator's output to a phono socket, adjacent to which there is a two-position slide switch which feeds the attenuator from either the oscillator or from an external source via a pair of input banana sockets/binding posts, with a second pair in parallel with a phono socket at the attenuator output.

The unbalanced attenuator of 600Ω impedance has a slide switch next to the output terminals for inserting a 600Ω termination, while the amount of attenuation is controlled by three rotary switches giving 10dB steps from zero to –90dB, 1dB steps from zero to –10dB and 0.1dB steps from zero to –1dB, 101dB in total.

As with other sections of the instrument, these controls and connections are grouped by dark grey markings on the light grey front panel with clear black legends making settings very easy to read.

86 ▶

RED
PROFESSIONAL



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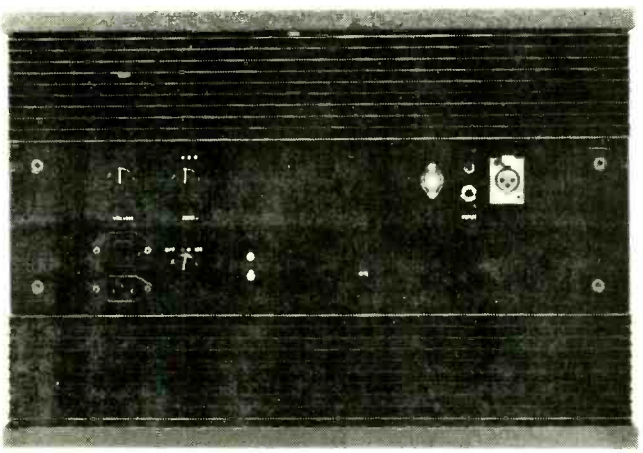
Size of unit is 345x480x335mm (hwd). Overall volume 32 Ltr. Weight 32kg.



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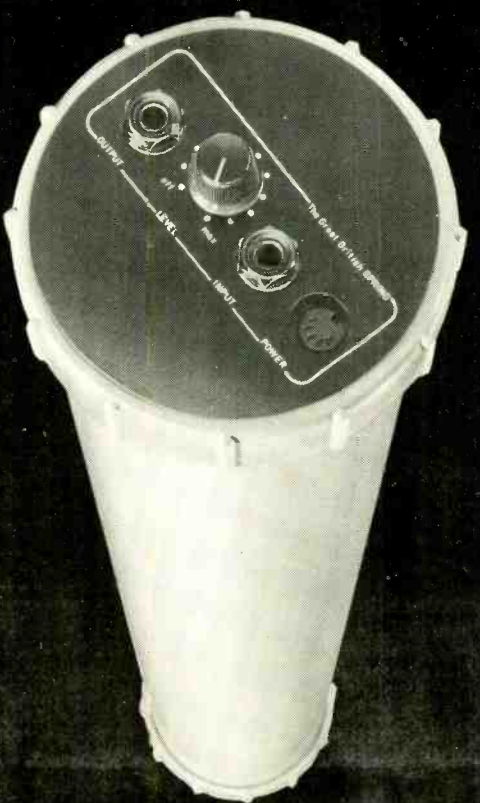

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Above the attenuator is the wow and flutter meter section. This incorporates a horizontal scale drift meter, uses the millivoltmeter's indicator to read wow and flutter and its input connectors for the wow and flutter meter's input but with a separate phono socket for the fixed 3kHz measurement oscillator's output.

The drift meter has a fixed range of ±5% with calibration points at 1% intervals, the set zero control having a range which covers both 3,000Hz and 3,150Hz measuring frequencies, but the internal oscillator is fixed at 3kHz which would appear to be an unfortunate choice because 3,150Hz is the international standard measuring frequency. It is also felt that the drift indication range is too large—1% drift is a poor performance and you can't read less than this.

Beneath the drift meter there is a green LED indicator to show that the wow and flutter section has adequate input level, and two 3-position slide switches. The upper one selects 'function' so that either the internal oscillator can be fed to the drift meter for zero calibration at 3kHz or wow and flutter may be measured either weighted or unweighted. The second switch selects the form of wow and flutter indication which may be to either the Japanese JIS standard using a 3kHz centre frequency and a rms rectifier, the CCIR standard using again a 3kHz centre frequency but with a quasi-peak rectifier, or the IEC standard (incorrectly stated as DIN) using a 3,150Hz centre frequency with a quasi-peak rectifier.

As previously stated, the wow and flutter is indicated on the millivoltmeter's movement, using the zero to three and zero to one scales, with a range switch selecting full scale sensitivities of 3%, 1%, 0.3%, 0.1% or 0.03%, the maximum sensitivity being adequate for any professional applications.

The millivoltmeter section has two sets of input connectors for left and right inputs, there being a toggle switch between the pairs of terminals to select the desired input with the unwanted input being isolated from the chassis. The input connections consist of phono sockets, a UHF connector and a grounding terminal, the latter two being sensibly arranged so that either 3mm banana plugs or adaptors with the standard ¾in spacing may be used.

The scaling of the meter is very clear with zero to three and zero to one scales at the top in black, a green zero to −20dBV scale and a red +2dBm to −20dBm scale, with the range switch having black legends for volts and red legends for decibels. As is usual, the range switch operates in 10 decibel steps from +40dB to −70dB with the equivalent voltage ranges being in 3:1 steps from 100V to 300μV full scale deflection. Also included in the millivoltmeter section is an 'A'-weighting filter which is switched into circuit by a slide switch. As is usual with inexpensive millivoltmeters, the instrument has an average responding rectifier with the calibrations being in equivalent rms values for a sinewave. For most applications the maximum sensitivity of −70dBV will be found to be adequate but in some circumstances the instrument is not adequately sensitive to measure noise.

The final section of the audio analyser consists of a small single beam oscilloscope with a green medium persistence tube in front of which there is a 8 x 10 division graticule. Whilst the oscilloscope is basically uncalibrated, it may be calibrated in time and voltage using the oscillator and attenuator; however the graticule is too far in front of the tube face for accurate measurements.

To the right of the tube are the normal intensity, focus and shift potentiometers below which is the input consisting of a UHF socket with an adjacent grounding post which similarly to the millivoltmeter may be used with 3mm banana plugs or standard ¾in spaced adaptors. By means of a three-position slide switch, the input to the Y amplifier can be either from this input with ac or dc coupling or from the millivoltmeter, in which case the oscilloscope is fed from the output of the millivoltmeter's amplifier, thus providing a very high Y axis sensitivity. Normally the Y axis sensitivity is controlled by a coaxial rotary switch and potentiometer, the potentiometer giving a variable control and the switch providing four decades plus an input grounded condition.

A second pair of coaxial controls affect the X axis with the potentiometer giving continuous variation of the X amplifier sensitivity and the rotary switch selecting the five decades of sweep frequency or an external X input via a banana socket.

Within the instrument, construction is modular with most connections to the printed circuit boards being by plugs, and access for servicing being good overall. The general quality of the components and the printed circuit boards can best be described as 'good domestic' with no components identifications for servicing being provided. With servicing in mind, it is unfortunate that the instruction book did not include circuits or any servicing information. Furthermore it was written at a very low level to the extent that it includes pictures to show how to use the twin 8Ω load box to form 8Ω and 16Ω loads!

TABLE 1

Dial	Decade	Percentage error x10	x100	x1000	x10K	x100K
1		−0.2%	+0.05%	−0.003%	+0.005%	−0.35%
2		+0.25%	+0.4%	+0.52%	+0.6%	+0.05%
4		−0.25%	+0.45%	+0.66%	+1.03%	+0.95%
6.5		+0.31%	+0.77%	+0.47%	+0.45%	+0.33%
10		+0.65%	+0.68%	+0.91%	+0.52%	+0.08%

The oscillator performance

Dealing first with the fixed 3kHz oscillator for wow and flutter measurement the frequency of this was found to be 3000.0Hz with less than 0.1Hz drift during the first hour from switch on—a very good performance. The fixed output level of 305mV from a source impedance of 4.8kΩ should be compatible with most applications, but the impedance is on the high side and the output on the low side for some professional purposes.

Similarly the variable oscillator has a rather small maximum output level for some professional applications at 6.22V rms from a source impedance of 600Ω or +12.1dBm loaded into 600Ω.

The output level was found to be flat to within +0.1dB −0dB up to 10kHz rising to +0.2dB from 15kHz to 100kHz relative to 1kHz with relatively mild amplitude bounce when altering the frequency tuning dial.

Checking the accuracy of the frequency calibration at five points in each decade provided excellent results as shown in **Table 1.**

All the above figures are very much better than the manufacturer's specification with many of the distortion performance figures also being well in credit. The second and third harmonic components were measured at three points in each decade with the results in **Table 2** which shows that the performance in the audio frequency band is quite respectable, but does not compare with very low distortion oscillators of a specialised type.

TABLE 2

Frequency	Second harmonic	Third harmonic
10Hz	0.30%	0.56%
50Hz	0.03%	0.04%
100Hz	<0.01%	0.04%
100Hz	<0.01%	0.025%
500Hz	0.011%	0.022%
1kHz	0.02%	0.03%
1kHz	0.012%	0.016%
5kHz	0.012%	0.03%
10kHz	0.016%	0.045%
10kHz	0.016%	0.03%
50kHz	0.009%	0.03%
100kHz	0.056%	not measured
100kHz	0.035%	not measured
500kHz	0.50%	not measured
1MHz	0.89%	not measured

Oscillator noise was also at a very low level, being at least 100dB below signal in the audio band, and no problems were experienced with hum or other unwanted tones in the oscillator's output.

The attenuator

The 600Ω attenuator was found to have a constant input impedance of 601Ω with the output impedance being within 0.5% of the nominal 600Ω. The accuracy of the 10dB steps was checked at 1kHz, 10kHz, 100kHz and 500kHz and found to be within 0.1dB at 1kHz relative to unity gain and within ±0.1dB at the other three frequencies. Checking the 1dB and 0.1dB steps showed that the worst error in the 1dB steps was a creditable 0.008dB and 0.0008dB in the 0.1dB steps—an excellent all-round performance

The millivoltmeter

The two switched inputs to the millivoltmeter were found to have an input impedance of 10MΩ in parallel with 49pF and 39pF respectively—an adequately high impedance.

The accuracy of the range attenuator was found to be within 0.1dB up to 200kHz, with the accuracy of the meter being within the readability of the scale at 1kHz. The frequency response of the meter at all range settings rose

88 ▶

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from −5dB at 2Hz, −1dB at 4Hz, to be within 0.1dB up to 200kHz with the rectifier having an average characteristic and the scale calibrated for the equivalent rms sinewave value.

Residual noise was about 10μV without the 'A'-weighting in circuit and not readable in the weighted mode. As can be seen from **fig 1**, the measured performance of the 'A'-weighting curve was very well within the IEC 179 standard limits.

Only one problem was experienced with the millivoltmeter and that was a tendency for input frequencies close to the mains power frequency or its harmonics to beat on the 300μV range and even removing the instrument's earth did not cure this trouble.

The oscilloscope

The basic input sensitivity of the oscilloscope could be varied from 3.6mV per division to 130V per division with ac or dc coupling available. When used in conjunction with the millivoltmeter, the oscilloscope was usable to examine waveforms down to 50μV rms. The Y axis bandwidth was such that the oscilloscope was usable up to 14MHz. It was however found that on the x1000 Y gain range there was fairly severe overshoot on squarewave inputs with or without the probe in use.

Timebase speeds had an adequate range from 17ms per division, to 800μs per division with the brilliance of the trace being good even with fast waveforms and the focus excellent.

When using an external X input, the single sensitivity control varied the X sensitivity from 16mV per division to infinity with the X input always being dc coupled.

The wow and flutter meter

Checking the accuracy of the drift meter showed that at the ±5% and ±2% points it was effectively within the readability of the scale with the drift zero setting having a range of +4.5% −2.49% of 3kHz in the JIS and CCIR modes or +4.43% −1.67% about 3,150Hz in the DIN mode (or more properly IEC mode).

The wow and flutter section required a minimum of 12.5mV input for the green LED indicator to become illuminated with the residual wow and flutter indication being less than 0.001% in any mode weighted or unweighted, with no leakage from the internal oscillator causing beats.

Calibration accuracy was such that an actual wow and flutter of ±3.02% at 4Hz gave an indication of ±3.1% with the 'frequency response' in the unweighted condition being flat up to 40Hz falling to −0.3dB at 63Hz and −3dB at 200Hz.

Fig 2 shows that the weighting curve is nicely within the IEC tolerances and checking the ballistics of the meter in the DIN mode showed that it too was within specification, an example being the test with bursts of unidirectional frequency variation which produced the symmetrical results shown in **Table 3.**

TABLE 3

Burst length	Indication	Standard
100ms	102%	100±4%
60ms	90%	90±6%
30ms	58%	62±6%
10ms	20%	21±3%

FIG 1
LEADER LAS-5500 'A' WEIGHTING CURVE

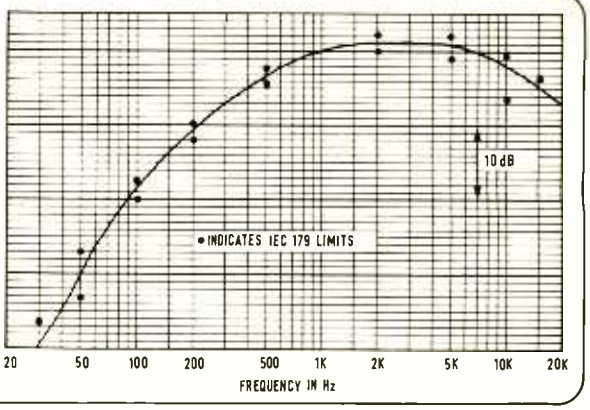
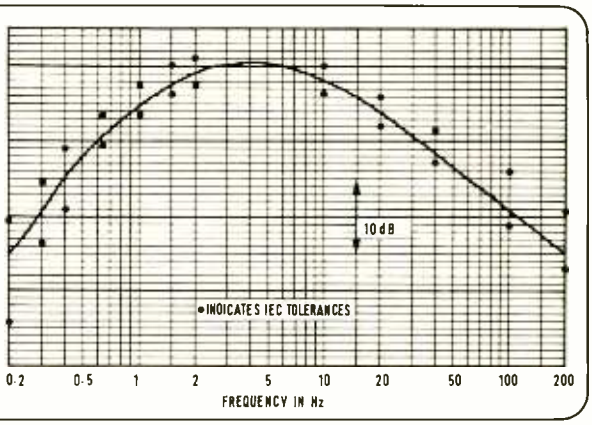


FIG.2
LEADER LAS-5500 FLUTTER WEIGHTING



Other matters

Checking the value of the twin 8Ω load resistors showed that at room temperature their resistances were 7.95Ω with no measurable inductance. However, after 10 minutes operation with one resistor dissipating 50W, its value fell to 7.87Ω, which is 1.6% below the nominal 8Ω and too large a variation for accurate measurements.

Not mentioned in the instruction book is a rear panel output of unweighted wow and flutter which gives an oscilloscope output of ±1V peak to peak for full scale unweighted wow and flutter indication without the dc drift component—a useful feature.

Summary

This audio analyser represents remarkable value when one considers that it contains an oscillator, an attenuator, a millivoltmeter, an oscilloscope and a wow and flutter meter—all having a good performance—at under £1,000.

Generally the performance of all parts of the instrument is to a very high standard having regard to the price tag, and no serious shortcomings were found during the review.

A clear front panel layout makes the instrument easy to use and its light weight and general portability together with storage space in the lid for oddments will make it particularly attractive for field servicing.

It is equally at home on the service bench, occupying far less space than individual instruments and eliminating many interconnections which clutter-up work benches.

Hugh Ford

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* Harmonizer is a trade mark of Eventide Clockworks Inc.

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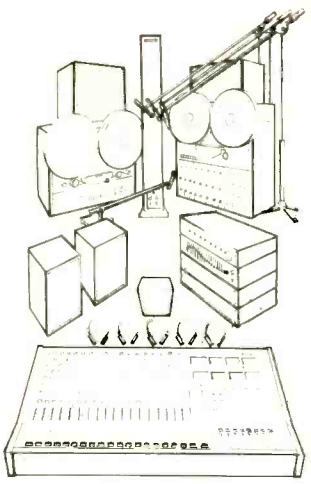

SYSTEMS

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.

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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.

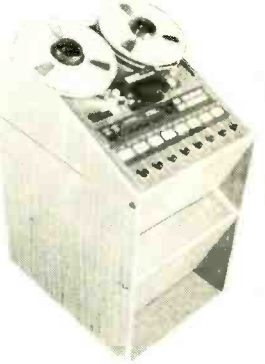
MICRO-PHONES

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.

SIGNAL PROCESSORS

The choice is immense. We cannot sell them all so we pick and choose the best.
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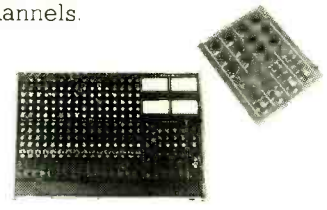
Roland of synthesiser fame, have introduced their 'Studio Series' of rack-mount units, including a phaser/flanger with extensive control facilities.
We also have the budget ACCESSIT range.

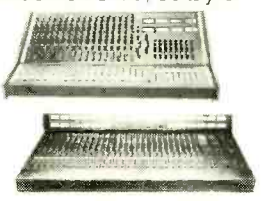
MIXERS

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.
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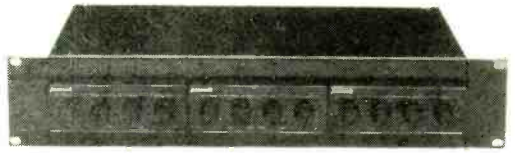
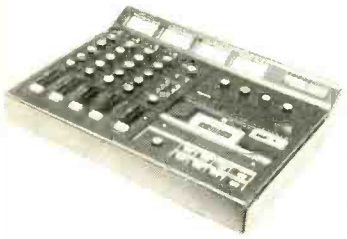


RacKit

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



PORTASTUDIO

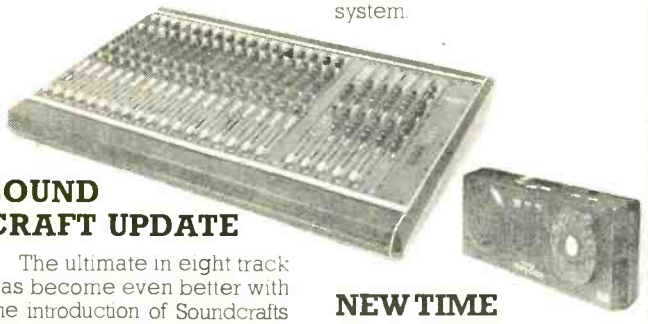
At last – TEAC's long awaited PORTASTUDIO. No bigger than a normal cassette machine this remarkable unit is a four channel mixer and simul-sync recorder in one. Add a microphone and a pair of headphones and you can make four track demos immediately. Available now.

RADIO BOOM

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

TOP SPOT

England's latest and most exclusive night spot is the Frimley Country Club. Turnkey recently installed the PA system which incorporates the new Soundcraft 400 Console, HH amplifiers and a Martin Bin system.



SOUND CRAFT UPDATE

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

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

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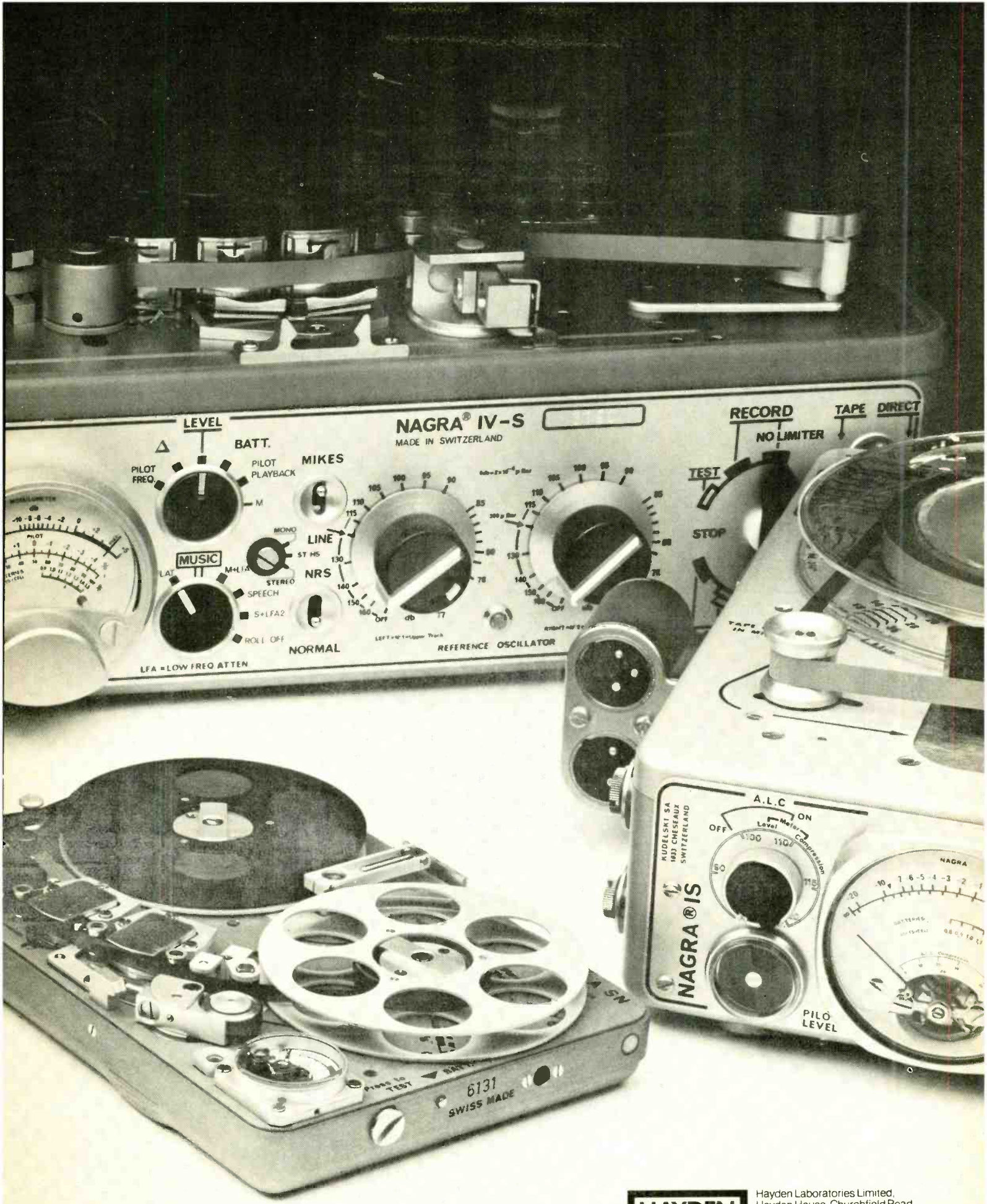
From the miniature SN (used by Chris Bonnington on his successful climb of Everest) to the 3-times Oscar award-winning 4.2, Nagra recorders have become unquestioned world-leaders.

Having created this height of perfection, Stefan Kudelski can surely be looked to for all the answers.

NAGRA KUDELSKI



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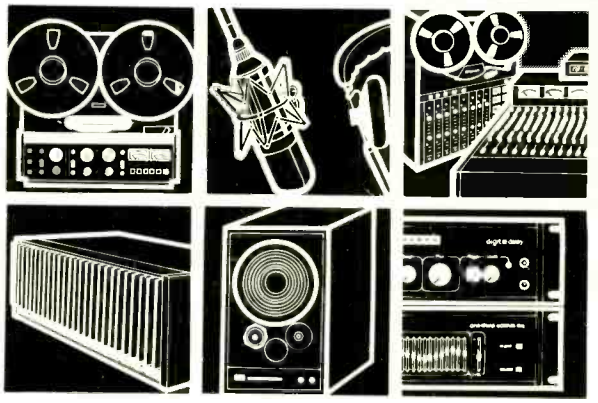

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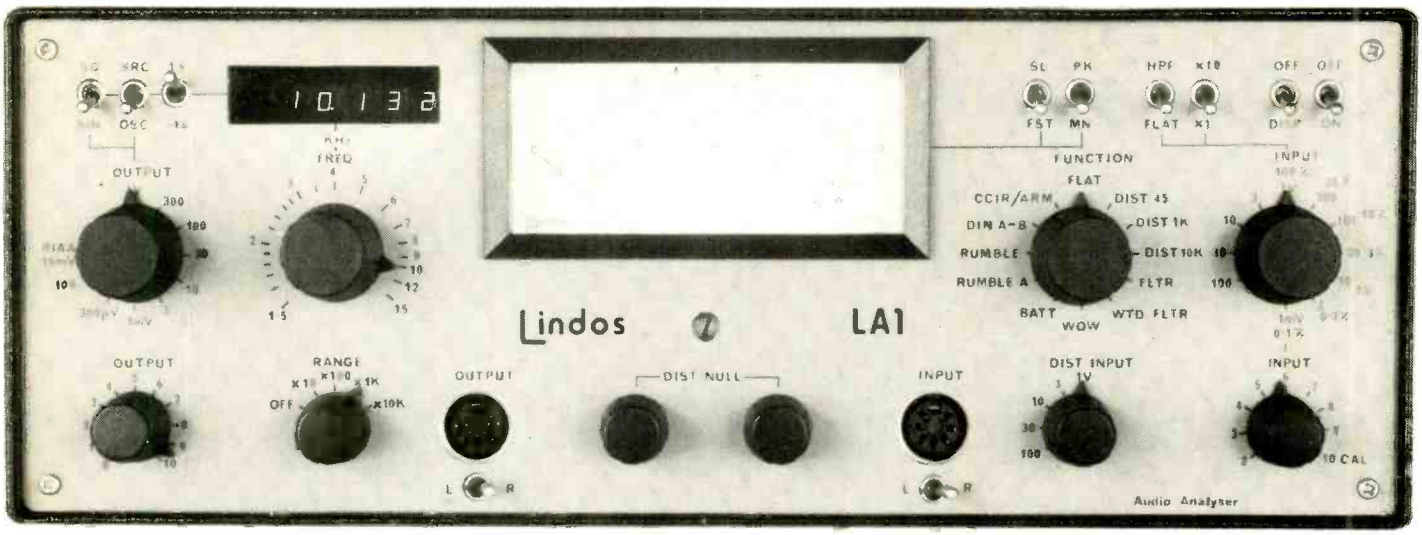

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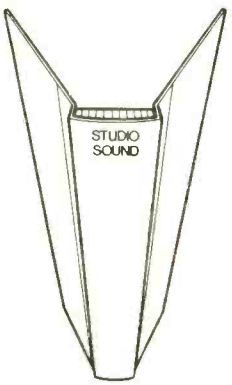

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Note: Advertisement copy must be clearly printed in block capitals or typewritten.
Replies to Box Nos. should be addressed to the Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside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

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50-99	48p	50p	52p	55p	58p	61p	68p	76p	84p	94p	104p	114p
100-149	47p	49p	51p	52p	54p	56p	63p	72p	79p	89p	99p	109p
150-249	43p	45p	47p	48p	50p	52p	60p	69p	74p	84p	94p	104p
250-499	41p	43p	45p	46p	47p	48p	56p	64p	70p	80p	90p	100p
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