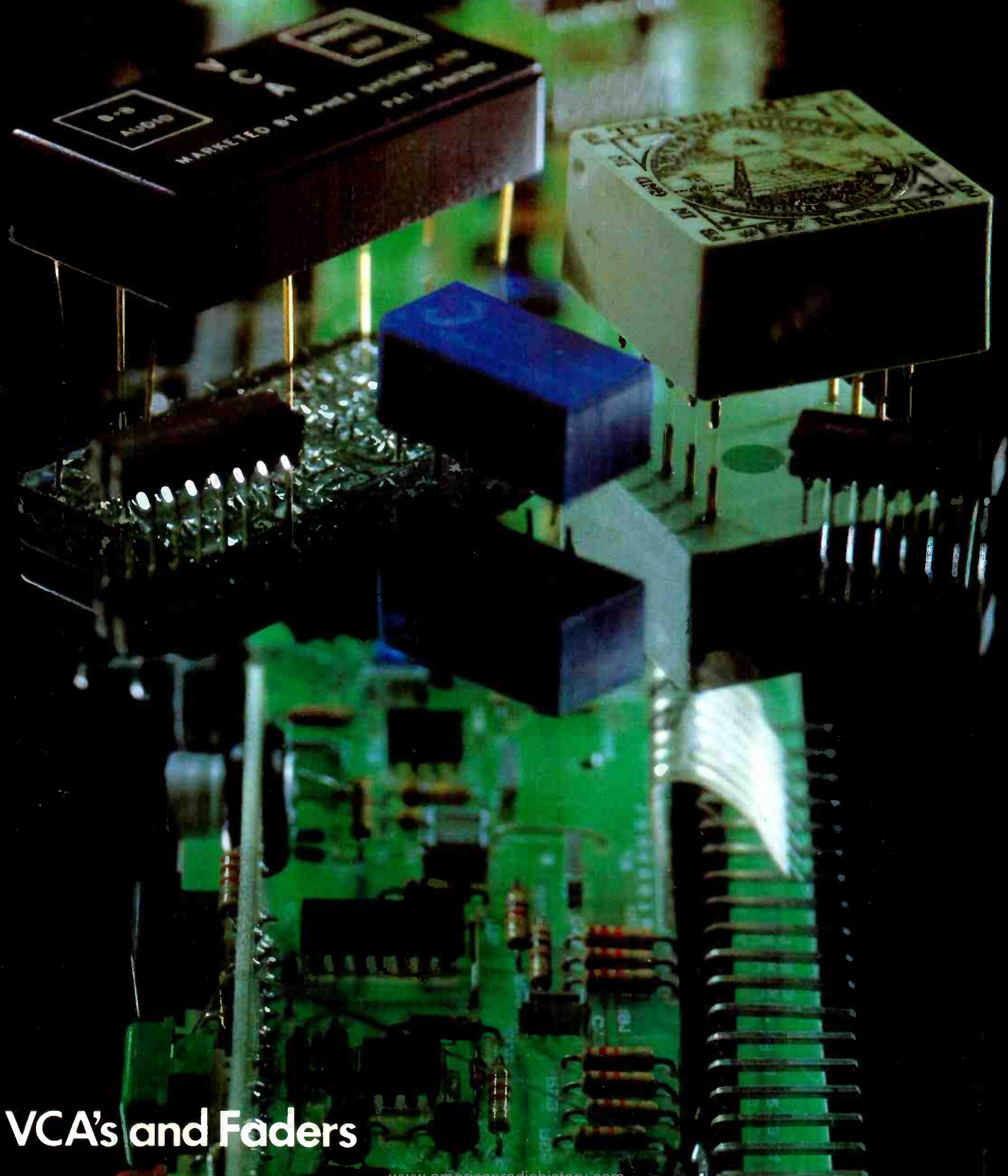


studio sound

June 1980 75p

AND BROADCAST ENGINEERING



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studio sound

AND BROADCAST ENGINEERING

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Nothing about exhibitions this month . . . It has been several years since we surveyed meters although we reviewed them slightly more recently (in September 1976). Most of the analogue meters examined back in 1976 are still around, although several electronic meters of various types have been introduced in the intervening years. There has been much discussion over the past 20 years about the merits, or otherwise, of VU (yes I know it should be vu, but we prefer it in capitals) and peak programme meters. It is true that there is only a single specification for a VU meter, and that the specification includes the scale length (which limits the possible sizes of meters), the scale colour (which should be buff) and the fact that no words should appear on the meter scale—so one can't legally add a channel number or manufacturer's name (unless it is hidden off the bottom of the scale so it can only be seen by peering at a ridiculous angle). But there are probably hundreds of different types of meters all calling themselves VUs around the world, all having different ideas about level measurement—although there are many that meet the more important electrical specifications of the standard VU meter. Whether mixer and tape recorder manufacturers are really interested in using a meter that was designed for measuring telephone circuits is again not the point. What is more to the point is that VU meters all heavily under read peak levels (typically 10 to 12dB difference), and when making a recording it is important that signals greater than the overload level are not presented to either electronics or the tape itself, so it is also preferable to have an indication of the peak signal level. Peak programme meters (PPMs) were first used by the BBC who were not so worried about distortion, but overloading broadcast transmitters—101% modulation can prove very expensive. If you do not modulate to levels approaching peak, the effective signal strength falls, which is why most AM stations are compressed to virtually no dynamic range. So today, broadcasters use PPMs to send the best possible level to the transmitter, while most recording studios still prefer the average reading VU. On tape recorders, the VU meter is only used for alignment using steady tones, a purpose to which the VU is ideally suited—but remember that it is calibrated in volume units, and these bear little resemblance to dBs, 0VU being rather lower than the peak level the machine is capable of handling.

LED indicators are rapidly dropping in price, and becoming available in special column packages which make them ideal for simple metering functions although the typical 20 odd LED column does not provide the same resolution as the average analogue meter, and often appears to be a little jumpy. Neon column (plasma display) meters have 100 or more segments making for much smoother transitions. Alternatively, a television monitor may be used to display a large number of channel readings simultaneously (up to 56 using special high resolution colour CRTs) and these are really resigned to supplement conventional metering on a console, rather than replace it.

Just as each console requires meters, they also require faders and often VCAs (voltage controlled attenuators/amplifiers). We have reviewed all the common professional faders and VCAs in this issue, and surveyed them together (since they all have the same basic function in life, reducing signal level).

Cover of Allison, B & B, and dbx VCAs, and Valley People Trans-Amp with Soundcraft mixer module, by Paul Burbridge and Ray Hyden.

JUNE 1980 VOLUME 22 NUMBER 6

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Picture shows one application for TV boom mount, with rumble filter on and cardioid pick-up pattern (H 15 + CK 1 + C 451 EB + W 17).

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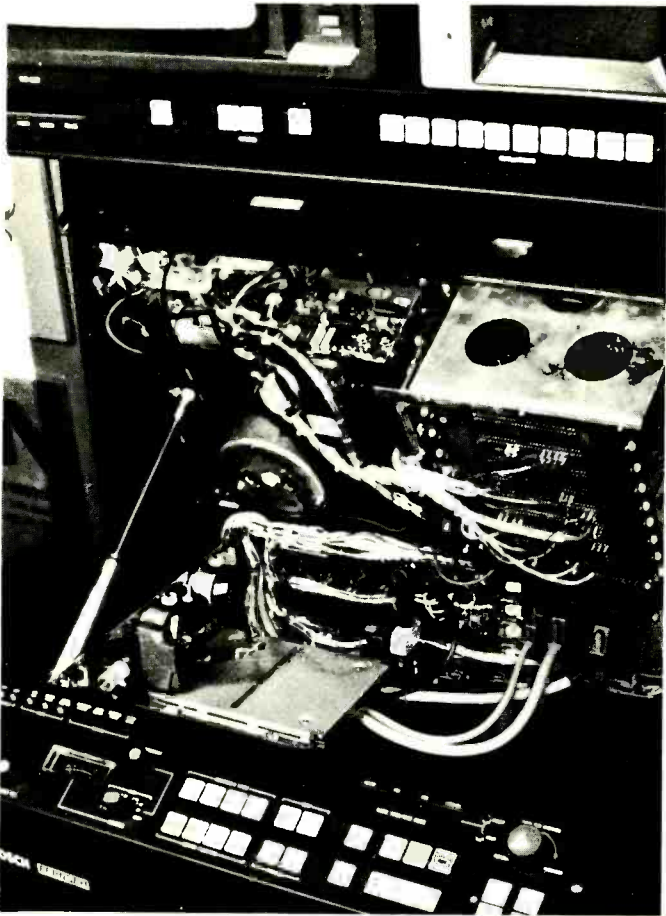
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However, there remains a major barrier in the way of broadcasters striving to improve television audio: VTR soundtracks. The better the rest of the studio and distribution chain becomes, the more the noise from the audio tracks of VTRs limits the ultimate television audio fidelity. The audio signal-to-noise ratio of 2" quad machines is typically worse than 50 dB, while the specs for the new generation 1" machines are typically 52-56 dB. That kind of performance is not as good as many consumer audio tape recorders, and unless improved, may always keep television sound from matching the high fidelity colour picture.

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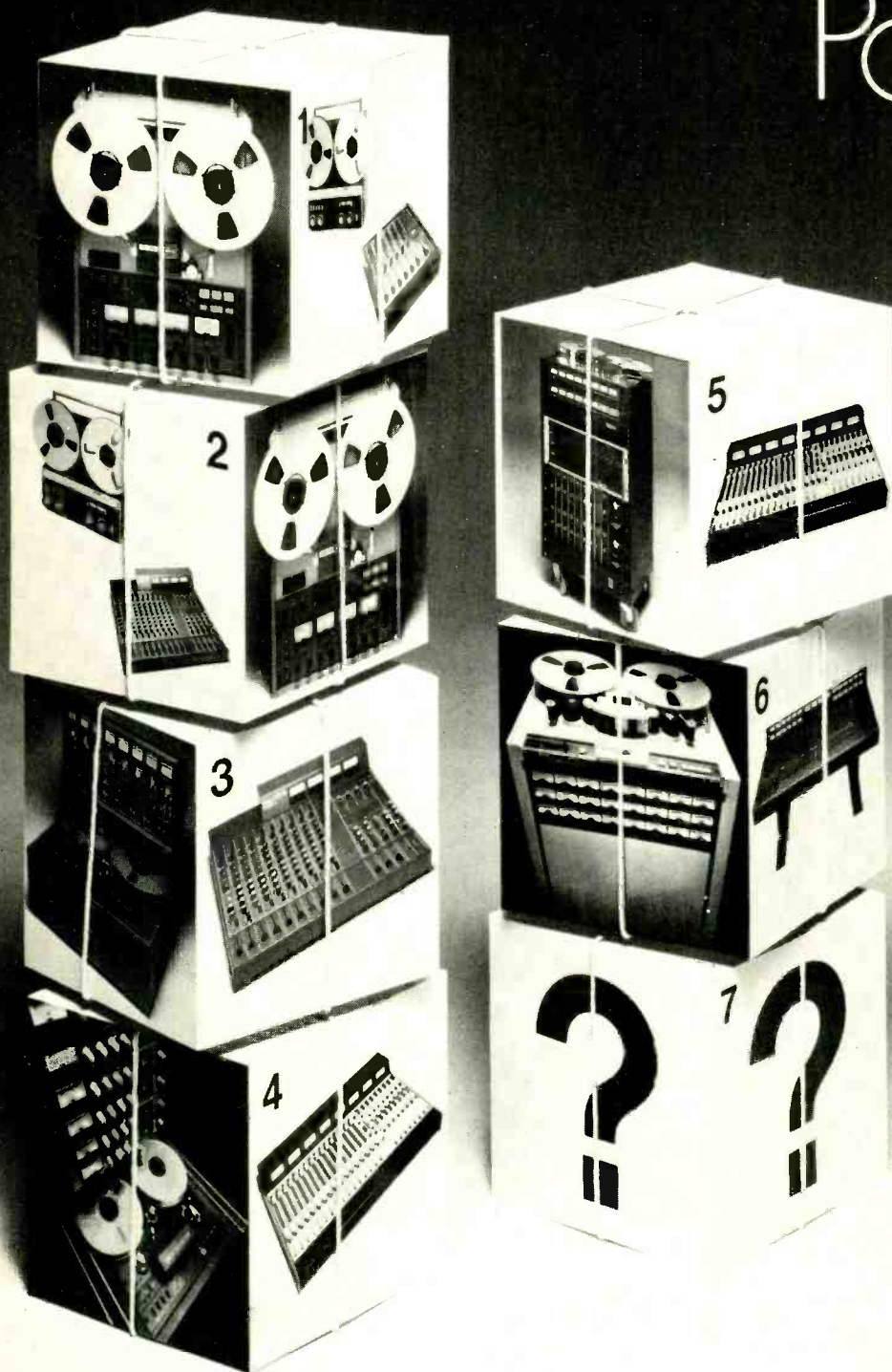
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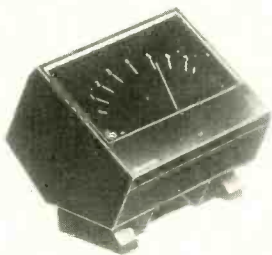
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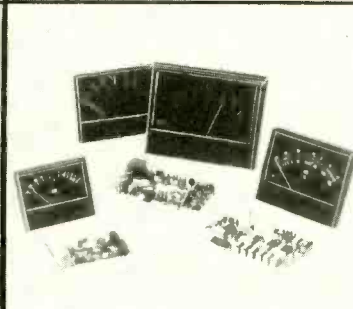
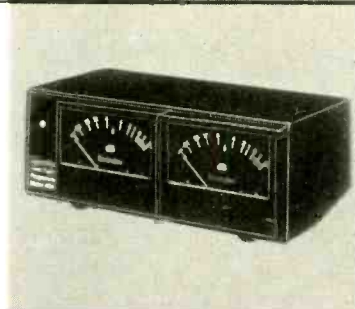
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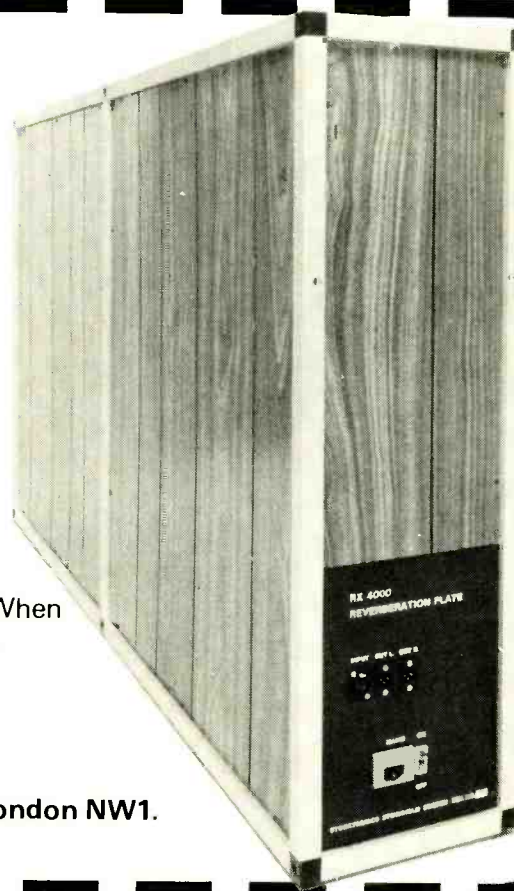
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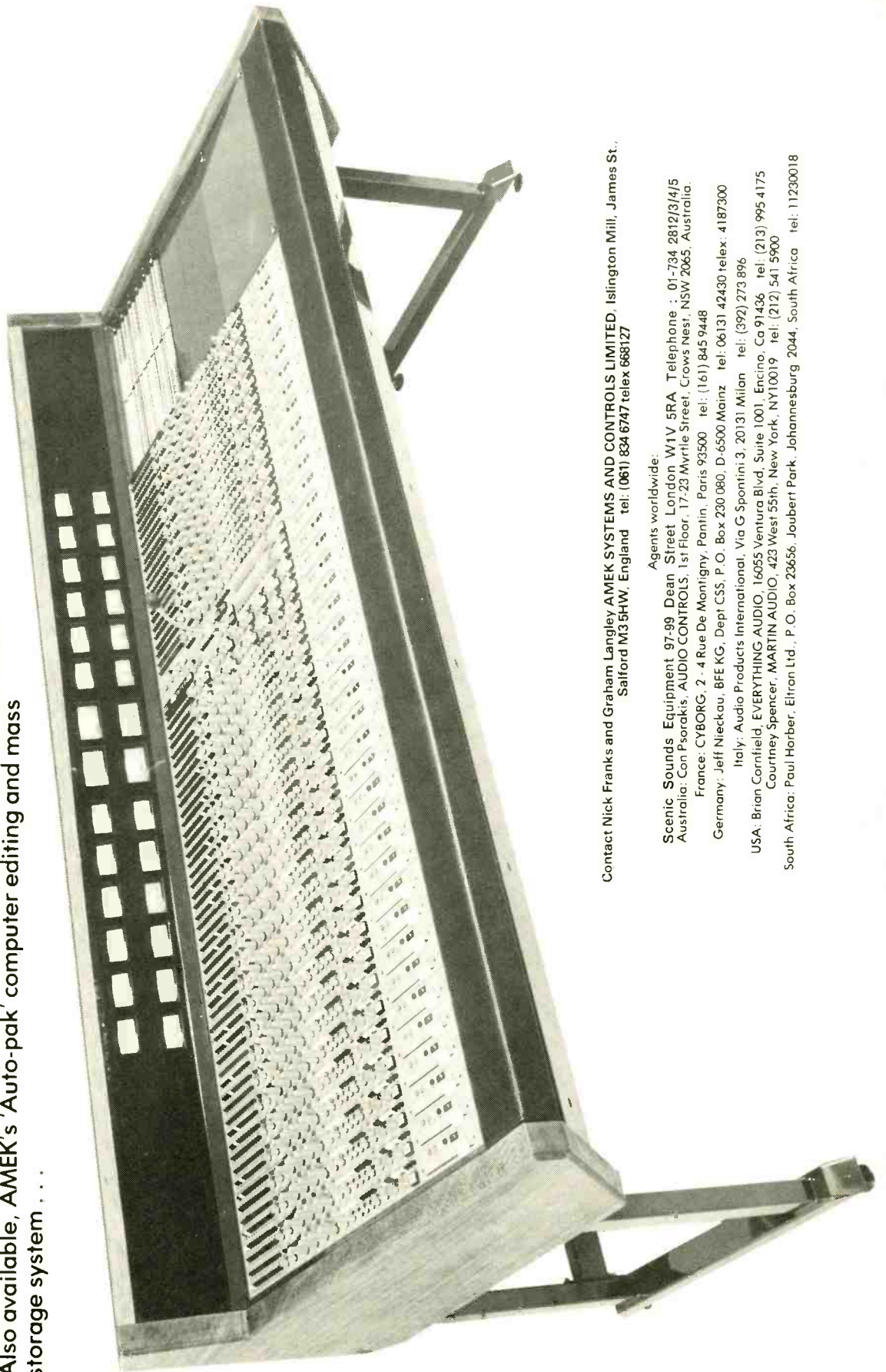
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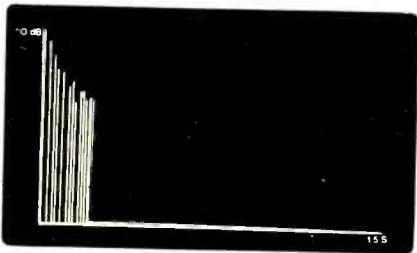


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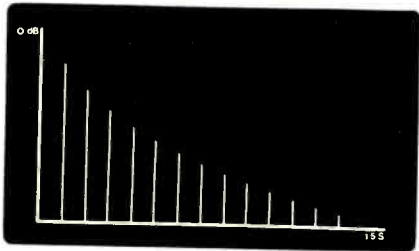
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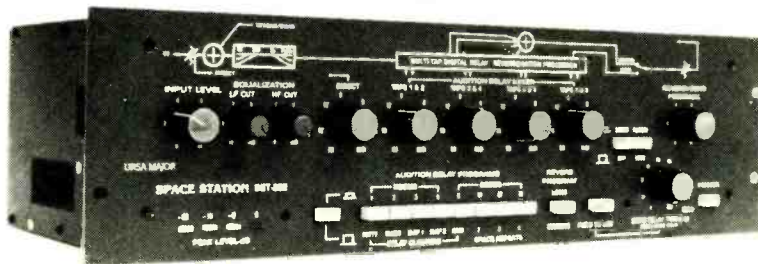
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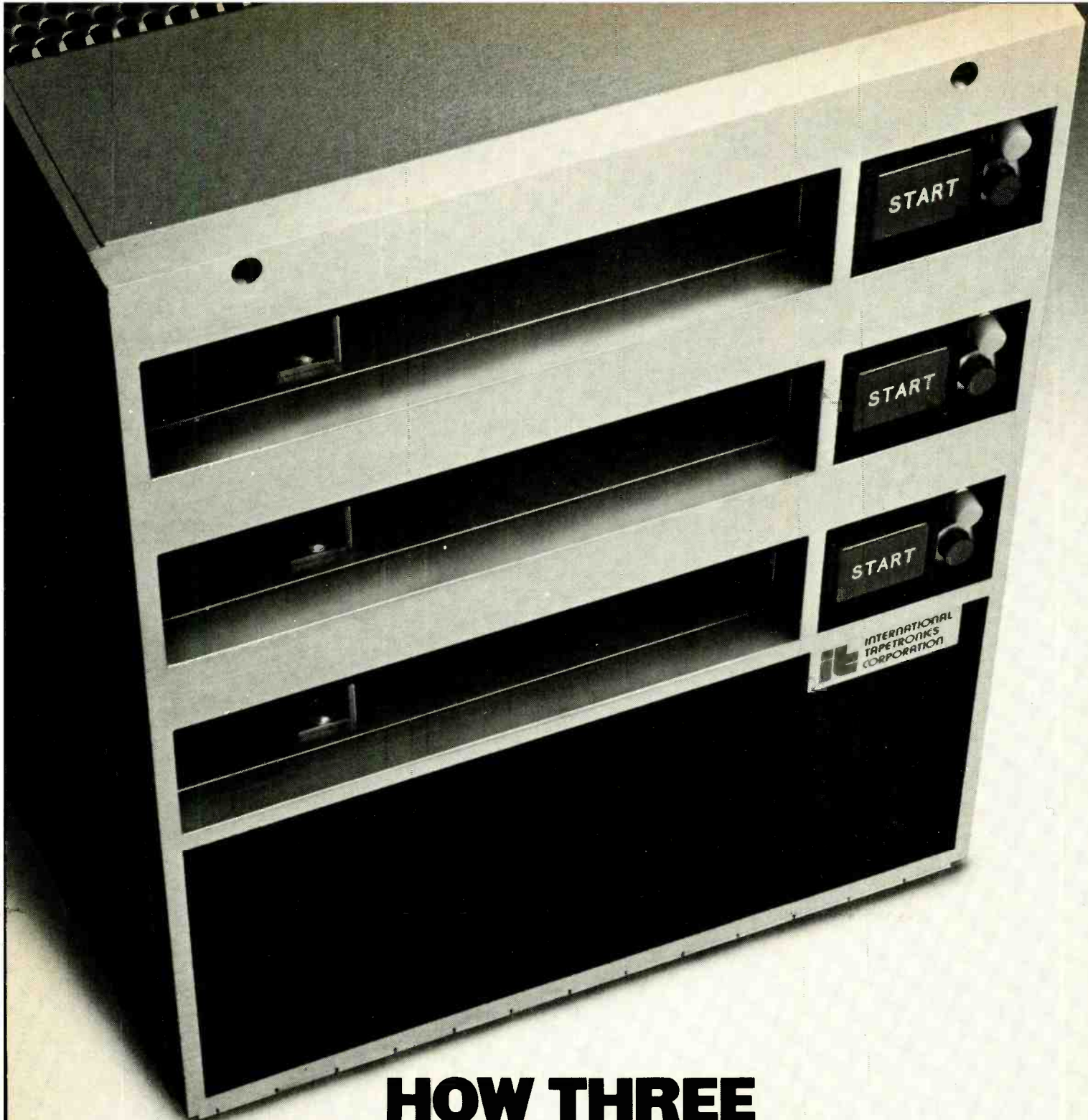
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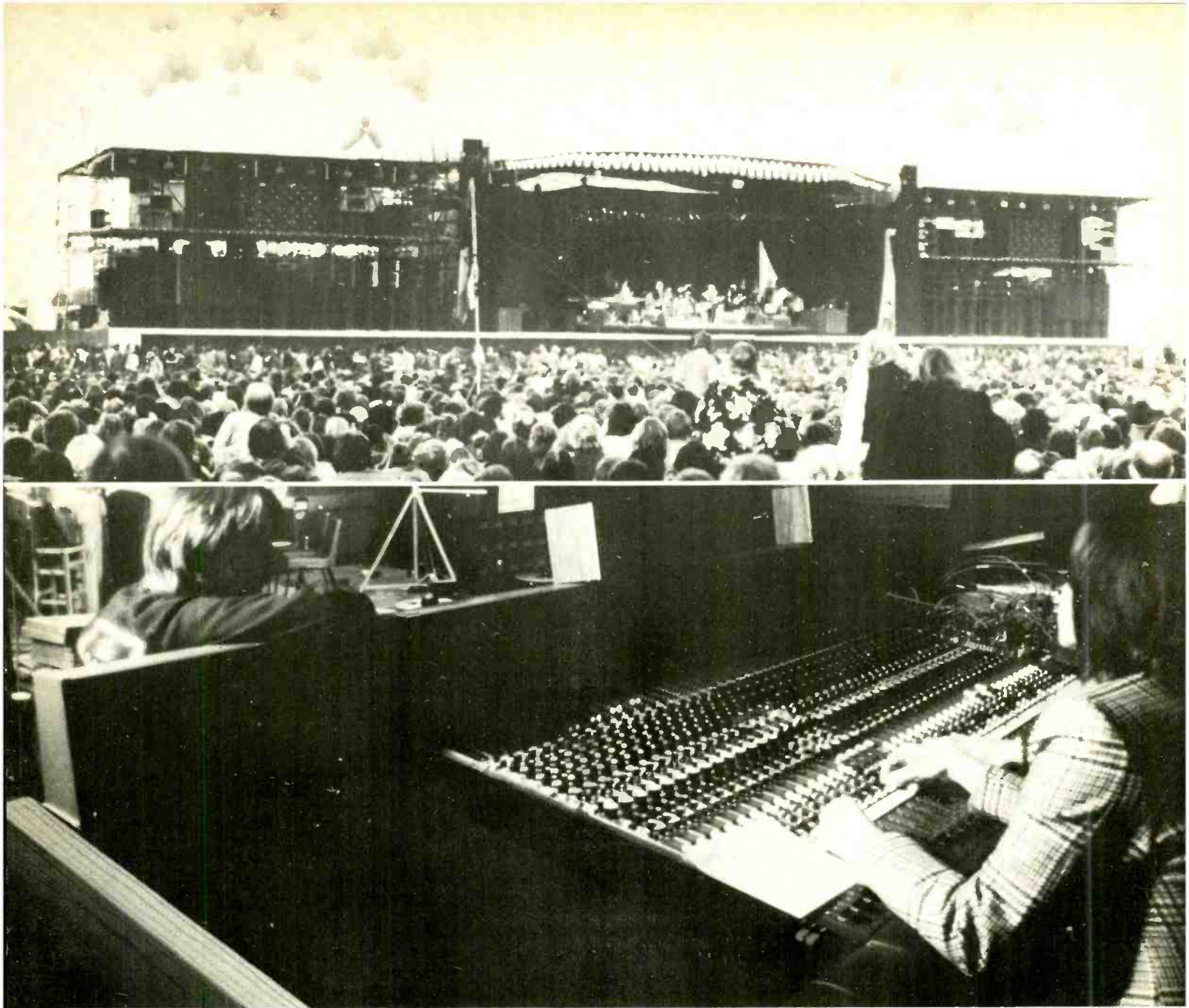
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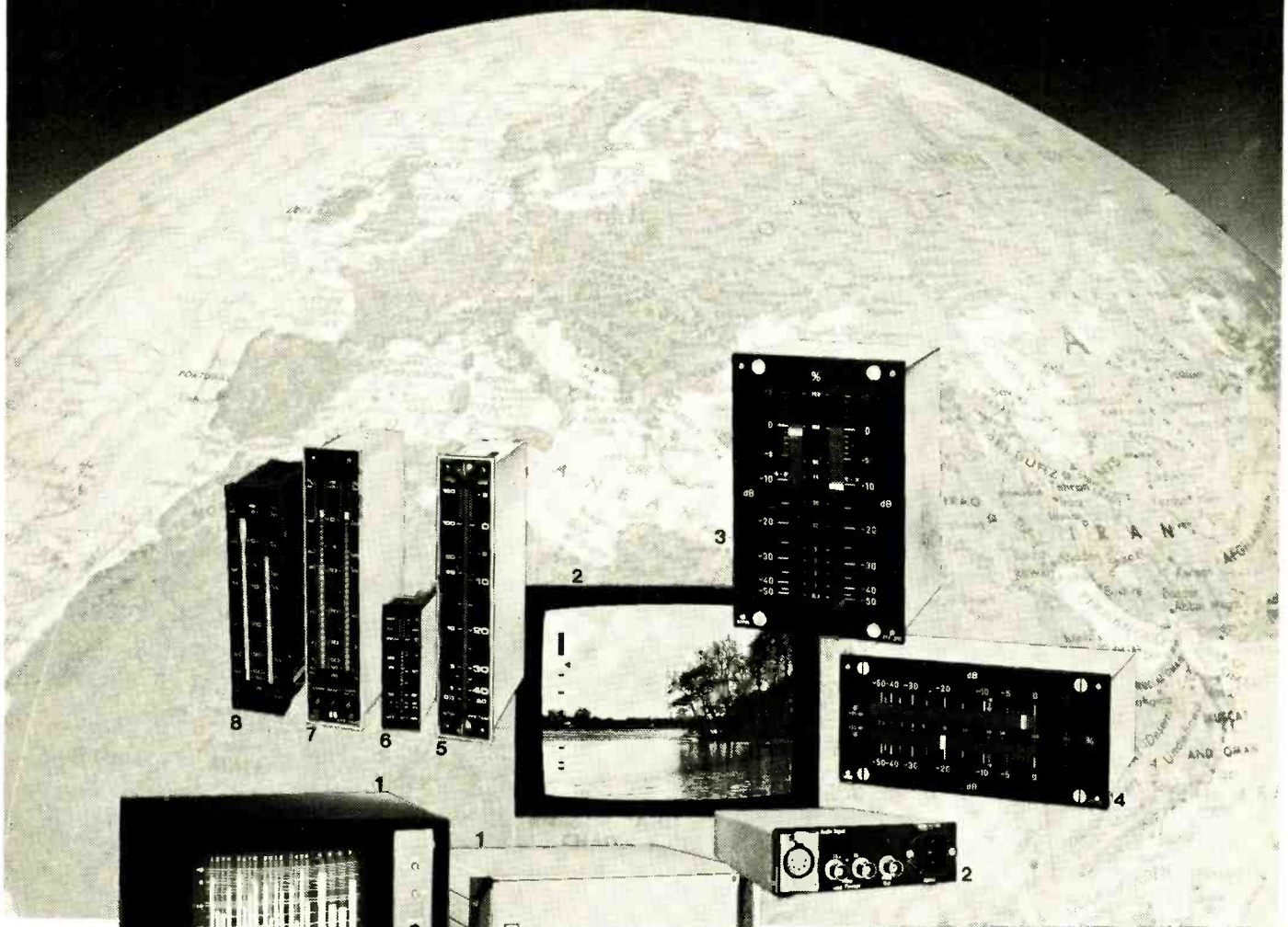
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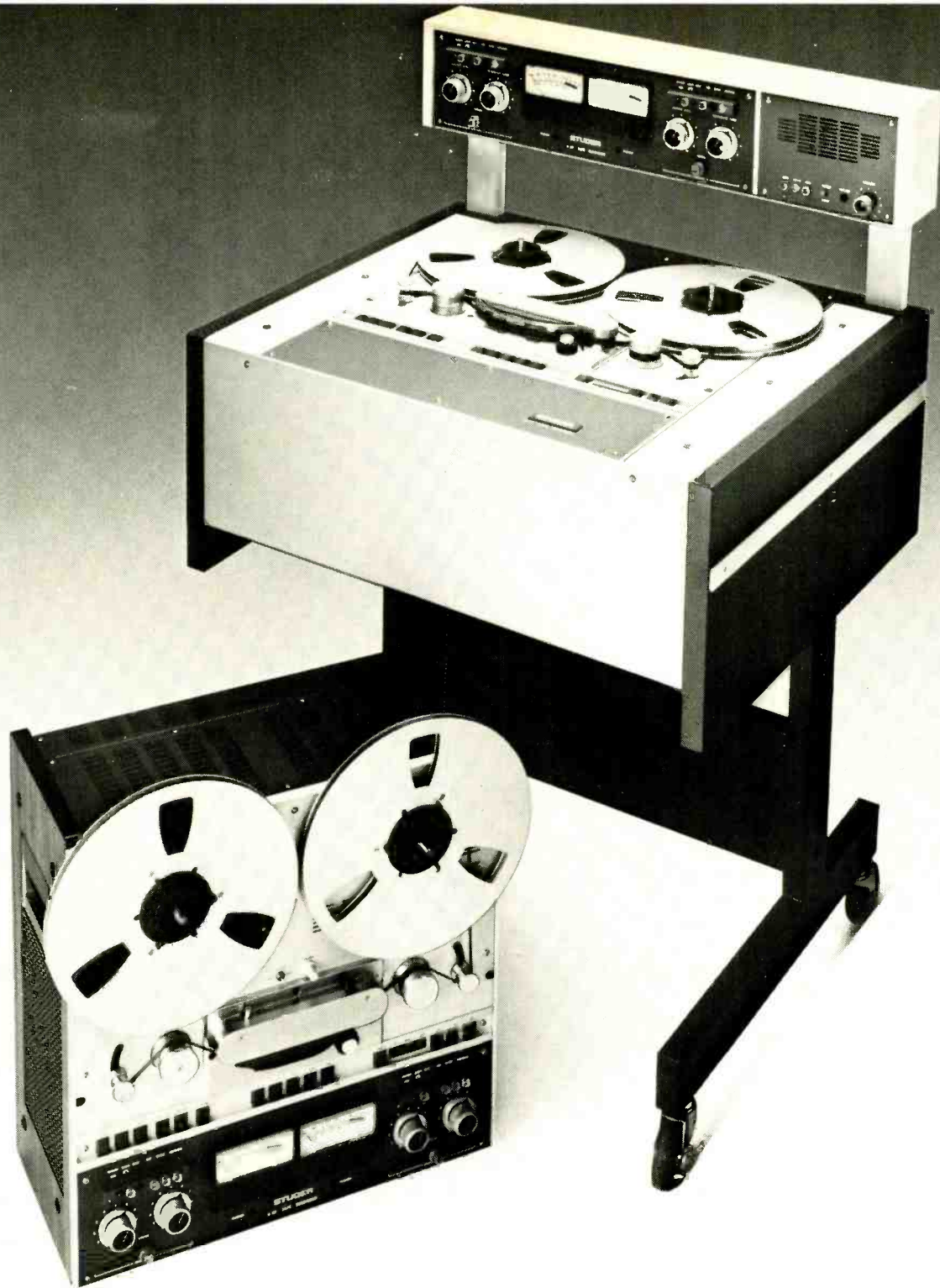


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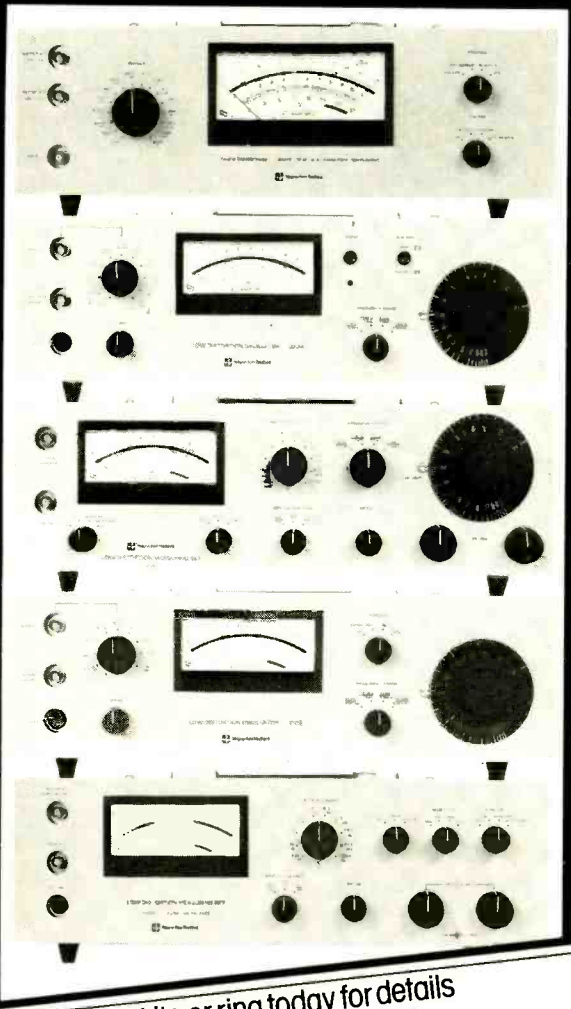
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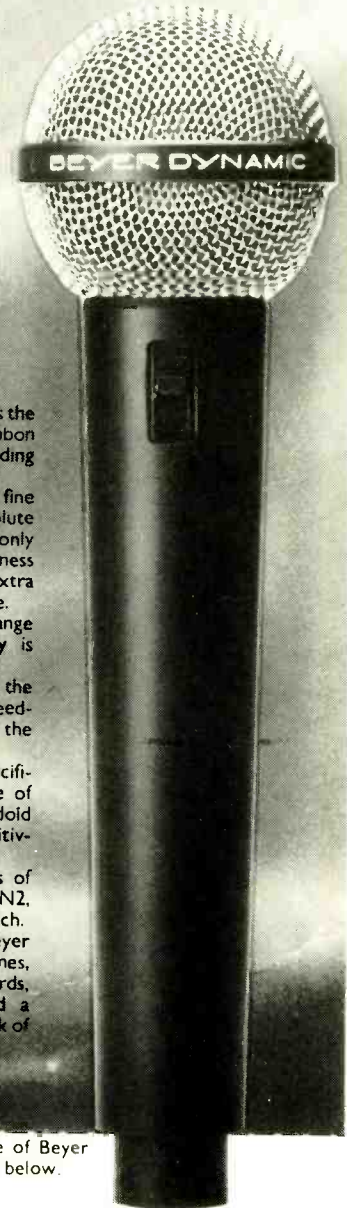
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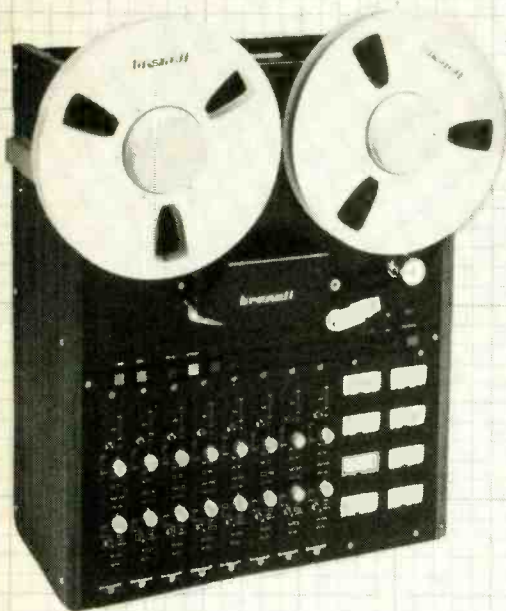
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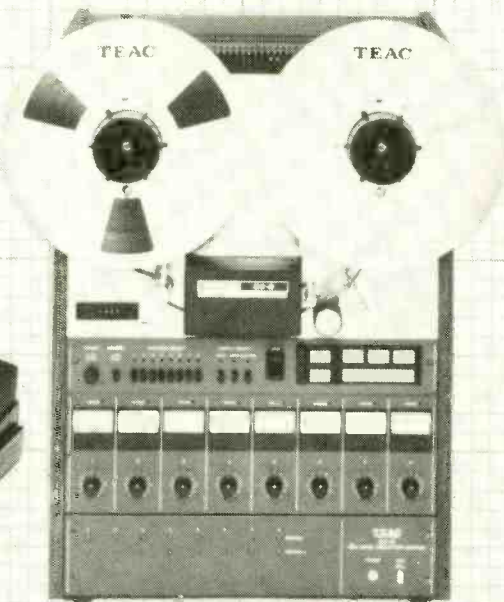
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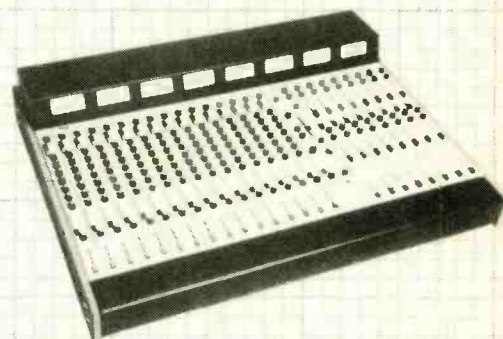
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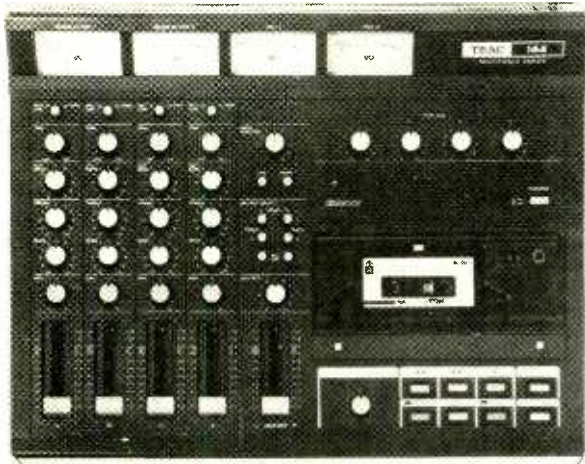
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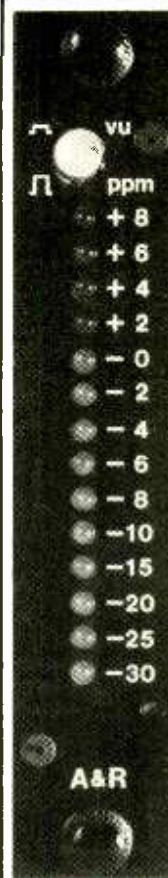
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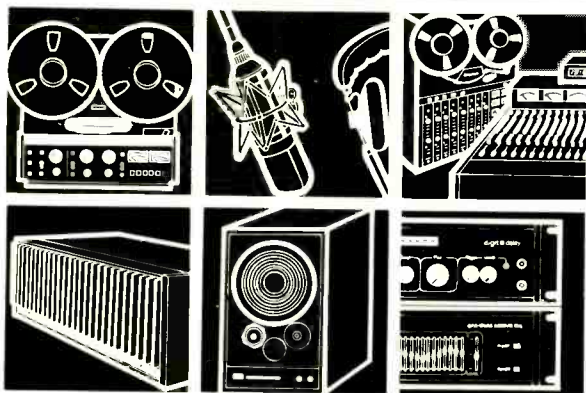
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With everything from the excellent MXR studio range, Reverbs by Furman, ACES, GBS, Roland, EMS Vocorders, and a full range of studio effects, to XLR connectors, patch bays, and Tannoy and JBL monitors, we can supply all your urgent needs from stock.

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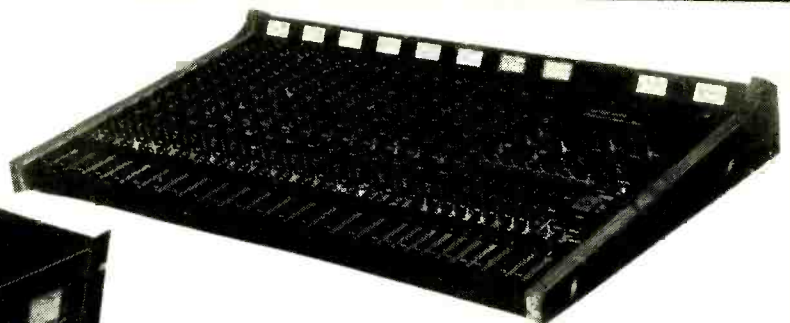
(0432) 55961/52016

AC-ES

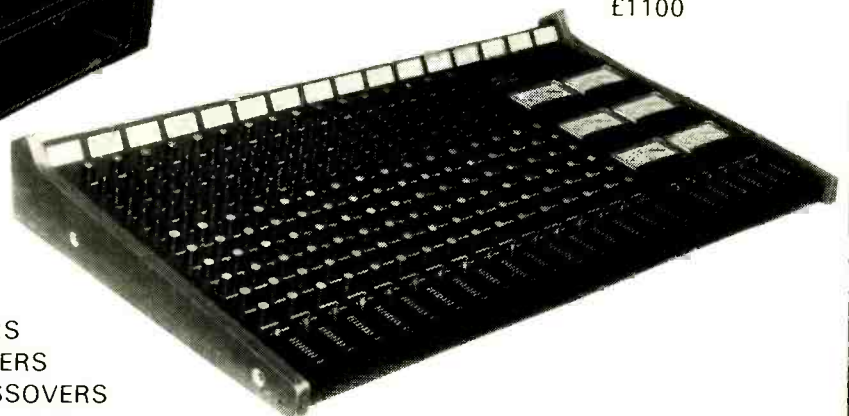
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MODEL SM16/8/2
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AUSTRALIA — Rank Industries Australia Pty Ltd, Tel: Aust. 406566. **CANADA** — Arri/Nagra Inc, Tel: 416 677 4033. **DENMARK** — Kinovox, Tel: 453 187617. **FRANCE** — Studio Centre, Tel: 331 362 7310. **GERMANY** — Austerlitz Electronic, Tel: 499 115 33333. **HOLLAND** — Sound Techniques, Tel: 3172 112944. **ITALY** — Audio Products International, Tel: 392 272951. **JAPAN** — General Traders Ltd, Tel: 157 2912761. **NORWAY** — Siv Ing Benum & Co, Tel: 472 564413. **SOUTH AFRICA** — Communication Consultants, Tel: 2711 834 7692. **SWITZERLAND** — Cinac, Tel: 4124 242048. **U.S.A.** — Coherent Communications, Tel: 213 766 5255. **ISRAEL** — Sontronics Electronic Equipment Ltd, Tel: 9723 475978. **BALKAN STATES** — Constantin Stavrinidis, Tel: 4121 327223.

C-ducer contact transducer

A new contact transducer for acoustic instruments, called the C-ducer, has been developed by three British engineers, Andre Walton, John Ribet and Francis Townsend. Suitable for all instruments with a soundboard the C-ducer may be used with pianos, harps, members of the violin family, acoustic guitars, drums and many other instruments. The C-ducer is a light, thin, flexible adhesive sensing tape which has a flat frequency response in the audio band. Signal separation is claimed to be excellent and the transducer is virtually immune to crosstalk and feedback, while the transducer's construction allows it to faithfully follow the surface contours of the instrument being played. The tape sensor is supplied in various lengths depending on the instrument and it is supplied with a small preamplifier/signal conditioner. In its professional format the C-ducer is available with either mains or phantom powering and a balanced 600Ω output. A battery powered stage version is also available.

C-Tape Developments Ltd, 97 Blackberry Lane, Four Marks, Alton, Hants, UK.
Phone: 0420 63623.

Turnkey Two

A new company, Turnkey Two, has been established—alongside the present Turnkey retail, installation, lease and hire company—as a consultancy specialising in the design and update of sound systems and acoustic environments to guaranteed performance criteria. The company offers a microprocessor aided analysis and design service allowing complete system performance to be assessed before installation. In addition, Turnkey Two will provide a basic control room analysis service. The company is the brainchild of Andy Munro, who has left Allen & Heath Brenell to concentrate his design skills on the new company. Andy is a graduate of Syn Aud Con, the California based study group which has pioneered such techniques as time delay spectrometry and live-dead (LEDE) control rooms. To date the company has supplied a 2kW reinforcement package to the Lakeside Country Club and a complete system for Scotland's National Theatre in Inverness, while a £30,000 PA rig for the Dooley's is nearing completion.

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

Klark-Teknik DN60

Klark-Teknik has introduced the DN60 $\frac{1}{3}$ -octave real time spectrum analyser with microprocessor control. The DN60 has 30 $\frac{1}{3}$ -octave two pole pair filters covering the range 25Hz to 20kHz on ISO centres, and has a 30×16 high intensity main LED display together with a separate spl display. Display resolution is selectable (1 or 2dB per sequence) and the display time constants are also selectable. Features include a peak hold facility, three memories, a weighting facility, an internal noise source, an external oscilloscope output, memory indication of control function, internal calibration facility, a range overload indicator, and adjustable display brilliance. The DN60 has mic/line inputs plus three individual inputs, and the inputs are electronically balanced. An RT₆₀ reverberation card is available as an option.

Klark-Teknik Research Ltd, Coppice Trading Est, Walter Nash Road West, Kidderminster, Worcs, UK.

Phone: 0562 741515.

Ampex increase prices

Ampex has announced price increases of between 5 and 10% on its ranges of professional audio and video equipment. The new prices came into effect on April 1, 1980.

Lindos audio analyser

Omitted from our test equipment survey was the LA1 audio analyser from Lindos Electronics, a compact portable unit which comprises a signal generator, frequency meter, wow and flutter meter, millivoltmeter, weighting filters, and a distortion meter. The analyser is available in two versions, one having DIN connections and incorporating L-R channel switching, and the other having BNC connections. The oscillator incorporates amplitude stabilising circuitry and covers 15Hz to 100kHz in four ranges with 0.015% distortion, output voltage being in nine ranges from 100μV to 1V rms. The frequency meter has a range of 10Hz to 200kHz and is a 6-digit LED display with selectable 1s or 100ms counting period. This LED display is a useful feature which can display oscillator frequency or alternatively can be switched to the output of the measuring section to display the frequency of incoming signals regardless of the range in use. When used with a standard frequency

Sifam transformers

Sifam has announced that it is now providing a made-to-order transformer service in the UK, based on the facilities available from the company's French subsidiary, Transformateurs Union SA. The service includes traditional laminated transformers, ferrite cores, toroidal coils and almost any type of winding customers may require, in an overall range of 50Hz to 50kHz. Virtually any type of impregnation, tropicalisation, potting or moulding (in epoxy, polyester or polyurethane) can be supplied, as well as any kind of termination and fixing arrangement.

Sifam Ltd, Woodland Road, Torquay, Devon TQ2 7AY, UK.
Phone: 0803 63822.

Aural Exciter for sale

Aphex Systems has announced that its Model 602B Aural Exciter is now available for sale. Previously, the unit was only available on a lease/rental basis. While the lease arrangement will remain available to Aphex users, the Model 602B can now be purchased for \$2,700. Additionally, the broadcast version is available for \$2,850.

Aphex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046, USA. Phone: (213) 655-1411.
UK: Aphex Audio Systems (UK) Ltd, 35 Britannia Row, London N1 8QH. Phone: 01-359 5275.

Wireworks mic cables

Wireworks has expanded its range of mic cables to include five different jacket types and 15 colour choices. The five jacket types (rubber, miniature rubber, hypalon, neoprene and PVC) will fulfil virtually any likely professional application and feature rugged Switchcraft QG Series XLR-type connectors. Each type is available in 5, 10, 25, 50 and 100ft lengths. The PVC jacketed mic cables are available in a choice of 15 extruded colours, making them ideally suited for colour-keying studio lines.

Wireworks Corp, 380 Hillside Avenue, Hillside, New Jersey 07205, USA.

Phone: (201) 686-7400.

Address Changes

● Synergetic Audio Concepts has changes its address and phone number to PO Box 1115, San Juan Capistrano, Cal 92693. Phone: (714) 496-9599.

● Audio & Design (Recording) has a new telex number: 848722. The company's address and phone number remain unchanged.

● Naim Audio has moved to Southampton Road, Salisbury, Wiltshire SP1 2LN. Phone: 0722 3746.

● Citronic Ltd has moved to Bowerhill, Melksham, Wiltshire. Phone: 0225 705600.

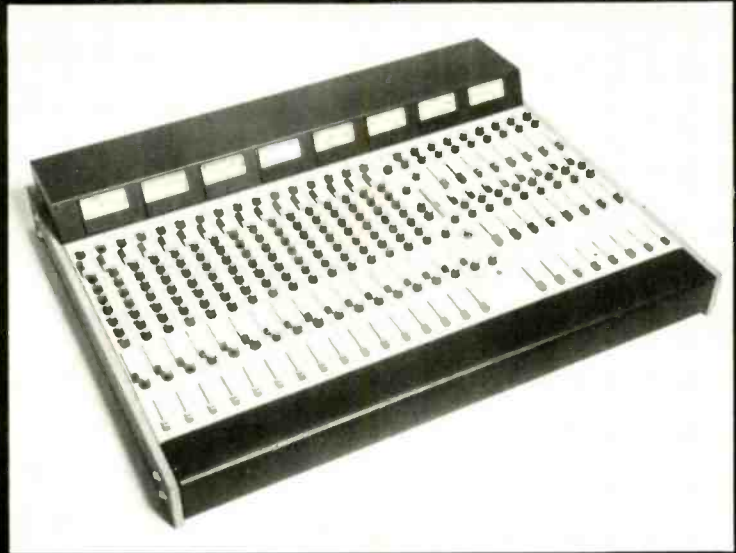
recording the digital readout also provides an instant check of tape or disc speed. The wow and flutter meter operates at 3,000Hz or 3,150Hz over the range 30mV to 10V and 0.01% to 10% fsd, with weighted and unweighted frequency response and mean or quasi-peak indication. The mean response allowing a good approximation to NAB measurement to be made. The ac millivoltmeter covers 100μV to 100V fsd in 13 ranges (—80dB to +40dBm), with fine input control giving up to 12dB gain reduction allowing reference levels to be set. Weighting filters to CCIR/ARM, DIN audio band, and DIN rumble are incorporated, while an optional plug-in WNI weighting network is available for IEC A- and C-weighting. The distortion meter is a fundamental notch filter type operating at three spot frequencies 45Hz and 1kHz (22Hz to 22kHz); and 10kHz (1kHz to 150kHz) over the ranges 0.01% to 100% fsd with an input voltage range of 100mV to 100V rms. Additional features include a 100mV oscilloscope out-

put; 1V dc output; a battery check facility; a high pass 400Hz 12dB/octave filter; and ±4.5V power outputs permitting the addition of preamps and active filters. The analyser operates from a PP9 battery while an optional MA1 mains adaptor may be fitted, or alternatively an MA2 adaptor with built-in monitor loudspeaker. An ancillary unit is the ST1 studio interface unit which provides balanced line interface to studio equipment and professional tape recorders, balanced output drive up to +26dBm, built-in mains powering (also powers the LA1) and optionally a built-in monitor loudspeaker. The ST1 is transformerless but where fully floating connections are required external transformers can be used. The LA1 costs £425; the ST1 £125 (with monitor loudspeaker £140); the WNI £20; the MA1 £30; and the MA2 £60.

Lindos Electronics, Sandy Lane, Bromeswell, Woodbridge, Suffolk IP12 2PR, UK.
Phone: 03947 432.

SPRING FEVER

Two special offers from AHB



The ubiquitous AHB package system now includes full remote control and varispeed, giving a total saving of over £900.00. It is the most versatile and economical professional system available. If you don't believe us ask John Entwistle, Peter Gabriel, Genesis, Gallagher and Lyle, Roger Taylor, Pierre Moerlen or one of the dozens of independent AHB equipped studios.

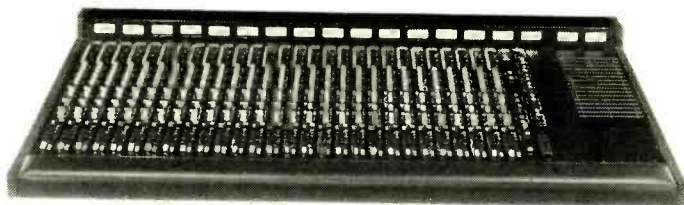


Syncon is an incredibly successful British In-Line console — this year will see the installation of the 100th unit. We are now building SYNCON for ex stock delivery with a 15% discount available from all our worldwide agents. Credit and leasing facilities are also available.

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audiomarketing ltd
Glenbrook Industrial Park
Stamford, Connecticut 06906
U.S.A.
Tel: (203) 359 2312



Speck 800-D console

American manufacturer Speck Electronics has introduced the *Model 800-D* modular console, a 28 input/16/28 output console. The console comprises 28 input modules, a master module, and a communications module housed in a mainframe with 16 VU meters. Each input module has eight pannel assignable, 3-band parametric equalisers, three sends, pan, stereo solo, a long-throw fader; and a second line input with independent slide fader, pan and a 2-band equaliser. As the console has two discrete line inputs in each input module and 28 assignable direct outputs in addition to the

console's eight submasters, the *800-D* is suited to a variety of applications. Also, since the stereo buss is independent of the multi-track assign section the console can feed several recorders simultaneously during mixdown. A 384-point patchbay is fitted as standard and the console is wired to accept two 16-track recorders, a 24-track or a 32-track. All connections to outboard equipment are via multi-way cables and connectors at the rear of the console. Price of the *Speck 800-D* is \$22,900.

Speck Electronics, 7400 Greenbush Avenue, North Hollywood, Cal 91605, USA.
Phone: (213) 764-1200.

Dutch consoles

Due to an error in the calculation of the exchange rate between Dutch guilders and sterling we gave incorrect prices for the consoles from D & R Electronica in our May issue. Typical prices in sterling are approximately 15 x lower than those stated.

Amek/SSE

Effective from April 1, Scenic Sounds Equipment Ltd are handling the entire UK sales of the Amek range of recording consoles. All UK enquiries should now be directed to David Rivett or Nick Martin at Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812.

Contracts

● Trident has supplied Sound Arts, Los Angeles with a *Series 80* console. In addition a *Series 80* console has been installed at Warehouse Studios, New York, the recording centre for Lucas/McFaul Productions. UK orders for *Series 80* consoles include Pluto Studios, Manchester; ICC Studio, Eastbourne; Free-Range, London; and Banana Stand, Ross-on-Wye. Trident also inform us that Mandrill Studios, Auckland, New Zealand is shortly to receive delivery of a *TSM* console.

● Pye TVT is to supply the IBA with sound-in-sync equipment for the signal distribution system of the UK's new fourth national television network.

● Audix has been awarded a contract by the Cyprus Broadcasting Corporation for several *B100* sound consoles and a number of turntable consoles to be installed in both radio and TV studios.

● Crown International has supplied over 50 amplifiers to power the sound system of the new Moscow World Trade Centre, part of the Moscow Olympic complex. In addition Crown supplied the majority of amplifiers at Lake Placid.

● Klark-Teknik has supplied ATV Studios. Elstree with *DN34* and

DN70 time processors and *DN71* controllers, primarily for use on *The Muppet Show*. Additionally, Pinewood Studios has bought analogue and digital time processors for use on the film *Superman II*.

● Alice (Stancoil Ltd) has been awarded a contract for the supply, installation and commissioning of the technical equipment for Devonair Radio. The initial contract is for equipment for the Exeter studios, due for installation in late summer. A further contract for equipping the Torbay studio centre, which will be in operation early in 1981, is under negotiation. Tim Mason, chief engineer of Devonair's ILR neighbour Plymouth Sound is liaising with Alice on the design of the special systems necessary for the first 'twinned' ILR stations. Mason is on loan to Devonair as a result of an agreement between Devonair and Plymouth Sound which could well point the way towards a possible solution to the chronic shortage of experienced engineering staff in UK local radio.

● Midas is to supply a 36 into 8-8 *TR System* theatre console to the Phoenix Civic Plaza, Arizona. New *PR System* contracts include a split 36 into 8/2 live sound console for Frank Zappa and a 24/8 stage monitor console for The Police.

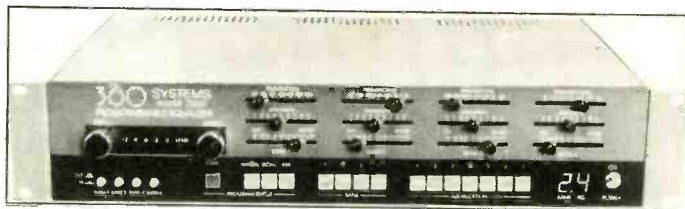
360 Systems programmable equaliser

American manufacturer, 360 Systems, has introduced a fully programmable parametric equaliser, the *Model 2800*. This equaliser can be used to store and recall up to 28 sets of equalisation curves and can make direct comparisons between different equalisations. In addition it can also set up a sequence of creative eq changes and execute them in order during a mix. The equaliser uses a *Z80* micro-computer system for control and CMOS memory for storage of 28 front panel settings, while a lithium cell guarantees the safety of stored eq curves when ac power is lost. The equaliser has three operating modes: manual; recall; and edit. In the manual mode the equaliser is under conventional control and its settings may be stored in any of the 28 memory locations (four banks of seven locations). In recall the equaliser is under memory control and the front panel controls are inactive, the equalisation depending upon which memory location is selected. The edit mode is a combination of the two previous modes, utilising memory but with the front panel controls active to facilitate any changes which may be required. The edit mode, additionally, may be used to arrange stored settings in a particular order for recall in sequence.

A display indicates which memory has been selected. All equaliser functions are programmable: frequency, bandwidth, boost/cut, and output level. The equaliser has four bands: 20Hz to 500Hz; 68Hz to 1.7kHz; 240Hz to 5kHz; and 800Hz to 20kHz. Bandwidth is adjustable from $\frac{1}{3}$ -octave to five octaves. Boost/cut +12dB to $-\infty$ (typically 60dB below input), while the eq contours are constant-Q rather than reciprocal. Output control features ± 12 dB gain adjustment. Each of the eq bands may be bypassed and the equaliser has a headroom indicator scaled in 3dB steps from clipping to -12 dB. This indicator shows true headroom by sampling six locations in the equaliser and displaying the worst headroom condition. Specifications of the unit are: frequency response ± 0.2 dB 10Hz to 20kHz; THD typically 0.05%; noise 86dB below max output; and output +21dBm. Options include installation of a second audio channel for stereo operation, provision of a balanced transformer isolated output, and the availability of a remote control connector allowing external selection of the stored eq settings.

360 Systems, 18730 Oxnard Street, 215, Tarzana, Cal 91356, USA.
Phone: (213) 342-3127.

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



People

● Philip Wadsley, previously a design engineer with Neve, has joined Clive Green & Co as sales engineer with particular responsibility for the Enertec range.

● Frank Manzanero has joined Vitavox to run the company's newly formed hire PA rig.

● Ampex has appointed Iain Fraser as consumer tape product manager.

● Eastern Acoustic Works has appointed Nancy Maher as marketing administrator; Robert Saunders as chief engineer; and Tom Hagen as production co-ordinator.

● Graeme Goodall has been appointed head of MCI's new Nashville sales/service centre.

● Thomas White has become President of White Instruments Inc. Gifford White, who founded the company in 1953, becomes chairman.

● Peter Horsman has been appointed regional sales manager of

Neve's Hollywood office.

Agencies

● Rupert Neve Inc has opened a regional sales office in Nashville to cover the Midwest and Southeast USA. Regional sales manager is Glen McCandless who can be contacted at PO Box 120907, 4124 Sneed Road, Nashville, Tenn 37212. Phone: (615) 385-2090.

● Audio & Design (Recording) has appointed four new distributors for its range of ancillary processing equipment. These are Ultralinear International in Singapore, Studer Revox Far East in Hong Kong, MS Audiotron in Finland, and the Holt Corporation covering Mexico, Colombia and Venezuela.

● SAE Professional Products has appointed Shalco Inc as its representative in Michigan State.

● MCI has opened a sales/service centre in Nashville at 176 Thompson Lane, Suite 105, Nashville, Tenn 37211. Phone: (615) 832-8914.

Expression through time delay.

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

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

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

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

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

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

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

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

MXR Professional
Products Group



New Rendar XLR mains connectors

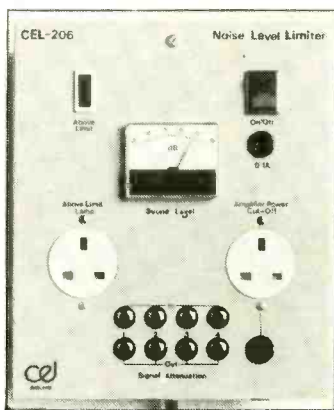
Rendar has launched a new range of XLR mains power connectors suitable for use with professional audio equipment, test instrumentation equipment, OB equipment and for other applications where heavy-duty power connections are needed. The connectors comprise an *XLRT-LNE11C* plug and *XLRT-LNE32* panel-mounting socket. These are 3-pole connectors for 250V working with 5A contact rating and the earth contact directly connected to the body shell. The terminations will accept 16/0.2mm cable. Live and neutral contacts are shrouded in plastic, limiting access to the live parts when the connectors are not mated. Mated connectors are secured together with a quick-release catch preventing accidental disconnection. Both the plug and socket will mate with similar XLR connectors of different manufacture. Rendar Division, Wilmot Breedon Electronics Ltd, Durban Road, Bognor Regis, West Sussex PO22 9RL, UK. Phone: 02433 25811.

UEP monitor loudspeakers

Unique Electronic Products and Coles Electroacoustics have collaborated in the development of two monitor loudspeakers. The first, the *UEP/Dynaribbon*, is a 2-way system with a ribbon tweeter and an 8in bextrene bass midrange driver. The enclosure is reflex-loaded and the loudspeaker will handle 75W per channel into 8 Ω , with a frequency response of 40Hz to 20kHz \pm 3dB. Price of the *UEP/Dynaribbon* is £780 per pair. The second loudspeaker, the *UEP/Coles* compact monitor, is a 3-way reflex design with an 8in bass midrange driver, plus a tweeter and super-tweeter. Power handling is 50W per channel into 8 Ω , frequency response 50Hz to 20kHz \pm 3dB, and price of the *UEP/Coles* compact monitor is £468 per pair. Unique Electronic Products, 26 Woodstock Road, London NW11 8ER, UK. Phone: 01-458 8118.

UK Harrison Agency

As detailed in our February 1980 issue, FWO Bauch have been appointed agents for the Harrison range of consoles and automation systems. Accordingly all UK enquiries regarding the Harrison *32-Series*, *24-Series*, *Alive* and new *MR-1* consoles, and the *PP-1* post production console plus the *Autoset* automation system, should now be directed to FWO Bauch Limited, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.



CEL-206 noise level limiter

Computer Engineering Ltd has introduced the *CEL-206* noise level limiter designed primarily with live music or disco entertainment noise level limiting in mind, but which is also suitable for numerous other applications. The *CEL-206* monitors noise level on a sound level meter covering a dynamic range of 50 to 100dB and continually compares it to a preset threshold level. This level may be set as either dBA or dB, dependent upon whether the noise problem is structure or air borne. When the threshold level is exceeded a warn-

ing indicator is illuminated allowing performers a short period of time to reduce the noise level before the unit introduces a temporary attenuation into the signal leads. If required, a third stage cuts the mains supply to the audio power amplifiers, completely shutting off the noise source for a short period. Housed in a robust steel enclosure, the *CEL-206* may be mounted onto a wall and wired directly into the mains electricity supply. A $\frac{1}{2}$ in mic with integral pre-amp is provided with the system and is set in the required monitoring position on a mounting bracket. A 10m mic cable is supplied as standard, but extensions up to 100m may be used. A security link is also incorporated so that the threshold level will be triggered if the mic is disconnected for any reason. During a performance it is obviously difficult to continually watch the unit's limit lamp, but CEL have solved this problem by providing a power outlet which is activated in unison with the warning indicator, and this may be connected to a lamp on stage which is clearly visible to performers.

Computer Engineering Ltd, 14 Wallace Way, Hitchin, Herts SG4 0SE, UK. Phone: 0462 52731.

CAE catalogue

Communication Accessories and Equipment Ltd has produced a comprehensive catalogue detailing its range of cords, connectors, jackfields, tools and accessories. Of particular interest are the company's pre-wired jackfields which are a very useful time and cost saver. The catalogue includes full descriptions and illustrations of each item making it a handy reference book.

Communication Accessories and Equipment Ltd, 70-82 Akeman Street, Tring, Herts HP23 6AJ, UK. Phone: 044282 4011.

Chartwell PM100 conversion kit

Following the success of Chartwell's polypropylene-coned bass/mid driver in its *PM110* mini-monitor loudspeaker, the company has produced a conversion kit to change the older bextrene-coned *PM100* (almost identically sized mini-monitor with a similar Son Audax tweeter unit) to an upgraded performance similar to the *PM110*. The kit comprises two 165mm polypropylene drive units and two crossover pcbs, and is available direct from Chartwell's service department at a cost of £59.80.

Swisstone Electronics Ltd, 4/14 Barmeston Road, London SE6 3BN, UK. Phone: 01-697 8511.

Labgear frequency counter

New from Labgear is the *CM7044* miniature frequency counter with a bandwidth of 10MHz to 500MHz. A lightweight, portable instrument, the *CM7044* is powered by rechargeable batteries making it ideal for mobile communications applications. Readings are presented on a 7-digit LED display in two switchable ranges, 50MHz and 500MHz. Included with the instrument is a small antenna, with BNC fitting, enabling measurement of transmissions to be undertaken without disturbing the transmitter or making connections.

Labgear Ltd, Abbey Walk, Cambridge CB1 2RQ, UK. Phone: 0223 66521.

Philip Drake Electronics 7000 Series

Philip Drake Electronics has announced a new range of audio products known as the *7000 Series*. The main units in the range are a dual line sending amplifier *PD7011*, a dual audio distribution amplifier *PD7012*, and a dual line receiving amplifier *PD7013*. The units are all based on BBC designs to a high specification and contain two independent amplifiers separately powered from a \pm 15V dc unregulated supply. The bandwidth of the *PD7012* extends up to 50kHz

New Pentagon cassette copier

Pentagon has introduced a new high speed cassette copier, the *Model C-10*. This features a new 3-motor, rugged tape transport with the company's Stabilign head-mount—a die cast metal head-mounting which eliminates most of the recording problems associated with misaligned heads, such as crosstalk or 'bleed-over'. The *Model C-10* will copy an hour's cassette programming in less than two minutes and has a number of automatic features. Electronic logic senses the end of a tape or a jammed cassette to keep valuable programme material safe and at the end of the copying cycle both master and copy cassettes are automatically rewound. Lighted pushbutton controls ensure simple operation of the copier. Optional accessories include dust covers and a portable carrying case.

Pentagon Industries, 4751 North Olcott, Chicago, Illinois 60656, USA.

Phone: (312) 867-9200.

BIC products

Cambridge Audio has been appointed UK agent for the BIC range of products manufactured in the USA. The BIC range consists of 2-speed cassette decks, *Sound-span* loudspeakers, turntables, and the *Beam-Box* indoor electronically directable FM antenna. Of most interest to studios are the 2-speed cassette decks. Four models are available with the model numbers and features increasing with price. Top of the range are the *T-3* and *T-4M* which are 3-head, dual capstan cassette decks operating at either 1 $\frac{1}{8}$ in/s or 3 $\frac{1}{8}$ in/s. The latter deck additionally capable of handling metal tape. Prices of the *T-3* and *T-4M* are respectively, £299 and £495.

Cambridge Audio Ltd, 105-109 Oyster Lane, Byfleet, Surrey KT14 7JH, UK.

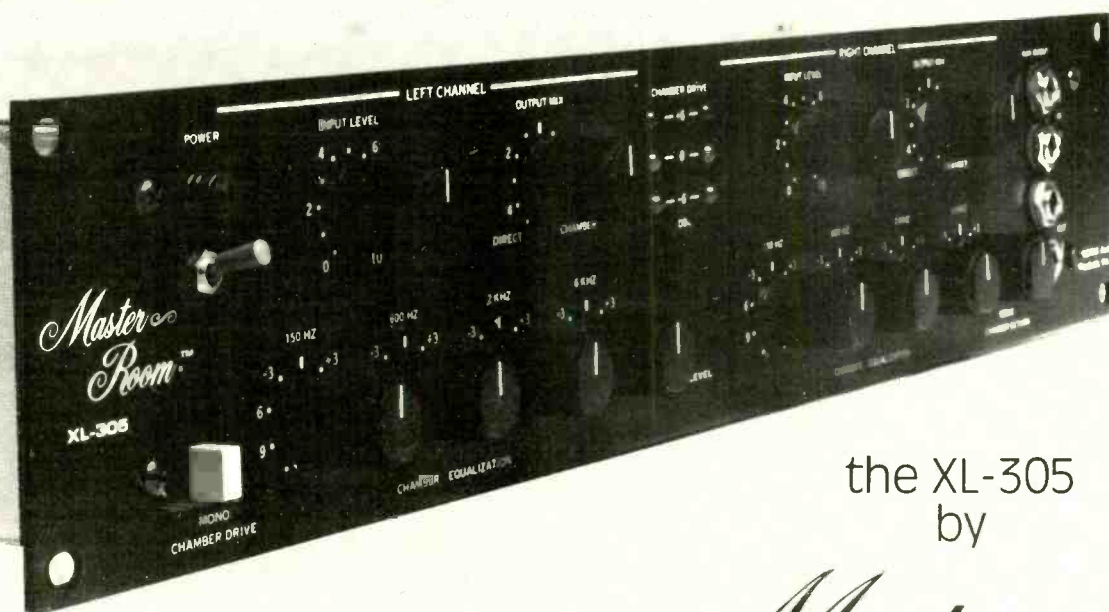
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making it suitable for handling time code signals in record or search (fast spool) modes. All the units are in the form of modules designed to fit a specially designed rack mounting frame. Other units to be added to the *7000 Series* range include a dc voltage controlled line amplifier, a line up tone oscillator, a loudspeaker amplifier, a mic amplifier, and a loudspeaker monitor amplifier.

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Holland **Pieter Bollen Geluidstechnik** Hastelweg 6, Eindhoven Tel: Eindhoven 512 777
Sweden **Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel: Gothenburg 130 216
Norway **Siv Ing Benum AS** Skovvn 22, Oslo 2 Tel: Oslo 565 753

studio diary

Sigma Sound, Philadelphia

Sigma Sound in Philadelphia is currently bustling with activity: a new album is being recorded by Gladys Knight for CBS Records. Candi Staton is coproducing an album with Sigma's Jimmy Simpson, Gato Barbieri is working on the rhythm tracks for his new album on A&M Records, the Village People are cutting the soundtrack for a film *Can't Stop the Music*, and Cat Stevens comes by to develop some experimental concepts in music.

Sigma has grown steadily since 1968 when Joseph Tarsia, president and founder, opened Studio One, his first 8-track facility, and in 1970 expanded it to 16-track and finally to 24-track. Studio One, approximately 1,000 sq ft, is equipped with a custom Electrodyne console, Allison automation, UREI 813 monitors, EMT 140 and a Lexicon 224 reverberation, 2in recorders are 3M M79s and 1/2in machines are Ampex ATR100 and 3M M79s.

As business continued to grow, Tarsia opened Studio Two, a 24-track studio, approximately 800 sq ft with modified MCI 400 Series console, modifications including quad joystick panning and buss panning with Allison automation, while recorders, monitors and reverb are similar to Studio 1. By 1974, Studio Three, opened as a post production and copy room with 3M 2-track, Revox 1/4-track, Nakamichi cassette recorders and two quality control turntables. Then finally Studio Four, approximately 500 sq ft, was opened and equipped similar to Studio Two.

Business in Philadelphia was so successful that by 1976 Tarsia felt that it was time to attempt expansion to New York City. He opened Studio Five, approximately 950 sq ft, with a custom console designed and built by Allison and MCI. It employs Allison's 'fabulous digital faders', custom equalizers and cue system, and contains a centred master control system. Recorders are again 3M M79 and Ampex ATR100s. Monitors are the new *Big Red Time Sync* system, power amplifiers are Crown PSA2, reverb EMT 140s and 240s, and Lexicon 224s.

Studio Six in New York City is a post production room with a custom six input console, and is equipped similarly to Studio Three in Philadelphia. Studio Seven in New York City, approximately 770 sq ft, is equipped similarly to Studio Five. Studio Eight, in New York,



◀ Control room Studio Seven New York.



▼ Control room Studio Four, Philadelphia.

is a mixing room with a 260 sq ft dubbing studio and is similar to Studios Five and Seven. Studios One, Two, Four, Five and Seven offer tuned drum kits, grand pianos, Hammond B3 organs, various guitar and bass amplifiers, various electric keyboards, Musser vibes and various percussion instruments. All control rooms have a complete compliment of auxiliary equipment including Lexicon DDL's, Marshall *Time Modulators*, KLH and SOR auxiliary monitors, Eventide *Harmonizer*, Dolby noise reduction and Lexicon *Prime Time*.

And the growth of Sigma Studios doesn't stop there. The studio just purchased a building which was built by Warner Brothers in 1946 from NFL Films, the film production division of the National Football League. The building is a natural for recording studios as it is made of strong concrete and has high ceilings and a spacious interior. Plans are to renovate the first floor for administrative offices and second floor for studios, the largest of which will record more than 50 musicians simultaneously. It will feature a custom console designed and built by Allison Research and Sphere, and features 48-track recording. The move is scheduled to take place around mid summer.

Sigma employs approximately 50 people, half in New York City and half in Philadelphia. Everyone hired for any position at all from janitor to office helper is screened very carefully for the company hires from within. Tarsia feels that early exposure to Sigma's method of operation allows a person to grow very easily into the organisation. Almost all of the mixers learned their craft while working at Sigma.

The business efforts are concentrated mainly on music recording, rather than on advertising agency work. Tarsia explained that

advertising clients work under a great deal of pressure and that he prefers the less hurried atmosphere of music recording.

Joseph Tarsia has seen significant changes in the industry over the last decade. He feels that the quest for multitrack separation has taken precedence over considerations of natural room sound, resulting in a sterile lifeless sound. But when separation is a necessary factor, delay and enhancement devices can be employed and in the mix stage of recording, it is not uncommon for selected tracks to be equalised, delayed and sent through studio monitors. This signal, carried via microphones, is then returned to mix as ambience enhancement. In reality, Tarsia points out the artificial methods are a poor substitute for that 'legitimate sound' that happens when all the musicians perform together. Tarsia feels that the use of microphones carefully placed allows the sound of one instrument or section to cross and blend with another, resulting in a fuller more natural recording.

Concerning the future of the industry and what changes might come to be, Tarsia feels it is very possible that in two to five years, the present 15ft mixing console will be reduced to about 3ft of digital controls, allowing the mixer to manipulate the remote analogue audio chain. The brain, he states, will be microprocessor-based and the console functions will be

monitored via colour video displays. But like most studio owners today, he has a wait-and-see attitude towards digital—that its time has not yet come. "It simply isn't cost-effective for a studio to invest large sums of money into equipment which is still being perfected and which will be obsolete or incompatible a year or two down the road. In addition, the recording industry in general will require technical people capable of maintaining the highly sophisticated equipment."

Tarsia takes an active part in the recording community. He is the newly-elected President of SPARS, the Society for Professional Audio Recording Studios. This organisation, dedicated to perfecting the craft, is composed of approximately 36 of the premiere studios across the United States.

Tarsia doesn't actively promote Sigma Studios. The quality of the product speaks for itself. Among the artists to record at Sigma are Edgar Winter, the Doobie Brothers, Rod Stewart, Robert Palmer, Steely Dan, Lou Rawls, O-Jays, Teddy Pendergrass, Ashford & Simpson, Diana Ross and David Bowie, who was particularly laudatory of the craftsmanship at Sigma during the recording of *Young Americans*. New people are requesting the studios and staff of Sigma all the time for the recording of their next albums. And for Tarsia, "There is nothing better than a satisfied customer".

Claudia Kienzle



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Akademski Studio, Ljubljana

Slovenia is the northern province of Yugoslavia having about two million inhabitants, 10% of whom live and work in Ljubljana, the capital city. In addition, Ljubljana also boasts one of Yugoslavia's few 16-track studios—Akademski Studio (Studio Academic).

Housed in an erstwhile music academy built around 1920, Studio Academic was set up about six years ago and is run by Miroslav Bevc ('Beoots') very much along the lines of a hobby. Miro is a sound engineer at RTV, Ljubljana, where, for production work they only have a maximum eight channels capability. Anything larger is usually done at Studio Academic.

The studio itself is very spacious being more or less rectangular with a drum/vocal overdub booth in the corner. The walls have been treated with wooden acoustic panels, veneered on two sides with a cardboard spacer and backed with mineral wool which is fixed to the wall and in most places the walls are finished with carpet while egg-boxes on the ceiling complete the job. The acoustic screens are homemade using a basic softwood frame with thick foam infill padding and a couple of rolls of heavy curtain material which can be hung to order. Some old Plexiglass doors have been acquired to create a 'live' area.

Capacity is about 30 musicians who, incidentally, would no doubt be intrigued to find that foldback headphones (AKG K16 with separate volume control) are stored on an antique bent iron hatstand. Generally the studio is bigger than average, with its wood/carpet wall

giving a surprisingly sumptuous appearance.

Moving on to the control room, overlooked by a basque relief of President Tito, the home built feel becomes more apparent. Running parallel with the studio, the control room communicates by sound only since a chimney stack runs between the two rooms ruling out the possibility of a communicating window. Originally Miro had planned to rebuild the control room but when he measured the acoustics they were found to be virtually ideal. Equipment is fairly basic but includes an AKG R20 reverb, MXR Digital Delay, Space Echo and two MXR limiter compressors. Miro had originally planned to have a compressor limiter on each channel, but scaled down to a group of about six using Audio & Design Compex electronics in a custom built unit. The tape ma-



Miro Bevc and Siggie Jackson (MCI) with the home built console

chine is entirely homemade and is a hybrid of Ampex heads, Studer capstan, transport, tape guides and varispeed, and Miro's own design of record/replay amps. In fact, Miro designed the electronics such that each of the 16 tracks will accept a mic level input and the machine has been used, on more than one occasion, for direct input live recording. Other tape machines include two old RCA RT21 ½-tracks used mainly for effects, and a pair of Revox B77s. No noise reduction whatsoever is used.

Monitoring is through a Malcolm Hill power amp and combination Tannoy/JBL and Auratones. Before acquiring the R20 reverb system, Miro used a long upstairs corridor having stone walls, floor and concave ceiling with a microphone and speaker at opposite ends. He had to be careful of visitors otherwise footsteps would come across the reverb. That in itself has been put to good use though. On one occasion an RTV radio production had need of running footsteps which they did not have in the sound effects library—Studio Academic duly obliged.

Questioned on the cost Miro tends to answer in terms of months rather than money since only barest essentials have ever been purchased—and then usually second-hand. Bearing in mind that there is very high customs and other additions to any imported items, Miro must have put the whole thing together on a shoestring—which just goes to show that you can have a fully operational 16-track studio turning out a reasonable amount of material provided you are prepared to work at it. Microphones in the studio vary considerably through a

U47 and U49 skulking in the corner to AKG 1200C, some really old RCA mics in the drum booth, Sennheisers, and an M49 Valve type.

Miro's latest accomplishments include a new echo room just completed in the basement. A new Soundcraftsman graphic equaliser and some home designed/built noise gates will eventually be incorporated into each channel on the desk, while on order is an MXR Flanger/Doubler. Future plans include the building of a 24-track machine based on Studer A800 mechanics and the syncing of this to the 16-track. The desk, of course, will be expanded to 40 inputs to match this.

Music tends to be of most types ranging from traditional Yugoslav folk music to some pretty heavy rock. Miro also finds time to master records for RTV Ljubljana which has a department devoted to issuing records throughout Slovenia, some of which may have been originally produced in other parts of the country. Other customers include Hungerphone, Hungary and RTB Belgrade.

All in all, Studio Academic is an excellent example of a studio where money is not forthcoming and all the usual niceties have to be forgotten—it doesn't seem to affect the finished product. Housed in a beautiful old grey stone building typical of the style in the area, Studio Academic's most endearing feature must, for me, be Miro Bevc's modest catchphrase—"small studio, BIG sound".

Harry Mangle
Akademski Studio, Polyanski 6, Ljubljana, Yugoslavia. Phone: 323123

Live One On The Wire

A recent arrival in the editorial office was a digital live album from Oneiric Records recorded essentially direct-to-disc. The album, called *Live One On The Wire* is a debut album from singer/songwriter Jeff Campbell and was recorded as a live 2-track recording using a Sony PCM-1 digital encoder and a video recorder with no mixdown or editing. The album was produced by Bill Sullivan and engineered by Paul Ratajczak in August 1978 at The Recording Suite, Long Beach, California and is probably one of the first digital recordings of popular music to have been issued. Disc mastering was carried out by Stan Ricker at the JVC Cutting Centre in Hollywood and great efforts were made to eliminate the prevalent 'snap, crackle and pop' pressing syndrome.

Although the album has been available since mid-1979 in the

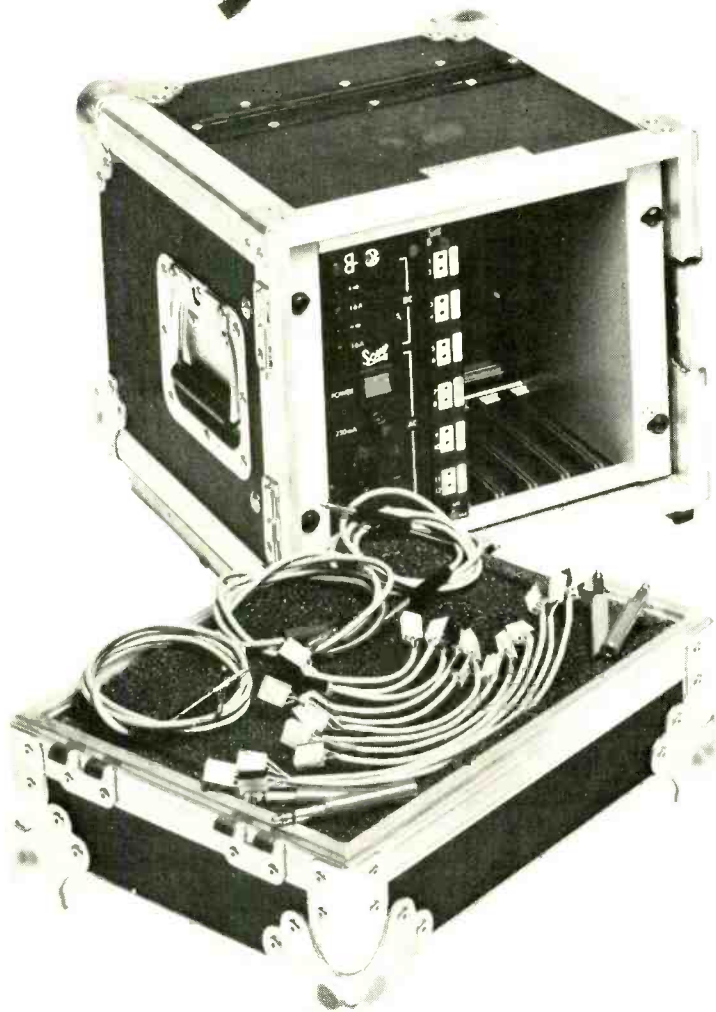
USA, this was my first contact with a digitally recorded popular music album. So how effective was the album? Whether or not listeners like the material recorded is immaterial, so I will devote my comments to the reproduced subjective quality. Listening to the record over a top quality hi-fi system (Sony 70W/channel amplifier, Gale loudspeakers, Garrard/SME/Ortofon turntable combination) a number of points were immediately apparent. There was a notable lack of pressing faults or static-induced distortion. However, the album appeared to be recessed and lacking in bite. I soon cured this condition though! When firstplayed I listened to the album late in the evening and hence in the interests of my neighbours I replayed it at a reasonable level, (referred to my Sony amplifier's average-reading power meters, average output power was less than 0.5W). At this stage I wasn't over

impressed even though the recording was clear and precise. However, feeling that the recording should have greater impact and an excellent dynamic range, I waited until a convenient moment arrived for me to replay the record with the wick turned-up. The difference was quite startling. With the amplifier's meters indicating an average output power of some 5W and the spl in the region of 90dB, the record was totally transformed. The life and bite of the recording returned and without doubt the nuances of dynamic range and impact which had been obscured at a lower replay level were immediately apparent. To put it simply, it was as though I had been listening to two different recordings of the same material.

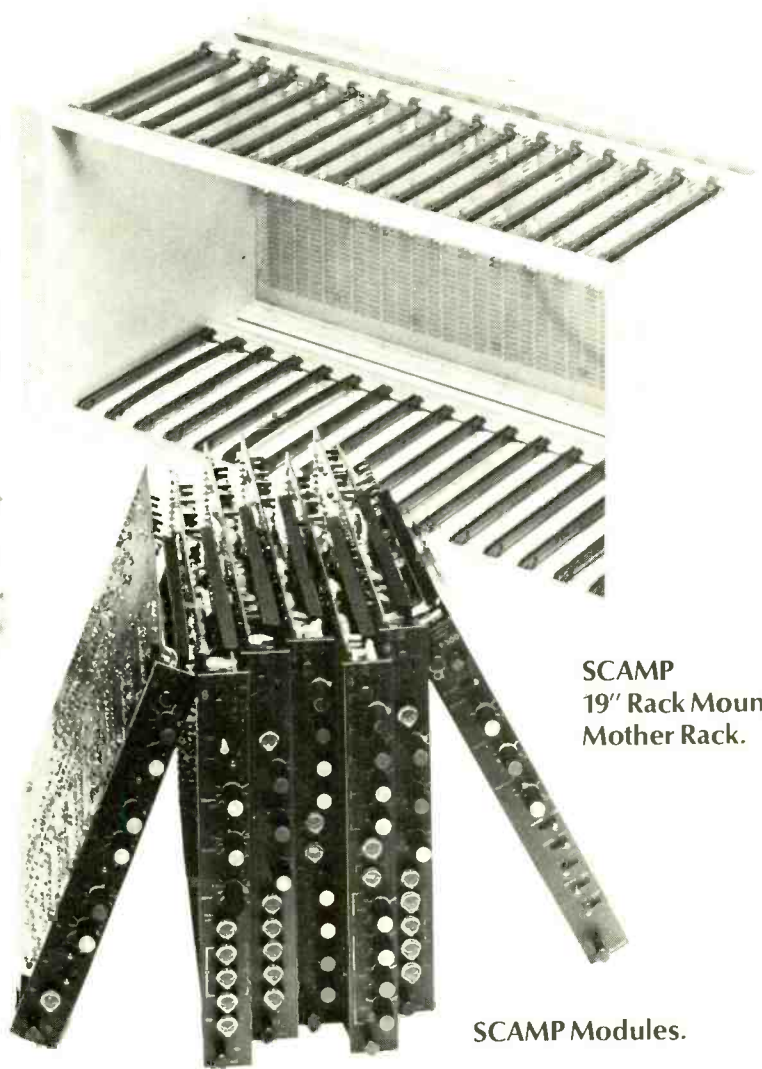
As a matter of interest I compared the Jeff Campbell album with a couple of digitally recorded classical records I have. These have

the same widened frequency range and increase in impact and clarity, but the low replay level problem was much less apparent. This begs the question of what cutting level is applicable in the intermediate stage between the availability of consumer digital audio and the present availability of consumer analogue audio? Where professional digital audio is available as an analogue record, and no doubt when completely digital consumer systems are available, it would appear that care will have to be taken in the amount of dynamic range available. Let's fact it not everyone has the equipment (or tolerant/distant neighbours) to allow the full benefits of increased dynamic range to be enjoyed. As a purist I would naturally like to have available as much dynamic range as possible, however, practical considerations

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suggest that until listening rooms are built like (and sound-proofed like) studio control rooms, a compromise solution is the answer. The Jeff Campbell album when replayed with the volume level turned-up over good hi-fi equipment is vivid and alive and fully justifies its recording technique, however, I doubt whether my neighbours would appreciate this replay level as the norm. To summarise, this album is well worth investigation by any reader interested in the possibilities of digital audio. To the best of my knowledge the album is still available and anyone wishing to acquire a copy should write to Oneirc Records, PO Box 4576, Santa Barbara, Cal 93103, USA. Price of the album, incidentally, is \$7.00.

Noel Bell

Sugarloaf View—new projects

Further to the *Studio Diary* item on Sugarloaf View in our February issue we have received fuller details on the complex the consultancy is designing in Nigeria. Situated on the outskirts of Lagos, the complex called Natral has been formulated by former Manhattan Borough president Percy Sutton in conjunction with the Nigerian government. The complex will include executive offices, employee and artist lounges, a cutting room, a pressing plant, employee cafeteria and an elevated walkway to a 24-track recording studio. The equipment for the complex, which will be supplied by Audiotechniques, is still to be finalised but will include computerised consoles and 16 automated presses. The design of

the complex makes use of indigenous materials such as Nigerian hardwoods and also utilises local building techniques. The complex has been designed to attract international recording artists and is expected to be operational by late 1980.

Other new projects include the design of a major video complex in the centre of Boston for Ross Cibella, owner of Century III Recording Studios. The new facility called Centel Video will occupy a three storey building on Beacon Street and will have video production and support facilities. In addition to this, Sugarloaf View has been selected as design consultant for the recording studio areas of the new National Recording complex, to occupy the former West Side Airlines Terminal Build-

ing, at 42nd Street and 10th Avenue in New York. Working in conjunction with Hal Lustig and Irving Kaufman, principals of National Recording, the consultancy has created a flexible 24-track recording facility designed to accommodate National's advertising and film clientele, as well as record projects. The consultancy has also consulted with National, and Hardy Holzman Pfeiffer Associates (supervising architects for the entire complex) on a series of smaller voice-over and dubbing studios within the building and two full scale film and television shooting stages. The multi-million dollar project, created under the auspices of the 42nd Street Redevelopment Corporation, will make National the largest audio/visual recording facility in New York.



Denon PCM recording

During early autumn last year I had the opportunity to attend a digital recording session in London where Nippon Columbia recorded the English Chamber Orchestra using the Denon PCM system. The digital session was one of a series being recorded in Europe for release on the Denon label. Denon already have a large number of digital recordings in their catalogue and have steadily improved their PCM system in the light of technological improvements and increased experience of PCM recording. Although based in Japan, Denon regularly visits Europe to record, and this latest tour took in Munich, London, Dresden and Prague.

First stop was Sound Track Studios, Copenhagen, where Takeaki Anazawa, the Denon development and recording engineer, and his colleague Yoshiharu Kawaguchi from Nippon Columbia's A&R department, checked over the PCM equipment. Also while in Copenhagen the Denon recording team worked out their recording plans with Peter Willemoes, their Danish record producer. As many readers will know, Peter has been responsible for the production of many European recordings, notably for the Erato label, and also regularly produces for Danish Radio. From Copenhagen the team travelled to Munich to record the Munich Chamber Orchestra in Bach violin concerti

and Mozart flute concerti.

Next stop was London, at the Henry Wood Rehearsal Hall in Southwark. The team were here to record the English Chamber Orchestra under conductor George Malcolm in CPE Bach piano concerti with soloist Andrezej Schiff. During a convenient break in the recording session, engineer Takeaki Anazawa detailed what equipment was being used in the Denon system and described its features to me.

The system was a third generation Denon PCM, comprising a Denon 4-channel portable encoder/decoder coupled to a Sony *U-Matic* video cassette recorder. In addition to this primary system the recording team also had a secondary 2-channel encoder/decoder for security, again coupled to a Sony *U-Matic*, plus a 4-track analogue recorder. The additional Sony recorder could also be used for PCM copying or simultaneous video recording and for synchronisation. Denon were utilising a Sony *BVG1000* SMPTE generator/reader.

The third generation Denon 16-bit PCM system is linear with the following emphasis characteristics: a 75µs time constant, plus a 15µs stop time constant, giving a similar effect to the RIAA magnetic phono replay curve at high frequencies. The Denon encoder/decoder can be used with any video recorder, but in this instance the encoder/decoder was coupled to a Sony *U-Matic X-Ray* recorder using Fuji Film *KCA-60 Beridox* video-cassettes. This particular Sony recorder was originally produced for recording black and white X-ray pictures which require a recorder capable of producing precise and detailed pictures with a high resolution. The *X-Ray* recorder is

accordingly more accurate than the standard Sony *U-Matic*. At the London recording session it was used as a 4-channel recorder, while another was used as a security recorder in conjunction with a 2-channel encoder/decoder using a 13-bit system with floating bits. However, to return to the primary PCM system, the encoder/decoder features a digital display, scaled in dB, of the system's headroom up to clipping level. This display only sampling the upper 8-bits of the 16-bit system to derive its indication. In addition to the headroom display there is an LED display of sound level in 6dB steps.

The performance characteristics of the Denon PCM system are: the system has a theoretical signal-to-noise ratio of 97.8dB, but in practice the S/N ratio is approximately 95dB (20Hz to 20kHz), with the actual S/N ratio governed by the settling time at high frequencies. Distortion is better than 0.1% over the range 20Hz to 20kHz, and is substantially better at low frequencies—for example at 1kHz distortion is typically 0.005%. The system currently uses a sampling rate of 47.25kHz, but the comparator is capable of operating at other sampling frequencies which are achieved by altering the crystal oscillator and ROMs. Frequency response of the system is 20Hz to 20kHz ±0.5dB (20Hz to 17kHz ±0.3dB) with a sharp cut-off at 20kHz, such that at 21kHz the response is already down to the -5dB point.

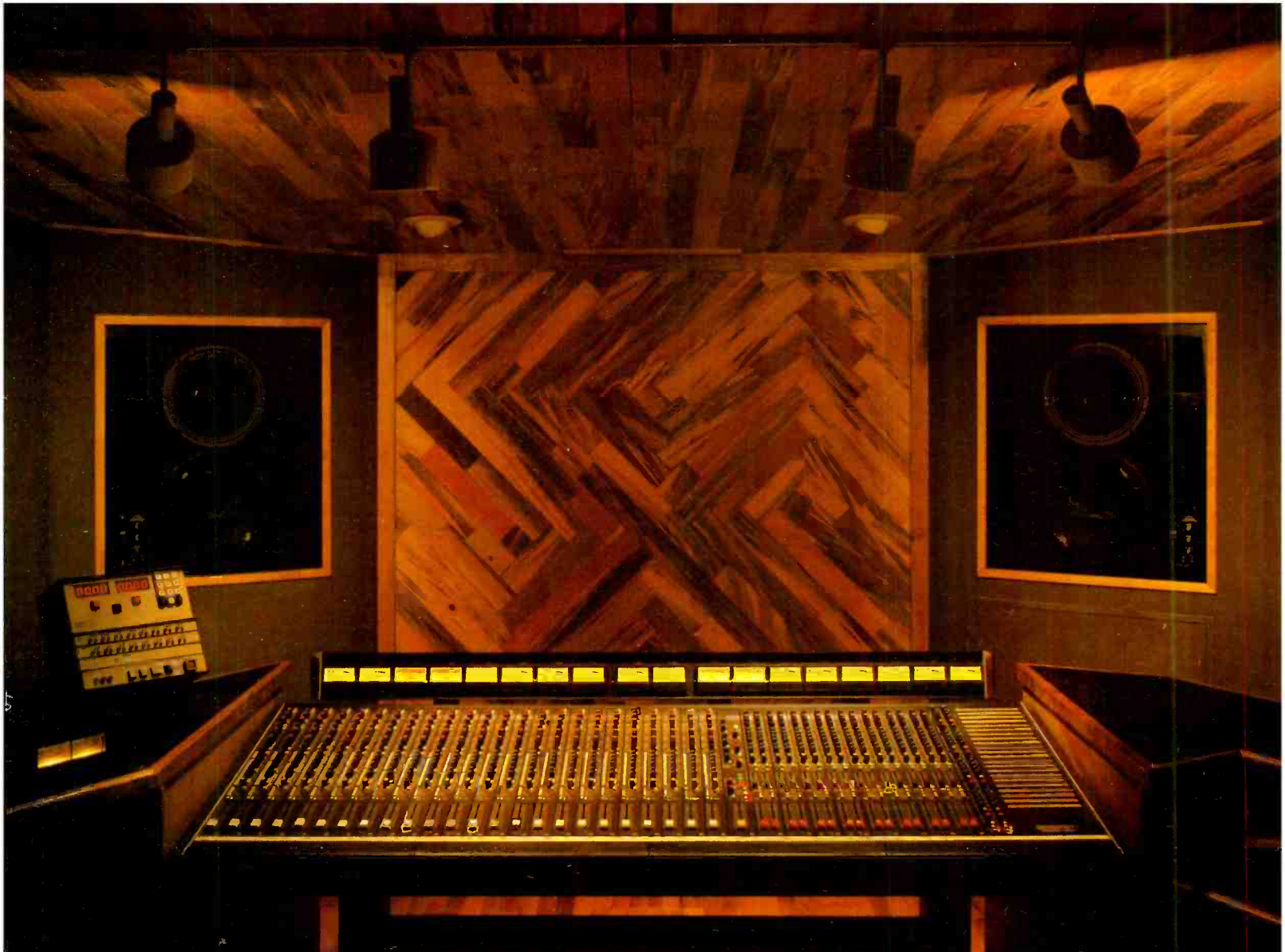
I asked Takeaki Anazawa how Denon edited their recordings. He explained that the digital recording would be transferred from video-cassette to 2in video tape in Japan, prior to editing. Once on 2in video tape they use an Hitachi quadraplex 2in broadcast NTSC video recor-

der, operating at 15 or 30in/s for editing. The editing is accomplished via normal analogue style tape editing with tape splicing (very rare nowadays for video editing).

While Takeaki Anazawa and all the Denon PCM equipment was placed along one wall of the control room (which was situated at the side of the Henry Wood Hall adjacent to the recording/rehearsal hall), producers Peter Willemoes and Yoshiharu Kawaguchi had their equipment facing the adjacent control room wall such that all the equipment was in an L-shape. Peter Willemoes was operating a Neve 12/2 portable console with aux/foldback channels, which was in use as a 4-channel desk. For security purposes Peter was also feeding a Lyrec 4-track analogue recorder operating at 15in/s and using four channels of Dolby *A361* noise reduction. Concurrently, Yoshiharu Kawaguchi was operating the remote controllers for the Sony *U-Matic* recorders. As there was no direct vision to the rehearsal hall, contact with the performers was via a JVC video monitoring system and talkback facilities. The mics were Schoeps capacitors and sound monitoring was carried out in stereo only, using a pair of Klein and Hummel monitor loudspeakers with built-in amplification and active crossover.

The recording session went very smoothly and was completed ahead of schedule and everyone was very satisfied with the results. The recordings are now being edited in Japan and Denon anticipate that they will be released in the summer of 1980. UK readers may like to know that Denon PCM records are available from Eumig (UK) Limited, 14 Priestley Way, London NW2. Phone: 01-450 8070.

Noel Bell



Soundcraft 1624

Manufacturing:
Soundcraft Electronics Ltd
5-8 Great Sutton Street
London EC1V 0BX
England
Telephone: (01) 251 3631
Telex: 21198

US Distribution:
Soundcraft Inc
PO Box 2023
Kalamazoo
Michigan 49003
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Brandon Wade's Crosstown Recording, Kalamazoo, Michigan.

Villa Recorders, Modesto

Since almost 70 percent of California's inhabitants live in the Bay Area or Los Angeles basin, few studios established outside those areas have attempted to compete with their city counterparts.

Villa Recorders is unusual in several ways. In spite of its location in the San Joaquin Valley (an area better known for producing fruit and vegetables than hit records) it attracts talent more often found at work in LA or New York. Well equipped and secluded, the 24-track studio has only recently raised its rates to \$95 per hour, and that includes accommodation and use of the swimming pool, jacuzzi, pool table and rehearsal room. Humble Pie just finished recording in time for Christmas and recent clients include Edgar Winter and Dobie Gray—quite a track record for a studio less than one year old.

Only one and a half hour's drive from San Francisco, the studio stands in 80 acres of almond orchards. Owner Fred Eichel explains:—"It all started when I was 18. I was building a barn for my dad and decided I should have a studio here—I had a 4-track at that point. With the help of my friends I rebuilt the studio several times and eventually got a 16-track. When I decided to do it right, build a good studio, and realised how much it was going to cost, I convinced Scott Snider to be my partner. We came across a good buy on a Trident board (an uncollected B series) and right after we bought it, Cherokee in LA needed a board to mix the *Sgt Pepper* soundtrack. They rented it for a month, and as part of the agreement converted it from 24/16 to 28/24. We had some problems with summing amplifiers, but it's a really good board now—clean and open." I wondered who had designed the control-room? "It's a copy of a room George Augspurger did for Chateau Recorders in LA when I worked there. The original speakers were built into the



Villa Recorders—control room

walls; a custom 4-way system, all Gauss, units. We got it flat in the room, but it didn't sound right, so we tried *Big Reds*, but they proved deficient in some ways—things done here were just not holding up outside. We then made a choice between Urei Time-Aligns and Tannoys—we went with the Time-Aligns because they're relatively new in this country and have a lot of credibility, and we've been real happy with them—plus we have the smaller Tannoys."

The latter belong to John Wright, resident engineer and troubleshooter. "He's amazing—he hears everything," continues Fred. "John originally came up here looking for a place to mix, right when we were having trouble installing the Trident. He helped us out with that and came to work here, bringing his Ferrograph, his Dolby's and his mics and a lot of good ideas. He designed the echo chamber, which worked out really well—we used special sand from Monterey. We've tried every kind of driver in it; 604s, JBL 4311s, you name it. Now we're using *Auratones* and a small amp—the big speakers were just overloading the chamber—and now there's much better

separation in stereo."

Tape machines are all Ampex; an *MM1200* and two *ATR 100s*, all with recently installed Dolby noise reduction. "I had a Studer 24-track priced out but then they had a big price increase, the DMark went up and the dollar fell and I was looking at \$65,000 for a basic machine," Fred comments ruefully "whereas I could get the Ampex with everything I wanted for \$40,000. Now I realise I should have got the Studer anyway, though I must say that the Ampex's have been rock steady now they've settled in."

Villa's microphone selection includes eight Neumann *U87s*, four *KM84s*, *AKG C451s* (with all the different pads and capsules), and pairs of *AKG C414EBs*, *Sony C22s* and *Beyer M500s*. Dynamics include an *AKG 200E*, Sennheiser *MD421s* and *MD441s* and Shure *SM56s* and *SM57s*. John and Steve Marriot were experimenting with an ancient Altec mic when I arrived; "Turns ssss into shhh like on those old soul records," Steve explained. "We haven't got into collecting antique mics yet," says Fred, "though I'd like a really good vocal mic, a tube *47* for instance."

Outboard equipment is comprehensive; as well as the chamber there is an *AKG BX20*, a *Lexicon DDL*, a *Marshall Time Modulator* and an *Eventide Harmonizer* with keyboard. Compressor/Limiters include *Urei 1176s* and *LA3As*, *dbx 160s*, *KepeX Gain Brain* and a John Wright special. Orban and Trident parametric and White one-third octave eq complete the picture, though an *ADR Scamp* rack is on order and a *Vocal-Stresser* is being evaluated.

The main studio is 30 by 32ft with two isolation booths 12 by 12ft and 12 by 13ft and features a cork ceiling and wood panelled walls. The acoustics are variable with a system of drapes and from their unsolicited comments it was obvious that Humble Pie enjoyed working there.

A 9ft Baldwin Concert Grand heads a list of available instruments that includes a Fender Rhodes piano, ARP and Oberheim synthesisers, Marshall and Mesa Boogie amplifiers and Slingerland drums with Zildjian cymbals.

Villa's guest accommodation couldn't be described as sumptuous, but ski-ing, wine-tasting, the Pacific Ocean and the justly famous Yosemite National Park are within a hundred mile radius. Modesto's night-life was aptly described in *American Graffiti* by director George Lucas who spent his teenage years cruising the valley, but for the dedicated raver Las Vegas and Hollywood are only an hour away by plane.

"The main thing is the atmosphere," Fred concludes. "We try to get real relaxed and we only charge for so many hours a day and then the rest is theirs; they don't have to worry about the money. We're definitely one of the best studios in Northern California, I believe, and our rates are incredible."

Chris Michie
Villa Recorders, 3013 Shoemaker Avenue, Modesto, Cal 95351, USA. Phone: (209) 521-1494.

Studio News

● Alpha Audio, Richmond, Virginia has completed large scale renovations and acoustic remodeling of its Studio I. Three isolation booths featuring variable acoustics and an orchestral shell area with stepped staging have been constructed. The orchestral area occupies approximately a third of the 2,200 sq ft studio and has cue feeds and electrical outlets built into the staging. Alpha's next project is completion of the construction of a new studio, Studio 4.

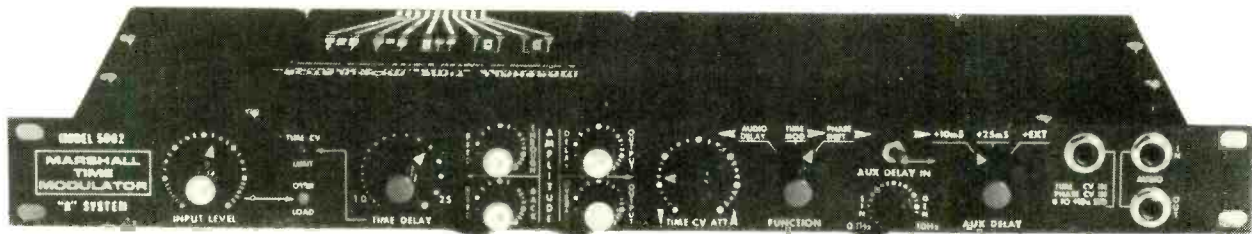
● Audio International, the equipment sales and installation servicing company, has acquired Masterstone Recording Studios in New York. Both firms will remain separate entities and Mastertone will continue to provide professional recording services including a 16-track studio, editing/remix rooms, a production studio, computerised disc cutting facilities with direct-to-disc capability, and a newly added 'self-service' Tascam studio. Audio International has also formed an 'on-call' maintenance service for pro/semi-pro facilities.

● Ampex Golden Reel awards have recently been presented to the following artists and studios: Bee Gees (Criteria Recording), Barbra Streisand (Sound Labs), Donna Summer (Rush Studios), Chuck Mangione (Kendun Recorders), Blondie (Record Plant), Kiss (Plaza Sound Studios), Abba (Polar Music), and the Kinks (Konk Studio). The Ampex awards are presented to artists selling over one million copies of a single or 500,000 copies of an album, the only condition of the award being that the recording must have been

mastered and mixed in a studio on Ampex professional tape.

● Radio Luxembourg (London) recording studios has re-equipped its Studio I to 16-track. New equipment installed includes a Neve 8066 console and a Studer A80 16-track with Dolby M16 noise reduction and Studer auto-locator. New ancillary equipment includes units from AMS and Audio & Design (Recording). In addition Studio 2, the 'self-op' production studio, has had its facilities improved.

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Above: Studio B control room
Left: Cutting room with VMS 70 lathe

MCA Whitney

The MCA Whitney recording studios were originally built around a large pipe organ which the studio's founder, E Lauren Whitney, used for religious music broadcasts. An early customer was the Walt Disney studios down the road in Burbank. The religious clients still come, as does Disney, but the clientele has widened somewhat since those early days and the studio is now in regular use by alumni of the music world. In 1978, the studio became part of the MCA stable, and they spent some \$50,000 refurbishing it.

In addition to the two main studios A and B, there is a demo room, a cutting room and a fairly large reproduction facility for duplicating tapes. Studio B was in the process of being rebuilt while MCA were taking over, and the rebuild is now complete.

The Robert Morton pipe organ that started it all still stands in Studio A, it is a massive wood and ivory structure, with more knobs and levers than you find in a control room, but it is the part of the organ that you don't see that is really impressive; the pipes and pumps tucked away behind the walls. The studio itself has the dimensions of a modest school gym, measuring about 45ft long at the apex of the rhomboid shape, and about 35ft wide. Some parts are very live with hard shiny floor surfaces, others are carpeted, and there are large effective sound boards with drapes and so on for adjusting the acoustics, a large glass isolation booth and a drum booth. The studio is used for every kind of session from film scoring, with up to 35 strings, to rock, soul and gospel. It is equipped with a Steinway grand, graced among others, by the fingers of Barry White, a Hammond organ with two Lesley speakers, a Celeste upright and a tack piano.

Control room one for studio A is the domain of Frank Kejmar, who has been with the studio for more than 15 years. The console is a Neve 24/16. It is nine years old,

and according to Frank it was one of the very first low-profile models. "This console has something, people are still beating down the door to use it. It's got to be one of the best investments we ever made."

Other equipment includes UREI limiters and Time Align monitors, a 3M M79 24-track with Dolby, and an Ampex MM1100 with interchangeable 16-track heads. Monitor amps are Cerwin Vega A300's, 625W into 4Ω. "We have to use that amount of power, because the room is cork-oak lined," says Frank.

Outboard equipment includes White 130 and 528 equalisers and a range of compressors. As in the other studio, there is an intelligent Audio Kinetics XT24 autolocator. It is 'intelligent' because as you run back to the same spot on a tape, each run gets a little shorter. There is a mixdown facility in the control room to two or four tracks on an ATR104 mastering machine. (The other studio has an MCI JH100, with two ATR 2-tracks for delay etc, considered very handy because of interchangeable speeds.)

One of the more visible results of MCA's takeover are two cutting lathes running in tandem since both parties had a lathe. The equipment now includes a Neumann SP75 console, and the two VMS70 lathes running in tandem, SX74 cutting heads and a Sontec parametric disc mastering equaliser. There are two 3M M79 copy machines, two Super Reds and Auratone speakers for monitoring. "We cut all of ABC, and MCA's product as well as product from Mike Chapman," says Gary Ross.

"Because this is also a record company, many people need copies for promotion and so on, so we have our own copy room for 4-track and 8-track. We also do the international export copies here, which have to be the best. We use old 3M machines which are great and never break down, we've also got a Studer for playback as well as Dolby facilities, and Pultec equalisers. All the rooms are connected by tie-line so that when anyone

mixes they can set-up the tie-line to the mastering line because they cut their product here, and it gives another reference. You can just step next door to the cutting room and listen," says Frank.

When Studio 'B' was rebuilt with input from Mike Chapman, one of the first things that was changed was the position of the door into the control room so that the monitors could be exactly centred. The room was also given a facelift to tone down the bass response. The studio was not acoustically planned to any great extent, but it works, according to Peter Coleman who happened to be there at the same time as *Studio Sound*. The console, a Neve 24/8, can be patched for 16 busses out, so it's effectively 24/16. Studio monitoring is with *Super Red's* and Auratone's. There is a new MCI JH100 series recorder with an *Auto Locator III* for almost random access to the tape.

There is also an Ampex ATR102 2-track tape recorder, and a whole 'bunch' of Sphere equalisers, which Peter Coleman said he preferred to Neve's. "They are a lot smoother, I find, than the Neve's, and have a variable bandwidth, so we can patch around the Neve eq's and get a smoother sound."

There are also 24 tracks of Dolby. Peter Coleman again: "I don't use the Dolby. If you elevate the tape at plus four over ten, on Ampex 456's at 30in/s there is no real noise to speak of. The Dolby's tend to take the whack out of the drums."

Studio B is about 25 by 25ft, with three separate isolation booths, and two live chambers at the rear, plus a room with six EMT 140 stereo plates. All the studio amps are contained in a cupboard just outside the studio; this includes the power supplies for the Neve and the Harman Kardon *Citations*, as well as for the McIntosh MC2105's which are used for fold-back. The hallway outside studio B becomes an isolation booth by closing the corridor doors which are double glazed. Alternatively, the hallway can be used to extend

the studio volume by leaving the adjoining room open. There is another booth with removable doors for the 7ft Yamaha baby grand. There is also a drum booth with good overhead mic'ing facilities.

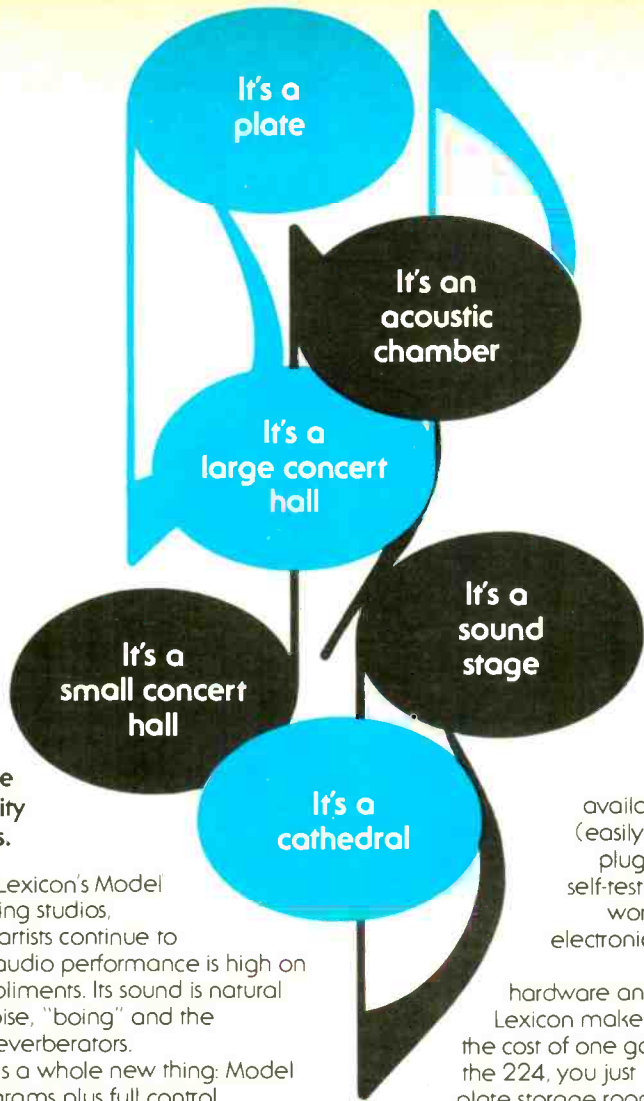
Studio B shares a good selection of mikes with studio A, including many old valve mics, Neumann 67's, 47's and 49's plus Telefunken 251 tubes, more Neumanns, AKG's, Sennheisers, and dynamic Shures. Studio B was occupied by a group from New York called Nervus Rex when *Studio Sound* called. Peter Coleman, engineer on the Nervus Rex session has also mixed tracks here by Exile, Thieves, Pat Benatar, Nick Gilder, Blondie, Smokey and Suzi Quatro. "We use this small room for overdubs and mixing. If we mix on these monitors, there's a punch hump at 800Hz. I like to mix here. Most of the basic tracks we put down in the big studio. The separate isolation booths in the smaller studio give a nice dry sound," said Peter.

Vice-president recording of MCA and studio boss Brent Allbright heads up a team of three engineers, Frank Kejmar, Terry Brown and Paul Elliot; two second engineers, Gary McGachan and Dave Hernandez, four maintenance staff—including Charlie Bolois who gave *Studio Sound* their conducted tour, admin and commercial staff fronted by the lovely Bunny Browne, a total of 23 people.

Bill Third
MCA Whitney, 1516 West Glenoaks Blvd, Glendale, Cal 91201, USA. Phone: (213) 241-4228.

Battery Studios, London

As a result of a novel purchase agreement a new recording studio known as Battery Studios has appeared on the London recording scene. Battery Studios are owned by a new company, Maytop Limited, formed for the purpose of developing recording projects. Maytop has purchased from Morgan Recording Studios, its Studio Four which is equipped with a Cadac 28/24 console, and effective from January 1980 this studio has been renamed Battery Studios. Studio manager at Battery Studios is Joyce Moore and studio engineer is Mike Shipley, both formerly of Wessex Studios. The principals involved in Maytop Limited are Clive Calder of Zomba Management and Publishers Limited, Dave Robinson of Stiff Records, and record producer Mutt Lange. Battery Studios, 14-16 Chaplin Road, Willesden, London NW2, UK. Phone: 01-451 3322. ■



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Communications circuits, their background Part One

Colin Seabright, Des Afford and Geoff Atkinson

IN ADDITION TO the usual business telecommunications requirements (telephony, facsimile, data etc), broadcasters invariably require programme circuits. Most broadcasting organisations have a centralised mixing point to combine individual programmes into a network service which may be called the Continuity or Master Control Area depending upon the organisation concerned. In this article, programme circuits taking a network service from the central point to the transmitters are termed 'distribution' circuits, while those bringing inserts or complete programmes into the central point (for either mixing into the network service or recording) from outside broadcasts (OBs) or remote studios, are termed 'contribution' circuits.

The Role of PTTs

Large broadcasting organisations use many hundreds of programme circuits every day and the provision of them creates considerable work and revenue for the telecommunications agencies. Consequently most PTTs (Postal, Telephone and Telegraph administration) throughout the world offer some form of programme circuit service, the cost and efficiency of which varies, as might be expected, from country to country. Although PTTs are the major suppliers of programme circuit facilities they are not the only ones. For instance in most countries broadcasters meet some of their own circuit needs, particularly those for Television OB microwave links, from within their own resources, and in France and Italy the Broadcaster is in fact the sole provider of vision and music circuits.

Circuit facilities in the UK

In the UK the Post Office (BPO) offers three basic types of programme circuit for hire: vision (video) circuits, music (or sound programme) circuits, and control lines.

A vision circuit must have a usable bandwidth which extends

During some stage in their career, most engineers have to send audio along long distance circuits, whether in broadcasting or remote recording. This short series of articles, written by engineers from the BBC's Communications Department (who spend almost £5m a year on communications circuits), attempts to explain the background to audio programme circuits, and their performance. Next month part two discusses the quality of communication circuits, and the necessary test procedures to correct and maintain transmission parameters.

from less than 25Hz to over 5.5MHz, and consequently it is the most expensive of the three types. For example a London to Birmingham vision circuit (100 miles) will cost approximately £33,000 per annum if rented on a permanent basis, or £103 for one hour's use if rented on an occasional basis.

Music (or sound programme) circuits supplied by the BPO have a wide range of bandwidths which, at one end of the scale, extend from 50Hz to 15kHz, and at the other extend from 300Hz to 3kHz. The former is the type of circuit one hopes to obtain for quality music relays and the latter the type of sound programme circuit that one often has to make do with when relaying commentaries from overseas sports events. BPO charges for music circuits are dealt with later.

Control line circuits are derived from normal telephony plant and, therefore, have a bandwidth of approximately 3kHz which broadcasters use to control and supervise their programme activities and also provide reverse programme feeds for cueing purposes.

Each type of circuit may be hired on a permanent (yearly) basis, or on an occasional basis, ie by the minute, hour or day depending on the type of circuit and its physical length. Permanent rental becomes an economic proposition once the planned usage of a circuit exceeds a certain amount (determined by the circuit's length) but may take up to two years to provide. Occasional circuits can be provided at very short notice—in some cases with less than 12 hours notice.

Permanent circuits (National)

Permanent circuits are also known as private wires and as already mentioned, should be considered whenever usage is of a regular and predictable nature and exceeds the break-even point. As distribution circuits fit this description (they are usually in use for at least 10 hours a day) broadcasters invariably adopt permanent rental for this category of circuit.

However, there are further factors to consider. Permanent circuits may take up to two years to provide but, once provided, are usually less fault prone than occasional circuits and of course always readily available.

In the UK permanent circuits should be ordered in the first instance from the local Post Office Sales office. If the circuit required is a local one this office will deal with the order in its entirety. If a longer circuit, which extends beyond the local PO area, is required the local office will put the customer in contact with the appropriate BPO regional, or Headquarters, group.

The rental charges for permanent sound circuits are determined by the type of circuit ordered (music or speech quality) and its length. For charging purposes, the length of a permanent circuit is defined by the BPO as being equivalent to the radial distance between the two terminals.

As an example, the rental for a standard, permanently rented, BPO music circuit (classified by the BPO as a tariff 'M' circuit) will be £75 per annum for a 1 to 1½ miles

circuit having a chargeable distance of 90 to 100 miles.

Speech quality circuits (control lines) have a bandwidth of approximately 3kHz, and are available in three insertion loss related forms. The three forms are defined by the circuit's nominal loss at 800Hz and are 17dB, 10dB and 3dB. The rental charges vary, of course, according to the nominal loss but, taking the middle range (10dB) circuit as an example, the rental for a 1 to 1½ mile circuit is £81 per annum and for a 90 to 100 miles £1,735. Speech quality circuits may be obtained in 4-wire or 2-wire mode, and with or without ringing facilities, in accordance to the customer's wishes.

The BPO also levies a connection charge for all permanent circuit installation. This is a once only charge and varies, according to the length of the circuit, from £19 to £188 for a tariff 'M' circuit and from £30 to £100 for a speech quality circuit.

Only the main trunk sections of tariff 'M' circuits are conditioned by the BPO and consequently the customer is expected to provide the topping-up equalisation and amplification needed to compensate for the untreated sections. However, the BPO will undertake this service if requested to do so. The bandwidth of a tariff 'M' circuit will not normally exceed 10kHz and may not (in a few cases) be greater than 6.4kHz.

The BPO may provide circuits of an improved performance (up to 15kHz) if requested to do so, but charge extra for this service, and a similar situation exists with regard to stereo pairs. The charges for the latter are specially assessed on each occasion.

Permanent circuits (International)

Permanent circuits may also be leased into the UK from overseas venues. Again the two basic types of sound circuit (music and control line) are available. The bandwidth of leased overseas music circuits

varies from 5.4kHz to 15kHz, the two most common types being 6.4kHz and 10kHz. Although this sounds rather vague, the various types are closely specified in the CCITT recommendations (section J).

Overseas leased circuits have to be ordered, and paid for, in two halves—overseas venue to midpoint and midpoint to UK destination. The UK portion should be ordered with the BPO's External Telecom's Executive, International Customer Service Section. This group will also advise on how to order the foreign section.

As an example of leased circuit costs, the rental on a Bruxelles to London control line circuit that is suitable for 'all uses' is currently UK section £5,272, Belgian section 600,000 Belgian francs, while a music circuit of up to 15kHz bandwidth will cost 1.33 times these amounts. At present no organisation leases international stereo circuits and hence no tariffs are published for this service. However, the CCITT recommendations state that the rates should be 2.66 times those for a control line circuit for 'all uses'. Connection charges are not applied to leased overseas circuits.

Occasional circuits (National)

Occasional circuits are used for commitments that are unpredictable and infrequent. Hence many of the broadcasters' requirements for contribution circuits, particularly those from OB venues, are met by the hire of occasional circuits.

As with permanent circuits, there are two basic types of occasional sound circuit, the music circuit and control line. The latter comes in several forms ie as a 2-wire or 4-wire circuit and with or without ringing facilities.

Occasional circuits, unlike their permanent counterparts, which are ordered as an end-to-end facility, are hired in sections, **fig 1**.

The local ends consist of dc plant and will typically be about 1¼ miles in length. The ones at the studio end will normally be permanently rented because the volume of traffic over this section will be sufficiently high to justify the cost of permanent rental. A studio local end may be used several times during a typical day.

Main circuits may be any length from a few miles to several hundred miles. Those up to 7½ miles are referred to as 'local' main circuits, and above this distance as 'trunks' on repeated plant (ie amplified).

Circuits from OB venues should be ordered with the Telephone Sales Office in whose area the OB is located and, if 'trunk' circuits are

required, a copy of the order should be sent to the BPO's Network Planning group at Stanmore. The area Sales Office will advise on this.

The basic tariff for a complete occasional circuit consists of three elements; local end charges, connection charges and main circuit charges. Local ends cost £52 for the first day of use and £7.50 for each subsequent day's use.

'Local' main circuits cost £1.81 per day irrespective of whether the circuit is a music or control line. The connection charge for this category of main circuit is £3.75 per day for a music circuit and £1.88 per day for a control line.

'Trunk' main circuits are placed in four charge bands according to length. For charging purposes the length of a main circuit is defined as the radial distance between the two terminal exchanges. The current trunk circuit charges are given in **Table 1**.

The minimum booking period for circuits in the 7½ to 10 miles band is 4 hours and the additional period charge relates to each additional half hour of use.

The minimum booking period for circuits, in excess of 10 miles is one hour, and the additional period charge is levied on each additional quarter hour of use.

To the above charges must be added the connection charges detailed in **Table 2**. This is a fixed charge which is levied once for

each period of use not exceeding 24 hours. If the use of a circuit extends into another day a further connection charge is due.

The BPO also levies penalty charges when orders for occasional circuits are placed after the specified deadlines, or if existing orders are amended or cancelled. The late order fees for local ends are £7.50 per circuit if less than 10 working days' notice is given, and £15 per circuit when less than 5 working days' notice is given. The late order fee for main circuits is £7.50 and this becomes due if less than 5 working days' notice is given. If an order is altered or cancelled within 3 days of the commitment, a penalty charge of £12 is levied.

Occasional international sound circuits

Occasional sound circuits are readily obtainable in the UK from overseas venues.

Those from European venues (continental circuits) are similar in type to their national counterparts. Most monophonic music circuits have a bandwidth of either 6.4kHz or 10kHz, and stereophonic pairs having a bandwidth of 15kHz are also available from most major European cities. The normal range of control line circuits (narrowband circuits) are also available including 2-wire circuits which may be ordered with or without ringing facilities and 4-wire circuits which

are only available without ringers.

Intercontinental sound circuits (international circuits from venues outside the continent of Europe) are mostly narrowband (unless provided in conjunction with a TV satellite video channel) and are only available as either one-way or two-way circuits without ringers. The latter, which are known as narrowband plus feedback circuits (just another name for 4-wire circuits) is a popular configuration as it costs the same as a one-way circuit but provides a very useful return channel which enables those at the receiving end to pass instructions, or feed 'cue programme', to their correspondent or commentator at the overseas venue. Wideband circuits (6.4kHz) exist from one or two intercontinental venues (Australia and New Zealand for instance) and may be set-up from other places by special requests, in which case a 10kHz circuit may be provided. The USA is the only intercontinental area from which an advertised stereo service exists although, again, stereo circuits may be obtained from other areas by special request (and at a special price!).

Occasional international circuits, both European and Intercontinental, should be ordered from the Post Office's (International) Programme Booking Centre (PBC). This unit's title (there is a PBC in every country) comes from the CCITT recommendation (E330) that deals in detail with all aspects of international programme circuit operations.

The charges for occasional international circuits which, unlike permanent circuits, are paid in full in the UK, are affected by exchange rate variations. Dealing first with European circuits and, once again, taking the Bruxelles/London route as our reference point we have **Table 3** illustrating the latest rates.

Intercontinental narrowband circuits (one-way or two-way) cost either £1.20 per min (charge code area 4) or £1.50 per min (charge code area 5). Wideband circuits, where available, cost double the above rates. In all cases there is a minimum booking period of 10 minutes. Stereo circuits from the USA (New York) cost approximately £750 per hour!

In all the above cases the rates given are those that are applicable to circuits originating in the 'gateway' city, ie the city in which the country's International Exchange(s) is situated. Extensions beyond the 'gateway' city may cost extra. ■

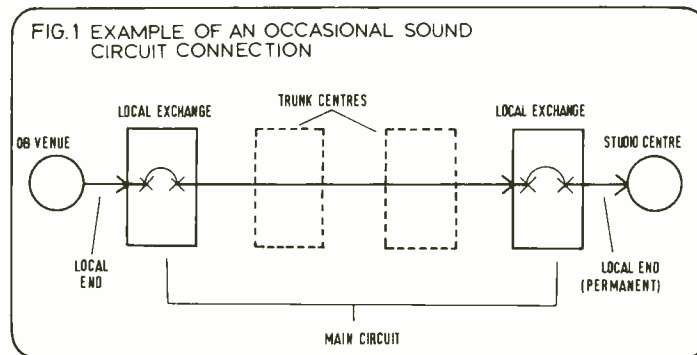


TABLE 1 Main Circuit Charges for Circuits in Excess of 7½ miles ('Trunk' Circuit Charges)

DISTANCE	MUSIC		CONTROLS	
	Minimum Charge	Additional Period Charge	Minimum Charge	Additional Period Charge
7½-10 miles	£2.25	£0.19	£1.81	£0.19
10-35 miles	£4.06	£1.00	£2.75	£0.69
35-50 miles	£6.81	£1.69	£4.50	£1.13
over 50 miles	£10.88	£2.75	£7.25	£1.81

TABLE 2 Connection Charges for Trunk Circuits

Distance	Music	Control
7½-10 miles	£3.75	£1.88
over 10 miles	£5.00	£3.75

TABLE 3 Occasional International Circuit Charges

2-wire control line (not used to carry programme material)	£0.11/min + fixed £7.52
4-wire circuit (used to carry programme)	£0.11/min + fixed £22.51
Mono music pair (10kHz)	£0.57/min + fixed £22.51
Stereo pair (2 x 15kHz)	£1.26/min + fixed £22.51

Acknowledgements

The Authors wish to thank colleagues who have helped in the preparation of this article and the Director of Engineering of the BBC for permission to publish it. Note: the tariff costs included in the text are simply a guide, and actual costs must be negotiated with the appropriate PTT (PO in Britain).

Louis Armstrong memories

A business lady in the recording industry told recently of her lovely memory of the late Louis Armstrong. By coincidence she and Louis shared the same New York dentist. Arriving one day to have her teeth fixed she saw Louis emerge from the surgery and walk down the hall. Unable to resist the temptation she said hello and Louis, always the perfect gentleman to ladies, stopped for a chat. They had music biz friends in common so the chat stretched out a while. But after around ten minutes she noticed that Louis was looking uncomfortable and standing with his legs in a curious crossed fashion. He'd only left the dentist's chair for an urgent pee and had been too polite to cut short his conversation with a stranger.

Carnival time

EMI may be down, but the company's certainly not out. Every winter, villages in the West Country co-operate to stage a massive street carnival procession of exotic floats that puts London's Lord Mayor's Show to shame. This year, in amongst elaborate mobile replicas of a paddle steamer, *Star Wars* and a Spanish bull fight, EMI Labs trundled past with a full-size recording studio. Despite torrential rain this was equipped with no less than three digital audio recorders as now being used at Abbey Road to record the likes of Andre Previn. At a conservative estimate, each is worth around £10,000.

Boom, boom

There were two main talking points at the audio and video exhibition held for the trade and press in Manchester early in 1980. First and foremost there was almost universal condemnation of WEA's decision to shut down the Enigma operation (or more accurately to sack the lynch pin Enigma staff). I doubt whether WEA has any conception of the all-round bad will generated by this move. Whatever the final outcome, and among many suggestions bandied around was an approach to the National Enterprise Board, I doubt that anyone in the trade who watched the Enigma label grow under its original founders will ever forgive Warner for the decisions they took in January 1980. Perhaps it is significant that WEA bought Enigma on April 1, 1978.

The second talking point was a recently released analogue pressing of a Soundstream digital recording of the *1812* by the Cincinnati Symphony Orchestra. The recording was made in three stages; orchestra first, then bells of the Carillon Tower in Mariemont, Ohio, and finally three 19th-Century cannons in the courtyard of Baldwin-Wallace College, Berea, Ohio. There are 16 cannon shots in the score and the loudest blew out the windows of the college English department. Stan Ricker transferred the digital tape to disc and the cannon shots (a 2-3kHz transient

followed by a 6Hz boom) are cut hotter than anything yet seen on a commercially released disc. Not surprisingly the disc is virtually unplayable. But predictably both manufacturers and owners of high-end hi-fi equipment are fascinated by the challenge. There is nothing the hi-fi fraternity likes more than an almost unplayable recording. Quadramail, of Huntingdon, are importing the disc in limited quantities and with tongue in cheek gave away ten copies to hi-fi firms exhibiting at the exhibition. From then on every one of the ten was claiming to have the only cartridge capable of tracking Ricker's cut and the whole exhibition site literally shook with the sound of cannon shots from all directions.

Some cartridges, for instance the JVC MCI moving coil and the Nagaoka MP-50, coped pretty well. Others simply took off vertically and tried to fly. Within a couple of hours Quadramail had sold all 75 available copies for nearly £10 each and were busy taking cash orders for future supplies. Perhaps this is a trend that could save the record industry? Instead of junking unplayable cuts, you simply advertise them as 'almost unplayable' and watch the money roll in.

Whoops

Unfortunate coincidence: Roger Scott, one of Capital's most professional DJs, was having a little moan over the air recently about the increase of postal service charges. (What service you might ask when I get a post, which isn't every day. It often flops through the door at crack of noon. And a recent press release from the Post Office arrived over a week late.) Anyway, back to Roger Scott on Capital. He'd worked out that the new British postal rates are equivalent to nearly half a crown of old, real, pre-decimal money. "I'd expect a ribbon round it for that price," he bewailed. Fine words, Roger, you tell 'em. But what a pity that just a few hours later LBC had to transmit an advert for the Post Office, over-voiced by the self-same Roger Scott, and cheerfully encouraging Londoners to 'get the most from your post'.

Swedish news

Chance led me to a band rehearsal at the Hamburger Bors night club in Stockholm on a minus 20°C night last winter. Inside, in the warm, the Leif Kronlunds band was rehearsing with Men, Woman and Song, a three boy, three girl vocal group of the type that goes down so well in Sweden. The Hamburger Bors, by the way, used to be a famous Stockholm nightclub. It was then demolished to make way for an underground railway station, but the station was actually built just round the corner. Presumably the construction engineers misread the plans and didn't find out their mistake until they had knocked down the nightclub. Anyway it's now been rebuilt with as much of the original decoration as survived the demolition and

after a few minor bugs had been ironed out, is now back in booming business.

One of the bugs involved the service lift which was installed to transport equipment from the basement depths up to the stage. Soon after opening night the entire 13-piece band piled into the lift a minute or so before curtain-up. Half-way up to the stage the lift jammed. Unfortunately the builders hadn't yet got round to installing an alarm button. While the 13 musicians worried about how long the oxygen in the overcrowded lift cabin would last them, the spotlight compere on stage was left announcing a band which was non-existent when the curtains opened. This is generally accepted to be the first time ever that a full 13-piece band disappeared without trace.

What struck me about the Bors was the exceptionally good stage sound. Between the rehearsal and evening show sound engineer Ola Sandborgh explained how he managed to get such a clean balance between the band and singers, with the latter able to move well up the front of the stage without any risk of feedback. It is very simple really, but rather expensive. The Bors boast two entirely separate sound systems, one for the band and one for the singers. At each side of the stage there are two separate stacks of JBLs, one for the singer, and one for the band music. The singers' stack is flown high and several feet in front of the music stack. The mixing desk has 16 channels, eight for voice and eight for music, and each speaker in the stack is separately driven by its own 300W power amp. By having the singer stacks well out ahead of the music stacks, the vocalists and voice acts are able to move well up front of the stage while still keeping their hand-held mics behind and outside the radiation pattern of their speakers. What's more, it's obviously easier to shift the balance between voice and music this way. Less obvious, and probably most important, there's also no chance of intermodulation distortion between voice and musical instruments, especially the bass. This two-system idea isn't a revolutionary new idea because touring bands, especially those working the Swedish folk parks, use a similar split system approach. And it's certainly not cheap. But the proof of the pudding is in the eating and it's an approach worth bearing in mind.

While in Sweden I wondered why several musicians, with tastefully furnished flats, keep a rather childlike painting on the inside of their front door. It shows a burglar carrying a sack of swag and carries a few cryptic phrases in Swedish. The notice is a 'thieves blessing'. Any musician who plays a charity gig at a prison in Sweden is given one of these signs to hang on their door and any burglar with a prison record who breaks into a house or apartment and finds a thieves blessing on the door says a silent thanks for past (and future) entertainment and moves off again without taking anything of value. ■



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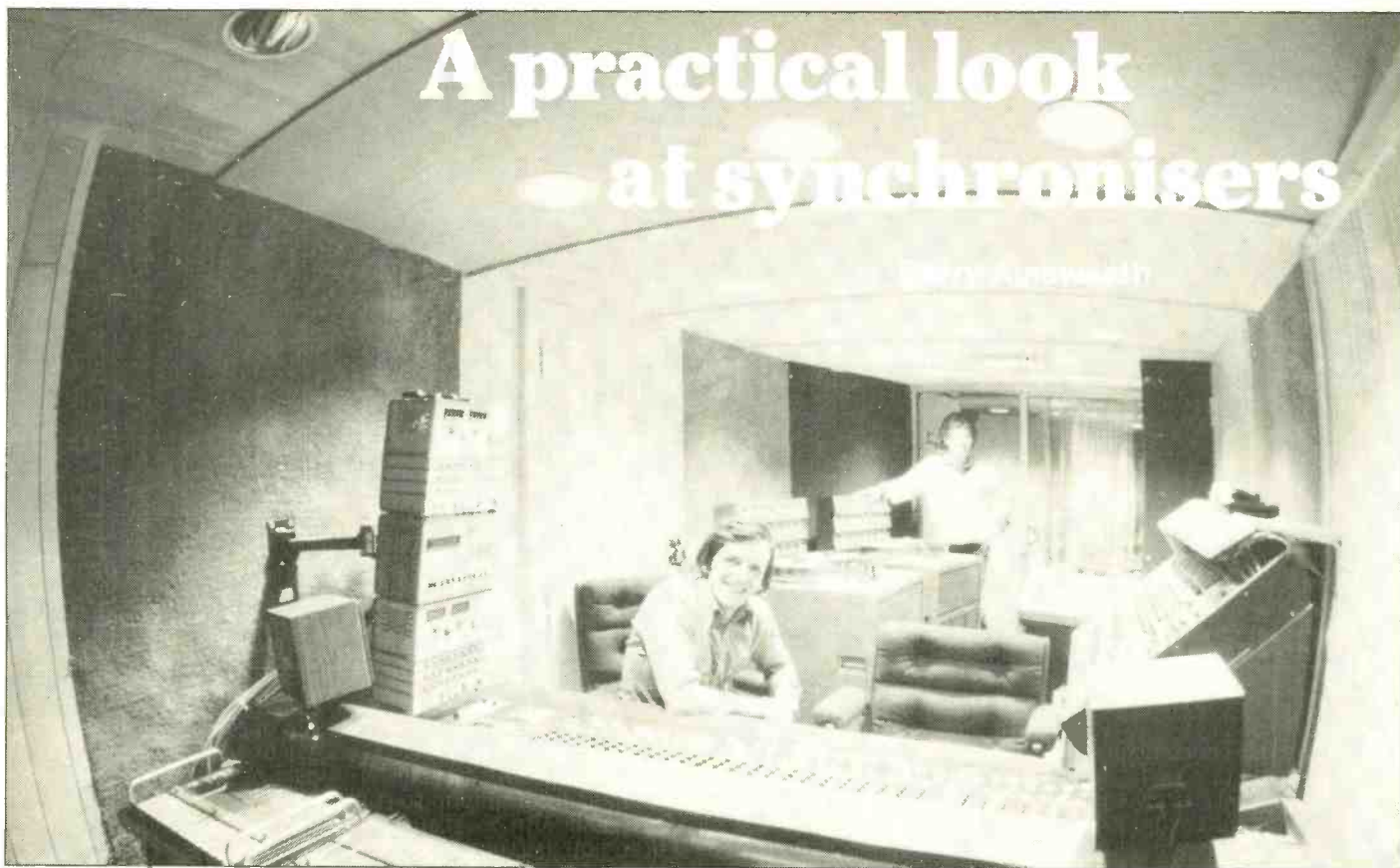
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A practical look at synchronisers



Barry Ainsworth seated at console in Mobile One with MCI Auto-Lock sandwiched between remote controllers.

WHAT IS A synchroniser? To the uninitiated it's a blackbox filled with micro circuits and buttons, digital readouts, and, with luck, managing to hold at least two tape recorders in synchronisation. Sometimes the system works and sometimes it doesn't. This can be caused by quite a variety of reasons, the most simple being the wrong information being supplied by the 'Black Box'. First check the tape recorder and examine just what has been recorded on the tracks where the meters appear to be reading 'tone'. With SMPTE timecode (which is short for The Society of Motion Picture and Television Engineers), this is easier said than done. There is quite a variety of information signals hidden in the noise, that sounds like a circular saw, including hours, minutes, seconds and frame pulses, while there are also other pieces of magic called user bits: Mmmmm!!! These are carriers that allow engineers to devise their own coding systems. Very useful for tape indents, record drop-ins, automatic play sequences, and any other useful information the engineer may like to keep handy.

The usual method of storing all this information is on tape, usually on one track of a multitrack or video recorder. The only problem here is that the code, being full of rapid pulses, can cause a certain amount of breakthrough across the next adjacent tracks. This can be avoided by either leaving the

March Studio Sound included a Synchroniser survey, which should have been complemented by this article, but which was delayed due to the author's absence from the country. While the survey examined the technical capabilities of the various synchronisers, this article looks at them from the human angle.

adjacent track empty or recording a signal on the next track that can beat the spikes of SMPTE timecode hands down, ie, very loud instruments, very 'toppy' instruments or if all else fails, sounds that don't need much level in the final mix. There are two other courses open to the engineer, either leave the adjacent track empty or use another type of code altogether—Maglink, but more about that later. It's also a good idea to record the code at least 5-10dB lower than any other track level. Most types of synchronisers will operate at -10 below 0VU. Watch out for this one, although most synchronisers happily accept low level, the actual code must be recorded without any degradation; otherwise the most surprising things happen, not the least, tape machines having a mind of their own. Copying timecode from one tape to another can also cause problems unless the code is 'regenerated' before re-recording.

Because of the degree of sophistication in the newer tape recorders their speed control has become far more accurate, therefore it could take some time before the machines,

thought to be locked together, start drifting apart. Most synchronisers can cope with this problem, either by throwing up random numbers as a warning or, with some units the slave machine turning itself off. This last effect can be quite funny with some video recorders. A critical stage has just been reached in the mixing process, the machines go out of sync, the video machine turns itself off, delaces the tape, and throws the cassette out like a piece of toast. What fun with a studio full of influential people. Not only is it necessary to rethread the tape, but with one type of synchroniser it loses all predetermined cues stored in its memory. How to win clients, and influence people...

Using synchronisers

There are many varied methods of using synchronisers, the most popular in music recording is to record all the backing on one tape, then transferring a rough mix of the basic backing track on to a second machine adding a code using a timecode generator, to both machines at the same time. The original tape of the backing track

can then be stored until the final mix. Both tapes are then played using a synchroniser, and you then have 46 tracks of recorded master. Up until now all that has happened is that the timecode has been recorded, we will presume, accurately, onto both tapes. Now the 'reader' part of the synchroniser takes over, and this is where the fun starts. In March Studio Sound there was a survey that included all the various types of synchroniser available, but it didn't state whether they were in use either here or in America, or in fact anywhere else people need to lock two or more tape recorders together. The market is growing larger all the time, so by the time you read this piece there may be many other makes of synchroniser in constant use throughout the world. But here it is only possible to discuss synchronisers currently in use here in England.

Synchronisers come in all shapes and sizes as well as differing degrees of complexity starting with simple units that will only lock one slave to one master machine, only allowing a sync condition to be attained providing the two machines are started at the same cue point. They then go up to the most complicated units that allow a greater number of slaves to run in conjunction with a timecode signal.

The face plate of these more complicated systems display a sometimes bewildering collection of buttons and digital readout displays. About the most important control is the 'lock' control which is the main function control. It reads timecode from the master machine, reads the signal from the slave machine, does a comparison and adjusts the speed of the slave machine to allow both machines to not only run at the same speed, but also exactly the same timecode point. An acid test of this function is to put a drum kit across both machines, bring the two outputs together in mono and listen for a phase shift, although in practice nobody in their right mind would split a drum kit in this manner. It's very easy for a manufacturer to confuse (although not intentionally) would-be purchasers by giving figures on the accuracy of their pride and joy when really all the engineer (who will be operating the equipment) wants to know is, will the difference between the two machines be noticeable. For a comparison try to put a drum kit across tracks one and 24 on ordinary multitrack. Even this could have exciting results.

Another important function of the basic timecode is that it will allow a predetermined point to be cued on either recorder using the timecode readout. Some machines have a keyboard which can be used as an artificial timecode display by simply dialling a number contained in the original timecode, and commanding the synchroniser to search and arrive at the same number on the prerecorded timecode. As soon as the machine starts to move, it tries to achieve a balance between the two codes, and 'abracadabra' up comes the exact cue point. There are two different ways in which synchronisers find this predetermined point: 1) The tape momentarily starts moving in a play mode allowing the actual code to be entered in the synchroniser. If the new figure is less than the selected point, the tape moves forward, if the number is higher, back goes the tape. Even to achieve this function there are two different methods adopted by the manufacturers. One way is to use another bit of engineering wizardry called a wideband amplifier. This sounds complicated but all that is involved is an amplifier that will react to a greatly extended frequency response as the timecode is replayed in either a fast forward or rewind mode. This can mean that the actual frequencies being reproduced by the amplifier are in the MHz bandwidth range. What this does to the wear on the actual replay head can be imagined. The companies supplying this type of equipment suggest that the tape

does not actually touch the head and therefore wear is negligible. I think that takes some believing but at this stage in the development of timecode units, there just hasn't been enough time to completely evaluate the comparative wear in the tape heads, against a tape machine that has never been used in conjunction with a wideband amplifier system.

2) The second way is to use a tachograph system. This operates in the same way, but as soon as the tape starts to move faster than the basic tape speed the tape is lifted away from the head and a count roller takes over, supplying pulses to the synchroniser until the predetermined point is almost reached, the tape slows down, and comes in contact with the head for the last few feet, or seconds, before the final cue point. This system, although kinder to the recorder heads, probably takes slightly longer to achieve a sync mode.

I have checked between the different systems, and there is no unusually large differences. Both types of search systems take about the same time. From an engineering point of view, sound screaming over a playback head is more nerve racking than a nice quiet tacho slowly getting itself together. Of course I will be taken to pieces by the manufacturers of the first system who will not be slow to point out that their machine switches off the audio, but I'm not sure that I could afford to buy new recorder heads, worn flat by tape travelling at high speeds and in direct contact, before I have to, in comparison with the more sedate tacho system. Another drawback with this system is that the wideband amplifiers are usually allocated to specific tracks on the recorder, and Murphy's law says that the tracks involved are used, or are going to be used, for something else. Then what do you do? Answers on the back of a £5 note please.

At this stage we will presume that the tape has got itself into a lock position. The display is showing a timecode readout, and everything is going fine. The next control is offset. This allows a slave machine to be adjusted in time, against the master tape, either moving the slave programme forward or backwards in relation to

the master programme. This is useful in audio when maybe there is recorded information not quite in time with the original master, ie guitars or voices. In video work it may be necessary to move an audio track backwards and forwards against the picture—usually sound effects are more believable if they come just at the point of a visual effect instead of slightly later . . .

There is nothing more annoying than seeing an obviously out of sync vocal in a music show when, with a little care, the audio track could be moved in relation to the picture. All that would be involved is an engineer experimenting with the offset control which usually allows a minimum change, within a video to audio system, of one frame. This can be equated to an audio only system where four frames is approximately the distance in time between the record and play heads on most machines. Therefore the accuracy of the system is, in engineering terms, between $\frac{1}{4}$ and $\frac{1}{2}$ in, as a minimum offset difference between the master and slave. It is also possible on some of the units to read this difference on the main readout display—this is useful if, at some later stage, the same effect has to be reproduced during mixing. Other controls look after the automatic record, replay and cycle functions.

Timecode

As I explained earlier, timecode is a series of numbers recorded in digital form onto the original audio multitrack tape which means that once recorded it always reads the same number at the same point on the recording, no matter what happens to the audio or video information on the master or slave track. Therefore by putting information into the synchroniser at predetermined places, the actual control of all functions of the recorder could be taken over by the machine. If, for instance, it was necessary for a tape to keep recycling to allow the artist to learn a passage, then the information could be logged in the synchroniser to play from a predetermined point, drop into record, move on in record, drop out of record, stop and rewind to the original start point then repeat the

cycle again without any help from the engineer. Of course there are a few autolocator units that do this, but the accuracy may not be quite the same as a timecode reader that is relying on signals recorded on the tape, rather than the pressure of tape against a tacho roller as on an ordinary autolocate unit. The question to ask at this point is, would you rely on a system to keep repeating itself for a period of time on a valuable recording, when tape slip can happen after each pass? I think not. Therefore to perform this operation successfully, using timecode is the only way.

Although time code has been used for quite some time, the eventual possibilities have still to be fully realised. Within the timecode are some spare sections of code that at this stage have no immediate use. This part of the code can be used to carry other information that the engineer would find useful, ie take numbers, programme indents, and any other relevant information regarding the recorded programme. This control is usually called 'user bits'. It means just what it says. The user can input any information onto the timecode, providing it is coded using a numerical system. Eventually it may even be possible to control a complete recording console by the information stored in a synchroniser timecode.

There are other controls on most synchronisers; these include SMPTE/EBU which accommodates the difference between the American and European systems by controlling the number of frames per second—different in video systems around the world being either 25 or 30. Drop frame is also a video orientated control, allowing the synchroniser to occasionally lose a frame for precise timing on American video formats. The final control that rounds off this section is the 'external crystal', 'external sync', or just 'external'. This gives the facility to allow an external sync code to be processed by the reader, and therefore control the recorders.

Education, not experimentation

After talking to engineers, and examining the various types of synchroniser, I have come to the conclusion that, as I said earlier, there is a great deal of experimentation, both from the manufacturer and the operator, to be done before the complete system is fully understood, and used to its full advantage. Since I started to put this article together I have found, which caused some surprise, there is quite a difference of opinion between the engineers using the



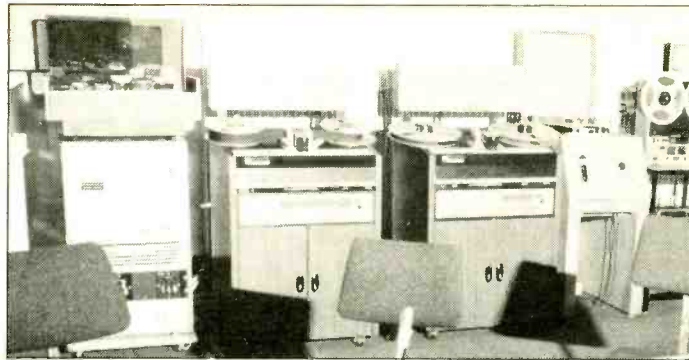
synchronisers

equipment, the engineers designing it and the electronics engineers installing and maintaining the units. Everybody thinks that their system is the best and most trouble free, and that they have thought of a function that will improve on the other systems. This I have found is not really the right approach. The most important point is to educate the person actually using the synchronisers — a recording engineer with a room full of clients does not want any problems that could be caused by either ignorance on the part of the recording engineer, or a fault developing within the synchroniser that only an engineer with the mind of a computer can fix. Because the systems are so new, there has to be a lot of experimentation done. Also the equipment has to be made to look as simple as possible so that the recording engineer starts at an advantage by quickly being able to at least understand all the relevant functions within a matter of a couple of hours. Here was the largest difference in approach between the systems. One engineer told me he still didn't understand all the options open to him six months after starting to use a timecode system. I realise that there is a great deal of new technology to be understood by recording engineers, but when it comes to the final analogy, an engineer must have confidence in his equipment before he is really happy about operating it on a day to day basis.

On reading the instruction details that come with the units there is a lot of confusion, and sometimes conflicting information written. It's as though the books were written as the development progressed and the manufacturers omitted to completely revise the instructions at each development stage. Therefore I would say to the manufacturers, rewrite your instructions in an English that is understood by the people using the equipment *not* in installation engineers' English. The recording engineer doesn't need to know about accuracy in mili micro seconds, he needs to know that he can instantly lock his machines together and complete a session without any hangups.

Selecting a synchroniser

When choosing a synchroniser it is important to choose the unit that will perform all the functions likely to be encountered within the studio facility. Within an ordinary audio recording facility all that is usually needed is a lockup between two machines, master and slave—the accuracy needs to be very good so



Maglink synchroniser in use at BBC Cardiff

that phase shift, even though it only affects 'spill over', does not cause a problem. In video work, sound is usually regarded as the poor relation, and, judging by the poor sound, the sync quality on some programmes, providing the picture and audio are more or less in sync, that is really good enough to some programme directors. The essential parameter here is the lock up of more than two machines. It is not unusual for at least four machines to be held in sync. Some of the synchronisers will hold this number of recorders together at very little extra cost, whilst others need extra reader units for more than one master/slave unit, and a merchant bank to finance it. Under some situations, it is essential to be able to very quickly change from one type of recorder to another, usually in video studios, where one minute a multitrack recorder needs to be locked to a video machine, the next a ¼in machine needs to be locked to a video cassette machine. There are few synchronisers that will allow this facility at all, and the ones that do require a grade one electronics engineer to rearrange the interface. What is required here is instant plug-in cards that can be preset to any machine, and therefore almost instant change round, with the minimum of electronic knowledge by the recording engineer. There is a surprising lack of interface units from machine to machine. Most manufacturers say: 'Oh it's coming,' and 12 months later it's still impossible to lock a machine to any machine. Therefore tapes have to be copied onto a working system or maintaining sync becomes even more time consuming using a very steady hand on a varispeed control connected to an audio recorder. Basically all synchronisers rely on the fact that the capstan motor is frequency controlled, and lock is effected by adjusting the frequency, and therefore speed of the capstan. All other functions are much more difficult to achieve, but at least this could be a good start since most audio tape recorders have an input for an external varispeed control. This would allow the purchaser to decide on the degree of sophistication requi-



Audio Kinetics Q-Lock at Record One in LA

red, machine to machine. There are times when only the facility of keeping the machines in sync is required, not auto record, roll back etc. For once let the customer decide on the price he wants to pay, not the manufacturer. The systems are still in their infancy, therefore there is still room for customer liaison in the manufacturing stages.

Regarding the cost of the units, I find it interesting that there can be such a wide fluctuation in price between the different manufacturers, for taking into account that there is an enormous difference in complexity between the units, the actual working accuracy as described by recording engineers is not that different. Prices vary from £2,500 up to £12,000, also some of the units are read only, therefore a timecode generator also has to be purchased adding more capital to the final cost—there are few studios that would need read only facilities. Whilst I am not saying that to have a separate timecode generator is wrong, it would be better to have a generator included within the electronics of the reader unit as a standard.

Overall it would appear that you always get what you pay for, the degree of sophistication is the deciding price factor. There are a number of facilities which, it could be argued, were not essential for the everyday operation under studio conditions. What would be an idea would be a generator/reader made up of different building blocks (circuits) that could be purchased individually and thus allow the

studios to decide on the degree of sophistication required.

Reliability

The next section to cover is reliability. One point that has come to light is the complexity of the system's 'faults' that appear, which may in fact not be faults at all but misuse of the equipment. In most cases the amount of level required on the tape is not critical, allowing $\pm 5\text{dB}$, but the quality of the timecode has to be accurate. If there is some inaccuracy in the information, this may show up as random numbers, or just not process at all. This is a case in point for having separate write/read equipment, at least the timecode can be monitored as it is laid down. Another technical problem is caused by 'spikes' in the main voltage supplied to the unit. This can also cause random numbers, as well as something much more exciting—machines starting on their own, and if a complicated programme has been set up, a 'memory lapse', much more exciting than just going back to the top of the title and playing again! To repair this fault could mean having to start again compiling drop-ins, starts, and roll backs. The general consensus of opinion is this is the most serious problem in any unit. The degree of serviceability is also another problem. Most units being 'state of the art' technology require specialised attention that is just not possible within the usual studio framework, therefore most engineers are reluctant to start servicing

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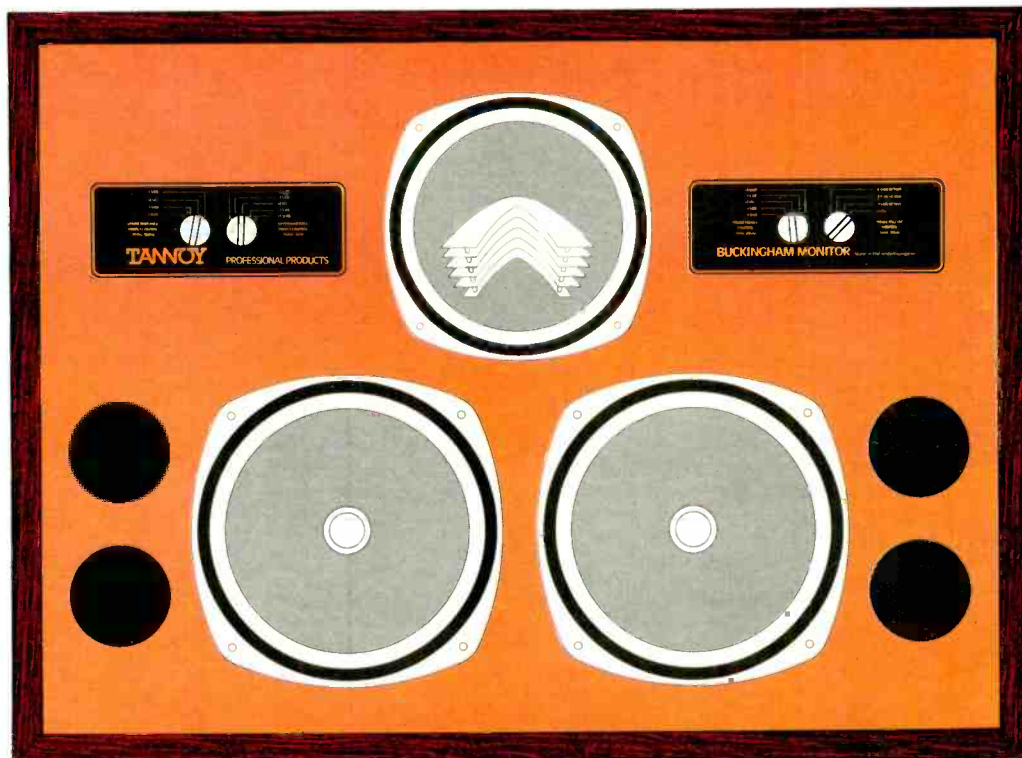
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synchronisers

procedures. If there is an engineer that thinks he can fix it, the service information is usually different from the actual units. This is the same problem as the instruction manual, the equipment is developed and the service notes are increased as each section is improved. How exciting to find, when the machine is opened, the cards bear no resemblance to the circuit diagrams. This usually happens at night, when the last people still at work are the studio engineers and not the equipment suppliers, and their 'instant help' department.

It would also appear that all manufacturers are unsatisfied with their latest product. The number of times I have been told: 'There are new proms, roms, read units, and all other manner of new and useful circuits (that means expensive, be warned) coming on the market next month'. The only way the equipment can be improved is by changing circuits, but as an engineer in a normal studio, when did you last have a completed update circuit diagram from the manufacturer without asking for one. It would take a crystal ball to be able to find the right circuit information on some of the units available. This does not only apply

to sync units, but to most of the equipment sold to recording studios. I would like to think that the people I have spoken to are the only ones affected by this problem, but it appears to be so common I think this problem must be general.

If I were doing a report such as best buy etc, I would at this stage name units and their different facilities, as well as their problems. At this time there are many units on the market, some are in use in England, some are not. Most are advertised as being available here. This is also possible. But for this report I went to the manufacturers and asked for a list of studios using their equipment. I then went to the individual studios and talked to at least two sound engineers, the people who actually use the equipment, and started to write. Overall the opinion of the units 'tested' were that all performed well, most were reliable (the problem unit here cleared up after a few months, and is now quite satisfactory), the manufacturers were helpful, and surprise, surprise, there were no serious grumbles.

The main criticism is the instruction manual; therefore, if, as an engineer, you are trying to understand a synchroniser manual, and having trouble, You Are Not Alone. All the manufacturers have

confidence in their equipment, which, after talking to the actual people using the equipment, I can confirm is as it should be, and I am indebted to Adams Smith, Audio Kinetics, BTX, EECO, MCI and Studer for their help in the preparation of this article on SMPTE timecode synchronisers.

Maglink

There is one other type of synchroniser in common use and that is Maglink. This system is completely different from the others, using an audio signal recorded on tape as the code information. The advantage of this system is the lack of crosstalk between code tracks and other information channels. When this system was first marketed it was the only one readily available, therefore there are a large number of units in the studio systems and most of them are at the BBC in this country. The problem is that the code is very different from SMPTE and therefore the tapes produced on this system can only be worked on in a Maglink studio. There is a SMPTE timecode to Maglink converter, but there is no Maglink to SMPTE, making the system less universal than the standard SMPTE systems. During the research for this article, the questions asked were the same for Maglink as SMPTE and the

answers came out about the same, so it would serve no purpose in listing the good points as well as the problems, which have already been covered earlier.

Conclusions

The most important thing to remember when using a synchroniser system is that it is a tool, and a very sophisticated one, that is there to help and not to confuse the engineer. Confusion comes when the systems are not explained properly, or when the engineer tries to operate the systems about three minutes after seeing the unit for the first time. These days freelance engineering is becoming more usual, therefore it is essential that all types of equipment, not only synchronisers, are easy to operate. I have yet to find an engineer that has problems operating an ordinary tape recorder; one reason is that tape machines have a common language describing their controls (stop, rewind, play, sel sync), for example. One day synchronisers may have the same language. This language is there now, all that is necessary is for the engineer to look, listen and pray he's got the right button, and everything will work, as if by magic.

Don't think you're sunk until you've tried to sync. It's a lot more complicated than it looks. ■

Studio Quality Conductive Plastic Faders

CGS announce the availability of a range of linear faders utilising long life, low noise conductive plastic elements.

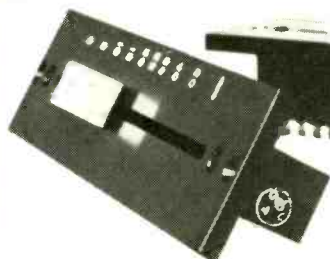
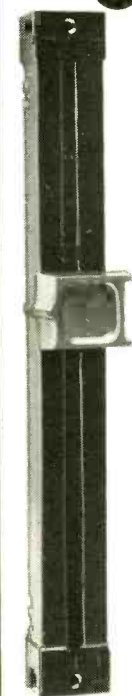
300 Series is metal housed offered in a choice of 3 track lengths of 66, 104 and 116mm either mono or stereo with electrical connections by plug and socket. Cue switches, escutcheons and knobs and special resistance laws with taps are available to choice.

400 Series is plastic cased and available with mono, stereo or independent dual tracks of lengths 70 or 108mm. Connections are by gold plated solder tags and escutcheons, knobs and cue switches are available to choice.

Certain styles are available from stock.

The infinite resolution conductive plastic elements have an established life of 50 million operations. Resistance values range from 600 to 100K ohms with a standard linearity (linear law) of $\pm 2\%$ or $\pm 4\text{dB}$ max (log law). Stereo matching is within 2%. Power ratings are up to 4 watts (lin law) and 0.4 watts (log laws).

Please contact us for further information

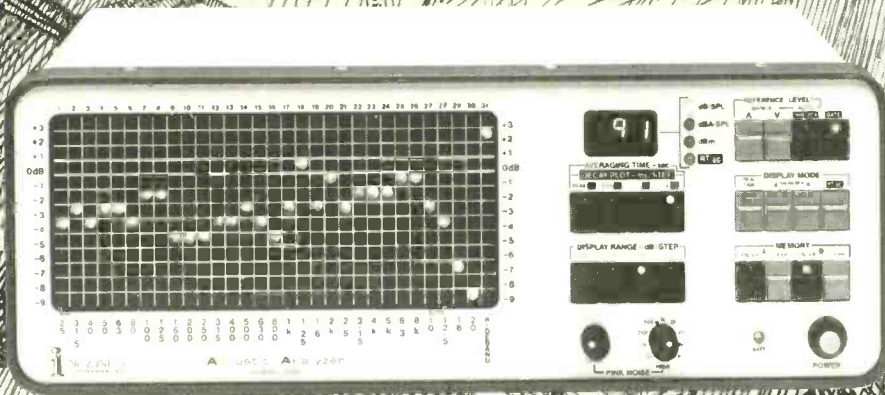


CGS

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Marsh Lane Lymington Hants SO4 9YQ
Tel: 0590 75255
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Inovonics Model 500 Acoustic Analyzer

Here's everything you need for one-third-octave sound-level and reverberation-time analysis in one easy-to-use package... Inovonics' Model 500 Acoustic Analyzer.

In the real-time mode, Model 500 shows you wideband or weighted SPL readings in each one-third-octave band from 25 Hz to 20 kHz. You set the reference level you

want, or Model 500 will seek the proper level automatically over a 100 dB range in 1 dB steps. The built-in pink-noise generator supplies you with wideband or octave-band test signals.

Then, touch a button for the RT₆₀ mode. The digital display shows reverberation time up to 10 seconds with 10 ms resolution, while the LED matrix plots the decay characteristic.

Rear-panel connectors provide an external oscilloscope output, an auxiliary test signal input, and digital I/O interface. The Inovonics 500 is ready for peripherals.

This rugged, lightweight, precision instrument goes wherever you go. From the freeway interchange to the auditorium, concert hall,

and laboratory. The Model 500 is completely self-contained, and comes to you with an internally charged battery.

For accurate, dependable level response and reverberation analysis, the sound choice is Inovonics' Model 500 Acoustic Analyzer. It's part of every sound design. Call or write us today for all the details. Model 500 - \$2750.

Inovonics Inc.
503-B Vandell Way
Campbell, CA 95008
Telephone
(408) 374-8300

U.K. Distributors



Feldon Audio Limited

126 Great Portland Street, London W1. Telephone: 01-580 4314. Telex: London 28668

Exclusive export distribution through
Gotham Export Corporation
New York
Telephone (212) 741-7411
Telex 12-9269

Introducing a present



Once you go through a recording session with the new ATR-124 24-channel recorder by Ampex, you'll want to go through another. Because with each new session you'll discover something new you can do. Things that you can only do with a recorder that's full of features of the future.

ATR-124 gives you the unheard of: Time on your hands.

Which means you can use that time to give clients more of what they're paying for—your creative skills. With the ATR-124 microprocessor-based control system, you can pre-program what you want to do ahead of time so you won't waste studio time setting things up. When their time starts, you're ready to record by touching a single recall button.

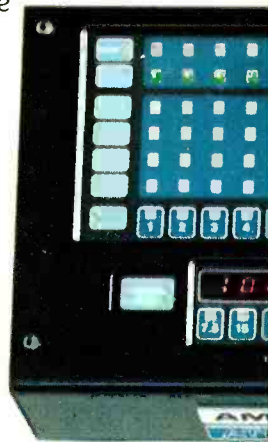
ATR-124 also lets you duplicate a technique you may have used earlier in the session without

having to rethink what you did. Just touch the memory button and it'll all come back to you. ATR-124 lets you rehearse what you've got in mind, without recording it, to make sure what you've got in mind is right. Tape can be manipulated faster which means you'll get the sound you want sooner. And the chance to try something "a little different." All because of the speed and accuracy that ATR-124 puts at your fingertips.

ATR-124 doesn't take away your creativity, it adds to it.

The less time spent setting up, correcting, and redoing, the more time spent creating. And when you add features that help you create to the ones that help you save time, you've got one very potent piece of audio machinery. Take the control panel for instance. It's like nothing you've ever seen. Pushpads linked to a microprocessor give you a new level of creative flexibility. Program a setup, then change it. Then change it back, all with a single fingertip.

A repeatable, variable speed oscillator for pitch correction and special effects is built in. In addition



from the future: ATR-124.

to the standard output, there is an optional auxiliary output with each channel that enhances flexibility. So don't think that ATR-124 is going to

Memory, and Record Mode diagnostics. The point is this: If you like the ATR-100, you're going to love working with the ATR-124.



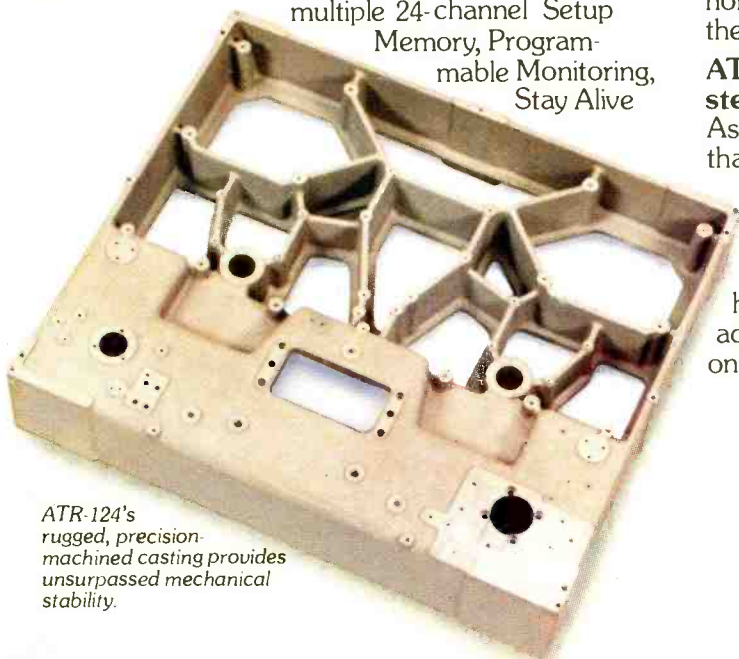
ATR-124's Control Panel. Speed and accuracy at your fingertips.

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

ATR-124 picks up where ATR-100 leaves off.

It's only natural that the people who brought you the ATR-100 should be the ones to bring you something better. ATR-124 offers you 24 channels instead of 4. You also get many new and exclusive features. The kind that have set Ampex apart from the crowd for the last 30 years. Features like balanced, transformerless inputs and outputs; a patented flux gate record head; 16" reel capability; input and output signal bus for setup alignment; membrane switch setup panel; fingertip-operated shuttle speed control; and microprocessor-based synthesized Varispeed -50% to +200% in .1% steps or in 1/4 tone steps. ATR-124 also features microprocessor-based control of Channel Grouping, multiple 24-channel Setup

Memory, Programmable Monitoring, Stay Alive



ATR-124's rugged, precision-machined casting provides unsurpassed mechanical stability.

ATR-124 options.

As impressive as the ATR-124 itself.

With the addition of a built-in Multi-Point Search-To-Cue (MPSTC), you can rehearse edits and control five tape-time actuated events and be compatible with SMPTE time code. Separately controlled auxiliary output amplifiers with each channel provide simultaneous monitoring of normal and sync playback as well as all other monitoring modes. A roll-around remote control unit can also be added to the ATR-124 which contains all control features normally found on the main unit.



ATR-124's Multi-Point Search-To-Cue (MPSTC). Provides 100 cue locations.

ATR-124. Your next step is to experience it firsthand.

As you scan the points we've covered, remember that you're scanning just a small portion of ATR-124's story. We haven't even begun to discuss the accessibility of key components for easy servicing and minimal downtime, or the features we've built in to give you greatly improved tape handling. To find out more, write to us at the address shown below. We'll send you a brochure on ATR-124, our latest audio effort.

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Survey: VCAs, faders and panpots

This survey contains both mechanical slider faders, and their equivalent voltage controlled amplifiers (or attenuators) but does not include low cost carbon track faders with short travel.

Since most of these products are generally purchased in quantity, there are invariably quantity discounts so pricing will generally be variable.

ALLISON (USA)

Allison Research Inc, 2817 Erica Place, Nashville, Tenn 37204, USA.

Phone: (615) 385-1760.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

Phone: 01-734 2812. Telex: 27939

EGC-101

Type: electronic gain control cell for OEM applications. Requires a minimum of external circuitry for precision VCA applications.

Gain control range: -100dB to +50dB.

Noise: (with 5534 op-amp) 0dB gain -88dBV, +20dB gain -80dBV, -20dB gain -99dBV.

Distortion: any control voltage within normal operating conditions, SMPTE, IMD or 1kHz THD, 0dBV output level 0.0025%, -20dBV output 0.0025%, +20dBV 0.009%.

Package: 8-pin miniature which plugs into standard 18-pin DIP socket.

Price: £12.

EGC-202

Type: voltage controlled amplifier using the EGC-101 electronic gain control element designed to replace the dbx 202 VCA, physically identical, minor electrical change required to interface circuitry.

Gain control range: -100dB to +50dB.

Noise: W/R in=Rout=12.5K -87dBV 20-20kHz.

Distortion: THD 0.005%, IMD 0.015%.

Modulation noise: increases 3dB with application of 1mA signal.

Price: £26.

EGC-205M

Type: voltage controlled amplifier using EGC-101 electronic gain control element, direct physical and electrical replacement for the Allison VCA-5M.

Gain control range: +50dB to -125dB with 13kΩ input resistor.

Noise: output noise at max attenuation -110dBV, unity gain -87dBV, +20dB gain -78dBV, 20-20kHz.

Modulation noise: -100dB.

Distortion: 1kHz THD 0.008%, 10kHz 0.015%, SMPTE IMD 0.015%.

Price: £29.

EGC-2500

Type: voltage controlled amplifier which is a direct physical and electrical replacement for the factory VCA module installed in MCI 500 Series consoles.

Noise: output noise -102dBV normal fader setting, -110dBV full attenuation, 20-20kHz.

Distortion: 1kHz THD 0.005%, SMPTE IMD 0.015%.

Price: £40.

FADEX

Type: programmable fader system designed to be fitted in new or existing consoles, which forms a direct interface to the Allison 65K automation prog-

rammer. Available in mechanical form to replace conductive plastic faders in USA and European formats. In addition to programmable level, FADEX offers up to nine VCA subgroups, channel mutes and solos, group mutes and solos, VCA grand master, precision nulling indicators, mute sensing LED and relay drive, 145dB gain control range. Employs Penny & Giles linear conductive plastic faders and Allison EGC-205M VCA. The FADEX system includes a module for each channel, one VCA grand master and stereo master, one master logic card, power supply, console interconnection package, and one 65K programmer.

Price: about £8,500 for 24-channel system with two masters.

AUDIOFAD (UK)

Audiofad, Unit 14, 31 Poole Road, Wimborne, Dorset BH21 1QB.

Phone: 0202 886322/511883.

Model 1040P

Type: conductive plastic linear motion faders, mono or stereo, front panel mounting, optional aluminium fascia with matt white characters from 0 to 40dB in 5dB steps, 50dB and infinity.

Resistances: standard 5kΩ, option 10kΩ, linear or log (standard grade ±1dB 0 to 20dB, premium grade ±0.5dB).

Maximum attenuation: 90dB.

Effective travel: 104mm.

Stereo: stereo tracks available with 1dB matching error.

Switching: optional microswitch at infinity end of travel.

Knob: 16mm white supplied, options 16mm red and black, 11mm white, black and red.

Dimensions: without fascia 135 x 18 x 36 (mono)/48mm (stereo) high.

Prices: around £13 to £14 for 10 off.

B & B AUDIO (USA)

Aphex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046, USA.

Phone: (213) 655-1411. Telex: 910-321 5762.

UK: Aphex Audio Systems UK Ltd, 35 Britannia Row, London N1 8QH.

Phone: 01-359 0955. Telex: 268279.

1537A

Type: voltage controlled attenuator in 14-pin DIP package requiring several external IC op-amps and other components for full operation. Claimed to operate as a true class A device to eliminate crossover distortion.

Distortion: THD 0.004% (+10dBm input, 10dB atten) 20-20kHz, IMD (SMPTE) 0.03% (+14dBm input, 10dB atten).

Noise: -90dBV ±1dB worst case, unity gain.

Modulation noise: 6.5dB.

Maximum attenuation: 94dB, 15dB gain available only to order.

Dc shift v attenuation: 5mV fader grade, 2mV select grade.

Price: fader grade 100 off £5.30, select grade 100 off £8.

VCA505

Type: universal VCA card using 1537A IC, but requiring no external circuitry, all op-amps on sockets so they may be easily replaced when better ICs become available. PC mounted with 15-pin card edge mount. Will retrofit many Allison VCAs if gain is not required.

Distortion: THD 0.01%, IMD 0.03%.

Noise: -90dBm.

Max attenuation: 100dB.

Dc shift v attenuation: 5mV.

Price: £47.

VCA500A

Type: retrofit card for the MCI 500 Series console providing VCA facilities.

Price: £47.

2521

Type: operational module 'the unpotted one', high speed, high output, short circuit proof buffer amplifier module. Provides 1W (+30dBm) into 62Ω, 50Ω driver version available to order.

Price: £19.

DANNER (West Germany)

Konstantin Danner, Zienstrasse 28, D-1000 Berlin 62, West Germany.

Phone: 0311 781-1822.

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

Phone: 01-953 0091. Telex: 27502.

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

Phone: (212) 741-7411. Telex: 129269.

Danner manufactures a wide range of high quality (and very expensive) linear motion faders. Further details upon application.

dbx (USA)

dbx Inc, 71 Chapel Street, Newton, Mass 02195, USA.

Phone: (617) 964-3210. Telex: 922522.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

Phone: 01-734 2812. Telex: 27939.

2001

Type: all-discrete VCA module with same physical dimensions and connections as the 202, a current in/current out device which needs a minimum of external components.

Gain control range: -100 to +60dB.

THD: 100ppm, typically 30ppm (parts per million).

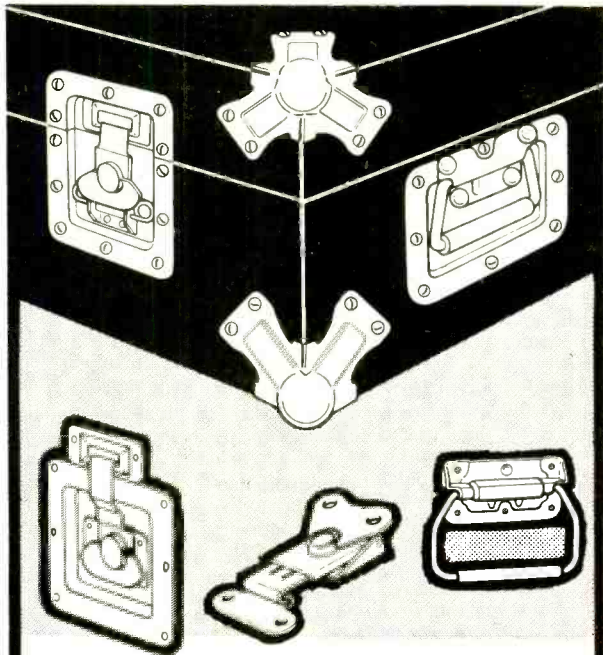
IM distortion: 100ppm.

Output noise: unity gain -87dBV 20-20kHz.

Frequency response: dc to 50kHz ±0.02%.

Control voltage feedthrough: 10mV.

Price: £26.



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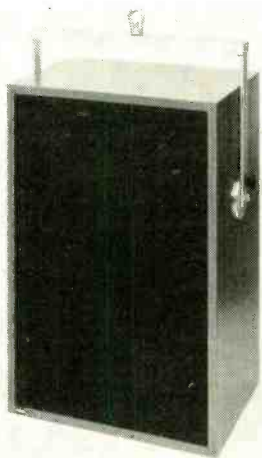
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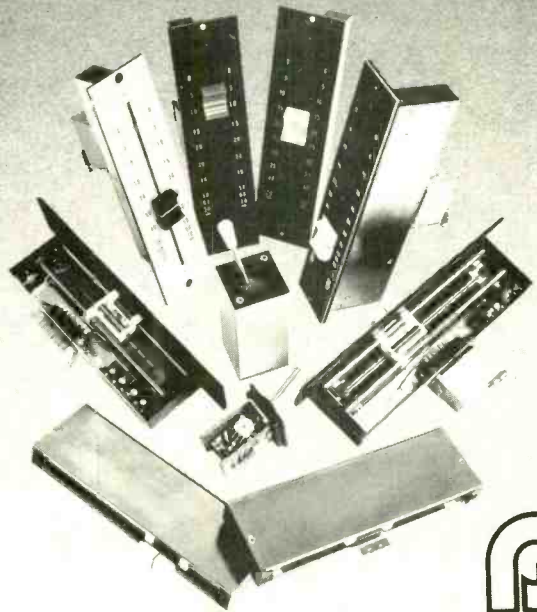
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Penny & Giles Conductive Plastics Ltd

Newbridge Road Industrial Estate
Pontllanfraith Blackwood Gwent
South Wales NP2 2YD UK
Telephone: Blackwood (0495) 223771 Telex: 498135

Survey

202

Type: voltage controlled amplifier with pin connections in an encapsulated package. Requires minimum of external components.

Gain control range: -100 to +40dB.

Distortion: 2nd harmonic 0.03%, 3rd 0.04%.

Input E noise: 2uV rms.

Frequency response: to 20kHz ± 0.3 dB.

Price: £26.

DUNCAN/CGS (USA)

Duncan Electronics, 2865 Fairview Road, Costa Mesa, Cal 92626, USA.

Phone: (714) 545-8261. Telex: 910-595 1128.

UK: The CGS Resistance Co Ltd, Marsh Lane, Gosport Street, Lymington, Hants SO4 9YQ.

Phone: 0590 75255. Telex: 47691.

Note: both Duncan and CGS are subsidiaries of Thorn Electrical Industries, a British company.

Metric series M400 Slideline

Type: conductive plastic linear motion faders, mono or stereo (and two wipers on a single track), injection moulded plastic construction, solder tag or pin connections, optional fascias calibrated 0 to 50dB in 5dB steps, 60dB and infinity, or 0 to 100 in 10 unit steps.

Resistances: linear 1k Ω to 250k Ω (optional centre tap) log 600 Ω to 25k Ω and balance with opposite log tracks 1k Ω to 25k Ω .

Maximum attenuation: 90dB.

Effective travel: two versions, 70mm or 108mm.

Stereo: ganged tracks in same package as mono.

Switching: optional twin microswitches at infinity end of travel.

Knobs: available as round, low profile, square or pointer, in white, black, red, blue, yellow and green.

Dimensions: 70mm travel version 108mm x 10mm x 20mm high, 108mm travel version is 152mm long.

Prices: \$13.30 to \$36.25 basic faders, switches fascias and knobs extra.

Series 300 Slideline

Type: conductive plastic linear motion faders, mono or stereo, or four, metal construction, PC male connector, optional fascias as for M400. Resistances: linear 1k Ω to 100k Ω , log 600 Ω to 10k Ω .

Maximum attenuation: 100dB.

Effective travel: two versions 117mm or 104mm.

Stereo: two or four ganged tracks.

Switching: optional single or twin microswitches at infinity end of travel.

Knobs: as for M400 series.

Dimensions: 160mm x 21mm x 57mm high.

Prices: mono \$62, stereo \$103, quad \$290, for basic faders, switches, fascias and knobs extra.

PENNY & GILES (UK)

Penny & Giles Conductive Plastics Ltd, Newbridge Road Industrial Estate, Pontllanfraith, Blackwood, Gwent NP2 2YD.

Phone: 0495 223771. Telex: 498135.

USA: Penny & Giles Conductive Plastics, 1640 Fifth Street, Santa Monica, Cal 90401, USA.

Phone: (213) 393-0014. Telex: 652337.

1500 series

Type: conductive plastic linear motion faders, available in mono, stereo, four or eight gangs, metal construction, 15-way socket connector (mating connector supplied) range of four top plates and fascias of different sizes, or rear mounting top plate (no fascia). Fascia calibrated 0 to 70dB and infinity.

Availability: unbal linear 1, 2, or 4 channels, unbal log fader audio taper 1, 2, 4 or 8 (to order) channels (includes infinity gap), unbal ladder fader 1, 2 or 4 channels, balanced ladder fader 1 or 2 channels, balanced fader audio taper 1 or 2 channels. Also special laws for VCAs.

Resistances: linear 1k Ω or 10k Ω , log 600 Ω , 5k Ω or 10k Ω .

Maximum attenuation: varies with models, 105dB generally, 90dB for some 2 and 4 channel models.

Effective travel: 104mm.

Switching: three choices of switches, aux equipment (operates within 4mm of infinity marking), infinity cut-off (shorts the wiper to common within 4mm of infinity marking), overpress (when knob is pushed back against an internal spring beyond the infinity marking).

Knobs: available standard as white or black, options for red, blue, green and yellow, 16mm or 11mm wide. Also ganging bar to link two adjoining faders.

Dimensions: fascias/top plates 174 x 45, 178 x 38, 190 x 40, 174 x 19 and 148 x 19mm (back mounting), 46mm high.

Prices: about £35 to £50.

1100 series

Type: conductive plastic linear motion faders, available in mono or stereo. Similar to the 1500 series but 'cost effective' with a more limited accuracy specification and without some of the features of the 1500 series. Normally back mounted, but optional fascias, dimensions being identical to the 1500 series. Only available in linear unbal and unbal log fader audio taper, infinity cut-off switch, flying leads (no connector), 85dB attenuation.

Prices: £15 to £25.

Digital fader

Type: conductive plastic linear motion fader providing digital output in 8-bit non-ambiguous Gray code, decimal 0 to decimal 255, 0.4mm resolution providing an electrical resolution of $\frac{1}{4}$ dB per step at 0dB when the fader output is used to generate the digital equivalent of an analogue audio taper law. Physically interchangeable with the 1100 and 1500 series faders and accessories.

Price: around £30.

1900 series

Type: conductive plastic linear motion fader, available in mono, stereo or four gangs, basically similar to 1500 series, but a longer 128mm travel. Available in linear or unbal log fader audio taper. Fascia calibrated 0 to 85dB and infinity.

Dimensions: fascia top plate 190 x 40mm, back-mounted 173 x 46mm, 46mm high.

Price: about £35 to £52.

2100 series

Type: conductive plastic linear motion fader, similar to 1900 series, but includes two separately operated faders in one housing with an overall width of

Above right,
Duncan/CGS
400 series
Slideline faders

Left, range of
Penny and Giles
faders

25.4mm, designed for backmounting. Both faders are stereo tracks, infinity and aux switches.

Price: about £60 to £70.

900 Slimline series

Type: Slimline conductive plastic linear motion faders, similar to 1100 series, but shorter 65mm travel and 12.7mm width. Available as mono or stereo, linear or audio.

Price: about £7 to £12.

Joystick quad pan pot

Type: quadrasonic pan potentiometer using joystick to divide a single audio input to four outputs. Uses conductive plastic tracks with a special law to provide a balanced sound effect with sensitive adjustment in the central position. Cut-off in corners 40dB, six tracks internally, 600 Ω input, 3k Ω output.

Price: about £90.

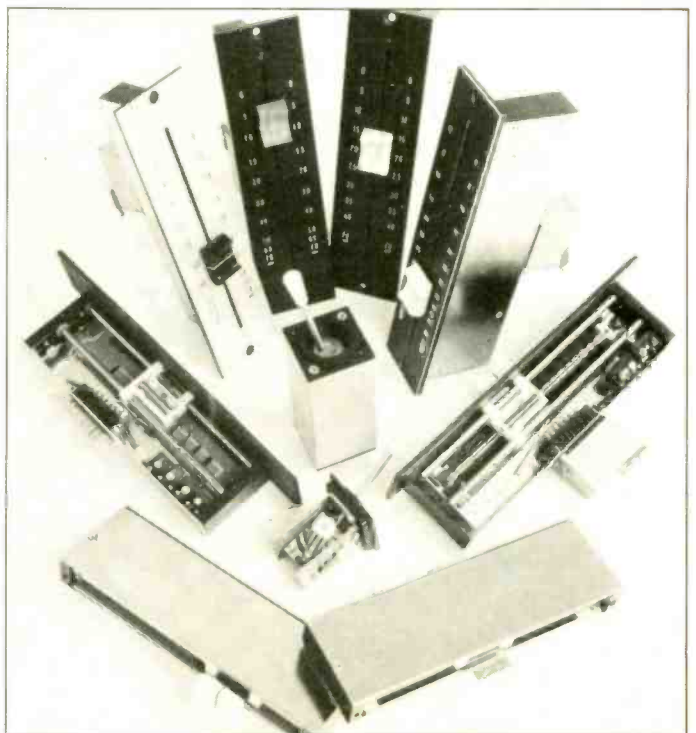
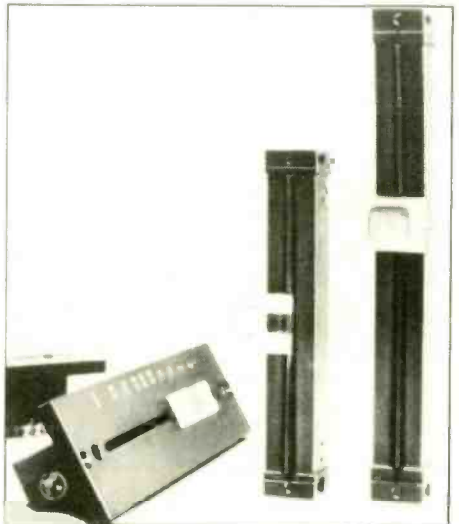
PLESSEY (UK)

Plessey Resistors Ltd, Cheney Manor, Swindon SN2 2P7.

Phone: 0793 36251. Telex: 44375.

USA: Plessey Capacitors Inc, 5334 Sterling Center Drive, Westlake Village, Cal 91361.

Phone: (213) 889-4120. Telex: 910-494 4779. 64 ▶



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Survey

FM4-C

Type: conductive plastic linear motion faders, available in mono or stereo, metal construction, either socket connected or flying leads, two widths of fascia, linear or dB scaling, forward or reverse reading. Fascia calibrated either 0 to 10, or 0dB to 30dB in 5dB steps, 40dB, 60dB and infinity.

Resistances: linear 1k Ω to 100k Ω , audio law 600, 1k, 2.2k, 10k and 100k Ω .

Maximum attenuation: min 85dB, and cut-off.

Effective travel: 98.5mm.

Stereo: stereo available.

Switching: up to two microswitches at each end of the fader.

Knobs: white or black, 25mm long.

Dimensions: fascias either 174 x 19mm, 174 x 45mm or 190 x 40mm, also available for rear mounting 142 x 19mm, 48mm high.

Prices: £25 to £35.

EM series

Type: quadrant faders (previously Painton), using a variety of tracks. Construction is metal plug-in with a curved front panel scale covered by perspex which may be illuminated in two colours (three in the *EM4*) by lamps at either end of the scale. The knob is mounted on the end of a pivoted arm mounted externally to the case, thus allowing the unit to be fully sealed.

Availability: *EM2* is the original stud fader using electro-deposited silver pads (29 pads and off, option on unbal for 58 pads), and silver graphite brushes, and precision fixed metal film resistances providing accurate resistance steps between each stud. Networks available for unbal pot, double unbal pot, bal pot or bridged T. *EM2C* has a moulded carbon track available as linear or audio law from 100 Ω to 1M Ω . *EM3C* is a non-enclosed quadrant fader without switches or lights designed primarily for lighting control, but may also be used for audio, moulded carbon tracks linear or audio law 100 Ω to 5M Ω . *EM4C* and *EM5C* are quadrant faders using conductive plastic tracks, non-enclosed but available with lamps and switches, edge connector, linear or audio laws from 1k Ω to 100k Ω , *EM4C* has rear connector, *EM5C* has terminations at an angle to reduce clearance. *EM5C* is same construction and facilities as *EM2*, but with a sealed conductive plastic track, linear audio laws to order.

Effective travel: 1 $\frac{1}{2}$ $^\circ$ between studs, total arm movement 52 $\frac{1}{2}$ $^\circ$.

Stereo: *EM2* is available with double tracks, also *EM6C*.

Switching: up to four microswitches may be fitted, two at either end of the track, or one may be replaced by a cam operated switch at any fixed position on the travel. Also overpress cue facility.

Knobs: white, black, blue, green, red, yellow or orange available.

Dimensions: front panel is 127 x 19mm, and 121mm high with connectors.

Prices: *EM2/EM2C/EM6C* £60 to £100, *EM3C* £15 to £20, *EM4C/EM5C* £7 to £95.

Plessey also manufacture a range of rotary attenuators and faders using stud techniques and precision resistor steps.

PREH (West Germany)

Preh GmbH, PO Box 1540, D-8740 Bad Neustadt S, West Germany.

Phone: 09771 921. Telex: 672503.

UK: Eardley Electronics Ltd, Eardley House, 182/4 Campden Hill Road, London W8 7AS.

Phone: 01-221 0606. Telex: 299574.

Film slider resistor 58

Type: carbon film linear motion fader, mono or stereo, available for PC mounting or with wire terminals, options screened, $\frac{1}{2}$ -taps, detents.

Resistances: linear 47 Ω to 16M Ω , log 220 Ω to 10M Ω .

Effective travel: 58mm.

Knobs: plastic.

Dimensions: 86 x 10 x 16mm high.

Price: around £1 each, 100 off.

Film Slider resistor 70

Type: carbon film linear motion fader mono only. Similar to 58, but 70mm effective travel, red knob.

Price: around £1.40 each, 100 off.

Film Slider resistor 100

Type: carbon film linear motion fader, mono or stereo. Metal housing.

Resistances: as for 58.

Effective travel: 100mm.

Knobs: red.

Dimensions: 145 x 30 x 12mm high.

Price: around £3.50 each, 100 off.

VALLEY PEOPLE (USA)

Valley People Inc, PO Box 40306, 2821 Erica Place, Nashville, Tenn 37204, USA.

Phone: (615) 383-4737.

Trans-Amp LZ

Type: balanced input amplifier module, a fully balanced differential-in, differential-out device employing symmetrically opposed feedback loops. Where true balanced inputs are not required, the *Trans-Amp LZ* may be used as two separate independent amplifiers.

Gain range: 10dB to 60dB.

Max input level: +12dBV.

Noise: at 60dB gain 1dB noise figure (equiv input noise=129.8dBV ref. 0.775V).

Distortion: IM 0.006% at +22dBV out into 600 Ω , THD 1kHz 0.006%, 20kHz 0.02%.

Full power bandwidth: 1Hz to 150kHz.

Output capability: +22.5dB into 600 Ω or greater.

Source imp: 50 to 600 Ω .

Input imp: 10k Ω .

Output imp: 22 Ω .

Availability: as module alone, complete mic pre-amp on plug in card or retrofit mic preamp for MCI 400 or 500 Series consoles.

Price: £23, £88, £85 respectively.

WATERS (USA)

Waters Manufacturing Inc, Longfellow Center, Wayland, Mass 01778, USA.

Phone: (617) 358-2777.

UK: Variohm Components, The Barn, Wood Burcote, Towcester, Northants NN12 7JR.

Phone: 0327 51004. Telex: 311754.

LM8 series

Type: conductive plastic linear motion faders, available in mono, stereo or quad, metal construction, edge connector.

Resistances: 600 Ω or 10k Ω , linear, modified audio or log tapers.

Maximum attenuation: 90dB.

Effective travel: about 125mm.

Switching: cue switch with detent.

Knobs: round.

Dimensions: 159 x 32 x 59mm.

Price: on application.

LM4/6

Type: conductive plastic linear motion faders, available in mono, stereo or quad, metal construction, terminal connectors.

Resistances: as for LM8.

Effective travel: LM4 70mm, LM6 104mm.

Knobs: round.

Switching: cue switch and detent.

Dimensions: LM4 108mm long, LM6 151mm long, 29mm wide, 13mm high.

Price: LM4 £9.50, LM6 £11.50.

MN4/6

Similar to LM4/6, but reduced width, 19mm, mono only, no switches.

Price: on application.

Optional
AUTOLOCATOR III
with full channel
remote and
transport control—
featuring 10
memory locations—
displays real time
up down counter
in minutes and
seconds—a “Yo-yo”
or repeat function—
and tape velocity
indicator which
simultaneously
displays inches per
second and pitch
shift in $\frac{1}{4}$ tone
increments.

**The JH24 is the new MCI multitrack
tape recorder. Available accom-
modating up to 14 inch dia. reels. New
transformerless electronics featuring
separate preamplifiers and separate
EQ circuits for playback and sync
playback. Phase linearity achieved
throughout the audio path NAB CCIR
operation selectable.**

Modular construction—
Automatic switching for overdubbing—
Full track erasure—
QUIOR (QUIet Initiation Of Record)
circuitry—
Servo controlled tape transport—
Phase locked capstan drive system—
2 speed, fixed crystal reference
variable speed external reference—
Spot erasure feature.



MCI

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

Survey: Metering

During the past few years, console manufacturers have been using LEDs (light emitting diodes) and plasma bar graph displays, in addition to standard analogue VU and PPM meters. There are also a number of bar graph displays using a television screen to simultaneously show a number of channels.

The question of whether meters meet their appropriate specifications is becoming less important with the introduction of new display devices. Note that the recognised specifications for both VU and PPM meters (ANSI and BS4297: 1968), require special presentation of the scales which limits physical size, so many meet the important specifications (ballistics etc), but not scaling.

ALICE (UK)

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

PPM775

Type: PPM drive circuit for analogue meter movements which meets BBC and IBA specifications. Comprises a PCB that mounts on the back of an Ernest Turner or Sifam movement. Requires +24V or $\pm 15V$, balanced differential input.
Price: £65, movement extra.

A & R (UK)

Amplification & Recording (Cambridge) Ltd, French's Mill, French's Road, Cambridge CB4 3NP.
Phone: 0223 354507.

PLM14

Type: LED column level indicator using 14 point source circular LEDs, -30 to 0dB green, +2 to +8dB red. Switchable VU or PPM characteristics, 38dB dynamic range, electronically balanced input, front panel sensitivity preset, remotely adjustable brightness. Module front panel is 126mm high, 24mm wide and 98mm deep. Requires external 24V.
Price: £50.40.

MC16

Type: channel case and power supply that accepts 16 PLM14 level display modules.
Price: £198.

AUDIO & DESIGN (UK)

Audio & Design (Recording) Ltd, 84 Oxford Road, Reading RG1 7LJ.
Phone: 0734 53411. Telex: 848722.
USA: Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310.
Phone: (206) 275-5009.

Scamp S14

Type: LED column display with four 12-section LED displays calibrated -30, -20, -10, -6, -4, -2, 0, +2, +4, +6, +8, +12dB with $\pm 10dB$ calibration

PPM characteristics, modifiable to VU, variable brightness. Can be ganged to other S14 modules. Fits into Scamp rack from where it takes its 60V power supply.

Prices: S14 £385, Scamp rack and power supply £275.

BACH-SIMPSON (UK/Canada)

Bach-Simpson (UK) Ltd, Trenatt Estate, Wadebridge, Cornwall.

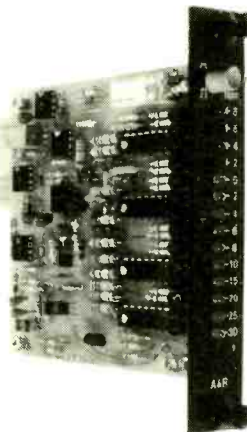
Phone: 020881. Telex: 45451.

Canada: Bach-Simpson Ltd, PO Box 5484, 1255-Brydges Street, London, Ontario, Canada.
Phone: (519) 452-3200. Telex: 0645843.

Wilbac range

Type: analogue VU meters with instrument construction, phenolic case, acrylic front cover. Front mounting, three models: 941W 44.5 x 44.5mm, 942W 66 x 60.4mm, 943W 88 x 76.2mm. Rear mounting, panel cut-out 1842W 62.8 x 34.8mm, 1843W, 85 x 43.7mm. Available with A or B scales, white or buff, meet ANSI and Bell specifications.
Price: from £9 to £11.

Audio & Design
Scamp S14



Excalibur range

Type: analogue VU meters with instrument construction, phenolic case, phenolic and glass cover. Front mounting, two models: 942EX 66.3 x 61.5mm, 943EX 87.9 x 76.7mm. Available with A or B scales, white or buff, meet ANSI and Bell specifications.
Price: about £11.

Designer range

Type: analogue VU meters with instrument construction, phenolic case, phenolic and glass front cover. Two models: front mounting 543W 100.4 x 67.9mm, 544W 114 x 73.8mm. Available with A or B scales, white or buff, meet ANSI and Bell specifications.
Price: about £12.

BURROUGHS (USA)

Burroughs Corp, PO Box 1226, Plainfield, New Jersey 07061, USA.

Phone: (201) 757-5000.

UK: Walmore Electronics Ltd, 11-15 Betterton Street, Drury Lane, London WC2H 9BS.
Phone: 01-836 1228. Telex: 28752.

Self-Scan Bar-Graphs

Type: high readability gas plasma bar-graph display devices (no electronics) providing a vertical bar made up of neon orange coloured segments which are easy to read even in high ambient light conditions. -250V is required for operation of the devices. Three basic versions are available: dual 100- and 200-element linear displays or a single 120-element circular display. Dual-Reset bar-graphs allow upper and lower set points on one bar, while the other displays actual measurement.

Prices: around £15.

CAPITAL COMPONENTS (UK)

Capital Components, 28 East Street, Rochford, Essex SS1 1PY.

Phone: 0702 547252.

UK: Cliff Electronics Ltd, 97 Coulsdon Road, Caterham, Surrey.
Phone: 0883 47713. Telex: 8813346.

Bargraph visual displays

Type: LED column level indicator using high intensity LEDs with either 12 or 20 segments, with bar or segment display. Switchable PPM or VU with optional peak hold facility, vertical or horizontal scales, optional scale illumination, finished in moulded case with matt black finish. Requires external 12V.

Price: from £7.50 to £18.

VU meters

Type: LED VU meters with a semicircle of 11 LEDs in a meter style case, available in mono or stereo (with two rows).

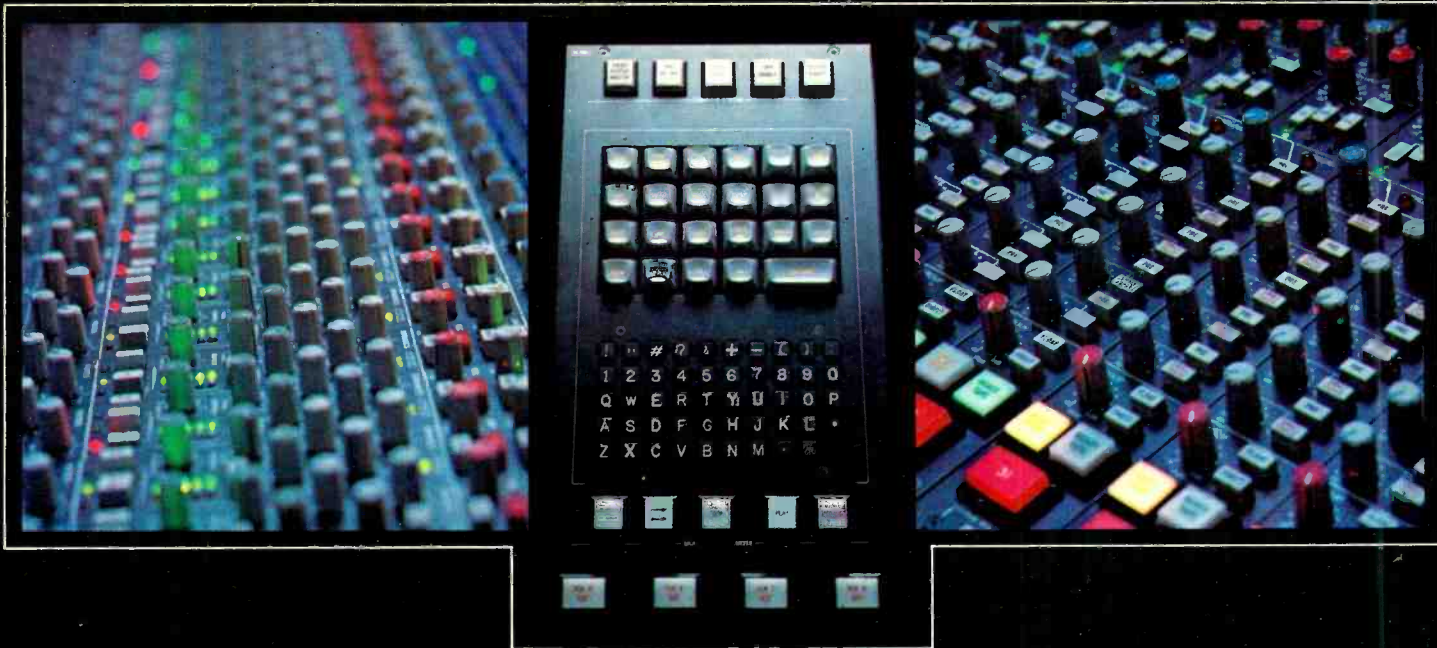
Price: mono £4.30, stereo £7.95.

COMPONEX (Japan)

Componex Ltd, 48-56 Bayham Place, London NW1 0EU.

Phone: 01-388 7171. Telex: 27364.

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

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

limited control of your audio without patching!

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

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

Solid State Logic

Master Studio Systems

UK and EUROPE
Solid State Logic
Stonesfield
Oxford, England
Colin Sanders
099 389 324
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

Regal range

Type: analogue VU meters which feature tough black picture frame bezels and glass windows, with bold flattened arc scales, optional illumination, external resistor required. *R-45* is 69 x 53mm, *R-55* 87 x 63mm, *R-65* 110 x 77mm. The *R-55* is also available as a PPM meter. Meets all the important ANSI specifications.

Prices: from £6 to £8, minimum order 10.

Kestrel range

Type: analogue VU meters which feature modern clearview plastic covers and rugged movement. The case moulding allows front or rear panel mounting, optional illumination, external resistor required. *KM48* is 44 x 21mm, *KM66* 66 x 60mm, *KM86* 86 x 78mm, *KM106* 106 x 83mm, *KM118* 118 x 106mm, window size is slightly smaller. Also available as PPMs to special order. Meets all the important ANSI specifications.

Price: from £5 to £8, minimum order 100.

L range

Type: analogue VU meters which interchange with the SEW SD range, meet BS89, and whilst offering satisfactory performance for most applications, just fall short of the ANSI specifications. 12V internal illumination provided as standard, 3.9kΩ resistor internally mounted, *2L* is 60 x 46mm, *3L* is 86 x 65mm, *4L* 110 x 83mm.

Prices: from £4 to £6, minimum order 10.

VU Mini-Meters

Type: low cost microammeters with VU scales and rugged movements suitable for portable equipment. Provide good level indication where the cost of a proper VU movement is not justified. There are six standard models and many others to special order. All may be front or rear panel mounted, *SU6* is 40 x 40mm, *ST7* 55 x 47.5mm, *SS8* 81 x 41mm with twin movements in one case, all with VU scales and suitable for external illumination, *SQ10* is 60 x 35mm with internal illumination. There is also a range of edgewise meters available to special order.

Prices: £1 to £2, minimum order 10.

Fluorescent Bargraph Peak VU Meters

Type: VU meter using fluorescent display and built-in electronics, optional peak hold, single or twin colour.

Price: on application.

DIXSON (USA)

Dixon Inc, PO Box 1449, Grand Junction, Colorado 81501, USA.
Phone: (303) 242-8863.

Manufacture a range of analogue VU meters.

ERNEST TURNER/CROMPTON (UK/USA)

Ernest Turner Instruments, Totteridge Avenue, High Wycombe, Bucks.

Phone: 0494 30931. Telex: 83444.

USA: Crompton Instruments Inc, 1562A Parkway Loop, Tustin, Cal 92680, USA.

Phone: (714) 731-2333.

Note: Ernest Turner meters are manufactured in both the UK and USA, being marketed under the name Crompton in the USA.

VU meters

Type: analogue VU meters available in a wide range of models conforming to ANSI C16.5-1954, full wave rectified, external resistor, frequency response 35Hz to 10kHz ± 0.2 dB, versions available for mounting on ferrous panels. Two scalings, A scale gives prominence to the VU values, while B scale gives prominence to the per cent scale. Scales available in cream (to meet ANSI), white or black. Optional external illumination.

Prices: £14 to £16.50 depending upon size, in 5 off.

Peak programme meters

Type: analogue PPMs available in a wide range of models with scaling and performance conforming to BS4297: 1968 which specifies a scale length of 80 ± 5 mm, and other instruments conforming but for scale length. Meters can also be supplied to meet the appropriate BBC specifications. Scales provided may either be BBC standard 1 to 7 white figures on black, or European dB unit black and red on white. Requires external electronics. Versions for mounting on ferrous panels, optional external illumination.

Prices: front mounting about £22, rear mounting £25.50 in 5 off.

Twin PPM

Type: basically similar to standard PPMs, but twin movement with two separate pointers on the same dial, pointers available in white and yellow (for L+R and L-R) and red and green (for L and R). May be externally illuminated, rear panel mounting.

Price: £70.

A back of panel mounting kit is available for many models, as is a meter illumination kit.

JEWELL (USA)

Jewell Electrical Instruments Inc, Grenier Field, Manchester, New Hampshire 03108, USA.
Phone: (603) 669-6400.

Manufacture a range of analogue VU meters.

MINIFLUX (UK)

Miniflux Electronics Ltd, 8 Hale Lane, London NW7 3NX.
Phone: 01-959 5166

MEG series

Type: range of LED peak level column indicators using separate close coupled large diameter LEDs in a vertical column with a variety of scales and different colours. The dynamic performance is claimed to be in excess of any standards, and requires degrading to meet the appropriate specifications.

Five different models standard: *MEG273* is a general purpose peak level indicator having a range of +3dB to -40dB against a VU type scale, switchable 20dB gain, 16 LEDs, green to 0dB, red above. *MEG290* is a wide range indicator with a single overall range of 70dB with 25 LEDs, green below 0dB, red above. *MEG295* has a scale marked according to EBU standard having a central 0dB test mark-

er, and a range of 12dB above (yellow) and below (green) the marker with 25 LEDs, switchable 20dB gain. *MEG293* has 25 LEDs calibrated from -20dB to 0dB (green), and 0dB to +6dB (red), also 20dB switchable gain. *MEG296* has a scale marked according to the BBC 1 to 7 PPM scale, with 6dB intervals between 1 and 2, and 4dB intervals up to 7, also 20dB gain, total range with gain 46dB, 25 LEDs, green below 4, yellow above. Miniflux also manufactures a bridge containing 26 channels of *MEG273* indicators with a stabilised power supply. **Prices:** *MEG273* £47, *MEG290* £140, others £70 each.

MODUTEC (USA)

Modutec Inc, 18 Marshall Street, Norwalk, Conn 06854, USA.
Phone: (203) 853-3636.

Manufacture a range of analogue VU meters.

NEVE/CHROMATEC (UK)

Chromatec Video Products Ltd, 10 Barley Mow Passage, London W4 4PH.

Phone: 01-994 6477. Telex: 8811418.

UK: Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU.
Phone: 0763 60776.

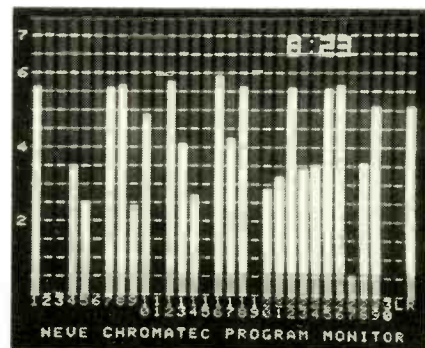
USA: Rupert Neve Inc, Berkshire Ind Park, Bethel, Conn 06801.

Phone: (203) 744-6230. Telex: 969638.

Multichannel Monitor/Spectrum Analyser

Type: modular rack mounted unit which provides, in conjunction with a colour television display (PAL television standard or RGB), the capability to monitor 56 audio channels simultaneously, switchable to a spectrum analysis of any single channel from 31Hz to 16kHz in $\frac{1}{3}$ -octaves. Level indication is bargraphs switchable to PPM or VU characteristics, which are identified in groups of four or eight, and which may be colour coded with eight different colours to identify groups etc. Overload on any channel is indicated by the bargraph colour changing to red above a preset height. An electronically generated graticule is calibrated in 2dB steps between +6dB and -24dB with alternative scales to order. White and pink noise generators are built in for spectrum analysis. Optional peak store cursor which rises as maximum bar height increases.

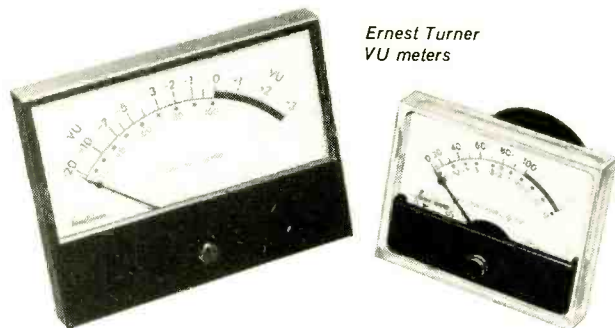
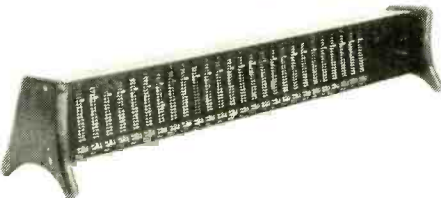
Prices: varies from £2,000 to £4,000 for 16 to 56 channels.



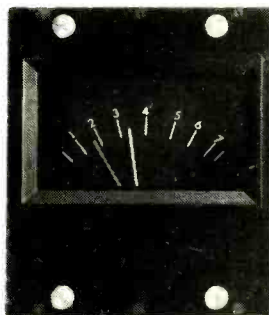
Neve/Chromatec 32 channel display

Ernest Turner Twin PPM

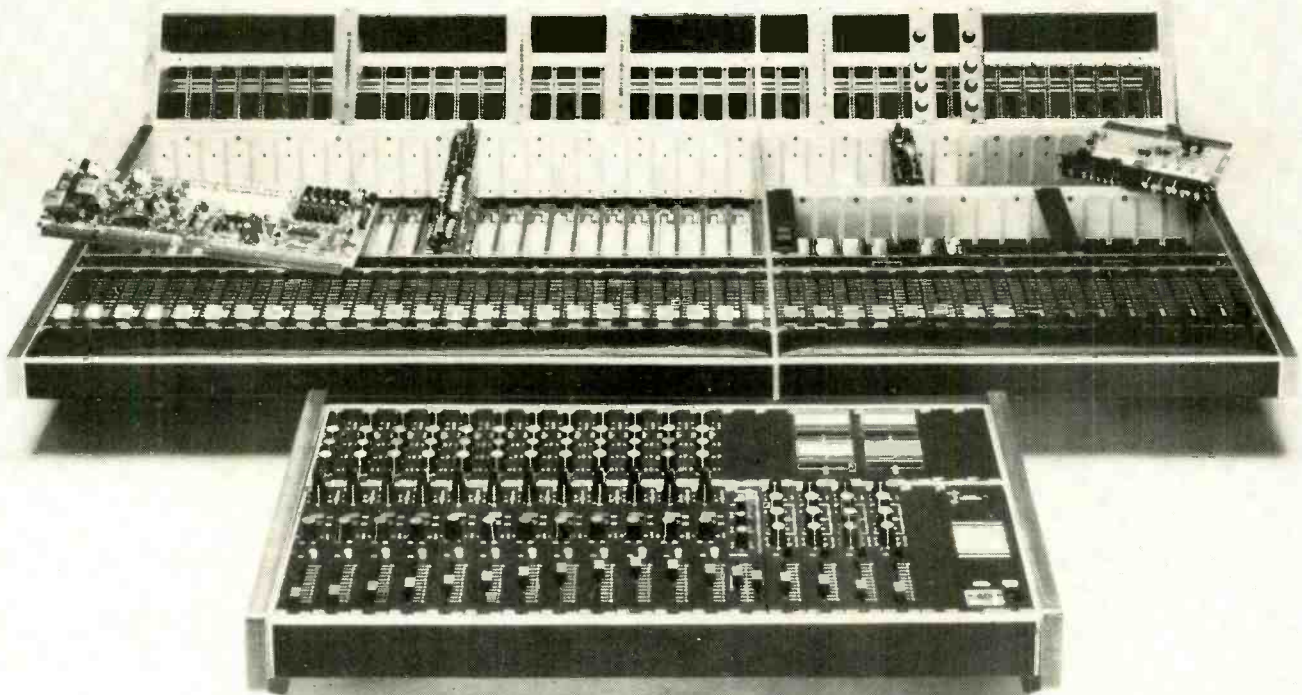
26-channel array of Miniflux MEG indicators



Ernest Turner VU meters



Have The System of Your Choice



Modular Mixing Systems

We know the Modular Mixing System can give you everything you want for creative recording and professional sound reinforcement.

Both of our systems offer a wide variety of control facilities and sophisticated monitoring is a particular feature of System 2.

The moment you look at our Modular Mixing Systems you cannot fail to be impressed by the craftsmanship. Closer examination will show you that each mixer uses state of the art technology. The quality of the construction and components is reproduced in the performance.

SYSTEMS 1 and 2 are modular in design, offering a variety of input and output combinations economically achieved by the selection of modules and mainframe.

SYSTEM 1 will accept from 4 to 32 input channels and 2, 4 or 6 group output channels.

SYSTEM 2 offers additional facilities and the increased flexibility to accept a wider range of input and output combinations.



P.O. Box 54 Great West Road, Brentford,
Middlesex TW8 9HR, England.
Telephone: 01-568 9222. Telex 27976.

Survey

NTP (Denmark)

NTP Elektronik A/S, Theklavej 44, DK-2400 Copenhagen, Denmark.
Phone: 01 10.12.22. Telex: 16378.

177-210/300/310

Type: light spot peak programme meters, self contained with built-in log amplifiers and input transformers, optical system with low power lamps providing a bright wide white bar with a black line in the middle for precise reading, scaled -50dB to +5dB, and % from 0.5% to 180%. Available in three formats, 177-210 is stereo with two vertical columns, 177-300 is stereo with two horizontal columns, while 177-310 is mono with a horizontal column. Meet DIN 45406 and IEC standards, 150mm scale length.
Price: 177-210 and 177-300 3,465DM, 177-310 1,995 DM (West German Marks).

177-400/410/800

Type: gas discharge display stereo peak programme meter with 100 individual orange glowing elements in each bar resulting in 1% resolution, overload shows as eight times intensity on display, scaled -50dB to +5dB, peak memory, switchable 20 or 40dB gain, 177-400 meets DIN standard, 177-410 is a EBU meter, 177-800 does not include peak hold. Power supply is single 24V. 127mm scale length.
Price: 177-400 and 177-410 1,890DM, 177-800 1,180DM.

177-700B/710

Type: LED column mono peak programme meter with 64 LEDs resulting in 148mm long vertical scale, scaled -50dB to +5dB, with two additional rows of LEDs above 0dB to clearly indicate overload, will also maintain peak reading, but no memory. Meets DIN and IEC standards. Available as 177-700B with red LEDs throughout, or 177-710 with green below 0dB, and red above.
Prices: 177-700B 1,685DM, 177-710 1,840DM.

177-750/780

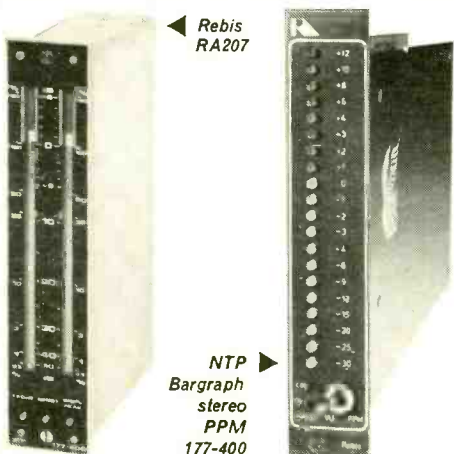
Type: LED column peak programme meters with 24 LEDs resulting in a 61mm long scale (vertical or horizontal), green LEDs below 0dB, red above, scaled -40dB to +5dB. Meets DIN and IEC standards. Available as 177-750 in mono, or 177-780 in stereo.
Price: 177-750 520DM, 177-780 967DM.

177-900/950

Type: 177-900 is a gas discharge stereo VU meter with 100 orange glowing elements in each bar. VU ballistics in accordance with ASA-C16.5-1961. 177-950 has one VU column and one PPM column, side by side.
Prices: 177-900 and 177-950 1,180DM.

M-900

Type: analogue PPM using Sifam movement with electronics contained on back of meter mounted



Rebis RA207

NTP Bargraph stereo PPM 177-400

PC board, dB scaling from -36dB to +9dB.
Price: 281DM.

M-920/177-600

Type: analogue PPM using edgewise movement scaled -40dB to +5dB, self contained, M-920 is in a low cost case, the 177-600 is identical but in a better module case.
Price: M-920 586DM, 177-600 685DM.

277-100

Type: eight channel PPM based on 200 element bargraph plasma displays, with electronically superimposed scale lines, with light intensity increase for overload, only 24V required.
Price: on application.

277-500

Type: stereo display instrument based on a 70mm CRT, providing combination stereo monitor oscilloscope and compatibility meter providing indication of phase- and amplitude-relationship between left and right channels in stereo.
Price: on application.

377-500

Type: video peak programme meter that superimposes a meter scale on the side of a television picture to provide level indication.
Price: 1,565DM.

377-100

Type: multichannel peak programme meter providing display of up to 28 channels (36 in special version) on a colour television monitor. The channels are divided into groups of four and the bars background illuminated, and red illuminated in overload, colour being remotely selectable. Scale is electronically generated, and output is CCIR RGB video. Electronics are rack mounted.
Prices: available from 12 to 36 channels, ranging from 9,850DM to 18,250DM.

506-100

Type: 1/3-octave analyser for 377-100 multichannel peak programme meter that selects one of 28 channels for display, with analysis from 40Hz to 16kHz.
Price: 11,590DM.

PSI (USA)

Project Synthesis International, 561 Carrick Court, Sunnyvale, Cal 94087, USA.
Phone: (408) 733-0065.

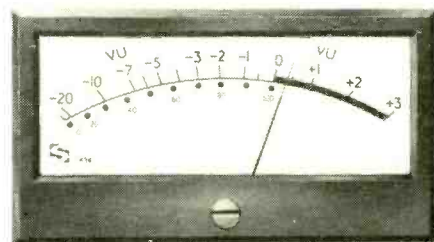
ALD-12

Type: LED column level indicator using 12 LEDs in three colours to indicate from -20 to +12VU, with labelling in VU/PPM and %. Ballistics provide for standard averaging or peak, externally selectable. Requires external 9-35V. Construction is an encapsulated PC board mounted by front panel, in either a standard card case, or on a panel cutout. The ALD-12CP series comprises 2-, 8- or 16-display channels case mounted with power supply.
Price: on application.

RACAL/BPL (UK)

Racal-British Physical Laboratories, Radlett, Herts WD7 7HJ.
Phone: 09276 4844. Telex: 25312.

BPL manufacture a wide range of analogue meters, and are able to supply VU meters in a number of types, to special order.



REBIS (UK)

Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 5AB.
Phone: 0384 71865.

RA207/RA207R

Type: LED column meter with switchable VU and PPM characteristics, comprising 20 LEDs green from -30dB to 0dB, red to +12dB. Front panel calibration preset for ±10dB gain, toggle switch to select PPM or VU characteristic. RA207R is similar, but switch has centre position for remote selection of VU/PPM. Requires external 40V. The RA200R series rack will accept up to 16 LED column modules, while the externally mounted RA200P series power supply will drive 16 modules.
Prices: RA207 £62, RA207R £72, RA200R £80, RA200P £78.

SEW (Japan)

SEW, Shinohara, Japan.
UK: ITT Instrument Services, Edinburgh Way, Harlow, Essex CM20 2DF.
Phone: 0279 29522. Telex: 81525.

VU meters

Type: analogue VU meters available in two styles and a number of sizes, rectified but requiring external resistor, no provision for internal illumination. MR range have a clear plastic front and are available in sizes 42 x 42mm, 50 x 50mm, 60 x 60mm and 86 x 78mm. SD range has a clear scale reading front, but black bottom of movement, and is available in 59 x 46mm, 85 x 64mm and 110 x 110mm. All are scaled -20VU to +3VU.
Price: from £6 to £9.

SIFAM (UK)

Sifam Ltd, Woodland Road, Torquay, Devon TQ2 7AY.
Phone: 0803 63822. Telex: 42864.
USA: Selco Product Co, 7580 Stage Road, Buena Park, Cal 90621.
Phone: (213) 921-0681. Telex: 655457.

Monitor range

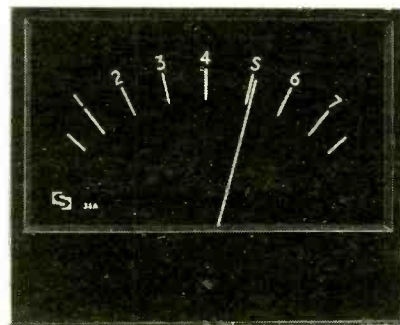
Type: analogue VU meters available in three sizes, styled to concentrate attention on the functional aspects of the meter, scale and pointer. Meter face is one third less deep than most meters giving a landscape shape, meter case is reinforced plastic with a black phenolic moulding for the instrument front. Meter is rear mounting with panel cut-outs of: R28 66 x 38mm, R38 88 x 48mm, R48 118 x 63mm. Require external resistor, meet relevant technical ANSI specifications, but not necessarily scaling. Optional illumination.
Prices: from £17 to £20.

Director range

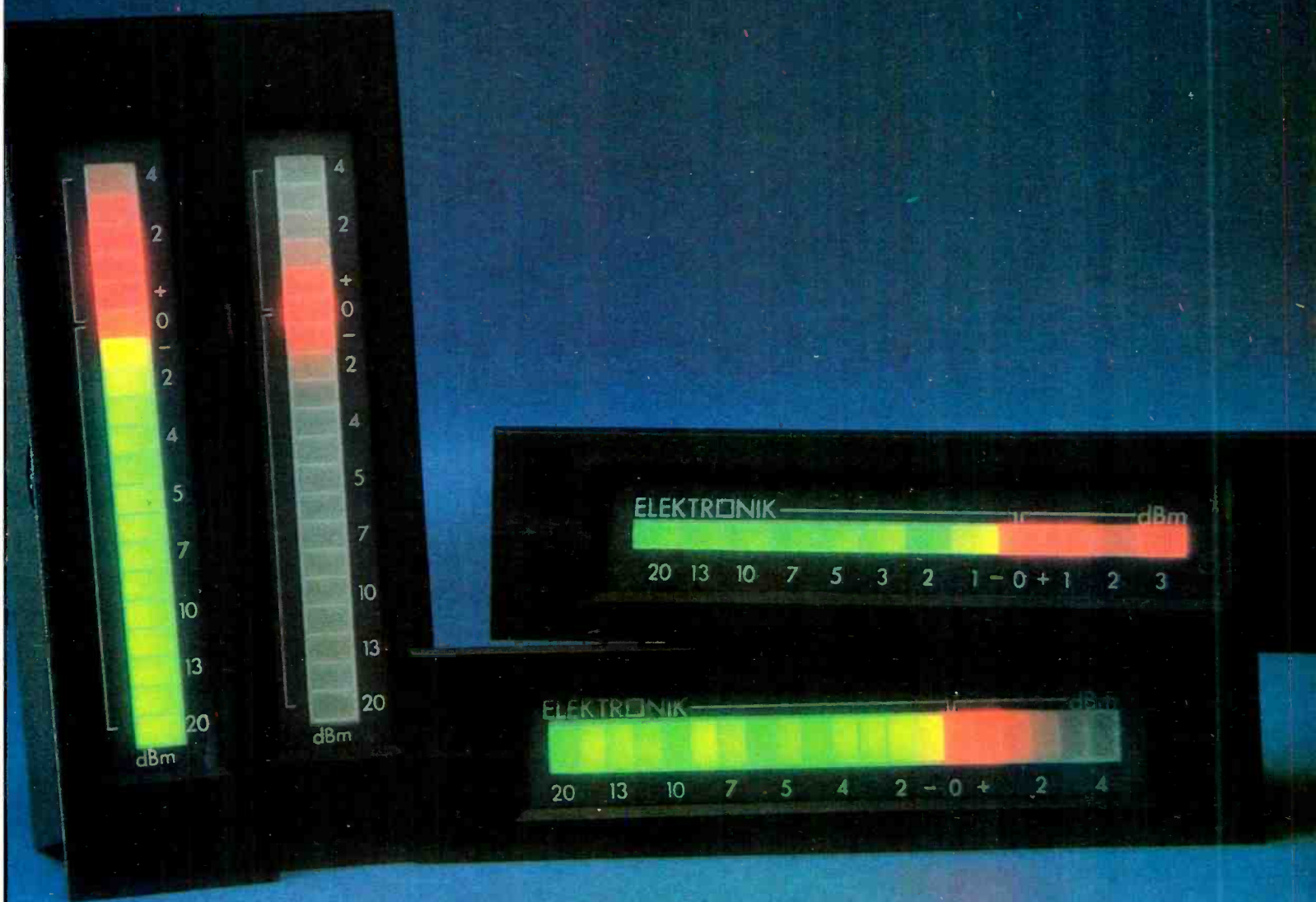
Type: analogue VU and PPM (requires external electronics) meters in four sizes, similar construction to Monitor range, but standard meter 'shape', front of panel mounting. Models with R are VU meter, without R PPM meter, overall dimensions:

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left, Sifam Monitor VU meter, below, Director PPM



ELEKTRONIK dBm



Professional Visual Displays

For full details contact U.K. marketing agents CLIFF ELECTRONICS LTD,
97, Coulsdon Road, Caterham, Surrey. CR3 5NF, Tel: Caterham 47713.
Telex 8813346. Manufactured in the U.K. by CAPITAL COMPONENTS,
28, East Street, Rochford, Essex. Tel: 0702-547252

Survey

R14 49 x 42mm, R24A 70.5 x 57.5mm, R34A 91.5 x 74.5mm, R44A 120 x 97mm. VU meters meet technical ANSI specs, PPM meters meet appropriate technical BS4297: 1968 specifications, but only 34A meets scaling spec. PPM 1-7 or EBU dB scales available. Optional illumination except for R14.

Prices: VU from £16 to £19, PPM from £15.50 to £18.

Clarity and Clarity Focus ranges

Type: analogue VU and PPM (requires external electronics) meters in several sizes. The VU meters are made with a modified specification with heavier damping and faster rise time than the standard specification, which perhaps makes them easier to read. They also have a larger than normal pointer that is easier to read than standard. PPM meters meet BS technical specifications, but only 22A meets scaling requirements. PPM 1-7 or EBU dB scales available. The cases are plastic moulded with a completely transparent acrylic front incorporating a black mask. *Clarity* is front of panel mounting with overall dimensions: R22A 75 x 61mm, R23A 61 x 61mm, R32A 90.5 x 74mm, R42A 120 x 97mm. *Clarity Focus* are back of panel mounting with diecast alloy frame finished matt black, panel cut-outs: R22AF 78.5 x 40.5mm, R32AF 94.5 x 51mm, R42AF 125 x 68mm. Optional illumination.

Prices: *Clarity* VU from £14.50 to £17, PPM from £13.50 to £16. *Clarity Focus* add £1.85.

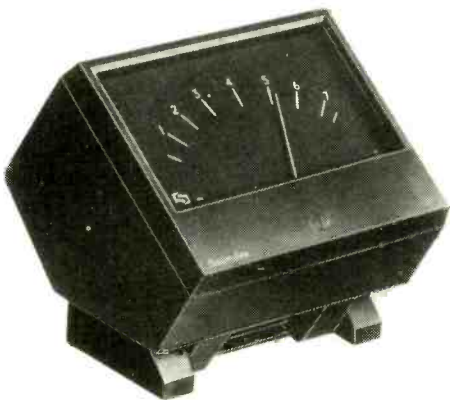
SOUNDEX (UK)

Bulgin Electronics Soundex Ltd, Park Lane, Broxbourne, Herts EN10 7NQ.
Phone: 09924 64455.

PPM 100 series/BS5428

Type: range of PPM meters incorporating Ernest Turner and Sifam analogue movements, with Soundex electronics which meet the BS5428 specifications with BBC style 1-7 scale. *PPM 100* is a self contained instrument in a stylish free standing case with adjustable viewing angle for desk or wall mounting, mains powered (240V or 110V), two XLR connectors, mains IEC connector, Sifam movement. *PPM 104* contains two meters side-by-side. *PPM 101* is amplifier card only for mounting on the rear of a meter for external 24V operation, while *PPM 102* is similar but supplied with an Ernest Turner 643 PPM movement.

Prices: *PPM 100* £136.80, *PPM 104* £180, *PPM 101* £57.35, *PPM 102* £85.35. Additional audio input isolating transformer £13.35



PPM 300 series/DIN 45406

Type: range of PPM meters incorporating Sifam analogue movements conforming to DIN 45406 scaled -50dB to +5dB, and 0% to 180%. Availability as for *PPM 100* series, but only available with movement.

Prices: *PPM 300* £158.90, *PPM 302* £99.50.

PPM 400 series/Soundex Standard 400

Type: economy standard range of PPM meters with a scale that has been rationalised from BBC and VU scales to provide high clarity and accuracy

of indication with a dB scale from infinity, -24dB through to +2dB. *PPM 400* is cased with flying leads, mains powered but no connectors, fixed viewing angle. *PPM 404* is twin meters mounted side-by-side. *PPM 402/34* and *PPM 402/44* are amplifier cards mounted on Sifam 34 and 44 sized meters.
Prices: *PPM 400* £75, *PPM 404* £95, *PPM 402/34* £39.95, *PPM 402/44* £41.50.

STUDER (Switzerland)

Studer International AG, CH-5430 Wettingen, Switzerland.

Phone: 056 26.87.35. Telex: 53682.

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

Phone: 01-953 0091. Telex: 27502.

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

Phone: (615) 329-9576.

Dual programme meter

Type: dual plasma display meter with 200 segments, available in PPM or VU characteristics, as console mounted or rack mounted, with optional peak memory providing momentary indication, peak indication only, or mixed. Contains two vertical displays side-by-side, scaled -44dB to +6dB in PPM or -20VU to +3VU. Requires 22V power supply.

Price: around £500.

SURREY (UK)

Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG.

Phone: 04866 5997.

PPM2

Type: PPM drive circuit for analogue meter movement, meets IEC268-10A, and BS5428. Based on ME1219 design under licence from the BBC. Mounts on the rear of Ernest Turner meter movements which are also available from stock.

Price: module £65.

UREI (USA)

United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352, USA.

Phone: (213) 767-1000. Telex: 651389.

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

Phone: 01-953 0091. Telex: 27502.

Model 970 Vidigraf

Type: bargraph display generator using a television monitor for display of 16 or 32 bargraphs. Provides standard VU ballistics with a 30dB dynamic display range. Can also display $\frac{2}{3}$ -octave spectrum analysis of audio input. Each vertical bar has two shades of grey, with the lighter shade above 0dB reference (monochrome display with EIA standard).

Price: £708, spectrum card £215, VU card £215.

WESTREX (USA)

Westrex Co, 2629 W Olive Avenue, Burbank, Cal 91505, USA.

Phone: (213) 846-3394. Telex: 698254.

UK: Westrex Co Ltd, 152 Coles Green Road, London NW2 7HE.

Phone: 01-452 5401. Telex: 923003.

RA-1558B

Type: light bar recording meter with a 42in long horizontal scale, which is ideal for film dubbing theatre applications. May be switched to peak, VU or VI (film industry volume indicator), adjustable brilliance, each bar measures 1.75 x 5.5in.

Price: on application.

Large Projection Meters

Type: range of analogue audio meters which have a projected image onto a 24 x 12in face. Available as VI or VU.

Price: on application.

Amcron Professional

Dealers in the U.K.

Buzz Music,
65 Widemarsh Street,
Hereford.

Tel: 0432 55961

Hardware House Sound Ltd.,
1-7 Britannia Row,
London NI.

Tel: 01 226 7940

R.E.W. Audio Visual,
114 Charing Cross Road,
London WC2.

Tel: 01 836 2372

Sound Control,
1 Thirlmere Gardens,
Belfast.

B15 5ER

Tel: 0232 772491

Service and Parts

Greenwich Audio Services,
16 St. Alfege Passage,
London SE10.

Tel: 01 853 1819

AMCRON 

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.



HIRE AND SALES

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

AES 66th Convention, Los Angeles - a preview

The 66th Convention of the Audio Engineering Society will be held from May 6-9 at the Los Angeles Hilton Hotel. Over 180 exhibitors will be showing their products.

●**AB Systems Design:** new *Model 1200A* power amplifier, *Model 2400* electronic frequency divider, *Model 912* pre-amp/mixer, and *Model 730* tri-amp system. ●**Accurate Sound:** *AS-2400* master/slave tape duplicating system, plus *Starbird* mic boom and *SAK 1* magnetic heads. ●**Acoustic Design by Jeff Cooper:** display of professional recording studio, control room, and film studio designs including details of recent design projects. ●**Acoustilog:** *Model 232A* reverberation timer and the new *Impulser* impulse excitation option which allows checking of loudspeaker polarity, phase and alignment in multi-speaker systems. Also the company's time delay spectrometry equipment used in conjunction with its acoustic consultation service. ●**Agfa-Gevaert:** range of tapes including *PEM-568* and *PEM-368* mastering tapes; *PEM-526* bin tape; *PE-611*, *PE-811* and *PE-1211* bulk cassette tapes; and *PE-36* duplicating tape. Two new professional tapes types *PER-528* and *PEM-428* will also be shown. ●**AKG:** new *C-567* condenser lavalier mic; the *C-414E* condenser mic; *D-300* series of vocalists mics: full range of mics and accessories; reverb units; and the *TDU 7000* modular time delay unit. ●**Allen and Heath Brenell:** *Syncon 16/24/28-track* console and the *AHB 8-track* package system based on the *Mod 3* console and *Brenell Mini 8* lin machine. ●**Allison Research:** *Kepex II* keyable program expander; *EGC-101* gain cell; *EGC-205M*, *EGC-202* and *EGC-2500* VCA modules; plus the *Fadex* programmable fader system and the *65K* automation programmer. ●**Alpha Audio:** *Sonex* acoustical foam ●**Altec:** range of studio monitor loudspeakers. ●**Amber:** *Model 3500* miniature distortion analyser with built-in oscillator, automatic operation, battery powering, and performance to 0.002% residual. Also the *Model 4400A* multipurpose audio test set. ●**Ampex:** *ATR-116* and *ATR-124* 16-track and 24-track recorders. Also the *MM-1200*, *ATR-100* and *ATR-700* tape recorders; the *ECCO MQS-100* synchroniser; the *ATR-102* and *ADD-1* disc mastering system; and Ampex tapes and cassettes. ●**Ampro/Scully:** broadcast equipment plus the *Scully LS76* disc cutting lathe; *Auto/Master* automated disc master

console; *284B* 8-track recorder with varispeed; and *280B Series 2* and 4-track recorders.

●**AMS (Advanced Music Systems):** new stereo version of the *DMX15-80* programmable DDL; new *DM-DDS* digital disc mastering delay line; and the *DM2-20* phaser/flanger.

●**Anvil Cases:** range of equipment cases including the *Amp Rack* series. ●**Aphex Systems:** *Model 712 Aural Exciter* designed to replace the *Model 602*; *Model 602B* broadcast version; *Model 1537A* VCA; *OAS-24* grouping and automation system; *CX-1* compressor/expander; and *EQF-2* parametric equaliser.

●**Ashly:** *SC-44* keyboard input processor; 2-, 3- and 4-way electronic crossovers; new *SC-66A* 4-band parametric equaliser and the *SC-63* (mono) 3-band parametric; plus updated versions of the *SC-50* (mono) and *SC-55* (stereo) peak limiter/compressors. ●**ATC:** range of loudspeaker drive units and the company's range of studio monitor loudspeakers which are now available in kit form.

●**Audico:** range of cassette rewriter/exerciser/timer units for duplication operations including the *Model 200-9* tape timer. Also *Hockey-Puck* splicers for $\frac{1}{2}$ in audio or $\frac{3}{4}$ in video tape and the *MF-6* 50Hz pulsing system. ●**Audicon:** *The Plate* reverb systems; *Alpha One* and *Alpha Two* monitors; multipair audio cable; and studio accessory items. Additionally, *Barth* signal processing equipment; *EELA* Audio mixers; *Raindirk* mixing consoles; *Woelke* test equipment and tape heads; and the *Court Acoustics GE60* 30-band graphic equaliser.

●**Audio Concepts:** no information received.

●**Audio & Design (Recording):** new modular *M600* series of limiters and active bandwidth restricting filters for broadcasters. Also *Scamp* signal processing equipment; the *Express Ashly SC-63* and *SC-66A* parametric equalisers

Limiter compact compressor/limiter/expander; *F760-RS* complex limiter; *F769-RS* vocal stressor; *E950-RS* paragraphic equaliser; *E500* band processor; *E900* sweep equaliser; and *F690* voice-over limiter. ●**Audio Engineering Associates:** the company's active matrix box; *Ecoplate* reverb units; and the *Schoeps* range of mics and accessories. ●**Audio Industries:** range of universal mic and tape panels; quick connection studio umbilical cabling systems; and remote 24-position stereo cue mixer.

●**Audio Kinetics:** the *QLOCK 210* SMPTE/EBU time code generator, synchroniser, reader; and the *XT-24* Intelocator. ●**Audiotek:** *Model 2000* tape duplicating system which features duplicating ratios of up to 64:1, automatic bin loading and unloading, automatic cue tone injection and closed-loop capstan drive. ●**Audiotronics:** *Model 532* automated modular console with up to 32 input channels and eight master effects modules. Also the *Model 110A* expandable, modular recording/remixing/on-air console designed to accommodate up to 16-track mixing.

●**BASF:** range of professional tapes, cassettes and magnetic film including calibration and test tapes. ●**Beyer:** range of dynamic and condenser mics plus headphones. ●**BGW:** range of amplifiers including the *Model 300* stereo power amplifier. ●**Biamp Systems:** no information received. ●**B & K Instruments:** comprehensive range of audio measurement instruments. ●**Bobadilla Cases:** no information received. ●**Bose:** *Model 802* loudspeaker plus the *802-E* active equaliser and other units.

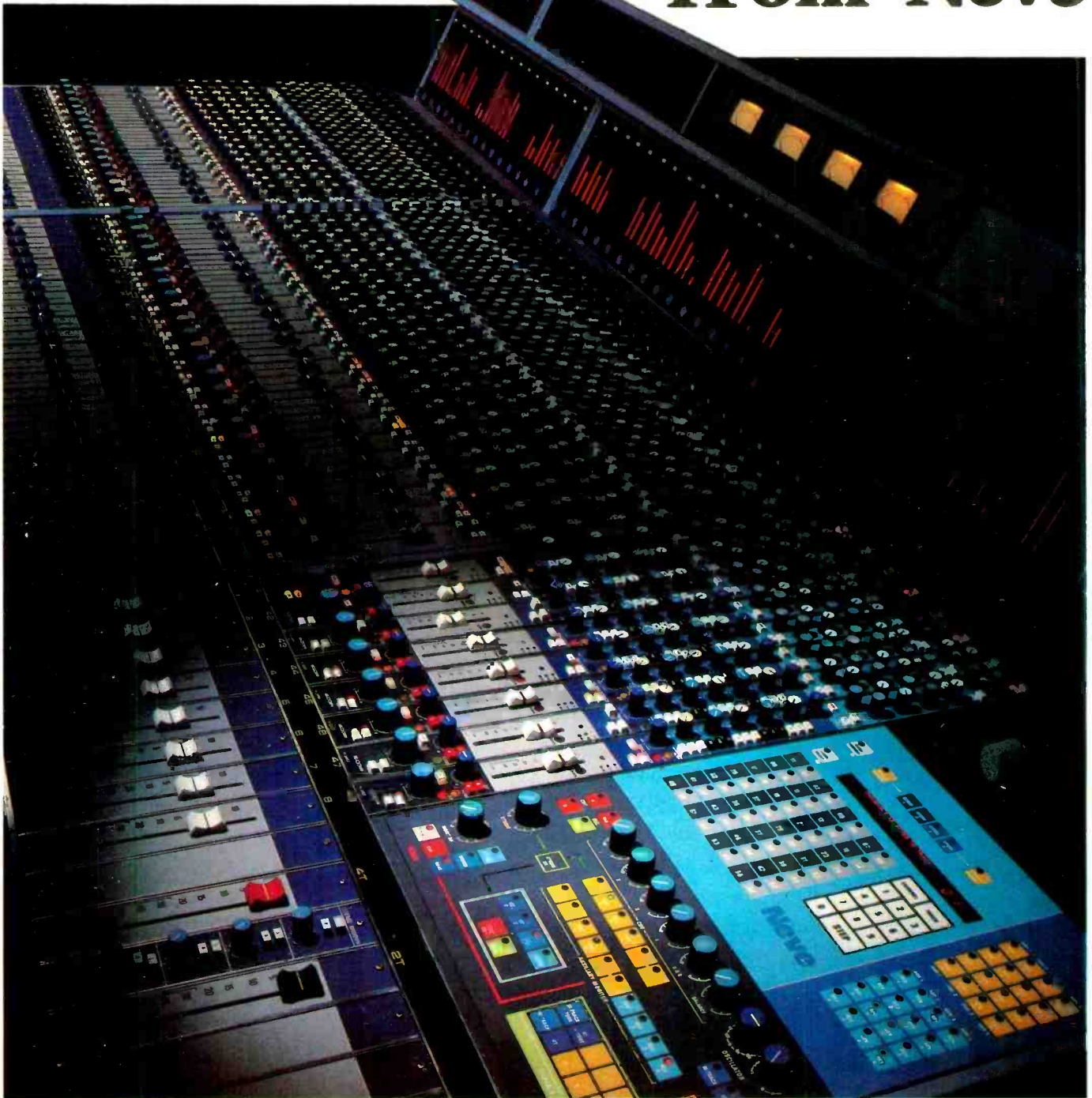
●**BTX:** *Model 4600* SMPTE tape controller—an audio controller and editing system for two, three or four audio or video recorders. ●**Burns**

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The 8108

another first from Neve



Our new 8108 console provides the optimum in Neve sound together with enhanced operational versatility using advanced signal routing techniques aided by a centralised control system.

- New Neve electronics throughout.
- New Sweep frequency 4 stage equaliser + 2 filters.
- Versatile mode switching with direct-to-mixdown facility.
- Logic display monitor panel.
- Assignment switcher with microprocessor central control.
- Switched insertion points.
- Unique interrogation system.
- Circuits in sub assemblies plug for efficient maintenance.
- 56 input 48 track or 48 input 32 track or 32 input 24 track—Sub fitted options.
- Optional output transformers, electrically balanced line inputs.
- VU, PPM, or Both at once.
- Audio track, VCA Sub Group or NECAM faders.

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

7533 Sunset Boulevard, Hollywood, California 90046 USA
USA. Tel: (213) 465-4822. **Rupert Neve GmbH** D-6100
Darmstadt, Bismarckstrasse 114, W. Germany. Tel: 6151-
87038 Telex: 419581. **Rupert Neve of Canada Limited**,
2721 Rena Road, Malton, Ontario L4T 3K1. Canada.
Tel: (416) 6677-6111. Telex: 21 06 9835 02.

AES preview

Eventide JJ193 digital delay line

Auditronics: range of ribbon, dynamic and condenser mics, plus studio monitor headphones and headphones for broadcast use.

●**CA Audio Systems:** improved *P Series* of the Cadac 'In-Line' series of consoles with full function flexibility and optional dc subgrouping, automation, and centralised routing.

●**California Switch & Signal:** no information received.

●**Canary:** range of consoles up to 16-track.

●**Canford Audio:** automatic cable tester; low noise battery mic pre-amp; telephone balance unit; studio ancillary equipment and EMO DI boxes.

●**Capitol Magnetic Products:** *Audiopak AA-3* broadcast cartridge; *Audiopak A-2* continuous loop broadcast cartridge; and *Type Q17* high output, low noise magnetic tape.

●**CB Electronics:** plug-in modular tape recorder electronics.

●**Cerwin-Vega:** range of monitor loudspeakers and amplifiers.

●**Cetec Gauss:** tape duplication system for a master and up to 20 slaves, plus Gauss loudspeaker drive units.

●**Cetec-Vega:** new *Model 80* and *81* hand-held radio mics, plus the company's established range of communication equipment.

●**Clear-Com:** intercom systems including the new *System II* remote stations and new *KB-124* duplex remote station.

●**Coherent Communications:** range of mini-production mixers, plus *Artech* radio mics and *Jensen* transformers.

●**Community Light & Sound:** range of high-level sound reinforcement equipment including the *PBL-90* cabinet. Also the *Z10D* range of radial horns.

●**Con Brio:** *ADS 100* digital music synthesiser.

●**Crest:** range of power amplifiers.

●**Crown International:** range of amplifiers including the *PSA-2* and *SA-2* self-analysing power amplifier. Also a new range of pressure zone mics, plus the *Badap 1* programmable audio measurement system from *Barclay Analytical*.

●**Cyber-sonics:** *DM2002* disc mastering lathe.

●**David Lint Associates:** *ITI P-1* 2-colour label printer and *L-1* cassette labeller; *QC-8/Q* quality control playback unit; and laminated sendust recording heads suitable for use with metal tapes.

●**dbx:** variety of noise reduction units and comp/limiters including the *Model 164*, a stereo version of the *Model 163*.

●**DeltaLab:** *DL-1* digital delay module; *DL-2 Acousticcomputer*; *DL-3* digital delay line; and *DL-4 Time Line*, a multi-function special effects delay line.

●**Design Electronics:** *Cuenix* studio foldback system.

●**Diacoustic Laboratory:** *Disc Decor* record storage unit.

●**Dolby Laboratories:** range of professional Dolby A noise reduction units, including the *NRU-10* unit for videotape recorders, and the *CP-200* for the reproduction of encoded stereo films. Also details of the Dolby FM system and the *HX* cassette headphone extension system.

●**Duncan:** *Series 400* conductive plastic faders.

●**Eastern Acoustic Works:** new *MS-50* studio monitor loudspeaker, plus the *MS-200* and *MS-300* monitors.

●**Edecor:** new *API0* multi-headphone amp and the *MA Series* of integrated mixer/power amplifiers with modular inputs and outputs.

●**Electro Sound:** tape and cassette duplicating equipment.

●**Electro-Voice:** full range of professional mic and loudspeaker systems, plus mixers and amplifiers from sister company *Tapco*.

●**Emilar:** new *ECS* ceramic driver, *EW15* lf driver for sound reinforcement applications, plus the *EAI75* hf



compression driver, *EH500* and *EH800* exponential horns, and *EX800* dividing network.

●**Eurotronic:** no information received.

●**Eventide:** *Model H949 Harmonizer*; range of plug-in realtime spectrum analysers for use with home computers; the *BD955* broadcast delay line; and the *RD770 Monstermat* mono/stereo broadcast matrix unit. Additionally, the *Instant Flanger* and *Omnipressor*; the *BPC-101* plug-in card which converts the *Instant Flanger* to an *Instant Phaser*; and the new *JJ193* and *CD254 DDL*'s.

●**Everything Audio:** details of studios the consultancy has designed and constructed, plus an *Amek Model 2500 36/24/24* automated console.

●**EXR:** *Model EX2* exciter plus the new *SPI* and the *BC1* bass clarifier.

●**Fulton Electronics:** monitor loudspeakers and a range of phono cartridges.

●**Furman Sound:** *RV-1* spring reverb system which includes a fast peak limiter, quasi-parametric midrange controls, a shelving control for treble adjustment, and independent wet and dry mix level controls. Also *TX-2* tunable crossover/bandpass filter; *PQ-3* parametric equaliser/pre-amplifier; and *PQ-6* stereo parametric eq/pre-amp.

●**Gotham Audio:** *Telefunken M15A* 32-track recorder; *TTM* 24-channel noise reduction frame and power supply unit; *EMT* reverb units, console components and test equipment; *Neumann* condenser mics; and other units from these manufacturers.

●**Grandy:** *Promix 1* adjustable multitrack head assembly with independent control of azimuth, zenith, tape height and wrap. Also replacement tape heads and a range of single crystal ferrite record heads for high speed duplicating.

●**Hammond Industries:** *Meteor Light & Sound* units including a small mixing console.

●**Harrison:** *Model 864 Autoset* microcomputer based control system; *4832C* and *3624 Series* automated consoles; and new *DCI* (Distributed Control Intelligence) *MR-1* digital/analogue hybrid console. Also *PPI* post-production console; an *Alive* console; and the new *Autoset II* automation programmer.

●**Heino Ilsemann:** *Type KZM3* automatic cassette loader and the *Type ETK-1* and *ETK-1S* cassette labelling machines.

●**HM Electronics:** wide range of radio mics and receivers including road-cases and accessories.

●**ITAM:** *Model 1610* 1in compact 16-track recorder with modular electronics and full function remote control; *Model 806* ½in 8-track recorder; and the *10-4* and *Model 882* mixers.

●**Infonics:** *200 Series* of tape duplicators including a high speed metal tape cassette duplicator.

●**Inovonics:** range of audio processing, recording and instrumentation equipment including the *Model 500* audio analyser; *Model 201* average/peak limiter; *Model 231* octave-band compressor; and the *MAP-II* broadcast audio processor.

●**Institute of Audio Research:** president Al Grundy and executive director Phil Stein will be available to give

details of the Institute's training programmes.

●**Interface Electronics:** range of mixers designed for recording, sound systems, theatres, stage monitoring and other applications. Available configurations range from 8/2 to 48/16 and features include wide range parametric equalisers.

●**International Audio:** *Alpha* high speed in-cassette copiers.

●**International Consoles:** new audio control console system.

●**International Sound:** no information received.

●**IRV Joel & Associates:** variety of equipment from several manufacturers plus the *JL-412* broadcast console.

●**Ivie Electronics:** *IE-17A* microprocessor controlled acoustics analyser and *IE-30A* spectrum analyser.

●**JBL:** complete range of studio monitor loudspeakers and the *7510* automatic mic mixer.

●**JVC:** *Series 90* digital recording system.

●**KEF Electronics:** range of monitor loudspeakers including the *Model 105*.

●**Keith Monks:** *EDC* radio mics; new semi-professional record cleaning machine; and a comprehensive range of ancillary studio equipment.

●**Kimball International:** *Bösendorfer* grand pianos and new *Kimball* professional grand pianos.

●**The Kind Horn:** range of PA loudspeaker horns.

●**King Instruments:** self-feed cassette loaders and various video tape loaders.

●**Klark-Teknik:** new *DN60* ½-octave realtime spectrum analyser; plus the *DN27* and *DN22* graphic equalisers; *DN70 DDL* and *DN71* controller; and the *DN34* and *DN36* analogue time processors. Also the *Statik Acoustic* range including the *SA30* electronic crossover; *SA20* dual reverb system; *SA10* octave equaliser; and *SA100* dynamic delay/flanger.

●**Klipsch:** range of monitor loudspeakers.

●**Lexicon:** *Model 224* digital reverb system; *Model 102-S* stereo delay system; *Model 92* and *Model 91* digital delay units; and the *Model 93 Prime Time* digital delay/processor/mixer.

●**3M:** 32-track digital mastering system; plus 4-track digital recorder; digital delay disc cutting preview unit; and digital editor. Also the *M79* 24-track recorder; *Wollensak* cassette duplicators; and *Scotch* audio tapes including *Scotch 265* digital mastering tape.

●**Magnefax:** range of high speed common mandrel ½in tape duplicators, automatic tape degaussers, and master tape loop bin/seven slave cassette tape duplicator.

●**Magnetic Tapes:** *Chilton* portable mixing desks and the *QM2* range of consoles.

●**Marshall:** new *Model 5402* time modulator; *Mini-Modulator* digitally programmed analogue delay unit; *5002A* time modulator; *5050* stereo effects expander; *HP400* expander; *P250* pre-reverb delay unit; and *P500* half-time variable delay unit.

●**Matthews Studio Equipment:** range of mic stands, booms and accessories.

●**MCI:** *JH600* console; *JH500C* console; *JH50* automation; *JH45* synchroniser; *JH24* tape recorder; and the *JH110 Series* recorders in various configurations. Also the *Autolock*



Like me, Statik's the smoothest operator in the business.

Strangely, it's what's missing from our SA20 Dual Reverberation System that makes it superior.

You'll find no driver-stage clipping or transducer saturation: thanks to an input limiter with frequency-dependent side chain.

You'll experience no output stage overload: the SA20's excellent headroom and equalisation effectively deal with spring resonances.

Our noise figure is remarkably low too, while the SA20's new spring arrays feature significantly reduced flutter.

The result is, quite simply, a more natural-sounding reverberation.

Like all Statik Acoustics products, the SA20 combines excellent specifications with a really competitive price tag.



SA20 Dual Reverberation System



statik

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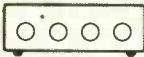
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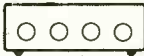
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AES preview

III and RTZ III locating devices. ●Meyer Sound Lab: range of studio monitor loudspeakers including the Swiss-produced ACD/Meyer reference monitor system. Also the new UM-1 UltraMonitor. ●MicMix: XL-305 reverb unit and the 265 Dynaflanger. New products to be shown are the XL-500 and XL-210 reverb units. ●Midas: PR System consoles in a variety of input/output configurations for sound reinforcement, on-stage monitoring, recording and production applications. Also new TR System modular theatre consoles available in 24, 30 and 36 into 8-8 formats. ●Music Technology: Crumar General Development System, a Z80 based computer controlled digital synthesiser. ●MXR: range of ancillary equipment including 31-band and dual 15-band graphic equalisers; the flanger/doubler; the digital delay; and the pitch transposer.

●Nady Systems: range of 'Nady Cordless' and 'Nasty Cordless' radio transmission systems. Also the recently introduced Nady VHF600 and VHF700 transmitter/receiver systems. ●Nagra: range of portable tape recorders in a number of configurations. ●NEAL-Ferroglyph: modular SP7 ¼ in tape recorder, available in a number of customised configurations. Also the Logic 7 and Studio 8 recorders; the RTS/2 and ATU/1 test instruments; and the NEAL range of cassette recorders. ●Neotek: Series I, II, III, IV and Theatre System range of consoles. ●Neutrik: Audiotracer 3201 audio analysis unit; AD-4 analogue delay line; and the company's range of connectors and modular in-line components.

●Neve: Model 8108 56/48 console with microprocessor controlled assignment facility. Features include channel to track routing memory; 4-band parametric eq; high and low-pass parametric filters; quad mixdown; 4-mono and one stereo aux send; in-line monitor facilities; programmable muting of inputs; and optional manual, VCA or Necam fader system. Also Lyrec TR532 24-track with ATC remote controller. ●New England Digital: no information received.

●Orange County: VS-1 Sressor and the PEQ parametric equaliser. Also the Stereo Processor, a self-contained signal processing system including peak limiter/compressor/expander/noise gate. ●Orban: Model 672A quasi-parametric equaliser; 526A single-channel de-esser; and an improved version of the 111B dual spring reverberation unit. Also the 245E stereo synthesiser; 418A stereo comp/limiter; and 622B parametric equaliser. ●Otari: MTR-90 2in, 16/24-track master recorder featuring symmetrical tape path and pinch-roller-free direct-drive capstan controlled by a phase-locked closed-loop servo system.

●Peavey: new EQ-27 graphic equaliser; SP-2 loudspeaker system which utilises a 15in Black Widow 1f driver; CS-800 power amplifier; and full range of loudspeakers, amplifiers and ancillary equipment. ●Penny & Giles: new digital fader with 8-bit digital output and the company's complete range of faders in various configurations, plus the QCPI quadraphonic joystick controller. ●Pentagon: range of cassette copiers including the Pro-Series and 1100 Series. Also cassette-to-cassette copiers including the new C-10. ●Pioneer: X-80 2-channel 16-bit PCM recorder; a 16-bit audio

laser disc system; and ribbon sendust tape heads. ●Professional Audio Systems: details of the company's monitor loudspeakers.

●Quad-Eight: MS-4024CX Coronado 40/40 console which includes the Compumix III automation system and has equalised automated echo returns, automated programmable muting and group solo features, and discrete amplifiers in the main signal path. Also the CL-22 comp/limiter which has a feed-forward VCA design, and the EQ-333 equaliser.

●Quantum Audio: mid-priced Gamma A modular 8-buss automated console, with separate stereo mixdown busses and 4-buss special effects. The main frame is available in 20/28/32-input configurations with or without patchbay. Also the QM-128 console.

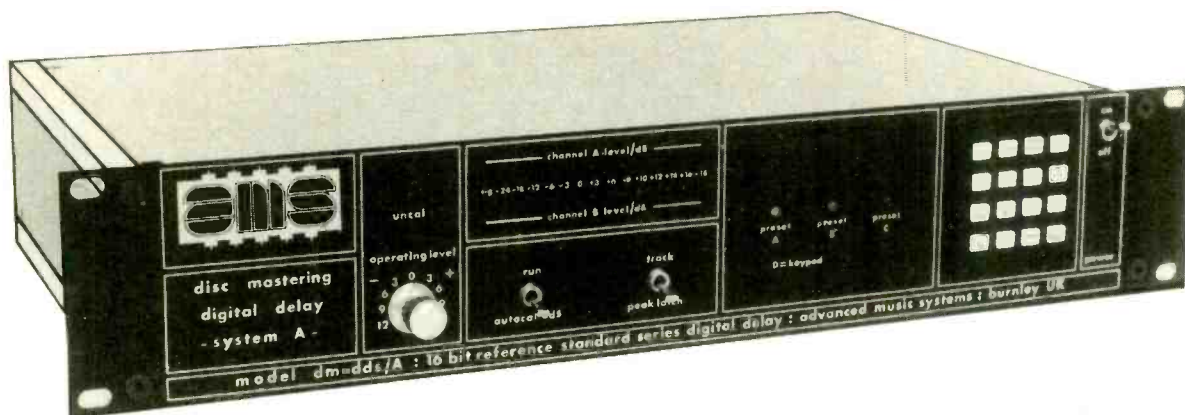
●Raindirk: Series III 28/24 console and the S2000 16-track console for studio, broadcast and sound reinforcement applications. ●Rank Strand Electric: modular Theatre Series and Concert Series consoles in various configurations for live and recording applications. Also examples from the company's range of theatre loudspeakers. ●Rauland-Borg: range of sound reinforcement equipment including several loudspeaker systems, together with the Model 3535 8-input mic mixer, and range of Spectrum Master equalisers. ●Renkus-Heinz: range of loudspeaker drivers, horns and passive cross-over networks. ●Rohde & Schwarz: range of audio test equipment. ●Roland: RSS Series of rack-mount signal processing units plus the RE Series of units. ●RTS Systems: range of intercom systems; a small battery-operated mixer; a phono pre-amplifier; audio distribution amplifiers; and dual-buffered amplifiers. Also the TW-1 telephone interface equipment.

●RWO/Fostex: wide range of studio monitor loudspeakers and drive units. ●SAE: new P-150 and P-300 power amplifiers; new EQ-4 parametric equaliser and new AC-3 active crossover. ●Saki Magnetics: range of hot pressed glass bonded ferrite heads including new heads for in-cassette duplicators and high speed metal tape duplicators. ●Salty Dog Recording Studios: information on a line-level transformerless mic studio design concept. ●Sansui: wide range of audio units including power amplifiers. ●Selco Products: range of nylon collet and push-on style knobs and accessories in a wide variety of shapes and sizes. Also VU and PPM meters. ●Sennheiser: new radio mic transmitter/receiver equipment using the company's HiDyn compander system to increase dynamic range. Also the company's range of mics and headphones. ●Sescom: expanded range of audio modules and transformers; and a new range of electronic products including a 3-band parametric equaliser, 10-band graphic equaliser, and 4-channel mic-mixer; plus several new 3-way splitter boxes. ●Shure: SM81 cardioid condenser mic; SC39 Series phono cartridges; and Pro Master sound system; plus the company's range of dynamic mics. ●Sierra Audio: details of the Sierra/Hidley facilities which have been designed and constructed over the past year and information on the company's consultation services and monitor systems. ●Sifam: wide range of VU and PPM meters, control knobs, switches and transformers. ●Solid State Logic: SL-4000 E Series automated console and SSL studio computer system, including several new hardware and software extensions, and a Total Recall option using a satellite computer to store and recall each control setting of the

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AES preview

console's I/O modules. ●**Sontec**: *Compudisc* digital control system for Neumann and Scully lathes; plus the *DTC-400* disc transfer console; *DRC-400* dynamic range controllers; and a range of equalisers. ●**Sony**: wide range of digital audio units including the *PCM-1600* 2-channel, 16-bit digital audio processor for recording PCM audio onto Sony *BVU-200A U-Matic* video cassette recorders. Also the *DEC-1000* digital editing controller; *DXR-2000* digital reverb; *DSX-87* digital sampling rate converter; and the *PCM-3224* 24-track, 1in digital recorder. ●**Soundcraft**: range of consoles and multitrack tape recorders. Tape recorders comprise the *SCM-381-8* 8-track and *SCM-381-16* 16-track, while consoles include the *Series 400*, *Series 1S*, *Series 1624* and the *Series 3B* automated console in 16/24/32-track configurations. ●**Sound Ideas Recording Studio**: no information received. ●**Soundstream**: digital audio recording system. ●**Sound Technology**: *Model 1500A* microprocessor based automatic tape recorder test instrument. Also *Model 1710A*, *Model 1700B* and *Model 1701A* distortion measurement systems. ●**Sound Workshop**: *1600 Series* console; *1280 Series* console; the *421* broadcast mixer; *242* and *262* stereo reverb systems; and *Super-Group* which extends the grouping capability of the *ARMS* automation system. ●**Spectra Sonics**: *Model 1024-24B* console; new *3000B* and *3085B* loudspeakers; new assisted resonance system for sound reinforcement; and new pre-amplifier and phono pre-amplifier. Also **Spectra Sound** *1000B* 10-band graphic equaliser, *4000* flanger, *4010* phase shifter, and *4020* delay line. ●**Stanton**: new *Model 310* phono pre-amplifier/equaliser and *Dynaphase 55* headphones. Also the *500 Series*, *680 Series*, *681 Series* and *881S Series* phono cartridges. ●**Stephens Electronics**: *821B* range of tape recorders featuring capstan-less and pinch roller-free drive. Models on show will include a 40-track, 2in machine, and a 24-track portable machine. Also the *Q-II* autolocator and other accessories. ●**Studer**: *A800* and *A80VU* multitrack recorders; *TLS 2000* SMPTE sync/edit system; 20-memory autolocator; remote control unit for the *A80VU*; *A80* disc cutting preview machine for use with the Neumann *VMS-80*; and the **Revox** range. Also the *Model 369 32/4* console; *Model 069 OB* console; package stereo local radio console; telephone hybrid; and stereo balancing unit. ●**Swintek**: *Q-dB-S* pocket receiver for radio mics; range of radio mic systems; hand-held lavalier cordless mics with multiple diversity antennae; and *MK200* communicator. ●**Synergetic Audio Concepts**: pressure zone microphones and details of time-energy-frequency measurement systems. ●**Synton**: *Syntovox 222* vocoder, a simplified version of the *Syntovox 221* effects vocoder; *Syntovox 202* vocoder designed for guitar players; and *Syntovox 232* 16-channel vocoder with a voltage controlled filter bank. ●**TAD (Technical Audio Devices)**: new 12in mid-bass loudspeaker drive unit capable of handling 300W. Also the company's beryllium diaphragm compression drivers. ●**Taber**: *Taberaser* bulk tape erasing unit and a range of reconditioned and replacement tape heads. ●**Tangent**: *Model 3216* console available in 16/24/32-channel formats. ●**Tannoy**: *Bucking-*

ham 3-way monitor loudspeaker system; *Classic Dual Monitor* and *Super Red* loudspeakers; new small dual-concentric *Super Red* monitors; and the company's hybrid passive/active crossover with time compensated circuitry and parametric equalisation for the low frequency section. ●**Teac**: comprehensive range of units from the *Tascam Series* including consoles, tape recorders and accessories. ●**Technics**: *SP-02* direct drive motor and drive electronics for a disc cutting turntable, plug-in compatible with Neumann lathes. Also turntable console for recording and broadcast use; professional PCM recording system; digital audio disc system; and *SP-15* and *SP-25* studio turntables. ●**Tektronix**: *TM500* range of audio test equipment. ●**Telex Communications**: range of headsets, intercoms, and cassette duplicators. ●**Tentel**: range of *Tentelometer* tape tension gauges for professional tape recorders. ●**Toa**: modular pre-amplifier/mixer system from the *VMS-2000 Series* designed for commercial and professional applications. Also the company's range of amplifiers, signal generators, power supply units, equalisers, monitors, meter units, filters, loudspeakers and accessories. ●**Trident**: *Series 80* modular console; *TSM Series* console available in 32/24 or 40/32 configurations; and *Fleximix* modular console system expandable to 24-track. Also the rack-mount parametric equaliser/filter and stereo limiter/compressor. ●**Unicord**: *Korg PS-3100* polyphonic synthesiser; *KP-30* synthesiser; *ES-50* polyphonic ensemble; *PS-300* polyphonic synthesiser; *VC-10* vocoder; *SE-500* tape echo with noise reduction; and *X-911* guitar synthesiser. ●**Urei**: wide range of signal processing units including the *Model 562* feedback suppressor; *Model 533* (single) and *Model 535* (dual) 10-band octave graphic equalisers; and the *Model 811* single-duplex and *Model 815* super woofer time aligned loudspeaker systems. ●**Ursa Major**: new *8X32* digital reverb system and the *SST-282 Space Station* digital reverberation system comprising a digital delay line and digital reverberation synthesiser. ●**Valley People**: *Trans Amp LZ* transformerless mic pre-amplifier. ●**Westlake Audio**: details of the consultancy's recent studio projects and its studio monitor systems. ●**Westrex**: disc mastering system featuring the *3DIIAH* recorder, *RA-1700* amplifiers and new *RA-1702A* power driver amplifiers. The lathe is equipped with Capps vari-pitch and depth, auto banding and the new *RA-1716* crystal controlled, dc servo turntable drive for Scully lathes. Also the new 3.5ft long *RA-1558B* light bar meter. ●**White Instruments**: *System 200* microprocessor controlled realtime analyser; plus numerous active and passive equalisers. ●**Wireworks**: range of hard-wired mic cables and multicables together with a number of audio accessories. ●**Xedit**: drift and flutter meter plus splicing blocks and a film strip pulser/converter. ●**Yamaha**: wide range of audio products including the *PM-2000* console available in 24 or 32-input channel configurations. ●**Zumaudio**: Zuma disc mastering computer system designed to accompany Neumann *VMS-66* and *VMS-70* lathes. ●**Studio Sound**: editor Angus Robertson will be attending the exhibition together with Phil Guy who will be available to meet advertisers. Additionally, Richard Elen, editor of our sister magazine *Sound International*, will also be in attendance. ■

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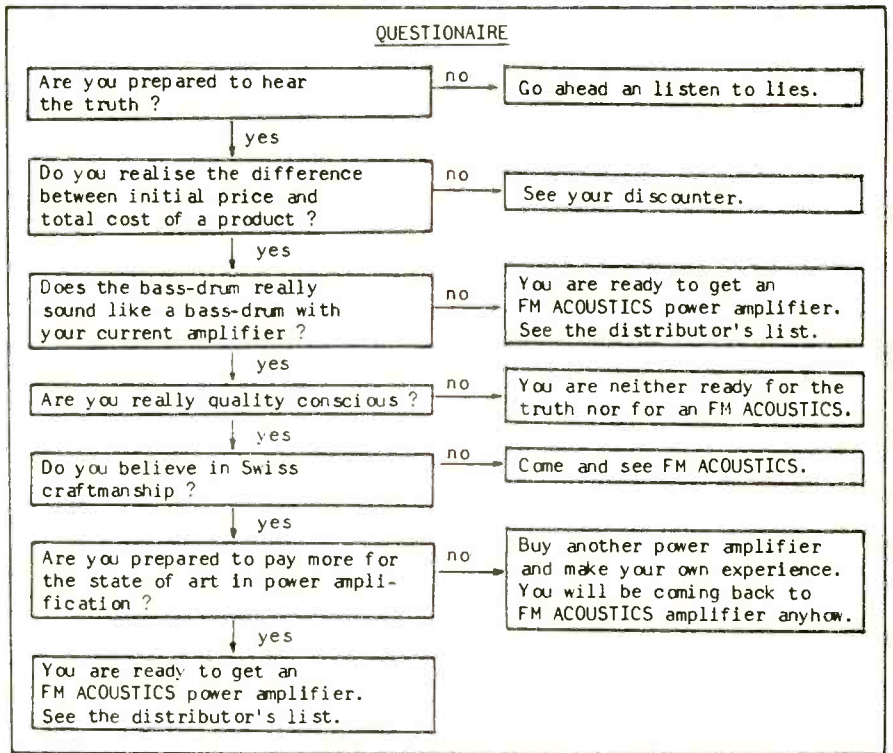
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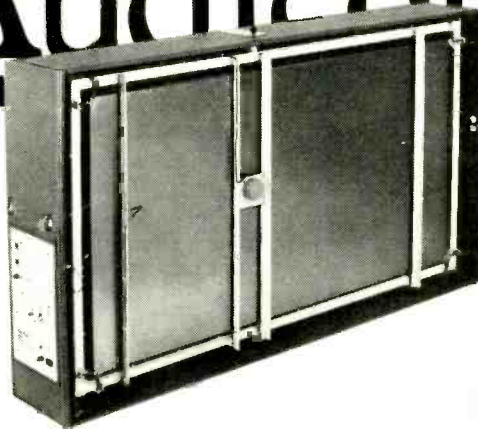
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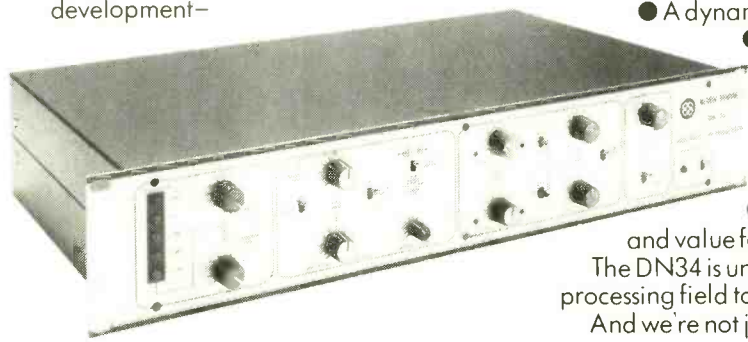
The Klark-Teknik DN34 analogue time processor also offers you:—

- A dynamic range better than 90dB.
- A time sweep range of 70:1.
- T.H.D. at less than 0.3%.
- Numerous exclusive features including full 'on board' mixing and phase reversal facilities.
- Amazing performance

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The DN34 is unequalled in the signal processing field today.

And we're not just saying that for effect.



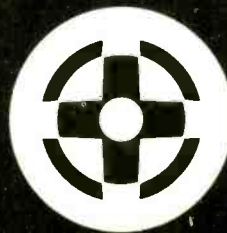
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WITH A LARGE stock of some 2,500 commercials, TBS Radio Station transmits about 900 each day, with 200 being replaced every week. Recently there has been a striking trend in shortening in the length of commercials and the frequency of their replacement and this trend has further increased the stock.

Exhaustive checks are required to transmit such large numbers of commercials without mistakes and expansion of stock inevitably increases handling operations.

In view of this, the development of an on-line system capable of handling all different procedures from commercial traffic to automatic transmission was much needed for a long time. In the case of radio commercials, there was no equipment capable of handling both information and material in an integrated system and they had to be separately controlled.

In 1973 a careful study and consideration on 'a desired system covering commercial traffic—transmission' resulted in a conclusion that a future filing device should be capable of not just storing commercials (the very basic function) but of transmitting them with both information and material in linkage. It was considered that the possibility of developing such a

Tokyo Broadcasting System Inc (TBS) has developed and put into practical use an on-line radio broadcasting commercials automatic transmission system, in which a massive volume of AD converted commercials are stored in magnetic disc memory, and picked up and replayed whenever necessary. The system utilises the high speed random access capability of magnetic disc and therefore is capable of multiplex processing as well as audio editing. The system can be applied not only to the handling of commercials, but also to the diverse fields of audio filing.

device would lie in the field of CPU processing connected with PCM coding.

In those days the project was thought too costly; however the TBS team believed that the project was in line with a right direction of technological innovation and continued its efforts in this connection with an unshakable conviction that the project would certainly be materialised before long.

In the autumn of 1975, in view of the development in PCM technology and the decrease in cost of bits resulting from enlarged magnetic discs, TBS launched into development of the Digital Audio File System in co-operation with both Matsushita Communication Industrial Co Ltd and Matsushita Electric Industrial Co Ltd.

In the autumn of 1976 a system called DPCM-AQ (Adaptive Quan-

tiser Differential Pulse Code Modulation) in which 12-bit PCM data was compressed to 8 bits was developed, and test equipment with this system manufactured and made public. Based on the performance and evaluation of this test equipment, it was further improved for commercial use. In June 1978 the device began to be operated on line and its operation very favourably received. It is planned that commercials will be transmitted through on-line real time processing beginning from April 1980.

The System

Digital Audio File is the on-line commercial automatic transmission system in which a number of audio signals are converted into digital signals, stored in large magnetic discs, and transmitted automatic-

ally on reception of transmission commands. Table 1 shows specifications of the system.

Table 1. Specifications of the System

Frequency bandwidth: 50Hz to 9kHz, -3dB.
Sampling frequency: 20kHz.
Number of bit words: 8-bit words (DPCM-AQ coding system).
S/N: better than 55dB (1kHz standard input level).
Dynamic range: 73dB (1kHz).
Maximum audio file capacity: 19,656s (2 spindles/1 disc unit).
Maximum audio file length in one segment: less than 195 seconds.
Access time: about 0.2s.
Audio input level: -24dBs to +4dBs, 10kΩ.
Playback: normal or twice normal speed (switchable).
Audio output level: +4dBm, 600Ω.
Line monitor: built-in, 1W speaker; external, +4dBm, 600Ω; jack +4dB, 10kΩ.

As the system makes use of the high speed random access capability of magnetic discs, its function is not limited to transmission of commercials and fillers alone, but it also works as a sort of announcing machine through combination of words. So long as traffic operations are carried out properly, the system guarantees the correct automatic transmission with no

Fig. 3



rehearsal needed for check-up. Furthermore, the data certifies the transmission of commercials.

The Audio File System, as shown in the system configuration in Fig 1 consists of two sections, the Audio File section responsible for audio input and output, and the Process Control section for information processing and operation control.

The Audio File section is an audio processing unit with a PFL16A microcomputer as central processor. The audio signals of commercials are converted into digital signals through 12-bit PCM coding and kept in store after being reduced into 8-bits through the DPCM-AQ coding system. Magnetic computer discs (FACOM 479B2 Model 400MB) are used for storing the digitised audio.

One magnetic disc unit (two spindles) is capable of storing about 1,000 commercials, each being 20s on average, and up to four magnetic discs can be connected.

Input and output of audio signals are extensible up to four systems, each independently performing input and output operation not being affected by others

and output is switchable up to twice normal speed.

Upon reception of transmission commands, the Audio File section searches for specified commercials through random access, and begins to output audio in 0.2s on the average.

The Audio File section has dual systems, one used for on-line transmission and the other for recording, deleting and rehearsing commercials. If one system breaks down, the other can take over the function. A photo-tape reader is used for loading the system programme and a typewriter for controlling the console. These machines are jointly used by the two systems through switchover when necessary.

The Process Control section is a general purpose computer system with a mini computer PFU-300, fig 2. As host computer to Audio File section, the Process Control section commands Audio File section with the commercial code number (7-digit) on input and output of audio signals, data inquiry, deletion and so on. The PFU-300 with a 20M Byte magnetic

disc can store commercial scheduling data for a week-long broadcasting and this is generated in a form of floppy disc through a commercial traffic system operating on a large computer (IBM S/370) which is employed for overall accounting operations of TBS Inc. The floppy disc is read to prepare necessary data file. The state of commercial scheduling is shown in colour display and changes in order, rehearsal and/or deletion of commercials can be made, when necessary, through a monochrome display terminal with keyboard.

Commercial transmission is controlled by start trigger either from studio or the automatic programming system. As for commercials already broadcast, the system automatically produces records confirming transmission together with the time of broadcasting, edits them ready for producing final bills for clients, and feedbacks the IBM S/370 through floppy disc. Of the two mini computers, one is used mainly for recording, deleting and checking commercials, and the other for recording and processing commercials to make them ready for use by the persons responsible for the due programmes. Both can easily be operated under the commands of floppy disc data output from S/370 in a conversational mode with the CRT display. Fig 3 shows two engineers operating the computers.

The Audio File System is linked with transmission units in both the radio centre and studio by Process Control section which is responsible for input and output of commercial data, indication and control.

With Audio File section treated as a sort of terminal, the Audio File System has the following advantages: 1) it is capable of having two systems including back-up system, and 2) with extensibility and flexibility of the whole system, alterations in operation mode can be coped with by simply changing software in the Process Control section while the Audio File section remains unchanged. Coupling between the two sections is carried

out through modem.

Audio signal processing

We have made subjective evaluations on PCM coding, supposing that the commercial tape supplied is $\frac{1}{4}$ in open-reel. Judging from the audio quality and the number of bits, parameters have been selected as 12-bits non-linear quantiser and 20kHz as the sampling frequency.

As linear quantising pulse code modulation will not provide high efficiency, we examined several compression and expansion systems which are generally adopted for saving bits. They are:

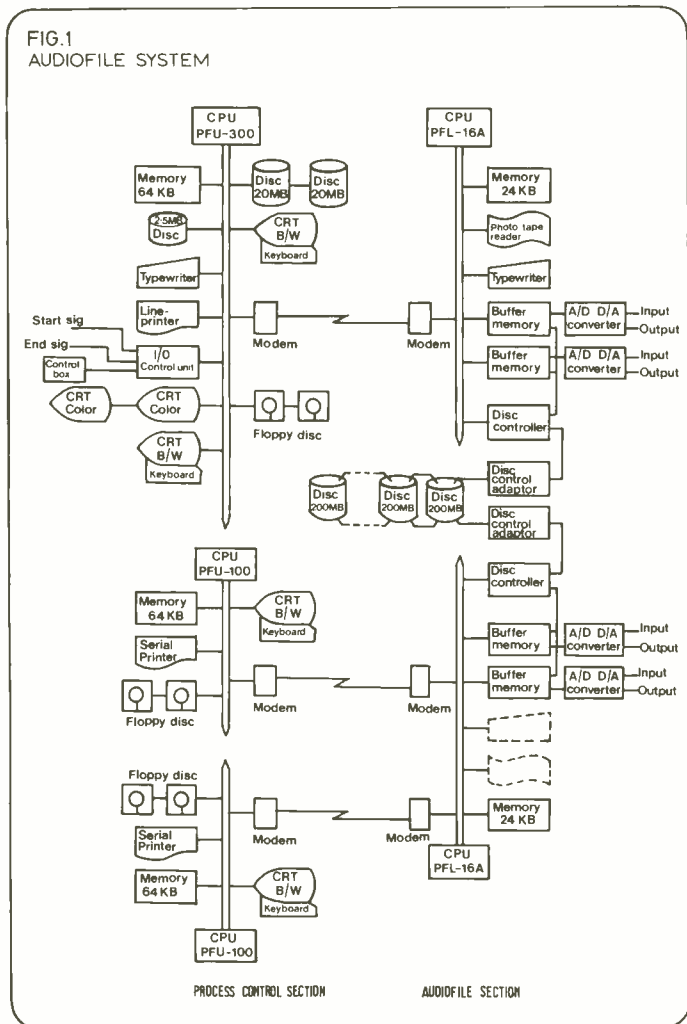
- 1) Non-linear quantiser pulse code modulation
- 2) Differential pulse code modulation (DPCM)
- 3) Adaptive quantiser differential pulse code modulation (DPCM-AQ)

Non-linear quantiser PCM is used for PCM recorders and adopts circuits with characteristics of 15 or 13 polygonal line so that amplitudes with high probability are quantised in smaller intervals and those with low probability are quantised in larger intervals. This system requires full matching of the compressor and the expander.

DPCM estimates a sample value based on the sample value of the preceding signal, and quantises only the estimated error which is derived as the difference of the estimated sample value and the real sample value. Thus, quantised sample value is coded and transmitted and transmission volume can be minimised if the estimated value is appropriate. In the case of audio, the estimation of repetitiveness is generally believed to be difficult and not so effective. However, even if a sample value of the preceding signal is picked up as the estimated advance sound value, it results in reduced number of bits in comparison with linear quantiser PCM system.

DPCM-AQ utilises the change in quantiser characteristics based on the signal statistic.

The signal quantiser noise ratios



Audiofile

obtained in our examination are shown in fig 6. As the result of subjective estimation and fig 6, we adopted a DPCM-AQ system in terms of the minimum number of bits and superior signal quantiser noise ratio.

Audio signal processing section

This section converts audio input signals into PCM signals, writes them into magnetic discs and transmits necessary material instantaneously upon receipt of an external control signal, fig 4.

The bandwidth of input signals is limited by the 11th-order Tchebycheff low pass filter (LPF) with 9kHz cut-off frequency to reject the generation of folded noise. The audio input signals passed through the LPF, through the Sample Hold circuit (SH) to give the 20kHz sampling frequency and converted into 12-bit linear quantiser PCM signals by the A/D converter.

First, one block (256 samples) is delayed while the maximum bit of DPCM signals within the block is used to compress DPCM signals into 8-bit signals. These compressed signals and the quantiser step are multiplexed and sent to the buffer memory, fig 5. As the A/D

converter outputs in two's complement, the input signal is first converted into folded binary which is easier to process.

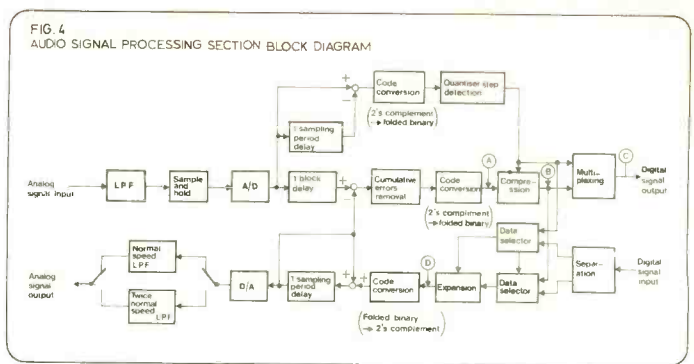
In the process of cumulative errors removal, abrupt level change caused by a signal interruption is moderated by automatic data complementation which gradually lowers the level to zero to prevent noise generation.

Digital signals from the buffer memory are converted into analogue signals by first separating quantiser step data and then adding it to the sample value of the preceding signal to convert it into 12-bit linear quantiser PCM data. Analogue signals decoded by the D/A converter are output through LPF as audio signals. The twice normal speed LPF makes the clock signal speed for sampling frequency two times faster to halve playback time.

Fig 6 shows S/N ratios at various input signal levels. The characteristics of DPCM-AQ is that the S/N ratio of a sine wave at 1kHz is the same as that of linear quantiser PCM because the digital compression is carried out after the 12-bit linear quantising, and the ratio is approximately 55dB at 1kHz.

Buffer memory

Data from the audio signal processing section is temporarily stored in the buffer memory which is



composed of two sets of 26Kbyte IC RAM. Each 26Kbyte memory can store 1.3s audio data and the access time of the magnetic disc is approximately 0.1s; however if two retry operations are allowed for an error code, this 26Kbyte buffer can completely guarantee the operations of up to four converters.

Table 2. Magnetic Disc Pack Drive Unit Specifications

Disc pack capacity: 200,036,560 bytes per spindle, 13,030 bytes per track, 19 tracks per cylinder, 808 + 7 (alternative) cylinders per disc pack.
Positioning time: mean 25ms, maximum 45ms, minimum 6ms.
Rotational delay: 8.4ms (average).
Data transfer rate: 806K byte per sec.

independently of each other. Disc packs can also be replaced independently on these spindles. The magnetic disc pack control adapter performs serial and/or parallel conversion of read and/or write data, generates the error checking and correction (ECC) code, and detects read errors. A single magnetic disc pack control adapter controls up to four (eight spindles) of magnetic disc pack drive units, fig 7.

Data transfer

As magnetic discs record data in concentric circle, data reading and writing cannot be carried out while the head is moving to another track (seek time) and while the track head is moving to the specified position (rotational delay time). Therefore, when recording a series of signals such as commercials data discontinuity may happen.

Further, while the magnetic disc drive units can transfer data at a high rate of 806Kbytes/s, the A/D

Magnetic disc drives

The specifications of the magnetic disc pack drive unit are shown in Table 2. A single magnetic disc pack drive unit contains two spindles which share the power supply and blower but operate

FIG. 5 DPCM-AQ CODE CONVERSION

	Absolute Value of the Maximum Values (7 bits or more)	
Difference Signal (12 bits) FIG. 4 (A)	1 0 0 0 0 1 0 0 1 1 1 0 1 0 0 0 0 1 0 0 1 1 1 1 0 0 0 1 0 1 0 1 1 1 0 1 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1 0 0 0 1 1 0 1	1 block 256 samples
Compressor Output (8 bits) FIG. 4 (B)	1 0 0 1 0 1 0 0 1 0 0 0 1 0 1 0 0 1 0 1 0 1 1 1 0 0 0 0 0 1 0 1 0 0 1 0 0 0 1 1	
Transmission Code FIG. 4 (C)	1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 1 0 1 0 0 1 0 0 0 1 0 1 0 0 1 0 1 0 1 1 1 0 0 0 0 0 1 0 1 0 0 1 0 0 0 1 1	← Marker ← Range data (This example shows 2-bit data is shifted) 1 block (256 samples)
Decoder Difference Signal (12 bits) FIG. 4 (D)	1 0 0 0 0 1 0 1 0 0 0 0 1 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0 0 1 1 0 0	1 block (256 samples)

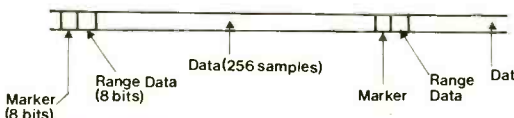
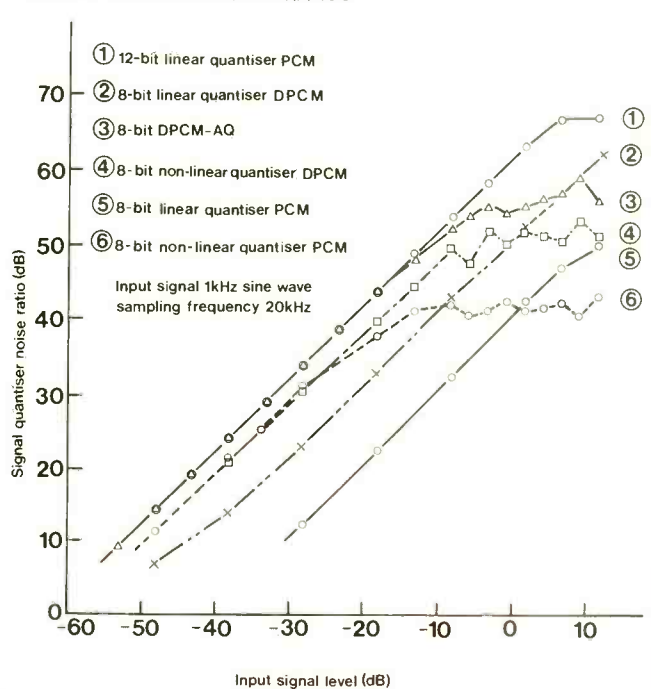


FIG. 6 SIGNAL QUANTISER NOISE RATIOS



SAVE MONEY SAVE TIME

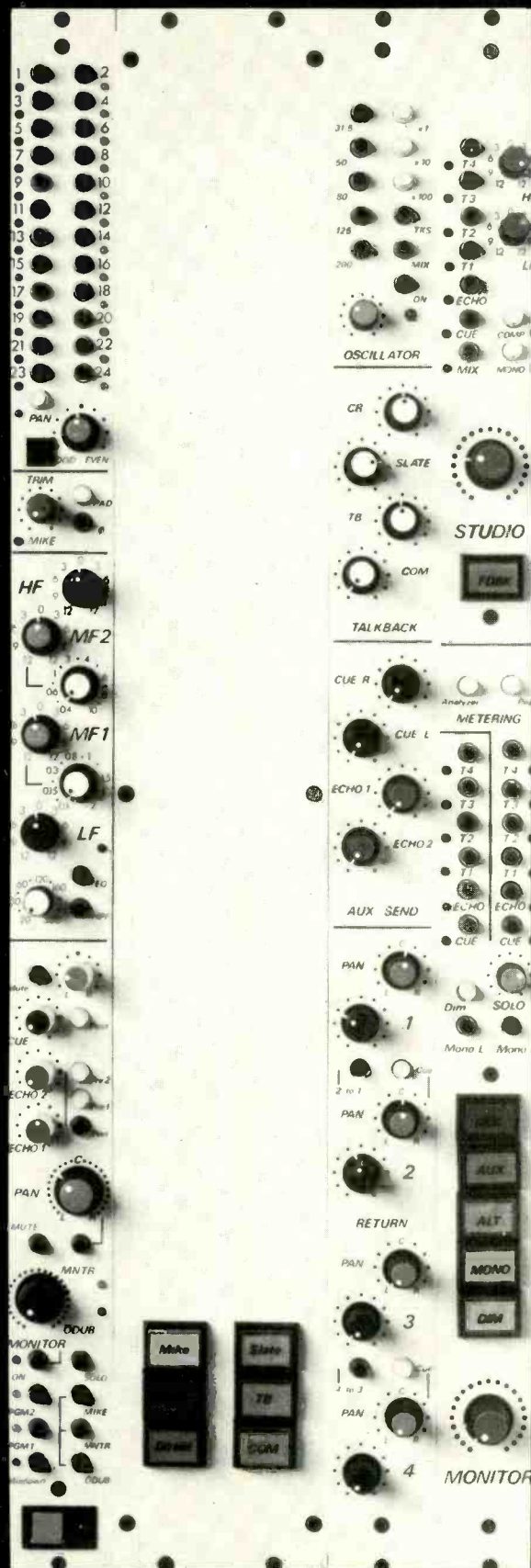
WHAT IS OPTIONAL FOR THE OTHERS IS FOR US A MATTER OF COURSE

- * From 16 to 52 in/out channels
- * 24 channel busses including panning
- * 4 band parametric equalizer
- * Continuously variable Hipass filter
- * Up to 28 sends as standard
- * 3 different channel mute grouping
- * Momentary short travel mute switches
- * All solo facilities including «Solo in place» either in monitor or in remix mode
- * 3 master status logically reversible on each channel
- * 28 light meters either vu or PPM and phasemeter as standard
- * 28 Iso frequency third octave analyzer
- * PLUS 30, RS64 automation with separate mute and level encoding using one 6502 microprocessor per channel
- * High quality and high performance components
- * Tough, reliable and attractively designed

PLUS 30

37, rue de ANNELETS
PARIS. 75019.

Tel: 202 5869 202 2102



Audiofile

converter can only convert audio signals at 20Kbytes/s. In order to solve these problems, the magnetic disc pack drive unit is equipped with two sets of buffer memory so that while external signals are inputting into one buffer memory at a low speed the contents of the other buffer memory can be transferred at a high speed. These operations are switched over alternately between the two buffer memories and the procedure called data chaining.

In the case of audio recording, audio input signals are processed by the A/D converter and the

bandwidth compressor and stored in the buffer memory 1, fig 8a. When the buffer memory 1 is filled, the switch is alternated and input signals start to be stored in the buffer memory 2, fig 8b.

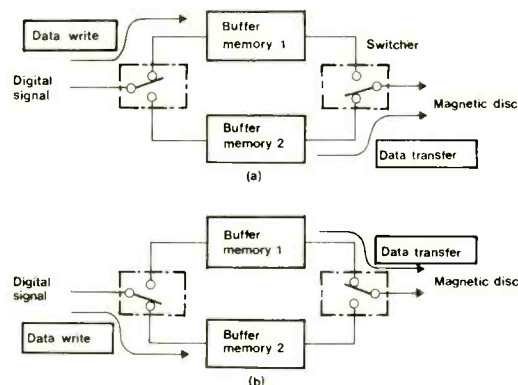
During these operations, the magnetic disc pack drive unit completes head movement or head switching, and when buffer memory 1 is filled, its contents (26Kbytes) can be transferred onto two tracks of a magnetic disc at a speed of 806Kbytes/s. Thereafter, every time a buffer memory is filled, these operations or data chaining is repeated on the two buffer memories.

In the case of playback, the reverse procedure occurs. Data in the magnetic discs are transferred to buffer memory 1 at a high speed and upon completion of the transfer, the contents of buffer memory 1 start to be output to the decoder while the switch is alternated to buffer memory 2 and the magnetic disc head moved or switched to transfer the next data to buffer memory 1, and so on.

Error code detection and correction

The magnetic disc pack drive unit has a function to locate the positions where read errors occur and to correct errors by using

FIG 8
DATA FLOW IN RECORDING



check codes given for individual areas in a record.

These error checking and correction (ECC) codes are called fire codes, can correct burst errors of 11 bits and less, and fully detect burst errors of more than 22 bits. If an error is not recovered by the fire code, the read operation is retried. If it still fails, the read operation is repeated twice.

Summary

Development of digital technology equipment has been rapidly pro-

gressing and the capacities and recording densities of magnetic discs continue to increase, leading to less expensive magnetic disc drive units. For the time being, with their cheapest bit cost, magnetic disc units will be the major force of mass memories. In the near future when mass memories without rotors (such as those adopting super large scale integration or magnetic bubble technology) are commercially available, the sizes of magnetic disc units will be further minimised.



Fig. 7

APRS 80 JUNE 18 19 & 20

INTERNATIONAL PROFESSIONAL RECORDING EQUIPMENT

EXHIBITION

CONNAUGHT ROOMS, GT. QUEEN ST., KINGSWAY, LONDON

Advanced Music Systems
Audio Developments
Audio & Design
AKG Equipment
Auxix
Allen & Heath
Ampex
Alice (Stancoil)
Agfa-Gevaert
Amek
Atlantex Music
Audio Kinetics
Avcom Systems
F.V.O. Bauch
BASF
B & K Labs
Beyer Dynamic
R. Barth
Brodr Jorgenson
Calrec Audio
Cetec International
Covemain
CB Electronics
Court Acoustics
Clive E Green

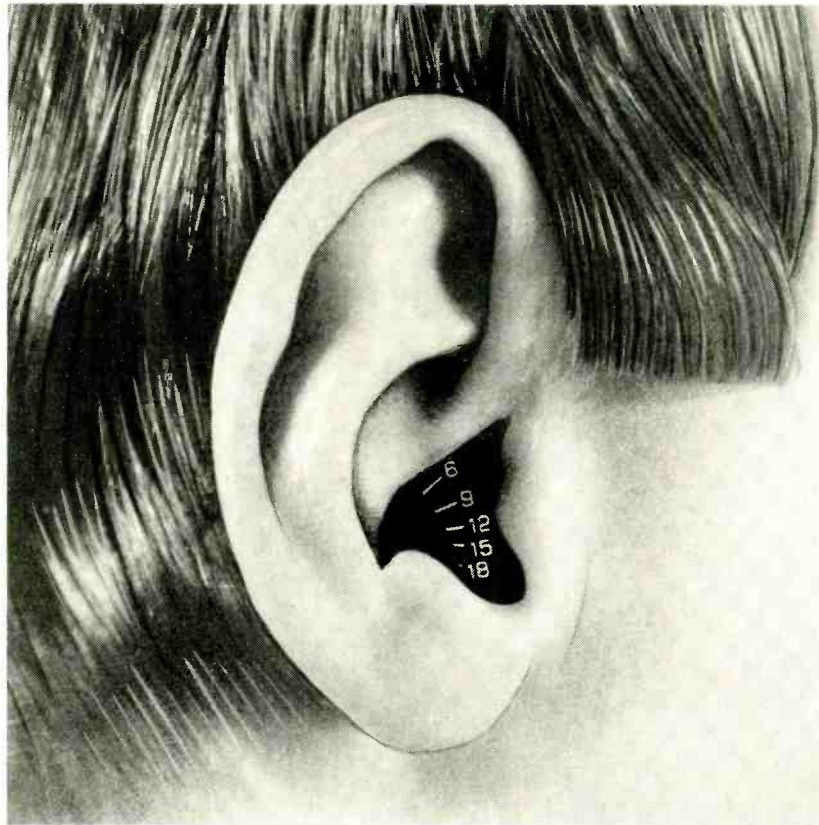
Canford Audio
Cassette Dup. Supplies
Capital Components
C.A. Audio
Dolby Labs
Design Electronics
Don Larkin Audio
EMI Tape
Eardley Electronics
Enertec Schlumberger
Future Film
Feldon Audio
Fraser-Peacock
Fitch Tape
Formula Sound
FM Acoustics
Gulton Europe (Electro-Voice)
H/H Electronic
Hayden Labs
Harman Audio
HHB Hire & Sales
Industrial Tapes
International Musician
Jackson Rec. Studios

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John Page
Klark-Teknik
Keith Monks
Lennard Developments
Lockwood
Leevers-Rich
Lee Engineering
Lyrec
Leeholme Audio
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Magnetic Tapes
Midas Audio
MCI
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Mosses & Mitchell
Malcolm Hill
Music Laboratory
Neve Electronics
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Philip Drake

Racal-Zonal
Recording Studio Design
Raindirk
Shure Electronics
"Studio Sound"
Scenic Sounds
Soundcraft
Sifam
Soundex
SES Studio Equipment
Sony (UK)
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Wayne Kerr (Wilmot Breeden)
Walter Luther

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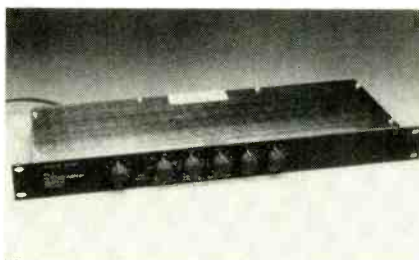
One of our best customers



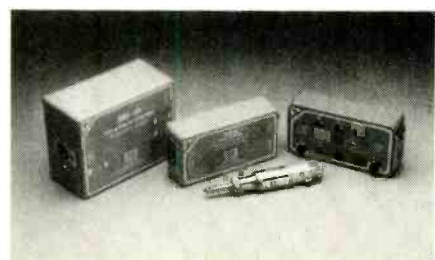
Atlantex products are designed to satisfy the calibrated earhole syndrome



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.

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Hertfordshire SG5 1LA.
Telephone 0462 31511
Telex 826967

Aphex Audio products are known and respected throughout the world for reliability and superb specifications. Here are five such products for the 1980's, each designed to give you a better sound.

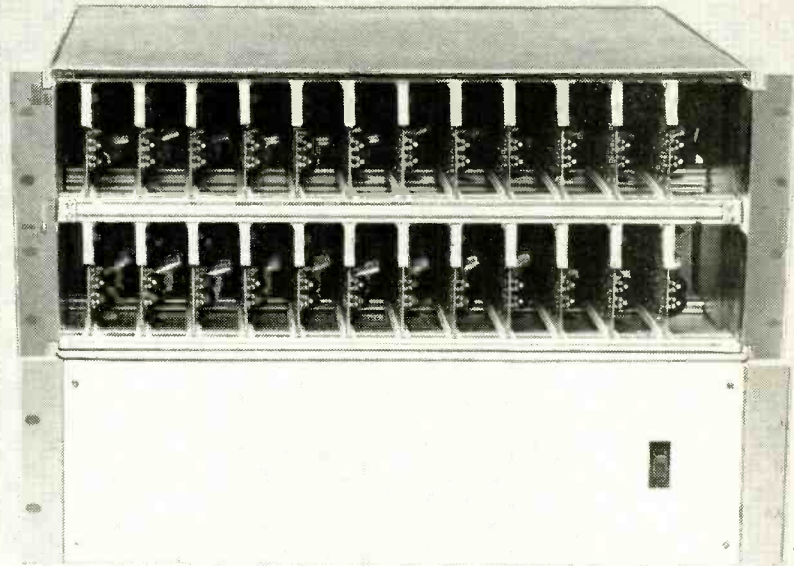
Aphex

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.



If you want full details on these products please contact any of the worldwide Aphex companies.

Aphex Audio Systems UK Ltd
35 Britannia Row
London N1 8QH England
Telephone: 01-359 5275/0955
Telex: 268279

APHEX SYSTEMS LTD.
 7801 Melrose Avenue,
 Los Angeles,
 California 90046
 Tel: (213) 655-1411
 TWX: 910-321-5762

APHEX AUDIO SYSTEMS AUSTRALIA, PTY. LTD.
 (Sydney) Tel: 212-4920
 TLX: (790) AA24035

APHEX BENELUX
 (Brussels) Tel: (02) 345.44.44
 TLX: (846) 26409 (TEMBEL B)

APHEX BRAZIL
 (Rio de Janeiro) Tel: 266-5117
 TLX: (391) 1121008 (NPSPC BR)

APHEX AUDIO SYSTEMS CANADA, LTD.
 (Toronto) Tel: (416) 363-8138
 TLX: 06225500 (OCTO TOR)

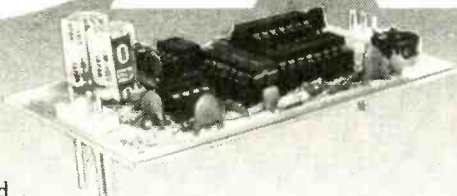
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APHEX COLORADO, LTD.
 (Golden) Tel: (303) 892-9245

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 (Copenhagen) Tel: (01) 59 1200

APHEX FRANCE S.A.R.L.
 (Paris) Tel: 251-4995

EX.



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.



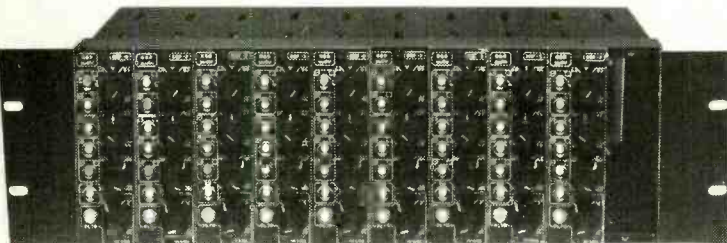
B&B EQF2 Parametric Equaliser/Filter

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.

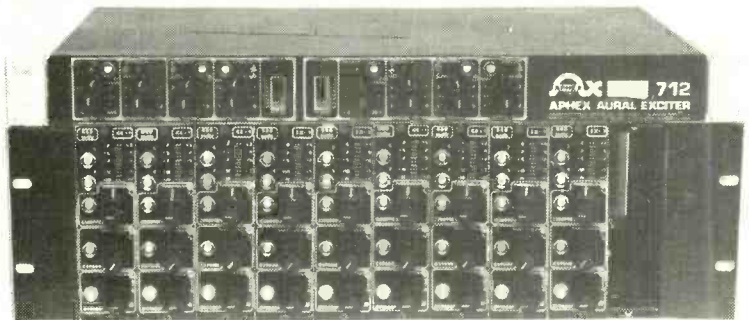
B&B CX1 Compressor-Expander

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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(Bologna) Tel: 051-76 66 48
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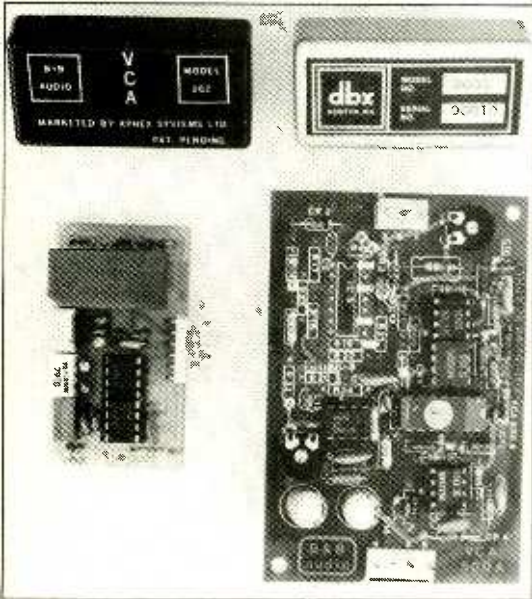
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Allison, B&B, dbx VCAs



Allison EGC-205M voltage controlled attenuator

MANUFACTURER'S SPECIFICATION

Input configuration: current summing point, virtual ground.

Maximum input level: $\pm 2\text{mA}$ (+27dBV into a 13k Ω input resistor).

Output configuration: voltage output, 33 Ω source impedance.

Maximum output level: +22dBV into 1k Ω or greater. +19dBV into 600 Ω .

Gain control range: +50dB to -125dB with 13k Ω input resistor.

Output noise: at maximum attenuation -110dBV, at unity gain -87dBV, at 20dB gain -78dBV (20Hz to 20kHz).

Modulation noise: at least 100dB below signal level.

Distortion: 1kHz total harmonic distortion less than 0.008% at any signal level from -20 to +20dBV, any gain setting -20 to +20dB. At 10kHz less than 0.015%, at 75kHz less than 0.25%.

SMPTE IM: less than 0.015% at any signal level from -20dBV to +20dBV and at any gain -20dB to +20dB.

Bandwidth: dc to 100kHz (-3dB), full power bandwidth greater than 150kHz without slew induced triangulation, input or output.

Slew rate: 13V/ μs input or output.

Maximum attenuation: given 20dBV input through 100k Ω resistor, 100Hz -125dB, 1kHz -120dB, 10kHz -105dB, 20kHz -100dB.

Power supply rejection reference input: -54dB at 120Hz, -46dB at 1kHz.

Control input rejection: adjustable to less than 20mV output shift with gain modulated from -100dB to +20dB with no input signal.

Price: £29.

Manufacturer: Allison Research Incorporated, 2817 Erica Place (PO Box 40288), Nashville, Tenn 37204, USA.

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

B & B 202 voltage controlled attenuator

MANUFACTURER'S SPECIFICATION

Bandwidth: dc to 200kHz $\pm 0.1\text{dB}$.

THD: 20Hz to 20kHz, 0.004% with +10dBm input and 10dB attenuation.

IMD (SMPTE test): 0.03% at +14dBm input and 10dB attenuation.

Noise: -90dBV, $\pm 1\text{dB}$ (worst case, unity gain).

Modulation noise: 6.5dB.

Overshoot and ringing: none.

Slew rate: greater than 10V/ μs , symmetrical and constant.

Input impedance: 20k Ω .

Maximum input level: +20dBV.

Gain: 0dB (up to 15dB gain available to special order).

Maximum attenuation: greater than 94dB, 20Hz to 20kHz.

Control voltage: can be scaled and needed.

Dc shift versus attenuation: less than 5mV.

Power requirements: regulated $\pm 15\text{V}$ at +25mA, -33mA.

Price: 1 £25.35, 25 £23.80, 50 £22.30, 100 £21.00, 1000 £17.65.

Manufacturer: Apex Systems Limited, 7801 Melrose Avenue, Los Angeles, Cal 90046, USA.

UK: Apex Audio Systems UK Limited, 35 Britannia Row, London N1.

B & B VCA500A voltage controlled attenuator

MANUFACTURER'S SPECIFICATION

Bandwidth: 1Hz to 200kHz +0.1dB.

THD: 0.004% typical.

IMD (SMPTE Test): 0.018% typical.

Noise: -92.5dBm at unity gain attenuating to less than -100dBm.

Modulation noise: 8dB.

Gain: 6dB.

Control linearity: +0.2dB.

Maximum input level: +14dBm.

Maximum attenuation: greater than -95dB (20Hz to 20kHz).

Price: 1 to 31 £47, 32 to 99 £37, 100 upwards £30.

Manufacturer: Apex Systems Limited, 7801 Melrose Avenue, Los Angeles, Cal 90046, USA.

UK: Apex Audio Systems UK Limited, 35 Britannia Row, London N1.

dbx Type 2001 voltage controlled amplifier

MANUFACTURER'S PRELIMINARY SPECIFICATION

Power supply: bipolar 12V to 27V.

Gain control range: -100dB to +60dB.

Gain control constant: -20dB/V.

THD: at any gain, any input or output level, less than 100ppm, typically less than 30ppm.

IM distortion: at any gain, less than 100ppm.

Output noise at unity gain: -87dBV (ref 1V rms, 20kHz bandwidth).

Frequency response: $\pm 0.02\text{dB}$ dc to 50kHz, unity gain +0, -1dB dc to 20kHz, +60dB gain.

Tracking accuracy: $\pm 1\%$.

Control voltage feedthrough: less than 10mV, typically less than 5mV from -100dB to +30dB gain, less than 20mV to +60dB of gain.

Price: £26.

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

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

Allison EGC-205M

THE ALLISON EGC-205M is a small module incorporating the Allison EGC101 VCA which itself plugs into a 18-pin integrated circuit socket. The remaining parts on the module consist of a couple of ic operational amplifiers, three preset potentiometers and 17 passive components. The three preset potentiometers control the minimum intermodulation distortion at unity gain and at $\pm 20\text{dB}$ gain, and also the dc control voltage rejection at the output.

The audio input is fed via a 13k Ω resistor to a summing point with a maximum input signal capability of +23dBm and a maximum output capability of +21.5dBm at the onset of hard clipping when using $\pm 15\text{V}$ supply lines. At zero control voltage input the gain was found to be 2dB with a control voltage versus gain characteristic very close to the nominal 10dB/V as shown in fig 1.

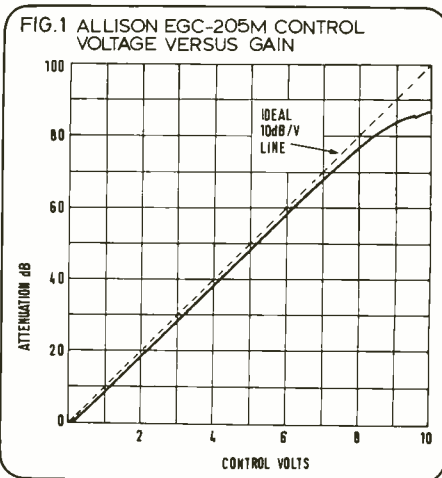
This gain control characteristic may be readily modified by changing the series resistor to the gain control summing point which has a sensitivity of 100dB/mA into a very low impedance.

The maximum attenuation available was found to be 98dB at 1kHz with a 10V gain control input falling to around 90dB at 20kHz. The overall frequency response at unity gain is shown in fig 2 which demonstrates a flat response within the audio band at unity gain, and at -20dB, -40dB and -60dB gain with the -1dB point at unity gain being at 80kHz falling to -3dB at 160kHz.

Noise in the output at unity gain was found to be -87dBm(A) falling to -114dBm(A) with a 10V control input with the dc at the output drifting 4mV over the full 10V control port input range.

Second and third harmonic distortion remained below -70dB (0.03%) within the audio frequency band at all attenuations and input levels with the twin tone intermodulation distortion also remaining within this limit. Checking the high frequency twin tone intermodulation distortion at -10dB attenuation

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turnkey mix

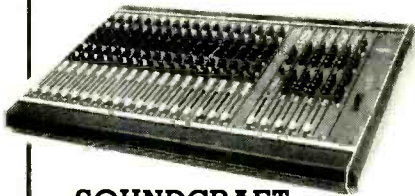
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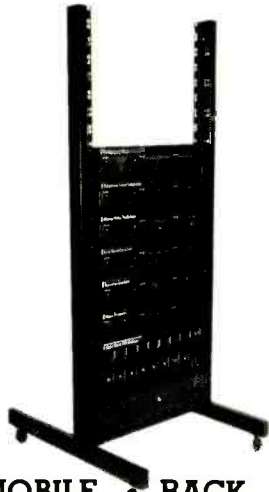


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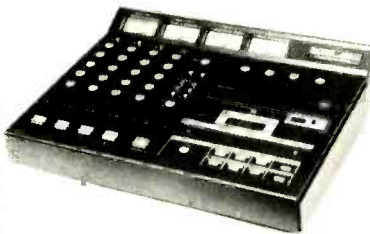


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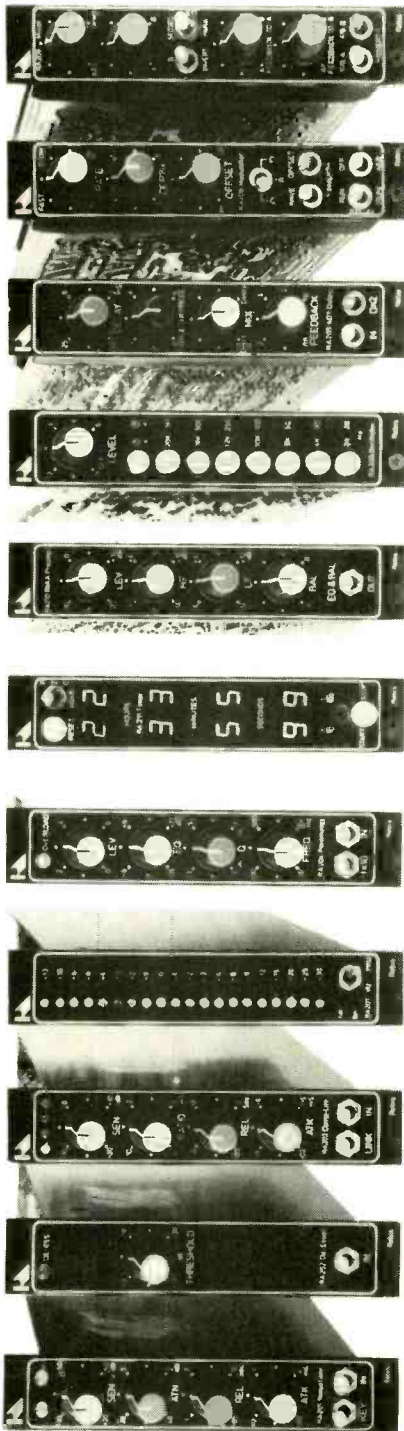


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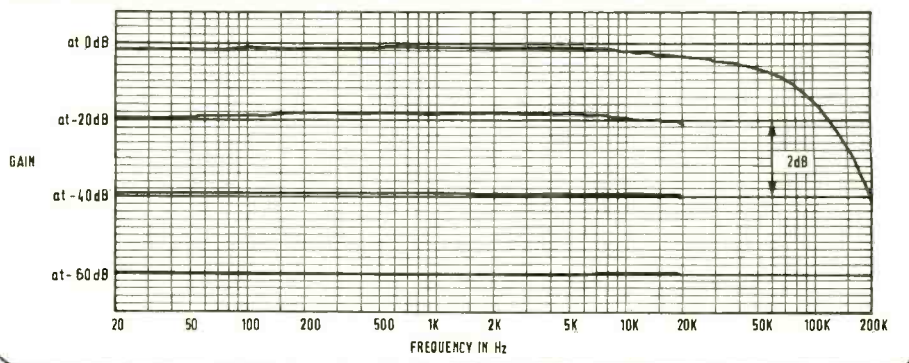


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REVIEWS

FIG. 2 ALLISON EGC-205M FREQUENCY RESPONSE AT DIFFERENT GAINS



showed that this remained below -80dB (0.01%) up to 120kHz rising to -73dB at 200kHz .

Total harmonic distortion and noise at various levels are shown in Table 1.

Intermodulation distortion to the SMPTE method was found to be 0.015% at unity gain with high input levels with a slight increase to 0.018% at 0dBm input with the output between -10dBm and -20dBm .

The response to an input of fast square waves did not reveal any overshoot, ringing or other unwanted effects at any input level or any attenuation with the rise time being $4\mu\text{s}$.

TABLE 1

	100Hz	1kHz	10kHz
+10dBm in and out	0.006%	0.005%	0.005%
+10dBm in, 0dBm out	0.01%	0.008%	0.007%
+10dBm in, -10dBm, out	less than 0.01%		
0dBm in, -10dBm out	less than 0.02%		

B & B 202

THE B & B 202 voltage controlled attenuator is supplied as a small 'potted' assembly with seven wire terminations at the base of the unit arranged on a standard 0.1in grid; the complete assembly being similar in appearance to the dbx 202 Series.

A minimum of external components are required, the unit only needing a suitably decoupled positive and negative power supply, an external dc shift potentiometer between the power supply rails, and a ranging resistor in series with the control voltage input—plus any audio decoupling to eliminate the possibility of dc components.

The input impedance at the audio input was

found to be just under $20\text{k}\Omega$ with the audio output impedance being very low, thus making the unit easy to interface with the audio circuits. Similarly the input impedance of the control port was low, requiring a $2.49\text{k}\Omega$ resistor to provide a control sensitivity of 10dB/V or $1.25\text{k}\Omega$ for 20dB/V sensitivity. As can be seen from fig 3 which is a plot of the attenuation versus the control voltage the unit has significant deviations from the true 10dB/V line with the control characteristic being non-linear.

Whilst this may not matter for many applications, it remains unknown if the characteristics of individual 202's are similar so that stereo matching can be satisfactory.

Checking the frequency response at unity gain, 20, 40 and 60dB attenuation produces fig 4 from which it is to be seen that the device

96 ▶

FIG. 3 B&B 202 CONTROL VOLTAGE VERSUS GAIN

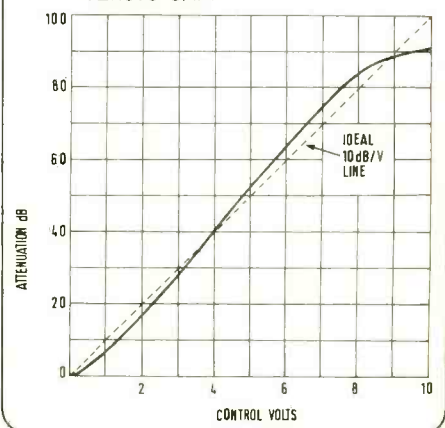
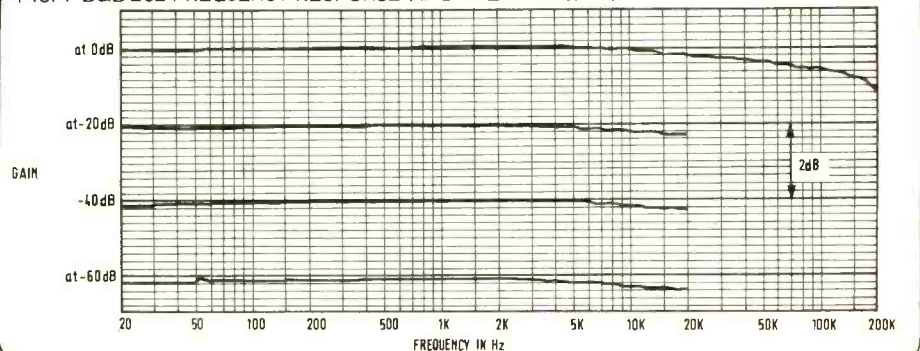


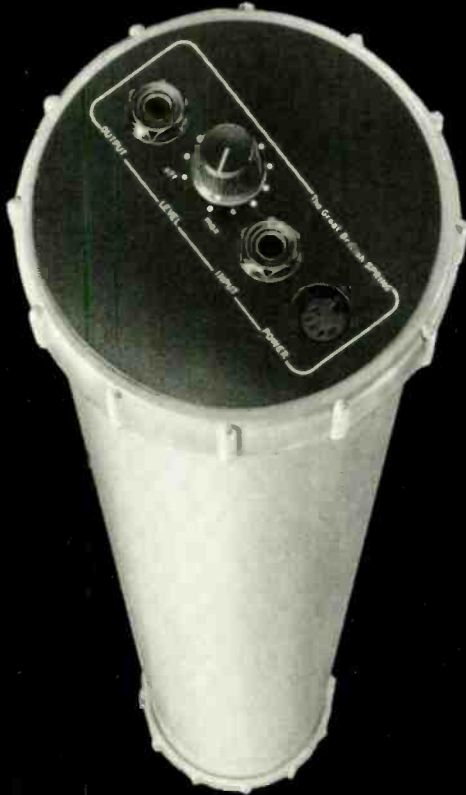
FIG. 4 B&B 202 FREQUENCY RESPONSE AT DIFFERENT GAINS



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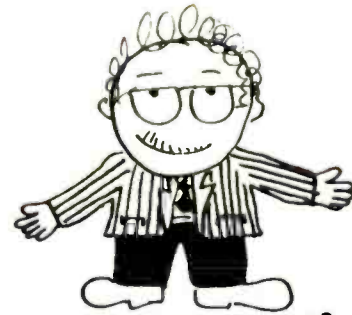
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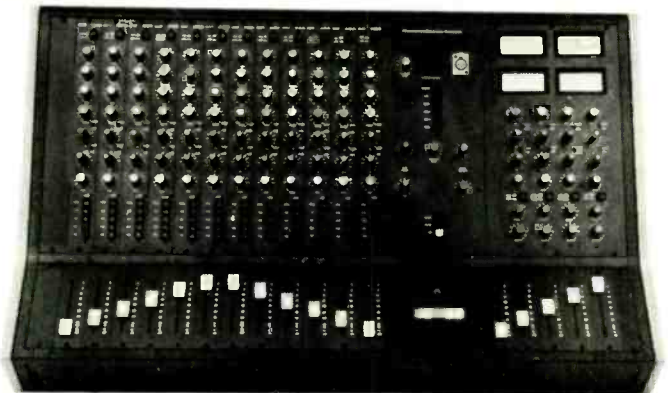
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is extremely flat within the audio frequency band and that at unity gain the response extends to -1dB at approximately 200kHz .

At zero attenuation the device had a control voltage input of zero volts with the maximum available attenuation being 95dB at 10V input or more to the control line. The maximum input and output levels were found to be $+20\text{dBm}$ with the noise in the output being -92dBm(A) at unity gain falling to -101dBm(A) at minimum gain. These figures in combination with soft clipping upon overload provided an excellent dynamic range.

Second and third harmonic distortion together with twin tone intermodulation distortion were found to be below -70dB (0.03%) at any input levels and any attenuation settings with the total harmonic distortion being shown in Table 2.

Measurement of intermodulation distortion to the SMPTE method showed that this was 0.03% at $+10\text{dBm}$ input and output, falling to 0.02% as the levels were lowered.

The rise time of $0.7\mu\text{s}$ was exceptionally fast without any sign of ringing, overshoot or instability. Large variations in temperature did effect the gain, but not the dc at the output (which sat at -70mV) nor effect the distortion performance.

B & B VCA500A

THE B & B VCA500A module is basically a retrofit card for the MCI 500 Series of desks which incorporates the B & B 1537A voltage controlled attenuator. The latter takes the form of an integrated circuit in a 16-pin package, however, it requires a considerable number of external components to make it useable. In the least critical applications at least two external operational amplifiers are required together with about 20 other components.

In the VCA500A form the VCA occupies a $30\text{mm} \times 90\text{mm}$ printed circuit board which contains six integrated circuits, numerous other components and two pre-set potentiometers, one for trimming unity gain and the other for nulling the dc shift.

Nominally the control port sensitivity is 10dB/V but as can be seen from fig 5 which is a plot of attenuation versus control voltage, whilst the control characteristic is a straight line it was not very close to 10dB/V , but nearer 8dB/V . Upon hearing this, the manufacturer explained that this module was a special one-off! Examination of a second sample gave a rather non-linear characteristic again deviating from the nominal 10dB/V line.

Turning to the audio input the impedance was found to be just below $10\text{k}\Omega$ with a maximum input level capability of $+12.5\text{dBm}$. The maximum output level was found to be $+10\text{dBm}$ before the onset of soft clipping with the gain trim having a range from $+2.5\text{dB}$ to -3.5dB with the gain control port grounded.

The overall frequency response at unity gain and at -20dB , -40dB and -60dB gain is shown to be flat over the audio band as shown in fig 6 with the response extending at unity gain to -1dB at about 120kHz . With 10V applied to the control port the attenuation was found to be 80dB independent of frequency with

TABLE 2

	100Hz	1kHz	10kHz
+10dBm in and out	0.01%	0.01%	0.006%
+10dBm in, 0dBm out	0.014%	0.01%	0.009%
+10dBm in, -10dBm out	0.013%	0.013%	0.01%
0dBm in, -10dBm out	less than 0.025%		

TABLE 3

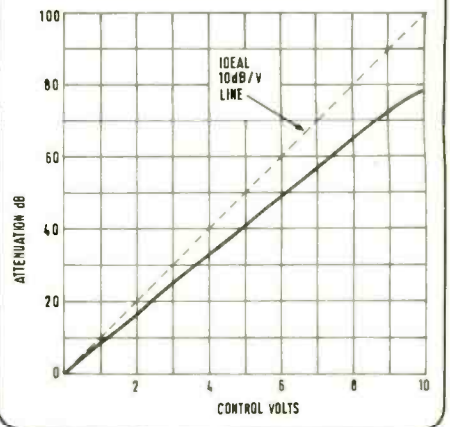
	100Hz	1kHz	10kHz
+10dBm in and out	0.011%	0.011%	0.011%
+10dBm in, 0dBm out	0.019%	0.018%	0.019%
+10dBm in, -10dBm out	0.02%	0.022%	0.024%
0dBm in, -10dBm out	less than 0.024%		

a maximum attenuation of 90dB being obtainable.

Measurement of the A weighted noise in the output showed this to be -93dBm(A) at unity gain falling to -102dBm(A) at minimum gain with a constant dc offset of 5mV at the output terminal.

Checking the second and third harmonic distortion and twin tone intermodulation distortion within the audio frequency band showed these to be below -70dB (0.03%) at any level and at any amount of attenuation with the intermodulation distortion at 10dB attenuation being below -80dB (0.01%) up to 200kHz .

FIG. 5 B & B VCA500A CONTROL VOLTAGE VERSUS GAIN




Measurement of total harmonic distortion and noise at various levels produced Table 3.

Measurement of intermodulation distortion to the SMPTE method showed this to be 0.06% at $+10\text{dBm}$ input and 0dBm output falling to 0.022% at lower input and output levels.

The application of fast squarewaves showed the VCA to be completely free from any overshoot or ringing with a rise time of $0.7\mu\text{s}$ constant with level and attenuation.


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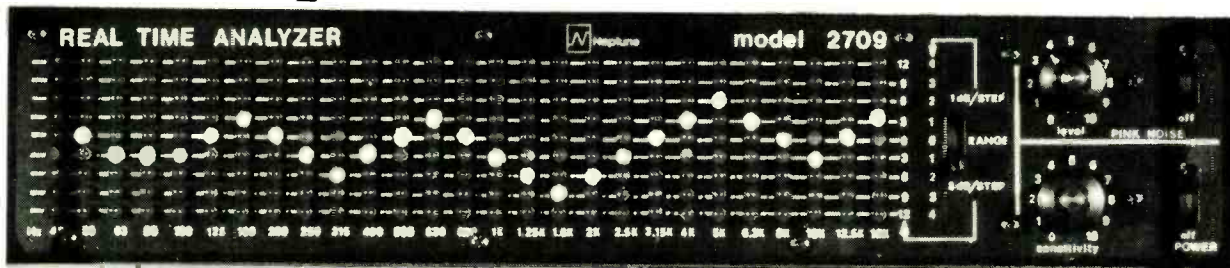


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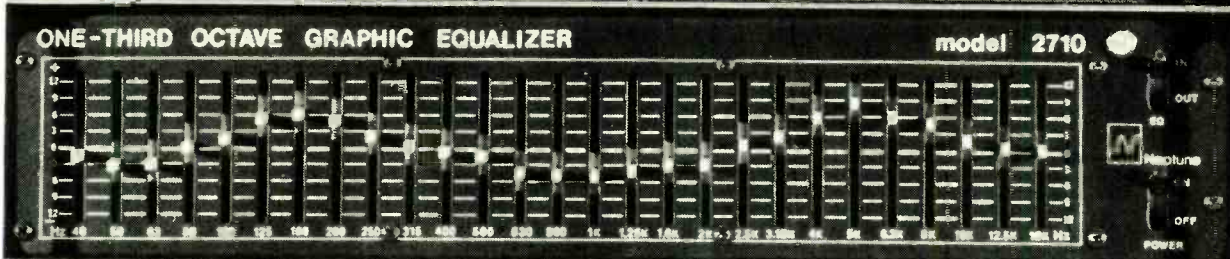
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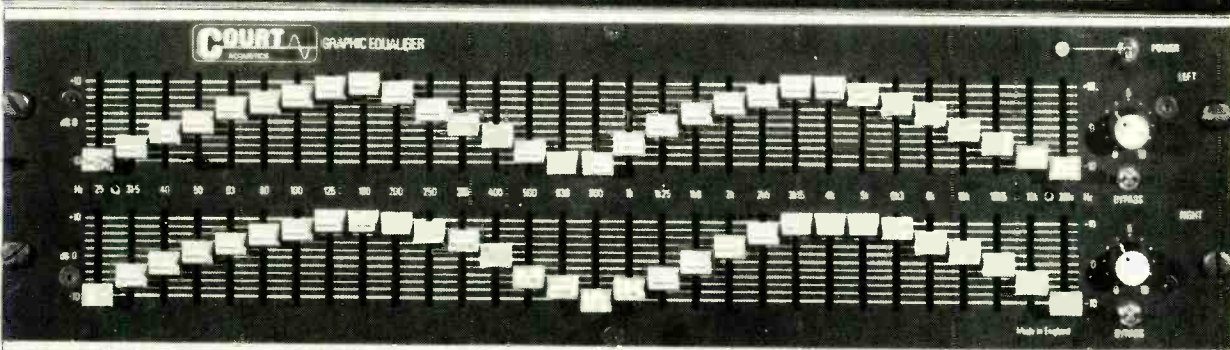
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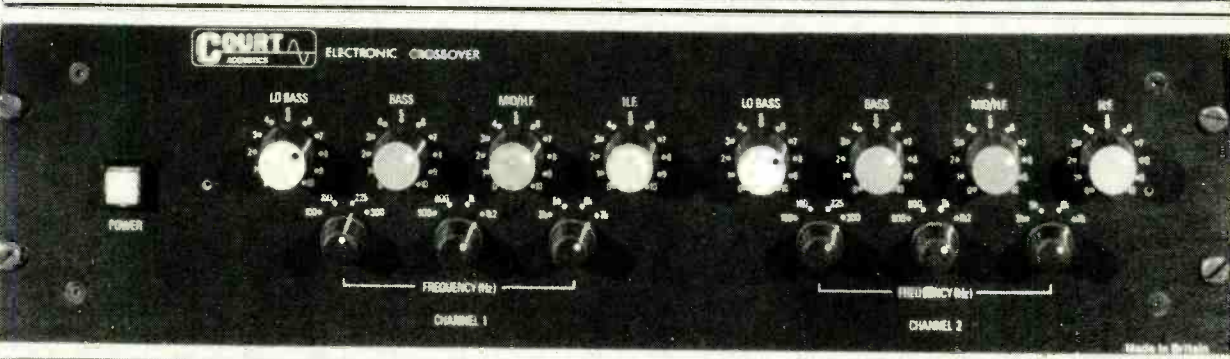
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dbx 2001

AS OPPOSED to the other voltage controlled attenuators reviewed here, the dbx 2001 may also be used as a voltage controlled amplifier thus providing an enormous control range of 160dB. Unfortunately at the time of this review little information was available upon the device which is quite different to the dbx 200 Series.

However the packaging is identical with all components being contained in a 'potted' box with the seven electrical connections being by means of pins on a 0.1in grid. Very few external components are required consisting only of a symmetry control between the positive and negative power supply lines and an input resistor in the audio input, the control voltage port having an internal scaling resistor giving a control sensitivity of 20dB/V. As can be seen from fig 7 which is a plot of attenuation versus control voltage, the device remains close to the exact 20dB/V line over a very wide range. Taking into account the impedance of the control port which was found to be 565Ω, it is easy to modify the performance for lower control port sensitivities.

Considering the audio input, this is of low impedance with a 10kΩ series resistor being recommended with the output being fed to an operational amplifier with a 10kΩ feedback resistor. In these circumstances the voltage handling capability with ±15V power supplies was found to be greater than +23dBm at the input and +22dBm at the output at the onset of hard clipping.

Checking the overall frequency response at unity gain and -20, -40 and -60dB gain showed that within the audio frequency band the response was extremely flat as shown in fig 8. As can be seen, the high frequency response at unity gain remains flat up to 100kHz falling to -3dB at 150kHz.

At zero control voltage input the overall gain was unity with the attenuation at 10V to the control port being 94dB at 1kHz falling to 81dB at 20kHz with the respective maximum attenuations being 101dB and 104dB. Reversing the polarity of the control voltage input was found to produce gain up to +60dB with the control characteristic remaining at 20dB/V at the control port input.

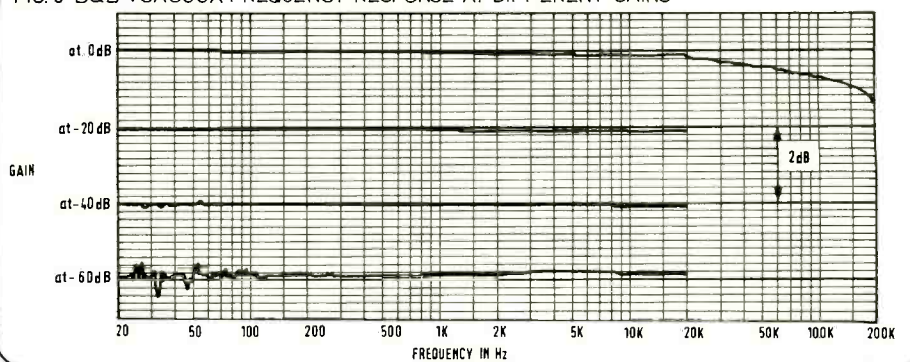
'A' weighted noise was measured at the output at unity gain and at minimum gain being -88dBm(A) and -100dBm(A) respectively. The dc offset at the output could be set to zero by the symmetry control, but, there remained a sensitivity to the control port input giving an offset of up to 150mV over a 10V input range. It was also noted that the dc offset was sensitive to temperature.

Second and third harmonic distortion were found to be below -70dB (0.03%) within the audio frequency band at any levels or at any attenuation as was twin tone intermodulation distortion below 8kHz. Whilst this rose significantly above 8kHz the cause may well have been the output amplifier rather than the VCA itself.

Total harmonic distortion and noise are shown in Table 4 for various levels.

Measurement of intermodulation distortion to the SMPTE method showed that this was less than 0.02% at unity gain and -10dB gain

FIG. 6 B&B VCA500A FREQUENCY RESPONSE AT DIFFERENT GAINS



at high input levels reaching 0.03% at 20dB and 30dB attenuation with 0dBm input.

The application of fast squarewaves showed some overshoot and ringing at all input levels and all gains with the rise time being 1μs independent of level or gain.

TABLE 4

	100Hz	1kHz	10kHz
+10dBm in and out	0.007%	0.005%	0.012%
+10dBm in, 0dBm out	0.012%	0.007%	0.009%
+10dBm in, -10dBm out	0.013%	0.011%	0.009%
0dBm in, -10dBm out	less than 0.02%		

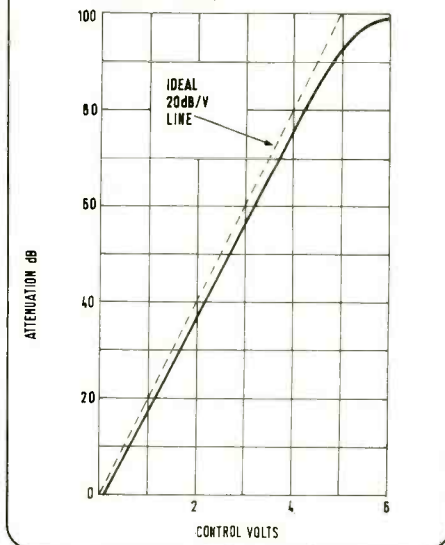
Overall summary of VCA's

Unfortunately these reviews are not nearly as comprehensive as I would have liked them to be because of the great difficulty in obtaining information about the individual VCA's.

Only a few minutes ago I received a telephone call from America to enquire about progress with a particular manufacturers' product. Upon complaining about a particular parameter I was told that the sample which I had been given was not expected to comply with the specification which I had been given—that sort of thing doesn't make life easy!

Anyhow, comparison of the VCA's is difficult in some ways because of their different configurations. Clearly it can be seen that frequency response does not represent any prob-

FIG. 7 dbx 2001 CONTROL VOLTAGE VERSUS GAIN

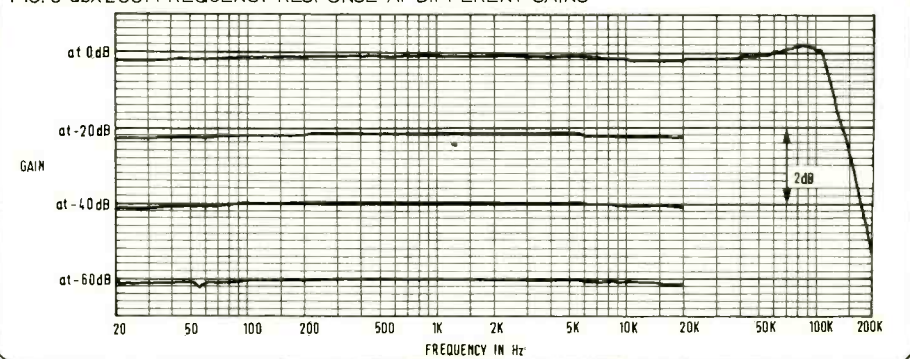


lem within the audio frequency band and in all cases the distortion levels are respectable with really little differences being shown. This fact makes me feel that the great distortion fight between the various manufacturers has little substance.

An area where significant differences do occur is the ability to hold the control voltage/attenuation characteristic and I suspect that there may well be undesirable differences between VCA's of the same make and type.

Hugh Ford

FIG. 8 dbx 2001 FREQUENCY RESPONSE AT DIFFERENT GAINS



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Reviews

Audiofad, Duncan/CGS, Penny & Giles and Waters faders

Audiofad 1040 P, Conductive plastic

MANUFACTURER'S SPECIFICATION

Stroke: 104mm.

Input impedance: standard 5k Ω , optional 10k Ω .

Law functions: linear $\pm 3\%$ independent.

Log tracking error: standard grade 0-20dB ± 1 dB, 20-40dB ± 2 dB. Premium grade 0-20dB ± 0.5 dB, 20-40dB ± 1 dB.

Stereo matching error: 1dB maximum.

Maximum attenuation: 90dB.

Life: greater than 500,000 cycles.

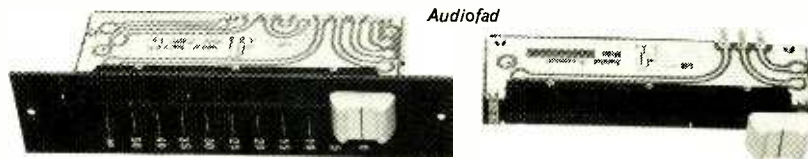
Electrical connections: solder tag.

Fascia: 2.6mm aluminium, matt black acrylic, matt white characters.

Knobs: 16mm white supplied with fader. Options 16mm black, red or 11mm white, black or red.

Price: around $\pounds 13$ to $\pounds 14$ for 10 off.

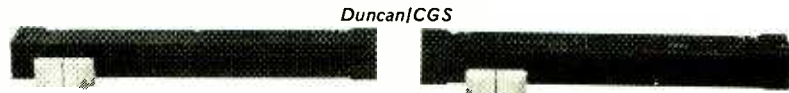
Manufacturer: Audiofad, Unit 14, 31 Poole Road, Wimborne, Dorset.



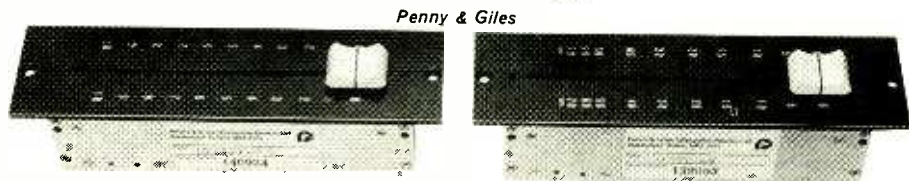
Audiofad



Waters



Duncan/CGS



Penny & Giles

Duncan/CGS M441, Conductive plastic

MANUFACTURER'S SPECIFICATION

Stroke: 108mm.

Maximum actuating force: 85g.

Stop strength: 4.5kg.

Number of channels: single or dual in identical case.

Terminals: solder type flat lugs (accept quick connect receptacles).

Ambient temperature: -55°C to $+125^{\circ}\text{C}$.

Taps: centre tap available on linear only.

Dual independent wipers: available on linear only.

Life: 5 million traverses.

Resistance range: linear 1k to 250k Ω , audio 600 to 25k Ω , balance 1k to 25k Ω .

Standard resistance values: linear 1k, 2k, 5k, 10k, 20k, 50k, 100k. Audio 600, 1k, 5k, 10k. Balance 1k, 5k, 10k.

Resistance tolerance: $\pm 20\%$, tighter tolerance to special order.

Linearity tolerance: linear type standard to $\pm 2\%$, special to $\pm 0.1\%$.

Taper conformity: audio type 0-20dB ± 2 dB, 20-50dB ± 4 dB.

Tracking of dual channels: linear type 2%, audio type 0-20dB 2dB, 20-50dB 4dB.

End voltage: linear type 0.5%.

Maximum attenuation: audio type 90dB.

Power rating at 70 $^{\circ}\text{C}$: linear type 4W, others 0.4W.

Options: cue switches, alternative escutcheons, alternative knobs.

Price: $\pounds 13.30$ to $\pounds 36.25$ basic faders, switches, fascias and knobs extra.

Manufacturer: Duncan Electronics, 2865 Fairview Road, Costa Mesa, Cal 92626, USA.

UK: The CGS Resistance Company Limited, Marsh Lane, Gosport Street, Lymington, Hampshire.

Input impedance: linear 1k or 10k Ω $\pm 20\%$, audio 600, 5k or 10k Ω $\pm 20\%$.

Absolute linearity: linear $\pm 1\%$.

Attenuation accuracy: audio 0-40dB ± 1 dB, 40-50dB ± 2 dB, 50-70dB ± 5 dB.

Matching accuracy: linear type $\pm 2\%$, audio type 0-30dB ± 0.5 dB, 30-50dB ± 1 dB, 50-70dB ± 5 dB.

Standard switches: auxiliary equipment and overpress changeover microswitches. Infinity cutoff integral with track on audio type.

Microswitch rating: 50V dc 100mA (gold plated contacts).

Electrical connection: 15-way socket connector—mating plug supplied.

Knobs: white or black, 16mm or 11mm.

Voltage rating: not to exceed 50V.

Options: red, green, blue or yellow knobs, 15-way plug in place of socket, special laws for use with VCA's.

Price: about $\pounds 35$ to $\pounds 50$, other similar models with less facilities $\pounds 15$ to $\pounds 25$.

Manufacturer: Penny & Giles Conductive Plastics Limited, Blackwood, Gwent.

Waters MMG

MANUFACTURER'S SPECIFICATION

Standard impedance: 600 or 10k Ω .

Attenuation: 90dB minimum.

Noise: -70 dB from 0.25V.

Frequency response: 0 to 100kHz.

Tracking (0 to 40dB): logarithmic ± 1 dB, linear or modified audio ± 2 dB.

Tapers: linear, modified audio, logarithmic.

Price: $\pounds 11.50$.

Manufacturer: Waters Manufacturing Inc, Longfellow Center, Wayland, Mass 01778, USA.

UK: Variohm Components, The Barn, Wood Burcote, Towchester, Northants NN12 7JR.

Overall performance

All faders were initially checked for actual end to end resistance of the tracks and for capacitance between tracks and chassis where a metal chassis is used. In addition, the end resistance of the linear tracks was noted together with the maximum attenuation of the audio track faders over the frequency range 20Hz to 20kHz.

An additional electrical test was to attempt to measure the noise. This was done by applying 10V dc across the tracks and then measuring the CCIR-weighted quasi-peak noise between the sliders and one end of the track whilst the slider was being moved at constant speed.

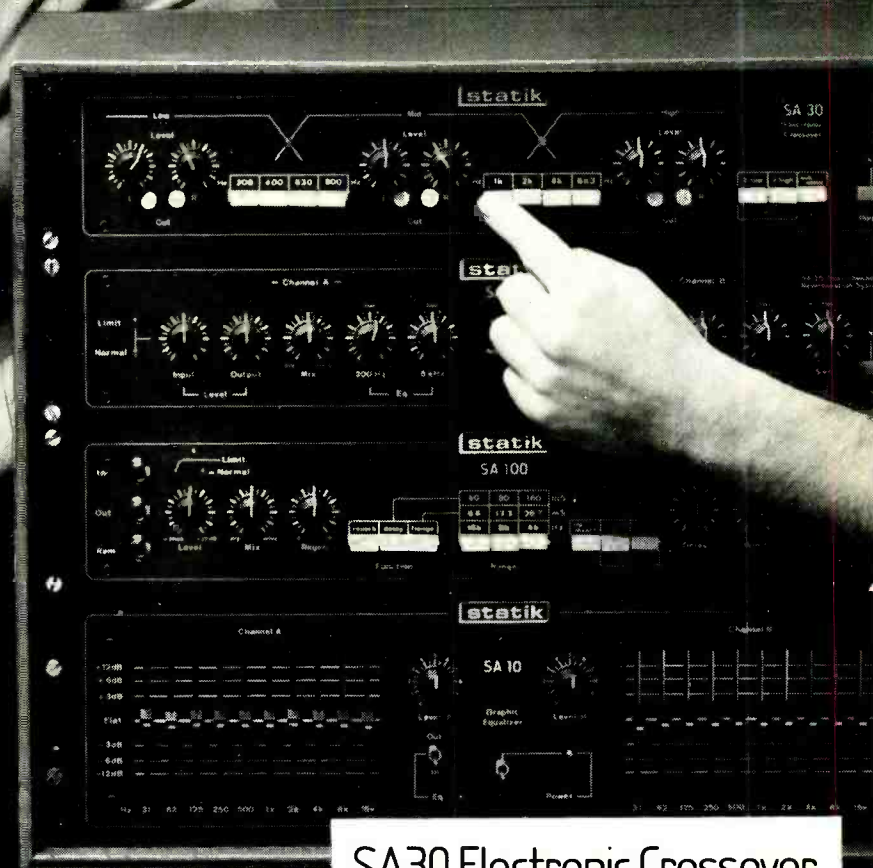
In the case of the linear faders the measured noise was nominally constant with fader position but in the case of the audio taper tracks the worst case noise was noted. The quoted decibel figures are purely relative with the most *negative* figures corresponding to the best performance.

On the mechanical front, the total movement of the fader was noted. Also the force required to provoke initial movement of the fader and force required for constant movement was noted, some faders having a distinct stick/slip action.

In all instances two samples of each fader were examined, Tables 1 and 2.

The taper characteristic of each track of each fader was examined by attaching the fader to the X axis of a X/Y recorder driven by a programmable calculator. It was then arranged for the X axis to be moved at a slow

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TABLE 1

	LINEAR TAPER FADERS		
	Audiofad	Duncan/CGS	Penny & Giles (twin)
Nominal resistance	10k Ω	10k Ω	10k Ω
Error in resistance	+3.5/+3.2%	-18/-3.5%	-15.8/-17.5% -8.7/-14.2%
Capacitance to chassis	30/30pF	-pF	40/40
End resistance	24/16 Ω	6/14 Ω	14/21 Ω 10/10 Ω
End voltage (%)	0.001%	0.08/0.0015%	0.002/0.0015%
Noise (dB)	0dB	0dB	-2dB
Operate force	40/40g	>100g	60/60g
Sliding force	30/30g	80/40g	60/60g
Total movement	105mm	108mm	104mm

TABLE 2

	AUDIO TAPER FADERS (stereo types except Waters)			
	Audiofad	Duncan/CGS	Penny & Giles	Waters
Nominal resistance	5k Ω	10k Ω	5k Ω	10k Ω
Error in resistance	+1.8/+2.2% -1.0/0.4%	+1.0/-7.0% +5.0/+6.0%	-1.2/+6.0% +2.6/-18.8%	+1.75% -1.2%
Capacitance to chassis	30/30pF	-pF	45/47pF	29/28pF
Maximum attenuation	94dB	93dB	97dB	94dB
Noise (dB)	0dB	-2dB	-4dB	-1dB
Operate force	80/60g	>100g	40/40g	>100/25g
Sliding force	30/30g	60/60g	40/40g	25/25g
Total movement	105mm	108mm	104mm	106mm

constant speed with the Y axis moving according to the attenuation of the fader and thus drawing its taper characteristic. In the case of linear tracks, the Y axis was plotted in terms of the percentage of the total input signal whilst with the audio tracks the calculator was arranged via a digital online voltmeter to plot the Y axis on a decibel scale.

Examination of these plots shows that all the linear tracks have excellent accuracy but that there are large differences between the various manufacturers' audio taper characteristics. Where decibel fascia scales have been provided by the manufacturers the supplied calibration points are shown on the X/Y recorder plots.

After the completion of the measurements, one sample of each make was dismantled and the parts examined, in addition to inspecting the faders for sealing against the ingress of sweet black coffee and cigarette ash and the other byproducts of a sound recording session.

Audiofad

In construction these faders consist of two main parts secured together by four screws, and may thus be readily taken to pieces for cleaning. One part comprises the slider mechanism which slides on two polished metal rods via plastic bearings, with the electrical part of the sliders comprising a small printed circuit board onto which the spring fingers are soldered.

The second part of the fader consists of a printed circuit board onto which the tracks are secured by through rivets, as are the solder tag audio connections. Also secured to the printed circuit board is an angled shield which is placed below the front panel slot with the fader's arm taking two right angle turns to get round the shield. The effect of this shield was to virtually eliminate any liquid or other matter

falling through the front panel slot so that unwanted matter had difficulty in reaching the mechanism.

In operation the Audiofad faders all had a smooth action with only a slight stick/slip and their form of construction was such that accidental damage appears to be unlikely.

Reference to fig 1 shows that the two linear track faders had excellent linearity with fig 2 showing that the calibration of the audio track faders was good. However, some difference in matching between the two stereo tracks is to be observed in the -40dB region, with less than 1dB mismatch in other parts of the tracks in both faders.

It should also be noted that the Audiofad faders did not show up well in the noise tests, but did have unusually small tolerance on their nominal resistances.

Duncan/CGS

The form of construction of the Duncan faders is two mirror image plastic mouldings with a separate slider. Grooves locate the slider within the two mouldings, which are secured together by a screw at each end.

For the stereo faders, a track is fitted within each half of the mouldings with solder tags protruding through the rear of the moulding, the tracks being located within the mouldings by means of three pins. Each half of the moulding has a plastic 'lip' through which the slider's arm protrudes while the tracks have a covering of grease.

This system was not impervious to the ingress of liquids and dust and whilst drain holes are present, it is felt that the combination of the grease and the ingress of dirt could cause problems. It is however simple to dismantle the faders for cleaning.

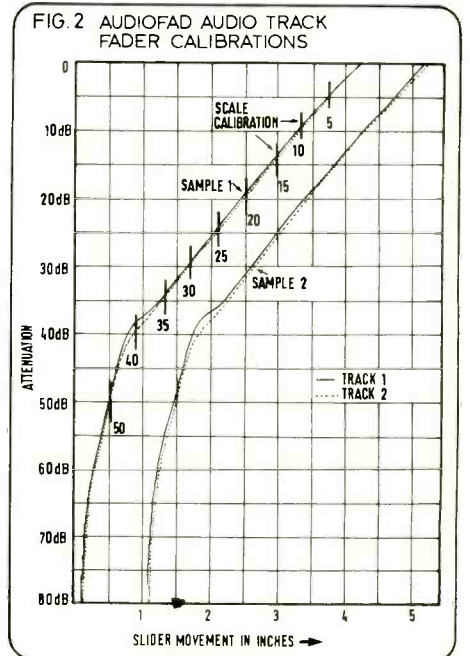
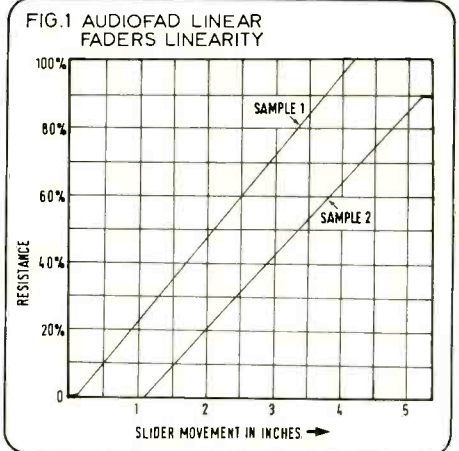
In operation, all four samples of the Duncan fader had a distinct stick/slip action with initial

forces in excess of 100g required to initiate movement. However, once movement had started the action was smooth.

Reference to fig 3 shows that the linearity of the linear faders was good with fig 4 showing the taper of the two audio track faders. Note that their taper has only a small section that approaches a dB linear characteristic, and that there is a distinct kink in the taper in the -40dB region. Whilst one fader exhibited virtually perfect matching between the stereo tracks above the -55dB point, the other fader had errors in the order of 1dB at various points on its track.

Penny & Giles

I have no hesitation in saying that these faders were far and away the most beautifully made with a very high standard of mechanical construction and excellent soldering. Access to the mechanism may be obtained by removing one side of the fader which is a plated metal cover secured by two screws. The removal of four further screws separates the mechanical part of the fader from the electrical part which is contained in a plated metal L shape with the conductive track being secured to one arm



of the L shape by two screws. A 15-way socket (with plug retainers) is secured to the other arm of the L shape with two microswitches being mounted at the bottom of the fader tracks. One microswitch operates as infinite attenuation is approached, with the other being an over travel microswitch which operates if the slider is pressed beyond the infinity point against a spring load on the wiper assembly. The changeover contacts from the two microswitches and the six fader terminations (for the stereo tracks) are brought out of the socket together with a fader chassis connection.

The wiper assembly consists of two polished metal rods which pass through a nylon moulding, upon which the spring wiper fingers in the form of metal brushes are mounted as a screw-on assembly. It follows that these or the tracks may be readily replaced as may any other part.

In action, all the Penny and Giles faders were exceptionally smooth in action with absolutely no stick/slip effects. Two right angle bends in the operating arm going round a shield prevents any liquid entering the fader falling upon the tracks, but liquid and dirt can

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FIG. 3 DUNCAN/CGS LINEAR FADER LINEARITY

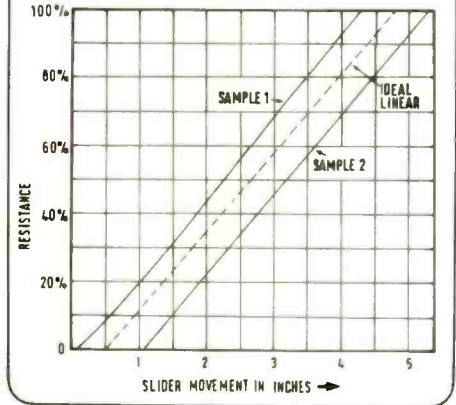
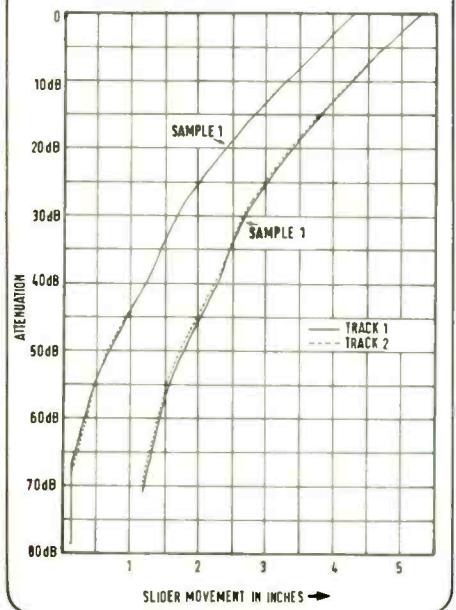


FIG. 4 DUNCAN AUDIO TRACK FADER TAPER



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fall upon the slider guide rods. However these may be easily cleaned.

Reference to fig 5 for the linear tapers for a stereo fader shows excellent linearity and matching between the two tracks and examination of the second sample showed equally good results. Fig 6 shows the tapers for both channels of the two samples of audio taper fader together with the accuracy of the front panel calibrations points. Matching between channels was so good that it was hard to discern the differences between the two tracks over the complete range of attenuation—on the original plots 1dB was equivalent to 0.1in.

It should also be noted that the Penny and Giles faders were less electrically noisy than the other faders reviewed, but that the tolerance on resistance was wide compared with the others although within specification.

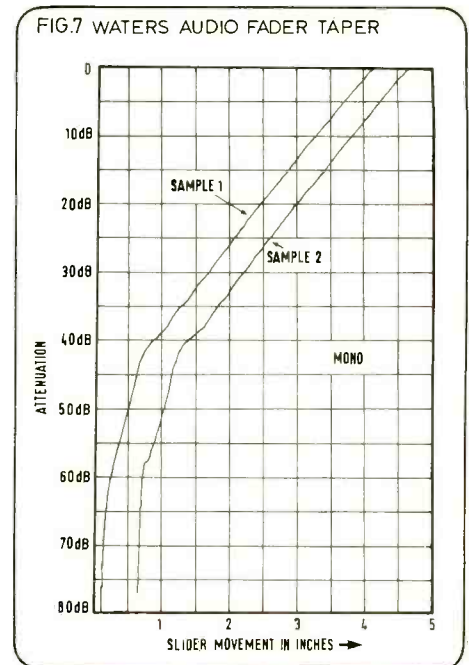
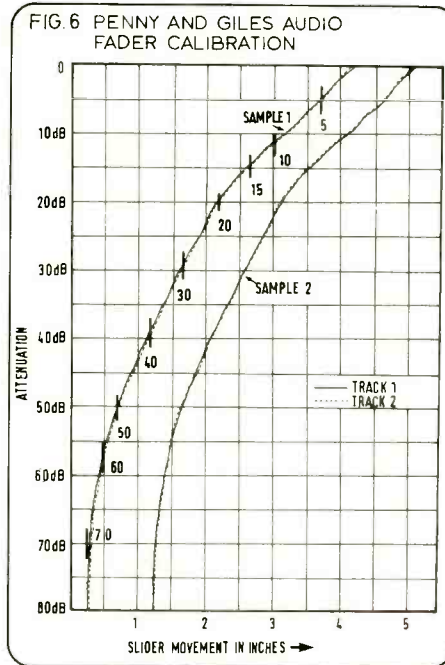
Waters

The Waters faders were completely sealed units which cannot be opened for cleaning without cutting off rivets which secure the L-shaped ends and hold together the extrusions which form the sides of the faders. Each side is equipped with a floppy plastic lip through which the actuating arm passes, the slider being formed from a rectangular piece of plastic which slides in slots in the side extrusions.

Only slight deformation of the fader is necessary to lead to a sticky slider and it was found that in spite of the lips and the presence of a bungy piece of plastic on the slider near the operating arm, the fade was far from proof against the ingress of dirt and moisture which could not be removed.

The fader tracks are formed on a rectangular section of glass fibre which slides into the extruded sides of the fader. The terminations were in the form of pin connectors to which the connections may also be soldered.

Fig 7 shows the taper characteristics of the two Waters samples with a significant difference between the samples in the -60dB region, but a flat dB linear characteristic above the -35dB point. **Hugh Ford**



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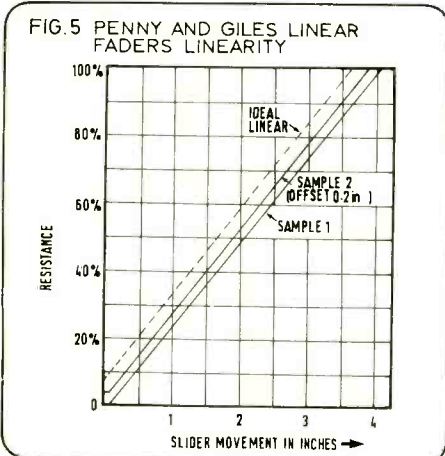
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Output +20 dBV.7 1 kHz -88 dB, 0.004%
30Hz-20 kHz -82 dB, 0.008%
Static intermodulation distortion 50 Hz +7 kHz, 4:1 Output +10 dBV.7 -90 dB, 0.003%
Dynamic intermodulation distortion 3.18 kHz square wave (single pole -3 dB at 100 kHz) +15 kHz sine wave, 4:1. Relative to 15 kHz component. Pre-emphasised input 500 mV pk-pk -70 dB, 0.03%
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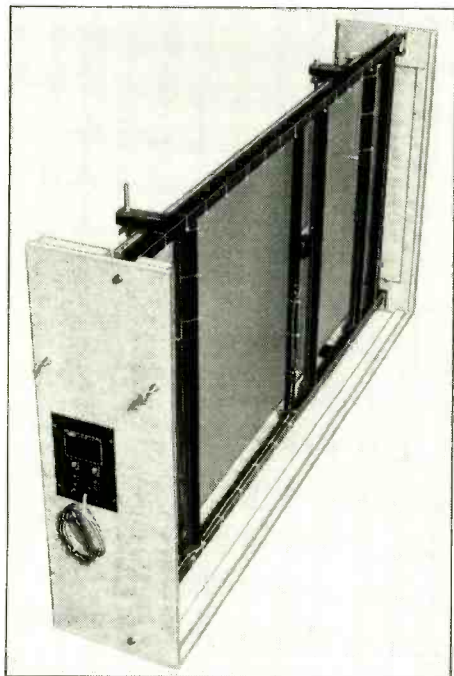
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MANUFACTURER'S SPECIFICATION

Frequency response of system: curve provided shows ± 5 dB reference 1kHz from 100Hz to 6kHz falling to -10 dB from 10kHz to 20kHz.

Reverberation time: adjustable from 1 to 7s.

Signal-to-noise: 60dB or better.

Inputs: two balanced inputs each of 10k Ω impedance, summed.

Maximum input level: +24dB (ref 0.775V) at 500Hz.

Outputs: two balanced 600 Ω outputs, transformer isolated.

Maximum output level: +26dB (ref 0.775V).

Drive amplifier output: 14W into 8 Ω .

Power supply: 120Vac 50/60Hz (European version available).

Weight: 170kg (375lb).

Dimensions: 2,310 x 1,220 x 410mm (91 x 48 x 16in) available in a horizontal or vertical unit.

Accessories: optional remote control unit.

Price: £2,595.

Manufacturer: Programming Technologies Inc, 666 N Lincoln Avenue, Lincolnwood, Illinois 60645, USA.

UK: Turnkey, 8 East Barnet Road, New Barnet, Hertfordshire.

THE BASIC mechanism of the *Echoplate* is a stainless steel alloy plate suspended in a fabricated steel square section frame by means of two eyebolts at right angles at each corner. The excitation of the plate is achieved by a loudspeaker type coil attached not far from the centre of the plate fed by flying leads, with the coil being inserted in a magnet fixed to the frame.

Two accelerometers mounted asymmetrically either side of the exciter provide quasi-stereo outputs to the amplifiers. From **fig 1** which shows the approximate layout of the plate, it can be seen that the arrangement is overall asymmetrical with the exception of the distance of the accelerometers from the top and bottom edges of the plate.

Reverberation time is effected by a damping plate of approximately the same dimensions as the echo plate, with the damping plate being mounted on arms so that its proximity to the echo plate can be altered by means of a spindle protruding through the fibre board casing. In order to provide some isolation from extraneous low frequency noises, the complete frame is mounted on rubber shock absorbers which may be locked for transportation.

Each end of the fibre board case is provided with two eyebolts for transporting the unit or for hanging it from the ceiling in environments where low frequency noise and vibration can be picked up by the plate. At the top of the unit a rather crude pointer/lever shows the set reverberation time on a calibrated scale, with

the electronics unit being mounted through a hole in the end of the casing.

Whilst the standard of construction of the plate part of the unit was satisfactory, the electronics unit was a different kettle of fish. The unit is made from thin sheet metal with loose screws attaching the mains transformer mounted together with the output transformers to the back plate of the chassis, this being attached to the electronics case with only two self-tapping screws. Within the case, the wiring was untidy and the standard of soldering and

construction poor with components mounted not very tidily on laminated tagstrips. The mains fuse (unidentified in value) was in the neutral line presenting an electric shock hazard when withdrawn. In terms of British Standard 415, there was inadequate clearance between parts connected to the mains and the chassis.

In addition to the abovementioned components, which are mainly connected with the power supplies, there are two plug-in printed circuit boards: one for the driver and one for the two accelerometer amplifiers. Here again the standard of construction was uninspiring and no component identifications were provided for servicing.

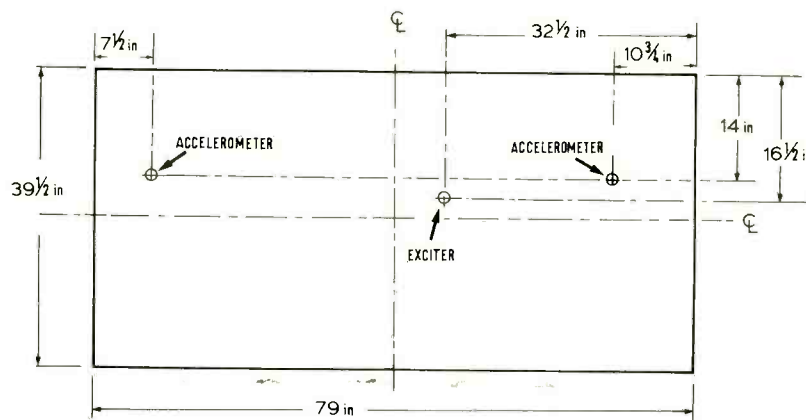
On the face of the electronics unit the balanced audio inputs and outputs are by means of XLR connectors providing electronically balanced inputs and floating, transformer coupled, outputs. In addition two 4mm banana sockets give access to the drive voltage to the exciter coil.

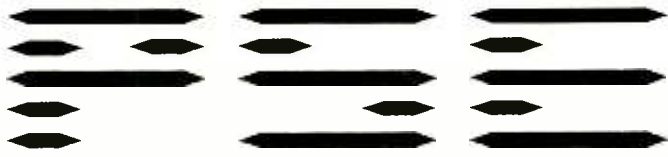
The mains power input is via a fixed lead with an adjacent imperial size mains fuse, an on/off switch and LED power indicators for the negative and positive dc rails. Removal of a small panel attached with non-captive thumbscrews gives access to the printed circuit boards. These have multiturn potentiometers for the adjustment of the two output gains, the input sensitivity and the high frequency characteristic of the drive amplifier. The location of these controls is clearly indicated on the removable plate.

Setting-up of the reverberation plate is initially done at the factory by tensioning the plate such that a 1.8kg force at the centre of the edges deflects the plate by 12mm giving almost equal tension in the edges. After this the plate is adjusted for equal reverberation

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FIG.1
PTI ECHOPATE MECHANICAL LAYOUT





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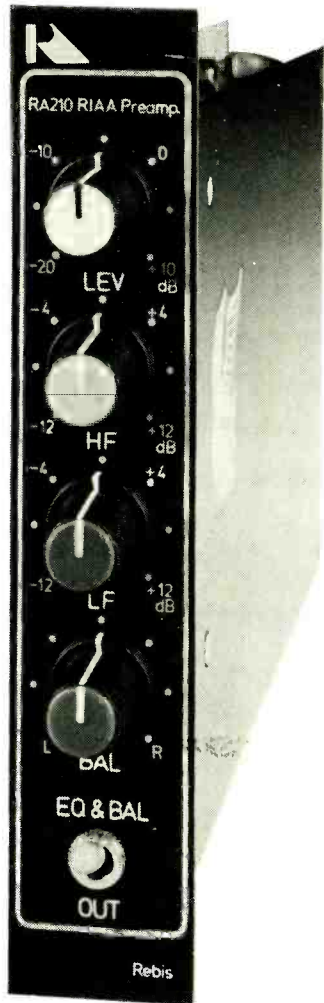
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times at 200Hz and 1kHz at the 3.5s reverberation time setting. User alignment instructions are provided in the instruction manual which also includes circuit diagrams and general alignment information.

Inputs and outputs

The two inputs had a measured impedance of 9.9k Ω and are fed to operational amplifiers with adjustment for common mode rejection, found to be 60dB at 50Hz, 66dB at 100Hz falling to 62dB at 1kHz. When operated unbalanced, the input impedance halves leading to an impedance which is on the low side for convenience. From the input amplifiers, the two inputs are combined and fed to the high frequency equaliser followed by frequency response correction circuits before the exciter driver, fed via a full range gain control.

On the output end, the two separate outputs are transformer isolated and floating with a source impedance of 42 Ω which is adequately low with a drive capability in excess of +30dBm loaded into 600 Ω .

With both inputs driven with equal signals, the overall gain was found to be +1dB with the input overload points being highly frequency sensitive. With the input gain set as supplied, the overload points are shown in Table 1.

The table shows that particularly when driving both inputs, there is a danger of saturating the drive amplifier if the input has any substantial high frequency content, this being a distinct risk if VU meters are used as

drive level indicators where zero VU corresponds to +4dBm and signal peaks can well be in excess of +14dBm when zero VU is indicated.

Frequency response and noise

The frequency response of the drive amplifier is shown in fig 2 for the extreme positions of the high frequency equaliser control, which was found in the maximum boost setting as received. Clearly the amount of high frequency boost in the drive amplifier accounts for the lower input handling capability shown.

At low frequencies, the frequency response drops at 12dB/octave below 80Hz thus reducing the susceptibility to unwanted low frequency effects while the high frequency equaliser provides a useful range for trimming the reverberation unit.

The overall frequency response as determined using random noise is shown in fig 3 which shows that there is a significant difference in

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TABLE 1
Frequency

Frequency	Both inputs driven	Single input driven
below 500Hz	> +23dBm	> +29dBm
1kHz	+20.5dBm	+26.5dBm
2kHz	+16dBm	+22dBm
4kHz	+9.5dBm	+15.5dBm
6.3kHz	+5.5dBm	+11.5dBm
8kHz	+3.5dBm	+9.5dBm
10kHz	+2dBm	+6dBm

FIG. 2
PTI ECHOPLATE DRIVER
FREQUENCY RESPONSE

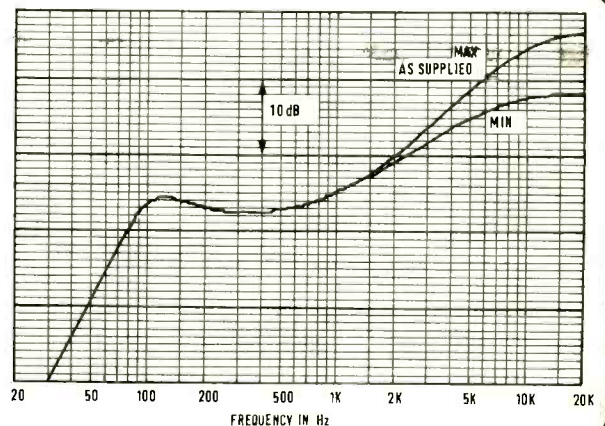
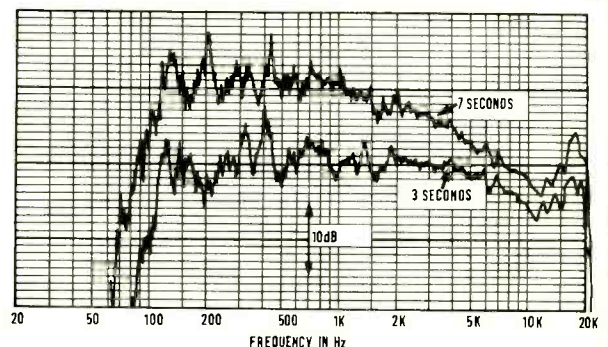
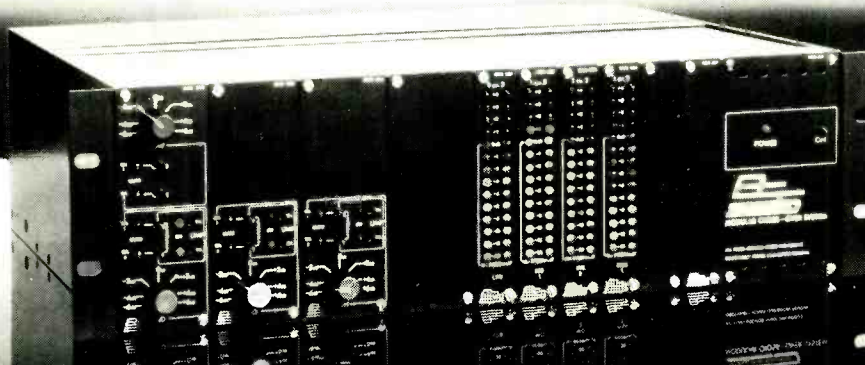


FIG. 3
PTI ECHOPLATE OVERALL
FREQUENCY RESPONSE
USING WHITE NOISE AT
-10dBm TO BOTH INPUTS



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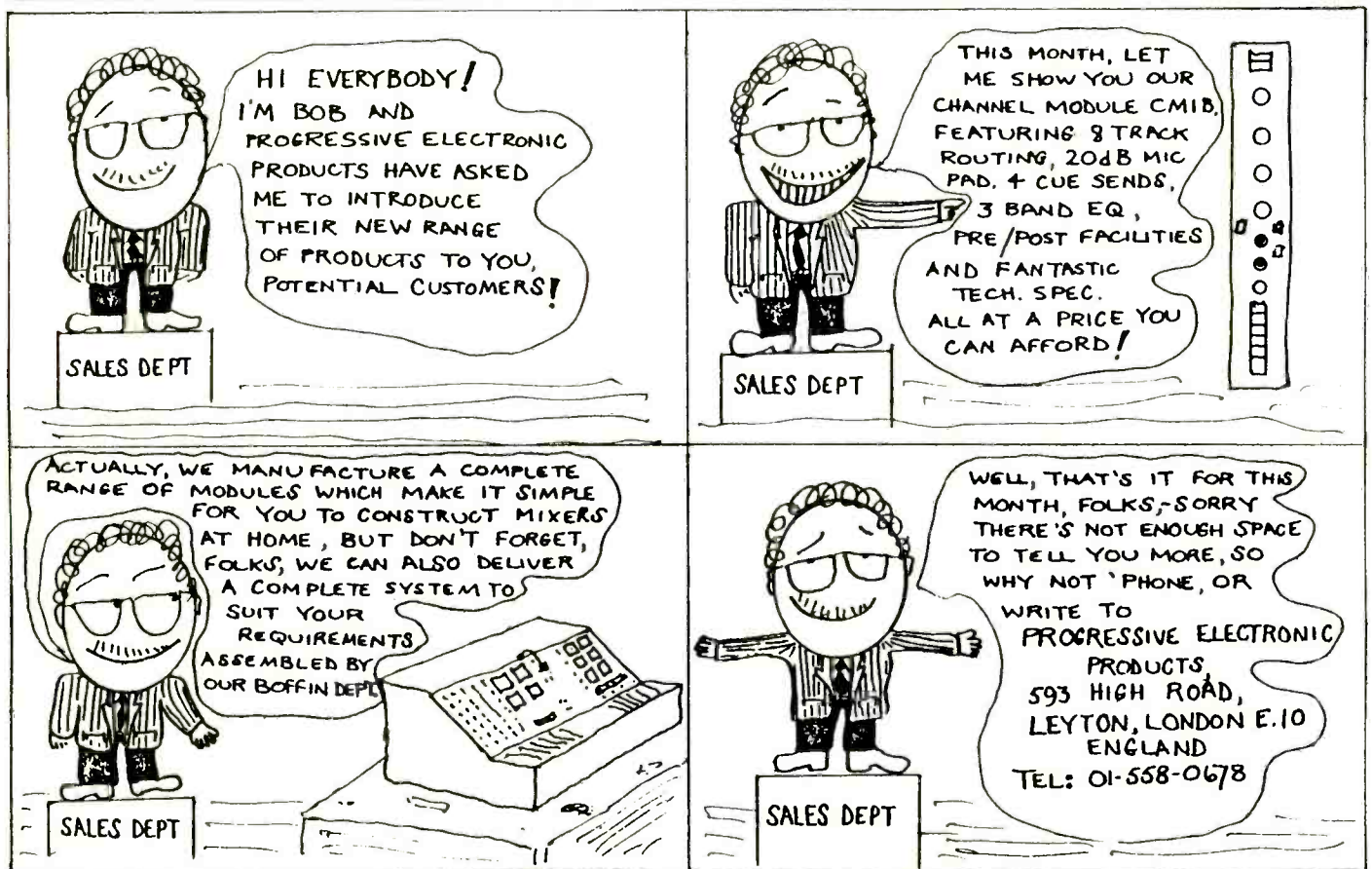


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frequency response for different reverberation time settings, with the longer reverberation time giving a high frequency loss in comparison with the shorter time setting.

On the noise front, the output noise was measured in both output channels with the input shorted, the results in Table 2 being measured in dBm rather than being referred to the available output signal which in practical use depends upon many factors.

TABLE 2: NOISE AT OUTPUT

Measurement method	Channel 1	Channel 2
A weighted rms	-69dBm	-71dBm
CCIR weighted rms	-66dBm	-67dBm
CCIR weighted quasi-peak		
ref 1kHz	-62dBm	-63dBm
50Hz hum	-63dBm	>-80dBm
100Hz hum	>-80dBm	-67dBm
150Hz hum	-60dBm	-62dBm

Other than the hum level, the output noise is at a satisfactorily low level and whilst the effect of extraneous noise is such that the unit may not be accommodated in noisy environments (such as the studio), the susceptibility to extraneous noise is not excessive.

So far as mains hum is concerned, the level varied wildly with the mains input voltage and the difference between the two channels is peculiar.

Reverberation characteristics

The relation between reverberation time and frequency for reverberation time settings of 3.5s and 7s is indicated in fig 4 which shows that whilst at the 3.5s setting the reverberation time is virtually constant with frequency, there are substantial changes in reverberation time at the 7s setting, both settings being reasonably accurate at 1kHz.

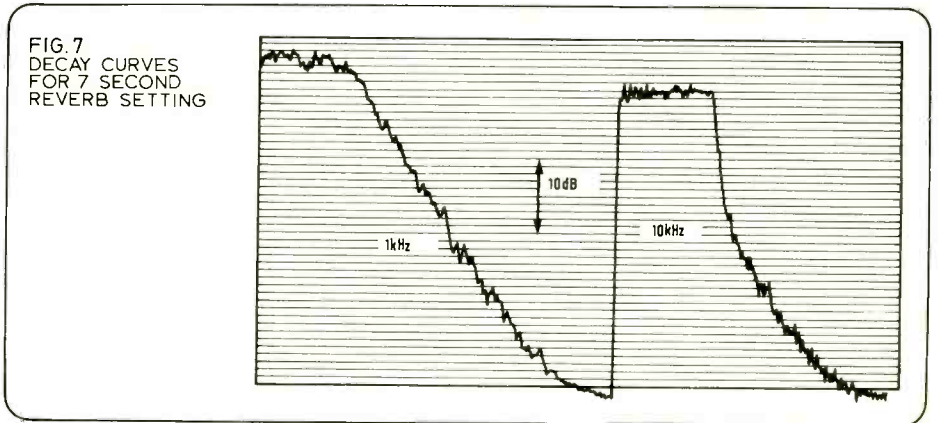
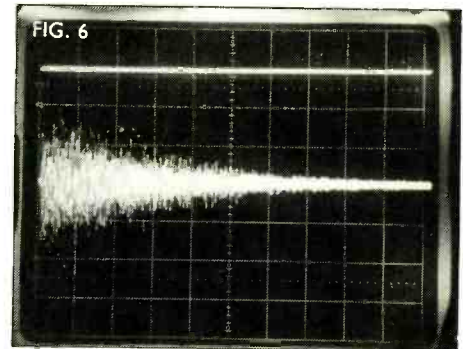
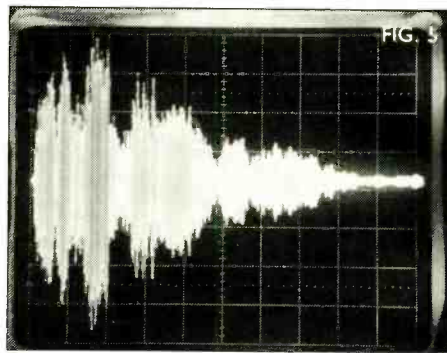
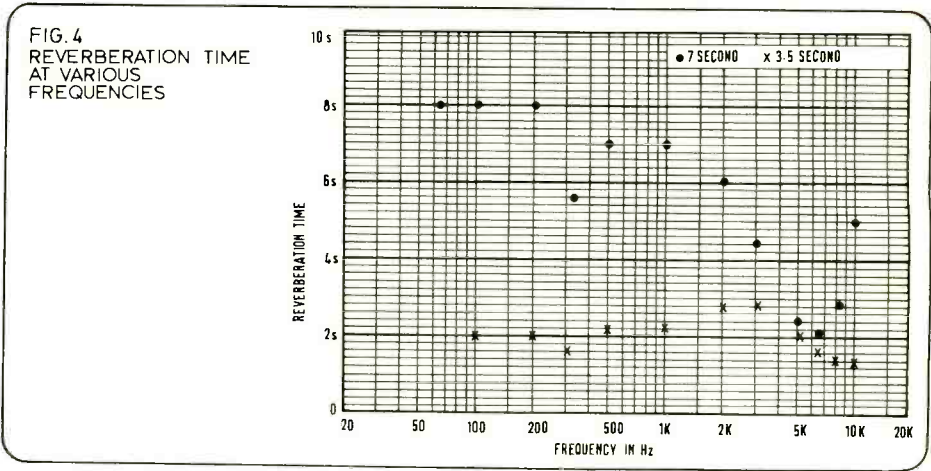
Unlike many reverberation units, it was the manufacturer's intention to make the reverberation time flat against frequency (unlike room reverberation) and this intention has succeeded certainly at the 7s setting. The manufacturer's claim is that this characteristic is better for 'pop' recording—all this is a matter of taste.

The result of exciting the unit with a 100ms burst of random noise is shown in fig 5 which illustrates that many reflections exist within the plate, whilst fig 6 is the result of exciting the plate with a single cycle of 1kHz tone and demonstrates a smooth decay again with multiple reflections. The plot of the decay curve for a 7s reverberation time setting is shown in fig 7 for 1kHz and 10kHz third octave bands of random noise, it being seen that at 1kHz the decay is smooth with a substantial early decay being introduced at 10kHz.

The subjective effects of these characteristics give this plate its own particular sound which, whilst it sounds like a plate as opposed to digital reverberation, does not have the 'tinny' sound of some devices.

Optional remote control

The remote part of this option consists of a small metal cabinet which houses a meter calibrated zero to 10 and two unidentified pushbuttons for increasing or decreasing the



reverberation time indicated on the meter. This remote unit connects via octal connectors to the remote drive unit which is screwed over the reverberation time pointer/lever and connected to its spindle via a flexible coupling.

The drive unit consists of a flimsy metal box with two unsecured relays, the mains transformer and the drive motor which drives the spindle via nylon reduction gears. The bits on the top of the box make the unit untidy and vulnerable to damage and I don't see why they were not contained within the box. On one side of the box is the fixed mains lead and unidentified fuse, and on the other side the octal remote socket.

Internally the wiring and standard of soldering is decidedly poor and untidy, and whilst the unit works and has its controls

properly interlocked, the standard of design and construction are poor.

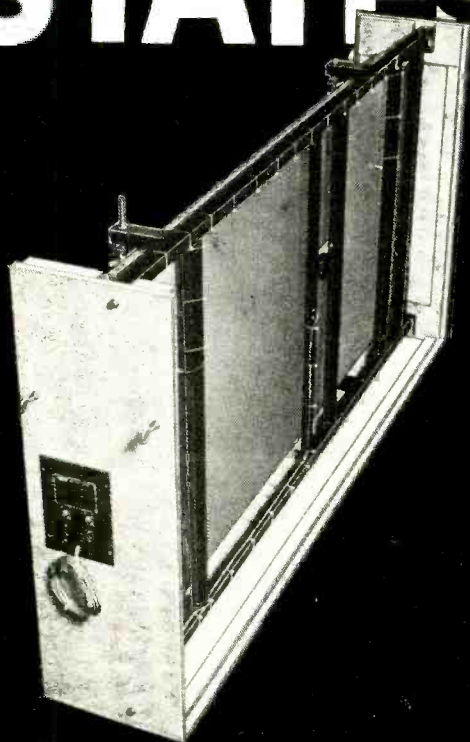
Summary

From the point of view of the reverberation characteristics this unit is unusual and may well prove attractive for many applications, but, in my opinion the sound cannot be considered similar to natural reverberation as would be used with classical music. However, this is all a matter of personal taste and I have but reported the facts in this review.

So far as the electronics are concerned (and the optional remote control unit) the standard of construction leaves something to be desired, but, the mechanical construction of the reverberation plate itself was to a good standard.

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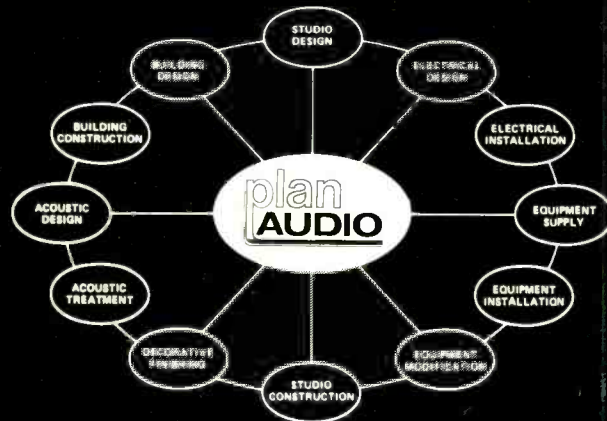
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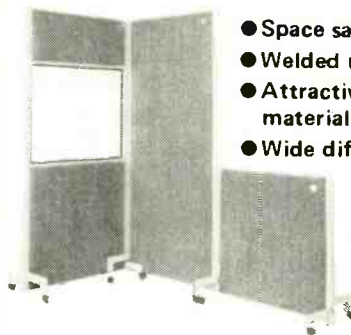


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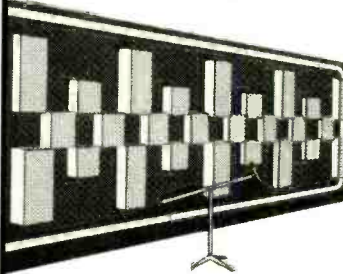
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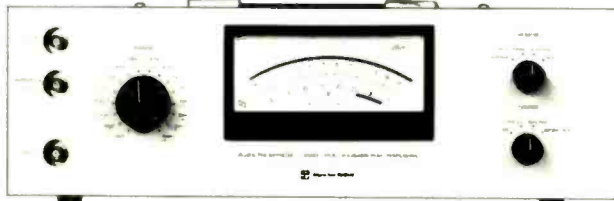
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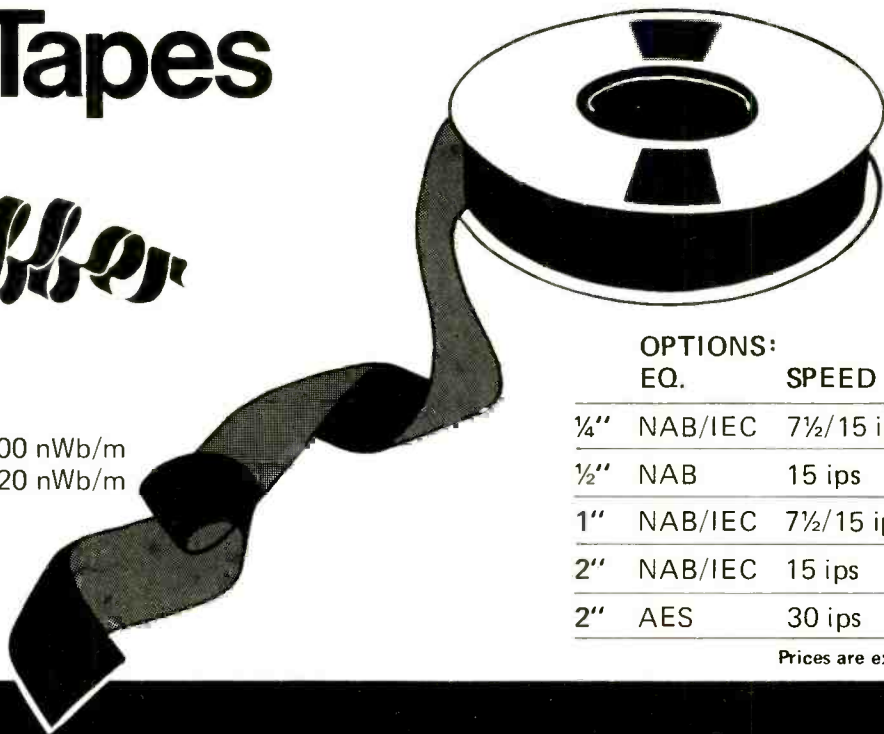
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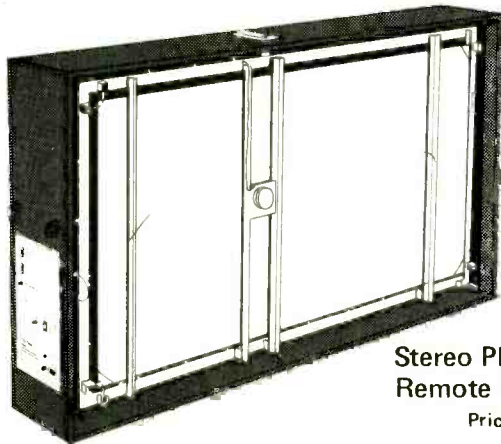
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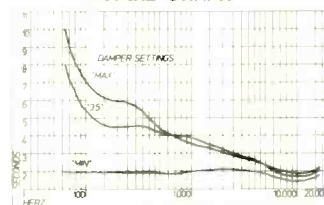
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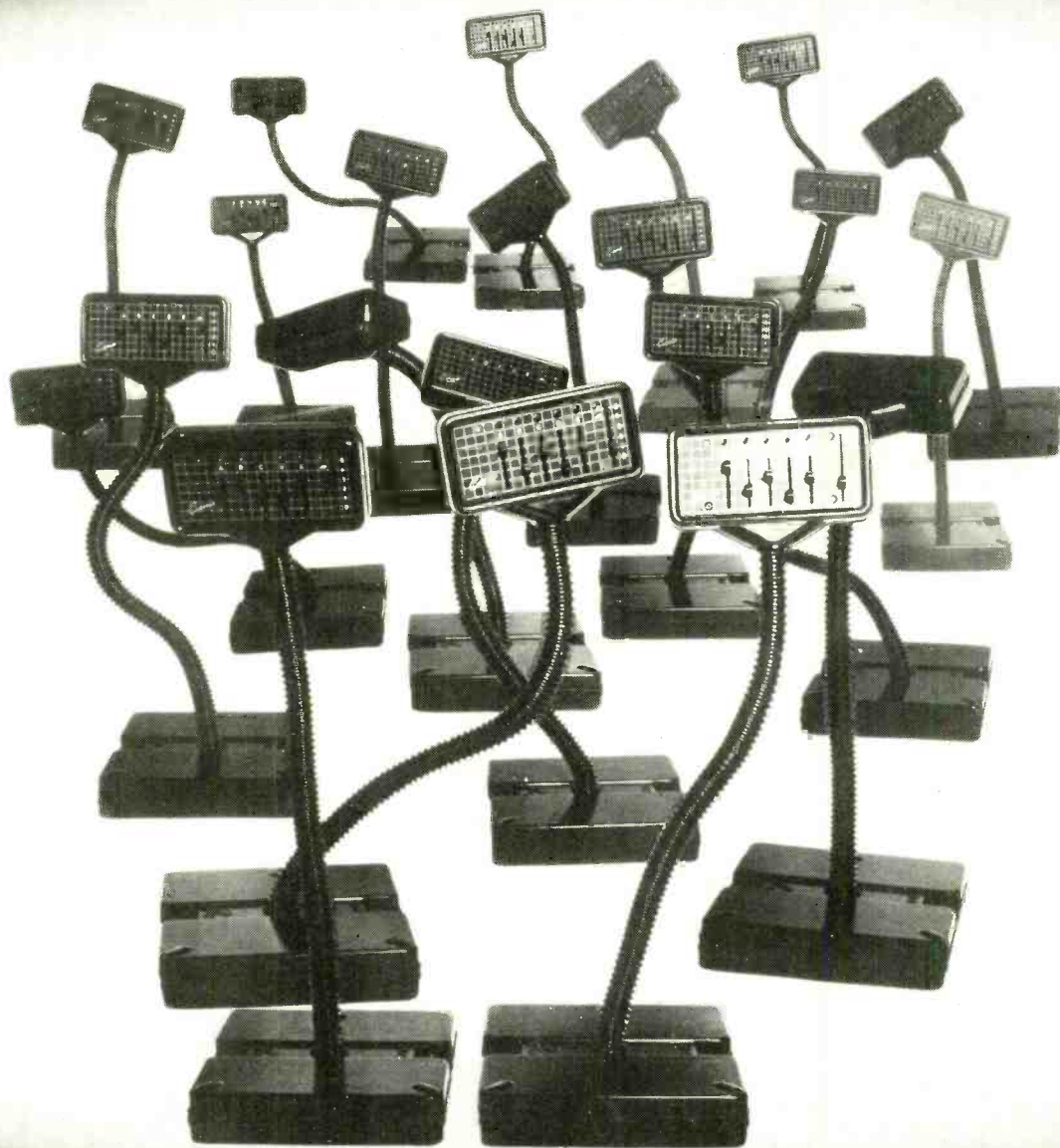
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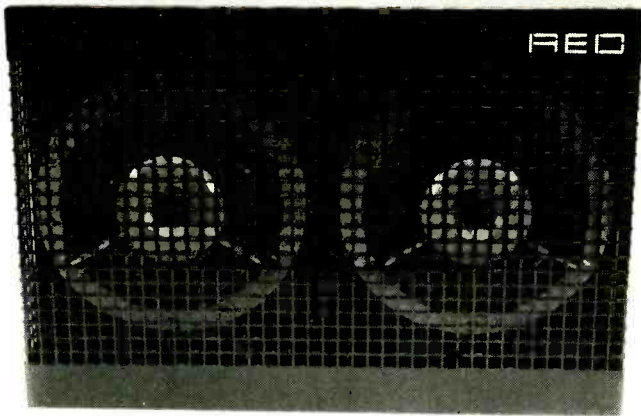
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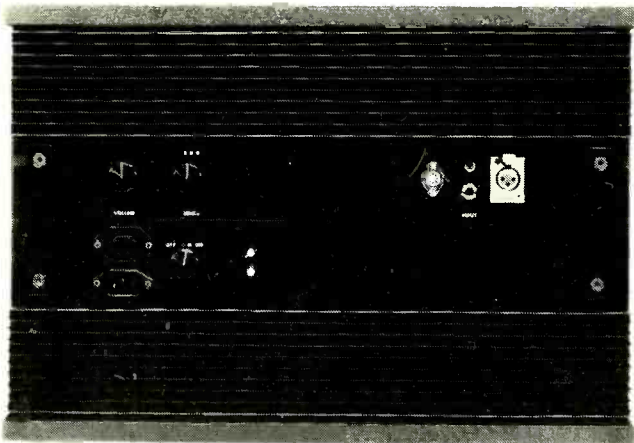
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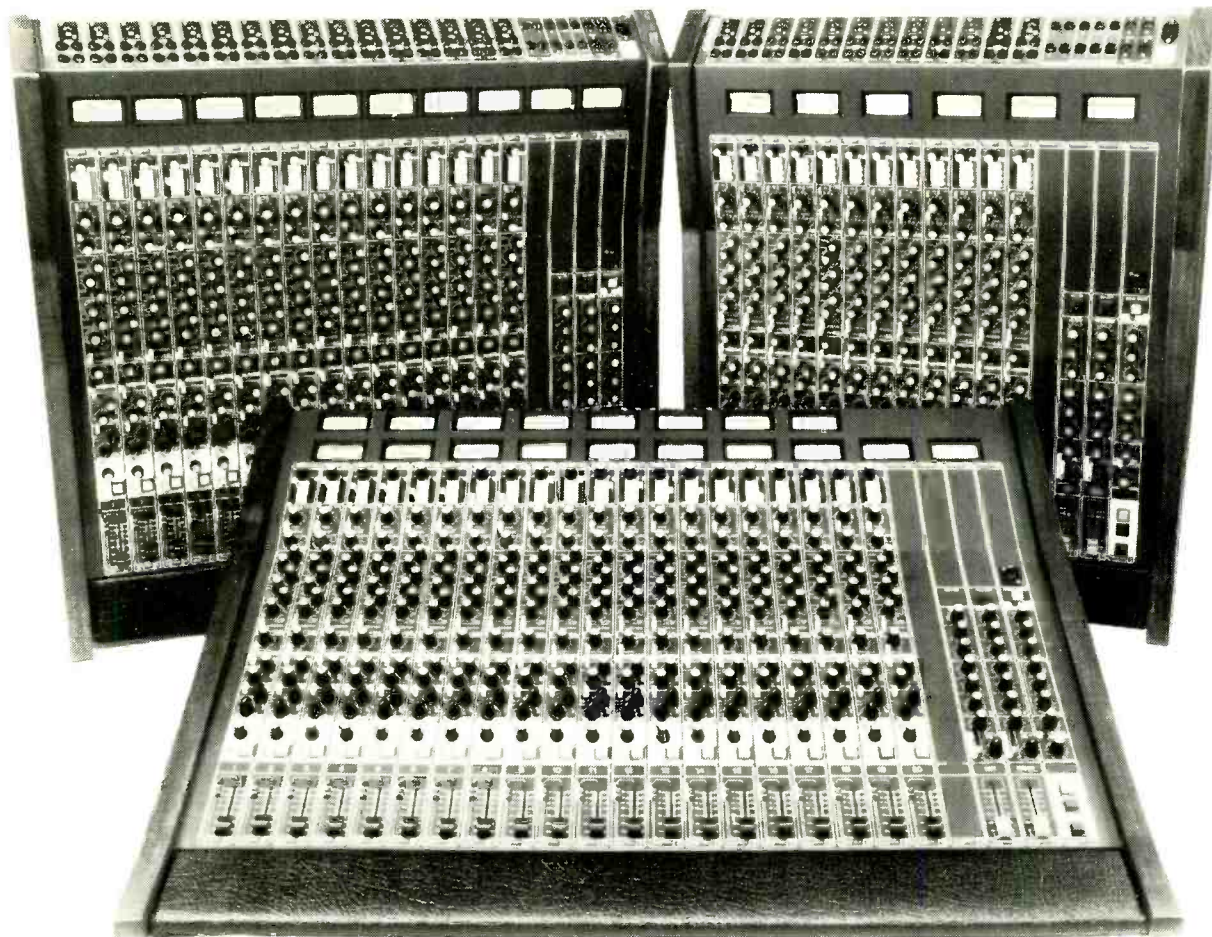
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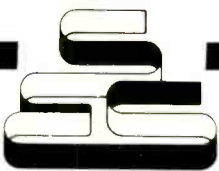
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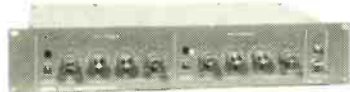
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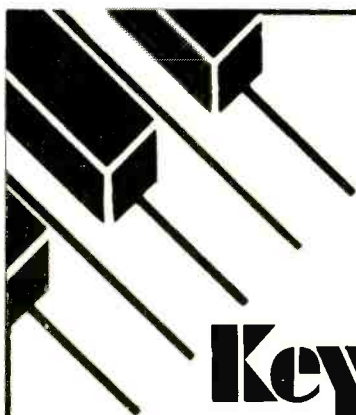
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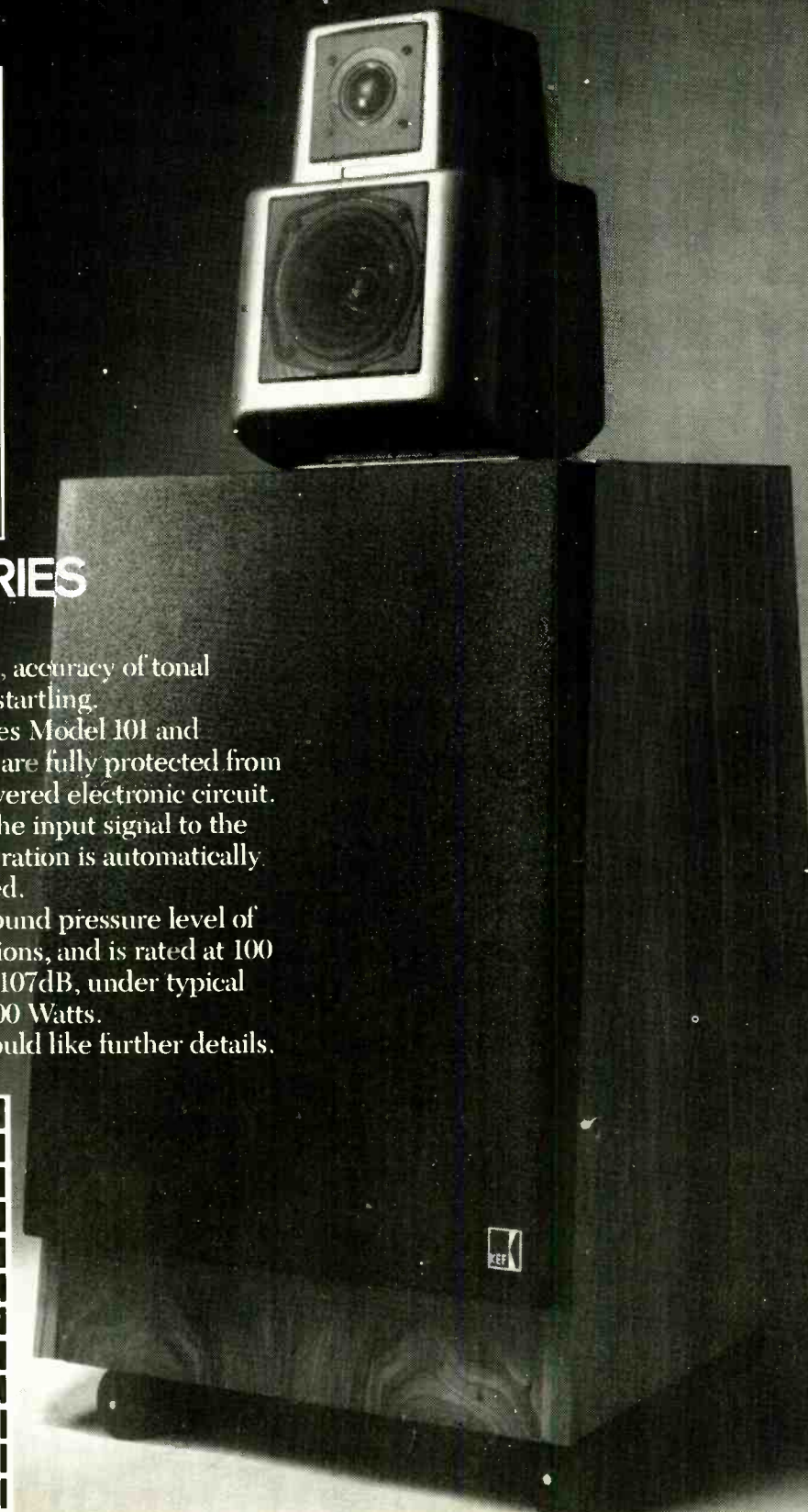
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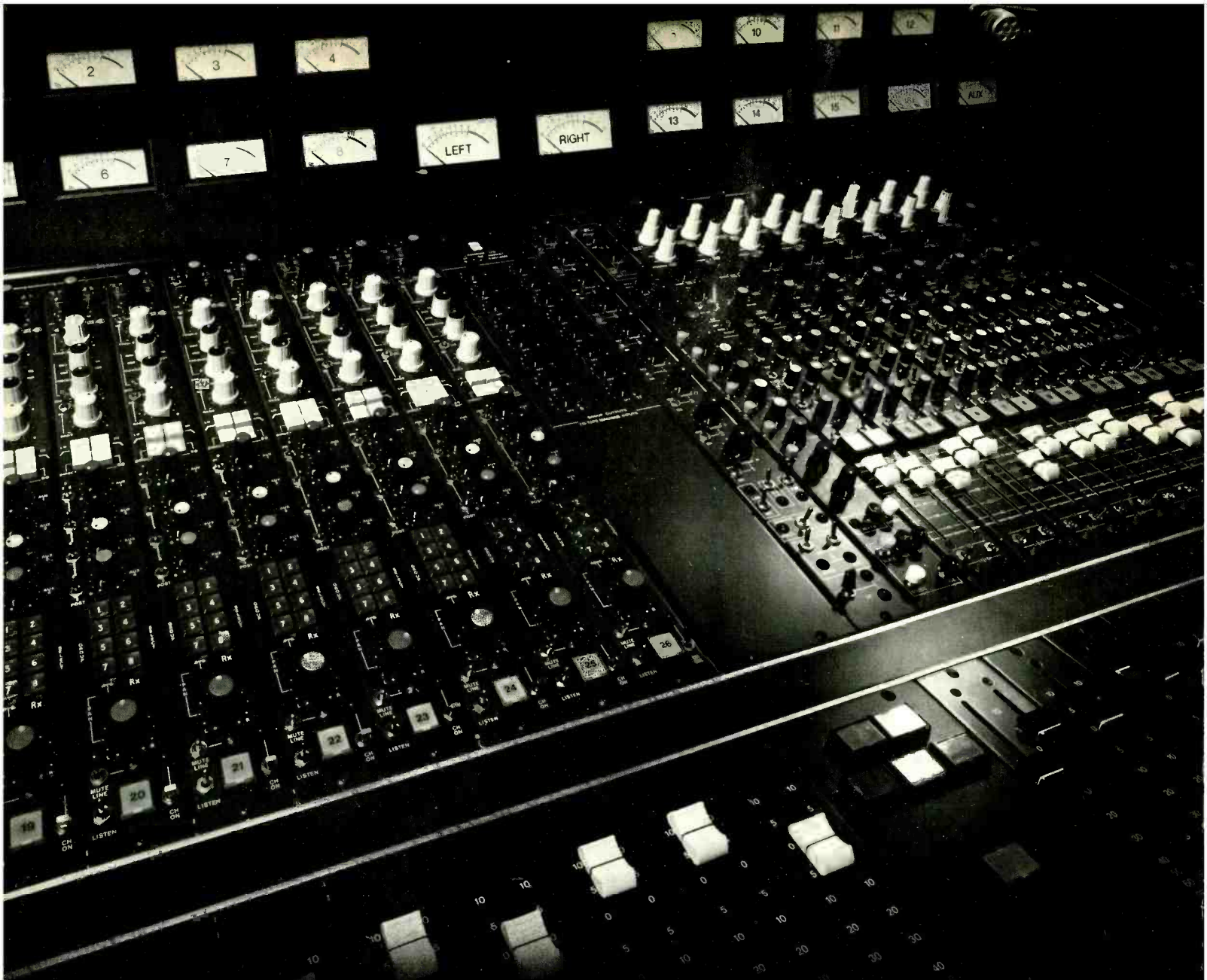
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10-49	51p	53p	55p	59p	63p	67p	72p	80p	87p	97p	107p	117p
50-99	48p	50p	52p	55p	58p	61p	68p	76p	84p	94p	104p	114p
100-149	47p	49p	51p	52p	54p	56p	63p	72p	79p	89p	99p	109p
150-249	43p	45p	47p	48p	50p	52p	60p	69p	74p	84p	94p	104p
250-499	41p	43p	45p	46p	47p	48p	56p	64p	70p	80p	90p	100p
500-999	39p	40p	41p	42p	43p	44p	51p	59p	67p	77p	87p	97p
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Tel: Maidenhead (0628) 39171.

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The MR-1 is clearly a console designed for the eighties, with the new technology of the eighties. Its technical advances allow for increased efficiency in the use of personnel and facilities by reducing redundant work load and increasing the throughput of the studio. Expanded automation opportunities,

many added features, ease of operation, increased reliability, and easier maintenance place the MR-1 way out front in terms of cost effectiveness, as well as ergonomics (human engineering).

NEW DCI CONCEPT

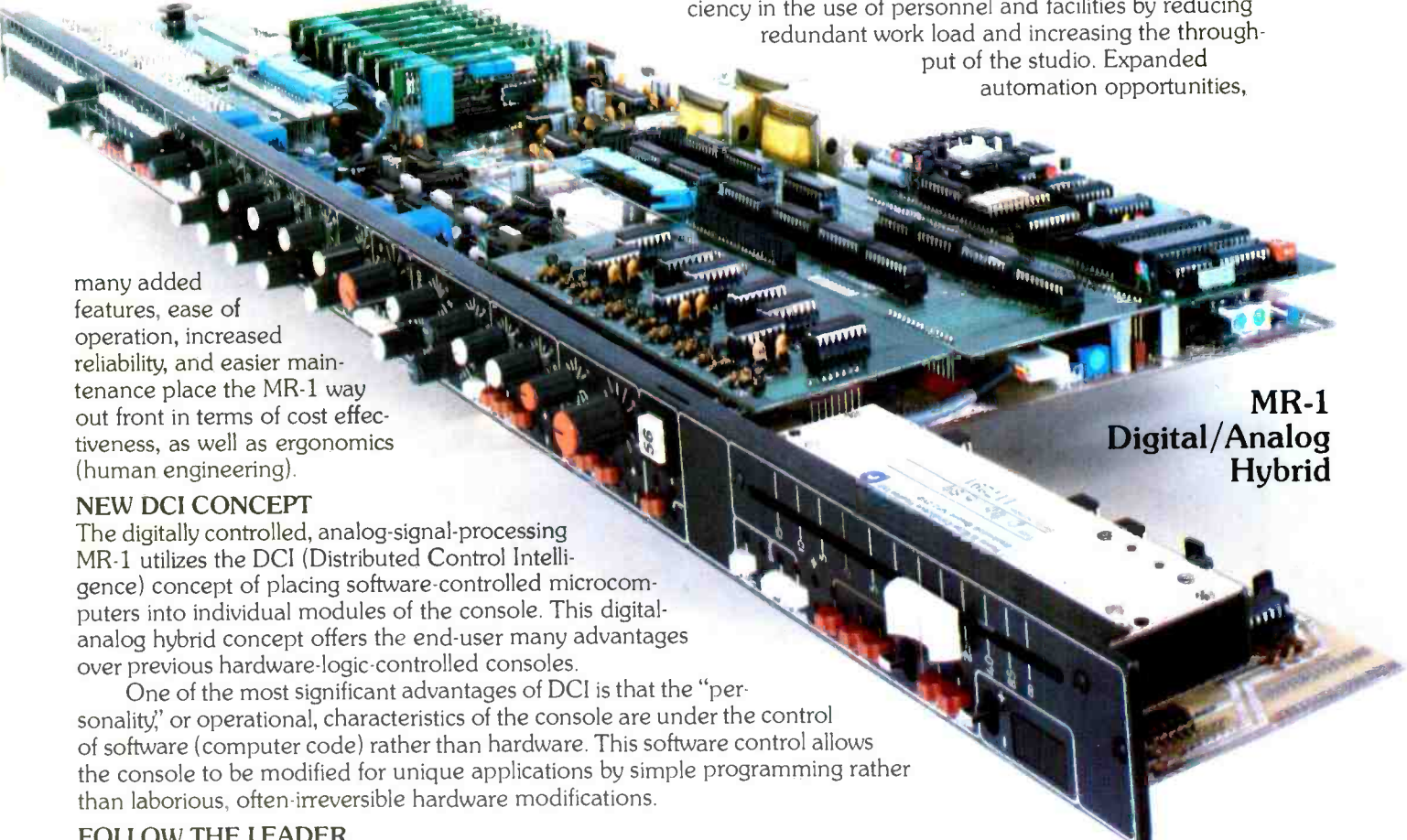
The digitally controlled, analog-signal-processing MR-1 utilizes the DCI (Distributed Control Intelligence) concept of placing software-controlled microcomputers into individual modules of the console. This digital-analog hybrid concept offers the end-user many advantages over previous hardware-logic-controlled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

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

FOLLOW THE LEADER

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

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



MR-1
Digital/Analog
Hybrid

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

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