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PUBLISHER DOUGLAS G. SHUARD

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STUDIO SOUND is published on the second Friday of the preceding month.

SUBSCRIPTIONS
STUDIO SOUND is available on a rigidly controlled requested basis only to qualified personnel (see back page for terms of control), or for an annual cost of £16.50 to non-qualifying readers or where more than two copies are required in a studio or small organisation.

UK Subscription cost £16.50.
UNITED STATES Surface mail subscription $40, airmail subscription $75.
OVERSEAS Surface mail subscription £17.50, airmail subscription £32.50.

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All subscription and circulation enquiries to: Controlled Circulation/Subscription Dept, Link House Publications Ltd, Link House, Dingwall Avenue, Croydon CR9 2TA, UK. Phone: 01-686 2599. Telex: 947709.

US mailing agents: Expediters of the Printed Word Ltd, 527 Madison Avenue, Suite 1217, New York, NY 10022.

CONTROLLED CIRCULATION POSTAGE PAID AT NEW YORK, NY

BACK COPIES
A limited number of back copies are available, at cover prices.

Total average net circulation of 13,056 per issue during 1980. UK: 5,662. Overseas: 7,394.

Printed in England

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AND BROADCAST ENGINEERING

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Sounds of success—and failure

Readers will know full well from our coverage and circulation that we are an international magazine, but we *are* based in Britain, and it is therefore quite pleasurable to hear that a British product in the audio industry has received the recognition that it deserves. We are therefore very pleased to hear that Solid State Logic have received a 1981 Design Council Award for their *SL4000E* automated console system, the first such award to be given to a professional audio product, awards also going to such diverse products and devices as the *Terence Piper Personalised Refreshment Service* (Share and Enjoy?), the *LO-Kata 5* radio compass, and the BL *Metro* and Ford *Escort* cars. Innovative products in all fields, from all countries, deserve official recognition.

Yet so often this is not the case. While other countries, notably the US and Japan, have poured millions into their high technology industries, the areas they know are going to bring in large incomes in the future, like computers and microelectronics, Britain seems more than reluctant to give support to its own industries of like type, leaving the task to private investment which is, in seemingly the only country in the world with no end to recession in sight, hard to come by to say the least. Whatever happened to our great microelectronic hope, Inmos, for example? And why isn't the British Government investing to ensure that when we eventually emerge from the recession (whether because of or in spite of present economic policies) we will have innovative ideas left, and the companies to exploit them? Britain has a wondrous store of good, new ideas, but it is becoming increasingly difficult to get them on to the market. During my time with *Sound International* I saw many small British musical instrument manufacturers, makers of world-beating products, heading towards economic doom, their workforce fated to join the dole queues, spending taxpayers money on producing nothing, where, with Government support, at least that public money would be going towards making products which, after the recession, would be able to pay back the investment. It seems as if, but for a handful of sturdy, well-established companies, there just won't be a British musical instrument industry in a year or two, apart from the importers. And this sorry state of affairs could so easily extend to our part of the electronics industry. We've seen too many good little companies ruined by high interest rates on capital and property, stifled by simple lack of official interest. To compete effectively with other countries, British industry needs the same support that other countries give to their industries, or a free market structure is no longer free: it is biased from the outset.

We in the British audio industry are lucky in the sense that we can obtain Board of Trade sponsorship for exhibitions abroad, and thanks to the administration of such benefits (although it may not be perfect), even small companies can get out and show their wares to the international market. But in other areas, book publishing for example, the lump sum is divided up in such a way that it can actually cost a small company *more* to exhibit *with* 'sponsorship' than without—surely an absurd state of affairs, condemning the smaller companies, often the innovators, to an economic outer darkness.

We, through our pages, are pleased to salute companies in professional audio for their new and exciting innovations, *whatever* their country of origin. We are an international magazine. But just once in a while, we'd like to see British innovators get a fair crack of the whip, and that means wholehearted Government support in these depressed times. That's not being parochial: it just means being fair.

Designing a mixing console

Because Steve Dove's mixer series is so long, it would have been difficult to hold publication until all the parts were received. This leaves us open to occasional problems, like this month, where Steve's latest instalment did not reach us from New York by the time of going to press. The series will continue next month, and we apologise to readers for the inconvenience.

Richard Elen

Cover photograph of Lansdowne Studios' Melkuist GT800 system by Roger Phillips

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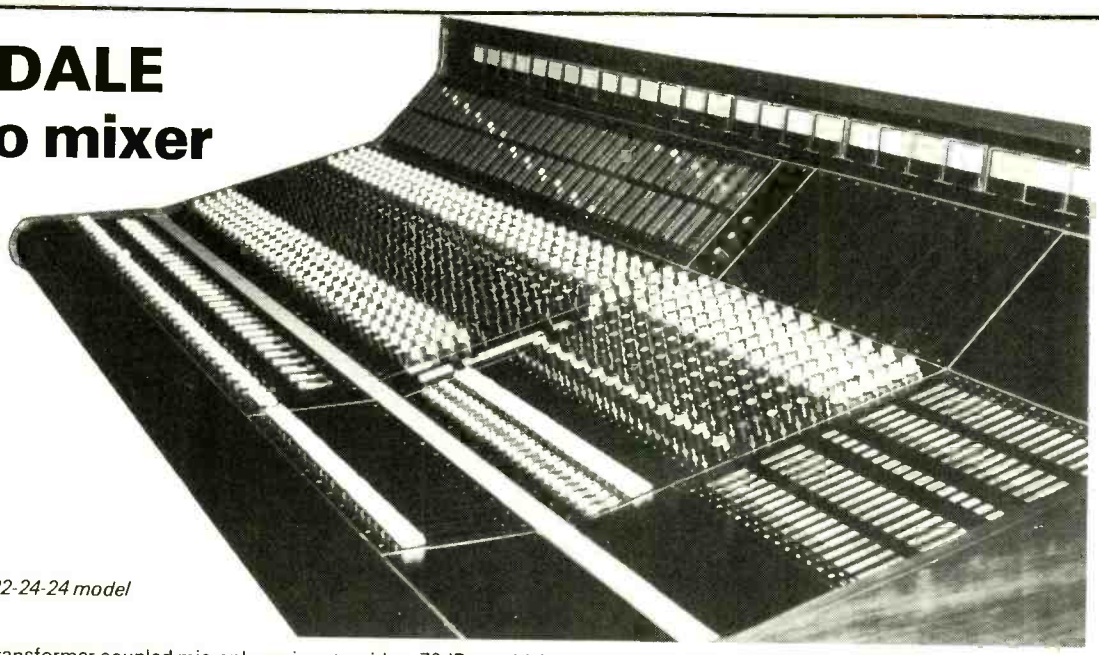

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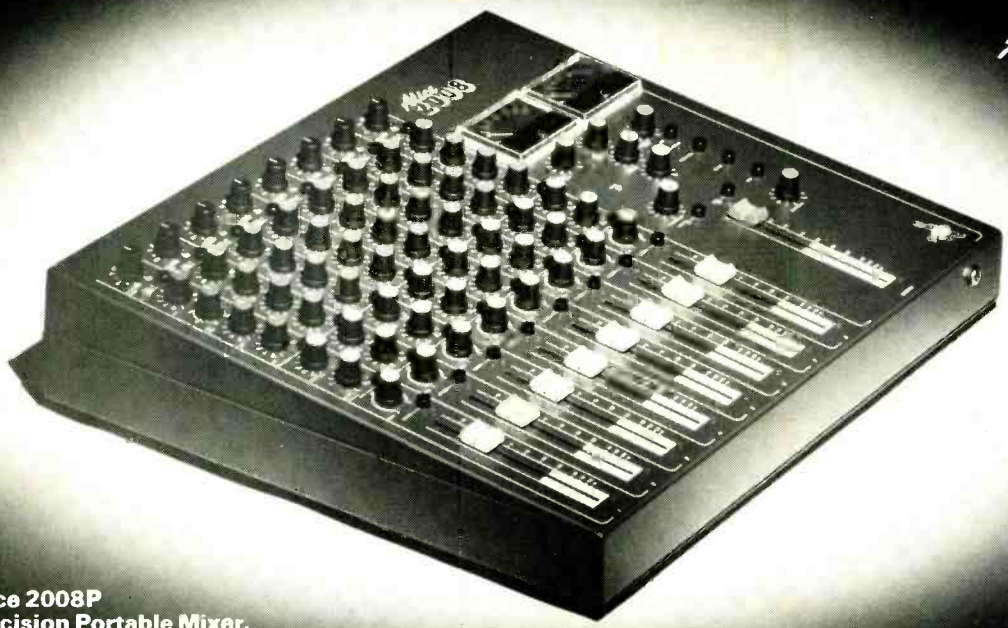

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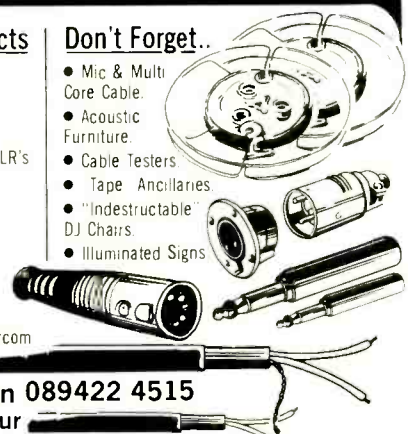

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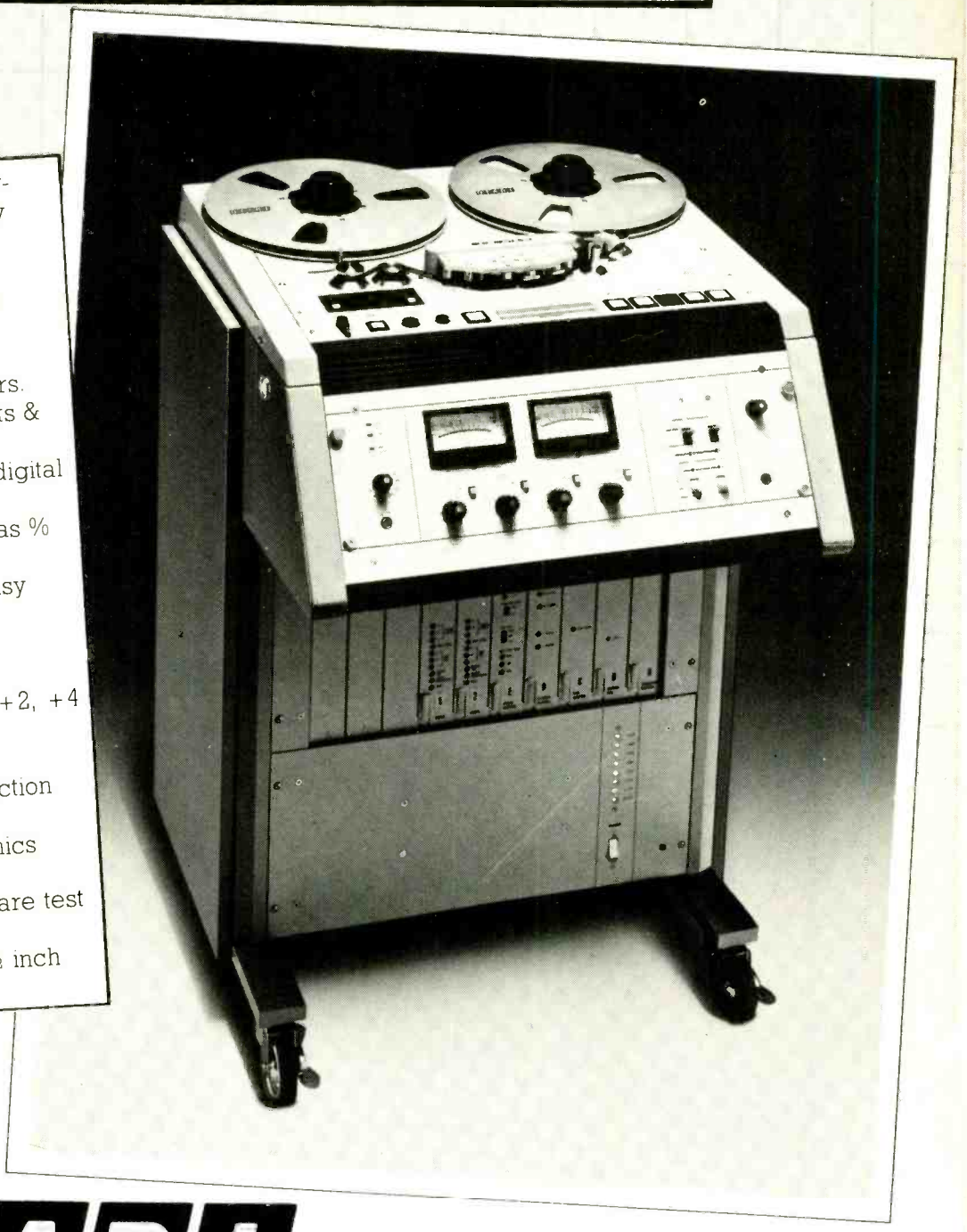

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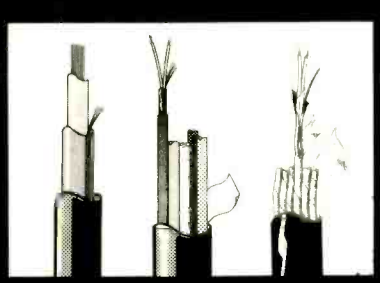

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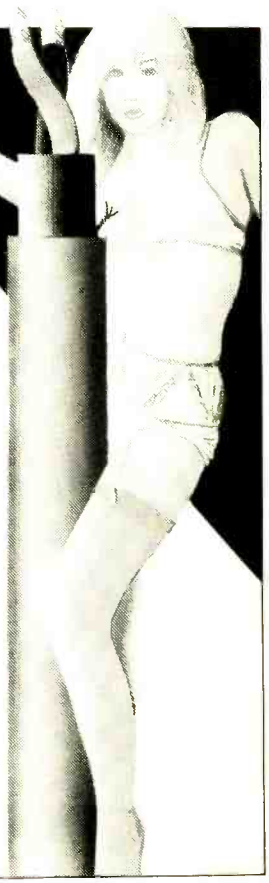

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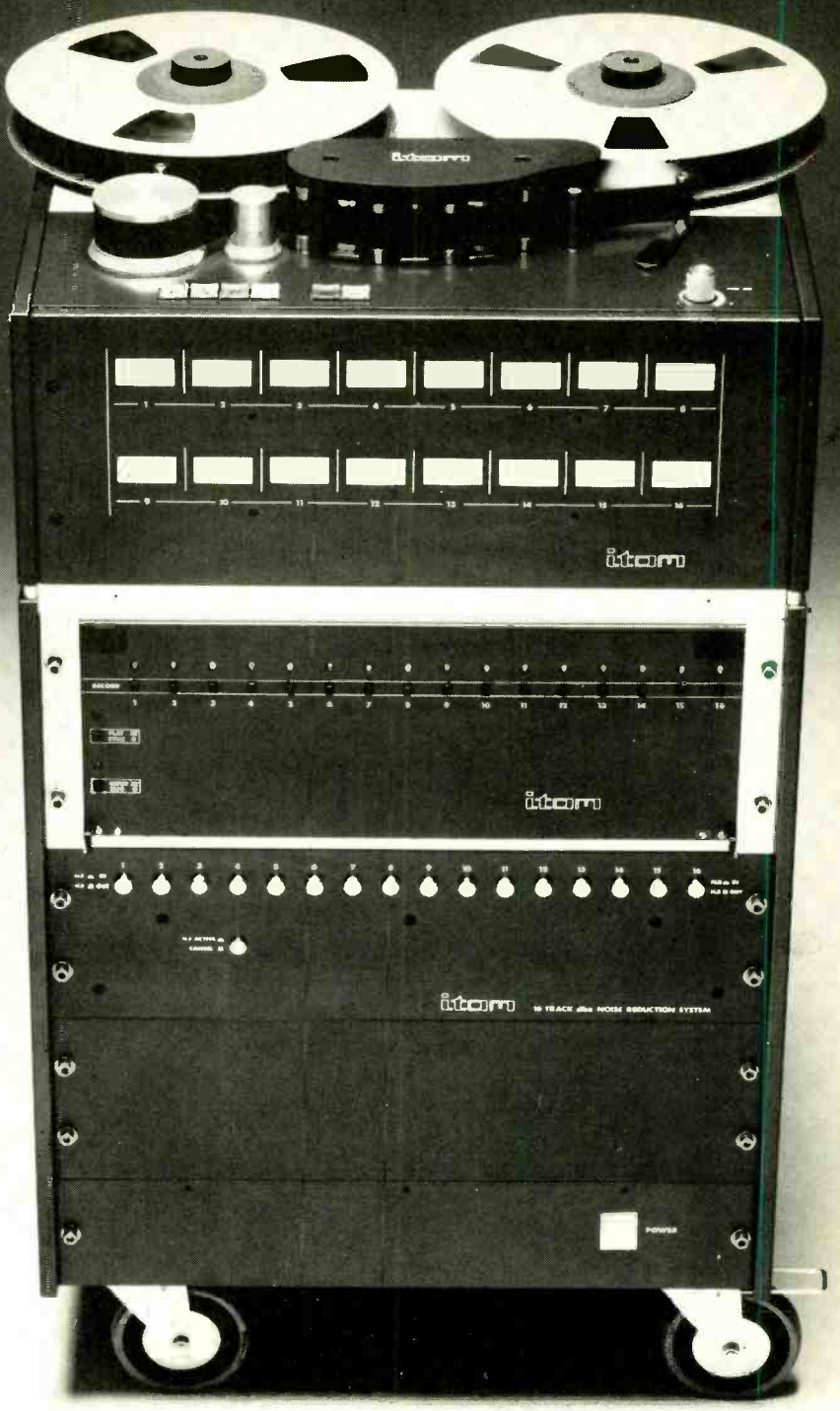

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		15	380		200		200 or 320
1	25	7½	190		200		200 or 320
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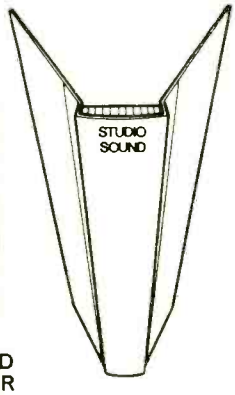

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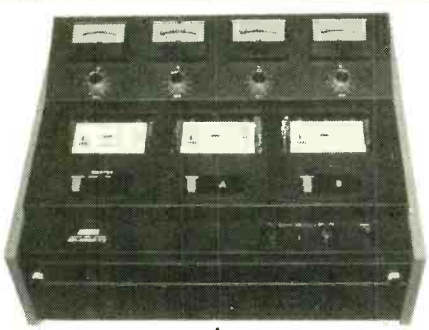

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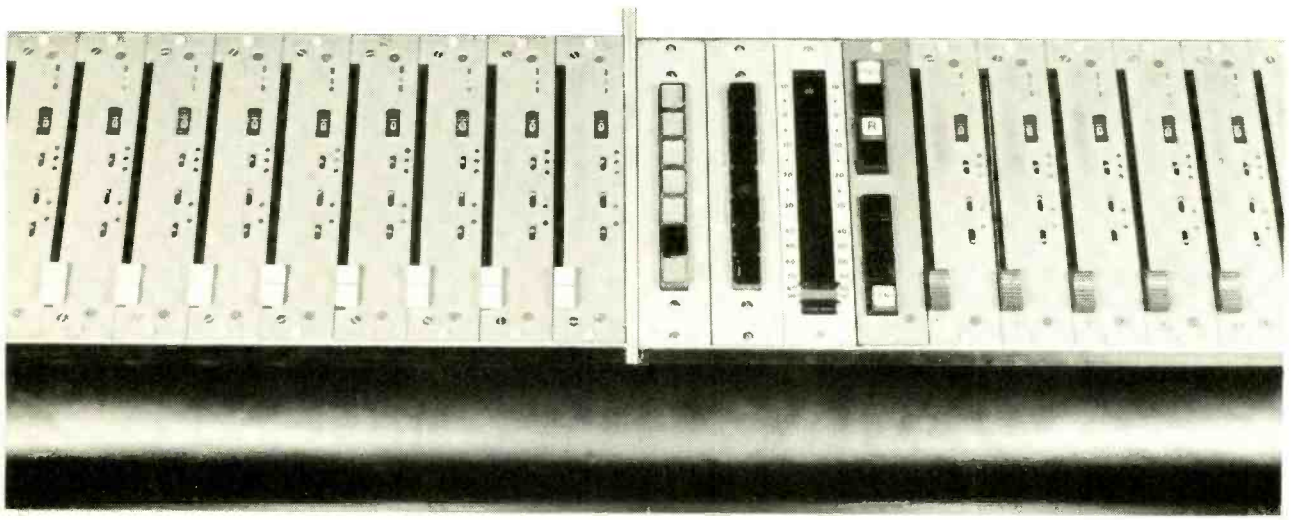

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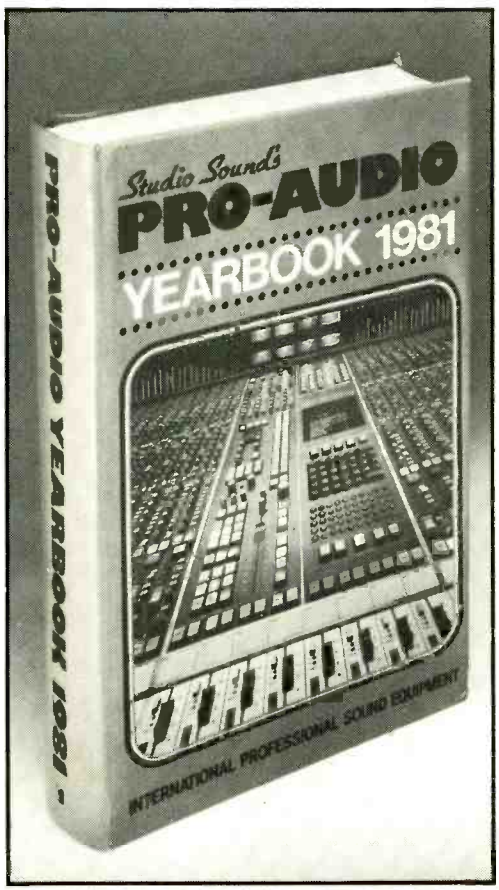

From the publishers of the monthly magazine *Studio Sound*, the *Pro-Audio Yearbook* is the latest addition to a series of comprehensive annual publications providing extensive coverage of the ever expanding audio and video markets.
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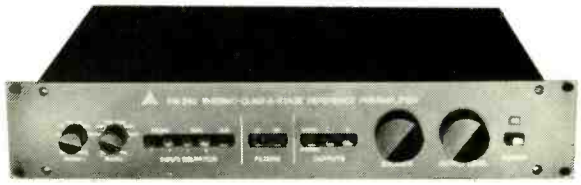
news



Reference preamp from FM Acoustics

The FM Acoustics *240* preamp is the latest in a strong line of professional audio equipment from this highly respected Swiss company. As for all their gear, a remarkable set of testing, calibration and selection procedures are followed before the unit is allowed to leave the factory. Apparently, one *240* requires the selection of over 300 transistors, because the reject rate is between 90 and 95% (and these are components from the world's top manufacturers!). Each preamp is handmade and burnt in for at least 50 hours, then vibration tested for a further two; finally, units are re-tested before they leave the factory.

These exhaustive procedures doubtless ensure the highest possible standards. They also mean that only small quantities are produced. The preamp has two magnetic cartridge inputs, phono 1 including full adjustment of input impedance and capacitance. There are also three high-level inputs, one lf filter for tonearm resonance damping, one rf filter, one mono/stereo switch and two individual outputs.

Balance and level control pots are conductive plastic types (also individually selected) and all ins and outs incorporate anti-thump contact circuitry. The interior of the preamp is beautifully finished, featuring a silver-plated pcb and no internal wiring.

The *240* is subtitled the 'Thermo-Quad-A-Stage' preamp, this name referring to the novel use of five single modules including four thermally-connected Class A amps, thus optimising thermal aspects.

Other FM Acoustics products include a moving-coil head amp (*212A*) as well as two high-power monitoring amps, the *600A* (250W into 8Ω) and *800A* (400W).

Other news from FM Acoustics is that Farmyard Recording Studios are to be supplied with two *600A* units, one unit also being supplied to MCI UK for their mobile. In fact, MCI UK have recently been appointed sole distributor for FM Acoustics in all Eastern European countries. Unfortunately, one FM *600A* has also been stolen in the UK, serial number 336L1. If you come across it, contact MCI (01-388 7867) or FM Acoustics, Weymouth.

FM Acoustics, Tiefenhofstrasse 17, CH-8820 Wädenswil, Switzerland. Phone: 01 780.64.44.

UK: FM Acoustics UK Ltd, 2 Kempston Road, Rodwell, Weymouth DT4 8XB. Phone: 0305 784049.

Pro-Audio Yearbook 1981

Angus Robertson, *Studio Sound*'s former editor, has, since leaving the magazine, been beavering away producing the first *Studio Sound Pro-Audio Yearbook*. Not a task to be undertaken lightly as the book is intended to be as uncompromising as the magazine. However, it is now available to all our avid readers and is the most comprehensive annual directory of products suitable for professional recording and broadcasting usage. Containing over 600 pages of information and photographs, the first Yearbook has over 70 sections covering equipment and services together with a full index giving instantaneous access to individual manufacturers, distributors, and pro-audio dealers worldwide. As a reference source for the industry the Yearbook is unparalleled in its coverage, and despite our close editorial liaison we have no hesitation in recommending it. Cost of the Yearbook is £19.50/$49.50 excluding postage.

Looking to the future, *Studio Sound* will be producing a complementary first edition of the *Recording Yearbook* later this year, covering all professional recording studios, disc cutting facilities, etc. Accordingly, we would urge all studios which have not already supplied us with information for inclusion to contact Angus Robertson, Special Projects Dept, Link House Magazines (Croydon) Ltd, Link House, Dingwall Avenue, Croydon CR9 2TA, UK. Phone: 01-686 2599. Telex: 947709.

B 67's for India

Studer International has concluded a supply contract with Meltron Maharashtra, India to supply *B 67* console, repro and portable tape machines for use by All India Radio, National Broadcasting of India. Under the first phase of the contract some 300 tape machines will be supplied and over the next five years a total of 565 console, 515 repro, and 312 portable machines are to be supplied. Present Indian import regulations only permit limited equipment importation, accordingly the second and third phases of the contract will therefore entail the supply of Studer equipment in knock-down kit form for assembly by Indian personnel specially trained in Switzerland.

Although the agreement, ratified by the Indian Government in December 1980, includes production of certain components in India, tape heads, motors, etc, will be manufactured in Switzerland and exported to India.

Micks Electronic Workshop

UK company Micks Electronic Workshop has moved to a new address and in addition undergone a change of name. Henceforward the company will be known as MEW and can be contacted at: 4 Send Road, Caversham, Reading, Berks, UK. Phone: 0734 473042. Telex: 87515.

Survey correction

In our survey of compressors and limiters in the March edition of *Studio Sound* we inadvertently gave an incorrect address for MXR. The correct address is: MXR Innovations Inc, 740 Driving Park Avenue, Rochester, NY 14613, USA: Phone: (716) 254-2910. Telex: 978451. Our apologies for the error.

MCI/Sony digital audio

MCI and Sony have jointly announced that MCI has adopted the common format for multichannel stationary-head digital audio which was announced last year by Sony and Studer. The announcement should certainly simplify the task of achieving a widely accepted industry standard for multichannel stationary-head digital audio recording tape machines; however, it remains to be seen just how important this decision will be.

1981 Audio Award

At an award ceremony held in late May, Sir Charles Groves and Kenneth Wilkinson (ex-chief recording engineer at Decca) were recipients of the 1981 Audio Awards which are presented to individuals for services to British music. Sponsored by the Composer's Guild, the MCPS, National Federation of Gramophone Societies, the National Music Council, Songwriters Guild, and the Performing Rights Society, in conjunction with our sister publication *Hi-Fi News*, this 15th award ceremony gave due recognition to both sides of the recording process in the form of a distinguished conductor and one of the most highly respected classical recording engineers. While Sir Charles in conjunction with three noted producers, Brian Culverhouse, John Willan and Christopher Bishop, plus of course the cream of British orchestras have given us many notable recorded performances, it was particularly gratifying to see the backroom work of 'Wilkie' as he is affectionately known being given due reward.

Although now retired, Wilkie has seen most of the major developments in recording technology in his long career which spans 53 years of recording. His involvement with Decca started with the Crystallate Record Company in 1931 which was taken over by Decca in 1937, and Wilkie has progressed from direct cut acoustic recordings, through the advent of electrical recording, to tape recording, the introduction of the LP and stereo recording, and up to date with the first Decca digital recordings. Despite being primarily involved in classical recording where Wilkie has recorded with over 150 conductors and is especially known for his orchestral sessions recorded at London's Kingsway Hall, Wilkie has also recorded contemporary popular artists such as Gracie Fields, Vera Lynn and Mantovani. Highlights of his career include the Britten *War Requiem* sessions and Solti's Berlioz *Symphonie Fantastique*, both widely acclaimed recordings.

In the light of *Studio Sound*'s current series of articles questioning present day attitudes and techniques of recording it is worth noting that Wilkie's preferred mic technique for stereo recording is the Decca 'Tree'. The original 'Tree' consisted of three mics arranged in front of the orchestra in a T shape, mounted on a boom stand just behind and above the conductor. The centre mic is in front of the two side mics and is panpotted on the mixer to centre front, ie equal amounts to L and R channels—the left and right mics being appropriately routed to the stereo recorder. This mic format is the Decca equivalent of the basic coincident pair-type balance favoured for example by the BBC. Wilkie argues that such a format using physically spaced omnidirectional mics such as the Neumann *M50* fulfils his stated aim of obtaining a 'natural sound in music' by giving a more realistic reproduction of hall ambience with an excellent stereo balance. In view of the success of Wilkie's classical recordings, this format is perhaps worth reassessment in the light of the current vogue for purist coincident mic techniques.

Noel Bell

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dbx

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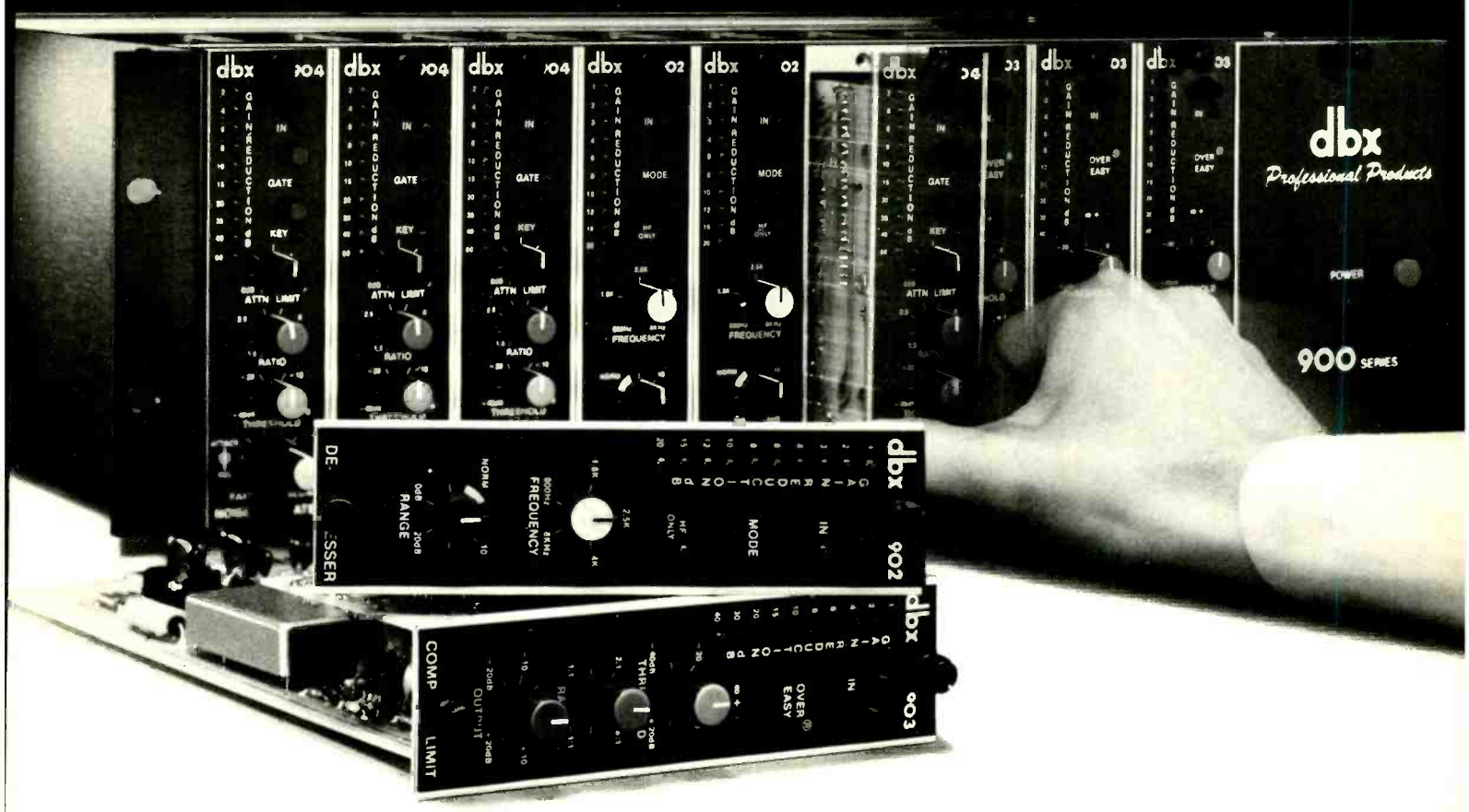

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Holland	**Special Audio Products BV** Scheldeplein 18, Amsterdam Tel: Amsterdam 797055
Sweden	**Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel: Gothenburg 130 216
Spain	**Mike Llewelyn-Jones** Francisco de Rojas 9, 2 DER, 9 Madrid 10 Tel: Madrid 445 1301
Germany	**Audio Vertrieb Peter Strüven GmbH** Hamburg Tel: Hamburg 5245151

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Studer Revox Compact Disc player

Studer Revox has announced that it has signed a license agreement with Philips/Sony for the production of Compact Disc record players. Following on from the agreement signed with Sony a few months ago, on a common digital format for a professional digital recorder, this new agreement will allow Studer Revox to produce not only professional digital recorders, but also consumer software playback units.

The Compact Disc accommodates 60 minutes of recorded audio on a 120mm (4¾in) diameter disc, and utilises an optical laser scanning playback system. Compact Discs incorporate CIRC error correction, use a 44.1kHz sampling rate and 16-bit linear code. Playback specifications include quartz controlled speed stability, S/N ratio ≥ 90dB, stereo crosstalk > 90dB, and total harmonic distortion < 0.05%.

ATOM vocoders

A new British vocoder system has recently come on to the market termed the ATOM. Comprising two units, the *SP400* vocoder and an optional special effects unit the *SPX400*, the full system is eminently suitable for recording applications. The *SP400* is a 20-channel vocoder with twin mic and line inputs and has a filter bank with 2 × 18 bandpass filters, plus high and lowpass filters. Primary function of the vocoder is the superimposition of one input (Articulation) on to a second signal (Excitation) although the *SP400* also has internal sound sources which may be used to synthesise whispered speech, speech on a monotone and speech of varying pitch.

Features of the *SP400* include go/no-go LED level indicators; a harmonic boost facility for increasing the harmonic content of the excitation input signal; a synthetic S facility allowing insertion of a noise burst into the excitation when a sibilant is sounded (LED indicators show whether a voiced or unvoiced sound is being uttered); an excitation follow mode to synthesise a voice with varying pitch; an output mixer to mix articulation, excitation and vocoder outputs; and remote switch facilities allowing preset mixes to be switched into live performances.

The optional *SPX400* special effects unit which derives its power from the *SP400* adds the following facilities: channel patching, allowing formant shifting, formant inversion and many other special effects; freeze facility (with LED indication and optional remote foot switching) allowing a vocoded output to be frozen on any selected syllable; and realtime spectrum analysis via an LED display. The latter function can also be frozen via the aforementioned freeze facility. Both units are 19in rack mount units and prices are *SP400* £1,195, *SPX400* £595, or if both units are purchased together £1,750 for the complete system.

Theatrescene Special Effects, Suite 4, 12-13 Henrietta Street, London WC2E 8LH, UK. Phone: 01-240 2116/2231.

Design Award for SSL

The UK Design Council has presented the Solid State Logic research and development team with the UK's top design award for engineering products. At a special ceremony held at the Royal Festival Hall, London, SSL's managing director, Colin Sanders, and industrial design consultant, Anthony van Tulleken, received their awards from the Duke of Edinburgh. The awards were made in recognition of the flexibility, efficiency, and ease of operation and maintenance of the SSL *SL 4000 E Series* console and computer system—and are the first awards to be made to a professional recording system.

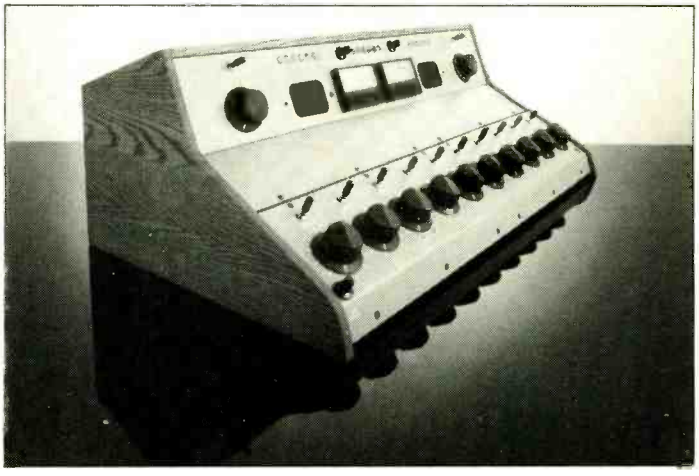
The Design Council Award is a fitting partner to SSL's recent Queen's Award for Export Achievement, highlighting both the technical and financial success of the company, despite the difficulties facing British industry in the current economic climate.

Howe 7000 broadcast console

Howe Audio Productions has produced a new broadcast console available in three configurations: the *7008* 8-channel mixer capable of handling 18 separate stereo inputs; the *7010* 10-channel mixer with the same facilities as the smaller model; and the *7012* 12-channel mixer capable of accepting 22 stereo inputs. The *7012* has six selectable inputs on channels 1 and 12, these inputs being designed as a summing system such that any number of sources can be used simultaneously.

The consoles contain two VU programme line meters, stereo cue loudspeakers, a peak programme LED display, programme/audition keys, the channel pots with cue detent, control room monitor level and headphone level controls, monitor/headphone mode selector, cue level control, and a headphone output. An optional 'A' panel is available which adds two more VU meters for the audition lines. A useful provision is a 4in blank panel situated in the middle of the console which is provided for the installation of any customised options. All the consoles are dc controlled with no audio in the faders or keys. The consoles are stereo, dual-channel mixers and have a mono programme output as standard. An additional feature is that they are all transformerless, active-balanced in and out. Prices of the consoles start from $3,995. Howe also produces phantom powered phone and mic preamps for its consoles.

Howe Audio Productions Inc, PO Box 383, Boulder, Colorado 80306, USA. Phone: (303) 494-4693.



Address Change

● Pro-Bel Ltd has moved to larger factory premises at Acre Road, Reading RG2 1QR, UK. Phone: 0734 866123. Telex: 849727.

People

● RTS Systems has appointed Jack Sympson, formerly with JBL, as its international sales manager.

● Paul Nagle has joined the Fostex sales team at Interlake Audio, Winnipeg, Canada as corporate sales manager.

● Texas Instruments Ltd has appointed Rod Attwooll as its new managing director.

Agencies

● Pentagon Industries Inc has announced that Jim Dow, vice president/marketing, has left the company to form a new manufacturers representative firm, Encore Marketing, in conjunction with Joseph Hollenkamp, national sales manager of Pentagon. Coinciding with this move Encore Marketing has been appointed Pentagon's sales representatives in the following American states: Illinois, Iowa, Indiana, Kansas, Kentucky, Minnesota, Missouri, Nebraska, North Dakota, South Dakota and Wisconsin.

Contracts

● Swisstone Electronics Ltd is to supply the BBC with a further 75 Rogers *LS5/8* studio monitors in addition to 150 Rogers *LS3/5A* and 75 *LS5/8* monitors already supplied. Other *LS5/8* customers include Nippon Philips (Japan), ITN, RTE, French Television and Ealing Music Studios.

● RTS Systems has supplied a large RTS *TW* intercom system to Catalena Productions, Vancouver for installation in a studio based mobile control room.

● Klark-Teknik has supplied Concert Sound, London with a custom *DN70* digital delay line incorporating a special lf sweep oscillator, allowing the unit to double up as an effects unit and digital delay line for loudspeaker arrays.

● Soundcraft has supplied the Zimbabwe Ministry of Youth with three *Series 800* 18/8 consoles and a 16-track recorder for PA usage at music and dance cultural events. The complete system also includes a Court Acoustics *Proflex* PA system powered by 24 BGW *750* power amps; 10 ADR *Scamp* comp/limiters; and a variety of AKG and Shure mics.

● Calrec is to supply the BBC with two *Mark 3* general purpose sound control desks accepting 22 outside sources, plus two *Mark 3A* desks handling 14 outside sources. The desks are to be installed in Broadcasting House, London and will be used for news, current affairs, and all major sports programmes.

● Altec Lansing are to provide the sound system for the new King Khaled International Airport, Riyadh, Saudi Arabia. The system will be the world's most powerful public address system, using 11,000 separate loudspeakers and capable of producing 85,000W of audio output. ■

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The Unlimited Limiter.

In keeping with MXR's expanding commitment to the professional recording industry, our engineers have designed and built the Dual Limiter. A world class mono-stereo limiter offering total flexibility and ease of operation, the Dual Limiter produces a musically natural response in any compression-limiting application. All of this versatility is built into a compact, rack-mountable package.

The totally unique VCA's at the heart of the Dual Limiter provide an exceptionally wide dynamic range with low levels of distortion. Continuous bass distortion is much lower in level than typical compressor-limiters, allowing more freedom in setting release characteristics.

The Dual Limiter is also a forgiving limiter. Attack and release characteristics dictated by the front panel controls are modified by program dynamics and compression requirements. The slope increases smoothly past the threshold point, allowing a *gradual* transition into compression. Varying the Dual Limiter's threshold region produces a variety of intermediate slopes with the primary slope being that chosen by the slope switch. These features permit apparent dynamics to be maintained even though the dynamic range is being controllably limited.

The Dual Limiter's remarkable versatility is based on the fact that it can be viewed as two independent mono limiters that can be patched together via front panel switches for stereo limiting applications. Each channel has an In/Out switch, Slope switch, Input, Output, Attack and Release controls and an LED display, showing the amount of gain reduction. On the rear are both XLR and ¼" phone jack (ring-tip-sleeve) input and output connectors. Each channel's detector is accessible via rear panel phone jacks to permit external tailoring of the detectors' frequency response. This feature allows for de-essing (reduction of vocal sibilance) and a wide variety of frequency dependent limiting needs.

Because virtually every form of musical signal was used to evaluate the Dual Limiter's response during the initial stages of development, its sophisticated internal circuitry enables it to sound musically *natural* — even at extreme compression settings.

Balanced inputs, the ability to drive 600 ohm loads, +19 dBm input and output and standard rack dimensions (1¾" high) allow the Dual Limiter to be easily integrated into any professional system. With an extremely rugged case, metal knobs and reliable internal construction, the new MXR Dual Limiter reflects the highest professional standards and has been fully designed and built in the U.S.A.

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MXR Professional Products Group

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studio diary

Danmarks Radio Mobile

If you pull out your 1978 *Studio Sound* binder, you will find on page 36 of the October issue, an interesting article which outlined the reasons why contemporary mixing consoles designed for commercial recording studios were not suitable for radio and TV music production.

The article was written by Danmarks Radio's Dan Popescu—just about the same time that Town House Studios were installing the first UK bound console from a little-known Oxfordshire-based manufacturer—Solid State Logic.

Three years on, Danmarks Radio are operating the first ever computer controlled audio recording truck which sports Studer multitrack and ¼in tape recorders, Eastlake/Hidley acoustics and monitoring, and Solid State Logic's *SL 4000 E Series* Master Studio System.

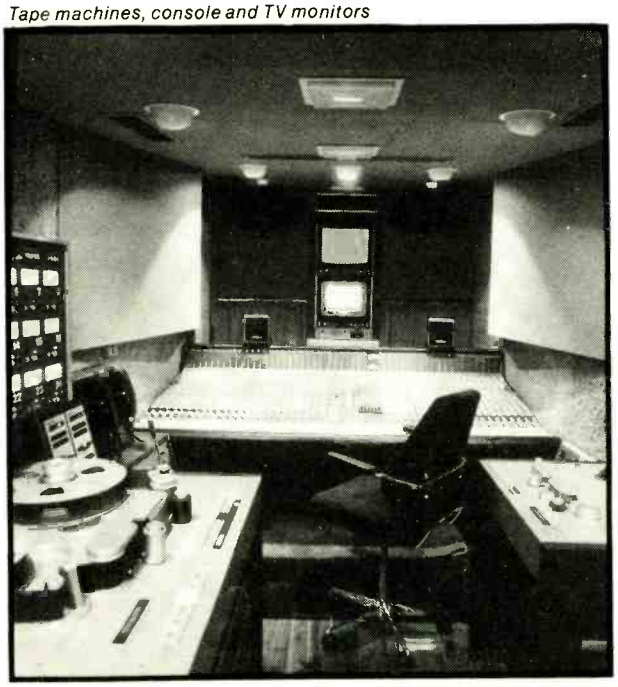
Danmarks Radio's philosophy in taking on this commitment is that the live broadcasting of concerts and other musical events are unique and precious occasions. In order to present these events to the public in the best possible manner, their engineers and producers need to work in an environment which provides the optimum in flexibility, efficiency and consistency of listening conditions between studio areas. This last point is an important one when you realise that the mobile project is only the first step in a plan which also involves the re-equipping of Danmarks Radio's Concert Hall Studio. The idea is that staff working on large scale radio and TV music productions should find both production areas consistent from acoustic, electronic, ergonomic and psychological aspects—particularly since productions rehearsed or recorded in one studio area may have to be completed in the other.

The truck itself is an articulated affair—the trailer is 40ft long by 8ft wide by 13ft high. Inside, there are two separate acoustic areas. The forward 10ft or so is the commentators' area—a particularly 'broadcast' type feature with a table, a chair, a video monitor and various intercoms—while the aft 30ft or so is the mobile control room.

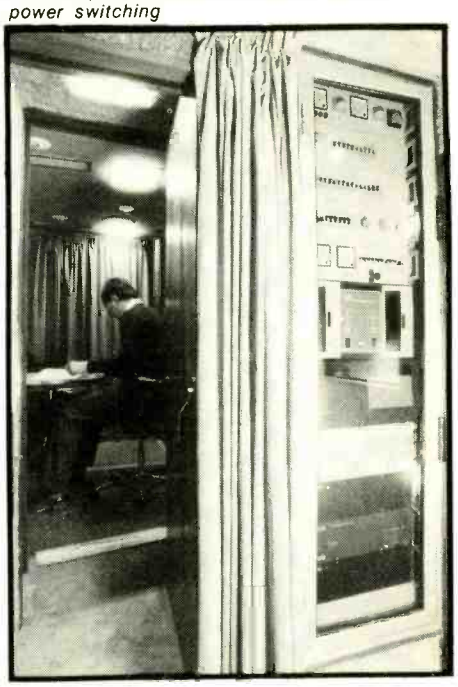
Initially, the most striking feature inside the control room is the familiar angled Hidley ceiling. Mounted at the rearward end of the truck facing forwards are the Eastlake *TM7T* monitors. They use a pair of JBL lf units together with a pair of TAD *4001* mf/hf drivers which operate into Eastlake timber horns (yet another familiar feature).

In between the monitor speakers, there is a rack full of assorted video and audio equipment. At the top, mounted one above the other, are two colour TV monitors. The upper one can be used either as a line monitor from a location video truck, as an off-air monitor via a receiver or as a closed-circuit monitor for the two remote controlled cameras that are part of the truck's visual monitoring facilities.

Tape machines, console and TV monitors



SSL computer in rack with desk PSUs and power switching



The lower colour monitor displays a variety of information from the current time code, to listings of various kinds—title/scene lists, cue lists, track lists and mix lists—as well as confirming computer status such as the current autolocation routine, automatic drop-in, or computer assisted mixing sequence. It will also display in full colour graphics, the set-up of every knob and switch on all of the mixing console's input/output modules. This is SSL's *Total Recall* system, which allows you to memorise and recall as many console 'set-ups' as you need, taking all the sweat out of trying to re-create the sound that you had on last week's or even last year's session.

Below the video monitors is the audio monitor power amp—a Studer *A68*. A Lansing crossover and two UREI graphic equalisers complete the monitoring system, although Dan Popescu tells me that the acoustic design of the truck has been so successful that they generally run the system flat. When the room was tested with a B & K pressure microphone, the frequency response without equalisers was found to be ± 3.5dB between 50Hz and 16kHz.

Immediately in front of the video and audio monitoring gear is a maintenance area with a door to the outside world, and in front of that is the 44-input SSL console. The console was originally designed for multitrack recording, but because the original system's design was approached with maximum flexibility in mind, it has been possible to provide additional switching logic which will reconfigure the console instantly from a multitrack status to a live-mix status—or in fact to a configuration which will allow the simultaneous production of a live mix to the transmitter, a 2-track recording of the broadcast, a multitrack master of the programme and a recording on floppy disk of the live-mix data.

In addition, the grouping system (both dc and patch-free audio grouping) has been found so flexible that many broadcasters—including Danmarks Radio, the BBC and ABC TV New York—are finding it the ideal answer to large-scale live music productions and/or video post-production.

The other feature of the console that appeals to live-mix engineers is that if no multitrack is required on a particular project, then the multitrack monitor faders may be quickly re-configured to double the number of inputs, or to provide any permutation of additional inputs, auxiliary sends or audio sub-groups.

Mounted in the wall to the left of the console facing rearwards are two bays. One is the console patchbay, which has two Lexicon *224* digital reverb controllers mounted above it. The other has various outboard processors such as harmonisers, delay lines, and M/S stereo panners. Included in this bay are Storno radio telephones for intercom purposes.

To the right of the console is another wall-mounted bay housing a pair of Sony closed-circuit camera pan and tilt controls.

Moving towards the forward part of the trailer are, on one side, a pair of 2-track Studer *A80*s, and on the other side, a 24-track Studer *A800 Mk II*. Wiring has been installed, and space is available for a second *A800*, but the second machine will be wheeled in from another area when required.

In the wall between the control room and the commentators' room, mounted either side of the connecting double doors, are two equipment racks. One has most of the power regulation and distribution gear along with the SSL *Total Recall* studio computer and its floppy disk drives—while the other holds the Lexicon digital reverb processors, Technics cassette machines and a TTM rack of *Telcom* noise reduction. The inputs to the latter can be remotely switched in and out, and also between the two 24-track machines.

As the Danmarks Radio Concert Hall control room is in the process of being re-designed (Eastlake monitors and design) and re-equipped with an *SL 4048 E Series* Master Studio System, the truck is currently being used as a temporary control room for the Concert Hall, and on going into service was quickly acclaimed as ". . . the best control room in the Danish Broadcasting System". **Bill Aitken** 22 ▶

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Product

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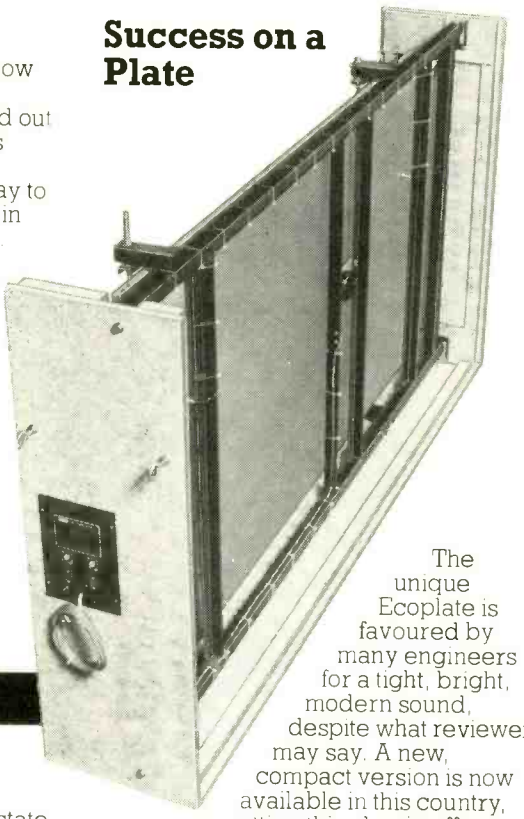

The unique Ecoplate is favoured by many engineers for a tight, bright, modern sound, despite what reviewers may say. A new, compact version is now available in this country, putting this classic effect within the reach of cost concious studios. Arrange for a demonstration, and hear what digital devices still have to catch up to.

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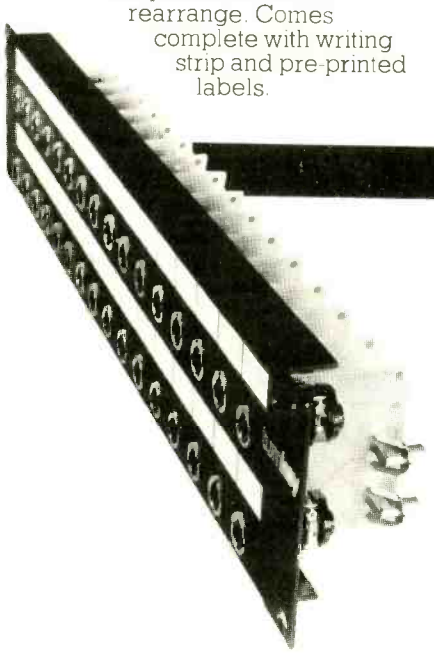

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Sarner Audio Visual, London

A recent addition to the ranks of studios serving the audio visual industry is a new complex built by Sarner Audio Visual, the West London based audio visual consultants. The company's new complex is probably the most advanced AV studio complex in Europe and was designed specifically to serve the sound recording, programming and equipment requirements of the AV industry.

Situated in Shepherds Bush, London, the complex took more than two years to construct and has 12 studios; five fully air conditioned for recording; four for sound dubing/copying; two for visual synchronisation; and a studio for audio systems design. In addition there is a comprehensive music and sound effects library with more than 30,000 tracks, a presentation theatre, conference room, and equipment hire, sales and service facilities.

Studio 1, the main recording studio, is equipped with an Ampex *MM1200* 16-track tape machine and an Alice custom built 16/16 console which features a matrix patching system to handle switching and routing. Other equipment includes MCI 2-track machines, dbx and Dolby noise reduction, and Neumann and AKG mics. The studio, which is moderately sized, can accommodate up to 10 artists. Quadraphonic monitoring is provided in the control room, the monitors throughout the complex being a mixture of Tannoy and Lockwood loudspeakers.

Studios 2, 3 and 4 are equipped with 8, 4 and 2-track facilities respectively and can accommodate up to five artists each, while Studio 5 is Sarner's 2-track 'Budget studio'. As with Studio 1 these are equipped with Ampex and MCI tape machines. Other equipment includes Neve and Alice consoles, plus identical units to Studio 1 thereby aiding interchange of work between the studios. All the sound studios are acoustically isolated—constructed on the 'room-within-a-room' principle on special rubber mounts to cut down air-borne and structurally transmitted noise. Each of the studios also has an isolated mains power supply to prevent mains borne interference or 'spiking'. A further feature is the provision of a standby generator to provide emergency power in the event of mains failure.

Studios 6 to 9 are the four sound copying studios. Studio 6 handles high speed cassette copying, Studios 7 and 8 handling sound transfer and dubbing and Studio 9 being reserved for pre-production selection of music and sound effects from the company's music and effects library.

Studio One at Sarner Audio Visual

Visual synchronisation facilities are provided by Studios 10 and 11, Studio 10 being a multi-image and programming theatre equipped to handle up to 36 slide projectors patched into a variety of microprocessor-based AV control systems. Features of this studio, the theatre of which will seat up to 10 people, include programmable lighting, laser projection facilities, quadraphonic monitoring, and dual intensity light boxes for visual (slide) selection. Studio 11 is a single screen encoding and viewing room with visual-sync pulsing facilities for all types of tape/slide and filmstrip systems. Equipment available includes projectors, dissolve units, dual intensity light boxes, and stereo monitoring.

Studio 12—'studio' being something of a misnomer here—houses the company's personnel responsible for the design of AV and sound installations commissioned by clients. An example of the department's work is the design and installation of an advanced system for a $40 million extension to the Mandarin Singapore Hotel.

A further facility which the company offers is a casting and phone-in voice service. Here tapes of voices are literally played down the telephone so that clients can make a voice selection from the comfort of their own offices. In addition to this service Sarner's also operate a AV script translation service.

Recording and production facilities for the audio visual industry have almost always appeared to be the poor relations of the sound recording industry. However, the Sarner complex seems to indicate that this image needs re-evaluation. As a comprehensive complex specially designed to service the sound recording and programming needs of AV users, it has few equals. Clients utilising the company's facilities should be more than satisfied, and the provision of such a complex bodes well for the future of sound recording for AV use.

Sarner Audio Visual, 32 Woodstock Grove, Shepherds Bush, London W12, UK. Phone: 01-743 1288. Telex: 85715.

Studio news

● Lansdowne Recording Studios, London has recently completed a major technical update under the guidance of new owners, Adrian Kerridge and Jonny Pearson. The technical refit included modification of the studio's Cadac console; installation of a 48-channel Melkuist *GT800* automation system; and installation of video equipment for music to picture and video post production work under computer control. Video equipment includes a JVC *8500 LE* U-matic machine; Sony multistandard monitors; SMPTE timecode generators; and an Audio Kinetics *QLOCK 310* synchroniser modified to operate with the Melkuist automation system.

● Universal Sound, Perivale, Middlesex has installed a digital pitch changer in its film transfer facility to retain correct natural pitch on original film recordings produced at standard 24f/s when transferred to video at 25f/s on telecine machines. Charge for this service is £25 per 1,000ft.

● CBS Records, New York has purchased a second Mitsubishi *X80* 2-channel digital recorder.

● FWO Bauch has installed a complete equipment package comprising a Harrison *24 Series* 36/24 console Studer *A80* 24-track, Studer *B67* tape machines, and a UREI *813* time aligned studio monitor system, to a new London studio situated in Bayham Street, Playground Recording Studio.

● Alpha Audio, Richmond, Virginia has completed its new Studio 4 which initially is scheduled for commercial advertising, audio visual and radio production work. Although initially a production studio, the new studio is wired for 32 inputs ready for the installation of multitrack equipment as demand warrants. The studio features a featherstone wall to break-up standing waves, a side wall with integral bass trap and hf reflector and an anechoic foam treated rear wall as a dead end. Similar treatment has been included in the control room which is an LEDE design.

● Universal Recording, Chicago has recently installed a 3M 32-track digital recorder.

● Eden Studios has become the first London studio to install a Solid State Logic *SL4000E* console. The console is a 32-channel desk and is fitted with the SSL *Total Recall* studio computer. Eden has also taken delivery of a Studer *A800* 24-track recorder with the new close proximity headblock.

● Soundcastle Recording Studios, Los Angeles has installed a Neve *8108* 32-channel, 24-track console.

● A new studio to open in Hollywood is Spindletop Recording Studios, owned by Hal and Vio Michael. The studio which was co-designed by the owners and Scott Putnam is situated at 3449 Cahuenga Boulevard West, Hollywood, California. Phone: (213) 851-1250. Studio manager is Mathew Vertin. Equipment includes an MCI *636* console with *JH-50* automation, *JH-24* 24-track recorders, various *JH-110B* recorders, and a *JH-45* generator/synchroniser providing video interlock and 46-track audio capability.

● Audiocraft Recording Company, Cincinnati, has installed an Allen & Heath 28-channel *Syncon B* console for commercials and film work undertaken by its Sound Images division.

● Pete Townshend of The Who has ordered a Solid State Logic 40-channel *SL4000E* console for installation in a new rock and roll video/audio complex being built in Twickenham, London. The console is to be equipped with *Total Recall* and SSL's new *Live-Mix* video production software package. The new studio will be equipped for simultaneous multitrack audio and broadcast quality video recording.

● Ampex has presented Golden Reel Awards to a number of artistes and studios: Buggles *(Video Killed the Radio Star)*, Sarm Studios and Nova Studios; Richard Clayderman *(Reveries)*, Delphine Studio, Paris; Bad Company *(Desolation Angels)*, Ridge Farm Studio; and Peter Gabriel for his (third) album *Peter Gabriel*, Town House Studios. ■

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Automation control techniques

The success or otherwise of automation systems relies on a number of fairly recent developments. The first is the all-important VCA, without which automation would be very difficult indeed; just think, we would have to resort to motor-driven faders without them! The other is a computer's basic analogue input-output device, the A/D converter.

EXAMPLES of electro-mechanical control of audio have been known ever since the early talkies required special effects which needed several different sound sources to be adjusted in synchronism. Not long afterwards, the variable-mu valve was also pressed into service despite its inherent non-linearity. After all, the film soundrack of the day was hardly a high fidelity medium and the ravages of the available audio chains had only a slight effect compared to the actual sound recording process itself.

The VCA

The discovery of the voltage-dependent properties of the FET really changed the technology of voltage control of audio; in fact, several limiter/compressor designs still use this technique even though there are a number of very much quieter and more linear solutions available today.

In a feedback-controlled limiter/compressor, the actual characteristic of gain change against control voltage/current happens to match the charge/discharge characteristic of the timing capacitor since the gain change/control signal is substantially linear and the exponential charge/discharge of the timing element in the control path gives the circuit the required dB/s recovery. However, the actual value of gain obtained from any given FET in a circuit has to be set up without any control and then the slope of the gain/control signal has to be adjusted if the circuit has to perform accurate gain control with fixed values of control signal.

A circuit is required where a linear change in control voltage will produce a linear perceived change in level, ie one that gives dB/V rather than V/V as the FET does, because for one thing, linear pots are a good deal easier to make than good logarithmic ones. Also, if computers are to control sound, the cheapest device for digitising the control signal is the linear-scale A/D converter (of which more later).

The other very important reason for having dB/V control characteristics is that it makes the design of dc grouping in consoles very much easier. Dc grouping is the technique where the control of VCAs in each channel is controlled by both a local pot—such as the fader—and also by an external control signal produced by another fader which is connected to several channels in parallel. By this means, the level of several channels can be controlled from a central point without having to mix them first and then control the overall level of that mix as is done in classical group mixing.

One other facility that dc grouping provides, having no direct analogue in normal console design, is the ability to adjust the level of outputs which contain different mixes of similar signals, such as foldback mixes, whilst maintaining the overall context of all the components of each mix.

All dc grouping relies on the preservation of the context of all the component signals in each mix or submix and thus a very close match of the control characteristics of each VCA. If we were to attempt to do this with FETs with a V/V control, the problems of matching would become extremely difficult given that we lose half our control range with each 6dB change in level. Suppose we chose 0V on our external control line to represent no effect on the local VCA, and 1V to represent 20dB of attenuation: 2V gives us 26dB, 4V gives 32dB, 8V gives 38dB, 16V gives 44dB and so on. To obtain something near shutoff needs voltage levels which are downright dangerous.

Looked at another way, if we make shutoff, say, a safe 10V, the size of signal to produce small changes in level near unity gain becomes dangerously small and all our control circuitry has to be very carefully screened and kept in constant-temperature surroundings.

Things are a little improved if we chose 0V to give shutoff, ie we produce our control voltage directly from an audio taper fader with our maximum control voltage at the top of the track. Again selecting, say, 10V as a safe figure, at 20dB from the top we have 1V of control; at 40dB, 100mV and so on. For loud music this system would work reasonably well since the odd noise pulse of a few mV would only cause closed channels to open down in the −70dB range.

The real breakthrough which made simple control of level possible came from the brilliant work of David Blackmer, the originator of the now famous dbx *202*. For some time, engineers had been experimenting with control using the ordinary bipolar transistor. The basic idea of multiplying one signal by another by converting one of them into its logarithm, adding to it the second signal as a linear function and then taking the exponent of the result, leads to a theoretically near-perfect device for controlling gain. The logged signal can be the audio and the linear multiplier the control. The first major drawback to the technique is that an audio signal is of course more or less sinusoidal and must therefore pass through an axis of symmetry. If this axis is taken as zero, then the device will be attempting to take the log of zero, which is infinity. One solution to the problem would be to bias the audio to a convenient reference voltage from which the peak negative swing would never quite reach zero. However, as control is added to this standing bias, the multiplying effect will cause the component of the bias at the output to rise and fall with control.

Another serious drawback is that when biased as above, the controlling devices are operating in a rather noisy mode. Various techniques have been used to balance out the dc shifts that occur on this type of gain control device but in the final analysis, the end result is not very stable with temperature unless all elements are diffused on to a common substrate, the die size is kept small and symmetry is the overriding design rule.

The dbx contribution was to make a pair of log/exponent circuits work around the same operational amplifiers, with one designed to handle positive and the other, negative quantities. At the zero point, each side shares a discontinuity where the array is made linear, thus neatly avoiding the problem of conversion of a zero input which should produce an infinite output.

The really startling result yielded is that the output section now operates under conditions of almost minimum noise. Also, since the device works exclusively in terms of current, peak voltage swings through the control section are small, making the input section's operational amplifier easy to optimise for low noise.

So far all seems ideal; however, one rather important problem remains. The point of discontinuity must be kept as near the centre of symmetry of the input waveform as possible, otherwise the positive and negative half cycles will be treated differently, resulting in the characteristic second harmonic distortion produced by a poorly adjusted VCA.

All the equations for the performance of the transistor contain a temperature factor and the log/exponent relationships are no exception. To preserve the above symmetry, the devices in the array must be kept at exactly the same temperature. Thus all VCAs are built with some form of tight thermal coupling between the various elements.

For ideal thermal coupling, the devices should be in the same physical space as each other and the closest we can get to this is to diffuse them on the same piece of silicon where spacings of a few thousandths of an inch are possible. Sadly it is not feasible to produce transistors of both polarities (NPN and PNP) on the same substrate unless the properties of one or the other are to be severely compromised. The dbx technique relies essentially on having pairs of NPN and PNP transistors as elements of the feedback loops

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Robin Bransbury
(Melkuist)

around operational amps and the devices must be as near theoretical perfection as possible if they are faithfully to perform the log and exponent function required.

Progress in semiconductor technology will change this picture soon as ways of producing both polarities on a common substrate are known; the process is, however, only in the development stage. As with all things to do with semiconductor design, development and, above all, marketing, the main problem is one of economics. To be worth designing, any chip which does not use the manufacturing techniques of the present day must have a secure market of at least one million units a year. Even assuming that all console manufacturers used the chip in all faders or other much-used level controls, the total market would only be about one tenth that required for viability. As every console manufacturer knows, one IC which he found particularly useful very nearly died a death a short while ago because of minor technical problems when diffusion was transferred, and the available market did not appear to justify the investment needed to sort them out. Fortunately, several other uses of the same chip were found in other industries and so supplies resumed.

In order to keep spacing down, the next best alternative to diffusion is 'thick-film', where a single ceramic plate having a high coefficient of thermal conductivity is used to mount the active devices. This technique has been used in one successful VCA design although, owing to some unfortunate circumstances, the company which made them is now no more. With the impending developments in diffusion technology, it is unlikely that the design will ever be made again.

One of the latest developments in the VCA science is to reduce the problem of unequal handling of the two halves of the audio signal as outlined above, and hence some of the problems of thermal stability, by widening the area of the central discontinuity. The best example of this technique is the Allison *EGC* which, after a slightly difficult beginning, is now becoming very widely used. As most console designers know, the device is not without its problems. The wide 'linear' area reduces the second harmonic drift to a second order problem but it now allows any imbalance between the negative and positive signal halves of the array to appear as a simple voltage offset at a point in the circuit where it can be modulated by the control signal.

The result of this imbalance shows up as an audible transient in the output when a large change in gain occurs. Also, having removed the most obvious flaw in the log/exponent circuit, very little attention to thermal linking was done which would have largely removed this last drawback. The compound used in the encapsulation does have a reasonable high coefficient of thermal conduction but the epoxy-encapsulated active devices could well be replaced with metal can ones, or still better, thick-film quad transistors.

The other problem on the thermal front concerns the very large thermal inertia of the unit as a whole, which means that any temperature gradient which needs trimming out takes a long time to reach equilibrium. Thus it is essential that all equipment which uses VCAs of this (and for that matter, anyone else's) manufacture should never be switched off except for repairs. The major stresses on all electronic components take place at switch on and off. This is only good practice anyway and is becoming the norm in the better studios.

Finally, on the VCA front, it is always worth putting a certain amount of positive feedback on the antilog stage because, although this technique slightly raises the low-level distortion by about 100ppm, it has a profound effect on the large-signal handling, especially at high frequencies. It can even be retro-fitted to existing Allison circuitry if high level third harmonic distortion is found to be a problem. (The author's UK patent is quite explicit on the subject.)

Analogue to digital converters

Taken at its most basic, the A/D converter consists of the following components:

- a source of stable voltage or current;
- a set of attenuators fed from this source which can be electronically switched into circuit to provide a signal which is the sum of each one's contribution;
- a comparator, which is a device with two inputs whose output will be at a high or low voltage depending on which input is above or below the other irrespective of the exact voltage at either input;
- some fairly simple switching logic to control the attenuators;
- optionally, an electronic switch which momentarily connects its input across a capacitor thus charging the capacitor to the peak value of the input so that when the switch is opened, the value stored on the capacitor provides a short term 'memory' of the input voltage at the moment when the switch opened.

The attenuators can have various values; however, the simplest array to understand is where each has an attenuation which is twice the value of its neighbour. Since the industry standard byte is a set of eight binary digits, let us have eight attenuators. Suppose also that our reference voltage is set at 10.24V. Each attenuator will now produce:

1 = 5.12V (half the reference voltage)
2 = 2.56V (half of no. 1)
3 = 1.28V (half of no. 2, and so on)
4 = 0.64V
5 = 0.32V
6 = 0.16V
7 = 0.08V
8 = 0.04V (the smallest value in the array)

and if we add these voltages together the total is 10.20V which is the value of the reference voltage minus the smallest step.

Suppose we now connect one input of the comparator to a variable voltage coming from an automated fader for example, and this voltage is sitting at a constant 6V. The attenuator switching logic is now told to commence conversion. It applies the first attenuator to the comparator and inspects the output. As the first try is not quite enough (5.12V) it tries again, adding the next value. The sum of these is 7.68V so the second attenuator is not needed. Next, the third is tried giving 6.4V, again too much, however the next at a total of 5.76V is needed, the next is not (6.08V) but the next is (5.92V) and the next (6.0V) and the next is not (6.04V).

So taking 'needed' as '1' and 'not' as '0' the binary value of 6 on a scale of 10.24 is 10010110, where the left hand digit represents the largest value tried and the right hand, the smallest (or least significant). Each of the digits is usually called a 'bit', hence LSB, or least significant bit.

Now 6.00V is a simple value to convert exactly. Suppose the input is 3.15V: 1 is too much (5.12V), 2 is needed (2.56V), 3 is not (3.84V), 4 is not either (3.20V), 5 is (2.88V), 6 is too (3.04V), 7 is (3.12V) and 8 is not (3.16V). The first thing to notice here is that the answer of 01001110 is not the nearest value at 3.12V, 01001111 would be much closer (3.16V). However the error is less than the LSB size and this uncertainty is present in all simple A/D converters.

The reason for this error is that the comparator can only determine if one input is above or below the other and not by how much. If we add more attenuators to the array so that the smallest step size becomes 0.02V or 0.01V, then the accuracy goes up in proportion. This new converter would give the value 0100111011 which is exactly correct; however, the computer would now have to handle 10-bit numbers and would be that much more complex.

Fortunately, the ear cannot recognise differences in level of less than 0.5dB except on constant tone and under ideal listening conditions, and the number of steps we can encode with our eight attenuators is the total reference voltage divided by the smallest step size or, 10.24/0.04 = 256. If we use a 120dB range from the top of the fader (full open) to the infinity shutoff point, each step represents 120/256 or a little less than 0.5dB. However, if the slope of the control voltage against fader position is made slightly non-linear and the same non-linearity is applied in reverse a little further down the chain from fader to VCA control input,

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there is a point in the middle where the scale of dB/V seen by the computer is compressed at the top and expanded at the bottom. By this means, one bit at the top of the fader's scale may represent only 0.2dB while one near shutoff can be 2dB, all of which allows the use of microprocessors designed to handle 8-bit numbers, avoiding the massive cost of both software and hardware design with minicomputers capable of handling the larger numbers 9- or 10-bit converters would produce.

All our computer has to do now is note down which attenuators the converter used during the process and tell it to start the conversion again. The front-end switch and capacitor is usually known as a 'sample and hold' circuit and is used when the input is changing in value so quickly that decisions made about 'higher' or 'lower' become incorrect during the finite time of the conversion itself. If more than one input is to be converted, as is the case with a single converter and a console full of faders, then an input 'multiplexer' is used. A multiplexer is only an electronically-driven selector switch which establishes a path between the converter input and each of the fader outputs in turn. Most multiplexers are built with a second on/off switch in series with the selector which conveniently performs the sample and hold function with a small capacitor on its output.

On the output side, the binary value that was obtained by the A/D converter is retrieved from the computer's memory and used to control an identical set of attenuators acting on the same reference voltage as used at the input. The output of these attenuators is buffered and sent back to the faders where it can replace the signal derived from the fader itself which drives the control input on the VCA.

The converter dealt with above is usually referred to as a 'successive approximation' converter and is chosen because it is, on average, much quicker than the older single-step type.

In the single-step converter, the comparator is provided with a voltage ramp which steps up by one LSB at each 'try' during the conversion cycle so that the comparator output is used directly to signal that the conversion is completed since the last step it receives is just greater than the input voltage. Again we can see that the accuracy attainable is the same as the SA device, in that the last step is greater than the input but we do not know if it is only just so, or if it is actually very nearly one LSB too much.

Comparing speeds however, for an input near 0V, say 0.08V, the SA requires eight decisions to make a conversion, the SS only two. For the example above, 3.15V, the SA makes eight decisions; the SS needs 79.

Multiplying D/A converters

While on the subject of D/A converters, it might be interesting to make a few points on the subject of the multiplying type in audio applications. As mentioned above, the D/A converter is only a set of electronically-controlled attenuators usually acting on a stable reference voltage. Supposing however we were to make the reference voltage an audio signal, and drive the switches from our computer? The resulting digitally controlled attenuator could provide the ultimate in electronic signal control. No setup pots to twiddle, no temperature drift problems, direct communication between the computer and the audio. Direct, yes but just how direct?

Bearing in mind that 10-bit multiplying D/As linear enough to be used with professional audio now cost less than VCAs, why are they so little-used?

The answer to this strange situation comes from the last 'advantage' above. Computers by their very nature use some pretty nasty-looking high frequency square-waves to communicate between their various parts and the introduction of control busses carrying this sort of electronic junk into a multiplying D/A separated by a few thousandths of an inch of silicon from our nice clean audio, gives so many crosstalk problems that the technique is virtually unusable as it stands.

Solution 1: Filter out the rubbish and drive the switches from nice slowly-moving dc control lines. Problem: what happens at the point mid-way up the control range, where all the little attenuators are switched out and replaced by the most significant one to give the required 1-bit change? Having replaced a well-defined switching instant with a slow moving ramp, it is now up to each switch itself to decide just when it is to open and close. Result: at each point where important gain changes occur, the level does a quick cha-cha.

Solution 2: Sample the audio and only allow gain changes to occur when the channel is quiet. Problem: try riding a guitar solo!

Solution 3: Couple the control inputs to the multiplying D/A with opto-isolators, thus avoiding all the nasty earth currents which contribute most of the noise. Problem: expensive but at least a viable solution. Let us now move on to the ZZZit problem.

Once upon a time, back in the early days of console design, we used to have things called 'stud faders' which consisted of a set of attenuator pads each of which came out to a stud on a thick piece of *Paxolin*. The studs were arranged in the arc of a circle and a substantial wiper with a large knob was fixed at the centre of the arc. By rotating the knob, one of the attenuators was placed in circuit and a well-defined signal level passed through the device. Because the standard impedance of the device was usually 600Ω, it was usually transformer-coupled to the valve stages of the day, thus eliminating any dc component on the wiper or the studs. The fact remained that if the control was moved on certain types of programme material, the switching of the studs could still be heard clearly.

When used to control midband dominant programme material, the material itself masked the switching noise but when controlling frequencies where the ear is less sensitive, such as bass notes from an organ, the sidebands of the amplitude modulation caused by movement of the control fall right in the ear's most sensitive range, so the movement can be clearly heard.

Obviously the first improvement to reduce the audibility of control movement is to reduce the step size thus directly reducing the amplitude of the sidebands. Sadly, if the ear's sensitivity curve is studied, we can see that as fast as the step size is reduced, the number of steps needed for an average level change in an average time period pushes the sideband frequency further and further into the most sensitive portion. For any design engineer contemplating the use of multiplying D/As let me suggest a simple, cheap experiment. Get yourself a 100K wirewound 10-turn pot from RS (stock number 173-445). Connect it to a signal generator with a good transformer and transformer-couple the wiper to a monitor amp. Set the generator to 10Hz or thereabouts and listen to the output when you turn the pot. Do the same with 20kHz then find out the step size of one turn of the helix using 1kHz and a millivoltmeter. Finally, work out the number of bits this represents in terms of a multiplying D/A. It's about 14 give or take a few LSBs.

So, simple step-size reduction is not the clear answer until multiplying D/As with, say, 16 bits become economic, and even then the problem will still be there although reduced to manageable proportions.

One rather elegant solution which has been proposed is to bring the actual audio signal into the control chain so that changes in gain only occur at the point of zero crossing of the audio signal. This works very well on midband programme but sounds very strange when any substantial low frequency components are added. As might be expected, control movements then cause a rather nasty intermodulation distortion to occur which abruptly ceases when level change stops.

Taken as a whole then, the multiplying D/A is a very good level *setting* device which gives low distortion, low noise if carefully driven, little, if any, setup adjustment and good value compared to VCAs when all the bits that have to be built round the VCA are taken into consideration. However, its use contributed to the downfall of one company in our industry recently which should be a salutory warning to anyone who thinks of it as a level *controlling* device. It's only the electronic analogue of the stud fader after all, and no-one uses them nowadays, do they? ■

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letters

Glyn Johns

Dear Sir, Although I enjoyed the Glyn Johns interview in the June issue, in which he rightly condemns some of the absurdities in today's recording techniques, I cannot agree with his view that the equipment manufacturers are responsible for the proliferation of these foul and unnatural practices.

He attacks "Manufacturers that introduce 'new and improved' consoles . . . etc, simply for the sake of bringing out more complicated product lines—which they can then argue studios into buying . . . ". No manufacturer can afford to invest huge sums of money in more complicated product lines unless he is certain that they will sell, this certainly being the result of market research. People make mixers, as Glyn Johns makes pop records, to make money. It matters not how demand arises, only that it exists. For an assortment of reasons, studio owners and clients want the use of these in-line, computerised monsters, and are prepared to part with astonishingly large sums of money for the privilege. This decision is entirely their own, as is the decision of engineers to put 12 mics on a deadened drumkit, or plaster contact mics on every instrument in an orchestra. The only part played by the manufacturers has been to make these techniques possible —it can hardly be their fault if their products are not put to good use.

My explanation for the decline in recording standards, and the ever-widening gap between the actual and the possible final product, is simply that the business is rife with producers who don't know their ass from their elbow and, disturbingly, have no need to as their efforts are gleefully received by DJs, critics, pluggers, A&R men, etc—the backbone of the music industry—who don't know theirs either. More to the point, the average record-buying punter doesn't give a damn how an LP is recorded, and as it's his money that keeps the show on the road, the industry will take its own course. There will never be a quality crisis in the recording industry as long as values are assessed from a subjective and ignorant standpoint.

So, Glyn Johns, by all means speak out against bad recording practice, but don't blame the tools —blame the bad workmen.

Yours faithfully, S G Smith, 22 Fordyce Street, Glasgow G11 5PH, UK.

Dear Sir, May I say my heart went out to Glyn Johns (Studio Sound, *June 1981). As a tape op of 1957 at IBC I can only concur with all his remarks. What has happened to the industry in the past quarter of a century? Technology has taken over and musicianship and musical quality seem to have been buried. There is no doubt that spontaneity has gone, one hopes not forever.*

At one time a faithful reproduction of what the musicians in the studio were playing was the object of the exercise—ie high fidelity as opposed to the 'hi-fi' of today. Technical and musical quality meant something. An album was completed in one day, ie two 3-hour sessions, and a single usually in one session. Producers kept to budgets and even 'pop' musicians rehearsed before arriving at the studio so that everybody knew what was expected of them.

Glyn Johns' comments on microphones are also very interesting: the early valve capacitor mics were very good. I have a couple of STC 4033A mics which give superb results with my Ampex 350-2; a dynamic mic 25 years old still sounds good.

There were some bad things in the 'old days' but there were a lot of good things. Listen to some of the 1958 stereo LPs—every bit as good as today's. Perhaps there will be a new breed of balance of engineers who will go back to the simpler methods of achieving the same if not better results.

Yours faithfully, Howard Yentis, 96 Deans Lane, Edgware, Middlesex, UK.

Dear Sir, I would like to say how refreshing it was to read the interview between Glyn Johns and Mel Lambert in the June edition of Studio Sound. *I must say that I totally support the views held by Glyn Johns regarding today's so-called modern recording techniques. I wonder how many of today's young engineers would know how to cope with a 'live' mix? With a good engineer and a good drum kit there really seems little point in using 12 mics when half that number, placed correctly, would do. We have got into the habit of using multitrack simply because it is there and in most cases it is an easy way out for the engineer.*

I would also agree that the Eastlake approach to studio acoustics gives a totally 'lifeless' sound. It would seem, for the vast amounts of money spent on new recording studios today, that we are going backwards rather than ahead, and seem to gear ourselves to the lazy engineer rather than the creative musician.

The best recordings that I have ever heard were done on a valve 4-track Studer with no noise reduction! So let's get away from the engineers trying to play at being little 'gods' and put the music back into the hands of the musicians which is really what it's all about after all.

I'm really not any part of the 'Back to mono' brigade, but it would be nice to hear of more examples of well-engineered records rather than the continual stream of plastic sounding rubbish that is being produced today.

Yours faithfully, Edward Widdowson, Wavelength Radio Production Co, 4 New Burlington Street, London W1X 1FE, UK.

Dear Sir, As a session musician (trombone) I have many times backed off from a mic which was too close in hopes of allowing some of my personal tone to survive. Also, I have always complained that dead, carpeted rooms make my sound drop to the floor as soon as it leaves the bell of the horn. The one fact that was stressed over and over to me by my teacher years back was that I should blow as though I wanted to hit the adjacent wall with my sound, not through volume, but through projection. Close miking and dead rooms are detrimental to the diaphragm-controlled, projected sound of any well-trained brass man. Finally someone with professional punch has said just that publicly, ie Glyn Johns in the interview in your June 1981 issue.

I handle Aphex for Spain and leasing of other equipment for Britannia Row in Spain. Understanding a bit about recording and recording techniques, plus being an active musician, gives one a different view than one who only works on one side of the glass. However, my comments above have been largely ignored over the years because I'm 'just a musician'. Maybe they'll listen to Glyn Johns!

Yours faithfully, Jim Kashishian, Kash Productions, Agastia 20, Madrid 27, Spain. ■

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4 May 1981

The Editors
Studio Sound Magazine
Link House, Dingwall Avenue
Croydon CR9 2TA
England

Gentlemen:

We read with great interest your Studio Diary article on the fine facilities at Sea West Studios here in Honolulu. Our attention was particularly drawn to the by-line at the end of the article, ascribing its authorship to Steve McGarrett.

The men here at Hawaii Five-O take a very dim view of foreign humour, particularly when it involves the unauthorised and illegal appropriation of the name of one of our most important officers. Fighting crime is hard enough without having to fight the press as well. I've told you guys a hundred times that we don't ever mind if you print the facts. But just be sure they are the facts. Got that?

And don't go trying to pass that old line about "another Steve McGarrett" off on me! I wasn't born yesterday. There is, was, and ever shall be only one Steve McGarrett allowed into the Hawaiian Islands. I've made sure of that personally.

Play it smart. Reveal the name of the true author, and I'll try to get the D.A. to go easy on you guys.

Yours carefully,

Steve McGarrett
Chief of Detectives
Hawaii Five-O Division
Honolulu Department of Police

P.S. Book them, Dano

OK, we'll come clean - the author is [redacted]

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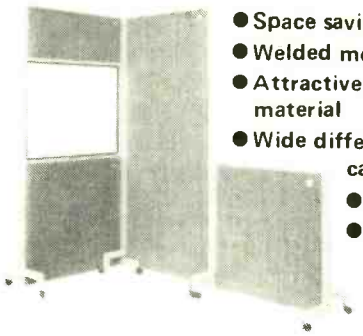

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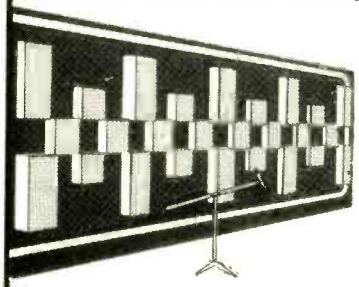

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AES 69th Convention, Los Angeles - a report

Richard Elen Noel Bell Bob Anthony

As usual, the Los Angeles AES Convention was the most lively and interesting of the three held every year. This time, the usual exhibition and papers were augmented with a series of workshops and discussions, held down the street from the main Convention location in the Hilton. Richard Elen reports on the Exhibition, Noel Bell the Convention papers and Bob Anthony gives a Workshop summary.

Aphex II aural exciter

THE exhibition included a number of new products, which we have attempted to cover here. As usual, we have concentrated on items which have not previously been shown or fully described. If we've missed anything out, please let us know for future inclusion.

Aco Pacific showed their 'alternative' family of precision microphones, designed for reference and measurement applications. The majority of these units are direct replacements for B&K mics and are compatible with existing accessories. The wide range includes mics for a number of functions, including environmental sound measurement, industrial acoustics, monitoring and acoustic measurement, and OEM devices. Two reference preamps, the *4012* and *4022*, are also available.

Acoustilog showed their updated *232A* reverb timer. Offering the same kind of facilities as the original unit, this device primarily features improved electronics. Room decay time may be computed within each of 19 frequency bands from 63Hz to 12.5kHz, and an improved frequency selection system permits the use of ⅓-octave steps by pressing two buttons simultaneously. The *232A* features direct digital readout with 10ms resolution, plus an exclusive level-detection system which obviates manual calibration. A pink noise source is included. As well as measuring RT_{60} in studio rooms, the unit may be used to set up echo devices and the like.

Aphex were demonstrating their new *Aphex II* units: one for the studio and one for broadcast operation. The principle of the *Aural Exciter* is now well known: the addition of these two units will no doubt enhance the system's reputation still further. Controls include drive level; tuning (corner frequency of the highpass network); damping (controlling the damping ratio of the side-chain); timbre (varies the balance of odd and even harmonics); limiter; and an input/output mix control.

Welcome news at the show was the fact that **API** still exists. The Automated Processes product line is now manufactured and marketed by Datatronix Inc, 2100 Reston Avenue, Reston, Virginia 22091 (phone: (703) 620 5300). Raata Audio Systems of 1446 N Cherokee, Hollywood, Cal 90028, have been appointed West Coast distributors for the range. The story, apparently, is that API officially dissolved in 1980, and the rights to the product line were bought by parent company Kappa Systems. The relationship between Kappa and Datatronix resulted in the licensing agreement, and production is now in full force. Products currently available include the *550A* eq module, *312* preamp, *525* comp-limiter, *440* conductive plastic fader, *2520* audio op-amp module, and *325* line booster/combining amplifier. We wish the company every success.

Audio & Design Recording were present as always, showing their *Transdynamic* tri-band audio processing system for broadcast use. The unit may be linked into a wide range of ADR complimiters and features two independent programme channels, field-tunable band-splitting filters (6 or 12dB/octave curves), separate control of compressor attack, release and ratio for each band, wide-band VCA output limiting, selectable pre-emphasis, adjustable peak modulation asymmetry for AM operation, switchable high/lowpass filters, easy setup adjustment with LED bargraph metering and built-in pink noise generator, solid-state switching, and easy maintenance. Settings are 'remembered' by a battery backup system for up to six months.

Audio Kinetics showed their 2-, 3- and 4-machine control time code synchronisers, the *Q-Lock* series, introducing a new model which does not need a control panel. Prices have been set very competitively, and each of the available packages has a number of outstanding features which, AK claim, make their system superior to others currently available. The success of *Q-Lock* rests on the fact that every tape machine on the market, both audio and video, needs specific capstan and other control signals to function effectively. Audio Kinetics have solved this problem by producing a series of customised interfaces, each designed to handle specific machines correctly. This offers far more accurate control over tape motion and recorder function than a standard interface system for all machines, although it means more work for programmers! Audio Kinetics have produced a brochure which provides direct comparisons between their *Q-Lock* and other systems, highlighting this fact, and pointing out that theirs offers unique facilities, such as record control and easily-altered machine hierarchies without synchroniser re-alignment. Applications software for the system is available also, under the name *Q-Soft*, comprising a range of packages optimised for different applications, notably automated multi-track recording and overdubbing, dialogue replacement for film and video, assemble editing for Telecine mastering, and automated sound effects assembly. This software support, they claim, is unavailable from any other control synchroniser manufacturer. Additionally, AK offer personal consultation on applications, and will work with a customer on interfacing the *Q-Lock* with existing computer control systems, supplying information for user-programming of the host system. The systems were demonstrated controlling a wide variety of tape machines.

An announcement from **BGW Systems**, made at the Convention, informed us that BGW are now responsible for the worldwide marketing of **Emilar** loudspeaker products, consisting of a wide range of lf speakers, compression drivers,

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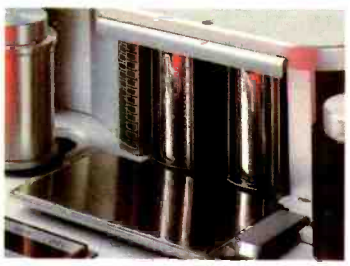

When you come to choose your new multitrack, deciding on a Studer will probably be easy. What will be a little more difficult will be *which* Studer to take - the new A80/VU Mk III or the new A800.

Both machines are superb examples of Studer precision. Both come with the new narrow head block that cuts the travel distance between the erase and record heads to 66 millisecs at 30 ips (now available as a conversion for existing A80/VU models). And both are available in several tape width/channel number configurations.

Whatever your criteria, choosing between the A80/VU Mk III and the A800 won't be easy. But then Studer never have been in the habit of taking the easy way out when it comes to performance.

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horns and crossover networks, plus a range of newly-developed products. This deal enables BGW to offer complete sound reinforcement systems. Last year BGW acquired exclusive US marketing rights for **Tannoy** studio monitors, enabling them to also offer complete studio monitoring systems. Emilar products will be sold under the BGW name.

The show also saw the premiere of the new BGW *7000* power amp, running 2 × 200W into 8Ω, 20Hz to 20kHz, at no more than 0.1%THD. The unit is a 5¼in rack-mount package with handles, and front-vented forced-air cooling. Level is adjustable via front-panel detented controls. In addition, two smaller amps were unveiled, the *75* (replacing the *50A*) rated at 25W/channel into 8Ω, 75W bridged mono; and the *320B* (replacing the *Model 320*) rated at 100W/channel with 25 and 70V distribution line driving capability.

Crown (Amcron outside the USA) also showed two new amps, the *PS-200* and *PS-400* units. Both feature the Crown *Multi-Mode* circuit, a 3-stage AB+B design. This operates as a Class A amp at low power levels, while at medium power, the output stages operate in Class B, while the drivers continue in Class A. At high power, the drivers function in Class AB, while the output stages remain Class B. Both amps feature front ends built around the Signetics *5532* dual low-noise op-amp. The amps run 95 and 180W rms respectively into 8Ω. Both feature 1kW power transformers.

An exciting new unit from **Eventide** is the *SP2016* programmable effects processor, offering a wide range of digital reverb programs, and accepting 'Reverb Library' ROMs for plug-in selection of new program sets, plus the *Digiplex* digital simulation of multiple-head echo. The unit also provides multiple chorus effects; full bandwidth delay (up to 16kHz), 0 to 1.6s in 25μs steps; selective band delay, in which a number of bands can be selected, each frequency band being able to be delayed independently up to 3.2s; flanging and phasing; digital filters; and full stereo 2-in, 2-out operation. As the system is fully programmable, a program software subscription service will be available, offering new effects and modifications via plug-in modules. In-field program development will also be supported fully by Eventide, who will encourage user information and software development. With all these features, the unit remains easy to use: a display keeps the user informed of the possibilities, and routines take the operator easily through the procedures required to get an effect. Program parameters can be preset or 'Live-edited'. Up to 32 different programs can be stored in non-volatile memory, each offering up to 18 preset effects.

The *SP2016* features a remarkably extensive self-test feature, which will even pinpoint the part number of a suspect IC! A unit like this will never become obsolete (what will they make next?).

Complex digital synthesisers are becoming more common at AES Conventions, and this one was no exception. Products on show included the **New England Digital** *Synclavier II* with Terminal Support Package (see July News), the **Fairlight** *CMI*, with new software demonstrated ably by Dr Bob Moog, the father of the modern synthesiser, and a new system from **E-Mu Systems**, the *Emulator*. This unit is designed to capture and modify real sounds, storing the final product on 5¼in floppy disk, two sounds per disk. The keyboard may be split into two sections, and various realtime functions may be called up, including vibrato, sustain, tuning, pitchbend and modulation. Two-, four- and eight-voice models are available, offering up to 2s duration of the original sound in the larger models (although the sound may be looped to become as long as desired). A 4-octave/49-key keyboard is incorporated, and three inputs offer low- and high-Z mics and line level, while outputs may be separated or mixed. Options include a polyphonic sequencer (available autumn 1981) and a flightcase.

E-mu Systems Emulator

One of the most fascinating ranges of new products at the Convention was a new line from Japanese manufacturer **Fostex**. The range consists of several extraordinarily compact units: the *350* 8/4/2 mixer; the *250 Multitracker*, a 4-track high-speed cassette unit not unlike the Teac *Portastudio* but including a wider range of functions and greater flexibility (the Fostex team includes several design personnel from Teac); and, most remarkable of all, a range of compact, light (29lb) reel-to-reel recorders, each taking up to 7in spools and offering 2-, 4- and 8-track recording with sync, all on ¼in tape *(even the 8-track!)*. The 8-track machine, type number *A-8*, records on alternative tracks at a time (up to four at once) to minimise crosstalk, and it is even possible to bounce adjacent tracks, claims Fostex. Comprehensive controls, including digital tape position counter, return-to-zero and transport functions with remote and footswitch-record capability, are specifically designed to make operation easy for the intended purchaser, the musician who wants to record at home and at a gig. The lightness and portability of all these units makes it quite practical to take the gear to the band rather than the other way around. Fostex are, they say, committed to the musicians' market and do not intend to move up out of the price range of the average serious musician. These units will be available in the UK via Bandive, and will no doubt make a great impact on the home recording scene. There is far too little space to describe the Fostex range fully: see the machines and be amazed!

Fostex A-8

Inovonics released and demonstrated their new *380* magnetic recording electronics system. The *380* is designed for OEM applications and for upgrading existing machines. Features include eq, level and bias settings for routine 2-speed operation plus an 'optimised' mode for different tape stock, level, track format, eq, etc; dropin record with adjustable delay, and sync with automatic monitor switching; remote selection of monitor function plus auto-muting during winding; adjustable circuitry to minimise tape compression and phase distortion effects; increased bias, erase, and signal headroom for high-coercivity tapes; switchable VU and 10ms quasi-peak metering; and easy interconnection for stereo and multitrack installations.

The unusual-looking black-panelled console from the **International Console Corporation** was finally unveiled in all its glory at the show. The ICC *3000* console first made an appearance at LA last year, with only one channel fitted, and at that time I was a little wary of the mysterious, LED illuminated, black perspex-clad desk. Without the other channels fitted, it looked decidedly odd. Seeing a compete console, however, has caused me to revise my opinion. The console includes some design ideas which are not only novel and intriguing but very effective, and the idea of illuminating different aspects of the signal path with different colours (green for inputs, yellow for processing, and red for outputs) when selected, by means of LEDs mounted behind the front panel knobs, is very effective.

Central to the design of the console is the fact that busses are used only when they are needed, thus avoiding signal degradation and unwanted path complexity. Comprehensive routing systems

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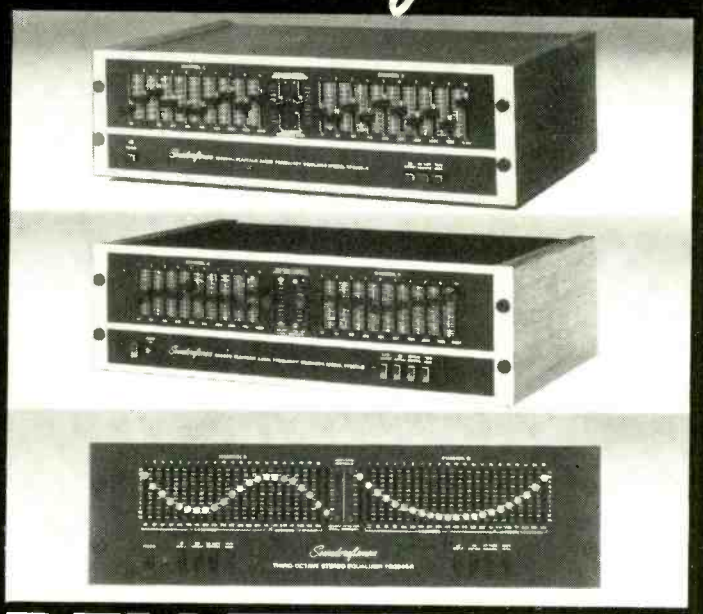

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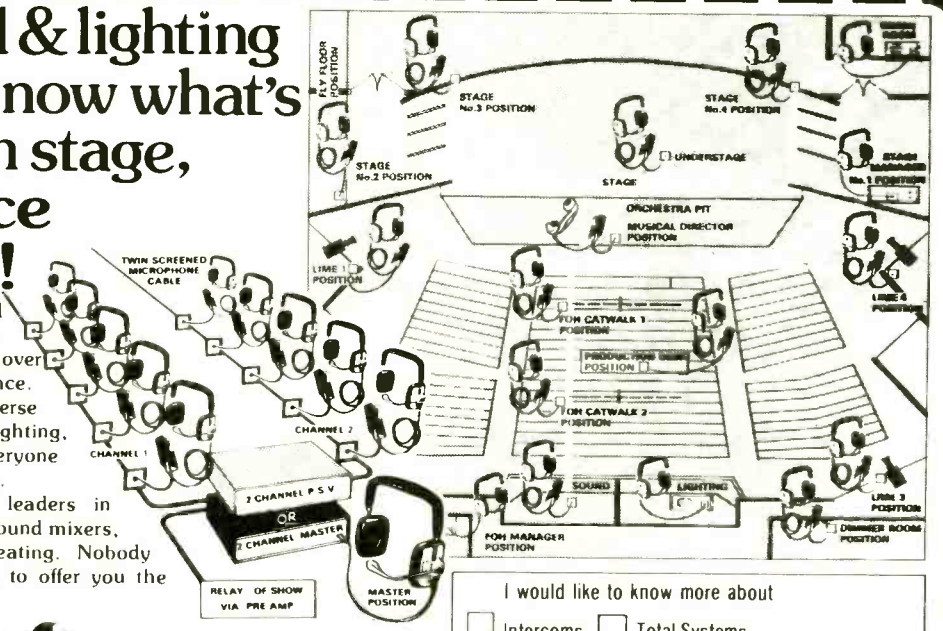

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enable the minimum required number of modules to be inserted in the signal path 'twixt input and tape (or tape and output), leading to superior overall performance. The tape machine can be 'inserted' into the signal path at three possible points, and signals can be routed direct from almost any point, with or without busses. A set of busses is nominally dedicated to foldback and stereo mix functions, while the rest may be used for subgrouping, or any other purpose. Thus the provision of 18 busses is quite sufficient for the most demanding session.

The modules too are more than interesting in themselves. The chief designer spent most of an evening with me, going through their functions and those of the entire board, and I was mightily impressed. The mic amp features a novel system called 'mic damping' which enables the user to simulate the effect of a high quality transformer on the input. The equaliser *looks* like a 5-band parametric with a built-in limiter, but the signal only passes through two active devices, minimising noise and distortion products (indeed, the designers state that every module has distortion and noise so low that it cannot be measured). A band-splitting technique provides the user with 20dB boost and cut at almost any combination of frequencies, Q, and high/lowpass filtering, with a mere five knobs, and the parallel paths are summed so as to give flat gain when all the knobs are set to the same value, thus providing automatic level compensation and compression make-up gain. Each channel incorporates a single-control noise gate, which varies from very fast/low threshold, to slower/high. A novel feature of the gating circuit is that when the gates are off, all non-playing channels are disconnected from the mix amps and master electronics, thus further minimising noise contributions. 'Ring of LED' VU meters monitor the signals at several stages of the signal path.

Difficult to describe, this console needs to be seen and used to be fully appreciated. The clarity, lack of noise and distortion, and simple 'feel' of the sound and the board are simply phenomenal. One ICC *3000* console has been installed at Audio Vision Studios, 74 East Center, Lindon, Utah 84062 (phone: (801) 785 0077), and they are apparently more than pleased with it. The console may be automated, typically with the Valley People *Fadex* system.

JBL showed an impressive batch of new products, including *2225H/J* and *2235H* 15in lf drivers, *4345* and *4355* studio monitors, and two new monitor systems, the *4430* and *4435*. The latter systems have been developed to meet the requirements of the latest digital and analogue technologies, and are both 2-way systems, the *4430* featuring a single lf driver, and the *4435* utilising a second lf unit, identical to the first, which operates only at the bottom end of the audio range. The main feature of the systems is the incorporation of a unique bi-radial horn for hf, the complete system offering constant vertical and horizontal dispersion which is both wide and flat over the entire audio range. The technical aspects of these designs were also embodied in a paper, AES preprint number 1784.

New from **Kdisc** is the *2572* output amplifier, designed to retrofit into the Studer *A-80* master recorder. Kdisc claim to have dropped IMD and THD by at least 10 times, improving S/N ratio by 10dB and increasing the slew rate 16 times. Lf response and hf detail are said to be markedly improved.

MXR introduced their new *Delay System II Model 151* DDL at the Convention. The *DSII* offers cost-effectiveness, combined with greater time delays and wider bandwidths than previous units, up to 3.2s delay being available with the added plug-in memory option (1.6s standard). The *DSII* also offers flanging, doubling, 'hard reverb' and echo in an impressively well-designed rack mounting unit with straightforward controls. Repeat-hold offers the ability to loop up to 800ms at 16kHz bandwidth, 1.6s at 8kHz bandwidth, and 3.2s with 4kHz bandwidth.

Otari offered preliminary information on their new 2- and 4-track master machines, the *MTR-10* series. Special features include dc PLL servo under microprocessor control; transport logic and realtime counting handled by a second micro; direct-coupled outputs with active balancing of ins and outs and optional transformers; adjustable phase compensation, bias, and record/play levels with integral square/sinewave generator; ±20% stepless varispeed with readout in in/s or %; return to zero as standard, and optional 10-memory autolocate; rear panel interface to transport and timebase functions for SMPTE interlock; and several other innovatons. Switchable NAB/IEC/AES eq is fitted.

Phase Linear featured a new series of units; three professional power amps, a parametric eq unit, a graphic and an active crossover. Of

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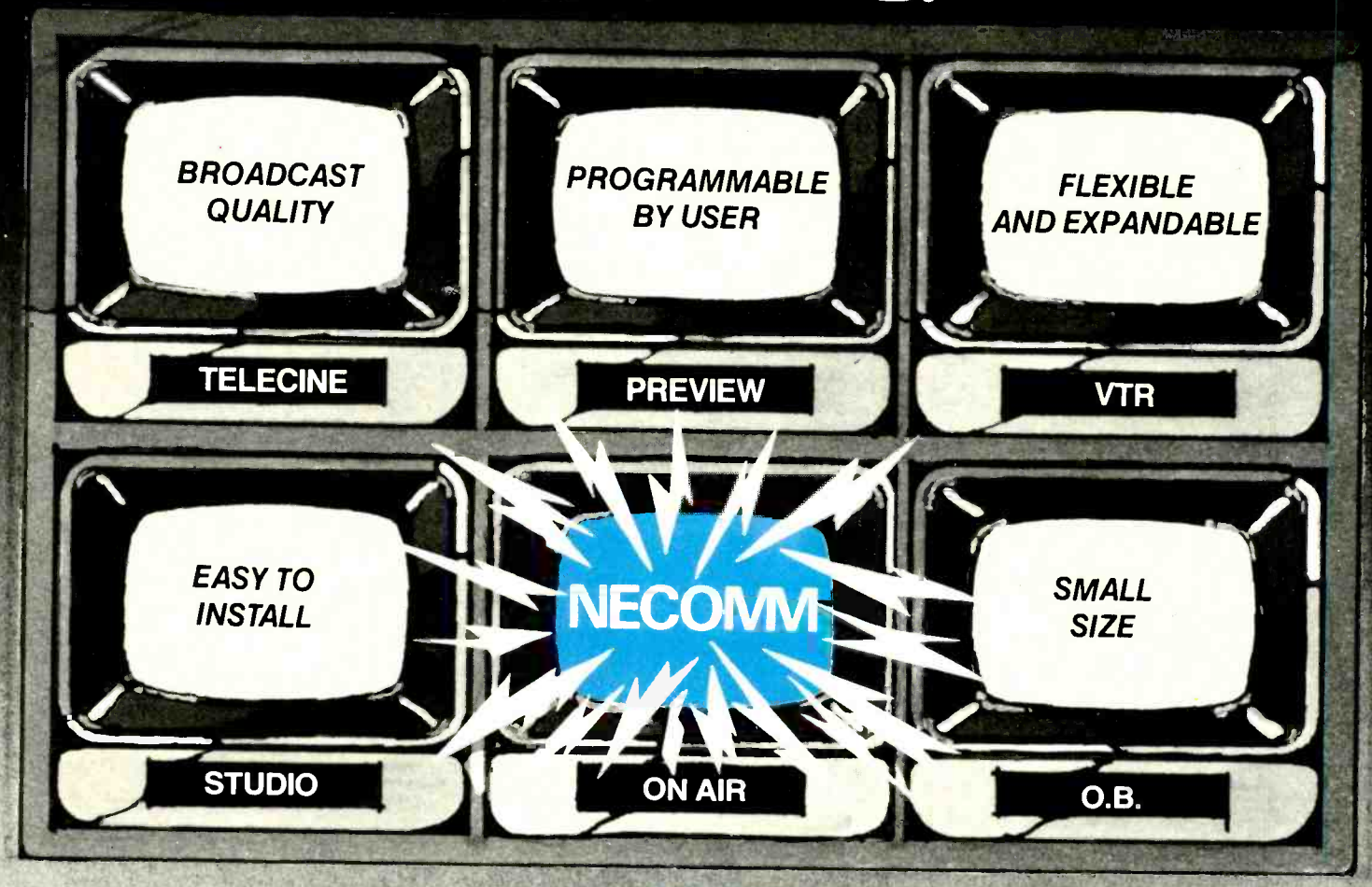

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AES report

particular interest were the new *A-15*, *A-30* and *A-60* amps, offering 65, 120 and 225W rms into 8Ω respectively. The *E-51* parametric represents the only 5-band parametric eq available in 1¾in of rack space, and features individual bypass switching and LEDs, switchable peak or shelf response on bands 1 and 5, +20dB gain for low level sources, auto balanced/unbalanced operation, and overall level control and bypass with LED.

Sony introduced a new 24-channel digital recorder, and announced an agreement with MCI on digital recording formats. The new *PCM-3324* recorder has 16-bit linear quantisation capability and a new code format, offering a dynamic range of over 90dB and dead flat audio response. Both electronic and razor-blade editing are practical on the system, which features stationary heads and pinch-rollerless tape transport. Two switchable sampling frequencies are available, 44.1kHz and 50.4kHz, derived from a built-in crystal oscillator. Recording time per reel of *D-1/2-2920* digital audio mastering tape is 60min at 50.4kHz sampling, and 68min at 44.1kHz.

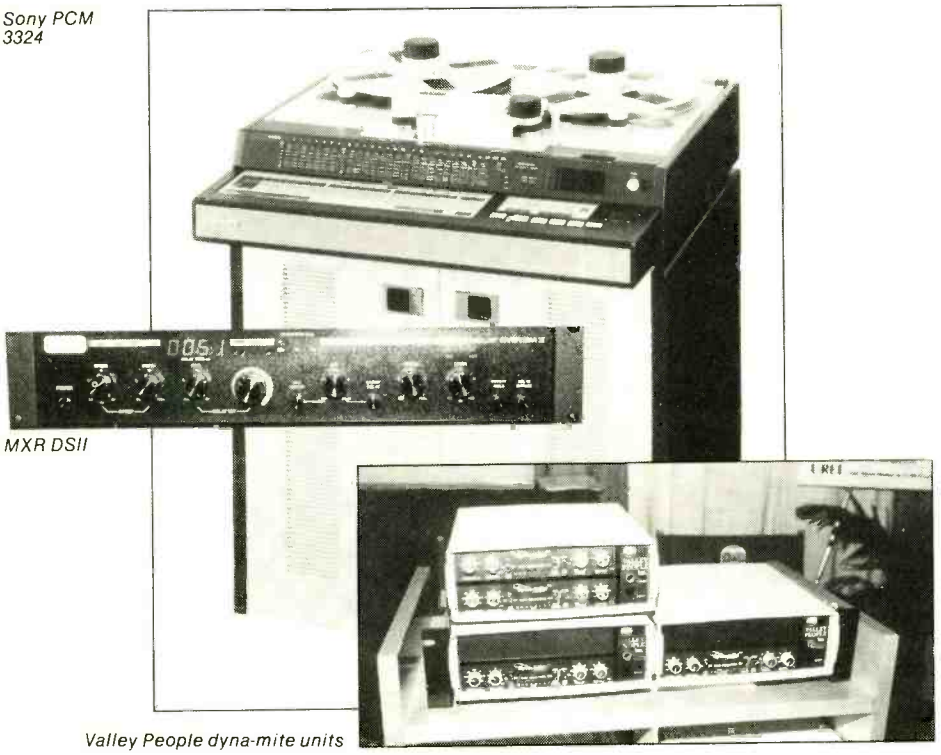
Sphere Electronics Inc exhibited a digital fader for the first time at the Convention. This fader unit comprises a recessed channel, the bottom of which is coated with Teflon. On either side of the channel is an array of LEDs and phototransistors, linked up to determine with great accuracy exactly where your finger is when it is placed in the channel. Sliding the finger up and down raises or lowers the level, indicated by a row of LEDs alongside the fader channel, plus a numeric readout above the module. Wherever you place your finger in the channel, the level can be raised or lowered from its previous position without having to match finger position with the LED indicator, as positive or negative increments are simply added to or subtracted from the current position. The fader, which is believed to use D/A converters under processor control and no VCA as such, is glitch-free and very smooth in operation. We may expect this fader to appear shortly in Sphere consoles; it will also be available on an OEM basis for what promises to be a very reasonable price. It is, of course, tailor made for computer automation.

On show from **Valley People Inc**, was the *Dyna-Mite*, a sophisticated unit combining a wide range of dynamic processing effects in a single package, including limiting, expansion, de-essing, noise gating, ducking, two independent stereo channels, and much more. Only limited information was available at the Convention, but we hope to examine this unit in greater detail in the near future. A rack-mountable yet compact package includes two of these units plus a PSU and linking circuit. It looks like a very useful and versatile device.

The Los Angeles Convention was once again very lively and exciting, and the range of new products on show for the first time underlined the fact that despite economic depression in many parts of the world, the industry is still doing well. Following a set of questionnaires sent to exhibitors regarding AES Conventions, the AES has decided that, from next year, there will be two shows per year, rotating through the three present locations, Los Angeles, New York and 'somewhere in Europe'. This year's New York Convention, and next February's Montreux venue will stand, but the next Convention will be in Los Angeles in November, followed by New York, presumably the following May, as far as we can ascertain at this time. We will publish complete and accurate details on these events when they become officially available. This move has apparently been made because some exhibitors have felt that there were simply too many exhibitions in the professional audio calendar, although some exhibitors (including *Studio Sound*) felt that two US Conventions per year were actually valuable. The AES decision appears to be an amicable compromise between these two points of view.

Sony PCM 3324

MXR DSII



Valley People dyna-mite units

Convention

Although I was unable to attend the Los Angeles AES Convention due to the logistical needs of producing the magazine (ie our APRS issue would not have been published in time for the exhibition otherwise), a perusal of the Convention programme and the preprints produced, indicated that once again a wide and stimulating programme of papers were given. While my absence from Los Angeles has unfortunately meant that firstly I haven't gained a suntan, and secondly I am unable to report on non-preprinted papers, I have however, selected a number of the more interesting papers and give details of these below.

As is usual these days, digital matters were again at the forefront. Matsushita presented two papers on digital audio. In the first of these, (AES Preprint No 1759), a design team from the company described the use of large-scale integrated circuits for digital signal processing based on a PCM format. Using these circuits two LSIs and one IC provide the same processing capabilities as that of approximately 500 conventional logic ICs, hence allowing more compact designs to be produced. The company's described design uses an *MN6601* LSI for recording the PCM digital signal; an *MN6602* LSI for reconstructing the signal during playback; and an *AN6860* IC for the time-base generator. The only other circuitry which is required being accessory circuits for the A/D and D/A converters. The second paper from Matsushita, (AES Preprint No 1760), described a digital audio cassette recorder with built-in *VHS* video tape mechanism in a single unit. This *SV-P100* unit uses the *VHS* cassette recorder as a digital audio tape machine; uses the circuitry described in the previous paper for the PCM processor; and utilises 14-bit A/D and D/A conversion. The recorder has full logic machine controls, plus remote facility; uses the NTSC signal format; is a two channel recorder; and has a maximum recording time of two hours. Although, presently a stand-alone unit, future facilities which Matsushita intend providing include digital editing and digital preview for record cutting.

Further to the Matsushita papers it is worth noting that JVC and Hitachi presented a paper, (AES Preprint No 1798), which also described the uses of LSIs in PCM audio processors, these again being used with consumer-type video cassette recorders. Additionally, Hitachi described a similar digital audio/video combination recorder to the Matsushita recorder, the *PCM V-100*. This unit being a 2-channel recorder using the NTSC signal format but also being PAL/SECAM compatible. Full details of the recorder are given in AES Preprint No 1791.

Staying with digital audio, Richard Molstad of 3M presented a paper on the design considerations governing digital crossfading in multichannel recorders, (AES Preprint No 1770). Comparing conventional analogue tape cut editing with the digital equivalent which is achieved electronically through a dubbing process, Mr Molstad describes the 3M digital crossfade system which utilises a write-after-read head, digital multipliers, adders and control electronics to provide the smooth transition between old and new signals at the edit point. Benefits of electronic editing include the ability to audition and preview the edit point and

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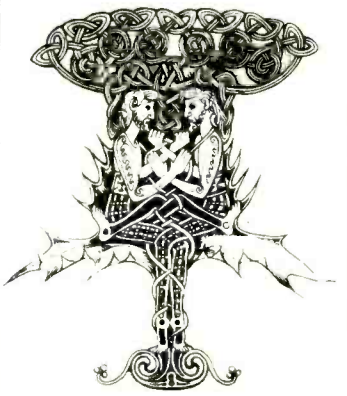

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AES report

the ability to refine edit points by as little as 1ms.

An interesting paper from Louis Fielder of Ampex, (AES Preprint No 1772), concerned the author's investigations into the dynamic range requirements necessary to produce subjective noise-free reproduction of music in a 'dithered' digital audio recorder. Examining such factors as peak levels in music, minimum noise thresholds, mic noise limitations, monitor loudspeaker capabilities, and performance environment noise levels, the author comes to the conclusion that a realistic dynamic range requirement for a noise free recording system is 118dB (non-amplified music), 124dB (amplified music), and for consumer playback usage 106dB. Before readers leap into the air in disbelief at these conclusions it should be stressed that they refer to peak instantaneous levels and are therefore perfectly feasible.

Cinema sound reproduction systems are often, as most readers know, exceedingly poor. It was therefore interesting to see that Mark Engebretson and John Eargle presented a paper, (AES Preprint No 1799), concerning recent technological advances in this field and design considerations governing such systems. In particular addressing itself to the problem that production and post-production technology and soundtracks have outpaced the abilities of cinema playback equipment to reproduce recent technical improvements, the paper indicates how bandwidth and dynamic range improvements can be economically realised. Improvements which are detailed in the paper include extension of the usable frequency range to 25Hz for lf and beyond 15kHz for hf; improvement of sound dispersion for uniform audience audibility; the lowering of loudspeaker-induced distortion; the provision of adequate electrical and acoustic power output capability to improve operating headroom by 10 to 15dB for signals above 50Hz; and the provision of amplifiers to deliver in excess of 115dB SPL for frequencies below 50Hz.

Moving on to the field of analogue signal processing, Joseph Lemanski of dbx presented a paper, (AES Preprint No 1775), describing the development and design of the company's new *dbx 902* de-esser module. This paper examines the nature of sibilants and their causes, describes the need for sibilant control, details typical control techniques, and describes the dbx unit. The *dbx 902* uses a sibilant detection circuit utilising a spectral-detection technique, while the gain-reduction topology is designed such that a constant sibilant balance can be maintained which is independent of the level of pre-equalisation. Operating range of the unit is 65dB without the need for user controls or adjustments.

John Vanderkooy and Stanley Lipshitz are well known for the high standard of their AES papers, and on this occasion they presented three papers two of which are of interest. The first entitled 'Polarity and Phase Standards for Analogue Tape Recorders', (AES Preprint No 1795), addressed itself to the task of proposing a polarity standard for analogue tape recorders. The authors having noted that under certain conditions reversing the polarity of an audio signal produces an audible but subtle effect, (and believing that the audibility of polarity inversion will become more significant as mic technique and transducers improve), they discovered that some analogue tape machines do not preserve overall record/reproduce polarity nor are polarity consistent on source/tape monitoring. To remedy this effect the authors have therefore proposed that Stodolsky's polarity standard, that tape magnetisation $\vec{M}$ in the direction of normal tape motion is positive, should be followed. Interested readers might like to know that the authors have available samples of a polarity standard tape allowing the reproduce polarity of machines to be checked. Turning to the question of phase standards, the authors discuss those aspects of the recording process relevant to phase distortions and indicate that phase distortion mainly occurs in analogue tape machines because non-minimum-phase losses in the record/reproduce process are compensated for by minimum-phase equalisation circuits in both the record and reproduce electronics. Because several commercial machines incorporate phase compensation circuitry which is incompatible, the authors therefore suggest a phase compensation standard to remove any confusion, the authors' suggested standard being that all phase compensation be incorporated into the record equaliser rather than in the playback equaliser.

In their second paper, Stanley Lipshitz and John Vanderkooy presented a review and critique of the acoustical behaviour of pressure-responding mics positioned on rigid boundaries, (AES Preprint No 1796). Working from the proposition that *PZM* mics exhibit a rising hf axial response when used free field, but not when flush mounted on a large rigid boundary, the authors contend that when *PZM* mics are used pointed towards a rigid boundary to obscure the diaphragm from receiving direct sound the frequency and polar responses are significantly degraded because the diaphragm is obscured. Hence, the belief that the on-axis hf rise characteristic can be cured by this arrangement is, the authors claim, untrue.

Continuing with the subject of microphones, Bruce Bartlett of Shure presented a paper investigating the tonal effects of close mic placement, (AES Preprint No 1782). Covering investigations into the effect of mic placement for acoustic guitar, piano, electric guitar amp, and voice, Mr Bartlett conducted spectral measurements, listening tests, and studied the radiation patterns of the instruments to reach suggestions for close-mic placement and equalisation to achieve various tonal effects. These suggestions are that for a realistic and natural timbre a distance of 1m from the source is preferred; for acoustic guitar a position 6in above the top of the guitar over the bridge is preferred; for grand piano (with lid at full stick) suitable positions are 1ft above the middle strings, 8in above the treble strings, or 8in from the hammers; for a guitar amp the bass/treble balance can be controlled by varying the mic distance and position relative to the loudspeaker cone centre; while miking a voice closely with an omnidirectional mic produces only minor colouration. Although these suggestions are only a brief summary of Mr Bartlett's investigations, details of many other mic positions are given in his paper.

A further paper examining mic technique was given by Wieslaw Woszczyk of McGill University. Entitled 'A Microphone Technique Applying the Principle of Second-Order Gradient Unidirectionality' (AES Preprint No 1800), this paper presented a theoretical basis and practical implementation of a mic technique which combines first-order and second-order gradient unidirectional characteristics, and allows for a degree of adjustment of the magnitude and polar response. Using this technique the author claims that high directivity pickup is extended to low frequencies resulting in a close sound without the distortion of close miking, less low frequency ambient leakage, and better separation.

Moving on to the broadcast field, a presentation which gives an interesting indication of the directions likely to be taken by broadcasters in the near future is a paper entitled 'Television Multiplex Broadcast Systems for Stereo, Bilingual and Other Purposes' by William Halstead, (AES Preprint No 1789). Refering to the successful stereo and bilingual multiplex broadcast system being operated by Japanese television stations, this paper gives background information on the development of TV multiplex systems, and concludes with the observation that multiple FM subcarriers on a simultaneous basis present no serious technical problems. As a fascinating pointer to what we are about to receive (Sorry!), the paper makes scintillating reading.

Finally, Michael Dorrough of Dorrough Electronics presented a paper on the thorny topic of the PPM versus VU meter controversy, (AES Preprint No 1794). Detailing the advantages and disadvantages of both types of display, Mr Dorrough, writing from a broadcasters viewpoint, comes to the conclusion that what is needed is a dual-function display. He then goes on to describe an LED arrangement with 40 LEDs which has both VU ballistics and peak indications on a single display. Arranged in an arc configuration the LEDs are from left to right 26 green, 3 yellow, 9 red and a further 3 yellow LEDs. Electronically, the meter's input signal is split into two separate paths which feed a common indicator. One path is a bargraph with a rise time slower than, and a decay time faster than a VU meter, while the other path is a peak circuit which is activated on the first half cycle of a programme waveform and illuminates a single LED slightly brighter than the bargraph LEDs at any given time relative to the programme/peak differential. Using this display the perceived loudness to the ear from source to source is determined by which circuit reaches its respective set of three yellow LEDs first.

Workshop summary

Year by year the Los Angeles AES show has grown in popularity, which is an encouraging omen for the ancillary music fields of sound reinforcement and recording. However, the increased numbers necessitated the securing of a second facility two blocks south of the hosting Hilton Hotel, and three floors below street level at the Hyatt Regency.

Although the workshops were held in the sub-sub-basement of the modern shopping/sleeping complex, once the location was discovered, the speakers and guests were greeted by a spacious, comfortable and, generally, well-prepared meeting room. Only the traditional (believe it or not) PA troubles, late-arriving demonstration equipment, and occasional lack of seating briefly interrupted the otherwise smoothly flowing programmes.

Set against a backdrop of richly-textured wood panels, and American-Indian-design wall sections as could be conceived only by a commercial interior decorator, most workshops were group presentations with the exception of a solo performance by Richard Negus (Purcell + Noppe + Associates, California) on Sound Reinforce-

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ment, and a duet entitled 'The Impact of High Level Sound on the Body' featuring Martin Polon (director of Audio-Visual Services at UCLA, Westwood, Cal) and Ken Fause (Fause and Associates, Century City, Cal).

Formats ran the gamut from structured talks to informal impressions/opinions on discoveries, developments and techniques in the additional areas of Console Technology, Stereo for TV, Microphone Techniques, Digital Editing, and Audio/Video Futures. Some highlights of those four days are elucidated below.

The impact of high level sound on the body

A subject of primary concern for all of us is the effect that prolonged exposure to high sound levels has on our health and hearing. Mr Polon and Mr Fause made some enlightening and alarming points. "The effect of sound on the body does not stop with the gradual degeneration of the inner hearing mechanism," says Polon. "Whole body damage is a phenomenon in which the activation of basic defence mechanisms by high level sound involves many different body organs and interferes with certain necessary bodily functions."

The brain can produce just about any drug known to man. Any sudden, loud noise will put the body into a state of preparedness through the use of these internally manufactured chemicals that are secreted into the bloodstream. Consistently high sound levels trigger these regular body responses that are intended to function infrequently. Such a constant stress condition is detrimental to the cardiovascular, nervous, and digestive systems. The most serious problem lies in the fact that the manufactured drugs can actually induce a pleasurable feeling similar to that of medicinal or recreational substances that masks the damage being done.

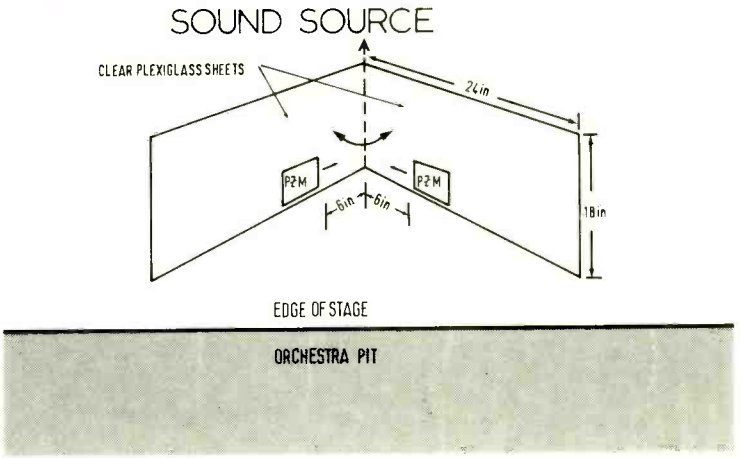
Since the tolerance levels vary widely from person to person, setting an exact limit is impossible, but generally, sustained sound around or above 100dB will eventually catch up with everyone.

Microphone techniques

PZMs (Pressure Zone Microphones) are becoming quite popular, and are generating a spectrum of reactions. Ron Streicher (Audio Engineering Associates, Pasadena) is convinced of the advantages and quality of the mic, but in his opinion, ". . . at this time there is no way to make a good coincident stereo recording with the lateral depth, full definition, and frequency response of traditional coincident microphones." **Fig 1** is his alternative method for stereo.

Because the size of the backing plate determines the range of frequencies the mic will accurately reproduce (the larger the backing plate, the wider the frequency range), two clear plexiglass sheets are placed about 2ft from the apron of the orchestra pit. The mics are positioned on the sheets approximately 6in from the junction, and aimed towards the source. By changing the angle between the pieces of glass, the engineer can control the amount of stereo imaging. This arrangement also eliminates phasing problems. Sometimes an additional mic on stage left and another at stage right are useful to reinforce the sound. The clear plexiglass allows the audience a relatively unobstructed view of the performance on stage.

FIG.1 ALTERNATIVE METHOD OF STEREO



Stereo for television

According to several surveys, the number one improvement that consumers wish to see in the near future is stereo TV—or at least higher quality television sound. That's best demonstrated in the audio industry where record executives said there was no market for quality recordings, yet direct-to-disc and digital classical sales are way above previous forecasts.

About 30% of the televisions sold in Japan are stereo or stereo adaptable, but stereo broadcasts account for only three hours of programming a day. Some US cable companies (Times/Mirror for one) are equipped for 2-channel sound, but they are forced to use synthesisers to recreate a 'pseudo-stereo'. The reason is the lack of available software. The cost of producing true stereo soundtracks is many times higher than mono tracks. Movie production companies often use stereo only with those visuals where a spacious audio effect really has an impact. Then to reduce costs, they collapse the soundtrack back to mono for the rest of the film.

In contrast to the previously mentioned rapid acceptance of stereo in Japan: after 20 years of available stereo programming, 65% of the FM radio music broadcasts in the USA are still monaural. The ultimate question is and ever shall be: which should come first—the technology or the software?

Digital editing

Digital editing has advanced by enormous leaps in just the last few months. What was dreamed about is now reality and those features that were unique are now commonplace. Multiple splices at any point can be made, auditioned and stored before finally choosing the best one; volume levels can be compensated effortlessly from one edit section to the next; and out-of-tempo edits can be corrected with a push of a button. Units offer a number of crossfade angles, and there is even a small editing wheel that simulates tape rocking for the die-hard analogue tape-cutter. The process is so easy that producers and musicians can work on the tapes themselves in a fraction of the normal time without fear of destroying a priceless master. Four-time Grammy-winning engineer Carson Taylor (Audio/Video Rents, San Francisco) warns that "a potential, but very real, temptation is to use that saved time and money to experiment with more edits, and hence, never commit to a finished piece."

Audio video futures

Is video the panacea for the depressed audio recording industry? With more successful artists building their own studios for tax purposes and convenience, and lesser acts logging fewer studio hours, video looks quite attractive to the empty-studio owner. But the cost of quality video production is greater than it seems on the surface if you take into consideration the expanded facilities (higher rent, power, ac, lighting, etc), machine maintenance, salaries for a video crew, and most importantly, a creative staff that knows what to do once the gear is installed and functioning. In addition, a growing number of television studios who already have the experience, staff, and equipment are looking towards the video market-place as a viable alternative to their own down time. Mel Lambert (*Recording Engineer/Producer* magazine) sees the studios more in the role of production houses—the co-ordinators who rent the equipment and hire the personnel on a 'per project' basis. For those owners desiring to become a full-service AV business, but lacking the liquid assets, there are always the more consumer-oriented clientele in need of wedding videos, lecture videos, and so on. This allows the fledgling producer to start with a small crew, experiment, and slowly upgrade the machinery. Post production services are always another possibility if a larger budget is available.

Whichever direction looks best, approach it cautiously. Video production can marry easily with audio work, but it's still a completely different industry.

And on that note, the 1981 spring AES show came to a close at 5.30 on a Friday afternoon. Outside was the Los Angeles weekend, bumper-to-bumper, rush hour traffic. Someone should have taped that so we could have just turned it off. ■

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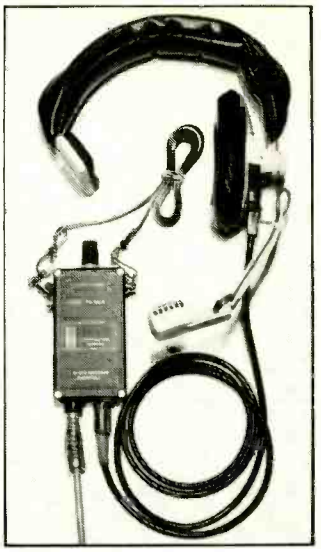

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UK: Cue Communications Ltd, MCI House, 54-56 Stanhope Street, London NW1 3EX.
Phone: 01-388 7867. Telex: 261116.
USA: Avab America, 1714 Stockton Street, San Francisco, Cal 94133.
Phone: (415) 421-3562.

HS1
Intercom system comprising belt/pocket pack and standard headsets, typically Beyer. The unit is battery powered and may be simply connected in parallel with up to nine other similar units, no central power supply being necessary. Plugging in the headset switches the battery on, and connections are 5-pin DIN for headset, 3-pin DIN for line. Size is 11 x 6 x 3 cm.

BANG-CAMPBELL ASSOCIATES (USA)

Television Equipment Associates Inc, Boway Road, Box 20, South Salem, NY 10590.
Phone: (914) 763-8893. Telex: 710-575 2600.
UK: Future Film Developments, 36-38 Lexington Street, London W1V 3LE.
Phone: 01-437 1892. Telex: 86754.

BCA Interphone
Intercom system comprising belt/pocket pack units into which standard headsets are plugged, mic/speaker panels with gooseneck mic, and director's console with various facilities. The system is two wire with no polarity problems (amp includes full wave rectifier), the mic amp accepts 200/300Ω mics or electret for which appropriate dc excitation is provided, and volume controlled receive amp drives 20mW into 600Ω. The belt box has a belt clip, 6-way DIN for headset, 4.57m of coiled cable for system connection, and mic switch. The same unit is available less box and coil cable mounted in U-frame for panel mounting. The power supply provides 24V dc with 20Ω internal resistance and 150Ω impedance over the audio pass band 200Hz to 4.2kHz, suitable for driving 2-wire systems. Available as either rack mount or pcb.
Prices: belt box around $200, mic speaker panels around $600, director's console built into power supply $200, separate $500, power supplies around $350.

BARKWAY (UK)

Barkway Electronics Ltd, Barkway, Royston, Herts SG8 8EE.
Phone: 076384 666. Telex: 817651.
USA: Fisher Berkeley Corp, Powell & Christie, Emeryville, Cal 94608.
Phone: (415) 655-9696.
800 series
Intercom system that can accommodate up to 56 stations. Station selection uses an 8-digit keypad with numbering scheme 1-8 and 12-87. Optional priority allows certain stations to obtain immediate access to the system which is voice switched two

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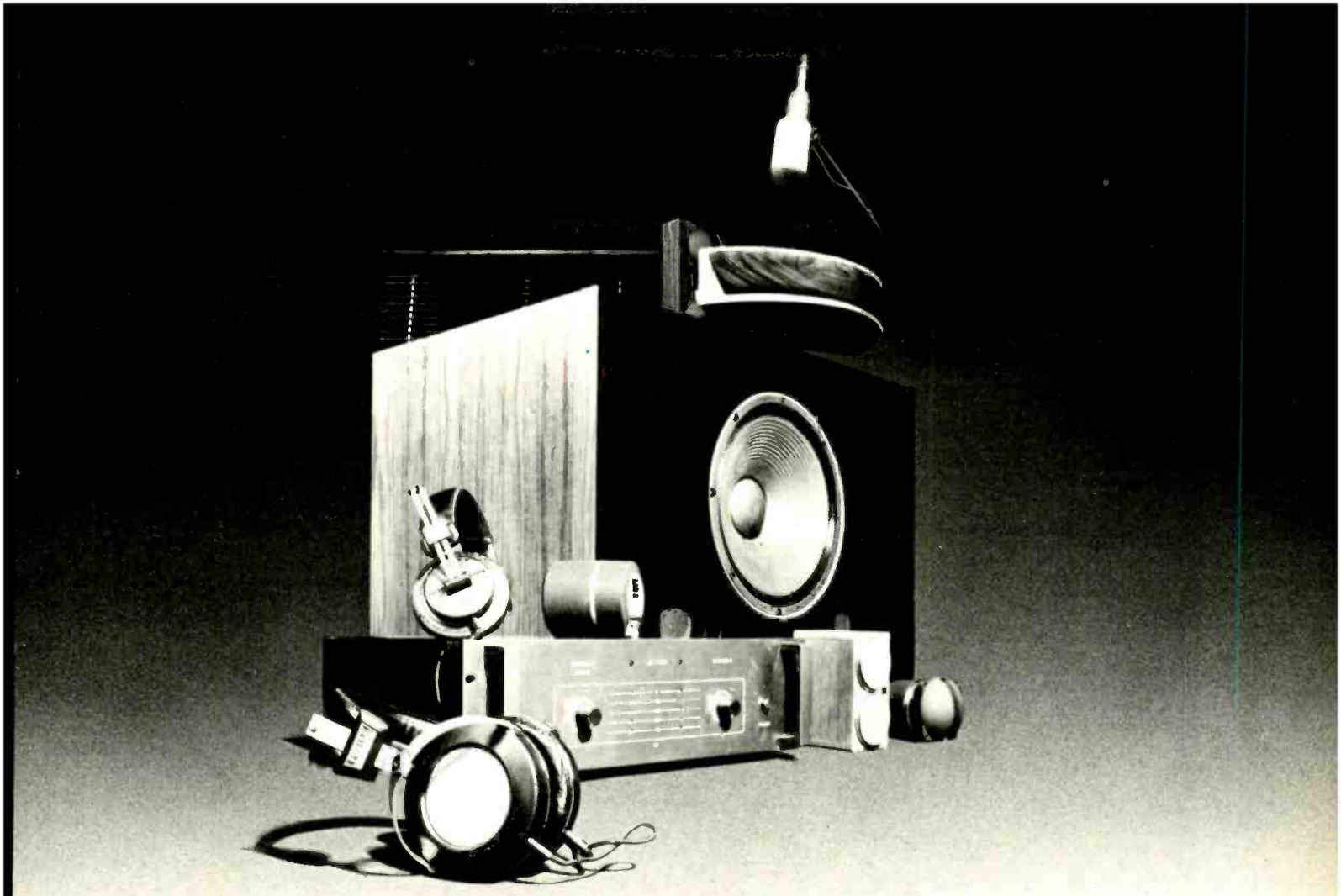

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Survey

wire duplex and can handle only one conversation at a time but with all call facility. Options include selective barring, automatic call termination unit, emergency alarm tone, public address facility and battery standby power.

200 series
Simplex intercom system comprising master and substations. Master stations are available with either five or 10 keys allowing a maximum of 10 stations to be called from each master. These may either be other master stations between which full communication is available, or substations which may only communicate with their associated master station. Any combination of master or subs may be used, so large systems may be built-up, but obviously with limited access between stations. Cabling is a pair for each master station in the system, and simple pair to subs. Each unit has press keys to talk and call. Construction is high impact ABS plastic cases, with interior, weather-proof and watertight stations being available. A separate power supply is used.
Price: five stations from £201, 10 from £310.

Polydex 1000 series
Microcomputer controlled intercom system available with from four to 200 stations using modular construction expandable in steps of four, to provide systems with maximum of 32, 40, 100 or 200 stations with two, four, seven and 14 speech channels respectively. Only two pairs are required by each station, with stations being hands free with optional handset. Facilities provided by the system include all-call to interrupt existing conversations temporarily for an all-call, automatic recall facility allowing connection when a station becomes free, call transfer (follow me), secretary transfer, priority calling. Options and external equipment also provide paging, conference, party line, intercommunication with mobile radio system, intercommunication with another exchange, connection of loudspeaker, control of electrical door lock.

BRABURY (UK)

Brabury Electronics Ltd, 119A Loverock Road, Reading RG3 1NS.
Phone: 0734 52434. Telex: 848760.

310 Series
Studio and OB talkback units built to customers' requirements. Features include electronic switching, multicore cable or encoded single core routing interconnect between remote stations and matrix. Remote stations are active and locally or remotely powered.

CALREC (UK)

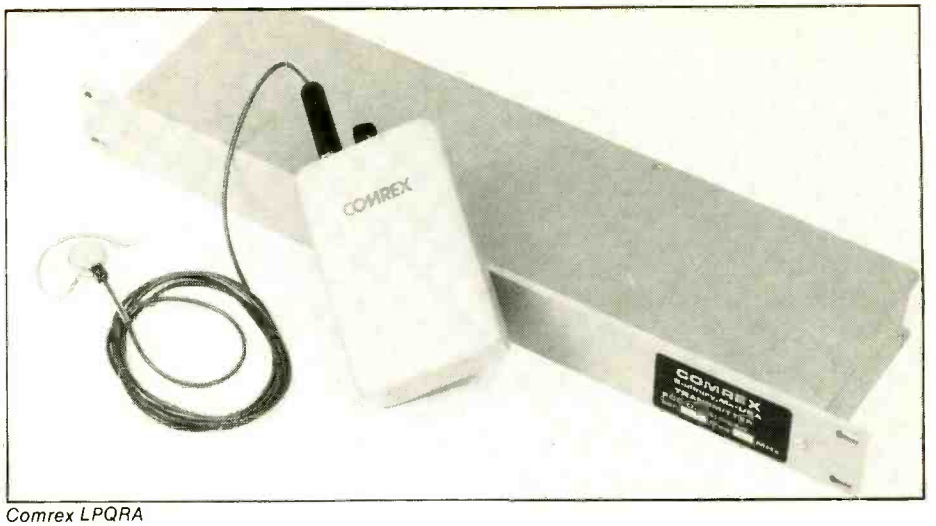
Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorkshire HX7 7DD.
Phone: 0422 842159. Telex: 51311.
USA: Edcor, 16782 Hale Avenue, Irvine, Cal 92714. Phone: (714) 556-2740. Telex: 685557.

Microprocessor controlled matrix
Microprocessor controlled audio switching matrix that may be used for talkback systems with multi access. communications systems with multi conference facilities, and assignable switching with memory to recall preset systems configurations. A small system would comprise a 16 x 16 matrix providing line switching to either A or B inputs of an audio mixer, and routing talkback and line outputs to outside broadcast points of a radio studio. Either mono or stereo signals may be handled, and the processor is connected to the matrix by a single screened cable. Optional VDU display is available.

CLEAR-COM (USA)

Clear-Com Intercom Systems, 759 Harrison Street, San Francisco, Cal 94107.
Phone: (415) 989-1130.
UK: TBA Lighting, Tim Burnham Associates Ltd, 381 St John Street, London EC1V 4LD.
Phone: 01-837 8968.

CS-200 series
Single and dual channel main intercom stations, available as portable or rack mounting. Will power up to 40 remote stations, includes intercom station, six parallel remote connectors, master gain control for whole system, two headset connectors on *XLRs*.
Price: *CS-200* 2-channel £267, *CS-200K* rack mount 2-channel £276.50.



Comrex LPQRA

PS-451
Power supply for feeding dual channel intercom systems, no intercom built in.
Price: £158.50. *BA1* allows the unit to power a second system £21.50.

PS-10/10K
Power supply, portable or rack mount, powers 12 remote stations, front panel connection, LED short circuit indicator, master gain switch.
Prices: *PS-10* £92.70, *PS10K* £101.67.

Remote stations
Various remote stations, dual channel for headset. *XLR* connectors, level control, specific call facility. Various types: *RS-100A* is portable belt pack with clip, *MR-102* is mounted on a brushed stainless steel panel for mounting in a conduit box, *KB-111* remote station is self-contained for wall or permanent mounting built-in speaker, *KB-100* is King Biscuit weatherproof remote station with permanently attached hand mic and built-in speaker, *PC-101* remote station kit designed for installation in console. *KB-111K* remote speaker station, for rack mounting with built-in speaker. *RS202S* remote station is 4-channel belt pack with side tone. *MR-202S* is stainless steel panel mounted with four channels, *KB-124* is portable hands free speaker station with threshold indicator, call light cueing. *MS-100* is 4-channel main station, *RM-400* is 4-channel remote station. *CP-100* is television belt pack accepting dynamic or carbon headsets.
Prices: *RS-100A* £84, *MR-102* £87, *KB-111* £96.50, *KB-100* £112, *PC-101* £68.50, *KB-111K* £112, *RS-202S* £116.60, *MR-202S* £110.70, *KB-124* £140.

SB-412
Four-channel switchboard and main station with switch matrix for 12 remote stations assigning them to any of four groups, or a fifth 'chatter channel'.
Price: on application.

SB-8 switchboard
Switchboard monitor which creates 8-channel intercom capability allowing for group or private communication between switchboard and remotes, built-in speaker or headset, signalling 3-mode switching.
Price: £776.

MX-840 slide matrix
Used in conjunction with the *SB-8* switchboard allowing either 20 or 40 stations to be pre-assigned to the eight channels using a slide matrix.
Price: £121.50.

AC-10 Adapt-a-Com
Allows interface of any Clear-Com intercom system with any known 2, 3 or 4-wire system including carbon mics and TV cameras.
Price: £140, rack mounting £149.

Clear-Com also produces a range of accessories to operate with its intercom systems. Clear-Com systems are 3-wire.

CLYDE ELECTRONICS (UK)

Clyde Electronics Ltd, Ranken House, Anderston Cross Centre, Glasgow G2 7LB.
Phone: 041-221 5906/248 3001.

CETB1
Communications (talkback) unit designed to provide simplex communications with 10 other stations. Outgoing audio is balanced and auto controlled over a 50dB range, a gooseneck mic is provided. A built-in speaker, headphones or a headset may be used. Cue programme may also be sent to an outside source.
Price: on application.

COMMERCE AIRBORNE (USA)

Commerce Airborne Corp, Suite 104, 16425 Hart Street, Van Nuys, Cal 91406.
Phone: (213) 785-5409.

CA-214
Airborne ENG controller providing complete audio, intercom and transmitter control for typically four stations in an airborne ENG system such as a helicopter or light plane (pilot, cameraman, engineer and reporter). Each crew member has a switching panel that allows his mic to be switched to either the audio channel (VTR or microwave down link) or two FM communications transmitters, select microwave uplink receiver output, VTR audio, FM receivers uplinks, TV off-air, airtraffic control, cue receiver, scanner receiver, end of tape warning (from VTR), provides full intercom between crew.
Price: basic per crew station $1,425.

COMREX (USA)

Comrex Corp, PO Box 269, 60 Union Avenue, Sudbury, Mass 01776.
Phone: (617) 443-8811. Telex: 710-347 1049.

CRA
Pocket sized monitor receiver covering range 50MHz to 550MHz (prefixed), 6kHz bandwidth, high level headphone output, battery operated.
Price: with squelch $550, without $395.

CTA
Rack mounting cue transmitter with 1W output in range 26.1 to 26.48MHz. Has programme and cue inputs, with cue automatically overriding programme.
Price: $750.

LPQRA
Pocket sized cue system receiver covering range 26.1 to 26.48MHz, headphone output, battery powered, 6kHz bandwidth.
Price: $395.

CROW/SANDAR (Norway)

Sandar Electronics Ltd, Redhustgaten 12, N-200 Sandefjord.
Phone: 033 67.222. Telex: 21547.
UK: Crow of Reading Ltd, PO Box 36, 76 Katesgrove Lane, Reading RG1 2NB.
Phone: 0734 595025. Telex: 847056.

Specially designed systems to customers' requirements.

DAC (UK)

Derby Automation Consultants Ltd, Dacom Works, Shobnall Street, Burton-on-Trent, Staffordshire DB14 2.
Phone: 0283 43471. Telex: 34654.

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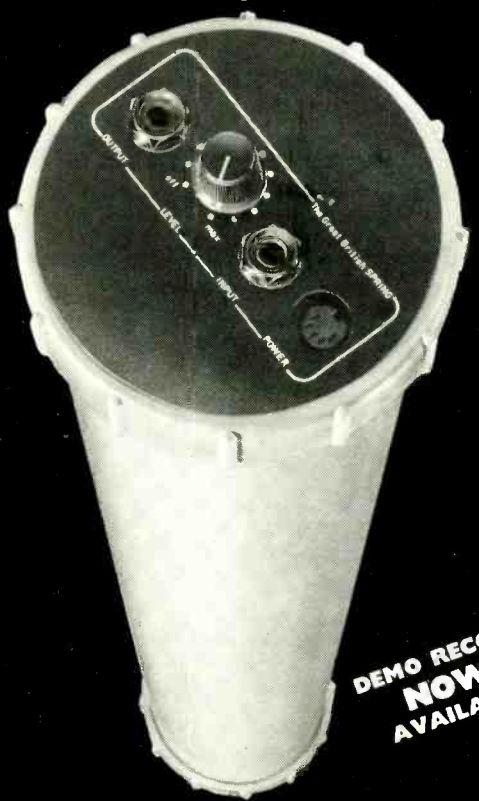

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01-458 9133

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0582 26693

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Survey

Wide range of communication equipment varied applications including hazardous and corrosive atmospheres.

The *Dacom S20* audio communication system uses a manual exchange with provision for 10, 20 or 30 lines with either two or four speech paths. Remote units are provided with mic and loudspeakers. Interface with transmitters and receivers may also be arranged.

DESIGN ELECTRONICS (UK)

Design Electronics, 100 Chalk Farm Road, London NW1 8EH.
Phone: 01-267 4499. Telex: 261653.

Cuemix
Foldback system designed for use on the studio floor, provides five separately controllable channels with stereo headphone output, each separate slider level controls, self powered with rechargeable lead acid battery. Receiver system comprises electronics and battery in floor sitting epoxy coated box, with flexible stalk with controls mounted on small top panel. Transmitter is rack mounted, and accepts line inputs, driving FM carriers into a loop antenna.

PHILIP DRAKE (UK)

Philip Drake Electronics Ltd, 23 Redan Place, London W2 4SA.
Phone: 01-221 1476. Telex: 87515.

Talkback unit
Equipment designed for use in television, radio and recording environments. Standard central switching units for 8 x 8 and 16 x 16 crosspoints available. Custom building of larger units for special requirements. Control panels built to specification with either mic and loudspeaker level working, or line level with dimming on mic and loudspeaker chains. Active panels can be locally or centrally powered.

Commsbox
Designed for mobile use, the *Commsbox* provides communication between up to 10 operators using communications type headsets. Battery or mains powered. Line level input and output can be provided, and boxes may be linked to increase capacity. Auxiliary switched busbars can be provided at extra cost.
Price: £186, AKG *K158/T301* headset £50, Beyer *DT109*/11 £85, beltpack £41.

Mini-Mobile talkback system
Part of the comprehensive Talkback system, providing communication between up to four locations and three cameras, designed for small TV OB units, goose neck mic, jack sockets for headset, option for external speaker.
Price: central unit £1,390, director's control unit £154, spare panels £165.

FARRTRONICS (Canada)

Farrtronics Ltd, 185 Denison Street, Markham, Ontario L3R 1B5.
Phone (416) 495-6720.
USA: Industrial Sciences Inc, PO Box 1495, Gainesville, Florida 32602.
Phone: (904) 373-6783.

Professional intercom system
Intercom system based entirely on line level audio switching (balanced to ground) in each Selective Calling Station. While the unit uses a central semi- or fully-programmable matrix, this does not have switches, relays or cross points, but provides hardwired routing between the switches on each station. The mic amp has an AGC range of 30dB with line level output, while the listen amp provides 3W into 8Ω load. Wiring is with 25-pair telephone type cable. Two selective call/listening station models, one with up to four pushbutton groups (24 stations), the other with up to seven (40). The semi-programmable matrix handles up to 15 stations, the programmable matrix has 44 vertical busses for 18 selective calling stations, expandable.
Price: on application.

GREEN GINGER (UK)

Green Ginger Ltd, 52 Potters Lane, Kilm Farm, Milton Keynes, MK11 3HQ.
Phone: 0908 566170.

CQ-B talkback communications system
Single channel intercom system comprising belt pack and standard headset, with indicator and level control, operates on ring system with screened pair cable, *XLR* connectors.
Price: *CQ-B1* £35, *CQ-B2* with light and buzzer calling, and mic mute switch £55.

CQ-B3/B4
Power supplies for intercom circuits, standard *B3* unit handles up to 20 *B1* outstations in one ring, *B4* handles 20 *B1* or *B2* outstations in one ring, may be adapted for multi-ring operation.
Prices: *CQ-B3* £45, *CQ-B4* £65.

CQ-B5/B6
Simple master unit using existing power supply, providing two loops under the control of a single designated outstation, *CQ-B6* also has centralised light calling and buzzer control facilities.
Prices: on application.

HIGHAMS (UK)

Highams Electronic Communication Ltd, Ferndown Industrial Estate, 96 Cobham Road, Wimborne, Dorset BH21 7RE.
Phone: 0202 893514/893539.

Hectaphone Mini
Four-way intercom system can either have four fully interconnected master stations or a master and four slave stations. Alternatively there can be a combination of the above units, ie, two masters and two slaves. A clear conversation may be conducted at up to 12m from the unit. Desk or wall stations. 8 core loop cabling.
Prices: control unit £69. 4 line master station from £49.

Hectaphone Maxi
Eight-way intercom system basically similar to *Mini* but maximum eight stations, desk or wall mounting. Eight core loop cabling.
Price: comprehensive master £79, wall mount £59, desk £69.

Hectaphone Magnum
21/27-way intercom system. Basically similar to *Mini* but maximum 27 stations, eight core cabling.
Prices: control unit £180, executive master £89, wall mount £69, desk £79.

LINK (UK)

Link Electronics Ltd, North Way, Andover SP10 5AJ.
Phone: 0264 61345. Telex: 47132.

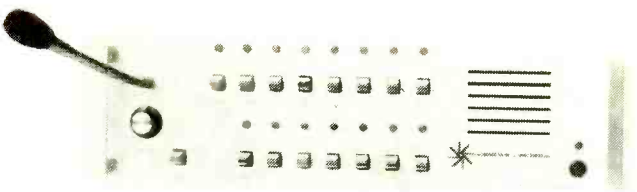
787 telephone exchange
Telephone exchange system capable of working with up to 10 external lines and up to five operating positions, each position having a keypad with an illuminated pushbutton for each line, and a buzzer that sounds for 2s when an incoming call is received.

708
Standard talkback unit, self contained providing communication between a producer and up to three cameras. Two-way communication, on-air cues, programme sound, two aux inputs, talkback out.

Talkback systems
Link produce a range of modules for custom built talkback systems using FET crosspoint switching in a central electronics unit, and outposts that may be cameras or panels with mics and loudspeakers, and can select any other station.

McCURDY (Canada)

McCurdy Radio Industries Ltd, 108 Carnforth Road, Toronto, Ontario M4A 2L4.
Phone: (416) 751-6262. Telex: 06963533.
UK: Seltech Equipment Ltd, Rose Industrial Estate, Cores End Road, Bourne End, Bucks SL8 5AT.
Phone: 06285 29131. Telex: 848960.



Philip Drake talkback unit

USA: McCurdy Radio Industries Inc, 1711 Carmen Drive, Elk Grove Village, Illinois 60007.
Phone: (312) 640-7077. Telex: 910-222 0436.

Series 9000 intercom systems
Assembled from two basic modules: *AP276* intercom preamp and matrix crosspoint card, and *AM278/478* output amps. Basic system is an electronic 10 x 10 matrix which can be expanded to 20 x 20, 30 x 30 or larger to order.

AP276
Accepts dynamic, carbon and mic or a line input and includes automatic gain control, and a 10 x 1 matrix which may either be discrete wired or BCD operated from a suitable key panel.

AM278/478
Consists of two amps each with a + 18dBm active balanced output, the *478* version including a transformer providing 3W into 8Ω.

Microprocessor intercom
Electronic, microprocessor controlled matrix intercom system. Matrix sizes from 20 x 20 to 200 x 200, 2-wire control, group and sub assignable, alpha numeric display panel.

Digitally controlled intercom
Matrix based intercom system using pre-programmed and programmable master stations. Each keypanel has eight keys that are EPROM 'hardwired' by a master control console, and an additional four keys that may be programmed locally from a hexidecimal keypad for either single or multiple assignments. Alphanumeric indication is provided of the source of incoming calls, and program monitor is also available. The matrix comprises four different types of card: input drivers, crosspoints, output amps and buss controller cards, systems being available in sizes from 20 x 20 to 240 x 240. A single pair is used for control data in *RS-422* 9600 baud format, with audio being carried on separate lines (not specified).

MARCONI (UK)

Marconi Communication Systems Ltd, Marconi House, New Street, Chelmsford CM1 1PL.
Phone: 0245 353221. Telex: 99201.
USA: Marconi Electronics Inc, 100 Stonehurst Court, Northvale, New Jersey 07647.
Phone: (201) 767-7250. Telex: 9919752.

B3656
Talkback communications system. Consists of a Communication Unit which accepts up to 13 inputs and provides a maximum of 20 outputs although any one station can only select 10 of these outputs. Each control panel provides key selection of 10 positions and has three talkback and programme sound circuits incoming. Although normal operation is with a mic and LS panel, a headset may be accommodated. Positions would normally be supplied for producer (studio director), technical manager, vision controller, sound engineer, lighting engineer, boom operator, and lighting gallery. Other positions are general purpose, cameras, and studio floor. All mic amps have a built-in limiter.

B3664
Intercommunication system. Provides duplex working between 13 stations (25 stations optionally) which are hardwired to each other. Selecting a particular station's key enables speech direct to that station from the mic. To reply, the called station selects the calling station's key thus allowing duplex conversation (providing level controls are set to eliminate howl round). Verbal announcement of station is however required. The 25-way includes calling lamps.

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A single channel, half-rack unit with patented electro-optical attenuator. Featuring smooth, natural sounding RMS action, it offers selectable compression ratios, a large VU meter, adjustable output and threshold levels and stereo coupling.

The Model 1176LN
A peak limiter which features adjustable input and output levels; individual attack and release time controls; selectable compression ratios; switchable metering; and stereo coupling. The 1176LN is the most widely used limiter in the world.

The Model 1178
A two channel version of the 1176LN in a compact (3-1/2') rack mounting design. Featuring perfect tracking in the selectable stereo mode, it additionally offers selectable VU or Peak reading meter ballistics.

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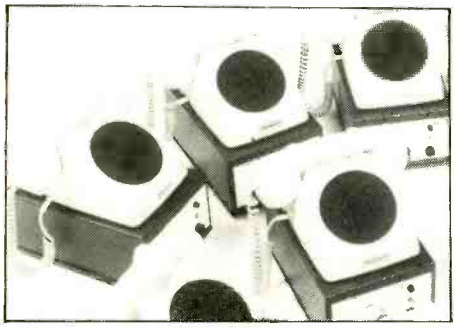
Survey

MILLBANK (UK)

Millbank Electronics Group Ltd, Uckfield, Sussex TN22 1PS.
Phone: 0825 4166. Telex: 95505.

Crew talkback system
Multistation intercom system using a master control unit. Any sub may call the master station or vice versa. Incoming calls trigger a tone and light the appropriate station switch position. The system is extendable in steps of six channels to a maximum of 18.



DIRT

DIRT talkback system
Direct Instantaneous Reverse Talkback telephone equipment comprising standard *700 series* telephone instrument mounted on a small box, and fitted with a loudspeaker instead of a dial. In normal use, it allows the user to hear talkback through the speaker, but becomes a 2-way telephone by simply lifting the handset. Typically used for OB contributions where rapid reverse communication is required, but normal exchange systems are not warranted.

MINICOM (USA)

Minicom, PO Box 302, Walnut Creek, Cal 94596.
Phone: (415) 820-1322.
UK: TBA Lighting, Tim Burnham Associates Ltd, 381 St John Street, London EC1V 4LD.
Phone: 01-837 8968.

Minicom Intercom System
Intercom system comprising belt pack for ring cable, and headset. It includes mic and receive amp, volume control and on/off switch. *PK-2* 2-channel six *XLR* outputs for 24 headsets. *PK-1* power supply operates on 110/230V, has three *XLR* outputs standard and provides drive for 12 headsets.
Prices: *DM-1* belt pack with double muff headset £62, *SM-1* with single muff headset £57.50, *PK-1* power supply £63.50. *PK-2* power supply £87, *LS-1* speaker station £39.

NEVE (UK)

Neve Electronics International Ltd, Cambridge House, Melbourn, Royston SG8 6AU, Hertfordshire.
Phone: 0763 60776. Telex: 81381.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801.
Phone: (203) 744-6230. Telex: 969638.

Professional audio equipment consultants and designers. Talkback communication supplied or under construction range from simple 15 station equipments associated with OB vehicle installations to very large system for broadcast complexes involving computer control.

NECOMM
Microprocessor based crosspoint intercom system offering dramatically smaller physical size and lower price per crosspoint than conventional systems. Available in sizes from 8 x 8 to 256 x 256, a complete family of terminals are available, ranging from simple passive panels to processor controlled stations with optional alphanumeric display and machine control facilities. Remote stations may also be connected via telephone lines, 2-way radio links or microwave systems. Features include intercom-follow-signal, signal-follow-intercom, logical (symbolic) station key assignments, machine control of intercom, intercom control of machine, machine control of machine via intercom, user selected and user mutable programme monitoring, selective privacy, selection lockout, priority override of privacy. Station keys may be preset to call individual or group destinations, and specific assignment maps stored and recalled for specific crews, programmes, etc. Where more complex displays are used, a range of information becomes available — calling party identification, called party busy, call waiting, programme monitor channel No, "XX seconds to airtime", prestored instructions ("roll tape"), status of privacy lockout, etc. All features are controlled by software configured for each customer from a library of standard modules, and these may be optionally updated over a telephone line from Neve's maintenance dept.

NTP (Denmark)

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

Type 330
Communications system comprising a number of interconnecting modules, *330-200* is 2-wire electronic hybrid allowing 2-wire subscribers (such as a telephone) into the system, manually balanced, *330-100* is a 4-wire interface unit, *330-500* mic amp and limiter, *330-660* loudspeaker unit with 1.8W amp, *330-700* test tone and white noise generator, *177-600* peak programme meter. Termination of the various units is with external summing resistors and *330-900* selector unit.
Prices: on application.

PB THEATRE SYSTEMS (UK)

PB Theatre Systems Ltd, 12 Century Street, Sheffield S9 5DX.
Phone: 0742 447511.
UK: Hardware House (Sound) Ltd, 34 St Philip's Road, London E8.
Phone: 01-249 0916.

Series 2
Single or dual channel belt pack type intercom systems, self contained without master stations, *XLR* connectors (3-pin for single channel, 4-pin for dual channel), suitable for most headsets, 15 or more units may be paralleled on the same system. A separate power supply is used, and single and dual channel units may be used on the same system with adaptor boxes, and external signals mixed in if required. Latching or non-latching pushbuttons, call light button and lights. Desk intercoms with gooseneck mic, and wall mounting intercoms also manufactured.
Prices: single channel belt pack £42.50, dual £48, single channel power supply £44, dual £48, splitter boxes around £17.50, desk intercom £144.

Minicom intercom system

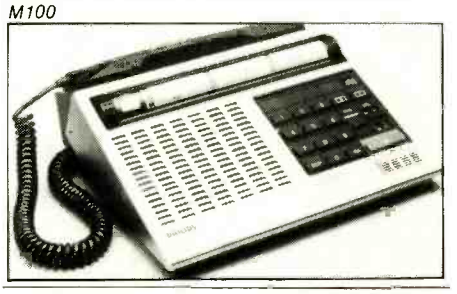
PHILIPS (Netherlands)

NV Philips, Electro-Acoustics Division, HBS 2, Eindhoven.
Phone: 040 79.11.11. Telex: 51121.
UK: Pye Business Communications Ltd, Northfield Industrial Estate, Beresford Avenue, Wembley, Middx.
Phone: 01-903 0171.
USA: Philips USA, 7530 Frontage Road, Skokie, Illinois 60077.

M28 intercom
Provides a maximum of 28 stations selected using an 8-digit keypad. Communication is full duplex and press to talk is only used in poor audibility conditions. The person receiving the call does not need to touch his intercom unit at all even while speaking. A handset can be used for privacy. All stations are connected together in parallel using an 8-pair cable.

M100 intercom
Similar in concept to the *M28* but able to handle over 1,000 stations all using the same basic 8-pair cable. Stations available include executive/secretary, handset stations, direct call units, sub-stations, wall mounted units and industrial stations. A wide variety of facilities can be provided such as automatic paging, group call, public address connection, floating numbers, and automatic recall.
Choice of *MFC4C* or *MFC12/32* control packs.

M100



PYE (UK)

Pye TVT Ltd, PO Box 41, Coldhams Lane, Cambridge CB1 3JU.
Phone: 0223 45115. Telex: 81103.
USA: Philips Broadcast Equipment Corp, 91 McKee Drive, Mahwah, New Jersey 07430.
Phone: (201) 529-3800.

TS10
Talkback system consists basically of a relay matrix and six different types of talkback units. The matrix accommodates up to 14 crosspoint cards each with 24 inputs and routes input mic signals and output production talkback, general talkback, mixed camera talkback and programme to the respective remote talkback units. Unit A consists of a mic, LS, level controls for four incoming talkback circuits, and 12 keys for station selection. Unit B has three incoming talkback circuits and a single out from a headset. Unit C has two incoming talkback circuits with a mic and LS. Unit D is similar to Unit A with the addition of a headset socket. Unit E is similar to Unit C. A commentator's unit may also be added to the system which provides selection of external programme, foldback, programme and talkback. Also includes cue lamps and headset facilities.

R-COLUMBIA (USA)

R-Columbia Products Co Inc, 2008 St James Avenue, Highland Park, Illinois 60035.
Phone: (312) 432-7915.

Intercom headphones
Self contained intercom headphones with integral electronics, up to 10 may be used connected for 'party line' operation, self contained battery, available with either standard or noise rejecting electet mics, single or dual earpiece models.
Price: $100 to $150.

ROH (USA)

ROH Corp, 3603 Clearview Place, Atlanta, Georgia 30340.
Phone: (404) 452-4240.

Series 300 intercoms
Intercommunication system, using rack mounting master stations with maximum 50-channel capacity which may be divided into any combination of intercom, conference party line, talent IFB, 2-way radio or telephone channels. The mic channels have AGC with noise gates, and the output amp is 4W. Based on 50-pair cable, stations are available with eight, 16, 24 or 32 switches for selectable channels. Switching within each station is crosspoint controlled.

Series 300 interphones
Party line based intercom system with either portable or rack mounting stations, the portable stations having two channels and program, while the rack mounting stations offer four channels and the capability to interface with *Series 300* intercom systems.

50 ▶

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Custom built studio? Call the professionals.

BRENELL MINI 8

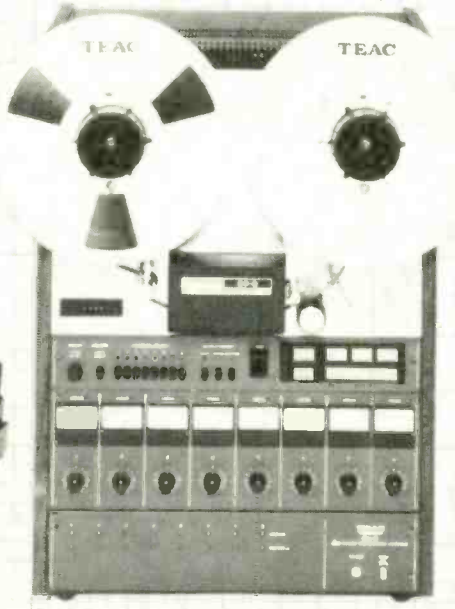
A truly professional machine within the reach of anyone seriously considering 8 track. I.C. logic transport control, sync facilities, silent drop in/drop out record functions, and everything that makes this 1 inch machine probably the best value for money on the market.

REVOX B77

The ideal mastering machine for the small studio giving really excellent results at a reasonable price. And for those who want to go even better we also stock the Revox A700.

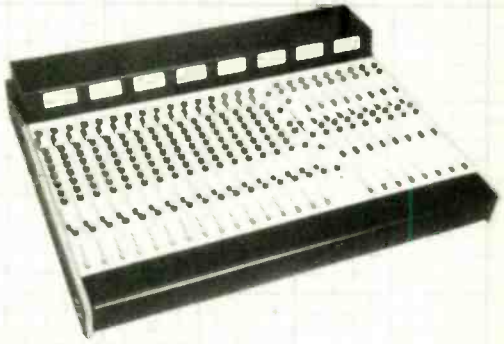
TEAC A3440

The new four channel machine replacing the famous A3340S. Now with even more facilities: — I.C. logic control, built-in pitch control, improved function select layout with auto sync for silent drop ins/drop outs, and a new monitor select system for easy monitoring in any mode direct from the tape machine.



TEAC 80-8

The ½ inch 8 track for the budget conscious studio. Giving high quality at a very reasonable price. The 80-8 has all the facilities normally associated with a machine of this calibre. And with the optional DBX unit gives excellent results.



A&H MODEL III

The high quality modular mixer for the quality 4, 8 or 16 track studio. Available in virtually any configuration up to a maximum frame size of 24/8. This mixer is available together with the Brenell Mini 8 at a special package price.

ALICE 12-48

The quality mixer for the 4 or 8 track studio. 12 inputs (16 input version also available) 4 outputs but wired for 8 track recording and monitoring. The standard model includes line up oscillator, talk-back and 48V phantom powering. Long throw conductive plastic faders available to special order. All in all a high quality mixer with all the facilities needed at a very reasonable price.

JBL MONITORS

We can supply the full range of JBL Monitor speakers from the small 4301 broadcast monitor; the 4311, popular with the smaller studio, through to the 4343 for more critical monitoring purposes.

REW

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

Full range of : AKG · Alice · AHB · Ampex · Beyer Dynamic · Calrec · dbx · JBL · Neumann · Shure · MXR · Quad · Revox · Teac · Soundcraftsmen · JPS · Roland · Auratone · Tannoy · Wollensak

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Survey

RTS (USA)

RTS Systems Inc, 1100 West Chestnut Street, Burbank, Cal 91506.
Phone: (213) 843-7022. Telex: 662404.
UK: Future Film Developments, 36-38 Lexington Street, London W1V 3LE.
Phone: 01-437 1892. Telex: 21624.

PS10/50 power supplies
Power supplies for *TW* two-wire intercom systems, the *PS10* powers 10 2-channel stations, the *PS50* 50 channel stations. Each output incorporates a dc voltage regulator, with an audio impedance generator which establishes a normal line impedance of 200Ω from 100Hz to 20kHz, and includes protection against mains. Includes a programme input which may be assigned to either channel.
Prices: *PS10* £301, *PS50* £514.

User stations — TW system, min two channel
SBP202 2-channel belt pack for headset, *XLR* connectors, belt clip, £128; *BP102* similar with signal lamp £151; *2-CRM* rack mount units with two channels, headset use, £135; *2-CRML* similar but with indicator lights, £162; *SPK-10* speaker unit, headset or handheld mic with push to talk and loudspeaker £179; *SPK-20* similar but desk stand mic, £187. *SPK-10L* and *SPK-20L* similar but indicator lamp, £200 and £205; *SPK-20RM* and *SPK-20RML* similar but rack mount with gooseneck mic, £247 and £283; *BP-501C* and *BP-501CL* belt pack user stations capable of monitoring both channels simultaneously, many options, £236 and £257; *SCR-110* special camera user station for RCA TV cameras, £122; *WM-102* wall mount station for conduit box, £151; *WMS-102* similar but loudspeaker station for double conduit box, £182; *CM-202* console mount user station, £145.

RTS also produce a range of accessories including splitters, programme coupling unit, footswitch, and the *TW-101 Interface Series* that allow the *TW System* to be interfaced to other manufacturers' intercom systems including 3- and 4-wire. and also to telephone lines (private wires).

Series 800
Master station intercommunication system which may be used as a self contained intercom system using six channels, or with existing systems such as RTS *TW*, Clear-Com, Daven, RCA, etc. Rack mounting, each of the six channels has separate talk and listen switches, gooseneck mic, speaker, optional headset, two interruptable feedback communications channels (switched talkback), interconnected using stardard 25-pair cable. *801* is basic master station, *860* supplements the system providing eight connectors for wiring to master stations, IFB outputs, channel interconnectors with other systems, switching, etc.
Prices: *801* £1,798, *860* £519.

Series 4000 IFB System
Communication system providing interruptible feedback (programme interrupt, switched talkback), that allows the programme director to communicate with talent on the studio floor. Typical system would comprise up to four control panels, providing either four, eight or 12 switched IFB channels with stage announce channels, four belt pack user stations with dual channels supply both programme and IFB, and a central electronics pack.
Price: on application.

Model 910
Switchboard intercom master capable of assigning and monitoring six independent intercom channels and three programme channels to 10 separate station lines. Individual line isolation and call signalling are standard, and a common party line is available at each *TW* intercom user station, with which the master station may be used.
Price: on application.

SAP-1026
Source assign panel for use with *TW* intercom systems, allowing any one of nine inputs (typically six intercom channels and three program), to be assigned to any one of 26 lines (six camera lines and 20 external lines), each line consisting of two separate feeds from the unit. Feeds are selected from two rows of 26 thumbwheel switches.
Price: on application.

Series 1000
Matrix intercom system providing communication by up to 10 user stations, each having direct communication with any other (an all master system). It may be used alone, or combined with a *TW* conference type system. Each user station is connected to a central matrix by 50-way microribbon cable.
Price: on application.

SOUNDOLIER (USA)

Soundolier Inc, 9380 Watson Industrial Park, St Louis, Missouri 63126.
Phone: (314) 926-9870. Telex: 910-760 1650.
UK: Planned Equipment Ltd, Belvue House, Belvue Road, Northolt, Middx UB5 5HP.

Telephone intercoms
Range of telephone handset type intercom systems, various modules including wall or desk telephones, phone with built-in speakers, various power units.
Prices: on application.

SPECTRUM (UK)

Spectrum Audio Ltd, Leeside Industrial Estate, Garman Road, London N17 0QP.
Phone: 01-801 7461.

Q-Comm intercom
Intercom system comprising beltpack Operator Station *HST* with locking DIN sockets, press to talk, LED indicator, optional call light and switch. *PSU10* and *PSU 20* power supplies provide for 10 or 20 stations respectively. Master desk stations have gooseneck mic with built-in speaker and ring power supply. *MCT* is basic master station with speaker doubling as mic, single channel. *MCU1* has separate mic, *MCU2* has two channels. System is 3-wire.
Prices: *HST* with standard headset £78.02, *PSU10* £79.67, *PSU20* £121.18, *MCT* £176.37, *MCT1* £263.64, *MCT2* £337.41.

SPT (UK)

SPT Video Ltd, Unit One Heybridge Industrial Estate, Heybridge, Maldon, Essex.
Phone: 0621 54633. Telex: 995133.
USA: SPTMC Inc, 1781 Ridge Road, PO Box 284, Ontario, NY 14519.

Command Talkback System
Talkback systems comprising wall or panel mounted control panels available in 3-, 7-, 14- and 21-way systems with handheld mic, built-in speaker with optional weather-proof horns, also simple one-way station.
Price: on application.

STRAND SOUND (UK/Canada)

Rank Strand Sound, PO Box 70, Great West Road, Brentford, Middx TW8 9HR.
Phone: 01-568 9222. Telex: 27976.
Canada: Strand Century Ltd, 6520 Northam Drive, Mississauga, Toronto.
Phone: (416) 677-7130. Telex: 06968646.
USA: Strand Century Inc, 20 Bushes Lane, Elmwood Park, New Jersey 07407.
Phone: (201) 791-7000.

Intercom systems
Communication system providing two channels. *SS701* is master station for portable or panel mounting, includes power supply for up to 40 outstations, master gain control, aux input, headset socket. *SS721* outstation is single channel belt pack with *XLR* connectors, call light and adjustable side tone with locking talk switch. *SS741* is rack mounted power supply for 40 stations.
Prices: *SS701* £236.50, rack mount £262.50, *SS721* £84, *SS741* £148.50.

TELEX (USA)

Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420.
Phone: (612) 884-4051. Telex: 297053.
UK: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA.
Phone: 01-749 2201. Telex: 897749.

Audiocom
Communication system comprising *IC-1* portable intercom station belt pack with *XLR* connectors, *IC-1F* is fixed intercom station for flush mounting. *IC-3M* switchboard provides connection for up to six intercom lines to any of three separate non-interfering intercom buss circuits, *XLR* connectors. *PS-1* is portable power supply for up to 30 headset stations or eight speaker stations. *PS-1F* fixed power supply is similar but flush mounting. *IC-S* portable speaker station has speaker and either headset or handheld mic. *IC-SF* is similar but fixed flush mounting. *IF-1* Interface connects the *Audiocom* systems with any other 2- or 4-wire communication systems, includes hybrid with balancing controls. Audiocom system is 2-wire.
Prices: *IC-1* $210, *IC-1F* $180, *IC-3M* $1,125, *PS-1* $210, *PS-1F* $135, *IC-S* $360, *IC-SF* $360, *IF-1* on application.

THEATRE PROJECTS (UK)

Theatre Projects Services Ltd, Electrosound House, 11 Marshalsea Road, London SE1.
Phone: 01-407 6781. Telex: 885659.

PS1
Simple power supply operating up to 16 outstations divided into three circuits which may be linked or separated.
Price: £78.

OS1 (top) and PS1

SB1
Splitter box that distributes one communications circuit to four outlets.
Price: £27.

MS1
Master station that powers up to 16 outstations on two circuits, the operator being able to talk to either circuit, but the circuits being separated. Each circuit has a call light that appears on all stations, two headset sockets with independent level controls, mic and line inputs.
Price: £192.31.

OS1
Belt pack or free standing outstation, into which a headset is plugged, tone control, mic on/off, listen level control, call light.
Price: £68. Headsets extra.

WARD-BECK (Canada)

Ward-Beck Systems Ltd, 841 Progress Avenue, Scarborough, Ontario M1H 2X4.
USA: Ward-Beck Systems Inc, 6900 East Camelback Road, Suite 1010, Scottsdale, Arizona 85251.

microCOM
Microprocessor controlled communication system which may be expanded in standard modular 24 x 24 crosspoint matrices and remote turrets, the central matrix being expandable up to 192 x 192 using a square or L configuration. The microprocessor central matrix controllers and master remote turrets require only a single 2-conductor cable for complete control including tally. An installed system can be reconfigured to specific and major communication changes by simply changing EPROMs. Slave turrets (up to 10) can communicate with master remote turrets permitting intercommunication between assigned master and slave turret positions, and without necessarily using the central matrix.

7000B series
Standard intercom systems based on 12 x 1 switching matrix, and available in standard packages of 12 x 12 or 24 x 24, and comprising two standard modules, the input/output amp and matrix module. All individual stations are passive, with station switches wired back directly to operate the crosspoints, and with 6, 12, 18 or 24 keys per panel. ■

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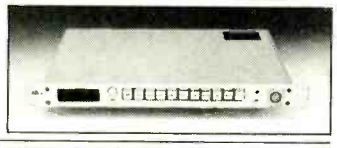
THE ADVANTAGE.

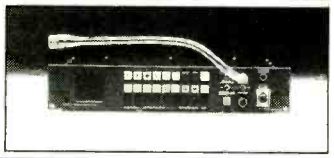
An intercommunications system so powerful, so flexible, so reliable, that it has become the standard for television production in the United States. The TW Intercom System has been serving the needs of teleproduction centers, broadcast stations and industrial users for over six years. The system represents a dedication to an unprecedented level of product capability. Please call or write for detailed literature.

Additional Product Lines

SERIES 1000 MATRIX SYSTEM
Dedicated-line matrix intercom/squawk system

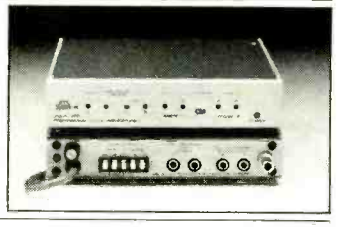


MODEL 801 MASTER STATION
Multi-channel communications center



SERIES 4000 IFB SYSTEM
Self-contained program interrupt system

SERIES 400 PRO-AUDIO
High performance amplifiers



International Distribution

SCV Audio
Batiment 3418 C,
Rue De La Jeune Fille
Zone De Fret Sud, B.P. 10314
95705 Roissy C.D.G. Cedex Fr.
Telephone: 862.43.04
Telex: (842) 212802

Future Film Developments
36/38 Lexington Street
London, W1R 3HR
England
Telephone: 01-437 1892
Telex: (851) 21624

Oceanic Trading Corporation
P.O. Box 891
Taipei, Taiwan
Telephone: 7077111-4
Telex: (785) 11458

ProSound
P.O. Box 31405,
Braamfontein 2017,
South Africa
Telephone: (011)
37-6556/9
Telex: (960) 8-0712

Intersonic AB
P.O.B. 42133
S-12612 Stockholm
Vretenborgsvägen 9
S-12630 Hägersten, Sweden
Telephone: 08-744 5850
Telex: (854) 11136

Otec Corporation
Otari Building,
4-29-18, Minami Ogikubo
Suginamiku, Tokyo, 167 Japan
Telephone: (03) 333-3891
Telex: (781) J26604

Patrick Trading Corporation
2004, Hang Chong Building
5, Queen's Road, Central
Hong Kong
Telephone: 5-220964
Telex: (780) HX75472

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Hunderstrabe 1.7100
Heilbronn, W. Germany
Telephone: (0 71 31)
48 01
Telex: (841) 728433

RTS Systems INC.

1100 WEST CHESTNUT STREET, BURBANK, CALIFORNIA 91506 213/843-7022 TELEX: 194855 TWX: 910-498-4987 A SUBSIDIARY OF COMPACT VIDEO SYSTEMS INC.

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Survey: automation

ALLISON (USA)

Valley People Inc, PO Box 40306, 2821 Erica Place, Nashville, Tenn 37204.
Phone: (615) 383-4737.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: 01-734 2812. Telex: 27939.

65K programmer
Programmer accepting and producing control voltages from 0 to + 5.6V dc. Basic programmer frame contains four *MUX-65K* cards with each one acting as 16-channel input multiplexer and 16-channel output de-multiplex/sample and hold. Extender frames may be used to bring the number of analogue functions to 4096. Each control voltage is divided into 128 increments and when used with VCA having 20dB/V, a 112dB dynamic range is processed. The system requires the use of a track on the tape recorder. No special adjustments are required other than normal. Can be used to program equalisers, pans, echo sends, etc, and any other programmable elements.
Price: 16 channels £2,290; 32 channels £2,500; 48 channels £2,700; 64 channels £2,900.

Fadex
Programmable fader system. Designed for use in new equipment or as a retro-fit into non-programmable consoles to interface with the *65K* Progammer. Designed to be 'standard' fader size and are available with differing dimension top plates. The fader element is P & G conductive plastic with *EGC-205M* VCA giving a control range of 145dB. *Fadex* provides in addition to programmable level control, up to nine VCA subgroups, channel mutes and solos, group mutes and solos, VCA master, nulling indication, remote/master control logic. Complete *Fadex* system includes *Fadex* module with VCA per channel, one VCA master and one stereo master, master logic card, power supply, console interconnection package and programmer to console interconnection and one *65K* Programmer.
Price: retrofit fader £185 each, stereo.

AMEK (UK)

Amek Systems & Controls Ltd, 2nd Floor, Islington Mill, James Street, Salford, Lancs M3 5HW.
Phone: 061-834 6747. Telex: 668127.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: 01-734 2812. Telex: 27939.
USA: Everything Audio, 16055 Ventura Blvd, Suite 1001, Encino, Cal 91436.
Phone: (213) 995-4175. Telex: 651485.

Auto-Pak
Computer editing and storage system using SMPTE timecode. Designed for use with Amek consoles but could possibly be used with other manufacturers as some Amek consoles are also compatible with the Allison *65K Programmer*. Master keyboard selectively lights the correct keys for each function group. Also performs as tape locator and motion control unit. *Auto-Pak* memory is 4K pages of high-speed RAM and is used only for fader movement. Mixes can be edited and stored on tape or in RAM.
Price: $25,000.

B & B AUDIO (USA)

Aphex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046.
Phone: (213) 655-1411. Telex: 910-321 5762.
UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS.
Phone: 01-749 2042. Telex: 28938.

Model OAS-24 grouping system
VCA subgrouping system in portable or semi-permanent form. Consists of control console with four or more dc group control modules each with 24 group assign switches, group mute and fader, with one master control module with 24 channel master group selection switches, mute sequence switch and master fader. Also the VCA/connector case housing the VCA cards and *XLR* connectors for inputs and outputs. The basic mainframe holds 9 subgroups and one master module but the system can be expanded to 48 channels.
Frequency response: ±0.5dB 20Hz to 100kHz.
THD: 0.02% at + 10dBV input.
Output noise: – 84dBm.
Max gain: unity.
Max attenuation: 94dB.
Tracking accuracy: 1.5dB between channels in any combination.
Inputs: 10kΩ unbalanced.
Outputs: 600Ω transformer balanced + 24dBm max.

HARRISON (USA)

Harrison Systems Inc, PO Box 22964, Nashville, Tenn 37202.
Phone: (615) 834-1184. Telex: 555133.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

Auto-Set
Originally designed for use with Harrison *24 Series, 32 Series* and *32B Series* consoles but can be used with any console operating with dc control voltages as the automation interface, including those designed to work with the Allison *65K* programmer. Uses include control of video, lighting and special effects control. Input is via a full ASCII keyboard with 5in CRT. Total system enclosed in single unit excepting power supply. Has ability to store up to four independent mixes on one track of an audio tape recorder with each of these mixes consisting of up to 63 console positions. Information may be extracted from the store as required for a particular channel without regard for the source selected for another channel.

Another method of operation is available when there is no storage medium for information and uses the internal memory of the *Auto-Set* which can record 10 static 'pictures' of the console positions. These being manually selected with a choice of an immediate jump between the two settings or a fade, variable from 0.1 to 9.9s. These settings may also be recorded on cartridge with up to 630 pictures on each one and recall is initiated by the keyboard controlling the integral cartridge interface of the *Auto-Set*. Further hardware will be made available for the *Audio-Set* including SMPTE timecode generator/reader and floppy disk storage system.

Auto-Set II
Hard disk based automation system for *MR-1* and *PP-1* hybrid audio mixing consoles which use DCI (distributed control intelligence). The system comprises a standard Remex Data Warehouse *RDW-3200* disk unit providing a fixed formatted 18Mbyte *Winchester* disk with twin double-sided double-density floppy diskettes for off-line back-up, providing 1.2Mbyte each, and the main *Auto-Set II* processor based on *Z8000* and *Z80* processors. Required peripherals are an *MR-1* or *PP-1* mixing desk with level I virtual console, and an external timecode reader or digital feet and frame counter. Optional additions are a CRT data terminal for level II and beyond, a colour CRT graphics generator and various automated peripherals. The main processor is supplied with eight high speed (800kbaud) serial ports for interface to the console, a CRT serial port and a synchroniser interface.

There are currently two command levels, I allowing the operator to generate data, use data, update data, store data on a diskette, and clear the data space, all controlled from a small switch and indicator array located in the mixing desk, while level II allows data to be stored in labelled files, to merge data files, generate windowed record and write commands, enter off-line data from external sources, and assign labels to timecodes, mixing desk channels and data files. Level II requires a data terminal for the greater complexity of inputing.

LEUNIG (West Germany)

R Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76, West Germany.
Phone: 040 229 8883. Telex: 0212095.
UK: Eela Audio Industries Ltd, 13 Molesworth, Hoddesdon, Herts EN11 9PT.
Phone: 09924 68674.
USA: Audicon Inc, 1200 Beechwood Avenue, Nashville, Tenn 37212.
Phone: (615) 256-6900. Telex: 554494.

Computer assisted equalisation system comprising a minimum of five components including central control panel, computer system, eq, power supply and monitor. The computer, eq and power supply are standard 19in rack mounting units of 3U high. The central control panel is 9 × 5⅞ × 3⅛ in with a soft leather cushioned back enabling it to be placed on top the console while being used. It consists of a calculator type keyboard with additional system control switching and a joy stick. The joy stick can be used to 'draw' an equalisation curve on the video monitor while the computer adjusts the internal filters to achieve it. The alternative method is to shape an already existing response. The eq may be heard whilst adjusting the curve.

Entire console equalisation can be stored in one of the 64 console memories which maybe copied from one to the other to assemble them into a chronological order and during the session they can be recalled by one key-stroke or by an external signal such as from a tape linked automation system or pulse on the tape. 32 standard equalisations may be recalled from any channel with a single button allowing comparison between different channel or complete console settings. All equalisers may be 'zeroed' by a single operation. The monitor can display instantly any of the console settings, content of the memory, channel status, channel failure and number of overloads, optional 10-band spectrum analyser display on equaliser channel with display of difference between total equalisation and input signal. All stored information may be transferred to cassette of floppy disk systems for permanent storage. The video monitor may be any model capable of accepting a 75Ω NTSC composite video signal.

The equaliser consists of low and high shelving eq, two mid peaking eq and high and low cut filters. Options include programmable gain, equaliser grouping and provisions for automation of send level and pan control in quad.

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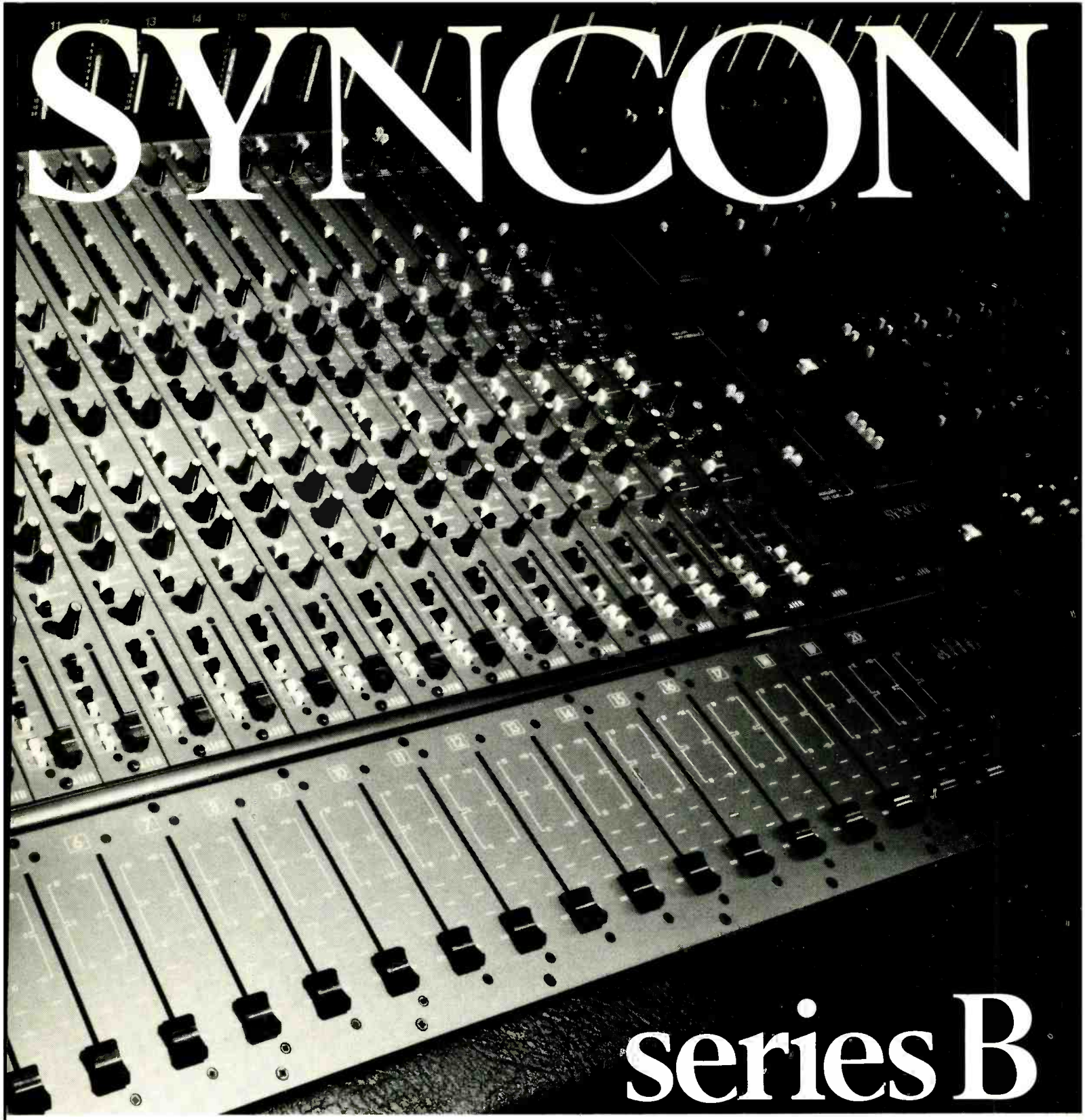

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Output: +24dBm into 600Ω unbalanced (balanced version available as option).

MCI (USA)

MCI Inc, 1400 W Commercial Blvd, Fort Lauderdale, Florida 33309.
Phone: (305) 491-0825. Telex: 514362.
UK: MCI (Professional Studio Equipment) Ltd, MCI House, 54-56 Stanhope Street, London NW1 3EX.
Phone: 01-388 7867. Telex: 261116.

JH-50 console automation
Originally designed for MCI consoles this system is now available for retro fitting in other consoles. Each channel to be automated requires a VCA fader package with the rest of the system comprising a 19in rack cabinet containing the digitiser and microprocessor boards and a power supply. This system will provide automation control for level, mute, subgrouping (eight) and solo-in-place. Information storage is on a track of the multitrack tape machine.

MELKUIST (UK)

Melkuist Ltd, 35a Guildford Street, Luton LU1 2NQ.
Phone: 0582 416028.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.
USA: Harrison Systems Inc, PO Box 22964, Nashville, Tenn 37202.
Phone: (615) 834-1184. Telex: 555133.

GT800
Console automation system designed to operate with mixing consoles capable of producing and accepting up to 64 voltage replicas of control functions. Uses BASF dual drive single density IBM format floppy diskette drives, high speed scanning alogorithm running at twice SMPTE/EBU timecode scan rate, special loose lock timecode reader for good low level synchronisation. The system uses standard EBU timecode recorded on the multitrack. The central processor keeps track of system operation displaying suitable error messages when problems occur, while comprehensive memory management techniques allow most damaged diskettes to be suitably recovered.

Interface to the console is by the digital filter subassembly, which contains all hardware for A/D conversion, data processing, communication, and D/A conversion, with 64 separate input/output ports. Fast digital filtering alogorithms process the derived movement coefficient matrix to create a new matrix of interpolation coefficients for transmission down the serial data link to the CPU. The *GT800* system may be used either with Melkuist digital transfer faders, or with conventional analogue transfer faders, such as *Fadex*. Each fader module has a linear slider fader, subgroup selection, isolate/read/write/update switch, and cut switch, with ready light. In isolate mode, the fader controls normal audio with no assistance, in write all movements are stored, in read the processor controls the audio and the fader is disabled, while in update the fader may generate manual offset, but not affecting the stored information. A null indicator shows when the current fader position and data returning are within a nominal 2dB. Various fader central operations are also provided.
Price: on application.

NEVE (UK)

Neve Electronics International Ltd, Cambridge House, Melbourn, Royston SG8 6QU, Herts.
Phone: 0763 60776. Telex: 81381.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801.
Phone: (203) 744-6230. Telex: 969638.

Necam
Computer controlled automated mixdown system. System comprises console fader package type *1785*, console peripheral unit, control unit, tape machine peripheral unit, and computer rack comprising CAI Alpha *LSI-2/20* computer and dual floppy disk drive with power supply. A SMPTE timecode generator is also required. The peripheral items maybe built into equipment as may the control panel but is normally free standing on the console. The principal feature of the *Necam* system are the servo-controlled faders which actually move following the original action and giving a very easy process with the possibility of manual override in mixing. Full remote and locate facilities are provided for the multitrack tape machine. One track of the tape machine has SMPTE code recorded on it and a special wide band head amp to enable the reading of the code at high winding speeds. Up to 999 points of the tape may be 'labelled' for use in automated runs. The control unit has 16 instruction keys, a numeric keypad and a 32-character alpha-numeric display provides full instruction for the computer. The system incorporates a sophisticated merge capability with the ability to merge certain tracks from different mixes. Version of *Necam* for post-production work known as *Necam 'II'*.

Neve Necam system

QUAD/EIGHT (USA)

Quad/Eight Electronics, 11929 Vose Street, North Hollywood, Cal 91605.
Phone: (213) 764-1516. Telex: 662446.
UK: Audio Kinetics (UK) Ltd, Verulam Road, St Albans, Herts.
Phone: 0727 32191. Telex: 299951.

Compumix III
Automation mixdown system with dual drive floppy disk storage. Capacity for 32 takes on each disk. Requires the use of one tape track for SMPTE timecode. Internal SMPTE generator and reader. Editing between mixes by entering timecodes into editing table on controller. Colour CRT to display VCA attenuation and mutes, operating instructions, automatic disk directory table, disk preset editing, timecode, prompting instructions, error instruction. Designed for use with *Coronado* console.

SOLID STATE LOGIC (UK)

Solid State Logic Ltd, Church Road, Stonesfield, Oxford OX7 2PS.
Phone: 099389 324/444. Telex: 837400.
USA: Washington Music Works, 3421 M Street, Washington DC 20007.
Phone: (202) 342-9010. Telex: 440519.

Total Recall
Automation system as an integral part of the *SL-4000 Series* console. The computer controlling the system can scan the complete console and store the entire console status including input selection, routing, monitor and foldback levels, panning, equalisation, echo sends and dynamics modifications. This information may be recalled instantly and the computer can display on the monitor which controls do not match the stored memory. Uses network of microprocessor controlled data busses which carry low voltage analogue information to each I/O module and enables use of continuously variable controls rather than multiple VCA or stepped controls. Floppy disk storage. Also acts as tape locator.

SOUND WORKSHOP (USA)

Sound Workshop Inc, 1324 Motor Parkway, Hauppauge, NY 11787.
Phone: (516) 582-6210. Telex: 649230.
UK: Trad Electronic Sales Ltd, 149b St Albans Road, Watford, Herts WD2 5BB.
Phone: 0923 47988. Telex: 262741.

Auto-Recall Mixdown System-ARMS
Although principally intended for use with Sound Workshop consoles it is also available for adaptation to most other mixing consoles. Consists of processor board and one to four digitiser boards (one for each 16 channels) which mount inside a Sound Workshop console, and a VCA package. Stores fader levels and mutes separately and also offers in-place solo and group muting. Information recorded on track of multitrack recorder. MCI *JH-50* compatible. ■

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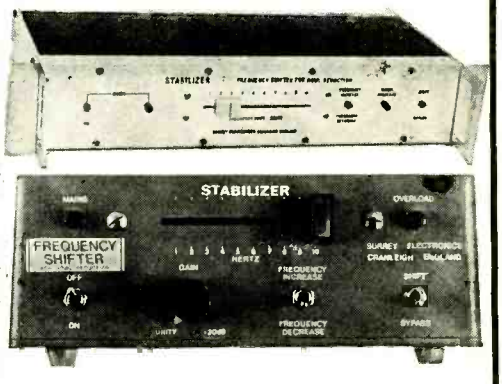

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Germany	**Audiolive** Kyffhauserstrasse 10A 5 Koln 1 Tel : Koln 230910
Holland	**Pieter Bollen Geluidstechnik** Hastelweg 6, Eindhoven Tel : Eindhoven 512 777
Sweden	**Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel : Gothenburg 130 216
Norway	**Siv Ing Benum AS** Skovvn 22, Oslo 2 Tel : Oslo 565 753

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Calculating axial room modes

Barry Hufker

The calculation of axial room modes is a useful pointer in studio design to standing-wave problems likely to be encountered in a studio's acoustics. Barry Hufker, of KWMU (University of Missouri), describes a program for the Ohio Scientific *C1P* computer which takes the tedium from such calculations.

ACCORDING to F Alton Everest's book, *Acoustic Techniques for Home and Studio,* axial room modes are one of three types of standing wave systems which colour sound heard in listening rooms and studios. Related to the room's dimensions (length, width and height), the three axial modes found in each room are caused by standing waves existing between parallel surfaces; north and south walls for example. Tangential and oblique standing waves can largely be ignored, though should not be forgotten, as axial waves are the prime source of sound colouration with problem modes confined to below about 300Hz.

In order to determine axial modes, one must first compute the fundamental frequency of each room dimension and its harmonics. These must then be numerically ordered and analysed, observing each frequency's relationship with adjacent ones. Troublesome modes are those frequencies separated from adjacent ones by 20Hz or more, as they are thus acoustically isolated; or those found to be repeated when calculating the frequencies of each room dimension. These repeated frequencies have no separation from each other and are disproportionally reinforced due to their re-occurence.

Calculating these modes is normally a tedious process but takes no more than a couple of minutes using the computer program presented here. A complete discussion of standing waves is beyond the scope of this article so the reader is referred to Everest's book upon which this computer program is based. Written on an Ohio Scientific *CIP* (*6502* microprocessor), the program fits comfortably in 4K of memory and should be easily converted to other forms of BASIC. The formulae used are for rectangular rooms, so to calculate axial modes for rooms with canted walls the user should first create an 'equivalent rectangular room' by drawing on paper the room as it exists and then drawing lines through the midpoints of each canted wall. Having done this, a rectangle is formed whose dimensions can be used to feed the program.

Receiving the room's dimensions from the user, the program first calculates and displays the ratio of these numbers, as some ratios have fewer problem modes than others. This ratio can be checked against the table of optimum room ratios located on page 68, in the paperback edition, of Everest's book to see if it is a favourable one. Continuing, the fundamental frequency of each room is determined by the formula, 'the speed of sound (1130ft/s) divided by twice the room dimension'. The harmonics of these frequencies are computed up to a minimum of 300Hz and then are automatically stored with the original ones. These numbers are then sorted and placed in numerical order. The final display contains two columns: the left column consists of the frequencies themselves while the right shows the difference, in Hz, between them.

To aid understanding, the following is a line-by-line explanation of the program: Lines 25 and 30 are largely self explanatory. They ask the user to type in the individual room dimensions, in feet, from smallest to largest. Be sure to separate each with a comma. The numbers supplied by the user gives values to variables X, Y and Z listed on line 35. Line 40 calculates and prints the ratio of the entered numbers while 45 through 55 urge the user to check the ratio against Everest's book. Stopping at line 60, the program waits until the user is ready to continue. Type CONT to go on. Line 65 computes the fundamental frequency of each room dimension and prints them on lines 70 to 95 from variables A, B and C. Halting once again, this time at line 100, the program waits so the user can analyse these frequencies if needed. Type CONT to continue the program.

DIMensioning an array variable, D, allows it to store a selected number of values, in this case 51. These values will be figured later in the program. The REMark reminds the user to dimension D with a larger number if one of the fundamental frequencies is below 20Hz. This enables D to hold more numbers and ensures that each room dimension will be calculated up to 300Hz.

Found on line 110, P is simply a counting variable that will step D through each of its 51 memory locations. Each time D receives a value P will increase by one. The values for D are derived from variables Q, R and S which are initially equal to A, B and C respectively. A, B and C contain the frequencies computed on line 65. With each pass of the computer through the program, Q, R and S will come to equal a new harmonic of A, B and C. The actual value determination of Q, R and S is done on line 115. These numbers are printed on line 120 as a visual indication that the program is working and are then fed into D's memory on lines 125 through 135.

If D's memory is not yet filled, the computer is instructed at line 145 to return to 115 to calculate more numbers for Q, R and S. Having filled D, "CALCULATION COMPLETE" is printed, the computer is told to skip line 145 and continue on 150. REM reminds the user to increase P's value if D was previously increased.

After printing "SORTING BEGUN. STAND BY," the program starts sorting (lines 155 to 215) the numbers stored in D in a manner which allows numbers of lesser value to 'bubble' to the top of the list until they are numerically ordered, hence the term "bubble sort." Printing again at line 220, the computer reminds the user about the nature of axial modes. Lines 225 to 310 print the stored frequencies down the screen's left side and the difference between adjacent frequencies down the right (lines 235 and 240). The GOSUB occurring at 245 sends the computer to the timing subroutine occupying lines 300 to 310. This subroutine controls the rate at which the computer displays its information and makes reading convenient. The display's speed can be increased or decreased by employing a number less than, or greater than, 250 in line 300. Jumping back to line 250 on the RETURN command in 310, the computer continues to print until all the stored numbers have been shown. At this point "PROGRAM COMPLETE" is printed with the program actually ending on line 265.

When printing, the computer will display all the numbers in memory even if they are greater than 300Hz. Since problem modes occur approximately below this frequency, higher numbers can be ignored. Also, while line 300 controls the speed at which the computer prints, <Control C> can be used to freeze the display. To continue, type CONT.

Once entered, the program provides a quick means of determining axial modes for any listening room or studio. ■

Studio Sound **welcomes computer programs which help to make audio and acoustic calculations less prone to error and time wasting. If you have a program which you feel may be useful to readers, please ensure that, if possible, the listing is submitted on plain white paper from a good quality daisy-wheel or matrix printer with a black ribbon—we want to be able to reproduce it without risking re-keying errors. Microsoft BASIC is the commonest high-level language and dialect, but we will consider programs in PASCAL or FORTRAN (although we can't test the latter right now). Assembly language programs would be a little too machine-specific to be generally useful to readers. Please also include in your article a full program description (as, for example, in the article above) and any notes on specific features your BASIC may have which are unusual and will need to be altered by other users.**

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The Program

```
 10  PRINT "CALCULATING AXIAL ROOM MODES"
 15  PRINT "BY BARRY HUFKER, 1981"
 20  PRINT:PRINT:PRINT
 25  PRINT "ENTER ROOM DIMENSIONS,IN FEET, FROM SMALLEST TO LARGEST"
 30  PRINT "SEPARATE EACH WITH A COMMA"
 35  INPUT X,Y,Z
 40  PRINT "THE RATIO OF THE ROOM IS 1X" Y/X"X" Z/X
 45  PRINT "CHECK PAGE 68 OF F. ALTON EVEREST'S BOOK"
 50  PRINT "'ACOUSTIC TECHNIQUES FOR HOME AND STUDIO'"
 55  PRINT "TO SEE IF THIS IS A FAVORABLE RATIO."
 60  PRINT "TYPE 'CONT' TO CONTINUE.":STOP
 65  A=INT(1130/(2*X)):B=INT(1130/(2*Y)):C=INT(1130/(2*Z))
 70  PRINT "THE FUNDAMENTAL FREQUENCY OF THE FIRST DIMENSION IS"A"HZ."
 75  PRINT:PRINT
 80  PRINT "THE FUNDAMENTAL FREQUENCY OF THE SECOND DIMENSION IS"B"HZ."
 85  PRINT:PRINT
 90  PRINT "THE FUNDAMENTAL FREQUENCY OF THE THIRD DIMENSION IS"C"HZ."
 95  PRINT:PRINT
100  PRINT "TYPE 'CONT' TO BEGIN CALCULATING ROOM MODES":STOP
105  DIM D(51):REM MAKE LARGER IF LESS THAN 20HZ
110  P=1
115  Q=Q+A:R=R+B:S=S+C
120  PRINT Q:PRINT R:PRINT S
125  D(P)=Q:P=P+1
130  D(P)=R:P=P+1
135  D(P)=S:P=P+1
140  IF P=52 THEN PRINT "CALCULATION COMPLETE.":GOTO 150:REM LINE 105
145  GOTO 115
150  PRINT "SORTING BEGUN. STAND BY."
155  REM BUBBLE SORT ROUTINE
160  FOR P=1 TO 51
165  F=Ø
170  FOR G=1 TO51-P
175  IF D(G+1)>=D(G) THEN 200
180  T=D(G)
185  D(G)=D(G+1)
190  D(G+1)=T
195  F=1
200  NEXT G
205  IF F=Ø THEN 215
210  NEXT P
215  PRINT
220  PRINT "AXIAL ROOM MODES ARE > 20HZ OR = TO Ø"
225  FOR P=1 TO 50
230  PRINT D(P)
235  K=D(P+1)-D(P)
240  PRINT TAB(10);K
245  GOSUB 300
250  PRINT
255  NEXT P
260  PRINT "PROGRAM COMPLETE."
265  END
300  FOR J=1 TO 250
305  NEXT J
310  RETURN
```


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business

BARRY FOX

Ripper tape tests

Earlier this year the British police arrested Peter Sutcliffe and, with astonishing lack of legal tact, made it abundantly plain that they thought he was the Yorkshire Ripper. The mass media, throwing legal caution for contempt of court to the winds, followed suit and publicised the police joy. Then came the inevitable recriminations, and reminders that in Britain even suspected 'Rippers' are innocent until found guilty in court. I had a story for this column written and ready to print before his arrest, but had to tear it up. Subsequently of course Sutcliffe was found guilty of murder when in a victory for common sense the jury threw out the psychiatric evidence that suggested he was mad. Since then the media have picked over the Ripper case and will doubtless continue to pick it over for months and years to come. But curiously, none of them have picked up the story which I tore up.

So here it is, albeit a few months late.

Shortly before June 18, 1979, a taunting cassette tape was posted to the West Yorkshire police by a man with a Geordie accent claiming to be "Jack". This followed three letters, apparently from the same source. The police took the letters and tape seriously. So seriously in fact that they spent the next 18 months ensuring that as many people as possible heard the tape recording. For a year or more anyone dialling a Leeds telephone number was able to hear a 2min excerpt from the tape. It was played on radio and television and over loudspeakers especially in those parts of the country from where the Geordie voice was thought to originate. At the height of the 'catch-the-Ripper' campaign the tape was being played from six centres over the phone to 32,000 callers a week. Curiously the police only forwent one opportunity for free publicity. In July 1979 Jonathan King's British record company, UK Records, pressed a pop single of the Ripper tape and planned to issue it through British record shops. But the single was never released. I tried phoning Jonathan King but was rewarded only by a recording of his rather hysterical voice asking me to leave a message on an answering machine. I did, several times, but never heard back. And the single never reached the shops, or charts. An uncharitable suggestion was that J King Esq received some subtle advice from Britain's boys in blue to the effect that if UK Records went ahead with the release, they would find themselves in the Old Bailey charged with hampering police enquiries, copyright infringement, dumb insolence, and you name it we'll charge you with it.

Despite growing concern, for instance by linguistic experts at Leeds University, that the tape and letters were a hoax, the Yorkshire police clung to their belief that recognition of the Geordie voice would lead them to the Ripper. At least 12 million people heard the tape over the telephone and many more millions heard it in other ways. But no one came forward to identify the voice. Even during Sutcliffe's trial and subsequently, no one has yet identified it.

At the trial, it became clear that Sutcliffe had escaped detection largely because those who suspected him of being the Ripper were reassured by the fact that the voice on tape did not match Sutcliffe's voice. This has prompted *The Sunday People* newspaper to offer a £10,000 reward for anyone who can help track down the Geordie voice that led the police on an expensive and cruel wild goose chase and, almost certainly, ensured that several women died unnecessarily because the Ripper remained free.

All manner of theories have been put forward. One theory has Sutcliffe working with a Geordie accomplice; another has the Geordie taper responsible for one killing and trying to confuse the issue by claiming others. But none of this alters the all-important question which no one seems to have asked, let alone answered. Irrespective of who the Geordie is, how can it be that no one has recognised his voice?

The human ear-brain combination is remarkably adept at recognising voices, even over the telephone. Although it's possible that the Geordie's relatives are protecting him by remaining silent, or are dead, or deaf, how can it be that no shopkeeper, publican or unemployment officer has recognised that much-publicised voice?

There is good reason to believe that the tape was made on a portable cassette recorder made by Sanyo. This was revealed by the British magazine *HiFi For Pleasure* at the height of the Ripper campaign. The magazine reported that the taunting recording had been made on a Sanyo C30 cassette of a type only available as a give-away with two Sanyo products, a music-centre and a cassette machine. Several machines were involved and a check was made on the distribution pattern of those machines. The police did not take kindly to the *HiFi For Pleasure* disclosure but it did point towards the tape being made on a budget or portable machine. If this had been used with fading batteries, or even the capstan drive deliberately filed down or built up, then the voice heard when the tape was replayed on a normal recorder would be disguised by mis-pitching. The tape played to the public has always been at the same pitch, and if it was the wrong pitch, then the widespread false impression created could help explain why no one recognised the voice. Interestingly the tape appears to vary in pitch between sections, anyway.

This isn't pure fantasy. An exactly similar situation occurred with the tape recording which featured in the Black Panther murder of early 1975. Lesley Whittle was kidnapped and a tape received. Audio tape specialist Angus McKenzie was called in by the media and identified the tape as made on a recorder with partially flat batteries. As a result he advised that it be broadcast by the BBC and IBA at correspondingly modified speed. McKenzie was not called in by the police, or even allowed to help on the Ripper case. In fact it was only through perseverance and the initiative of a local newspaper that he was able to obtain a very poor quality copy. This had been so degraded by noise and multiple copying that it was useless for the tests he had planned; for instance analysis of mains hum breakthrough to establish the original recording speed. After an appearance on a TV news magazine programme another copy was provided by the IBA. This was of better audio quality but had been severely edited to close the spaces between words. So McKenzie, who is blind with very acute hearing, was unable to listen for telltale signs of origin, like room reverberation. In the Panther case he had correctly diagnosed that the tape had been made in a cavernous location. Lesley Whittle's body was found in a 60 foot shaft. Donald Neilsen, the Black Panther, was arrested in December 1975 and charged with kidnapping and murder.

When I phoned the Yorkshire police before Peter Sutcliffe was caught, they would only confirm their refusal to release the original tape for tests and their refusal to discuss the tests carried out. A police spokesman vaguely claimed to have the original in safe keeping. Fears were at that time growing that the original cassette might have been damaged or destroyed in forensic tests, for instance analysis for finger prints or material traces. Audio engineers feared that the police might have been working on the sadly mistaken belief that a first generation copy would yield as much audio and acoustic evidence as the original cassette.

The question of whether the original tape was still intact was raised in print in *New Scientist* of December 4, 1980. Within half an hour of publication my home telephone line started clicking in exactly the same way that it had clicked when I wrote a piece a few years earlier on letter bomb detection. It's nice to know that someone, somewhere has time to spend on hearing what my children have to say to their friends.

Shortly afterwards and by pure coincidence, a technical seminar organised by BASF confirmed the value of preserving original tapes intact. In a German murder case the victim was strangled by a length of magnetic recording tape. The police then found an incomplete roll of tape at the home of the suspect. BASF, manufacturer of the tape, was called in to analyse the two samples. The company's chemists were able to state categorically that the murder weapon had come from the same production roll as that owned by the suspect.

Just before re-writing this article I phoned the Yorkshire police again. They still flatly refused to discuss what tests have been carried out on the tape. So for all we know, they never did check for residual mains hum or other fixed frequency references, to establish the correct pitch before embarking on their mammoth campaign. The good news is that an official enquiry will probably be held into police handling of the Ripper investigation, for instance the absurdly inadequate use of computers for cross-correlating the mass of evidence collected from statements. The bad news is that the enquiry will almost certainly be conducted by other policemen, who probably won't know enough about tape technology to ask the right questions.

Boxing sound

In a previous column item I suggested that it was about time that the TV crews covering boxing matches used directional mics to pick up the live sound in the ring with more dramatic effect, if necessary riding the faders of a mixing board to track the action round the ring while minimising stray noise. A cry of impossible went up but it is interesting to note that on recent fight transmissions from the US there has been the equivalent of close-miking. This is starting to make the whole thing sound more like a Hollywood fight film with post-dubbed sound effects. This can't be bad because it helps bring home the reality that when men-mountains slug each other for prize money it is no fun whatsoever and a very dangerous game. Boxing isn't a Tom and Jerry cartoon, or TV crime show, where violence doesn't hurt. ■

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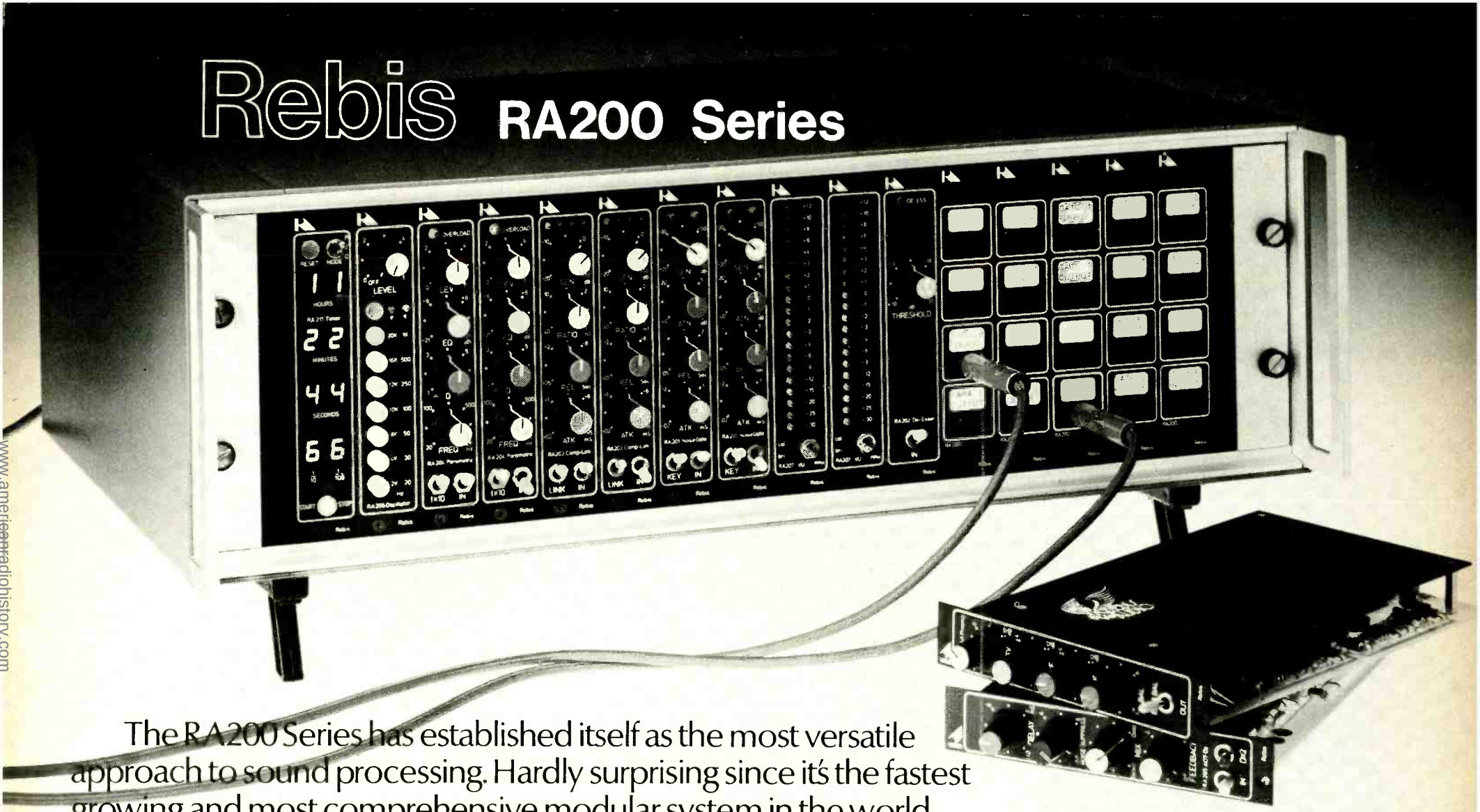
Rebis RA200 Series



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NAB 59th Convention and International Exhibition, Las Vegas - a report

Angus Robertson

The National Association of Broadcasters' annual convention and technical exhibition was held in the Las Vegas Convention Centre from April 12 to 15.

WHILE predominantly a television show, if one looks at the impact that the exhibition stands make, nevertheless there were a large number of audio companies (both broadcast and pro-audio) exhibiting at NAB this year. One important new exhibitor was *Studio Sound,* attending the show for the first time, and we were one of a very select few British companies—Advanced Music Systems, Audio & Design Recording, Audio Kinetics, Neve, Keith Monks, Neal-Ferrograph, Autocue, EEV, Marconi, W Vinten, Quantel, Rank Strand and Tweed—and a handful of video companies, but we were somewhat dwarfed by the hundreds of North American companies. Unlike the pro-audio business where Britain has a respectable share of the American market, our impact on broadcasting is very small, but growing. Meanwhile, there was no lack of new products on show at NAB.

Broadcast consoles

Mixing consoles for use in broadcasting are rather different to those used in recording studios, and a group of manufacturers has grown up to meet this specialist market, a particularly nationalistic market due to the 'specialist requirements' of broadcasters in different countries. Each country has its own idea for broadcast console specifications, and being mostly government run (in one way or another) they tend to support local manufacturers and often their consoles are so specialist that little export potential for them exists. For instance, many US radio broadcasters still favour rotary faders (which you can actually get your hands around) rather than the sliders used by almost everyone else. While many companies manufacture primarily for broadcasting, some of the well known names are just as involved.

ADM Technology Inc manufacture a range of broadcast consoles including the *2400 series* production console which provides 24 input channels, four submasters and two masters with comprehensive monitoring facilities, the *1600 series* production console is rather more compact offering only 16 input channels but still with four submasters and two masters. The *ST series* of stereo broadcast consoles have rather more limited channel facilities and are designed for on-air use with metering for 'audition' and programme, and also mono, and are available in 10-, 16-or 20-input configurations with up to three stereo and one mono outputs. In addition to consoles, ADM also offer a range of touch tone accessed audio routing switchers available in various sizes up to 150 × 200.

Arrakis Systems, from Missouri, exhibited compact broadcast radio consoles. The *500R series* is available in either 8 or 12 channels, mono or stereo and features dc control of all level and switching functions with the electronics package remote mounted. Half the channels have two inputs, the remainder four. The *1000R* is eight channel, but with functional simplicity for ease of operation.

Audioarts Engineering introduced two new mixing consoles, the *8000 series* which features eight groups, four send busses, 3-band eq, stereo master, assignable returns, and is available in 32/8/2, 24/8/2, and 16/8/2 configurations in addition to a stage monitor version providing eight separate stage monitor mixes with 32-, 24- or 16-input channels. A modest budget four buss system, the *44 series* console offers similar configurations to the *8000 series,* but is minus the VU meters and has reduced group features.

Auditronics Inc *200 series* mixing console is designed for on-air applications, and is available in 6-, 12- and 18-input position versions using VCA technology controlled by P&G slider faders, and includes an equalised headphone module, two-way communication, adjustable line input padding, +30dBm output capability, optional personality equaliser module, telephone interface module, noise gate/compressor, stereo line input selector, digital clock and timer, and analogue peak meters. Prices range from $3,900 to $6,800 for the basic mainframes.

Autogram Corp, Plano, Texas, also manufacture on-air mixing consoles, in 8- or 10-input versions, mono or stereo, all with rotary faders, VU meters, cue outputs, switchable inputs and monitor L/S output.

Cetec Broadcast Group introduced its new *Cetec 8000* audio console which features eight channels (24 inputs) as standard and is expandable up to 16 channels. Successor to the *Centurion series,* the new console has five lighted panel meters and two peak LED enunciators to provide the announcer with any of five alarms or messages. Standard features include P&G faders, liquid crystal display clock/timer, built-in intercom, 4W cue amplifier and ready/play cart machine indicator. Cetec also showed the *2000 series* compact consoles which have five and eight channels.

Howe Audio Productions Inc, of Boulder, manufacture a range of stereo consoles, all with eight or 12 channels, with twin or four VU meters, stereo cue meters, rotary faders with dc control, and various options including stereo phono preamp, stereo mic preamp, FET 30W power amp, telephone coupler with built-in limiter, and *Mini-600* 6-channel mic mixer. Prices start at $3,955.

Although **MCI** made its name in the recording market, broadcasting is becoming an increasingly important aspect of the business. With this in mind, a new version of the established *600 series* console was shown, the *JH-636M* mobile recording console designed for outside broadcast or mobile recording vehicles. The console is designed to mount securely to the bed of a van or truck, and all input/outputs and maintenance access is from the front, the 36-channel console being only 36in deep and 62in wide. Features include 24 output busses with VU metering, in-line monitoring, capability for simultaneous multitrack recording and stereo output mix with no interaction (for live broadcasting), six effects/foldback sends, VCA grouping, four dedicated

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From Allison Research—Makers of the recording industry's most widely used Automation Programmer—The fader that brings Level Automation, VCA Sub-Grouping and other facilities to any professional recording console.

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Not only do you get 65K Automation, FADEX gives you a 9 buss grouping system, group and channel mute and solos, grand master and other good stuff.

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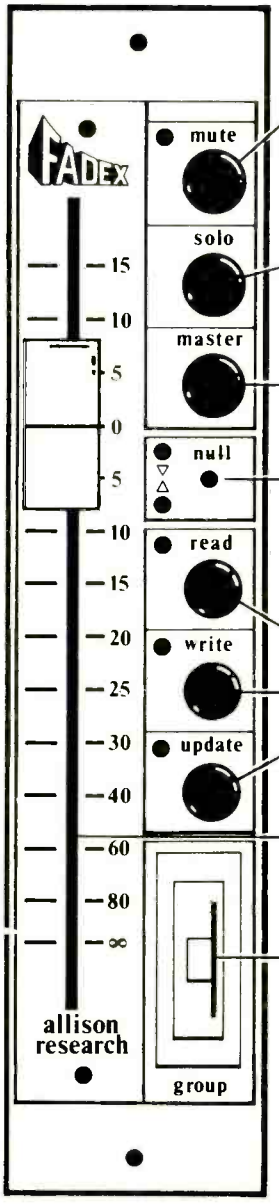

Programme channel and group mutes. Automatic mute detection system illuminates LED and provide logic to signal external mute relay when programmed attenuation exceeds 100db, regardless of attenuation source.

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NAB report

group master faders and eight aux communication input/outputs capable of tying into an external intercom system. For those larger events, an input module with dual mic preamps summing into a single fader output is optionally available, providing a maximum of 72 inputs.

Ramko Research showed the *DC-12* remote console that features remote rack mounted electronics, and includes one to 12 channels, LED VU meters, mono output on stereo consoles, built-in talkback, gain selectable inputs, and optional remote start/stop for cart machines, tape recorder and turntables.

Sphere Electronics Inc manufactures the *1604 Satellite Mixer* with 16 inputs and four outputs taking 7in of rack space, allowing existing consoles to accept temporary overloads for large productions, each channel having slider fader, phantom powering, mic or line select, attenuation pads, and four buss output select.

United Recording Electronics Industries (UREI) offers the *MOD ONE* range of on-air consoles for AM and FM radio, in mono and stereo, available with various input modules. Up to 10 input modules are accepted, providing up to 30 inputs, with silent action switches for all on-air functions, linear faders, headphone amp and VU meters. Plug-in amps include stereo and mono line, monitor, headset and cue booster.

Ward-Beck Systems Ltd manufacture a wide range of broadcast consoles including the *Standard R1200* radio console, the *T1202* compact transportable TV console with 12 inputs and two masters with applications in video editing, post production and mobiles, the *L3242* standard TV production and on-air console with 32 inputs, two submasters, and two masters (also available with 20 inputs), and finally custom consoles for specific broadcast requirements.

Ancillaries and effects

Advanced Music Systems again expanded its range of digital audio processing equipment with the Digital Loop Editing System option for the established *DMX15-80* series of programmable digital delay systems, which allows sound loops to be run continuously, with varispeed and editing. The latest in the series of digital systems is the *DMX15R* digital reverb system, which interfaces to any of the *DMX80* processors, offering selection of one of up to nine programs providing a reverberant field, with fundamental parameters being alterable, such as pre-delay, decay times and high and low frequency decay profiles.

Aphex Systems Ltd introduced the new *Aphex II Broadcast Aural Exciter,* a development of the original Aphex unit. The broadcast version has all its controls as presets behind a panel, while the studio version (introduced four weeks later at Los Angeles AES) has the same controls on the front panel. The unit 'resurrects' the overtones present in acoustic sounds such as voices, strings, guitars, pianos and percussion instruments, by creating a signal composed of frequency dependent phase shift, amplitude dependent harmonics which is mixed with the original signal. Price in mono is $2,350, and stereo $2,950.

In video studios, digital processing equipment is becoming very common for television, be it for video effects or merely synchronising applications, and each time video passes through one of these digital units it becomes slightly delayed. The effect becomes cumulative and can cause loss of lip-sync even on live broadcasts (a similar problem to sea routed audio circuit across the Atlantic, followed a second later by the pictures via Intelsat). Audio digital delay manufacturers are finding a new market for their products, providing compensating delays for the audio in these applications (and 'recession' is an unknown word to broadcast engineers). While most audio delays would have to be adjusted manually to provide the correct compensating delay, the *Model ADC-100* audio delay compensator from **Automedia Inc** (North Granby, Connecticut) provides automatic delay setting by looping the 'before' and 'after' video through the unit. A digital system using 78.67kHz sampling locked to video reference, it provides a claimed 15.5 bits effective dynamic range resolution with 90dB S/N and 15Hz to 20kHz ±0.5dB response, the delay range may be set up to six NTSC TV frames (or 200ms). The *ADC-100* may also be slaved to another unit.

Eventide introduced its latest product, the

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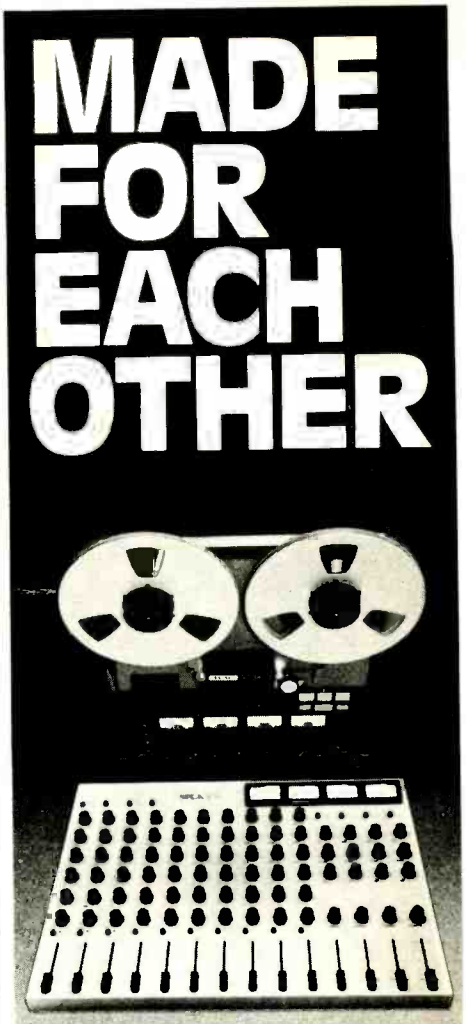
MCI JH-636M



The **Seck** 104 is designed specifically to work with budget multitrack recorders.

The mixer has prewired mixdown facility, a four way stereo monitor mix that is switchable between line and tape, and a comprehensive musicians cue mix system. All levels are −10 and 0dBm compatible.

A six channel stereo version **Seck** 62 is also available. This is based on the original Prokit design and features new panel graphics, meter pod and upgraded IC's.

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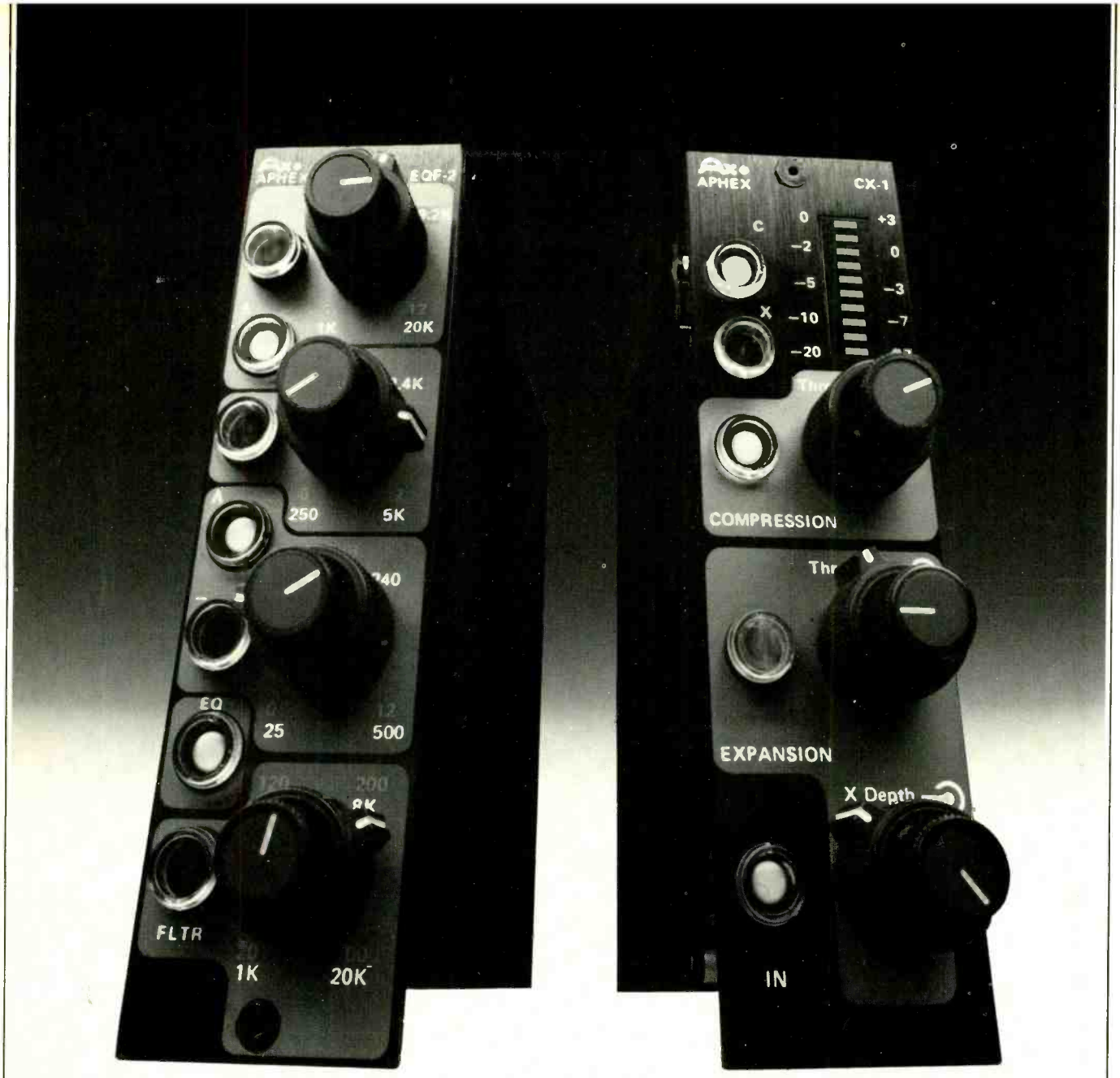

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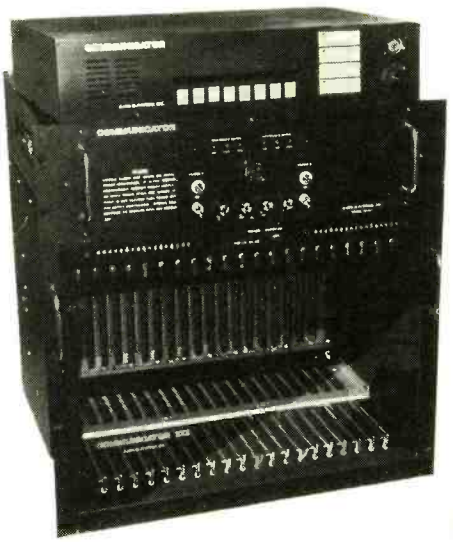
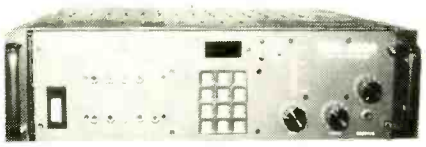


Necomm

Timesqueeze system, which allows the running time of recorded audio tape, video tape and film material to be changed to fit a given time slot. Having overtaken the PET computers used for its spectrum analyser, Eventide is now using a Hewlett-Packard *HP-85* desk top computer, which controls a *H949 Harmonizer* (with de-glitch circuitry) and a *PTC945* precision tape controller which looks after interfacing to the tape recorder. The computer provides all operational controls, using menu driven software, and keeps the operator informed of all operating parameters via a built-in CRT. Interface can be voltage, frequency or tachometer feedback for motor control, and the operating characteristics of different machines may be stored. Price including *Harmonizer* is $8,500.

TDM-8000



Another *Audio Time Compressor*, the *TDM-8000*, was shown by **Integrated Sound Systems Inc** of Long Island City. Using analogue storage, the system provides compression from 1x to 1.5x max, with a 20Hz to 20kHz unspecified bandwidth, and 3% distortion at maximum speed. It may be interfaced to track variable speed playback devices through an external potentiometer, external motor speed circuit command or motor tachometer. Price is $8,000.

Lexicon exhibited the established *Model 1200* audio time compressor/expander which handles changes from 0.5x to 2x original (0.9x to 1.25x recommended for broadcast applications), with 72dB dynamic range and bandwidth from 40Hz to 10kHz +1/—2dB at all tape playback speeds.

Ursa Major demonstrated the new *8 × 32* digital reverb system that includes 32 non-volatile registers for different reverb set-ups, and is available self-contained or remote controlled. All parameters are displayed on LEDs, and pre-set programs may be easily modified by the front panel controls, and range from a small fast diffusing plate to unnaturally large echoing space, variable early reflections, initial delay time and level, decay times and trimmable lf and hf decay. Price is around $6,000.

Intercoms

Since intercoms and talkback are separately surveyed in this issue, including those products shown at NAB, this section is rather brief.

Clear-Com expanded its wide range of products with a new line termed *System II*, which offers increased station capability, higher output levels, and very stable sidetone, several products are now available with 4-channel capability.

Neve introduced an intelligent intercom and audio routing system called *Necomm*. Designed by Kappa Systems Inc, the system is micro-processor controlled using distributed processors and software control, and may be configured up to 256 × 256 for large systems, using a novel tree routing structure.

ROH Corporation, in Atlanta, manufacture the *Series 300* intercommunications system offering 50-channel capability divided into combinations of intercom, conference, talent IFB, 2-way radio or telephone channels, with rack mounting or portable units.

RTS Systems introduced a number of new items, including the *Model 910* switchboard master intercom station handling six separate channels with common party line 'chatter' channel, *Series 1000* matrix system for 10 station intercommunication providing point-to-point operation between all stations, and finally the *SAP-1026* source assign panel taking six intercom inputs and three programme inputs, and selectively switching two to each of six camera lines and 20 external lines.

Ward-Beck Systems Ltd introduced a new intercom system called *microCOM* (not actually living up to its name, since it comprises several 19in racks!), which can be expanded up to 192 × 192 using standard 24 × 24 modular crosspoint matrices, all operating with single pair cable to each remote 'turret'.

Computer systems

While computers in broadcasting used simply to look after financial affairs, the past couple of years has seen a considerable expansion of small

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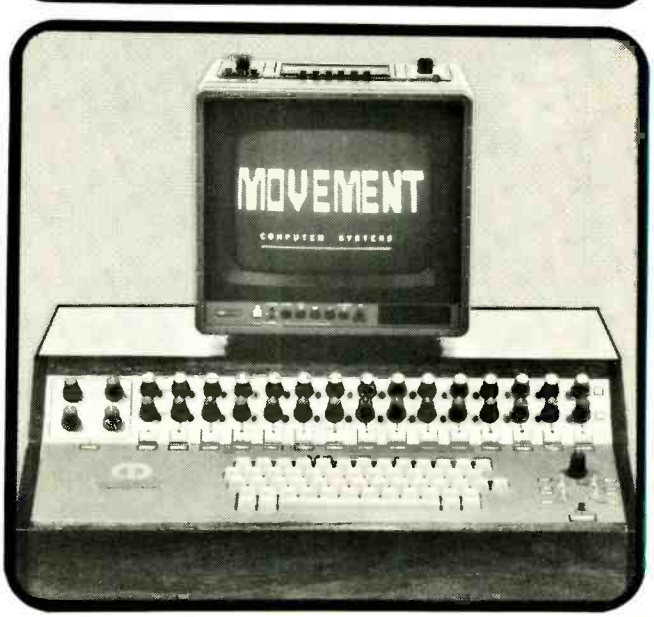

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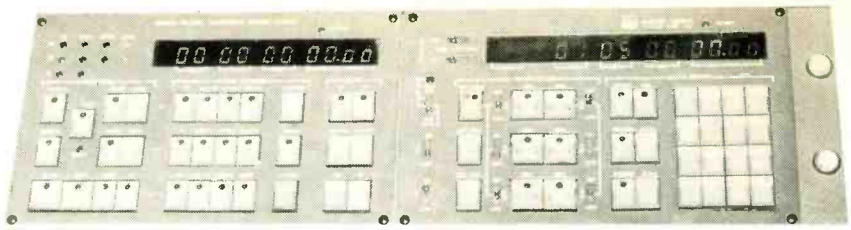


TS-1605 Television Sound Editor

computers into other areas of rather greater interest to engineers and journalists, and particularly owners of smaller stations. The three principal new applications are newsrooms, libraries, and commercial traffic control and accounting, the latter often being linked to an automation system. Many companies are involved in this rapidly expanding business, and again it is only possible to briefly mention the area of activity of each company.

The *Ritme-Cx Library System* from **Federico Savina** in Rome, uses a computer controlled 16-track multitrack tape recorder to provide a storage capacity of 41 hours with each separate musical item separately catalogued on a computer. This provides random access to specified items, and keeps other text about each item including title, author, publisher and timing, access time to any item being not more than 30s.

BMIS, from **Computer Management Systems Inc** is a broadcast management information system designed for commercial sales. The *Chase Media* broadcasting station system from **Cado Systems Corp** provides trafficing, accounting and music format control. The *MAPS* radio business system from **Cetec Corp** provides custom designed accounting for broadcasting, management information, programming and sales tools. **Columbine Systems Inc** offer a complete broadcast information system (used by LBC and Metro in the UK) using IBM *System 32* and *34* computers. **Computer Concepts Corp** offer traffic and accounting systems using Wang equipment, and providing full log facilities. **Custom Business Systems Inc** also use Wang computers, for radio traffic, radio accounts and general ledger accounting. **Cumberland Broadcasting Co** market the IBM *5120* radio broadcast system providing order entry, scheduling and accounting. **Data Communications Corp** market *Buy-Line* which provides research capabilities with market planning and contract production, etc. **Generic Computer Systems** provide a low cost traffic and billing computer. **Groton Computer** provide logging, billing, affidavits, sales projections, etc, using an Apple computer. **Jefferson Data Systems** provide newsroom computer systems and sales, traffic and accounting computer systems. **Northeast Automation Systems** market a broadcast automation system for traffic and sales. **Nidus Broadcast Systems** provide a complete service using mini computers for scheduling, availabilities, billings, management analysis, etc. **Patrick Computer Systems Inc** market the *Leprechaun* computer system with word processing, inventory control, time billing and general ledger. **McInnis-Skinner & Associates** market a wide range of automated newsroom computer systems using Hewlett-Packard computers with television weather display capabilities and including an election coverage package. **Station Business Systems** provide the *BAT* system which handles log preparation, billing, playlist preparation, research capabilities, and traffic. The *Newscom* newsroom computer system is also available.

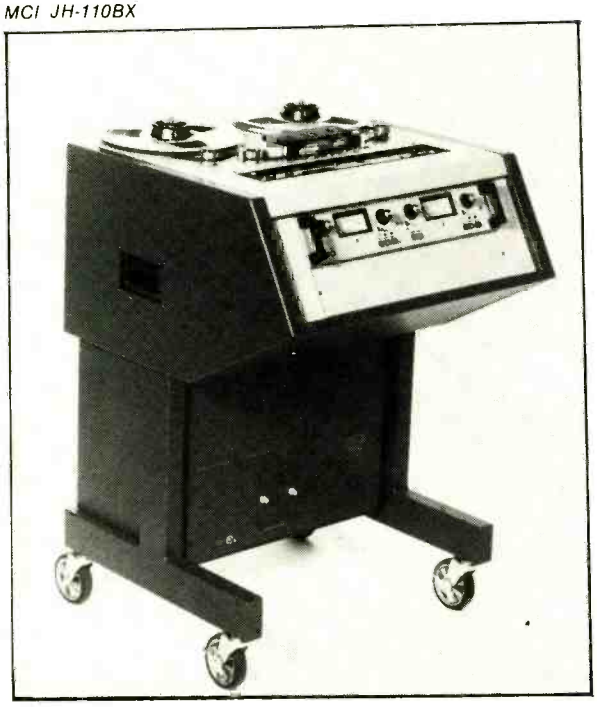
Synchronisers

Adams-Smith Inc introduced the *TS-1605 Television Sound Editor* which slaves one or two audio transports to a single video tape recorder, and with telecine sound follower equipment such as magnetic film recorders. Six separate control outputs can be used for record start or aux start functions, under memory control with 100 registers.

Audio Kinetics were demonstrating the *Q-Lock* synchroniser system which is now available with interface to the 3M *Digital Mastering System,* and has also been repackaged as the *Q-Lock 'S' series* allowing hardware and software for specific applications to be purchased separately allowing optimum pricing. Starting with a 'chase' only synchroniser, the system may be expanded with up to four slaves with full pre-programmed control, and high speed timecode readers (0.1 to 70x play) for machines unable to provide tacho pulses. *(See also the AES report in this issue—Ed.)*

The BTX Corp introduced the *Shadow* synchroniser which uses either timecode or tacho pulses to lock two machines together, to within 1/100th frame in play modes, and 10 frames max in wind modes, 'chase lock'. A standardised *RS-232C* interface is provided allowing further computer control, and it comes with a control console but requires an external timecode generator.

MCI JH-110BX



Recording

Audionics of Oregon provides replacement record and playback electronics for ITC cartridge machines. They are exact physical and electronic replacements for the *SP, WP, 3D, RA* and *WRA* models and are claimed to offer improved performance over the originals.

International Tapetronics Corp introduced the new *770 series* open reel tape machine, designed for continuous 24-hour operation with minimum maintenance, including disc brakes, cast stainless steel turntables, dc servo capstan motor, and heavy duty pushbutton switches.

MCI showed the new *JH-110BX* series of tape recorders, available in mono or stereo, 7½ or 15in/s, servo controlled, transformerless, *RTZIII* tape timer/locator with four programmable memories and tape velocity indicator. Also seen was the new *JH-110C-8* 8-track recorder with similar facilities.

The Rest

Pacific Recorders & Engineering Corp (now distributed by Leevers-Rich in the UK) was showing a wide range of studio cabinetry designed specifically for radio broadcasting.

Bald Mountain Lab in Troy, NY state, offers the *781F* decibel meter providing digital readout auto ranging for levels between —90dBm to +40dBm, while the *1760* audio step generator provides frequency sweeps for broadcasting.

Gregg Laboratories manufactures the *2650* AM and *2530* FM audio processing systems for mono or stereo broadcasting which provide triple band processing.

Xedit Corp showed a wide range of editing blocks, including those from Editall, which the company recently took over, and which are available for all shapes and sizes of audio and video tape.

Finally, **Amber** is introducing two accessories for the established *Model 3500* distortion and noise measuring set, the *Model 359* balancing box using Jensen transformers for balanced inputs and outputs ($500), and the *Model 358* high resolution frequency counter which auto-ranges from 10Hz to 1MHz, and is only 1in high (also $500). ■

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Melkuist GT800 automation system

The Melkuist *GT800* automation system has been in operation at London's Lansdowne Studios for several months, and the system has now been fully tested operationally under a large number of different session conditions. This article gives a basic operational overview of the system.

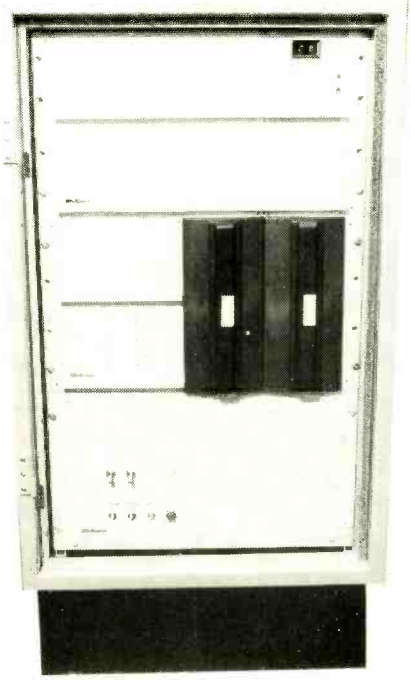
View of the console and control panel with monitor

LANSDOWNE Recording Studios, in London's Holland Park, took delivery of the Melkuist *GT800* automation system in October 1979, as part of a major technical upgrade which included the addition of the system to the existing Cadac console, plus other modifications to the desk by CEG & Co, and new video equipment for music to picture and video post-production work under computer control. A JVC *8500 U-Matic* recorder, plus Sony *Trinitron* monitor, forms the basis of the video system, and transport sync is maintained by an Audio Kinetics *Q-Lock* system, with customised interfaces by Tim Whiffin of AK to work with the Melkuist computer. Many of these units are to be seen in the accompanying photographs and in the cover picture.

Hardware

The Melkuist system is based around the highly versatile Motorola *6809* microprocessor, two of which are used with different functions, one as a central processor and the other to handle the disk stores. The bulk of the hardware is fitted into a small 19in rack unit, about 18U high, which may be divided into three 6U sections: at the top is the central processor, which contains nothing more on the front panel than a set of LEDs and a 2-digit numerical display which indicates the state of the system. The central unit contains the two BASF 8in single-sided, single-density floppy-disk drives, which gives the system a very useful edge: not only are these drives very reliable and well-constructed, they are also almost totally silent. An optional smoked-glass door to the rack unit makes the system completely inaudible, and while the Lansdowne system does not have the door, the quiet whirring of the drives during disk accesses, and the underdriven fans at the rear of the unit do not interfere with the recording process. As a result, the system, unlike almost any other, may be fitted in the control room rather than 'next door', making replacement of disks easy and trouble-free. The disks are IBM-formatted, and the forced-air ventilation system keeps a positive pressure within the rack unit to repel dust from the disks and drives, leading to a very reliable combination. Beneath the disk unit is the over-voltage crowbar-protected power supply.

Rack-mounted computer system with two BASF 8in disk drives



Peripherals

Apart from a communications unit mounted under the desk, the peripheral aspects of the Melkuist system may be divided into three sections: the TV monitor, which presents details of available functions and responses, plus the system status; the numeric control panel which enables commands to be entered; and the console controls, mounted on the faders and in a central module, which co-ordinate the fader status and functions. In addition, there is a separate master reset button, which restarts the system in the event of an error (or for other purposes), and a light which illuminates when timecode is received from the master recorder.

The control panel is a small unit, consisting of nothing more than a numeric 0-9 keypad plus three extra buttons, a yellow one which is used to take the system on and off-line (whose function is confirmed both by the monitor display and by an LED, next to the button, labelled 'on-line'), and red and green buttons which have multiple functions. The red button accesses the 'computer status' page on the monitor, and is also used to

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answer 'no' to prompts, while the green, 'yes' button accesses the function list on the monitor and is used to affirm the operation of a particular command. The operation of these buttons will be described below.

Monitor display

The TV monitor normally displays the current status of the system, including such parameters as the amount of disk storage available, the number of the current mix, and the store in which it is to be held. In addition, it indicates whether the system is on or off-line, ready or not, and the status of the master recorder transport. Another page provides a menu of available functions, each function being allocated its own page of display. At present there are six such pages, as detailed below:

PAGE	FUNCTION
1	Protect mix
2	Remove protection
3	Set source mix number
4	Copy
5	Display store/mix numbers
6	Reset mix numbers

The *GT800* utilises eight separate stores which contain one mix each at any one time. Each time a mix is performed, it is saved automatically in the next available store that has not been protected. The eight stores are allocated on the two disks such that stores 1 – 4 exist on Drive 0, and stores 5 – 8 are on Drive 1. Each time a mix is performed, it is allocated a mix number, sequentially from 1 – 99. This concept of 'source mixes' and 'stores' is fundamental to the operation of the system software, and explains how the pages are used. Thus Pages 1 and 2 enable the user to protect or remove protection on a source mix, thus removing the appropriate store from the normal sequential allocation of source mixes to stores. When activated, by pressing the appropriate page number and the green key, the appropriate page is displayed. The mix number to be protected or 'unprotected' is then entered, and the system responds with the message 'Are you sure?'. Pressing the green button carries out the function with a prompt to the user, and returns to the menu, while pressing the red button cancels the request and returns to the status page.

Page 3, 'Set source mix number', allows the operator to call a previous mix up by number if, for example, it is desired to return to a previous version of the track being mixed, subsequent modifications being unsatisfactory. The 'old' mix is automatically allocated to the next available store in the sequence.

Page 4, 'Copy', enables the engineer to transfer a source mix from one store to another. As the first four stores are on one disk, while the other four are on the second, this provides the simplest method of creating a 'master disk' of master mixes or mixes which are required for the future on a single floppy disk rather than having a selection of wanted and unwanted mixes on two disks.

Page 5, 'Display store/mix numbers' produces a readout of the store numbers, mix numbers and their status. For example, one might see:

STORE	MIX NUMBER	STATUS
1	3	PROTECTED
2	9	UNPROTECTED
3	10	ACTIVE + UNPROTECTED
4	6	UNPROTECTED
5	7	UNPROTECTED
6	8	PROTECTED
7	1	PROTECTED
8	2	PROTECTED

From this display, we would gather that the mix currently being worked on was mix 10, going to store 3 (hence the 'Active label), and that mixes 1, 2, 3 and 8 were considered viable enough to be kept for the time being. We also notice that mixes 1 and 2 have probably been copied to their current stores early on, and that the system is probably on its second run 'round the stores'.

Page 6, 'Reset mix numbers', produces a similar display, but with the warning message, 'Are you sure?'. This is because pressing the green 'yes' button at this point will alter all the mix numbers, and you'd better remember which is which! The reset command takes the *lowest-numbered* mix and re-labels it 1, and sets all following mixes to the same intervals as before. Thus, if mix 17 was the lowest-numbered mix, then it would become 1, while mix 19 would become 3. This may seem confusing at first, but is easily understood with use. It's far less disconcerting than seeing all kinds of numbers up to 99!

There is, in addition, a 'sign-on' page which is displayed on power-up, as the system prepares itself. This typically announces the systems and the name of the studio, in this case reading "GT800 Automation system by Melkuist for Lansdowne Recording Studios London". Disks are then inserted into the drives and their directories, if any, are read automatically into memory.

Console controls

The console controls may be divided into two sections, fader controls and centralised functions. The central functions are grouped together on a module about the size of a fader in the centre of the board, and consist of two groups of four illuminated pushbuttons. The upper group controls all the faders on the desk, placing them into Isolate (automation effectively disconnected), Write (allows the automation to write fader positions to memory and thus to disk), Read (in which previously stored values are used to drive the mix) and Update (which enables faders to be moved *without* altering stored information). Update is not a writeable function — so that if, for

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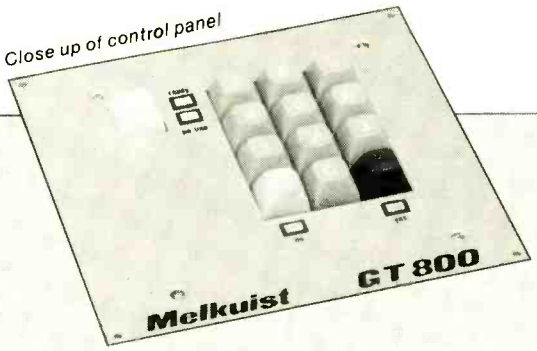
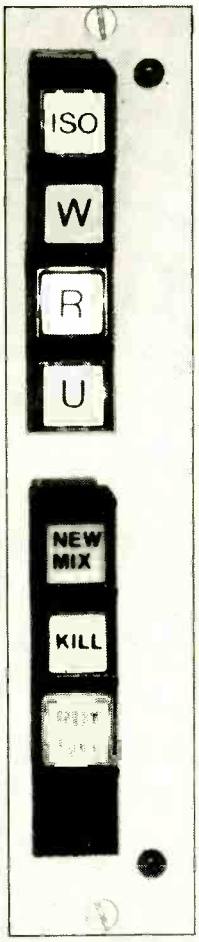
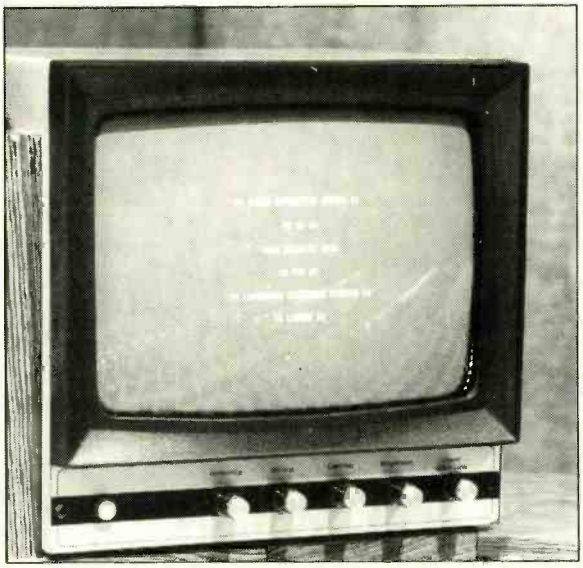
Close up of control panel





Central control module



Close up of TV monitor with 'sign on' message

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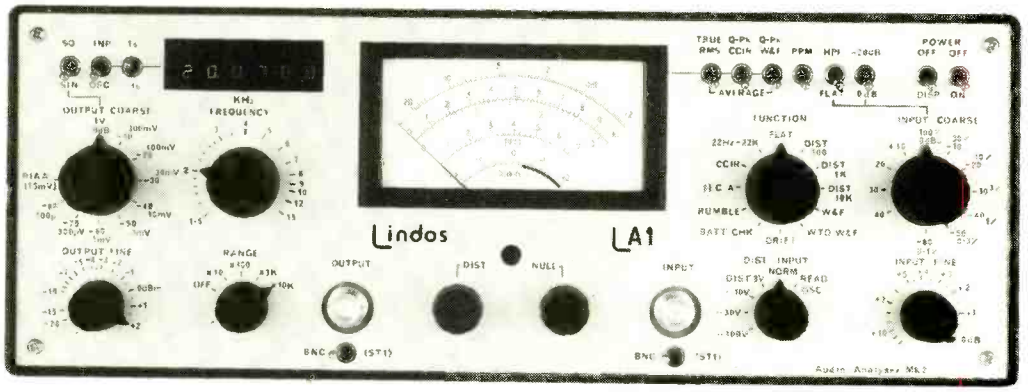

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example, a series of level alterations have been made correctly but the whole signal is too low or high on a given fader, that fader can be moved up or down to alter the overall gain of the track without modifying the short term automated level changes. In other words, Update adds or subtracts the current fader value to the stored value.

The second set of buttons controls automation functions New Mix, Kill, Ready Changeover and Enable. Enable activates a predetermined function, so, for example, at the start of a new session, New Mix and Enable are both pressed together, wiping the current disks and setting up the system for a series of New Mixes. The need to push the two buttons simultaneously reduces the chances of inadvertently wiping out all your work! The Kill button enables a change which has been programmed during the current pass to be erased if it was incorrect, while Ready Changeover works in conjunction with fader position to enter and exit from 'write' on specific faders on the following movement through the 'null' position after Enable has been selected.

Fader controls

Melkuist use a digital transfer fader system in a totally 'transparent' way. Write, Read, and Update may be selected locally for each fader, with the functions outlined above. Normal 'Dc Grouping' is also available via numeric thumbwheels, allowing any number of VCAs to be controlled in the various modes by one separate group fader.

To the top right of each fader is a 3-LED null indicator, with a nominal 2dB window. Either side of a yellow-illuminated fader position, the appropriate red LED comes up. The indicated null is the difference between current fader position and returning data. The null indicator informs the engineer of the direction in which the fader must be moved to find the null.

A 'Ready' light and switch on each fader enables local read/write functions to be accessed, and pushing the Write master button on the central module places all faders in this mode ('All Write') during the first pass of a New Mix. In this condition, the track can either be played down from one end to the other, with appropriate level alterations, etc, or a rapid 'snapshot' can be taken of all the fader positions by playing a short piece of the track. As soon as timecode is established, the 'snapshot' is taken and this data will hold for the whole track unless modified.

The 'Ready' function has three modes, allowing the fader to be set locally to Write; allowing the master Enable button to select Write when depressed and Read when not depressed (with master changeover inactive); and, when the Ready Changeover button is pressed, the fader enters write when passed through null. To return to read, the local Ready may be deselected and the fader nulled, or the master Enable may be inactivated and the fader nulled, thus allowing a smooth transition between originally-stored data and additions. This mode is the most-used after a basic mix has been established.

The 'Enable' function may be footswitch-controlled if required, and this makes the system very easy to use if all your hands are occupied with the faders. With the appropriate faders in Ready, the Ready Changeover switch is pressed, and the footswitch is pressed as the cue approaches. The next pass through the null position on the faders activates their Writes, and the alteration is written. Pressing the footswitch Enable again before the end of the modification ensures that the faders will drop into Read at the next pass through the null.

As the Update function, which adds the current fader position (+ if above zero, − if below) to the returned data, might affect data accuracy if the addition was automated, it is purely a manual function, enabling 'live' alterations to the overall level of a track without changing stored movements of that fader. If an Update is required to be written, the best way is probably to route the signal from that channel through another, unused fader, writing that level information in addition. A new development makes accurate writeable updates possible.

To avoid problems, Writes are deselected when the master machine is spooling.

The Cut function is also handled by the *GT800*. Separate control lines are used, so that if a mute is found to be not required, the data on levels during the mute action will not be lost. The cut switch on each channel has three positions, channel open, channel cut, and 'listen'. If the switch is in the

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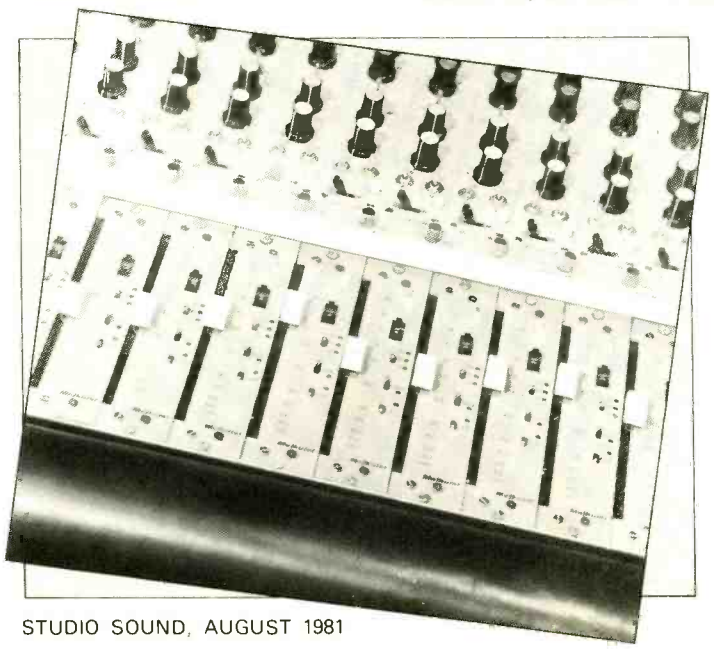
The Melkuist faders



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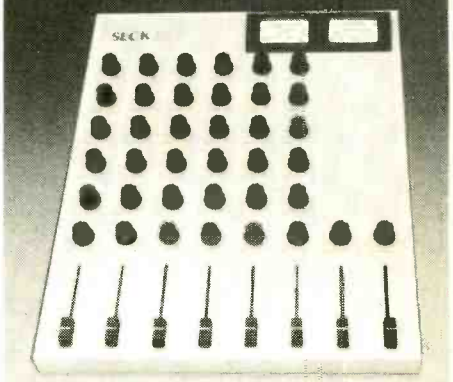

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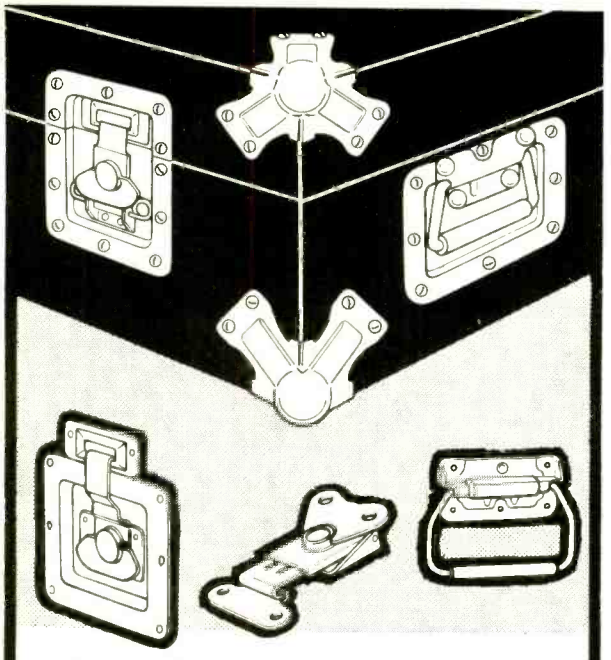

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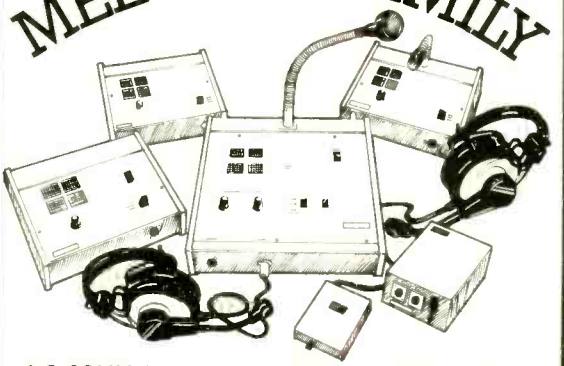

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open or cut position and this differs from the previously stored data, the new status is written. If the switch is in the centre position, however, the channel cut status follows the automation's instructions. As only a change of state is noted by the system, it only has to be written at the start of a tape pass, and remains in that state until countermanded. Thus if a cut is written at the start of a pass, and the pass doesn't continue to the end of the track, the system will assume that a cut is to continue unless it's told otherwise.

At the start of each pass, channels are set to 'open' until a change of state is dictated by the automation or the operator. Because only changes of cut state are recorded, it is useful to complete a cut operation before stopping the tape during a pass. Thus, if a section of a solo is required to be removed and another switched in, the cut out and in should both be done, if possible, on the one pass, otherwise the automation will leave the channel off!

Ease of operation

The *GT800* allows the tape to be spooled to a point in the track and then started in Play. In this case, the computer assembles the data up to a point a couple of seconds ahead of the 'drop-in' point and only releases the system when the tape passes this point. The Ready light on the control keypad lights when this happens, and all Writes that occur while the light is off are ignored. The new data created by a mix is stored in memory until the tape is stopped or spooled, at which point it is compiled into a new disk store. This happens automatically, so the Kill button allows the user to avoid saving a mix if a change was incorrect. This must be done, however, before the tape is stopped, or compilation into a new store will already be under way. In the case of a change not being desired *after* this point, however, the previous mix can still be recalled after the tape has been stopped or spooled by the use of Page 3 to call the previous wanted mix into the next store. A new mix is usually compiled in under 5s, so this process does not interfere with the normal course of a mixing session.

The Melkuist *GT800* automation system must be about the easiest to operate, yet it offers a wide range of functions. Operation is begun simply by applying power, inserting a pair of disks, loading the multitrack tape, and placing the processor on-line. As all the data is recorded on disk, the only aspect of the multitrack required by the system is the presence of SMPTE timecode on an unused track. A built-in generator may be used to record this if it is not already on the tape. No further recording on the tape is necessary, and the system is thus not prone to the possibility of errors resulting from the storage of sensitive automation data on audio tracks.

If fresh work is to be done, New Mix is selected, and the green key is pressed to proceed. When restarting from a previous mix, the machine is simply run from the top of the track without pressing New Mix. When the tape is started and timecode is received, the Ready lamp illuminates and a 'bleep' sounds. If this light does not come on, timecode is not being returned to the system. As soon as the system is ready, fader movements and mutes may be written, and since the entire mix is stored, the process is very much akin to manual mixing, and there is no need to designate sections to be worked on. Write functions are simply selected, the faders required are brought up, and the mix proceeds as normal. It is about the most 'natural' automation system around.

Maintenance and reliability

I discussed aspects of reliability with both Adrian Kerridge and with Bob Butterworth, who took me through the system, and learned that apart from a very small number of simple component failures during the early days of the system after installation, there have been virtually no faults, apart from occasional error conditions resulting from timecode dropouts on the tape. Even without considering the complexity of a control room based computer system suffering the normal rigours of studio life, the system has proved to be exceptionally reliable. Modular construction of the electronics makes the system easily serviced in case of failure, and Lansdowne report that Melkuist have always been more than willing to assist in cases of difficulty. In addition, Melkuist have supplied periodic software updates which have added useful extra functions to the system.

Overall, the Melkuist *GT800* represents an excellent choice of automated mixdown systems where faders and mutes only are required to be automated, in particular with regard to ease of use, reliability and freedom from maintenance problems. It can now be fitted to many different consoles, notably Trident, Harrison and Cadac and is proving itself through a growing number of satisfied customers. As one user put it, "It's the first system I've come across which actually makes an automated mix easier than a conventional one, without having to rethink your way of working." And although there are other systems which offer the control of more facilities (notably the SSL system), that about sums it up.

Richard Elen

Many thanks to Adrian Kerridge for allowing me to come into the studio, to Bob Butterworth for taking me through the system, and to Chris for letting me play with his tape during lunch!

Reviews

We regret to inform readers that our technical equipment reviewer, Hugh Ford, was taken ill recently, while working on a series of microphone reviews for our June issue. I am sure that you will join with us in giving him every wish for a speedy recovery.

As a result, we are currently unable to present our intended series of reviews, including those of microphones and those scheduled for this issue. As it seems likely that Hugh will be unable to take on a great deal of work for the time being, we have appointed three new reviewers to continue this important facet of our publication. They are each experienced writers, sound engineers and technically qualified people, and their articles will be appearing from the September (Effects) issue onwards until further notice. Of course, each reviewer's style is different, and someone of Hugh's calibre able to 'fill in' for us would no doubt be impossible to find, but we hope that you will find these reviews both useful and interesting, and will bear with us until things return to normal.

Simply creative

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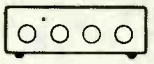
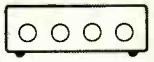


Compressor £31·97 variable attack and release times give scope for a wide range of effects. Input from 40dBm at 33kohms. Output from 0dBm at 600ohms. Noise less than 60dBm. Attack from 0.5mS to 5mS. Release from 0.1S to 2S. Ratio approx 6:1



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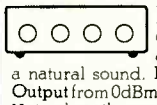

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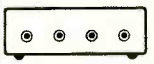

Booster £33·12 unique switching systems give the option of use as four separate line drivers or as a distribution amplifier, with balanced or unbalanced outputs. Input 0dBm or − 10dBm switched at 47kohm single, 12kohm mult. Output 0dBm unbalanced, + 6dBm balanced to drive down to 600ohms. T.H.D. less than 0.1%. Noise less than − 80dBm.

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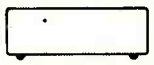

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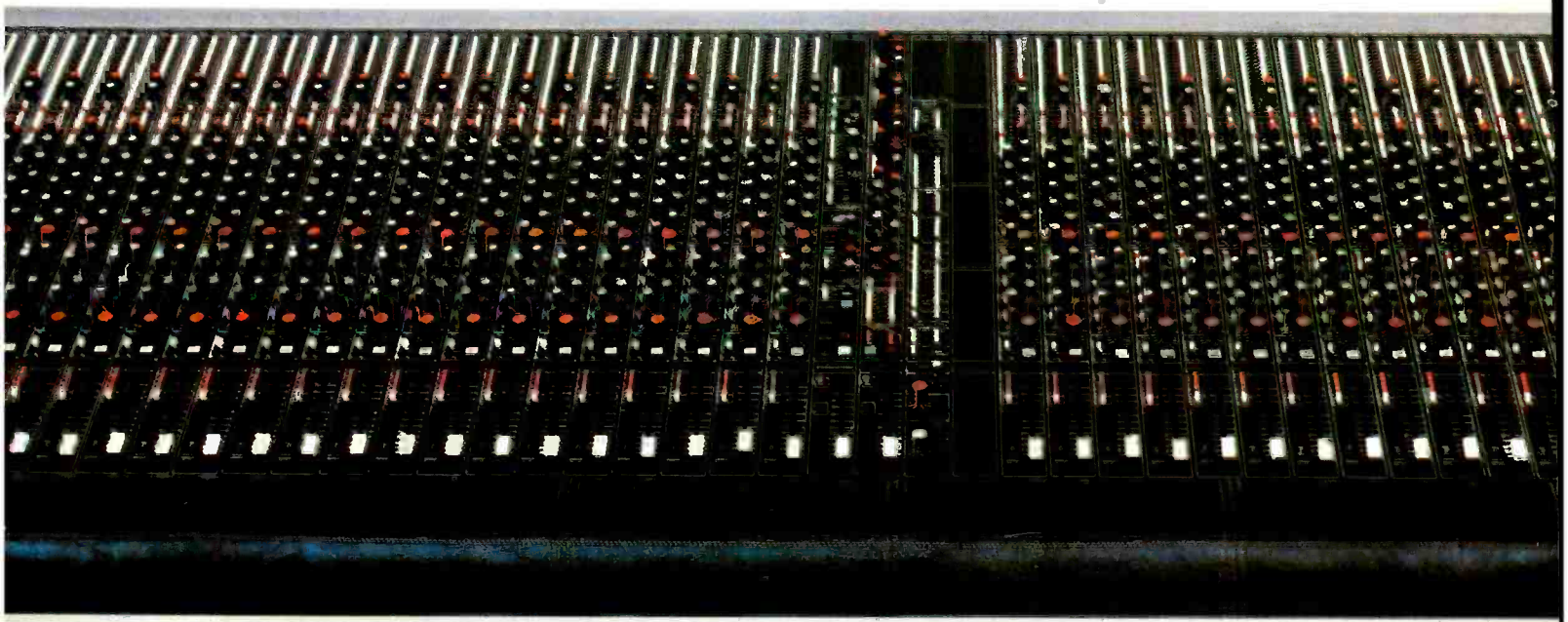

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