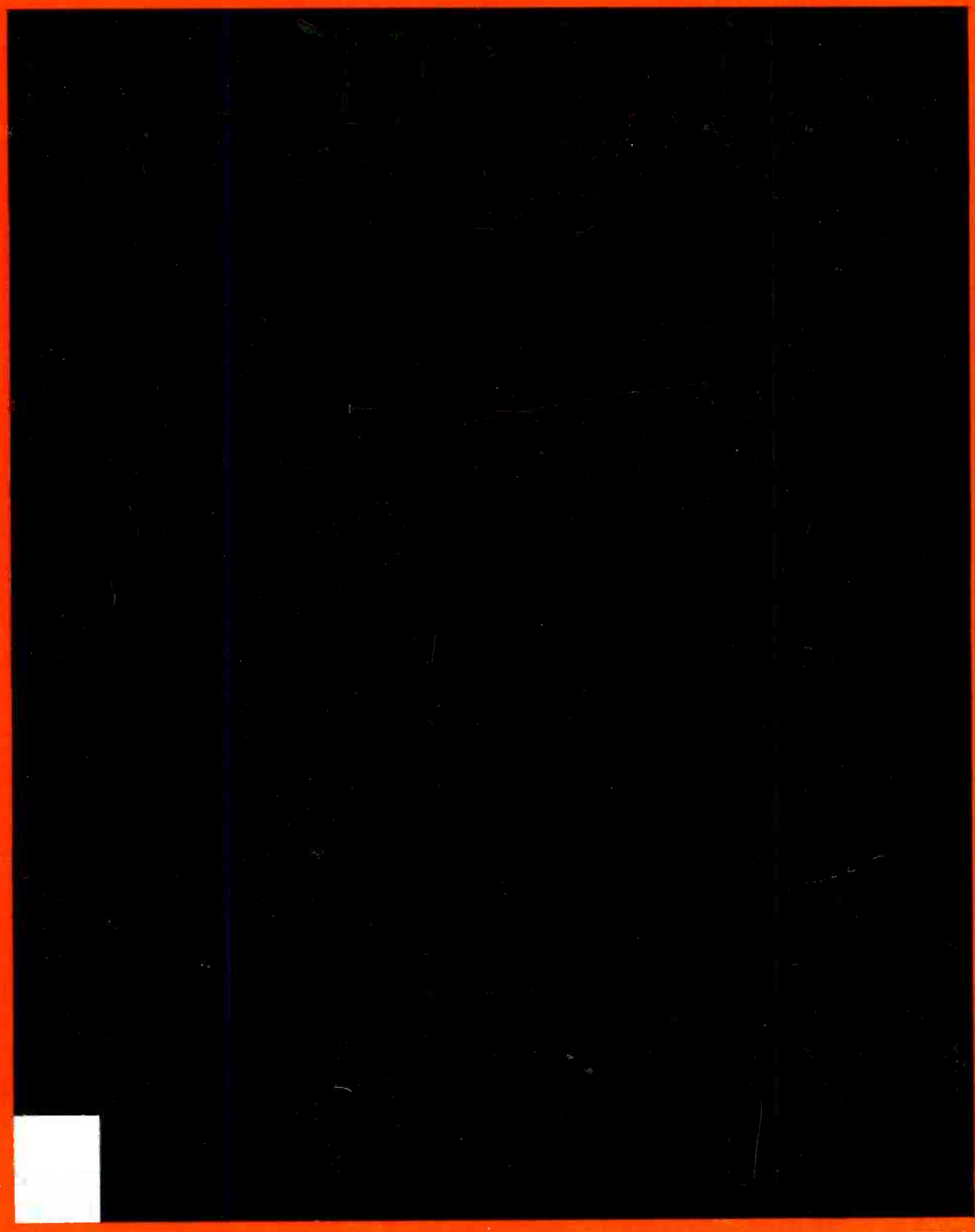
August 1978 50p

studio sound

AND BROADCAST ENGINEERING



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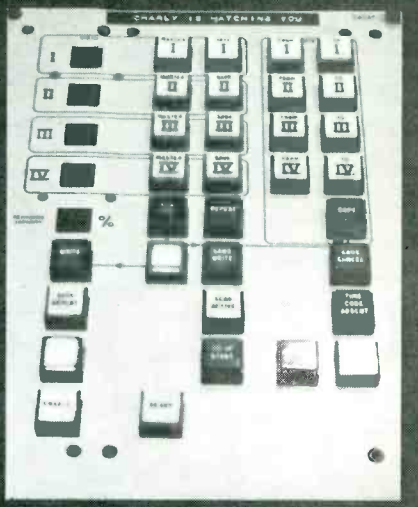

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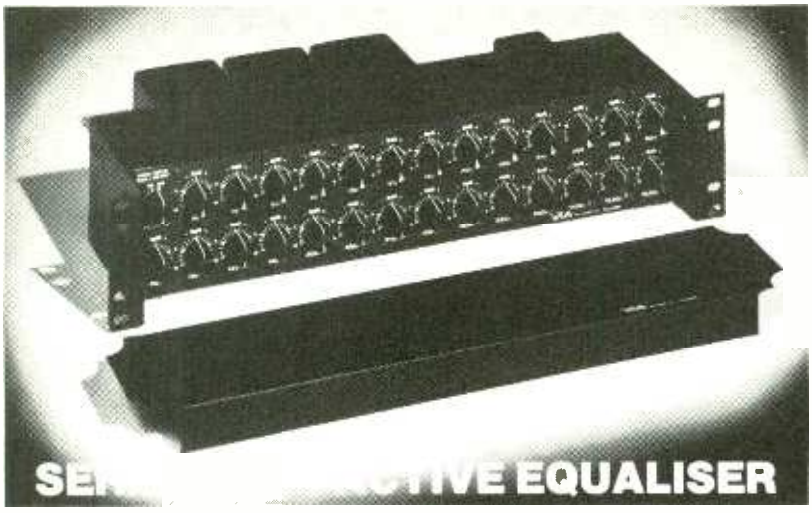
studio sound

AND BROADCAST ENGINEERING

By the time this is read, I hope to have met many of those who made the annual June pilgrimage to the plush Connaught Rooms for the only British based studio equipment exhibition APRS. Hopefully, our presence will also have been extended to many studios through the beer mats judiciously scattered around the exhibition. I hope to develop *Studio Sound* in similar vein to Ray Carter and Mike Thorne—International coverage will be extended and a regular Studio Diary column providing snipits of 'happenings' introduced. Hugh Ford will continue his excellent internationally respected equipment reviews while Adrian Hope provides his own interpretation of events behind the news. Future plans for *Studio Sound* include an analysis of rapidly advancing digital technology from which we hope to draw conclusions on the multiplicity of standards emerging, and a short series examining the impact of commercial radio in Britain after five years of broadcasting. And who else but Hugh Ford could write about measurement techniques? Various aspects of consoles will be discussed over the coming months together with our regular coverage of forthcoming exhibitions including the International Broadcasting Convention and New York AES.

For those interested, I have been working on *Video* magazine for the past few years, *Video* of course being a spin-off from *Studio Sound* about four years ago and edited by David Kirk who originally developed *Studio Sound* from its previous entity as *Tape Recorder*. So, anybody who needs assistance in video, you know where to come.

Angus Robertson



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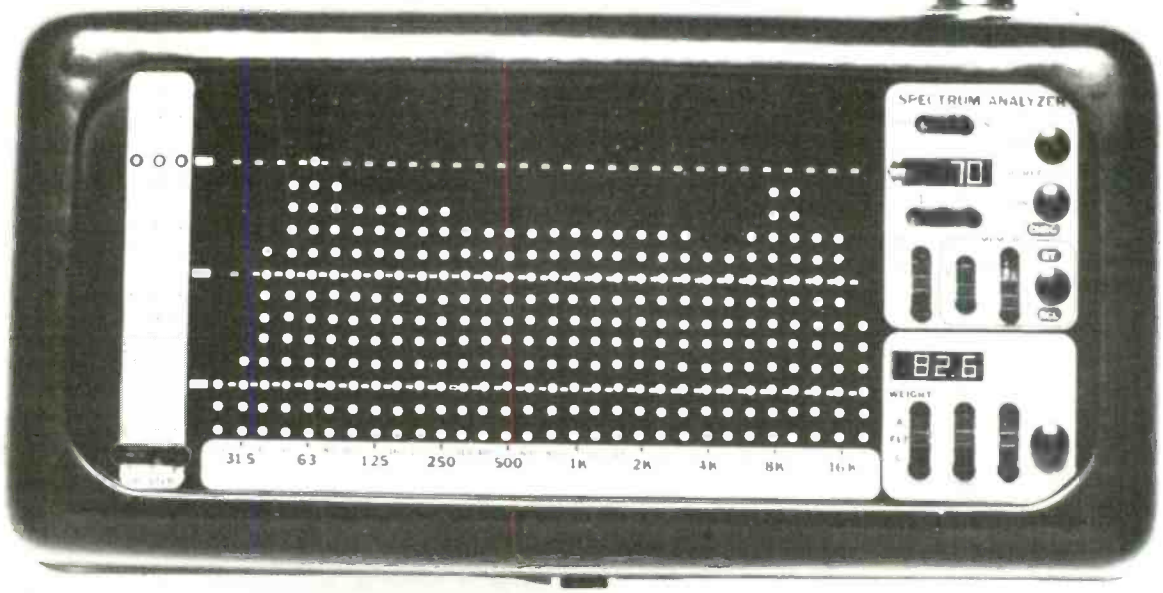

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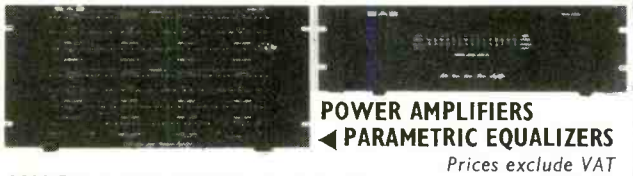

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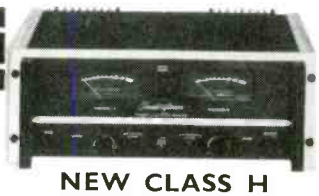

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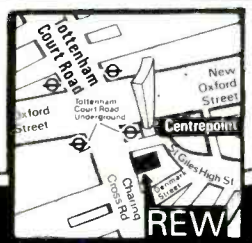

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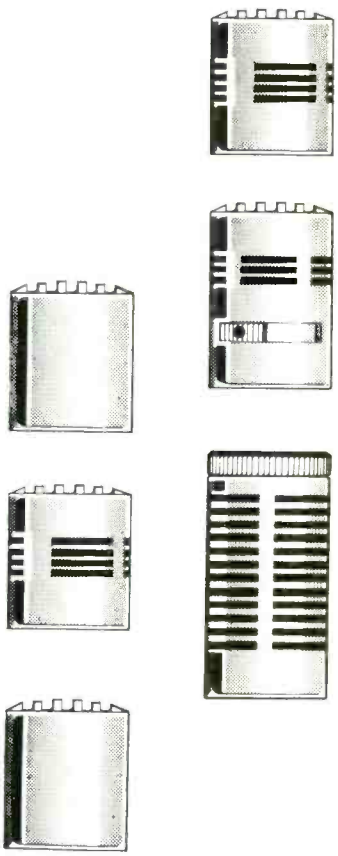

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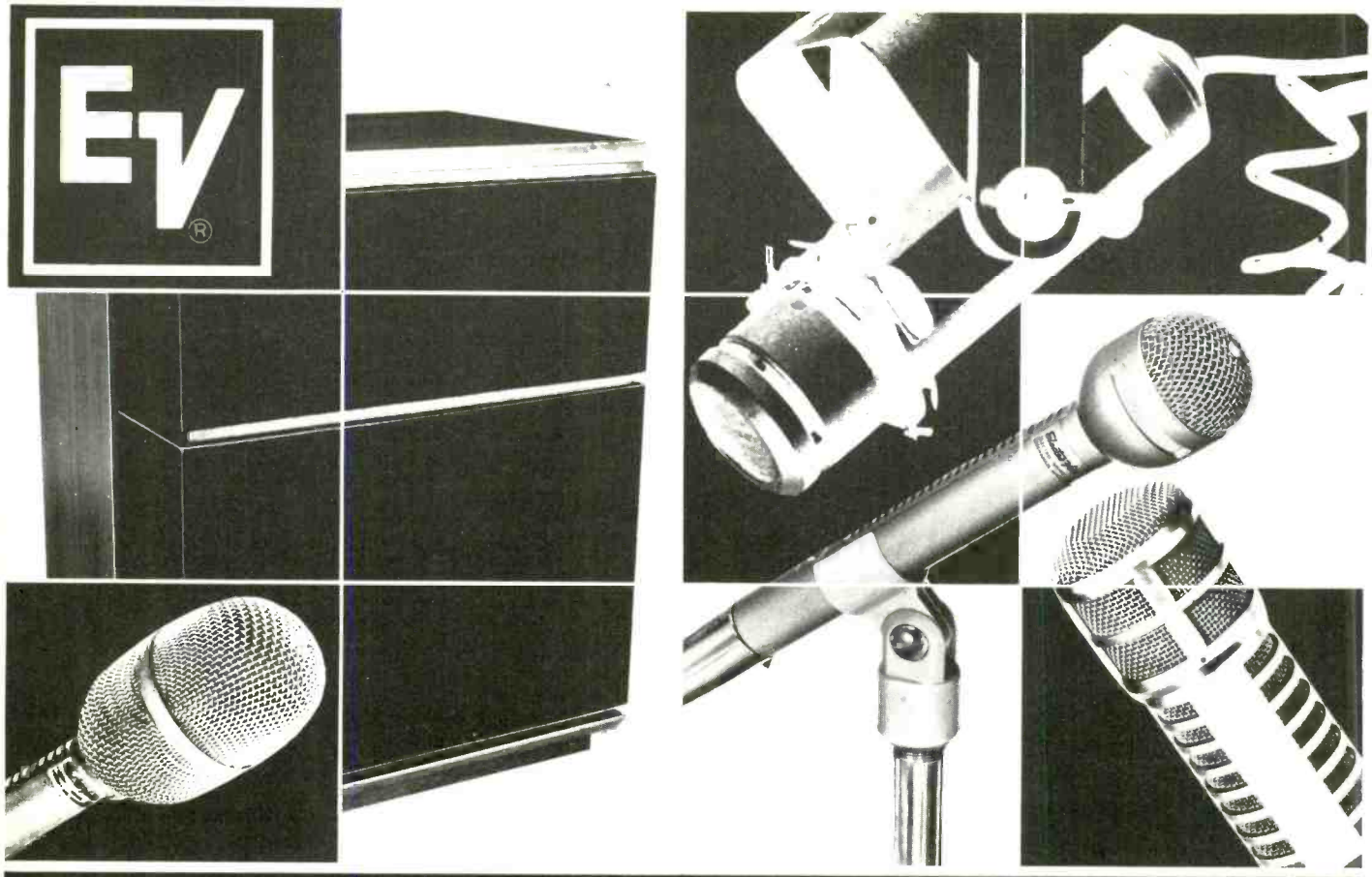

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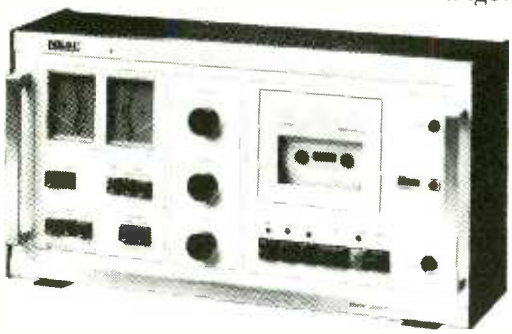

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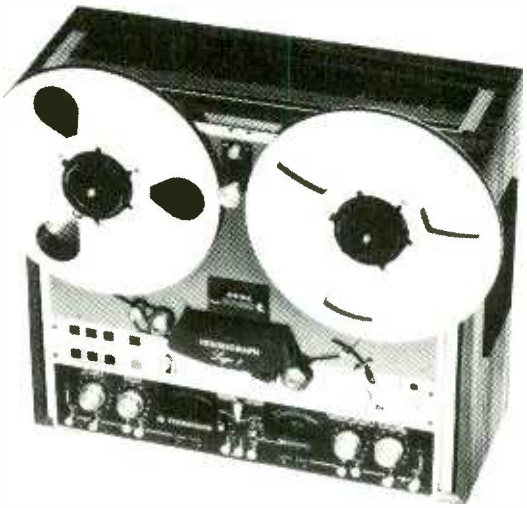

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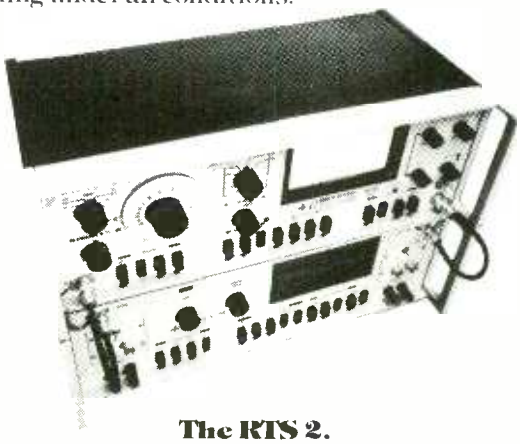

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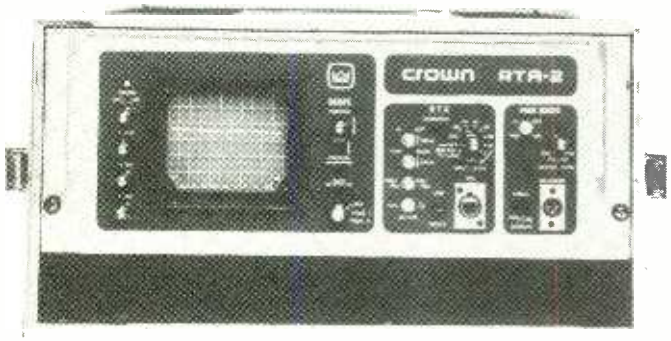

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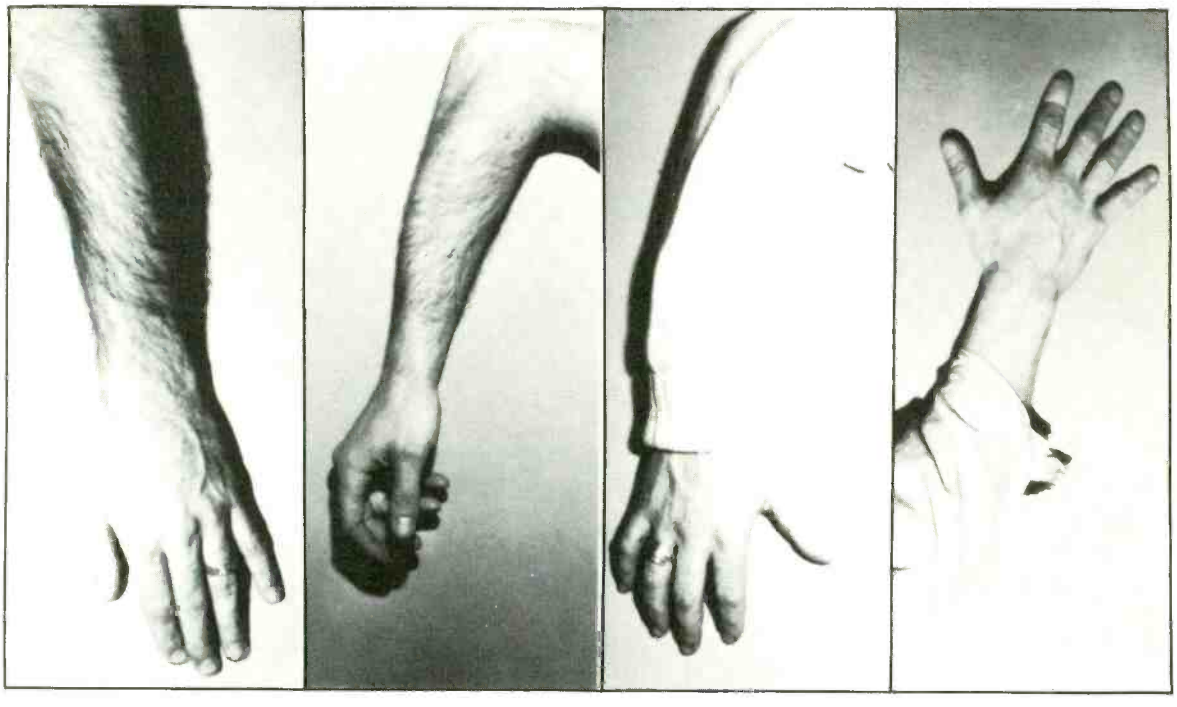

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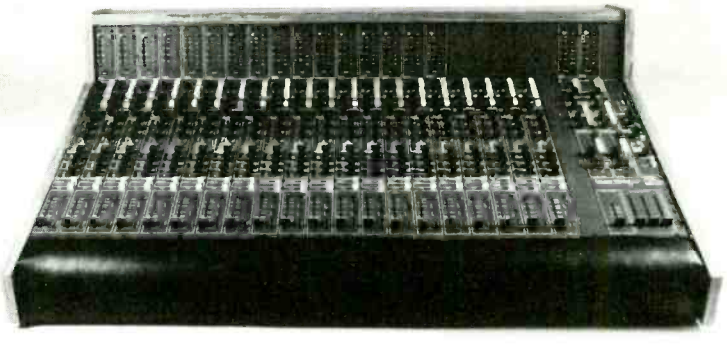

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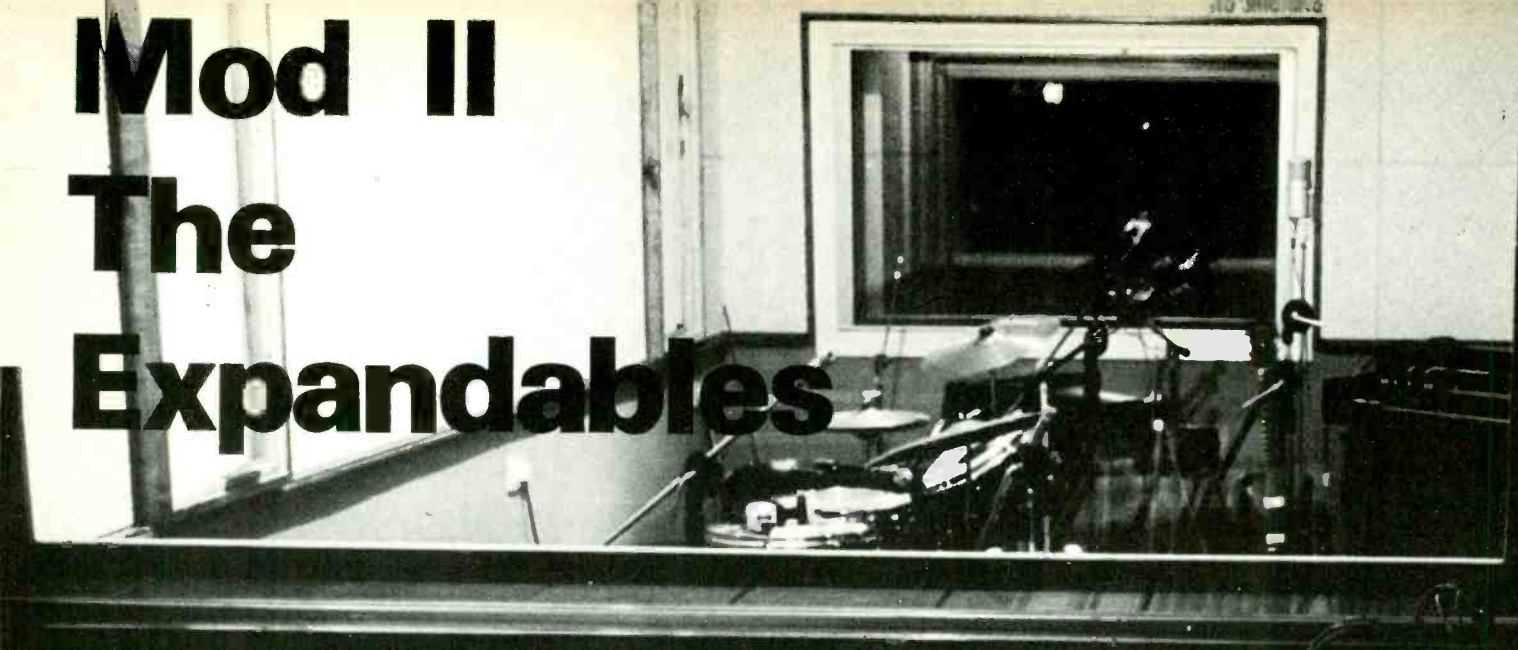

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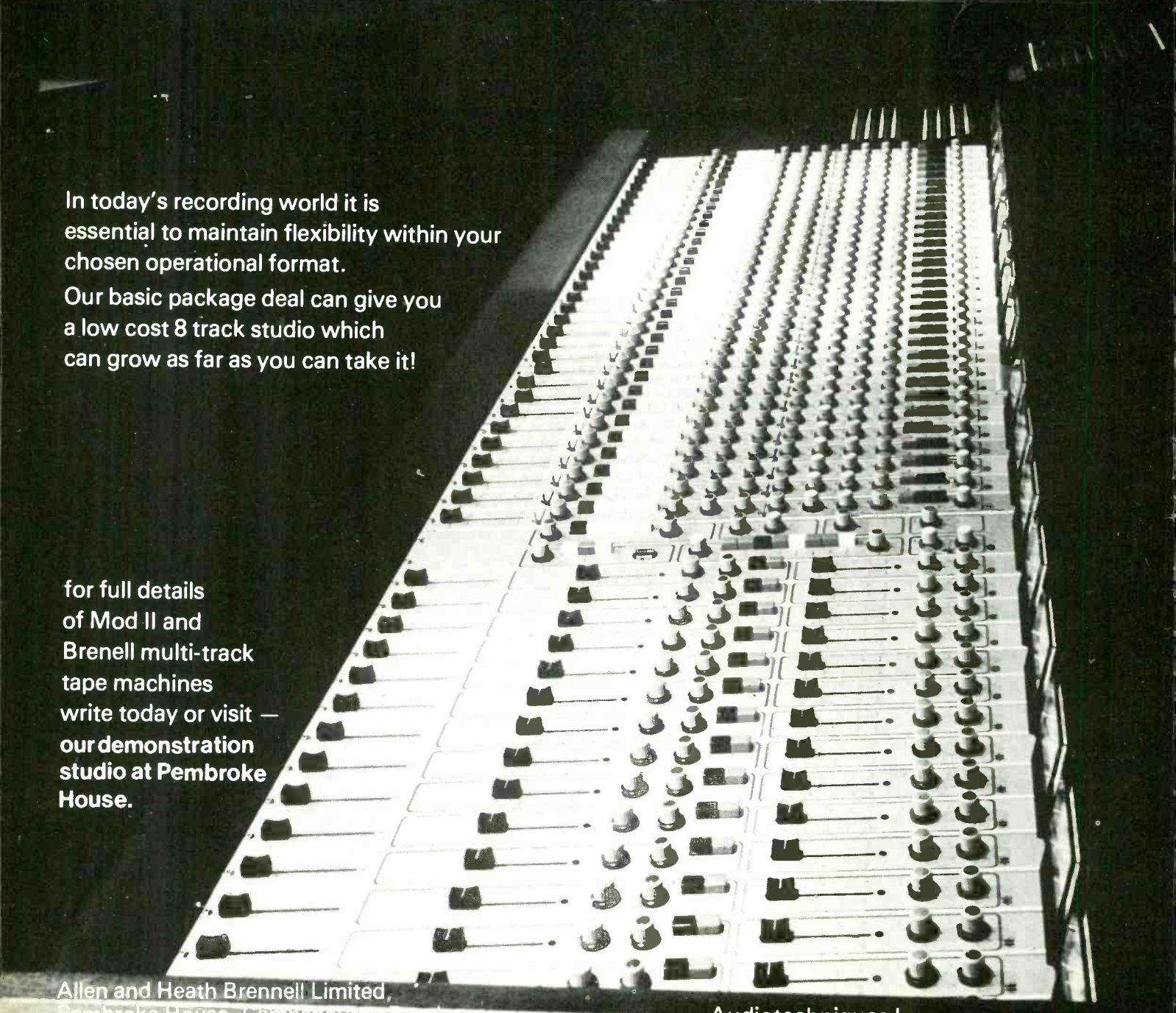

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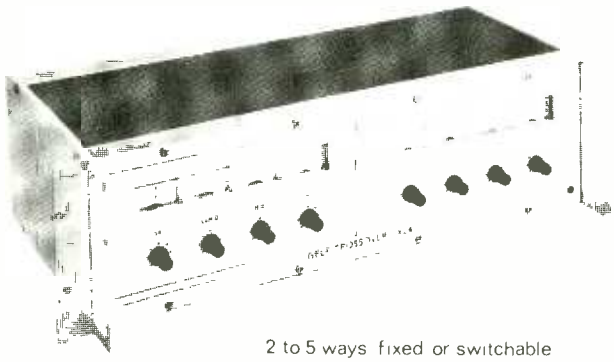

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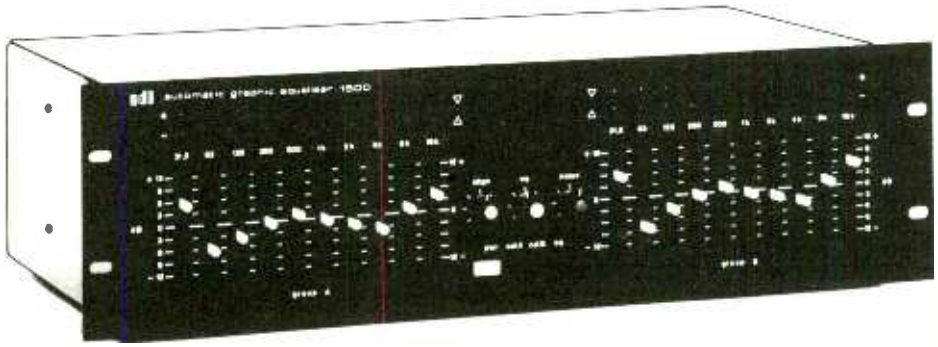

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news

High-speed B77

FWO Bauch, UK agents for Revox, tell us that a high-speed version of the recently-introduced *B77* (see review in December '77 issue) is now available at a rrp of £575 plus vat. Customers also have the choice of IEC or NAB equalisation.

FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

Poole sound system

The new Poole Arts Centre, which opened on March 5, was the subject of a £40 000 sound reinforcement contract for Pye Business Communications, which is roughly the same thing as Philips.

The contract covered the supply of sound equipment to two halls, the first of which seats 1600 people while the second holds around 600. In spite of the apparent size, the larger hall is equipped with only 400W of amplification in the form of four column speakers; the second hall—a theatre auditorium—weighs in with only 300W. Hardware architecture includes a sound desk for each location.

The contract also includes a separate paging system.

According to Pye, the engineering of the 400W system posed certain problems, since the larger Wessex Hall has a variable height floor introducing an equally variable function into the acoustics. A certain Professor Parkin of Sound Research Laboratories Ltd was called in to sort out the problem, which he would appear to have done. A reverb system has also been added.

Pye reports that the contract required a total of £11 000 of cabling, which is no mean figure. Poole Arts Centre must have enough balanced coax wiring to represent it as a new art form. That leaves a sum of £29 000 to buy and install two low-powered sound systems. A rapid calculation puts the equipment cost at £38 per Watt, which must be something of a record.

Pye Business Communications Ltd, Cromwell Road, Cambridge CB1 3HE, UK.
Phone: 0223-45191.

Curve store ▶

Wayne Kerr has brought out a new piece of equipment to complement its *RA200* audio response analyser. The *ASD1* is a digital store that enables up to four response curves to be digitised for subsequent playback in anachronistic fashion.

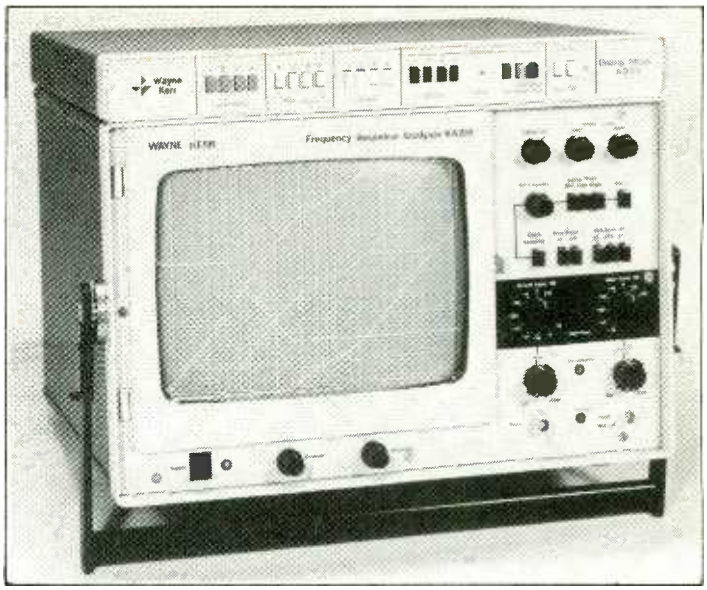
The equipment can be used to make before and after or a/b comparisons in any application which generates a conventional analogue curve. Additionally, stored curves can be summed to provide a differential graph from two inputs.

The memory array is a non volatile type which can be kept power down for periods in excess of two weeks. Further, the manufacturer claims that the digitising process has enough resolution to record sharpness of all transients likely to be encountered in audio use.

Wilmot Breeden Electronics Ltd, 442 Bath Road, Slough SL1 6BB, UK. Phone: 06286-62511.

John Page moves

The UK agents for Stellavox equipment now reside at Wesley House, 75 Wesley Avenue, London NW10. Phone: 01-961 4181.



New Turner amp

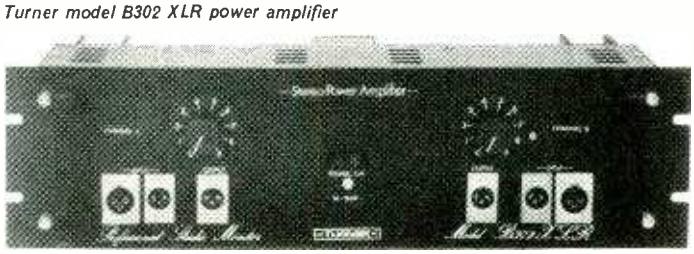
Turner has brought out a pair of power amplifiers specifically for pa systems at, says the company, 'an attractive price'.

The *B302-XLR* costing £305 produces 100W into eight or 150W into four ohm. A larger model, *B502-XLR*, is claimed to push out 190W into eight or 340W into four ohm. The quoted distortion level is 0.003% (no datum point given) and the noise figure 'is totally inaudible' which, one supposes, it would be. Turner claims a power bandwidth from 20-20k Hz within 0.1 dB.

Both amplifiers feature front-panel *XLR* connectors, which is said to make things easier when using racks of amps with active crossovers. The larger unit costs £420.

Turner Electronics Industries, 175 Uxbridge Road, London W7 3TH, UK. Phone: 01-567 8472.

Turner model B302 XLR power amplifier



Turner model B502 XLR power amplifier

Changes at DJM

The new studio manager is Alan Florence, who joins the company after two years at Sonaland in Madrid. Prior to that he was with Pye and Music Centre. Also new to the staff is Dick Plant, one of the senior engineers, who comes from De Lane Lea.

Racal tape for BBC

Racal-Zonal has been awarded a major contract to supply the BBC with over 200 000 reels of recording tape for its national, local and overseas radio services.

In a written statement, the company claimed that the *666 Series* tape was developed in joint consultation between Racal and the BBC. It uses a matt-backing to improve the winding properties and to enable a stronger splice. Inevitably, the tape is described as 'very low noise with excellent print-through characteristics.'

Racal-Zonal Ltd, Holmethorpe Avenue, Redhill, Surrey RH1 2NX, UK. Phone: Redhill 67171.

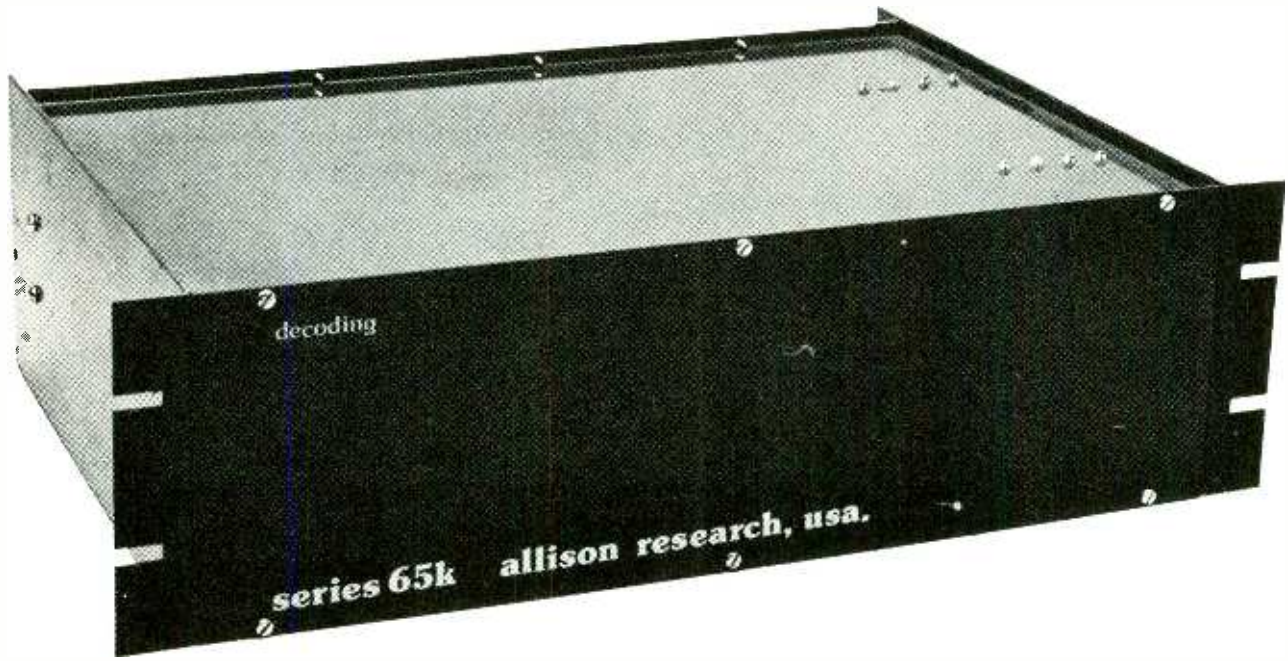
Build your own mixer

We have had many enquiries over the last couple of months asking where potential constructors can obtain printed circuit boards for David Robinson's mixer design (see various 1970 and 1971 issues of Studio Sound). Readers are advised that Q-Energy Solution Ltd can supply said pcbs. Their address is Highfield House, West Kingsdown, Sevenoaks, Kent, UK. Phone: 047485-2344. 24 ▶

The Industry Standard

Allison Research 65k Console Automation Programmer –

Nearly one hundred units in world-wide daily use with API, Harrison, Helios, Sphere, Trident and other fine mixing consoles.



Allison Research's 65K second generation programmer accepts and processes control voltages in the range 0 to + 5.6 VDC from VCA type faders. These analogue control voltages are converted by the 65K Programmer to data words which can be stored on any non-critical tape medium. Upon replay of the data the original DC levels are re-created . . . . accurately and unerringly.

Applications of the 65K Programmer to any recording console fitted with suitable VCA faders permits comprehensive and reliable level automation. The 65K Programmer illustrated can be expanded from a basic 16 fader capacity (UK list £2362) to 64 fader capacity (UK list £3153) simply by the insertion of expander cards.

Unlike other console automation programmers, the Allison 65K when fully expanded can handle 8000 analogue functions or 65,000 digital bit functions – sufficient capacity to allow it to be used with subsequent generations of programmable equalisers and other devices.

For full information on Allison Research's Industry Standard Automation Programmer contact:

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

France
3M France SA, Mincom Div.
Boulevard de L'Oise
95000 Cergy
Telephone: 749 0275

Scandinavia
Siv Ing Benum A S
Skovyn 22
Oslo 2
Telephone: (02) 56 57 53

US
Allison Research Inc.
2817 Erica Pl.
PO Box 40288
Nashville Tenn. 37204
(615) 385 1760

Broadcasting below the belt

British airwaves, as most people know, are getting a little overcrowded. What isn't so well-known is that sometimes this overcrowding is the result of illicit broadcasters. Discounting the several medium-wave and fm 'pirate' stations, which are arguably legitimate, if technically illegal (they can't get a licence, although often they would like to) there is the odd occasion where correctly-allocated channels have been 'taken over' by pirate signals. And, recently, by more mysterious electromagnetic visitors. As readers of the British trade and national press will have noticed, one such problem area for authorised users is the vandalistic jamming of vhf ham radio repeaters, to which the British Home Office apparently turn a blind eye (presumably because they want to grab the band for more financially-lucrative commercial users). A less-known but far more original source of amazement in official circles is the takeover of broadcasting channels.

The first occasion when this happened in the UK (although it had previously occurred in Europe) was on April Fool's Day 1976, when BBC Radio 2 on vhf was taken over throughout the South and West of England, during the John Peel rock programme between 11.00 and 11.35 pm. The source of the problem was the BBC relay station at Rowridge on the Isle of Wight, which takes its vhf signal off-air from Wrotham and in turn rebroadcasts it to other repeater stations as far away as the Channel Islands. The pirates, on this occasion led by the mysterious 'Captain', planted a small, low-power stereo vhf unit on Wrotham's frequency in the hedges near the relay station, and simply swamped the legitimate signal with a stereo programme originating from a cassette machine in the aforementioned hedge. BBC officials were powerless to stop the offending transmission—a bizarre take-off of the John Peel show with various banned records and strange 'anti-metrication' commercials warning householders that failure to metricate would lead to 'waking up in the morning to find your house has been bulldozed. . . Metrication: You Know It Makes Sense'. Thirty-five minutes into the illicit programming, BBC engineers managed to replace the off-air signal with a mono, poor-quality land-lined feed from a Long Wave receiver 'somewhere in England'. Listeners later in the evening heard a continuity announcer apologise, rather strangely, for the fact that 'some listeners may have been receiving the wrong programme'.

The following year very nearly the same occurred again, this time after BBC vhf radio had closed down. Both Radios 2 *and* 3 were re-activated at three in the morning by an odd signal claiming to be 'KSAT—Europe's first satellite broadcasting station transmitting to North-West Europe!' The three-hour programme went out without interruption and consisted of music. And this, too, was in stereo. It was also relayed by a pirate repeater station in London on another channel, receiving Rowridge off-air!

But the mind-bender of all time was yet to come. Following the first Rowridge takeover in 1976, there had been speculation in the trade press that a tv transmitter would be the next to fall to the mysterious 'piggy-back pirates'. An article in 'New Scientist' predicted a takeover by Christmas '76, according to allegedly 'informed' sources. It never came. It was almost a year later that the forecast event took place, and the circumstances were even more strange than anyone could have imagined.

TV stations are far harder to 'get at' than radio transmitters. There are many tv repeaters in the UK, but most of them are heavily guarded, not by men, but by sophisticated electronic devices that monitor the signal and automatically inform a central monitoring station if anything untoward occurs. And, of course, jammers have to deal with both video and audio signals. On the video signal is a test system called ITS (insertion test signal) which is designed to indicate faults by means of video test waveforms. A potential pirate would somehow have to inject a signal and rebroadcast the ITS intact to avoid the transmitter being switched off immediately. In the final event, the audio signal only was taken over, but this would have meant receiving the composite signal, extracting the ITS and video and retransmitting them, while simultaneously inserting a new audio signal. Very sophisticated equipment would have been required to do this without detection, yet, somehow, it was done.

Even more remarkable was the way in which the relay station at Hannington, near Newbury, was got at. Hannington receives its signal off-air from—would you believe?—Rowridge and transmits Southern TV to much of Southern England. The receiving antennae are both high up on the mast and highly directional. The transmitter itself is approached up a long, shallow hill, giving no nearby high-point to aim into the receiving antennae. Transmission must have occurred from almost directly under the tower, to do nothing less than 'blast' into the antennae and overcome their directional properties, the only alternative being to fire into the beam from the nearest hill some miles away. Both options would have needed either extraordinarily high power (impossible from a portable location) or massive aerial systems that could hardly be hidden from view. Yet it happened. Even today the authorities are uncertain as to how it was done. It was certainly no 'in-house' job.

But most bizarre of all was the message. It came over thousands of tv sets during the early-evening news spot. Preceded by a strange humming, a seemingly electronic voice announced that it was 'Vrillon, representative of the Ashtar Galactic Command', and warned the governments of Earth to lay down their weapons to avoid the risk of destroying the entire planet. Strange words indeed, yet UFO researchers from many parts of the world have suggested that this form of message is quite usual in the 'flying saucer' field and has many hundreds of antecedents. They also suggest that this sort of communication, taking over a broadcasting channel, while unusual, is by no means without precedent. It was 'obviously' a hoax but, as a letter in 'The Times' pointed out, there is no way we can be *certain* of this—while the mystery remains unsolved.

Almost curiouser, however, was the reaction of the Press to the event. The broadcast went out on a Saturday, and was picked up by the weeklies, the dailies on the Monday, and by Independent Radio News almost immediately. Almost without exception they stated that Vrillon had threatened the world with 'intergalactic invasion', something that was never even hinted at in the message itself. The following day IRN obtained a good-quality, off-air recording of the event, but merely changed their broadcast announcement to include 'edited highlights' of the transmission. However, although they *must* have listened to the tape, they persisted in leaving the 'invasion' reference in their copy. The broadcast aroused considerable phone-in comment during the following week but, although several listeners mentioned the discrepancy, it was never corrected. So much for objective reporting: maybe paranoia ruled OK?

'The Space Agency'

New BGW amp ▲

The latest from BGW: a pair of professional stereo power amplifiers types *750B* and *750C*. 'Differing mainly in their front-panel metering displays, these new top-of-the-line units combine characteristic reliability with tremendous power', it says here . . . 'A full 360W per channel at 4 ohms'.

'Unique protection circuitry, massive heat sinks and a low noise, rear mounted fan with a removable filter element . . .' smoothly hummed as Erik gunned his machine into life with a jab of a black leather riding boot. "Ich kann nicht autobahnen gefinden", he muttered as Heidi sunk her supple fingers into the depths of his (cont p94).

'Equally important, speakers are protected under catastrophic conditions by BGW's exclusive arc interrupting design . . .' etc.

BGW Systems, PO Box 3742, Beverly Hills, Ca 90202, USA. Phone: (213) 391 0320.

UK: Webland Electronics, 129 Walham Green Court, Moore Park Road, London SW6 2DG. Phone: 01-385 9479.

AES digital deliberations

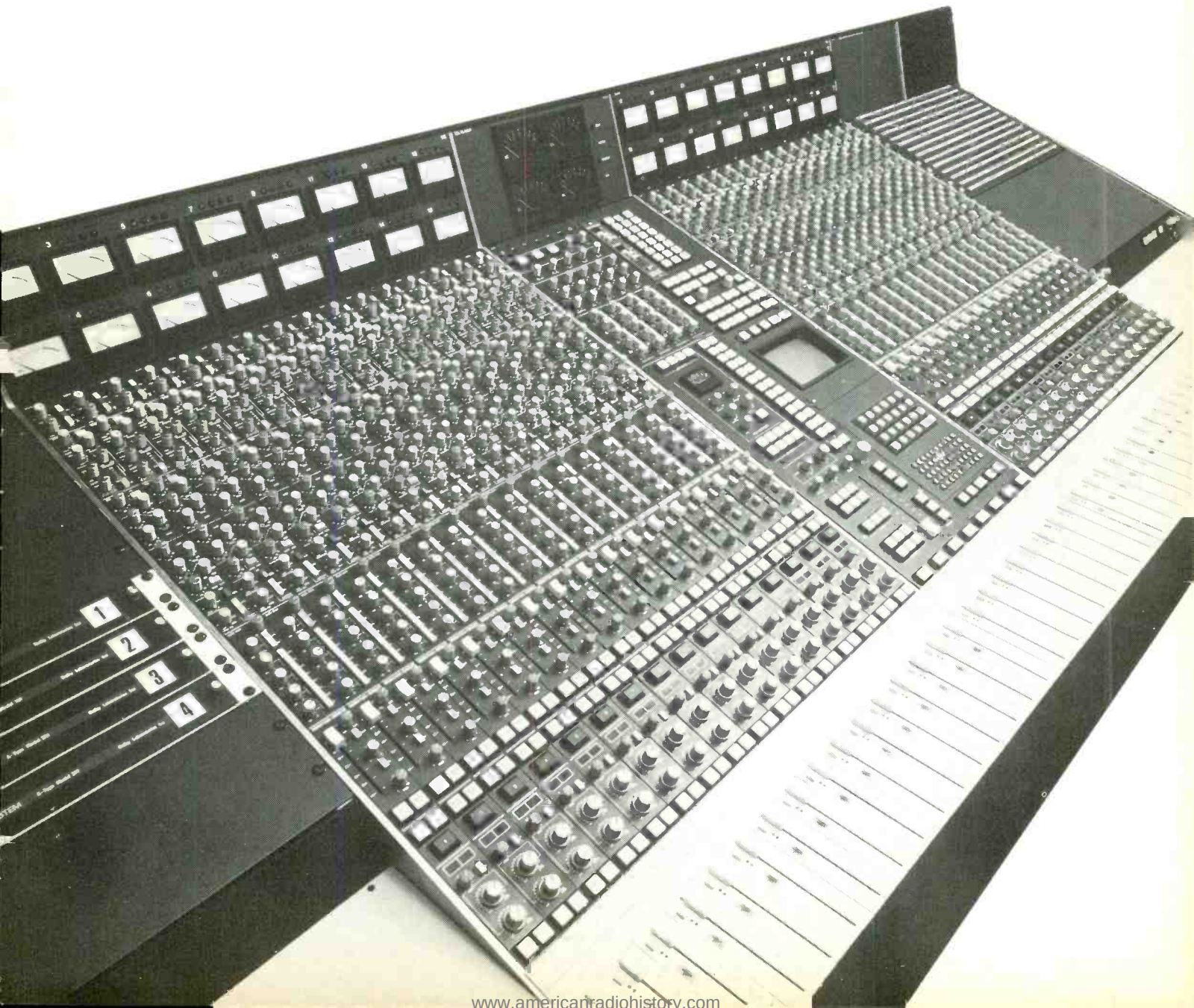
The Digital Audio Standards Committee seems to have made further progress, following the latest meeting at the Hamburg AES. A report

26 ▶

If you aren't thinking about this you shouldn't be buying a console.

Solid State Logic Ltd. Church Rd. Stonesfield Oxford England. Telephone (099 389) 324.

U.S.A. — Australasia: Sierra Audio Corp. Burbank California U.S.A. Telex 691138.



issued after the event stated that the first choice for sampling frequency was 44.05594 kHz; this would cover all audio digitisation for both consumer and professional applications. The rather exact nature of the choice derives from the line period of television pictures; when digital audio recording becomes a low-price reality, the machines used will be adapted from helical scan video recorders. This particular sampling frequency expedites the adaptation.

From the point of view of digital signal processing, the Committee felt that there was some case for a second sampling frequency standard of 50 kHz. The higher frequency would certainly help the implementation of such features as varispeed. Further studies of the problem are to be presented at the next meeting.

Also discussed was the analogue-to-digital conversion process. The principal agreement was that, for main channel applications, digital words should be 16-bit length encoded in two's complement. No complementary emphasis should be used in the processing chain. There were several other detailed conclusions relating to the further characteristics of digital processing that would appear to have sown the subject up fairly firmly—or at least until somebody within the AES finds another digital axe to grind.

Accessories

Amber has released details of a wide range of accessories for use with its *4400* test set (reviewed in February 1977 issue of STUDIO SOUND). All the units are designed as a series of add-on-extras to make the test set even more versatile than it already is.

The *441* recorder interface permits an external standard XY recorder to derive plot data from the *4400* main memory, or in real-time in unison with the digital plotter within the *4400* mainframe.

The *4416* precision programmable attenuator permits the basic test set to perform two additional operations: it enables plots of gain/loss transfer functions, and allows weighted measurements to be made for subsequent plotting on a linear scale. Possible applications include the production of transducer frequency response curves differentially with that of a standard test transducer. Attenuator control is by either an 8-bit digital word or linear voltage control.

The *4410* narrow-band filter/distortion analyser, when used with the *4400*, enables narrow-band spectral analysis and distortion vs frequency plots. The unit contains a low-distortion sweep oscillator and narrow bandpass or reject filter tracking in synchronism with the oscillator. The swept range may be up to three decades between 10 and 100k Hz. In the band reject mode, the residue can be plotted to provide distortion curves of the normal variety. Distortion curves may also be made in the bandpass filter mode with the filter locked to the harmonic under investigation.

The *4420* acoustic measuring package extends the basic range of the *4400* specific to basic acoustic measurements. It comprises digital delay line, send/receive gating circuit, programmable sinewave oscillator, programmable attenuator compressor, dual microphone preamplifiers, reverberation processor, precision filter set, warble generator and weighting networks.

Amber Electro Design Ltd, 4810 Jean Talon West, Montreal, Canada HP4 2N5.
Phone: (514) 735 4105.
UK: Scenic Sounds Equipment, 97/99 Dean Street, London W1V 5RA.
Phone: 01-734 2812. Telex: 27939.

Very quick indeed

Within 30 days of receiving the order, Audix, in collaboration with Dell Technical Vehicles of Southampton claims to have delivered a complete sound ob truck to the docks for delivery to the Solomon Islands. The van was required for the independence celebrations in July this year.

Acceptance for the Audix tender came on February 20 the latest delivery date for March 20.

The vehicle chassis is a standard *Range Rover* incorporating the usual air conditioning, reinforced roof rack and special sun shields for all the windows. The technical spec includes an eight-channel Audix mixer, two tape machines, a turntable unit, music landline link terminal plus radio telephone studio talkback. It also contains its own portable petrol generator.

Audix Ltd, Station Road, Wenden, Saffron Walden, Essex CB11 4LP.
Phone: 0799-40888.

Electro-Voice UK sales

E-V tells us that the new address of its UK sales manager is:
Mr J C Cook, Gleve House, Wood End, Ardeley, Stevenage, Herts SG2 7AZ.
Phone: 043885-465.

Sony man

The new managing director of Sony (UK) Ltd is Bill Fulton, who was previously sales and distribution director, a post he has held since 1977.

Music centre

A group of extremely new wave electronic music buffs have put together some ambitious plans to establish a British centre for electro-acoustic music. Their proposals would also include the formation of a British Electro-Acoustic Music Association.

According to reports from the would-be founders, experts from 21 UK computer and electronics music laboratories met Arts Council officials to discuss the venture. The object of the meeting was 'to agree proposals for the formation of a National Association in the near future'.

The outcome of the discussion was not reported.

The apparent object of such an association would be to 'rationalise the work of hitherto isolated EA music laboratories and create an integrated network of specialist research with improved internal communications, business and public relations.'

It is proposed that the electronic music centre would be situated in London, and would act as national headquarters for the association as well as shop window for its various activities.

In moral support of their venture, the authors of the policy statement invoke the name of Boulez and Stockhausen, pointing out that *avante garde* music has always led the way in technical innovation, defining needs and creating prototypes of new musical experiences. They also say that today's *avante garde* composer is still 20 years ahead of the industry in charting the evolution of taste and audio technology.

The authors maintain that the gap can be shortened, given closer co-operation between research and industry. 'The centre will offer specialist advice to industry on the latest developments in systems design and presentation, as well as introducing new forms of audio-visual entertainment to the public... Provisional specifications for the centre are a sound theatre, studio and equipment testing laboratory, workshop . . . restaurant and exhibition facilities, including an international conference centre.'

The statement continues further to a considerable length.

Overall, it's a fairly harmless idea coming under the heading of crackpot thesis rather than Arts Council rip-off. The trouble is, as with all attempts to exploit new art forms, there is never any money to back it up. The authors of the thesis hope to find sponorship from within the pop music industry (sic). Unless you happen to be the other half of 10cc, there is no bottomless pit of finance, if any at all. The very idea of Mickie Most spreading the bread for an international conference centre, complete with piped Stockhausen in every water closet . . . Ho, Ho, Ho.

However, it could just be that the 'Guardian' will decide to put its artistic weight behind the project, in which case the poseurs on the Arts Council will undoubtedly cave in.

Frank Ogden

Audix ob vehicle for Solomon Islands

Prime Time™

Digital Delay Processor

professional quality delay plus special effects

Lexicon's new Model 93 "Prime Time" digital delay processor gives recording studios and entertainers an easy-to-use professional quality time delay with special effects and convenient mixing all at a price you can afford. It combines a degree of flexibility and versatility never before offered in equipment of full professional quality.

- Two delay outputs independently adjustable from 0 to 256 ms
- Complete mixing for delay and reverb processing, freeing up main console channels and tape tracks
- Integral VCO for special effects like vibrato, doppler pitch shift, flanging and automatic double and triple tracking
- Long delay special effects — up to 2 seconds
- All dynamic functions can be footswitch controlled
- 90 dB dynamic range, total distortion below 0.08% at all delay settings

Lexicon

Lexicon, Inc., Waltham, Massachusetts 02154, USA

F.W.O. Bauch, Ltd., 49 Theobald St., Boreham Wood/Herts WD6 4R2, Telephone 01 953 0091

studio diary

The R G Jones re-build that almost didn't

The redesigning and rebuilding of R G Jones Studios in Wimbledon is now complete. The changes, which include all parts of the building, took nearly seven months to complete and were delayed due to the liquidation of F G Minter the main contractor.

Sandy Brown Associates, fulfilling the dual roles of architects and acoustic designers for the studio and control room, have, also incorporated a new reception area, kitchen, tape library, and additional office space in their design. R G Jones tell us that regular clients have been impressed by the transformation and improved facilities, particularly the new studio and control acoustics.

A removable carpet over parquet flooring and very large acoustic screens mean that acoustics can be varied considerably in different parts of the studio, successfully used recently to produce very live drum and guitar sounds. Strings and brass are sounding much brighter and recent recordings of film and television music have shown that good separation can be achieved with up to 30 musicians playing together. A number of deep, low-frequency absorbers have been used in the drum booth.

Since re-opening the studio has produced several albums and singles with artists including Cleo Lane, Franck Pourcel and His Orchestra, Carl Douglas and Johnny Wakelin. Television music for Mike Batt and Lulu, and film music for France have also been recorded.

Despite the high cost of the rebuilding and additional equipment, R G Jones claim that their rates for 16 and 24-track recording are still competitive.

R G Jones Studio

Marcus Music goes 46-track

Opened in 1974 by Marcus Osterdahl as the first 24-track studio in Sweden, Marcus Music Recording Studio now tell us they are the first to go 46-track, using the *Minimag* tape sync system.

The control room boasts a Harrison 40/32 with an Allison *65k* programmer for automated mixdown. Tape machines are all Lyrec, and monitoring is via a JBL tri-amplified system in quadraphonic format. The studio, at 60m², can accommodate about 30 musicians and, Marcus claim, is the first outside the USA to be using a Pollard *Syndrum* electronic drum set.

Abba have been frequent visitors to Marcus Music, and their own studio, presently under construction, will be equipped with almost identical equipment. Well, they do say imitation is the highest form of flattery . . .

Northern Eastlake treatment

Arctic Studios Norway, possibly one of the most northerly studios in the world, recently had its control room sorted out and rebuilt by Eastlake. Initial reactions are that the treatment made a 'really fantastic difference' and has shown up the glaring faults of the old room, which suffered from standing waves and a lousy bass-end (painful).

Centre-piece in the new control room is a three-year old Helios console equipped with 30 inputs, 30 direct outputs and eight main groups. The desk was originally designed for quadraphonic recording, but has never been used in that format. In fact, the control room has full quad *TM3* monitoring, but only the front pair contain any drive units. If there is a demand, Arctic may complete the other pair.

Ancillary gear includes a *Scamp* rack housing six *F300* noise gates and six *SO1* compressor-limiters; four Kongsberg compressor-limiters; a Lexicon *Delta-T 102* ddl; an EMT four-output echo unit; a pair of Master-Room reverb units; an Eventide *Instant Flanger* and *Harmonizer*; and a Marshall *Time Modulator*. Mastering is handled by a 24-track 3M model *M79* machine, with a two-track *M79* on hand for reductions. Other tape machines include a pair of high-speed Revox *A77*s and a Ferrograph *Logic 7*. A full complement of Dolby *361* units are on hand to keep the hiss down to reasonable levels.

There are plans for the existing studio (some 19m deep by 10m wide) to receive the Eastlake treatment some time later in the year.

Arctic Studios are located at Ovre Bakklandet 2-4, 7000 Trondheim, Norway. Phone: Trondheim 24574.

And now—Air Montserrat

Montserrat, the Caribbean Crown Colony island, is to be put well and truly on the recording industry map by Air Studios, London. They are to build a major studio complex, to be known as Air Studios Montserrat, on the tiny island, complete with 15m swimming pool and sleeping accommodation. Total available space is 23 acres of land.

Dave Harries, studio manager of Air London, flies the 6500 km to Montserrat this month to oversee the project. He'll be there, for six months. The 11 x 9m studio plus control room is expected to be ready for use in September of this year. Bookings are already being accepted.

Montserrat stands a succulent 16 degrees north of the Equator, as one of the Leeward Islands. The nearest international airport is 56 km north on neighbouring Antigua. So far Montserrat has survived, with a substantial British subsidy, on export of cattle, fruit, vegetables, and re-capped tyres (delicious!).

Equipment going in to Air Montserrat will include a 52-channel Neve console and switchable JBL/Tannoy monitoring. Tape machines are to be MCI throughout, with master recording on either two 24-track machines locked in sync or alternatively a single Telefunken *M15A* 32-track machine (as yet undecided).

Denny Bridges, operations controller at Air London, is to stand in as studio manager during Dave Harries' absence.

Marquee automation

Marquee Studios has completed its current £120 000 investment programme by installing a new MCI *542* console complete with MCI automation. The control room has also been completely refurbished and improvements made to studio facilities. Furthermore, the Marquee's year-old *542* console in the remix suite has been brought up to the specification of the new studio console with the addition of a plasma light meter display unit and MCI automation. A lounge area is now being added for clients using the remix suite.

The completion of this programme, Marquee claim, make them one of the first studios in the UK to operate commercially with *two* automated consoles.

Marquee were able to remain open during refitting. Regular visitors have been Biddu with engineer Richard Dodd, who were completing the Biddu Orchestra's *Stud Theme* from the *Stud* album. The Real Thing, Linda Lewis, Bill Frederick, and Tina Charles have also been in. Biddu previously completed Tina Charles *I'll go where the music takes me* at Marquee and he is now working on more tracks with Tina Charles and Jimmy James.

Engineer John Eden has continued his work with producer Pip Williams on Graham Bonnet's album. John and Pip have also finished an album with Strapps—apparently very popular in Japan. The Japanese connection continues with engineer Phil Harding working with Japanese producer Robby Wasa.

Geoff Calver was the first of the Marquee engineers to use automated mixdown facility while co-producing with Dave McCrae, an album by Pacific Eardrum. Geoff Calver was previously busy working with producer Phil Swern on a single for folk rock duo Therapy, released in May. Geoff and Phil also completed a single for vocalists from Iceland, called Hot Ice, and Geoff has also been working with producers Ron Roker and Gerry Shury laying down tracks for Ofanchi.

Producer Robin Cable was one of the first clients to use the new *542* console in the studio when he was laying down tracks for an album by Dave Townsend with engineer Steve Holroyd. Steve has also been working with producer Martin Birch on Wayne County and the Electric Chair's new album, which will be released in August.

John Eden has been working with producer Geoff Westley on tracks for ex-Hollies man Terry Sylvester, finding time to co-produce with Status Quo's Francis Rossi an album for Nutz.

Finally Marquee Studios recently recorded the Scottish Football World Cup Squad, overdubbing tracks laid down by Rod Stewart produced by Jimi Horowitz with engineer Phil Harding.

Marquee's new model 542 automated console

Photo courtesy Nicholas ffrench

◀ *Surrey Sound control room. Note the ancillaries 'bin' on the right.*

Surrey Sound update to automated 24-track

Surrey Sound Studios tell us they have recently installed an MCI *JH-400B* console complete with automation (a combination unique in the UK) linked to an MCI 24-track tape machine. All this would not have been possible (moneywise) without extensive work coming the studio's way from a string of 'name' artists, in particular Lol Creme and Kevin Godley. Lol and Kevin have been in recently recording some of the material for their forthcoming album, which we hear will be less conceptual than *Consequences*.

Company md Nigel Gray is naturally delighted by the exceptional growth of Surrey Sound since it's inception in 1975. The studio, a converted Co-operative hall, was initially equipped on a budget of £1200, functioning as a rehearsal space and demo studio.

'Actually I was motivated by my own rehearsal needs initially,' said Gray, a qualified general practitioner. 'Whilst studying at Birmingham University I got involved with a band and bought some recording gear. The recording process became more and more fascinating to me and I soon ran out of space in my living room. Tape decks, amps and microphones were all over the place! So I looked around for somewhere to use the equipment properly. The Co-op hall, holding 40 musicians, was ideal; large, with good natural acoustics.'

Gray persuaded a reluctant bank manager to part with the money with the plan of hiring facilities to other musicians. 'He thought I was mad,' Gray remembers, who with his brother Chris worked overtime installing gear and subsequently engineering sessions. They found the inherent acoustics of the 186 m² hall very favourable and had only to coat wall areas with acoustic tiling. Following a policy of profit reinvestment, the original four-track equipment was updated to 16-track using Ampex *MM1000* machines and an Alice desk. From then on the studio reputation grew steadily. Gray was so impressed by MCI's approach to console design that, when the time came to expand, he specified their equipment. 'Now that the desk is in and working,' said Gray, 'I'm amazed by the almost total lack of desk noise; even the MCI engineers commented on the fact.'

Any further studio improvements on the way? 'We've already increased our repertoire of ancillaries and tape machines considerably,' said Gray. 'One thing we'd like to upgrade is our drum booth. To be honest, as a drum booth, it's awful! When we called in Sandy Brown Associates to check the acoustics, the studio was pretty flat but the drum booth was rather puzzling. However, we plan to install a false ceiling with suspended traps, and reposition the glass partition to overcome the acoustic problems. At present we use the booth only for isolation of di or close-miked sound, and drums are recorded in the studio'.

Well, from four to 24 automated tracks in two years can't be bad, but we were particularly amazed by Surrey Sound's hourly rate. OK, so we don't normally make a point of publishing studio rates, but automated 24-track at '£25 negotiable' per hour is a justifiable exception!

agony

Recently there has been much talk about how Petula Clark is to sing songs with Roddy Llewellyn, occasional friend of Princess Margaret. Petula's husband Claud Woolf is guiding Roddy's career, and a fly on the studio wall during a session at which all three were present predicts at least widespread popularity for Mr Llewellyn in the recording world. It was a Pet Clark session, but during the morning Llewellyn slipped unobtrusively into the control room. Nothing special about that, of course. But what he brought with him and liberally dispensed for elevenses was a very special bottle of five star Martell brandy. 'That man will go far' said one happy session man.

business

ADRIAN HOPE

Digital recording

INTERESTING THINGS are happening on the digital front. Development work carried out by the BBC jointly with 3M has been well reported in these pages, but less well publicised has been the manner of progress by Sony on two fronts. On the professional front Sony has developed a fixed head multitrack, generally similar to that from 3M. Full details aren't yet available because they won't be fixed until agreement on a digital encoding standard has been reached by the AES committee.

But there are no secrets over the options that Sony has developed. The fixed-head machine will use 25.4 mm tape running at either 38 or 57 cm/s past stationary heads with each channel of sound ie equivalent to each track on an analogue machine) spread over either two or three tracks of the tape. For a tape speed of 57 cm/s the spread will be over two tracks and for the lower speed of 38 cm/s spread over three tracks.

Here rises an important point. Conventionally studio engineers think and talk of 'channels' into a mixer desk with mixdown and recording onto 'tracks' on the tape. In digital parlance the words 'tracks' and 'channels' are used rather differently. If the mixer desk has 16 or 24 outputs in an analogue situation each output goes to one tape-track, but in a digital situation each output is thought of as a 'channel' and may be spread over several 'tracks' of a tape. Thus, if you apply digital parlance to a normal 24-track studio situation, 24 'channels' of sound will be recorded on 48 or 72 digital tape tracks.

Just as there is no agreement yet on what tape speed or track spread to adopt as standard, so there is no agreement on what sampling rate to use for the analogue-to-digital conversion and what digital code to use in describing such samples. One suggestion at 50.4 kHz for a linear, fixed head machine and at 44.056 kHz for systems that rely on a helical scan tape machine to record the digital signals. These rather odd sampling frequencies were not just chosen out of a hat but are governed by factors such as the presence in the video waveform of synchronising pulses and frame blanking.

Sony is unambiguously in the lead on domestic, or semiprofessional, two channel stereo digital recording. Already there is an add-on unit, the *PCM1*, which can be used with the domestic *Betamax* video cassette recorder or the semi-professional *U-Matic* machines. The NTSC *PCM1* sells in Japan for well under £1000 and a similarly priced PAL unit for Europe is expected soon.

An NTSC *PCM1* and an NTSC *Betamax* have however, been brought into this country for demonstration and evaluation (see July p96) which has been on loan recently to Enigma Records who have been using it alongside analogue machines to record a series of musical sessions. Results so far are extraordinarily encouraging and it is on the cards that Enigma will issue a commercial disc recording (in conventional analogue form of course) made from digital tapes. Enigma's experience with the *PCM1-Betamax* system will be the subject of a future feature in STUDIO SOUND. But as an appetite whetter, suffice it to say now that recordings made with the *Betamax* running at 2.4 cm/s on a video cassette recorder plus PCM converter system together scheduled to cost less than £2000, and using a cassette of 12.5 mm tape with around three hours continuous playing time costing around £15, were *better* than 38 cm/s analogue recordings made at the same time and using a stereo Studer with Dolby A. Watch this space for more details.

However, in Japan, Sony has already launched a Mark II version of the *PCM1*! This samples at the same rate as the *PCM1* (44.056 kHz) but describes the samples with longer digital words (16 bits rather than 13 bits per sample) and has full error correction, rather than error detection and buffer memory compensation as with the *PCM1*. Unfortunately the price to be paid for those three extra bits per sample and error correction (more powerful than that used in the Apollo spacecraft computers) is heavy in terms of cash. The Mark II PCM unit is priced at around 20 times the cost of the *PCM1*, ie around £20k. As yet there are no plans for a European launch, but to paraphrase the immortal words of the Six Million Dollar Man, 'We have the technology, all we need now is the market.'

And selling digital audio to the studio industry will initially not be very easy. A small company like Enigma, with very little investment in analogue equipment and no interest in multitrack, can reasonably afford to go digital. But for a 24-track studio to go digital it will need some very brave decision on the part of the money-man. All the analogue equipment will have to be junked, and replaced by equivalent facilities in digital format. And remember that with digital tape you can't simply cut and stick as with analogue tape—you have to edit electronically in the manner of video. But once engineers start to hear and see for themselves what going digital means, someone might just be brave enough to be the first to take the decision. Electronic editing can be very precise, and of course is available at the push of a button. Digital tapes can be copied repeatedly with virtually no loss of quality or increase in signal-to-noise ratio. Wow and flutter virtually disappears to below measurable limits and distortion levels drop dramatically. It becomes less critical to line up machines accurately and, with strong error correction in the code, tape dropouts are inaudible.

But perhaps most important of all is one of the least obvious advantages. It is now common to find video recorders with the facility to replay 'slow' or 'fast' to provide slowed down or speeded up motion. It is quite feasible, by using related technology, to devise a digital sound recorder that can produce sound slower or faster than the recording rate, but without any change of pitch. Think what it will mean for tape editors. A musical passage can be played at ½ or ¼-speed, without pitch distortion of the music and with only the tempo changed, thereby making it far easier to find the perfect edit point.

Time will tell

HIGH-POWERED publicity is a risky business. When Roddy Llewellyn was booked into Air to make his 'recording debut' virtually every national newspaper and tv news programme ran the story. But none of them seemed to mention the studio by name, which must have been something of a disappointment to Air London who had hosted the press. Also the public at large is now awaiting eagerly for Roddy's first lp, which they imagine must now be out very soon in fact the Air session was just a voice test, rather than a recording proper, and it could be quite a while yet before there is any lp to issue.

What's more a fair percentage of the whole wide world is now watching and waiting for Roddy to fall flat on his face. Remember what happened to Brinsley Schwartz? To launch them the press were flown to the States on a massive binge and the poor group had virtually no chance whatsoever of living up to the image created for them. Roddy Llewellyn will have to produce a very good record to match up to all that original publicity. There is, however, one thing in his favour (apart from being Princess Margaret's friend) and that is that he is managed by Claude Wolff of Petula Clark fame. It's unlikely that either Wolff or Clark would waste their time on a no-hoper. But only time will tell whether the singer can transcend the hype.

But meanwhile . . .

THE LLEWELLYN voice session was in the Studio 3 Necam mixdown suite at Air, where recently I chanced on a mixdown and overdub session centering round percussionist Frank Ricotti and a pretty extraordinary percussion instrument, the *Syndrum*. This is a four-drum percussion kit made by Pollard in the US. There are only a few *Syndrum* kits in the UK mostly bought by drummers at well over £1000 a time, but there is one available on hire 32 ▶

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for about £24 a day (at the time of writing) from Julians Studio Instruments Rental.

Four shallow tom-tom drums each contain a microphone looking rather like a small loudspeaker but working in reverse. The lead from each mic is plugged into a small console with four separate synthesiser sections so that the sound picked up from each tom can be individually shaped. There is also a foot pedal to double up on some of the console functions. A single tap on the drum can be transformed into a note or a series of notes at any pitch with or without the sound of a snare added electronically. A simple drum phrase can thus produce a complex bell-tree effect, the sound of birds, an anvil or even a normal drum kit sound.

The *Syndrum* comes complete with a chart giving basic guidance on what control settings will produce what basic sounds. But the whole point of the system is that a very simple percussion pattern can be transformed into an almost infinitely wide range of sounds, with their pitch pattern either preprogrammed or controlled at the foot pedal. In many respects the *Syndrum* serves the same purpose as a keyboard synthesiser. But it has the advantage that it can be incorporated by a drummer into his normal kit and preset to produce a special effect literally at the touch of a drum stick.

Drums were just about the last instrument of a live band that could be truly acoustic. Now it seems as though electric drums are to join electric piano, electric bass, electric guitar, organ and electrically-bugged wind instruments.

Gizmology

MEANWHILE news of another gadget of potential interest to studios. *The Gizmo*, invention of Lol Creme and Kevin Godley and featured on *Consequences*, will of course already be well known to most engineers. To recap briefly it's a small battery-powered device which mechanically bows the strings of a guitar, either all together or separately, to create a wide range of 'organic' guitar sounds. When *Consequences* was launched there was talk of the *Gizmo* being sold early in 1978 at around £75. Consequences itself was marketed at £11, understandable considering the 16 months it took to conceive and record, but a ludicrously high price for an album intended as much as a promotion for the *Gizmo* as an entertainment.

Although no official sales figures are available *Consequences* certainly hasn't sold well. The *Gizmo* hasn't yet sold at all but for the simple reason that it isn't yet available. The most up to date news is that manufacture and marketing is in the hands of the New Jersey firm Musictronics and initial shipments are expected in the US in August and in the UK in September. Suggested retail price in the USA will be $250, which will put it at around twice the the price already suggested for the UK. But interest in the gadget is still high and unless the price rises to unreasonable heights the *Gizmo* seems all set to become a standard studio toy.

Pitfalls of microwave (and other stories)

A WHILE BACK I mentioned the possibility of using high-quality microwave links to enable direct-cut recordings to be made on location, without the need to uproot and re-bed the cutting lathe. It was suggested that one problem with such a link might be the risk of dropout, and thus loss of a master lacquer, caused by a flock of birds flying through the beam—especially as the first plans for a link were across a bird-busy lake in Canada.

Well, a Canadian reader reckons the bird-drop risk is non existent. He acknowledges that a bird will absorb microwave energy if it gets in the way of the beam; as will any animal—just ask the American woman who recently put her shampooed poodle in a microwave oven to dry it off and ended up with medium-to-rare dog steak. But the reader reckons that in practice it isn't a real risk. Likewise low-flying aircraft aren't reckoned to be a real risk because, unless the obstructing object passes close to the transmitting aerial, only a fraction of the beam is blocked at any one time. Apparently there has only been one concerted effort to keep aircraft clear of a microwave link, and that was in Montreal in 1976 for the Olympics. The satellite communication aerials were then protected by a line of sight zone 1.6 km out from the transmitter, from which aircraft were banned.

All this may be so. But it prompts me to pass on an apocryphal story which has the ring of truth. In Australia a broadcasting company used a microwave link to beam programmes between stations across the desert. A farmer with a small-holding in the desert region was sufficiently *au fait* with microwave techniques, and map reading, to find that his land lay slap in the line of the beam. Using old timber and oil drums he erected a tower smack in the line of microwave fire. Birds and aircraft moving through a microwave beam may not block it, but a solid tower of old oil drums certainly will. Reputedly it cost the broadcasting company a fair price to get the tower knocked down again.

While on the subject of apocryphal tales here's one that I've now heard in slightly different form from no less than three separate and reliable sources. Western diplomats visiting Russia are becoming increasingly nervous over bugged rooms, especially if confronted with an obliging hostess. One vip (some say it was Leonard Bernstein) visiting Moscow set about methodically searching for the bug he felt sure must be in his hotel room. He checked the lights, the curtains, the pictures and the wall panelling. All to no avail. Finally under the carpet he found what he was looking for; a slight bump which turned out to be a nut-shaped object with a couple of connecting wires. With initiative he procured a spanner to fit the nut and worked hard to free it. It proved surprisingly tight but he persevered. As the nut came free the wires tightened and broke, their ends disappearing into the floor. Downstairs, in the hotel ballroom, £50 000 worth of antique chandelier crashed to the floor.

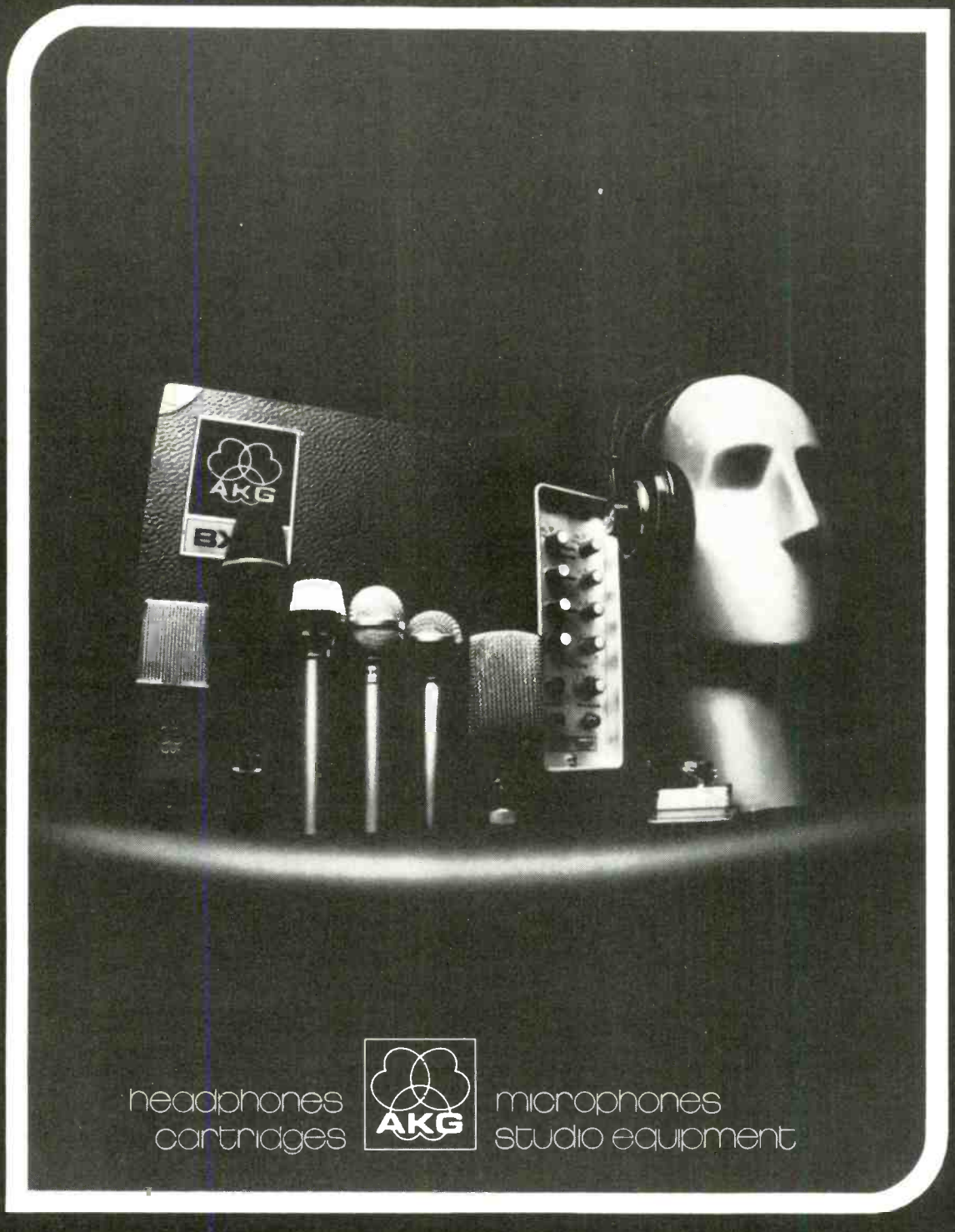
The chandelier tale is easier to swallow whole in the company of another tale that most definitely is true. A British pop musician was recording in Moscow recently and checked into his hotel on route to the studio. He looked round briefly and noted that there was no television. 'What about a tv set then, Boris?', he said to the walls and ceilings and went off to work. By the time the session was over and he had returned to the hotel room there was a tv set ready and waiting for him.

Speed freaks

RICHARD DEAN, reporting on the new Strawberry Mastering room (July issue, page 36) mentioned how Sean Davies has done something 'unique in the business' by synchronising the Studer *A80* tape replay machine to the mains, rather than its internal crystal servo (which is of course independent of the mains supply). I wonder how many readers recognise the real significance of this move, which like all the best ideas is both brilliant and simple?

In the UK the various electricity boards have a legal obligation to keep the mains supply voltage to within 6% of the nominal voltage. This represents a legal voltage swing of 29V on a nominal 240V supply. Anyone with an accurate voltmeter can readily check for themselves that voltage is very seldom exactly what it should be and in some areas is consistently high. It is less well known and less easy to check that the electricity boards work to a legal margin of ± 0.5 Hz from the nominal 50 Hz mains frequency. (Of course the frequency must average out at exactly 50 Hz over a 24-hour period to keep electric clocks accurate.) Thus there can be and often is, a drift of $\pm 1\%$ in the mains frequency and a corresponding speed drift of any equipment locked to mains frequency.

Whereas tape machines are normally independent of mains frequency, cutting lathes are not. It follows that many records on the market may have a speed error built-in of up to $\pm 1\%$ even though the hi fi world is currently obsessed with speed accuracy. The in-thing is now a record player that is crystal-controlled to an accuracy of $\pm 0.025\%$. By over-riding the internal speed servo of the *A80* and locking it to the mains frequency, Davies has at a stroke (if you'll pardon the expression) ensured that whatever mains frequency errors exist at the time of cutting they will cancel out—because both the *A80* and the Neumann lathe will drift together in mains-locked synchronism. I'll bet that once the significance of what Davies and Strawberry have done is widely recognised, the procedure will be copied in mastering rooms throughout the world. ■



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Sound on stage—Pink Floyd

In the fourth and final part of his series on stage sound, **Terry Nelson** *examines the system used by the Pink Floyd, possibly the best exponents of the philosophy 'make technology your slave and not your master'.*

WHEN I first went down to meet the Pink Floyd in 1967 with a WEM *Audiomaster* five-channel mixer, four column speakers and the staggering power of two 100W power amplifiers, I don't think any of us realised that from these embryonic beginnings the giant sound system used ten years later for *Animals*, would evolve. At that time the 'sound system' consisted of three Selmer 100W stereo guitar amplifiers (50+50 or 100 mono) and a Binson *Babu* for the guitar. However, even in those days it was evident that it is not so much the gear that is important but how you use it. The instrument cabinets (all four by 12-inch enclosures) were assembled in two stacks of three, one each side of the stage with guitar, bass and organ each having a cabinet in each stack. Fairly primitive, perhaps, but it did work and with the Floyd's use of dynamics sounded a lot better than most of the early 'heavy' groups then starting up. In fact, on the 1967 Hendrix-Move tour the Floyd were, in my opinion, the loudest group from the point of view that loud passages came over as well as the quiet ones. Whereas the other amplification was flat out all the time with the instruments struggling to get through the amplified rf!

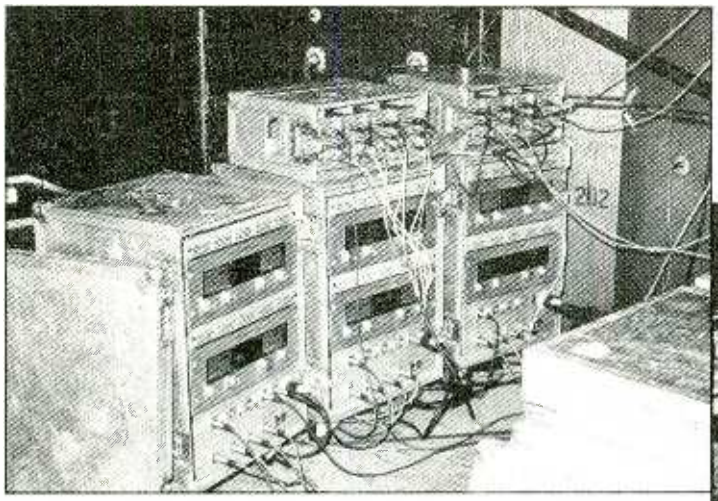
On this tour we were using four columns a side (fitted with Axiom *301*s—wot, hi-fi speakers for pa?!) and two for stage monitors, with the then princely power of between 500 and 600W. We had started off with 800W and four more columns but the cut-down setup sounded better. Microphones consisted of two Shure *Unispheres* on the drums and three vocal mics. These latter were the Sennheiser models seen on countless Floyd photos which, as well as having a good response, had the added feature of being very directional which meant that the performer had to be very close in order to get a reasonable output. This last feature was the deciding factor, since previously we were getting far too much of the instruments through the pa muddying everything up. With the Sennheisers things improved noticeably. I also took along my trusty *Echorec 2* for special effects and echo on the voices plus trying out things on the drums. By the way, it was quite amazing the complete sound we got on the drums just by using two mics—and without too much crosstalk either. It must go to prove something though, what I'll leave up to you!

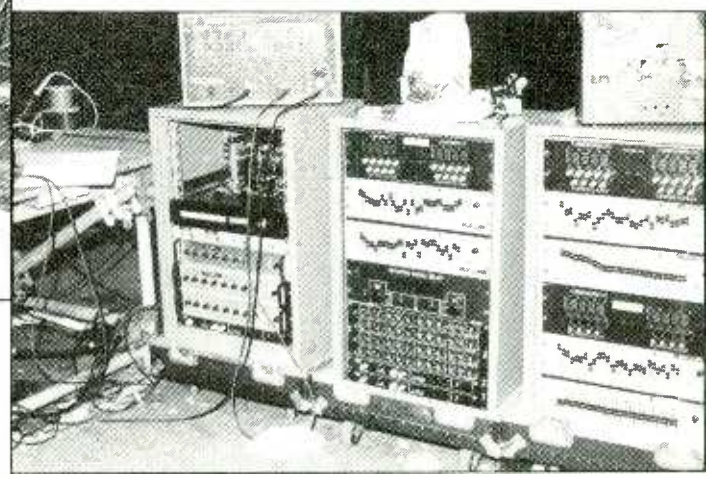
As we noted earlier, it is how you use the gear at your disposal that makes the difference. You'd be surprised what effects can be created by treating an instrument as a tone generator, and playing loud guitar chords while simultaneously pumping the volume control up and down or detuning the bass string, grabbing a handful of organ keys to make an atonal montage of sound. And processed the whole with lots of reverb and a wah-wah pedal, slow repeat echoes on voice or even just good old plain feedback on the echo unit by turning up the length of swell control. The Floyd were always into playing electronics (as was Hendrix into playing his guitar *and* amplifier) and not the other way round, so their present system only represents what seems to me to be the logical state of affairs. I last worked with the group in the beginning of '68 and only finally managed to catch up with their stage presentation again last year in Zurich. (Why is it you are always playing or out of the country when your favourite group is giving a concert?) In ten years things had changed more than a bit but the philosophy remained the same: make technology your slave and not your master.

Now might be a good time to have a look at the routeing diagram for the pa, and for the back issue hoarders to re-check out '*If pigs could fly*' in the June 1977 issue of STUDIO SOUND. However, before going on I think we can insist upon the fact that, as with the Grateful Dead, the vast array of equipment is there because of the music and not the music because of the gear. One of the problems of modern multitrack recording is that groups make records in the studio first and then play the new numbers onstage, instead of the other way round as was the case some years ago. This accounts for the fact that onstage versions of records are often much better than the records themselves, the music having benefited from being played before an audience, reaction noted and the arrangements modified accordingly. (Perhaps this also accounts for the increasing popularity of live recordings.) The Floyd, however, are still one of the few who play new material onstage first (*Dark Side* was on the road for about a year before the record came out) thus leaving the options wide open for the final version, with an opportunity to change things as suggested by the stage experience and audience reaction. This also means that the stage equipment has to be flexible enough to meet any foreseeable demands (plus a few unforeseeable ones!) since it all serves the creative process and is not there to merely reproduce a studio performance. If you back this up with the fact that the Pink Floyd are a very creative group of gentlemen, especially when it comes to using the electronic media, then it becomes apparent that all that pa equipment is there because of a desired effect.

Stage setup

As can be seen from **fig. 1**, this starts with a mixture of mics and directs from the instrument amplifiers and offstage Leslie, mics from the drums and vocals, directs from the keyboards and the output from the four-track back projector. For the interested musician amongst you, the guitar amplification appears to be a mixture of *Hi-Watt 100*s and Fender *Twin Reverbs* plus large Yamaha speaker cabinets, aided and abetted by the inevitable Binson *Echorecs*. Bass is also through *Hi-Watts* with bass bins, while keyboards are mixed through a specially modified Allen & Heath mixer. (As with the Dead, the setup is changing all the time so this lineup may only be an approximate representation.) Six stage boxes are used—first guitar, second guitar, bass, drums, keyboards and four-track projector—which pass into a patchbay fitted with miniature normalled jacks and three main outputs. The first output goes to the onstage 28/8 Midas mixer for the different monitor mixes. From the Midas there are then three main routeing arrangements: an output to wedge monitors driven





by Phase Linear *400B* amplifiers; an output to Koss headphones driven by Quad *303K* amps (used for click tracks and cueing); and a summed output of the programme material and the main pa feed to Dave Gilmour's JBL *4333* monitors driven by a Crown *DC300A* amp. (Dave prefers to hear what is going out front rather than use normal stage monitoring—remember what we said about foldback from groups—and also has his monitors equalised to stage acoustics with a Klark-Teknik *DN27* graphic.) The second output from the patchbay goes to an Allen & Heath mixer where Roger Waters can adjust the mix for his headphones, also driven by a Quad *303K*. The third output feeds the main Belden multicores from the stage to the mixing area.

Speaker array

As fans of the Pink Floyd will know, this is divided into the main stereo pa and the three 'quadraphonic' stations, the main pa providing the fourth station when the quad—or as I prefer it, surround sound—system is thrown in (**fig. 2**). The outputs from the main console go into a summing/distribution amplifier and from there to pa left and right and quad left, right and rear.

Pa left and right

The feed to each side passes through a Klark-Teknik *DN27* ⅓-octave graphic equaliser (for system equalisation) to a five-way crossover. From the crossover the low-mid and high-mid signals are routed through two dbx *162* limiters before joining the others in the Belden cable going to the onstage amplifier racks. Low-bass is handled by bass bins containing two 15-inch *Gauss 5831* bass speakers powered by Phase Linear *700B* amplifiers. Bass signals are handled in the same way but with *Gauss 5842* speakers. (In fact, the low-bass setup is only used in open-air environments so that more power can be used to get the really low end across.) Low-mid signals are via twin fifteen cabinets using *Gauss 5841B* mid-range speakers again powered by Phase Linear *700Bs*. High-mids are handled by a mixture of Altec *329A* dispersive horns with twin Altec *290E* drivers and JBL long-throw festival horns with *2482* drivers, power being provided by Phase Linear and RSD amplifiers. Finally, the treble or high end is catered for with a mixture of *HF4000* drivers with *2345* lens and cabinets containing four JBL *075* drivers and one Vitavox *S3* driver with a 4 kHz dispersive horn, power is respectively by RSD *400* and Quad *303K* amplifiers.

Quadraphonic stations

The feeds to the three quad speaker arrays each pass through a Lexicon ddl (about which more later) and then a Klark Teknik *DN27*, again for system equalisation. Next in the chain is a four-way crossover with dbx *160* limiters on the low and high-mid outputs. The bass and low-mids are handled in the same way as the main stereo pa—twin fifteen *Gauss* bass bins and mid-range cabinets both powered by Phase Linear *700Bs*. High-mids are by *HF4000s* and RSD *400* amplifiers, with Quad-driven JBL *075*/Vitavox dispersive cabinets for the high end.

All in all, this makes for a lot of speakers and amplifiers with a total output power probably in excess of 80 kW! In addition, due to the efficiency of the system the array need never be driven to the limit, so that the quality is there as well as the quantity. (A philosophy also reflected in the Grateful Dead's system.) I also noticed at the group's concert in Zurich last year that the main pa was built *up* and not out—the twin 15-inch mid-range cabinets formed towers 2 x 16 speakers high, for example—with the appropriate sound quality. The three quad stations were positioned high up on the top of the arena (the Hallenstadion is an indoor cycle track, just the place for rock concerts!?) so that the 'surround sound' effect really was around and above us.

Mix area

This is the nerve centre and hub of operations where Brian Humphries gets it all together while the group get it together onstage. Focal point of the operation is the Midas quad/stereo desk which is classed as a 64 into 34 mixer by the Floyd crew, including 40 microphone channels. (Those of you who are fond of statistics might like to know that about 4½ miles of microphone cable are used.) Coming down to basics, the desk is in three sections: two input and subgroup/aux send and return sections and master console with the quad and stereo main outputs. The first two parts of the console each contain 20 mic channels, four effect send/return groups and four stereo subgroups mixing down to one stereo output master; the third part of the console features four quad inputs, six quad subgroups fitted with quad panpots and the quad and stereo master output groups. The rest of the equipment, as can be seen from **fig. 3**, forms the complement to what is in effect a very comprehensive mobile studio used for live mixing in conjunction with prerecorded backing tapes. With the difference that the 'playback' monitors are a properly designed sound system for large venues, and that the engineering philosophy is geared to live stage performance.

The desk

The layout from left to right of the first section is 20 mic/line input channels, four send/return groups, one control talkback module, four stereo subgroups and stereo master; the second section is a mirror image of the first. (Controls as listed go from 36 ▶

right to left.) Looking more closely at each channel strip, the top starts with input gain—80 dB for mic and 50 dB for line—followed by three toggle switches for mic/line selection, 48V phantom powering and input attenuator of 20 dB. Equalisation is threeband: treble ±16 dB at either 6, 10 or 15 kHz; midrange ±16 dB at 500, 800, 1.5k, 2.5k, 3.5k or 5k Hz; bass ±16 dB at 40, 80 or 160 Hz. There is also a highpass filter of 16 dB/octave at 60 and 120 Hz, plus in/out selection. Next in line is the echo or auxiliary send section. This consists of three pots with illuminated on/off pushbuttons and pre/post toggles that are respectively linked to three thumbwheel routeing switches for the eight send/return modules. These are followed by two toggles, one for eq in/out and the other for insert cancel. The latter switch is a useful facility that allows an external processor (equaliser, ddl, compressor etc) patched into the channel to be switched in or out at will. The two toggles are followed by three pushbuttons for channel mute, solo and pfl. The channel strip is rounded off by the panpot, complete with cancel pushbutton, and three peak-reading leds indicating −15, 0 and +15 dB.

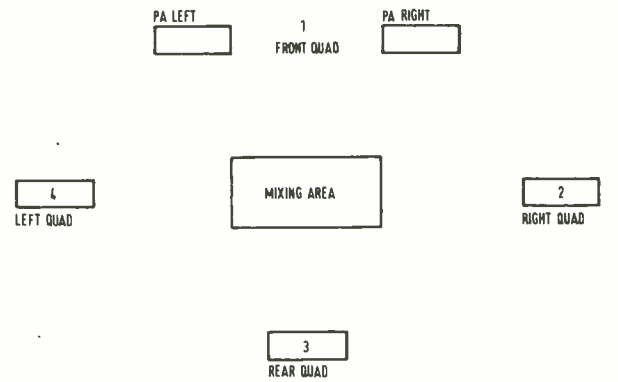
After the input strips we arrive at the send/return modules, the send section being at the top of each strip. Controls for the send output consist of output volume (−40 to +20 dBm), insert on/off toggle, solo and afl pushbuttons, plus bass and treble eq of ±16 dB at 50 and 15k Hz. The return section consists of input gain, treble, midrange (3 kHz), bass and spin—the spin control being linked by a toggle switch to either post insert on the send section or pre-eq on the return. These are followed by four pushbuttons for spin mute, return mute, solo and pfl, channel insert on/off toggle, panpot with cancel button and three peak-reading leds as already described for the channel strips.

The next module in line is the control module which contains the talkback controls and facilities, as well as a ten-frequency oscillator for line-up. Both facilities have comprehensive routeing possibilities. Also included are master solo and headphone level controls. The desk is finished off with four stereo subgroups and stereo output modules.

The master section comprises the four auxiliary quad inputs, six quad subgroups plus quad and stereo output masters. The auxiliary quad inputs are used for the four-track projector, backing tapes, keyboards etc, each input having four trimpots for each 'track' of quad signal with ganged bass, mid and treble controls plus quad channel fader. Metering is by peak-reading led vus mounted above the subgroup and group modules. Similar meters are also fitted above each of the two control modules for checking on individual channels, the meter being activated when the relevant pfl button is depressed on either an input or aux return channel.

Routeing is accomplished by 16 illuminated pushbuttons mounted above each channel strip and send/return module—eight buttons for each of the eight subgroups, six for the quad subgroups, plus two buttons for the 'Q' and 'SM' switches. The former controls the output from the six quad routeing buttons, enabling the channel to be assigned to a preset quad position independent of the stereo routeing and thrown in by simply depressing the relevant Q button. The SM button routes the channel directly to the stereo output master fader, bypassing the stereo subgroups.

FIG. 2 PINK FLOYD SPEAKER LAYOUT

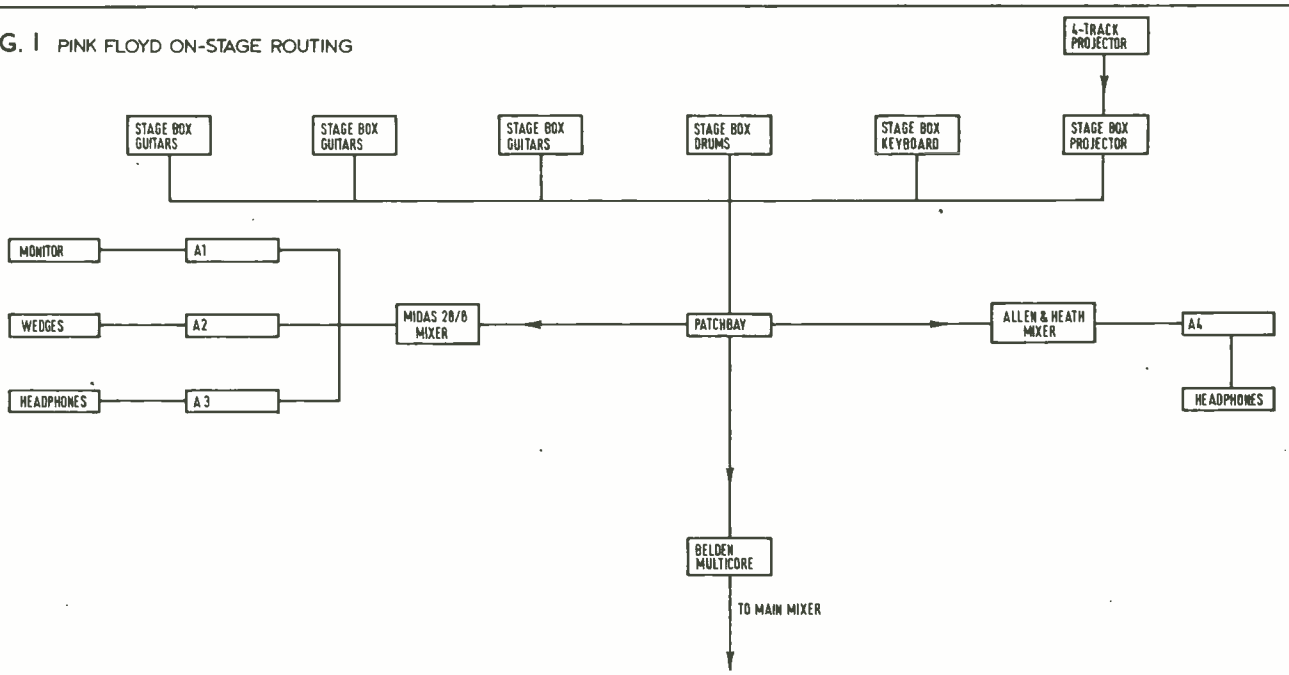


Operation

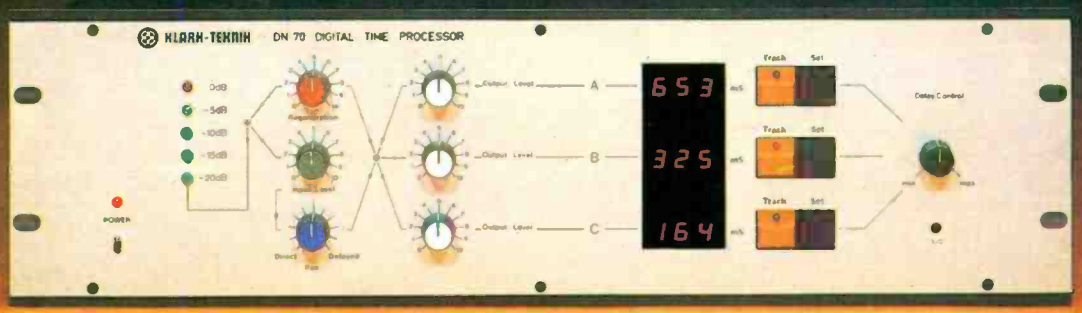
Though the desk may seem fairly straightforward by normal studio standards, it is also obvious that it offers a lot of flexibility. The provision of an extensive patchbay and choice of echo and auxiliary sends makes the job of creating special effects a relatively simple one from the point of view of patching in equipment. A quick look at **fig. 3** will confirm that a lot of auxiliary processing gear is available, and it may be an idea to take a brief look at their functions. Working from left to right (or anti-clockwise):

Eleven *Kepex* noise gates used on the drum mics to clean up the signal. Though the *Kepex* gates work fairly well in a stage 38 ▶

FIG. 1 PINK FLOYD ON-STAGE ROUTING



The new DN70 digital time processor.



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situation, Robbie Williams and Nigel Taylor of Britannia Row tell me that they are difficult to set up correctly and that other solutions may be envisaged.
Two Urei *1176LN* limiters, one each for Dave Gilmour and Roger Waters for use on their vocal mics.
Gelf phaser for use on vocals. In fact several of these units can be employed for special effects, such as phasing the whole pa!
Marshall *Time Modulator*, again used for special effects on vocals.
Lexicon *Delta T* ddl, used for adt on vocals and another *Delta T* for doing adt on the drums.
Sixteen channels of dbx *310D* noise reduction cards used in conjunction with:
Master Room MkII reverberation unit, together with Lexicon ddl patched in on the feed, mainly for vocal use but which finds its way into other situations as well.
Roland *Space Echo*, principally used for echo effect on instruments.
Otari eight-track tape machine. Four tracks are used for the prerecorded backing tapes, the remainder for cue and click tracks.
A Urei *LA3A* limiter is used on the cue track of the Otari.
Brenell eight-track tape machine as the 'backup' system in case of failure of the Otari.
Four-track magnetic sound from the 35 mm backstage projector.
dbx *160* limiter, also used for cue tracks going to the stage.
Urei *LA3A* limiter used in conjunction with an MXR ddl on click track to stage. This is only used when the ddl on the quad inject to the front pa is on (more later).

This ends the list of equipment connected to the dbx noise-reduction.
Next in line is yet another Lexicon *Delta T*, ddl, complete with logic link. This piece of equipment is an example of the price of perfection, being used for long repeats in, for example, *Us and them* from *Dark Side*. Previously, the band were using a Revox with varispeed for repeat echo, but due to operational hassles and varying quality—the repeats *have* to be in time with the music otherwise it's very 'ard—plus a certain amount of pleading on the part of the group, the Lexicon was added to the team. The logic link from the main frame is used to preserve the quality of the repeat, ie analogue input to *Delta T*, conversion to digital, output to logic link, still digital, return to main frame and output reconverted to analogue. In this way high-quality repeats are available with fine control on the timing. By now some of you must be thinking that a considerable number of *Delta T* ddls are used (meaning a considerable amount of money) and wondering about the economics of the setup. The reason for this, aesthetics apart, is that the *Delta T* is the most rugged ddl for road use, again proving the point that often the most expensive is the most economical in the end.
Court Acoustics ⅓-octave real-time spectrum analyser is used in conjunction with the Klark Teknik *DN27* graphics for system equalisation. As mentioned earlier, the control modules in the desk provide routeing for line-up tone or pink noise to be sent to individual speaker systems for precise setting up of crossover points and output levels.
Nakamichi cassette for recording performances or playback of 'mood' music.
Three Aphex stereo units, one each for saxophone, guitars and vocals. These are the latest additions to the Floyd's arsenal, brought in during the American tour. They are used to recreate the mysterious 'Haas' effect—giving the sound a sort of three-dimensional effect—a phenomenon easier to hear than to describe.
Last but not least is a Lexicon *Delta T* on the quad signal inject to the front pa. (The main stereo system forming the fourth 'quad station'.)

In addition to the equipment shown, there are also parametric equalisers, compressor/limiters (used, for example, on the mic and di feeds from the bass guitar), de-essers etc that can be patched in for additional processing on channels that need attention.

We can also now go into the function of the ddls on the four quad stations. The mix area is always positioned in as central a position as possible, that is at the centre of a square in order to obtain the best balance between the main stereo pa and the four-channel system. However, life being what it is, many venues will not have such symmetrical shapes and it is possible that the front and rear quad stations will find themselves further away from the desk than the left and right stations, or vice versa. The ddls are used to adjust the four stations so that the signal arrives simultaneously at the mix area. Some doubters may say that this is fine for the mixing crew but what about the audience who cannot all be at the centre of things; in point of fact in practical terms the resultant sound to the audience area in general is also much more satisfactory when using this technique. This also explains the need for the MXR ddl on the quad click/cue track to stage when the ddl on the quad front inject is in operation—ever tried playing ahead of a tape machine? This way the stage performance can be played in perfect synchronisation with the backing tracks.

At this point many of you will be able to appreciate the many possibilities offered by this sound system. For example, consider guitar input insert patched to Aphex; aux 1 to *Master-Room* reverb on send/return group 1; aux 2 to *Space Echo* on s/r group 2; vocal channel insert patched to de-esser (Orban/Parasound sibilance controller), aux 1 to *Master-Room* on s/r group 1, aux 2 to Aphex (vocals) on s/r group 5; and aux 3 to Marshall *Time Modulator* on s/r group 3. Add to this the facility of cross-fading between stereo and quad systems with pre-determined image positions, introduction of tapes and effects, quad panning etc etc, and it is easy to see why a Pink Floyd performance is more a site of pilgrimage than an ordinary concert. The audience is treated to the whole gamut of studio electronic effects in a live situation, coupled to a concert by their favourite group in an audio-visual context—the 20th-Century version of the opera and ballet staging extravaganzas of the 16th to 19th Centuries. One is often hard put to understand the negative criticisms of groups like the Floyd, though certain music papers seem to think they're being 'with it' to knock successful groups and promote rubbish, in view of the fact that concert attendances and record sales are always on the increase and that all these customers would be surprised to learn that they are living in blissful artistic ignorance. No doubt these same critics would say the same things such as 'nothing new', 'predictable', etc when Covent Garden Opera stages *Swan Lake* or *Aida* with reasonable regularity. Perhaps they are so intent on finding something to criticise that they miss out on the performance altogether!
Oh well, each to his own.

KEY TO FIG. 3

SPEAKERS: S_1, S_2, S_3, S_7 and S_8 contain two 38 cm *Gauss* units; S_4 a JBL *2482* coupled to an Altec *290E*; S_5 and a S_9 *HF4000/2345* lens array; S_6 and S_{10} JBL *075* units.

AMPLIFIERS: A_1, A_2, A_3, A_4, A_7 and A_8 are Phase Linear *700B* units; A_5 and A_9 RSD *400*; A_6 and A_{10} Quad *303K*.

LIMITERS: L_1, L_2, L_9 and L_{10} are dbx *160* units; L_3, L_4, L_5, L_6, L_7 and L_8 dbx *162*.

All equalisers are Klark-Teknik *DN27* units.

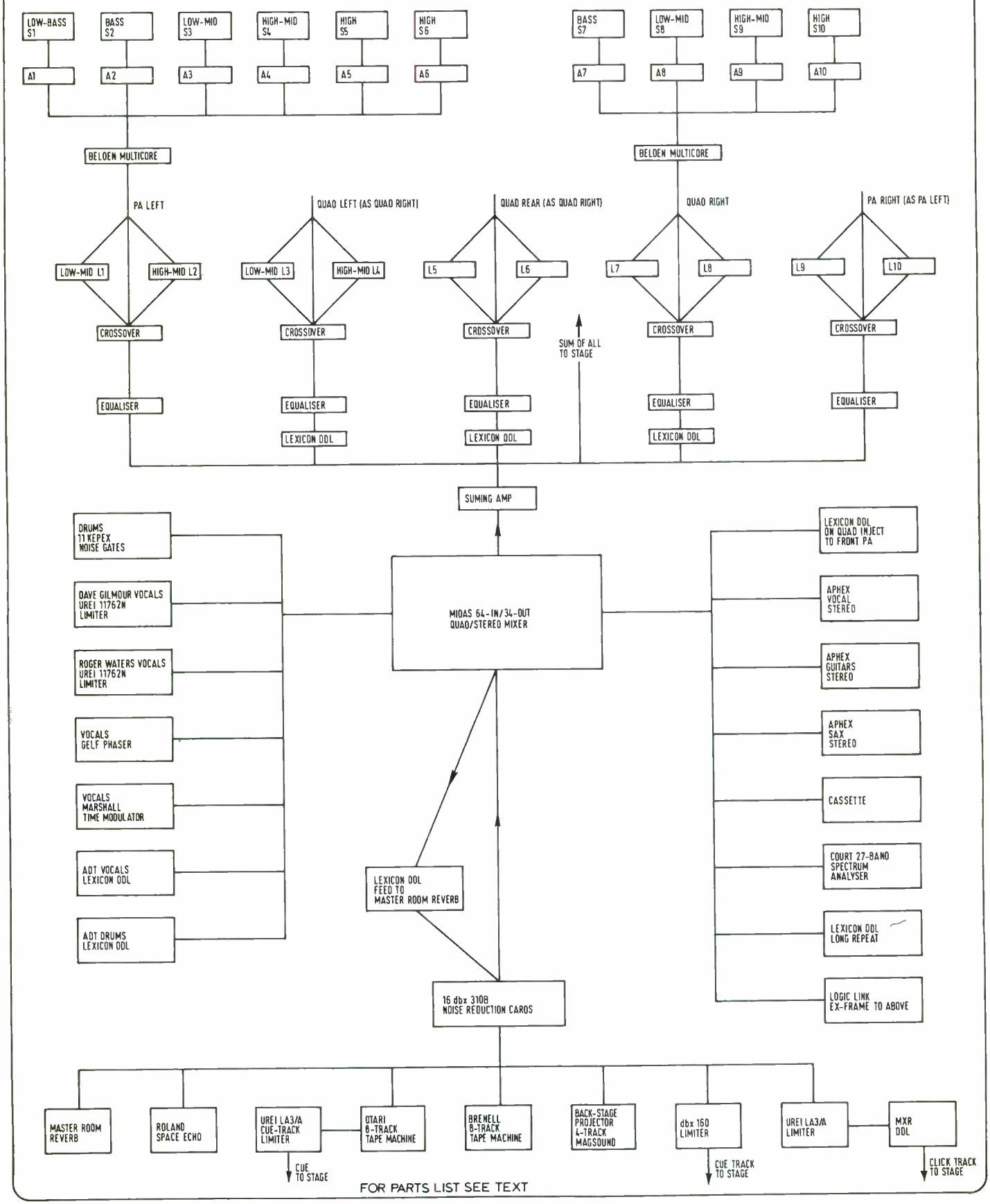
Summary

In these four articles I have tried to present as broad a picture as possible of the problems that lie in wait for constructors and operators of sound systems, but also the rewards and benefits that can come from live performance. Indeed, it is the positive side of the situation that merits the most encouragement. I believe that a record will never beat live performance, no matter how good, if the performance is presented with all the means at its disposal—including the engineers—to create and recreate the artistic objectives of the performances. Obviously concerts will never replace records—the two need each other as much as bread and water—but the apparent lack of real enthusiasm for the technical side of live performance could do with a kick up the backside in certain quarters. The full potential of enhanced or live sound is enormous—it would be a shame to let it go to waste.

(Special thanks to Nigel Taylor and Robbie Williams at Britannia Row for details of the Pink Floyd system, also to Seth Goldman of Britannia Row)

■

FIG. 3 PINK FLOYD LIVE



work

Strawberry Recording Studios South

Strawberry Studios have just planted fresh roots in the hitherto unconquered pastures of Dorking, Surrey, and named the offspring, logically, Strawberry Studios South. The original studios in Stockport, Cheshire, now designated Strawberry Studios North, have qualified for both popular and professional press interest to date, for three important reasons. Firstly, the organisation grew from virtually nothing in the so-called cultural revolution of the late Sixties; secondly, Strawberry has a rather famous group connection, ie 10cc; and thirdly (as a bonus to most press) it happens to be well respected as a studio. But in case you've never heard of them (unlikely), and to put the new southern installation in perspective, I shall briefly re-cap the it-could-never-happen-again story.

It all started when Eric Stewart and Pete Tattersall, now studio manager at Strawberry North, acquired a two-track demo studio above a record shop in Stockport in 1968. The studio expanded to four-track and two years later Hot Legs, comprising Eric Stewart, Kevin Godley and Lol Creme, had a hit single with *Neanderthal Man*, mastered on Strawberry's Ampex four-track for the Philips label. Soon the group were to meet songwriter Graham Gouldman, with whom they formed 10cc. The group's agency, Kennedy Street Artists, bought shares in Strawberry, by now a limited company, as did 10cc member Graham Gouldman. Stewart and Gouldman formed a partnership in 1975 to create Strawberry South. Meanwhile, Godley and Creme left 10cc and were replaced by four new members.

The studio building is a converted cinema in one-way South Street, and like the northern parent, is frankly unimpressive from the outside. The front has been shop fitted and above are two luxury flats. But on the side of the building is the Strawberry entrance, and it's only when you have passed through these doors that you realise just how much space is left. One of the 10cc roadie's artwork, a huge red, pink and green strawberry on the main wall of the spacious reception area reminds you where you are. Another wall depicts a saucy waitress bending over a fruit sundae in an attempt to remove a strawberry, this lady being the inspiration of a professional artist. Adjoining the reception is a lounge, equipped with pool table and a hi-fi system whose auxiliary inputs are connected to the studio monitor lines. By switching to 'aux' the visiting musician can observe progress and be paged by the studio. Adjacent are toilets and a small kitchenette. Opposite the main entrance, at the far end of the reception area, is a heavy door leading, via workshop and tape store, to the studio. More heavy doors, but this time double, separate the workshop from the bright isolation room through which the studio proper is reached. Apart, perhaps from the reception suite shag-pile carpet, the doors provide the first sumptuous sign of Eastlake design. 'These doors are the original Tom Hidley of Eastlake design, lined with lead', said studio manager Tony Spath. 'In other parts of the studio we've done a bit of modification and used doors which are just as good, but aren't lined with lead and are consequently much lighter.

The isolation room is a marble-floored wedge shape with mirror tiled walls. Cord pull curtains, with a drop of about 2m, can be drawn to dampen reverb decay. Most of the studio can be seen through the room's sliding double glass and opposite, across the shaggy carpet, the control room double glass. Stepping onto the studio carpet is registered by a dramatic change in acoustic, and a springy feel underfoot. OK, so shag-pile carpet is more springy than marble, but there's more to it than that. The studio floor is built on a unique sandwich of fibreboard, machine rubber and plaster, a cocktail evolved from the ideas of Tom Hidley by 10cc. 'The whole place,' remarked Tony, 'strikes me as typically 10cc in that they've taken ideas that are very good to start with, and made them even better.' As you would imagine, the original cinema floor was ramped down to the screen; all that had to be removed before the new floor composition could be laid.

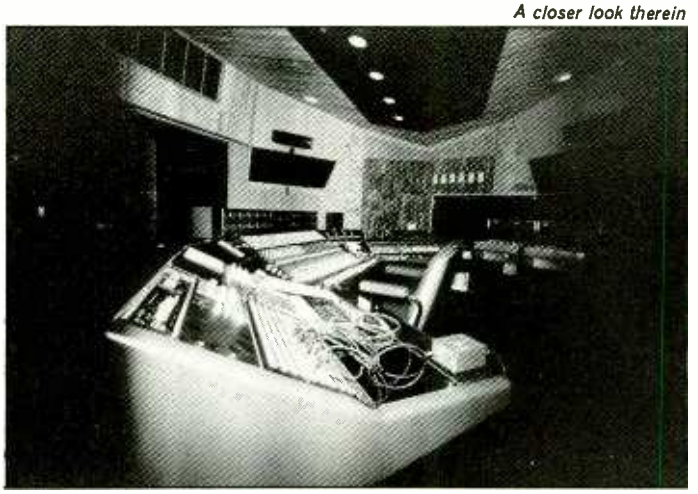
Hidley's control room/studio double-glass panels are usually on slides to create an inter-panel booth, but I noticed that was not so in this case. 'The booth didn't really work,' said Tony. 'We got much better separation by using the studio instead. So we replaced the sliding glass panels with a conventional fixed arrangement.' The drum riser stands in a corner surrounded by a low, bass-isolating wall that turned out to be two mating doors. 'We hinged these sections for practical reasons,' said Tony, 'and carpeted the drum-facing sides. The separation we can achieve with drum cage is fantastastic!' You may have gathered that the studio was effectively built once, and then modified. 'When we had the piano trap here,' said Tony, indicating a spot fairly near to the cage. 'The overhead piano mics could be opened right up with the negligible drum crosstalk. But now that the piano trap has been moved the crosstalk is practically immeasurable.'

The new piano trap housing a Bosendorfer is situated in the wider, recently built 'other half' of the studio which can easily be screened off with a cord pull curtain mounted across the studio's width. The V-shaped trap comprises, on each side of the V, full-length wall traps in which are suspended wide strips of glass-fibre wool, mounted parallel to each other and edge-on to the studio. Absorbtion efficiency is increased by the simple expedient of a flexible link between strips on their bottom edge centres. The recesses are covered with cheese cloth and draped with sheer curtain. All very Hidley; but they have been modified to permit external adjustment of reverb time by effectively opening, and closing portions of the trap entrance.

In the same half of the studio, small traps are recessed into the walls near ground level, resembling an extravagance of air conditioning grilles at first glance. Apart from controlling general studio reverb, they serve as direct traps

That'll cost you another £50!

A closer look therein

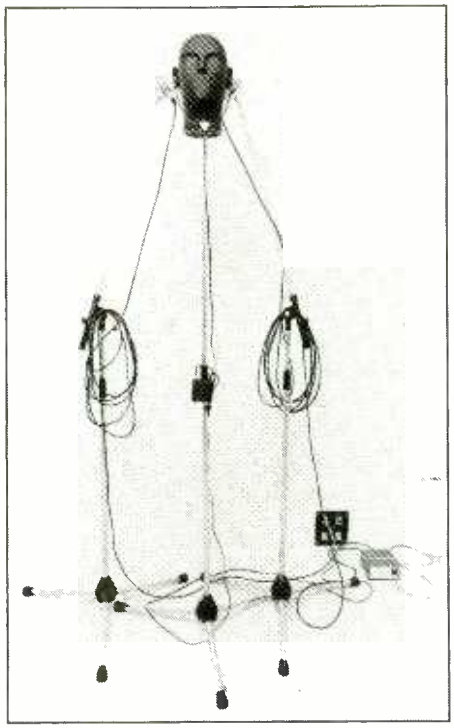


for miked up amplifiers. Above head height, more trapping is installed. Both high and low elevation trap arrangements operate on a similar principle to the piano trap, though of reduced depth. But the daddy of them all has got to be the trap in the ceiling. Above the entire grille cloth false ceiling of the studio, large strips of glass-fibre wool are suspended from the real ceiling, some 2m up. 'That's an original Tom Hidley idea', said Tony, which we had the space to put into practice. What we've aimed for in the studio, with high and low-elevation trapping, is an acoustically two-dimensional room with high absorbency in such areas whilst retaining an acceptably natural sound at vocal and guitar elevations.' The idea was graphically demonstrated by taking a short distance from the floor, the shorter reverb time being immediately obvious.

Bass trapping (yes, all right, I've nearly finished the traps) is provided by another suspended arrangement of glass-fibre wool, but this time supplemented by horizontal elements, occupying a deeper recess (about 2.5 m), and faced with plasterboard. The entire studio, including drum cage and isolation room, covers an area of about 125 m^2. A total of around 108 mic lines are terminated in the studio (patched in the control room) allowing a large number of carefully positioned mics to be simply patched in or out of circuit, as required. Foldback output takes the form of two mono signals, between which the musician mixes, and sets monitor level, on his plug-in box. Talkback speakers are hidden in the ceiling.

We left the studio through one of Strawberry's modified Hidley isolation doors, to a corridor leading to control room on the left, and loading bay on the right. The loading bay is at present outside the main inner shell, but is to be made into an equipment pool where group's gear can be loaded, to be drawn off for studio use when required; a simple but useful idea, saving a lot of wasted loading and unloading time. The area is partially occupied by a service staircase, leading to inner shell rooftops, on which are mounted air conditioning plant (one system each, studio and control room) and two 13 m^2 echo chambers, each capable of producing up to five-second delay. One chamber is cubic and picks up on a Sennheiser dummy head, while the other is oblong and uses a Neumann *KM88* figure-of-eight pair configuration. Each chamber is driven with a Philips 'motional-feedback' monitor unit. In fact the studio rooftop is a heavy duty floor, for despite the 2 m trap drop above the studio's false ceiling there is adequate headroom to comfortably accommodate another storey, sitting on the trap top. Such is the size of the old cinema. After all, if you're building a decent ceiling and you've got that sort of space, why not build a decent floor? Strawberry evidently want to keep their expansion options open.

Downstairs in the corridor, the so-called 'amp room' is on the right, before reaching the control room straight ahead. Here 50 Hz harmonics hum quietly, this being the home of the three-phase mains termination. Racked are Amcron *DC 300A* studio monitor amps and Amcron *D60* foldback amps, while two EMT stereo, *Master Room* stereo, and AKG *BX20* reverb units stand free, as does a UREI *Cooper Time Cube*. Also in evidence is a bank of lighting dimmer control units. connected to a separate power phase.



Who's a dummy?

And so onto the control room, ostensibly a characteristic Hidley creation, but again one steered and modified by 10cc. In fact, it turned out that 10cc influenced Hidley quite substantially when he was working on Strawberry North (the company's third UK conversion) for Westlake. When Hidley formed the European Eastlake, he was all set to import labour and materials from the States. But Strawberry found British supplies which are now used.

The monitor response was designed with particular care. Unusually, consideration was given to the disc mastering process subsequent to final mixing. But Tony Spath tells the story better: 'A flat room is personality-less, for a start. The other consideration is that it's got to cut disc and sound great. So what we've done in this room is boosted up a little high bass, so that you put a little less onto the master tape and hence disc. We've rolled off some of the extreme top. We also played a lot of tapes and discs from different places through here, and looked at the response on a spectrum analyser; we found there were holes in the frequency response that consistently appeared. We tried boosting these frequencies and found the sound really started coming to life. So these frequencies were backed off on the 27-way White monitor graphic equalisers, so that you compensate for them when recording !

All this led to a compound monitor curve being derived, which is now used in Strawberry North and South. Very interesting. Had Tony got a copy of the curve? Of course he had. Could I see it, or maybe borrow a copy for the benefit of STUDIO SOUND readers? Was I joking? Well, actually um . . . well yes of course, I suppose I was really, yes.

Four wall-recessed monitor enclosures of standard Hidley design are installed in quad format, but only the front pair have drive units fitted. 'Originally they were *Gauss* bass and mid, with Emilar tweeters—as specified by Eastlake', commented Tony. 'We changed them to JBL bass mid and tweeter, in conjunction with a JBL electronic cross-over. The crossover was put in because it rolls off at 18 dB per octave at crossover frequency, rather than the unit Hidley uses, which has a roll-off of 6 dB per octave. We've thus eliminated any possible phase cancellation around the crossover point. The original Emilar tweeters rolled off at 14 kHz, the idea being that you tried to hear higher frequencies and so put more on tape. The principle's fine, but you need a driver unit capable of performing flatly, far beyond that frequency to preserve transient response. So we opted for JBL tweeters, which operate up to 22 kHz. The overall difference in sound as a result of these changes is fantastic.'

The control room side of the double-glass panel is equipped with a heavy cord-pull drape, for use when overdubbing or mixing which, as Tony puts it, 'brings the sound right up to your face'. The wrap-round console is a 28/24 built from Automated Processes modules by Formula Sound. The same company built 10cc's pa gear, and reside at the second floor of Strawberry North's address in Stockport. The standard of metalwork on the desk is high; precision mating of corners, smooth edge profiles and accurate accommodation of modules are all examples. Healthy safety factors are evident on supportive frame members and the overall finish is good. The rear panel comprises two sections, each hinged at the bottom, permitting swift access to plug-in circuit boards mounted beneath. Metering is on ppms.

The first 12 input channels have parametric eq controls that offer shelf, narrow or broad-peak shapes over a useful frequency range, while the remaining 16 channels are equipped with nine-way graphic equalisers. 'These controls allow you to infinitely vary the sound', commented Tony, 'but the way we work is that if there is a problem that can be corrected in the studio, we'd rather do that before using electronic correction.' Despite this philosophy, there is no shortage of ancillary equalising gear; two Aengus stereo graphic equalisers, whose frequencies overlap the channel graphics; an Orban Parasound stereo parametric; and two Klark-Teknik graphic equalisers, 27 and 11-way respectively, complete the picture.

Twenty-four output channels with six vca subgroups are installed on the right of the desk, in addition to the 28 input channels straight ahead. The desk is wired for quad but, of course, is operated in stereo mode only at present. The echo system is pretty complex, an eight send six stereo return arrangement, the latter being terminated on a separate panel to the left. Momentary functions (such as clear mute mode) are actuated on microswitches, while permanent modes are selected on fluorescent dot type pushbuttons. We didn't want to waste time changing bulbs and we needed reliable switches', remarked Tony. Foldback can be selected from monitor or output channels. A bantum patch-panel on the desk terminates the studio mic lines; the first 28 are normally connected by break jack directly to corresponding channel inputs.

Time-based effects are supplied by MXR

42 ▶

Auto Flangers and *Auto Phasers* (two of each), AMS stereo phase/vibrato and digital delay/harmoniser units and, of course, the ubiquitous Marshall *Time Modulator*. We listened to the digital delay set to one second, using some material from the forthcoming 10cc album. Equally impressive as the music, was the clarity and in particular the low noise of the sound; and with a signal-to-noise quoted at 90 dB, that was not surprising.

The compressor-limiter complement comprises the Audio & Design stereo *Compex* limiter, dbx *162* stereo compressor, two Allison *Gainbrain* limiters and a Neve *32245E* limiter, all patchable. Three Roger Meyer noise-gates are also available. 'We like to think we've got the facilities, should they be required', said Tony. And with that lot, who can argue?

There was a certain inevitability about the Auratone mini monitors flanking the central section of the desk. It's just that everybody seems to have them. Powered by Quad *303* amps, did they truly represent a domestic sound? 'They provide a small speaker rather than a domestic sound,' said Tony. 'Although they are not equalised to the Strawberry monitor curve used on the main system. Some producers won't mix on anything else—you've got to have them. For a domestic sound we've always got the hi-fi system in the lounge.' As previously described, monitor feed can be routed to the hi-fi but, in addition, a very nice Technic *Isoloop* stereo tape deck, provided in the lounge, can be used.

The tape machines, a 3M *M79*, two stereo Studer *A80*s and a stereo Studer *A62*, all have their varispeed controls remoted on the desk by a fine/coarse pair of pots. Mode select is also remoted of course, the 3M control panel (plumbed into the desk) driving the 24-track. Noise reduction is housed in a large rack containing 32 channels of dbx and 26 of Dolby. It's unusual to see the two systems so strongly represented together, but more surprising is the facility of switching between individual channels. 'We want to be flexible with all our facilities,' said Tony, 'and switchable selection between the two noise-reduction systems gives another option.' Yes, but why individual channels, why not just one master switch? 'Again, it means more flexibility. A producer might prefer to use Dolby on strings rather than dbx, just as an example. And as long as he doesn't take the tape away and decode all channels Dolby or dbx, why not. Also if a channel goes down and we don't have a spare, then provided it's OK with the producer we could switch that channel to the other system.'

Strawberry staff are simply Tony Spath, who studio manages and engineers, and Keith Bessey, 10cc's on the road engineer, and Aidan Gaule, assistant engineer. Barring the receptionist and a 'flying doctor' maintenance engineer on 24-hour call, that's it. While studying for his Bachelor of Music sandwich degree at Surrey University, Tony applied for a tape op job at Strawberry. Fortunately for him, when he got his degree Eric Stewart offered to keep him on. After making tea, looking after tape files, doing the paperwork, ordering stock, and engineering (not necessarily in that order) it was decided that he was performing the role of studio manager. So that he became.

So what was Strawberry South's function? Was it to be inaccessible to outside producers and bands, as Strawberry North had been, because of blanket booking by 10cc? 'There's a misconception about 10cc's use of Strawberry North,' said their studio manager Pete Tattersall. 'We always got about 80% of our work from outside. Strawberry South was built, in fact, so that 10cc would have somewhere to record. But obviously they won't be in there all the time, and the studio will be available for outside work when they are not using it.' Tony Spath points out 10cc book studio time like any other client. 'If 10cc have booked in then outside work will have to wait; if outside work is booked in 10cc will have to wait. It's as simple and as fair as that.' In fact, 10cc were booked in until mid-June. Somehow I don't think dead studio time will be a problem. 'I've done no advertising so far,' said Tony, 'but already enquiries have been received from some top names in the business. We've also shown a few people round.' But at around £3500 per week studio time isn't cheap; nor, to be fair, is the standard of the studio. The whole installation, unassuming as it is from the outside, has been painstakingly designed, and fitted with the best equipment available. Here then is the best of Strawberry—with cream.

Richard Dean

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The Music Laboratory just has to go!

Due to rapid expansion of business over the last two years, we have been forced to move to larger premises, which are situated in Central London, making it more convenient for our professional customers.

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3M

letters

Institute of Broadcast Sound

Dear Sir, I was saddened to read your disparaging and patronising report on the Institute of Broadcast Sound in the May issue.

Ron Ferris's enthusiasm is well known to the members. So is that of the treasurer, the chairman and other members of the committee who have had a difficult year trying to break through the bureaucracy that surrounds the setting-up of a new institute.

One good reason that the membership has not grown faster is the present state of salaries within the public service broadcasting section. Potential members are having to think twice about spending even £13.

The committee will always have an attendance problem. By the very nature of our jobs, we are mostly all shift workers with a bias towards evening work. I would have thought that an attendance of 60% at any meeting would be very good going.

There was an implication in the article of who needs another institute. There are working within the broadcasting services a large number of people who balance the sounds of everything from punk rock to parliament. Each works within a specialised area of tv or radio where, for instance, the balancers working on the Proms in quad probably never meet their counterparts recording drama in quad. Add to this the diversity of regional centres and you should be able to see that there is a wide spectrum of knowledge and expertise that the IBS can draw together and interchange. This can only be of benefit to our 'customers'; the listeners or viewers. There is no other organisation that does this.

Yours faithfully, Peter Wisbey, MIBS, 12 White Cottage Close, Farnham, Surrey.

Frank Ogden replies:
Awfully sorry if you and your fellow members took the hump from the flip side of my news note . . . and I would most respectfully beg you not to endorse my tv licence.

Far be it from me to bring the good offices of Mr Ron Ferris and the IBS into disrepute; I wrote simply on the basis of information supplied by Mr Ferris. If that gentleman's unbridled enthusiasm were more tactfully directed in his press releases, then it would make it far easier for jaded hacks, such as myself, to treat the Institute with the reverence that it probably deserves.

As it was, the IBS newsletters seemed much more like a Billy Graham-style report on a Mothers Union strawberry jam session than the proceeding of a learned society.

I accept that there may be a call for yet another body to maintain ideals and uplift standards etc, although it seems unlikely. I would point out that the BBC has its own staff association, and that its employees have access to the SMPTE, the Royal Television Society, the APRS, ACTT and NATKE to name but a few. Most of these organisations would welcome new members together with their annual subscriptions.

In having the last word, I would point out that if the eloquently titled Institute of Broadcast Sound has any real stature it should be able to survive—and accept—life's small pin pricks in its stride.

Another cutting letter

Dear Sir, With reference to 'The unkindest cut' item in the Adrian Hope 'Business' column. He states that 'The simple truth is that single-edge blades just aren't being made in the UK anymore.' He's wrong; they are!

I have a quaint vision of giant metal storage cabinets being trundled into studios the length and width of the country. Hundreds of gummed labels with 'single-edged razor blades store cabinet' being stuck onto to them. Giant padlocks with great big keys that are kept in safes. Begging letters written to unsuspecting foreign clients. Tape ops, engineers and musicians that trim reeds, walking about with blood-soaked bandages on their fingers, hoping that a kindly Yank might smuggle them one or two 'whatsits you can't get at the chemists over here' in for them. Cries of 'Oh no!' at being asked to edit up an lp.

It seems a shame to have to spoil my vision but here goes. Try Valet Auto-strop *blades. They are made by Gillette Industries Ltd, Great West Road, Isleworth, Middlesex. At around 23p for five they can be obtained at most smaller chemists who can order them from their wholesaler for you.*

Yours faithfully, Dick Sefton, Pollen Studios, 96/97 Bishop Witton, York YO4 1SQ.

Thank you . . .

Dear Sir, This is a long overdue letter in appreciation of your efforts in publishing STUDIO SOUND.

Out of the many professional magazines I receive each month, I find your magazine to be one of the most helpful in my work, and one of the most enjoyable to simply read.

Your editorial mix of unrivaled technical reports, operating news and humour is unusual and most effective. The articles by Hugh Ford and Adrian Hope are especially appreciated, as are the efforts of your entire staff.

Thanks again.

Yours faithfully, D. O. Easton, Technical Operations, National Broadcasting Co, Burbank, California, USA.

Survey: power amplifiers

While the main emphasis of this survey is towards studio-quality power amplifiers—high power beasties with reasonable frequency response, distortion and noise performance—we have included several models more suited to pa and sound reinforcement applications.
Forthcoming surveys include studio ancillaries (October), broadcast and pa mixers (December) and multitrack consoles (January 1979). Manufacturers and agents are invited to submit product details for inclusion to reach the editorial office (address page 3) at least six weeks before the issue publication date (preferably a lot earlier).

AB SYSTEMS

AB Systems Design Inc, PO Box 369, Fair Oaks, Ca 628, USA.
Phone: (916) 988 8551.

MODEL 410
Power output: 325W continuous power per channel into 4 ohm; 205W into 8 ohm.
Total distortion: less than 0.1% at rated output (to 15 kHz; 0.25% 15-20 kHz).
Noise: 101 dB below rated output.
Full power frequency response: 20-20k Hz, ±0.25 dB.
Price: $800.

MODEL 205
Power output: 200W continuous power per channel into 4 ohm; 100W 8 ohm.
Total distortion: less than 0.1% at rated output (to 15 kHz-0.25% 15–20 kHz).
Noise: 101 dB below rated output.
Full power frequency response: 20-20k Hz ±0.25 dB.
Price: $560

MODEL 710
Number of channels: mono bi-amplified.
Power output: low-frequency channel 200W into 4 ohm, or 255W at 8 ohm ; high-frequency channel 100W into 4 ohm, 65W into 8 ohm.
Distortion: less than 0.25 thd or im, typically 0.07%.
Noise: 100 dB below rated output.
Full power frequency response: 20-20k Hz, ±0.25 dB.
Price: $700; *Model 720* (stereo version) $900.

ACCUPHASE

Kensonic Laboratory Inc, Japan.
UK: Pyser Ltd, 102 College Road, Harrow, Middlesex HA1 1BQ.
Phone: 01-427 2278/9

M-60
Power output: 450W into 4 ohm, 300W into 8 ohm and 150W into 15 ohm.
Distortion: less than 0.1% at rated power output.
Noise: 100 dB below rated power.

P300
Power output: 150W rms, both channels driven, 200W rms into 4Ω.
Power bandwidth: 20-20k Hz, ±0.2 dB at rated power.
Hum and noise: 100 dB below rated output.
Distortion: less than 0.1% thd and im (any level and mixture between 20 Hz and 20 kHz) at rated output.
Other features: produces 'subtle nuances of inner musical fabric which stir and warm the soul with emotion'.

P250
Power output: 100W rms, both channels driven.
Power bandwidth: 20-20k Hz, ±0.2 dB at rated power.
Hum and noise: 94 dB below rated output.
Distortion: less than 0.1% thd and im (any level and mixture between 20 Hz and 20 kHz) at rated output.

ADI

Audio Developments International, 644 Emerson Street, Palo Alto, Ca 94301, USA.
Phone: 415 321 3035
UK: Feldon Audio Ltd, 126 Great Poland Street, London.
Phone: 01-580 4314.

TYPE 1252
Power output: 250W per channel into 4 ohm; 185W per 500W in bridge mode.
Price: $1185.

ALTEC

Altec Lansing, 1515 South Manchester Avenue, Anaheim, Ca 92803, USA.
UK: Theatre Projects Sound Ltd, 10 Long Acre, London WC2 9LN.
Phone: 01-240 5411.
Agents in most countries.

SYSTEM 2200
Power output: 600W continuous average power into 8 ohm (when eight *model 2275* incremental power cards are fitted in parallel/bridge mode).
Harmonic distortion: less than 0.05% (1 kHz) at rated output.
Noise: 93 dB below rated output.
Full power frequency response: 20-20k Hz, +0,−0.5 dB.

BGW

BGW Systems Inc, 13130 South Yukon Ave, Hawthorne, Ca 90250, USA.
Phone (213) 973 8090. Telex: 664494.
UK: Webland International Ltd, 129 Walham Green Court, Moore Park Road, London SW 6
Phone: 01-385 9479.

750A
Power output: 300W continuous average power output per channel into 4 ohm; 200W into 8 ohm.
Harmonic distortion: 0.1% at rated output.
IM distortion: less than 0.02% at rated output.
Noise: 110 dB below rated output into 8 ohm.
Full power frequency response: 20-20k Hz (tolerance unspecified).
Price: £710.

500D
Power output: 250W continuous average power output per channel into 4 ohm; 200W into 8 ohm
Harmonic distortion: 0.1% at rated output.
IM distortion: less than 0.2% at rated output.
Noise: 110 dB below rated output into 8 ohms.
Full power frequency response: 20-20k Hz (tolerance unspecified).
Price: £616.

250C
Power output: 126W continuous average power output per channel into 4 ohm; 100W into 8 ohm.
Harmonic distortion: 0.15% at rated output.
IM distortion: less than 0.3% at rated output.
Noise: 110 dB below rated output into 8 ohm.
Price: £395.

BOGEN

Bogen Division, Lear Siegler Inc, PO Box 500, Paramus, New Jersey 07652, USA.
Phone: (201) 343 5700.

TECHCRAFT
A range of single-channel amplifiers with the output coupled through a line matching transformer.
Power outputs: 60/125/250W rms.

48 ▶

OTARI

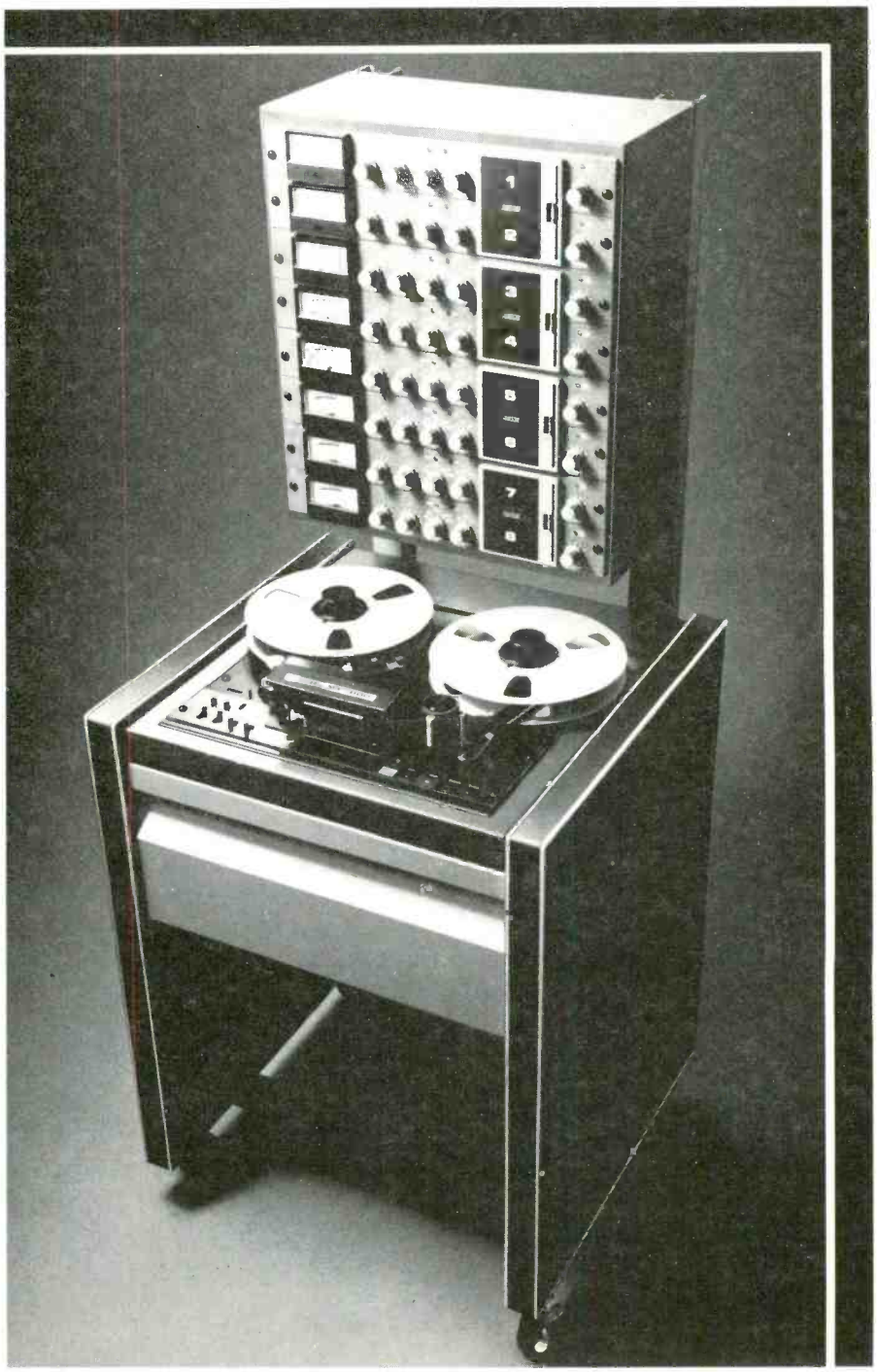
Professional perfection to produce one-inch eight-track masters. Otari MX7800 for discriminating recordists.

Otari sets another new standard in multichannel recording. Incorporating latest electronics and engineering technologies, the new MX-7800 is designed to meet the demands of professional recordists. Direct-drive DC-servo capstan motor for less than 0.04 % wow/flutter, with ±12 % pitch control. Standard servo controlled reel motors and LSI-TTL motion sensing control logic. Greater-than-63dB S/N. Front panel edit and adjustable cue. Stepless bias capability for high energy mastering tapes. +4dBm output with XLR connectors. NAB, CCIR, IEC or AES equalization. Remote controllability for transport and amplifier sync play functions. And it comes with the latest plug-in electronics with instant accessibility.

Its reliability and durability have been proven through strict testing which stands behind all Otari products designed to withstand critical professional applications. For the full story of the sophisticated machine, get in contact with your nearest Otari distributor.

U.K.: C.E. Hammond & Co., Ltd., 111 Chertsey Road, Byfleet, Surrey KT14 7LA
France: Reditec, 62-66, Rue Louis Ampère, Zone Industrielle des Chanoux, 93330 Neuilly-s/Marne
West Germany: Peter Struven GmbH, 2 Hamburg 53, Bornheide 19
Belgium: Trans European Music S.A., Koeivijverstraat 105, 1710 Dilbeek, Brussels
Italy: Exhibo Italiana S.R.L., 20052 Monza, Via F. Frisi, 22
Switzerland: Audio Bauer AG, CH-8048 Zurich, Bernerstrasse-Nord 182, Haus Atlant
Australia: Klarion Enterprises Proprietary Ltd., Regent House, 63, Kingsway, South Melbourne, 3205
Japan: Otari Electric Co., Ltd., 4-29-18 Minami Ogikubo, Suginami-ku, Tokyo 167, Japan

Please send me details on
MX7800
Name
Company
Address
SS



SURVEY: POWER AMPLIFIERS

Output levels: 25, 50 or 70V line balanced or unbalanced; 16V direct, unbalanced.
Frequency response: 20-20k Hz, ±1 dB at rated output.
Noise: 86 dB below rated output.

TCB-S160
Power output: 80W per channel into 8 ohm, 10-20k Hz.
Distortion: less than 0.1% at rated output over the quoted frequency range.
Intermodulation: less than 0.1% at any power to rated output.

BOZAK
Bozak Inc, Box 1166, Darien, Conn 06820, USA.
Phone: (203) 838 6521.
Export: Elpa Marketing International Ltd, Thorens Building, PO Box 1050, New Hyde Park, NY 11040, USA.
Phone: 516-746 3002.

CMA-2-150
Power output: 150W rms continuous per channel.
Distortion: less than 0.2% at rated output (1 kHz).
Noise: 100 dB below rated output.
Full power frequency response: 20-20k Hz ±1 dB.
Price: $750.

CMA-1-120
Power output: 120W rms into 8 ohm.
Noise: 80 dB below rated output.
Frequency response: within 1 dB, 20-20k Hz.
Distortion: less than 0.5% thd.
Price: $500.

CMA-1-80
Generally as above but 80W rms output. Price $460.

CMA-1-50A
Generally as above but 50W rms output. Price $420.

CERWIN-VEGA
Cerwin Vega Inc, 12250 Montague Street, Arleta, Ca 91331, USA.
Phone: (213) 896 0777.
UK: CE Hammond and Co Ltd, 105/109 Oyster Lane, Byfleet, Surrey KT14 7JH.
Phone: Byfleet 51051.

A15001
Power output: 225W rms per channel into 8 ohm or 350W into 4 ohm.
Distortion: 0.08% or less.
Power Bandwidth: 20-20k Hz, +0, −1 dB.
Intermodulation: SMPTE 0.025% or less.
Noise: 100 dB below full output.
Price: $900.00; £625.00.

CROWN/AMCRON
Crown International, 1718 West Mishawaka Road, Elkhart, Indiana 46514, USA.
Phone: (219) 294 5571. Telex: 2942160.
UK: Macinnes Laboratories Ltd, Macinnes House, Carlton Park Industrial Estate, Saxmundham, Suffolk IP17 2NL.
Phone: 0728-2262/2615.

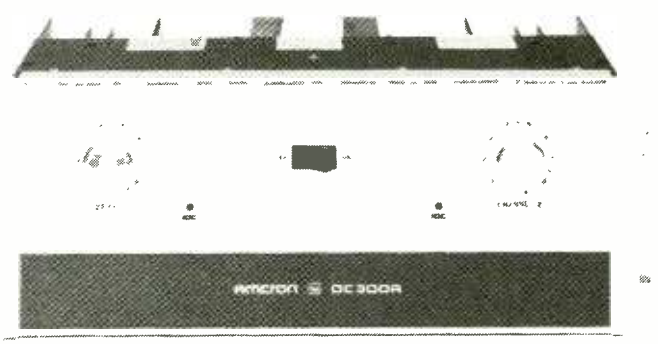
D150A
Power output: 75W rms, both channels driven, 100W rms into 8 ohm one channel.
Power bandwidth: 5-20k Hz, ±1 dB at rated output.
Hum and Noise: 110 dB below rated output.
Distortion: below 0.05% to rated output; im (SMPTE) better than 0.05% to rated output.

DC300A
Power output: 150W rms both channels driven.
100W rms/1Ω
500W rms/2.5Ω } one channel only
200W rms/8Ω
Power bandwidth: dc to 20 kHz ±1 dB.
Hum and noise: 110 dB below rated output.
Distortion: im and harmonic below 0.05% to rated output.

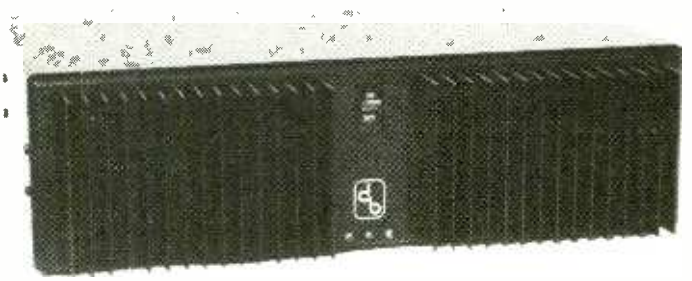
DB
DB Systems, PO Box 187 Jaffrey Centre, NH 03454, USA.
UK: Audiomaster Ltd, 33 Bridle Path, Watford, Herts WD2 4BZ.
Phone: Watford 33010.

DB-6
Power output: 60W rms per channel into 4 ohm,

50 ▶



Amcron DC300A ▶ with the recently introduced Input Output Control (10c) leds that indicate amplifier originated distortion.



◀ DB-6 amplifier from DB systems

Aphex Dealers

Aphex Audio Systems UK, Ltd
35 Brittania Row
London N18QH England
Tel: 01-359 5275–0955/6
Contact: Richard Kelley
Robbie Williams

Aphex West
7801 Melrose Avenue
Los Angeles
Calif. 90046
Tel: 213.655.1411
Contacts: Kent Beyer
Pat Taylor

Aphex New York, Ltd.
1400 Pleasant Valley Way
West Orange
New Jersey 07052
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Contacts: Stephan Galfas
Charlie Conrad

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Contact: Ron Lynch

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Contact: Georges Blumenfeld

Aphex Germany, GmbH
c/o Rockoko Production
Elsterweg 4,
6333 Braunfels
Germany
Tel: (06442) 5303
Contact: Peter Hauke

Aphex Benelux
18 Avenue Besme
1190 Brussels
Belgium
Tel: (02) 345-4444
Contact: Lucien F. Velu

Aphex Scandia
Box 5349
102 46 Stockholm
Sweden
Tel: 08-678069
Contact: Bengt Olwig

Aphex Systems (Suisse) S.A.
Place du Grand-Mont
CH-1052 Le Mont-sur-Lausanne
Switzerland
Tel: 021-33 3355
Contact: Gaston Schaefer

Aphex Audio Systems Australia, Pty Ltd.
21 Pier Street
Sydney 2000 Australia
Tel: 261381
Contact: Ron Purvis

Aphex Hawaii Ltd.
679 Auahi Street Honolulu
Hawaii 96813
Tel: (808) 521-6791
Contact: Sam Holt

APHEX

This tape has been Aurally Excited.

The ®Aphex Aural Exciter is an astonishing signal processing instrument, which brings sound to life and makes it louder without any actual level change.

This is the principle behind it.

Sound waves enter our ears with subtle phase information relating to the location of the sound source–left or right, up or down, front or back, direct or reflected. By using a sum and differencing technique, the brain provides us with our critical aural perception.

But collecting sound, mixing it and then recording it often destroys or masks much of the subtle information resulting in a "flatter sound" than the original.

However, the Aphex introduces phase information in the form of a series of minute delays, whose magnitude depend on frequency.

The formula by which Aphex selectively processes the audio signal is not random; it has been designed after considerable research into the mechanisms of the ear, in particular the reflections and minute time delays caused by its shape.

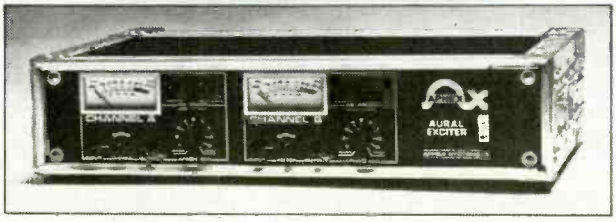
Aphex is best used on selected channels, normally in the remix stage of production, fed from the echo or foldback send. The output from Aphex is then mixed back into the main signal at about −15 to −30dB.

Aphex is already famous for what it does to vocals. But any instruments with natural sound (ie not electronically produced) like snare drums, cymbals, acoustic guitars, strings and brass sound amazing when Aphexed.

Call it what you will, this effect causes no changes in level, confirming that it is truly a psychological effect.

Because the Aphex principle is young, we expect to replace it continually with new and even more exciting versions, so you can't buy it; you must lease it.

Contact us for more details, or to arrange for a demonstration.



APHEX

APHEX AUDIO SYSTEMS UK LTD., 35 BRITTANIA ROW, LONDON N1 8QH. TELEPHONE 01-359 0955/6

® APHEX IS A REGISTERED TRADEMARK OF APHEX SYSTEMS, LTD OF LOS ANGELES, CALIFORNIA, USA.

SURVEY: POWER AMPLIFIERS

40W rms into 8 ohm; 225W rms into 4 ohm, 140W rms into 8 ohm in bridged mode.
Harmonic distortion: less than 0.008% at rated output.
IM distortion: less than 0.002% at rated output.
Noise: 112 dB below rated output.
Full power frequency response: 20-40k Hz, +0, −1 dB.
Weight: 8.2 kg.

EXPOSURE

Exposure Electronics, Richardson Road, Hove, Sussex, UK.
Phone: 0273-777912.

EXPOSURE IV

Power output: 70W rms per channel into 8 ohm.
Distortion: less than 0.01% (both channels driven).
Input sensitivity: 1.2V at 22k ohm.
Full power frequency response: 10-20k Hz, ±1 dB.
Price: £200.

FM ACOUSTICS

FM Acoustics Ltd, PO Box 18, CH-8702, Zollikon, Switzerland.
Phone: 01-655153.
USA and Canada: Dayton Wright Associates Ltd, 350 Weber Street, North Waterloo, Ontario N2J 4E3.
Phone: 0519-8844510.
UK: Michaelson and Austin Ltd, 140 Bond Street, London W1Y 9HF.
Phone: 01-499 3510.

FM 600A

Power output: 300W rms into 4 ohm, single channel; 250W rms into 4 ohm, both channels; 150W rms into 8 ohm, single or both channels.
Distortion: typically less than 0.1% 20-10k Hz, 0.25W to full output.
Noise: 105 dB below full power typically, 90 dB minimal unweighted.
Full power frequency response: 20-20k Hz, +0, −1 dB.

FM 800A

Power output: 550W rms into 4 ohm, single channel; 400W rms into 4 ohm, both channels; 300W rms into 8 ohm, single or both channels.
Distortion: typically less than 0.1% between 20-10k Hz, 0.25W to full output.
Noise: 110 dB below full power typically, 95 dB minimum unweighted.

ICE S200 power amp from IC Electronics.

Full power frequency response: 20-20k Hz, +0, −1 dB.

HARMAN/KARDON

Harman/Kardon, 55 Ames Court, Plainview, NY 11803, USA.
UK: Harman (Audio) UK Ltd, St John's Road, Tylers Green, High Wycombe, Bucks HP10 8HR.
Phone: 049481-5221.

CITATION 16

Power output: 150W rms per channel into 8 ohm.
Harmonic distortion: less than 0.05% at rated output.
IM distortion: less than 0.05% at rated output.
Noise: 100 dB below rated output.
Full power frequency response: 4-40k Hz, ±0.5 dB
Price: £620.

CITATION 19

Power output: 100W rms per channel into 8 ohm.
Harmonic distortion: less than 0.08% at rated output.
IM distortion: less than 0.08% at rated output.
Noise: 100 dB below rated output.
Full power frequency response: 5-45k Hz, ±0.5 dB
Price: £443.

H/H

H/H Electronic, Viking Way, Bar Hill, Cambridge CB3 8EL, UK.
Phone: 0954-81140.

S500-D

Power output: 340W/channel into 4 ohms, 210W into 8 ohms, 110W into 16 ohms; up to 900W in bridged mode.
Distortion: less than 0.02% 10-10k Hz 'at all levels up to clip point'.
Intermodulation distortion: less than 0.02% from 0.1W to 200W into 8 ohm by SMPTE.
Frequency response: within 0.2 dB dc to 20k Hz, dc coupled.
Noise: 105 dB below 180W into 8 ohms.

TPA 25D

Power output: 30/65/70W into 15/7.5/4 ohms.
Distortion: less than 0.1% 20-20k Hz at load impedances between 7.5 and 15 ohms.
Frequency response: within 0.4 dB over the audio range.
Noise: 100 dB below rated output.

TPA 50D

As *TPA 25D* except 60/80/100W power output.

TPA 100D

As *TPA 25D* except 100/180/250W power output.
Distortion: less than 0.2%.
Frequency response: within 0.5 dB over the audio range.

ICE

ICElectronics Ltd, 131/132 Blackdown Rural Industries, Haste Hill, Haslemere, Surrey GU27 3AY.
Phone: 0428-2015.

5200

Power output: 175W rms per channel into 4 ohm; 115W rms into 8 ohm.
Harmonic distortion: 0.001% at rated output (calculated).
Noise: 110 dB below 175W into 4 ohm.
Price: £299.

JBL

James B Lancing Sound Inc. 8500 Balboa Boulevard, Northridge, Ca 91329, USA.
Phone: (213) 893 8411.
UK: Harman (Audio) UK Ltd, St John's Road, Tylers Green, High Wycombe, Bucks HP10 8HR.
Phone: 049481-5221.

6233

Power output: 300W rms/channel into 4 ohm; 200W rms/channel into 8 ohm; 700W rms in bridged mode.
Harmonic distortion: less than 0.05% at rated output.
IM distortion: less than 0.05% at rated output.
Noise: 100 dB below rated output.
Full power frequency response: 20-20k Hz, ±0.5 dB.

6021/6022

Power output: 200W into 4 ohm (*6021* transformer output; *6022* direct output).
Harmonic distortion: less than 0.2% at rated output.
IM distortion: less than 0.2% at rated output.
Noise: 100 dB below rated output.
Full power frequency response: *6021* 35-20k Hz, ±0.5 dB; *6022* 20-20k Hz, ±0.5 dB.

6011/6012

Power output: 100W rms per channel into 4 ohm.
Harmonic distortion: less than 0.2% at rated output.
IM distortion: less than 0.2% at rated output.
Noise: 90 dB below rated output.
Full power frequency response: *6011* 35-20k Hz, ±1 dB; *6012* 20-20k Hz, ±0.5 dB.

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FM Acoustics FM 800A power amplifier. (Linguistic point: front-panel 'error' light indicates overload.)

32 tracks available now. The complete system: TELEFUNKEN "magnetophon" 15A

Unprecedented flexibility and operating ease. A system approach to all accessories: a micro-processor based autolocator with 9-position memory and stop timer, remote track selectors and a capstan speed controller with crystal precise digital speed read-out. The TELEFUNKEN M15A multi-track. All in all a totally new generation of master recorders from the inventors of modern tape recording. Up to 32 tracks on 2" tape! 12 1/2" reel diameter capacity. Versions with the TELEFUNKEN "telcom c4" noise reduction system (built-in for up to 24 tracks). Readily upgradable to higher track configurations. Crystal locked 7.5/15 or 15/30 ips tape speeds, NAB/CCIR/AES switchable equalization and clock-timed record/erase functions to permit gap-less, inaudible electronic splicing. It's the recorder for the engineer who wants to pay for performance – not for gadgets: the experienced professional.

Please send me the brochure on »magnetophon 15A Multi-Track-Systems«

Name

Address

Telephone

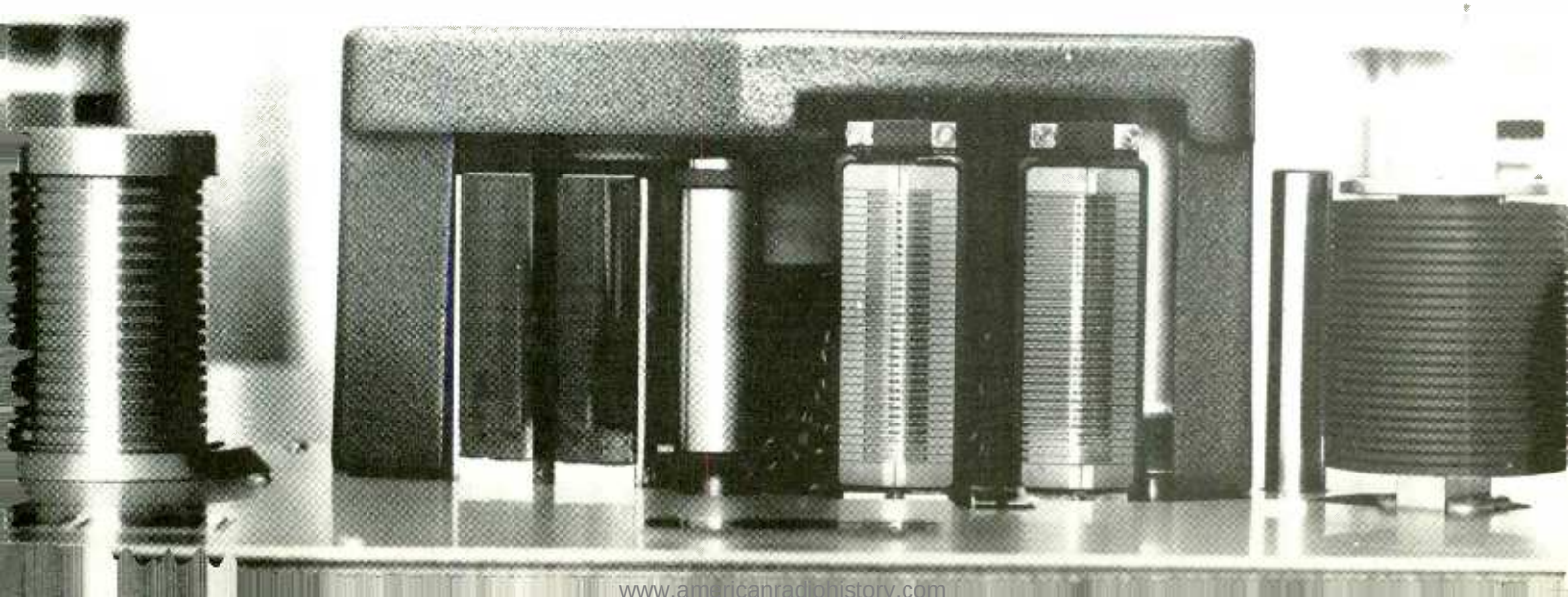
GOTHAM AUDIO CORPORATION
741 Washington Street
New York, NY: (212) 741-7411
1710 N. La Brea Ave.,
Hollywood, CA: (213) 874-4444
USA

Hayden Laboratories Ltd.
Curchfield Road
Chalfont St. Peter, Bucks. SL9 9EW
Gerrards Cross 88447 (STD 02813)
U.K.

AEG-TELEFUNKEN
Magnetbandgeräte
P.O. Box 2154
D-7750 Konstanz
W.-Germany

professional tape recorders by AEG-TELEFUNKEN

WAK 752



SURVEY: POWER AMPLIFIERS

JPS

JPS Associates, Belmont House, Steel Road, Park Royal, London NW10 7AR, UK
Phone: 01-961 1274.

1002L/1002LS
Power output: 100W rms per channel into 8 ohm.
Harmonic distortion: less than 0.06% at rated output.
IM distortion: less than 0.04% at rated output.
Noise: 115 dB below rated output.
Full power frequency response: 10-20k Hz, ±0.2 dB.
Weight: *1002L* 9.5 kg. *100SLS* 8 kg.

1502LS
Power output: 175W rms per channel into 8 ohm; 220W rms into 4 ohm.
Harmonic distortion: less than 0.06% up to 200W rms output (8 ohm).
IM distortion: less than 0.04% up to 200W rms output (8 ohm).
Noise: 115 dB below rated output.
Full power frequency response: 10-20k Hz, ±0.2 dB.

3002LS
As *1502LS*, excepting:
Harmonic distortion: less than 0.06% up to 300W rms output (8 ohm).
IM distortion: less than 0.04% up to 300W rms output (8 ohm).

LUX

Lux Corporation, 1-8-31 Nagahishi, Nishinari-ku, Osaka, Japan.
Phone: 632-0031.
UK: Howland West Ltd, 3-5 Eden Grove, London N7 8EQ.
Phone: 01-609 0293/6.

M-4000
Power output: 180W per channel continuous into 8 ohm.
Harmonic distortions: 0.05% at rated output.
IM distortion: 0.05% at rated output.
Noise: 108 dB below rated output.
Full power frequency response: 20-20k Hz (tolerance unspecified).

M-6000
Power output: 300W per channel continuous into 8 ohm.
Harmonic distortion: max 0.05% at rated output.
IM distortion: max 0.05%.
Noise: 100 dB below rated output.
Full power frequency response: 20-20k Hz, ±1 dB.
Price: £1650.

5M21
Power output: 100W per channel continuous into 8 ohm.
Harmonic distortion: 0.005%.
IM distortion: 0.005%.
Noise: 120 dB below rated output.
Full power frequency response: dc to 100k Hz, ±1 dB.
Price: £950.

MARANTZ

Marantz, Avenue Van Overbeke, 17, 1080 Brussels, Belgium.
UK: Marantz Audio Ltd, 203 London Road, Staines, Middlesex.
Phone: Staines 50132.

JPS model 1502LS stereo amp.

510M
Power output: 330W rms per channel into 4 ohm; 256W into 8 ohm.
Harmonic distortion: 0.05%.
IM distortion: 0.05%.
Noise: 115 dB below rated output.
Full power frequency response: 5-100k Hz (no tolerance).

250M
Power output: 165W rms per channel into 4 ohm; 126W into 8 ohm.
Harmonic distortion: 0.08%.
IM distortion: 0.08%.
Noise: 106 dB below rated output.
Full power frequency response: 20-70k Hz (no tolerance).

170 DC
Power output: 108W rms per channel into 4 ohm; 86W 8 ohm.
Harmonic distortion: 0.03%.
IM distortion: 0.03%.
Noise: 110 dB below rated output.
Full power frequency response: dc to 70k Hz (no tolerance).

MICHAELSON/AUSTIN

Michaelson and Austin Ltd, 140 New Bond Street, London W1Y 9HF, UK.
Phone: 01-499 3510.

TVA-1
Power output: 70W rms per channel into 4, 8 or 16 ohm.
Distortion: less than 0.2% (10W at 1k Hz).
Noise: 88 dB below rated output.
Frequency response: 15-25k Hz, ±0.2 dB at 65W.
Features: 'the only amplifier designed specifically with sonic considerations in mind.'

MILLBANK

Millbank Electronics Group Ltd, Uckfield, Sussex TN22 1PS, UK.
Phone: 0825-4166.

PAC 30/50/100
Power output: 30/50/100W rms per channel into 8 ohm.
Distortion: less than 0.44%, typically 0.2% (1.5 dB below rated output at 1k Hz).
Noise: 80 dB below rated output.
Full power frequency response: 30-20k Hz, ±3 dB.

PAC 100MB
As *PAC 100* with automatic battery operation in event of mains failure.

NAIM

NAIM Audio Ltd, 11 Salt Lane, Salisbury,

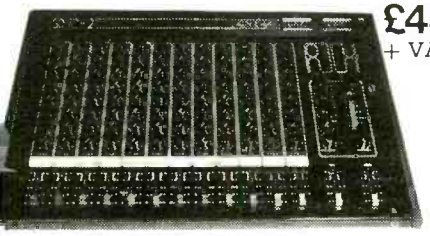
54 ▶

REVOX B77

The new Revox with full logic, easy editing, varispeed option. Check our new low prices on this and the A77 range.

ALLEN & HEATH SD12-2

New 12/2 Sound re-inforcement mixer which may also be used for 4 track recording.



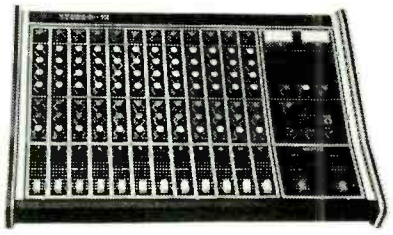
£430 + VAT

H/H STEREO 12

Quality 12/2 desk from a manufacturer needing no introduction – many features at a sensible price.

£330 – VAT

on demonstration with companion echo/effects module.



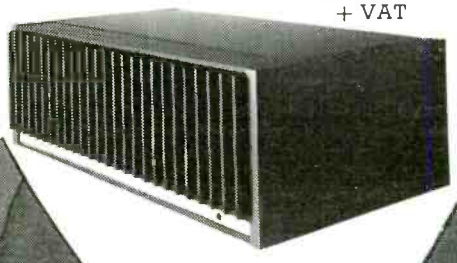
Roger Squire's PRO-AUDIO

BRITAIN'S LEADING SUPPLIERS OF PROFESSIONAL AUDIO EQUIPMENT

QUAD 405

Unique "current dumping" monitor amplifier

£160 + VAT



TEAC TASCAM 80-8

Economic operation, simplicity of use – 8 track recording at a price for those with more talent than money.

£2314 + VAT

DX-8 8 channel DBX Unit
£690 + VAT

All Teac/Tascam multitrack range on full demonstration.

ANGLE POISE MICROPHONE ARM

We are sole U.K. distributors of this product. Available with wall, table or clamp mounting bracket. Available in black and chrome.

£14.75 + VAT

All prices correct at the time of going to press.

You'll find the approach quite different at Roger Squire's Pro-Audio, it's something known as service. Like other suppliers we carry large stocks (a wider range and larger than most). Yet before the point of purchase we want you to be convinced you are making the right choice.

You are invited to visit our showrooms where you will find a vast range of mixers, multi-track tape machines, microphones, monitor amps, etc. wired ready for demonstration, which together with our Technical Advisory Service is an unbeatable combination.

Should you meanwhile wish to consider the extent of our product range, it's contained in our NEW 60 page catalogue. We would be pleased to send a copy FREE of charge upon request.

Branch Manager : Cliff Lake
Sales Engineer : Dave Whittaker
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Local parking – 5 mins. from St. Johns Wood Tube.
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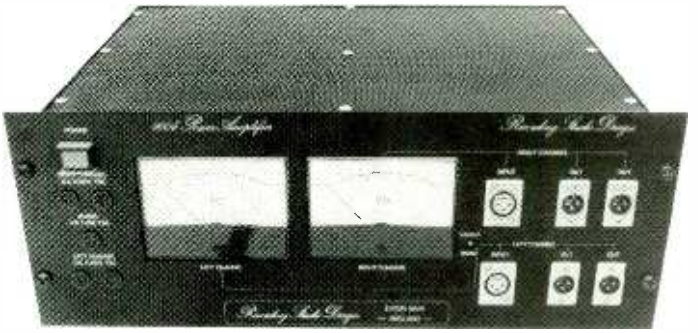
Naim cont'd

Wiltshire SP1 1DT, UK.
Phone (0722) 3746.
US: Audiophile Systems, 5750 Rymarck Court, Indianapolis 46250.
Phone: (317) 849 7130.

NAP120/160/250
Power output: 40W/50W/70W per channel into 8 ohms, both channels driven.
Distortion: less than 0.03% Intermodulation distortion products at 35W.
Price: from around £140.



Recording Studio Design 800b amp with XLR connectors installed uncommonly on front panel.

PEAVEY

Peavey Electronics Corporation, Meridian, Mississippi 39301, USA.
UK: Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX.
Phone: 0825-5566.

CS-800
Power output: 400W rms per channel into 4 ohm.
Harmonic distortion: less than 0.1% at rated output.
IM distortion: less than 0.2% up to 400W rms into 4 ohm.
Noise: 100 dB below 400W.
Full power frequency response: 5-30k Hz, ±1 dB.

QUAD

Acoustical Manufacturing Co Ltd, Huntingdon PE18 7DB.
Phone: (0480) 52561.

405
Power output: 100W rms per channel into 8 ohm.
Distortion: less than 0.01% total distortion at rated output (1k Hz).
Noise: 95 dB below rated output ('A' weighted).
Full power frequency response: 20-50k Hz, ±3 dB.
Price: £160.

303
Power output: 45W rms per channel into 8 ohm.
Distortion: less than 0.03% total distortion at rated output (1k Hz).
Noise: 100 dB below rated output (A-weighted).
Full power frequency response: 30-35k Hz, ±1 dB.
Price: £108.

QUINTESSENCE

Quintessence Group, 2898 Del Paso Blvd, Sacramento, Ca 95815, USA.
Phone: (916) 920 2215.

PA11
Power output: 200W/channel into 8 ohm.
Power bandwidth: dc to 74k Hz (*sic*).
Distortion: less than 0.2%.
Noise: better than —95 dB.
Price: $1300; £760.

PA1
Power output: 90W/channel into 8 ohm.
Power bandwidth: 68k Hz (*sic*).
Distortion: less than 0.2%.
Noise: better than —95 dB.
Price: $650; £380.

RAC

Rugby Automation Consultants, 19 Freemantle Road, Bilton, Rugby CV22 7HZ, UK.
Phone: 0788-810877.

RACAMP 50/100/200
Power output: 50/100/200W rms.
Power bandwidth: 10-20k Hz, ±1 dB.
Hum and noise: 76 dB below 50 mW.
Distortion: 0.025% thd at 1k Hz, 0.15% at 12.5k Hz, power level unspecified. 1m less than 0.25%.
Price: £72/80/120.
A 50+50W/channel dual *Racamp 50* is available, price £95.

RADFORD

Radford Audio Ltd, Ashton Vale Road, Bristol BS3 2HZ, Avon, UK.
Phone: 0272-662301.

ZD 200/100/50
Power output: 150/90/70W per channel into 8 ohm; 250/150/110W per channel into 4 ohm.
Distortion: less than 0.004% thd at 1k Hz, rated power 8 ohm.
Noise: 110 dB below rated output.

RECORDING STUDIO DESIGN

Recording Studio Design, Home Farm, Northall, Dunstable, Beds, UK.
Phone: 0525-221331.

800b
Power output: 340W rms into 4 ohm; 220W rms into 8 ohm.
Distortion: less than 0.25% at rated output; typically less than 0.05%.
Noise: 100 dB below 200W into 8 ohm.
Full power frequency response: dc to 20k Hz (tolerance unspecified).
Price: £503.

SAE

Scientific Audio Electronics Inc, 701 East Macy Street, Los Angeles, Ca 90012, USA.
Phone: (213) 489 7600.
UK: REW Audio Visual Ltd, 146 Charing Cross Road, London WC2.
Phone: 01-240 3064.

2400L
Power output: 200W per channel.
Distortion: less than 0.05% thd and im.
Noise: 100 dB below rated output.
Price: £650.

SHURE

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

SR105C-E6
Power output: 200W rms into 4 ohm; 100W rms into 8 ohm.
Distortion: 2% max at 1k Hz, 200W into 4 ohm.
Noise: 80 dB below rated output.
Full power frequency response: 20-20k Hz, ±1.5 dB.

SONY

Sony Corporation, PO Box 10, Tokyo Airport, Tokyo, Japan.
Phone: 488-221
UK: Sony (UK) Ltd, 134 Regent Street, London W1R 6DN.
Phone: (01) 439 3874.
US: Sony Corporation of America, 9 West 57th Street, New York, NY 10019.
Phone: (212) 371 5800.

TA-N88 PWM AMPLIFIER
Power output: 160W rms per channel into 8 ohm.
Harmonic distortion: less than 0.5% at rated output.
IM distortion: less than 0.1% at rated output.
Noise: less than 0.1mV (8 ohm load, A-weighted).
Full power frequency response: 20-20k Hz, ±3 dB.

TA-N7
Power output: 100W rms per channel into 8 ohm.
Harmonic distortion: 0.01% at rated output.
IM distortion: 0.01% at rated output.
Noise: 0.024 mV (8 ohms load, A-weighted).
Full power frequency response: 5-35k Hz, ±3 dB.

SOUNDOUT

Soundout Laboratories Ltd, 91 Ewell Road, Surbiton, Surrey KT6 6AH, UK.
Phone: 01-399 3392.

M200/S400
Number of channels: *M200* monophonic; *S400* stereophonic.
Power output: 210W rms into 4 ohm, 150W rms into 8 ohm.
Distortion: 0.15% at 200W into 4 ohm, 0.13% at 1W into 8 ohm.
Noise: 92.5 dB below 200W.
Full power frequency response: 10-28k Hz, ±3 dB.

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The Studer A68 Amplifier – a powerful break with tradition

The Studer A68 is a unique breakthrough in high power amplification for professional use. Its 100 watt per channel (into 8 ohms) power capability is achieved through completely new design concepts which have eliminated transient intermodulation distortion while keeping harmonic distortion below 0.1% at all power levels. The result is a fully professional low distortion amplifier ideally suited to continuous high power operation under arduous studio conditions.

Other features of the Studer A68 include:

- ☐ 100W stereo or 350W mono (into 8 ohms)
- ☐ Fully electronic protection circuitry
- ☐ Low overall feedback for very low distortion
- ☐ Complementary push-pull circuits throughout
- ☐ Standard 19-inch rack mounting size
- ☐ High efficiency power supply amply rated for continuous high power operation
- ☐ Level controls for each channel on the front panel

F.W.O. Bauch Limited

49 Theobald Street, Boreham Wood,
Hertfordshire, WD6 4RZ
Tel: 01 953 0091 Telex: 27502

SURVEY: POWER AMPLIFIERS

SOUNDCRAFTSMEN

Soundcraftsmen, 1721 Newport Circle, Santa Ana, Ca 92705, USA.
UK: REW Audio Visual Ltd, 146 Charing Cross Road, London WC2.
Phone: 01-240 3064.

MA5002
Power output: 250W rms per channel into 8 ohm.
Harmonic distortion: less than 0.1%.
IM distortion: less than 0.05%.
Noise: 105 dB below rated output.
Full power frequency response: 20-20k Hz (tolerance unspecified).

SPECTRA SONICS

Spectra Sonics, 770 Wall Avenue, Ogden, Utah 84404, USA.
Phone: (801) 392 7531.

701
A system comprising up to eight power amplifiers cards fitting within a 483 mm rack.
Power output: 80W developed across 2 ohm; modules may be bridge connected to double individual ratings.
Power bandwidth: within 0.3 dB at rated output (4 ohm) dc-20k Hz.
Total harmonic distortion: less than 0.01% at full output.
Intermodulation: less than 0.1% at full output.
Signal-to-noise ratio: better than 120 dB below full output (20-20k Hz).
Price: $89.00 per module.

STUDER/REVOX

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf, Switzerland.
Phone: 01 840 29 60.
US: Studer Revox America Inc, 1819 Broadway, Nashville, Tenn 37203.
Phone: (615) 329 9576.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham-wood, Herts WD6 4RZ.
Phone: 01-953 0091.

A68
Power output: 100W/channel into 8 ohm; 175W/channel into 4 ohm; bridge connected 400W into 8 ohms mono.
Frequency response: within 1 dB from 20 to 20k Hz.
Distortion: less than 0.1% at rated power.
Noise: better than 100 dB.
Price: £528.

A740
A 'consumer' version of the *A68*. This unit has unbalanced inputs, headphone outputs, etc, and features two front panel signal meters.

SWEET C

Sweet C Productions Inc, 522 Bryant Street, Palo Alto, Calif 94301, USA.
Phone: (415) 321 3004.

MODEL 2300
Power output: 300W rms per channel into 1-4 ohm; 175W rms into 8 ohm.
Total distortion: less than 0.1% at rated output.
Noise: 115 dB below rated output.

TAPCO

Tapco Corporation, 3810 148th Avenue, N E Redmond, Washington 98052, USA.
Phone: (206) 883 3510.

CP500M
Power output: 250W continuous power per channel into 4 ohm; 150W in 8 ohm.
Harmonic distortion: 0.05% at rated output.
IM distortion: 0.05% at rated output.
Noise: 95 dB below rated output.
Full power frequency response: 20-20k Hz, ±0.2 dB.

TECH-CRAFT

Lear Siegler Inc, Bogen Division, PO Box 500, Paramus, NJ 07652, USA.

TCB-5320
Power output: 160W rms per channel into 8 ohm.
Harmonic distortion: less than 0.1% at rated output.
IM distortion: less than 0.1% at 80W into 8 ohm.
Noise: 100 dB below rated output.
Full power frequency response: 10-20k Hz, ±2 dB.

TURNER

Turner Electronic Industries, 175 Uxbridge Road, London W7 3TH, UK.
Phone: (01) 567 8472.

B502
Power output: 340W rms per channel into 4 ohm; 190W into 8 ohm.
Harmonic distortion: typically less than 0.005% at rated output.
IM distortion: typically less than 0.02% at rated output.
Noise: typically 110 dB below rated output.
Full power frequency response: 20-20k Hz, ±0.1 dB.
Price: £395.

B302
Power output: 150W rms per channel into 4 ohm; 100W into 8 ohm.
Harmonic distortion: typically less than 0.005% at rated output.
IM distortion: typically less than 0.02% at rated output.
Noise: typically 110 dB below rated output.
Full power frequency response: 20-20k Hz, ±0.1 dB.
Price: £280.

UNI-SYNC

Uni-Sync Inc, 742 Hampshire Road, Westlake Village, Calif 91361, USA.
Phone: (805) 497 0766.

MODEL 100
Power output: 150W per channel continuous average power into 4 ohm; 100W into 8 ohm.
Harmonic distortion: 0.03% at rated output.
IM distortion: 0.01% at rated output.
Noise: 105 dB below rated output.
Full power frequency range: 20-10k Hz.
Price: $549.

MODEL 50
Power output: 60W per channel continuous average power output into 4 ohm; 50W into 8 ohm.
Harmonic distortion: 0.03% at rated output.
IM distortion: 0.01% at rated output.
Noise: 105 dB below rated output.
Full power frequency range: 20-20k Hz.
Price: $329. ■

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AES 60th Convention, Los Angeles—a report

Gordon Skene *attended the 60th Convention of the Audio Engineering Society which was held at the Los Angeles Hilton from May 2 to May 5 and relays how he saw it.*

UNFORTUNATELY the Los Angeles AES show held few surprises that hadn't previously been seen at the Hamburg show. Distressing in many cases, this show held few nuances, save of course for the great leaps in digital recording and the unveiling of the *Tascam Model 15* console. By and large though, I must confess this show was quite boring and uneventful. It may be that the flurry of technical advances in the digital process, the increasing awareness in the States of direct-to-disc recording, and the ever-growing number of low-budget *Tascam*-oriented studios have proven to be a bit of an overload for many individuals.

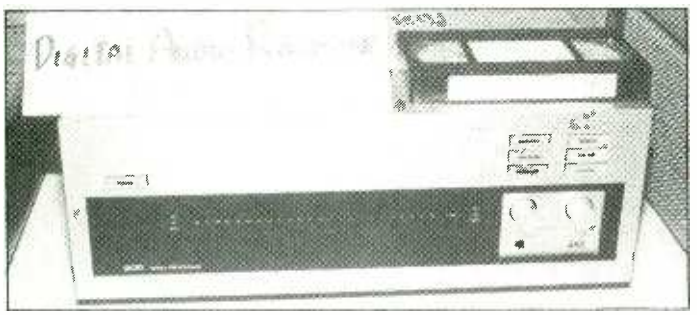
The other facet, which I found to be rather precarious, was the predominant emphasis on the 'new technological dialogue'; in essence, the explanation of audio engineering in such highly technical terms that the novice is stunned almost immediately. Many conventioneers seemed to fail to fully understand what exactly digital recording is all about, let alone the direction in which it was going. Many of the engineers in charge of explaining these fine points immediately employed vast amounts of abstract theorum. With the result that the curious were turned away in droves, scratching heads and shrugging shoulders. (If only Hugh Ford had set up a translation booth to relieve scrambled minds!)

If the conventioneers didn't walk away confused by the digital angular dissertations, they were turned away with various degrees of deafness due to the new 'harsh-is-beautiful' motto adopted by the majority of studio monitor manufacturers. Let me first set the record straight by saying that I have nothing against vibrant, loud sound; given, of course, that it doesn't come complete with shrieks and mud. Loud is beautiful if it is *clean*, and this was not clean. I fully realise that one must make allowances for the catch-as-catch-can aspects of hotel showrooms and their dubious acoustical properties. But for the past five years I have been to the same rooms used by the same companies, heard the same excuses and nothing has been done. It is my gut feeling that if something weren't legitimately wrong these manufacturers wouldn't need to make excuses. And that the plethora of engineers, who spend the entire length of the convention tweaking and glueing things together, could arrive between themselves at some sort of satisfactory solution to this supposed problem.

But enough of the negative aspects. Oddly enough the positive aspects, although they were few and far between, did exist.

The presence of the *Tascam Model 15* console was indeed a welcome sight. **Teac** have done an amazing service to those who want to get into engineering, but suffer from limited funds; to them we owe a large debt of gratitude. This is a Stateside feeling, and I hear that only a smattering of their recent products are available in the UK. I do not fully understand why this is so, but the feeling I get is that the Teac Corporation would see the same overwhelming response to their range of consoles and tape machines in the UK as they do in the US. In the course of conversations with a *Tascam* engineer there were hints that Teac in the very near future will offer an automated set-up for use with the *Model 15*. At present the 24-in/8-out console will retail for $9500. As full details of the console were not available at press time—the board on display being only the second one built —information will be forthcoming. Teac is also offering the *90-16* sixteen-track on 25.4 mm tape machine in a more accessible console configuration than was previously available. In addition, the newer *25-2* two-track and *40-4* four-track tape machines

As it says on the label: a prototype pcm digital processor for recording audio signals on a conventional video cassette machine.



The new Teac Tascam Series Model 15 *24-input/8-output group mixer with two auxiliary sends per channel and latching solo and mute controls. Cost is a very reasonable $9500.*

feature a better laid-out deck arrangement than the previous *3300/3340* series. All in all, *Tascam* is proving to be a conscientious friend to the novice and low-budget engineer/producer.

I was rather amazed to see that with the large number of direct-to-disc sessions taking place in the US and the incredible number of record companies springing up from nowhere, there are several disc-mastering manufacturers emerging to meet the increasing demand. Most interesting of these is a new company, **Cybersonics,** who are currently offering their *Disc Master 2002* lathe system. Stressing convenience and simplified operation with specific design towards the smaller studio application, the *DM 2002* appears to be an efficient and sleek entry into disc mastering. The system, which was on show for the first time at the Los Angeles AES, is going for $46 000 with slave units an extra $32 000. Cutting heads, of course, are an optional extra but the system will work with all the presently-available units. It will be interesting to see how this system fares with budget studios, as it has always been a problem to find a small studio with funds to accommodate the client who wants reference cuts, or for that matter mastering. I seriously doubt whether the average *Tascam* studio owner will be able to afford such a system, even at such a relatively reasonable price. (Or maybe the combined forces of Teac and JVC are plotting something we don't know about yet; interesting to ponder nevertheless.)

3M was proudly displaying the new *Digital Audio Mastering System* and, as a sort of acknowledgement that digital is the way of the future, also unveiled their *Scotch 265* digital mastering tape. The digital system stressed the amount of flexibility available in the remote logic control, which features all modes of operation and led level indicators in one unit.

If 3M's mastering system is impressive for the studio, JVC's digital playback system is equally impressive for use on possibly a more consumer level. It employs a *Vidstar* (*VHS* format) video cassette machine with digital information being recorded in video format and translated by JVC's processing system. The quality of the tapes, well over fourth generation copies played back at the 7.5 cm/s equivalent speed, was astounding. Unfortunately little or no information was to be had from the JVC people, owing to the fact that very little English was spoken and nods of heads would have to suffice. Because the *VHS* and *Betamax* video formats are so popular in the US, it would be easy to assume that JVC and Sony will have no trouble introducing their digital playback systems to already existing customers, and their number grows daily. Somehow, the wave of the future is becoming encased in concrete.

Still on the subject of digital, the demonstration of the **Coupland** *Digital Synthesiser* designed by Rick Coupland was a rather interesting experience, perhaps not so much for the actual performance but rather the clever environment in which it was introduced. Walking down the aisle with manufacturers glutted on either side I noticed an inordinate amount of feet dangling from a large capsule. At first I thought it was something new and rude for the home; something on the order of the 'thousand-tiny-fingers-urging-her-to-let-go' sort of thing. Closer inspection, however, found this to be an interesting listening environment, encasing the listener in a darkened, almost soundproof cocoon and bathed in massive doses of Rick Coupland's new creation. The bombardment lasted for two and a half minutes, after which all of the recipients sat up and walked out somehow refreshed; not necessarily impressed by this yet-another-synthesiser but instead enthusiastic over the environment. Calling cards for the capsule's manufacturer went faster than leaflets on the synthesiser, which just goes to show that even in Hollywood clever promotion may be more effective than the product.

Although the AES Convention exhibition is primarily concerned with the exposure of studio-oriented items, it was rather interesting to see **Jonas Miller Sound,** a consumer store dealing with what amounts to probably the 'Rolls Royce' of domestic equipment, displaying new items for home reproduction to rival—and in many cases surpass—what was being offered to the professionals. In their booth I discovered that there is still a place where loud can be beautiful. Hailing from France (and drifting down through Canada) the *Acoustic 3A Andante* biamplified master control monitors produce the cleanest, clearest, most transparent sound I've heard in years. Unfortunately, this

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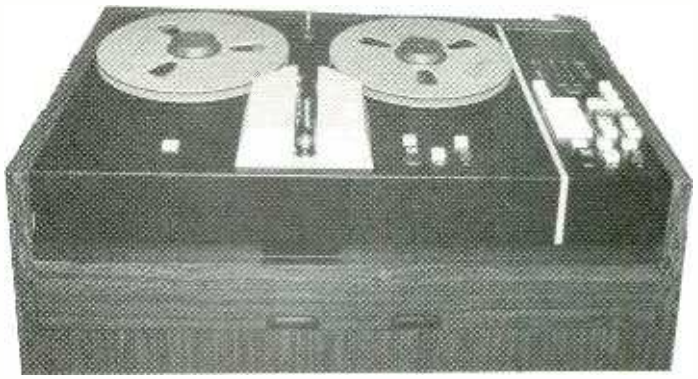
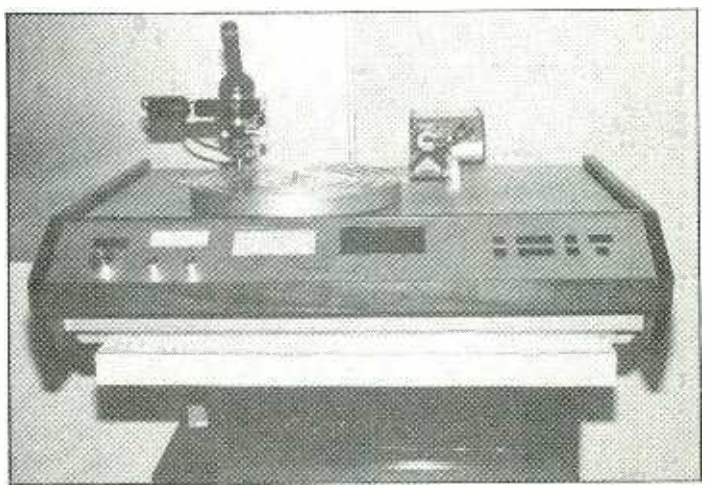
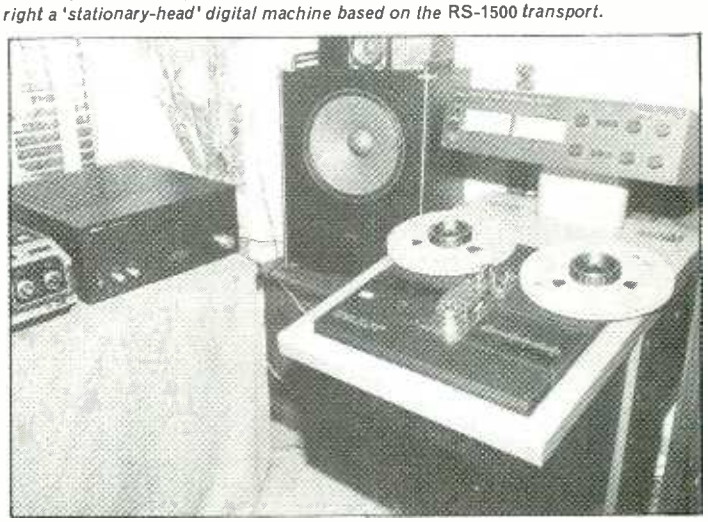
The new 3M four-track on 12.5mm digital tape machine attracted a lot of attention. Whither analogue ?



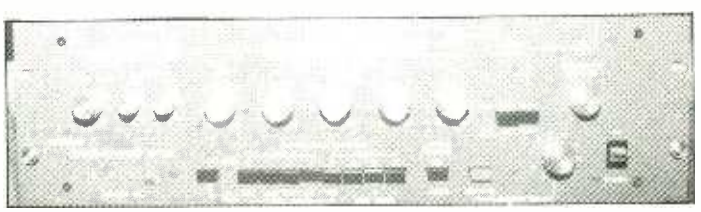
The new Cybersonics disc-cutting lathe will be available at the end of this year for around $46k.



Technics were showing two new pcm recording systems; on the left the encoder/decoder unit for use with video cassette machines; and on the right a 'stationary-head' digital machine based on the RS-1500 *transport.*



The new Ursa Major Space Station *special effects unit combines a nine-input stereo mixer, 256 ms delay line and reverberation processor in a rack mounting package costing only $1995.*



monitor is extremely difficult to find and is not one of your common items in stereo shops. But, in keeping with the tradition of the Jonas Miller organisation, it is one of the finest. They are currently being used as mastering monitors at Miller & Kreisels Real Time Records, a company totally devoted to direct-to-disc releases. The current US price for the *Acoustic 3A* is $1600 a pair.

Each year there is an increasing presence on the part of manufacturers of special effects equipment. One of the newer entries is **Micmix** featuring *Master-Room* reverberation in *Super C*, *Standard C*, *Studio B* and 'basic' models, as well as the *Dynaflanger*, *Time Warp* and *Master Audio Meter*. Of the lot, the item most played around with was the *Dynaflanger*. I admit to not being very impressed. The supposedly 'sweeping' flanging effects were just too synthetic and uninteresting in comparison to what is already available in other units.

In response to 3M's entry into the digital market, **Ampex** has just issued their *Series 460* digital tape. According to Ampex the tape is capable of resolving signal wavelengths as short as 1.5 microns, and is tested for end-to-end surface integrity with extremely tight control on dropout levels. Ampex *460* is available in two configurations: 12.7 mm by 4600 ft and 25.4 mm by 4600 ft. So once again Ampex and 3M are neck and neck in competition. Which is interesting since Ampex's quality control has risen sharply over the last few years from their former dire position both in the US and UK. A note in passing: Ampex video cassettes in 19 mm format have considerably improved in quality over the past two years, making them good competition for Sony whose quality has dropped off in recent months due to a switch-over in manufacturing location from Japan to America.

I also hear that the new tape has been used on three recording sessions to date. One of these, featuring the Duke Ellington Orchestra with vocalist Diahann Carroll, is expected to be released in the near future.

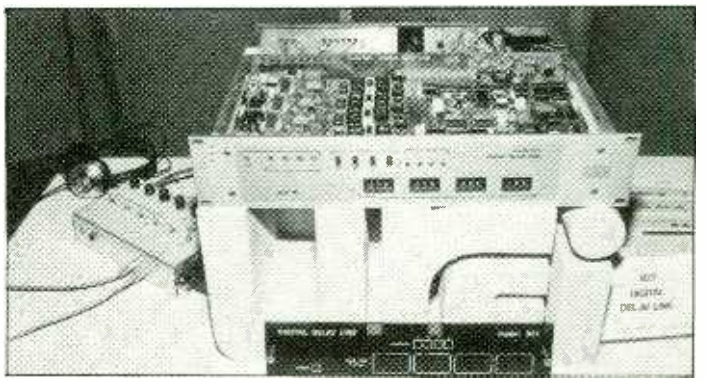
It appears as though the ever-elusive **Nagra** *Model T*, about which we have heard only vague rumours, is as much a mystery to the Nagra representatives as it is to us. No information, not even rumours, were circulated around the Kudelski reps.

Gotham Audio, who represent the interests in the US of Telefunken, EMT, Studer, Neumann and many others, were proudly displaying the new Studer *A800* and Telefunken *M15A* multitracks plus the newer Neumann disc-mastering setup. As these items have been covered in other issues it would be pointless to reiterate their finer points here, save only to mention the wide amount of interest that is poured over them every time these companies make so much as a sideways move. With the rave response Studer is having in the US it would only seem natural for Telefunken to get in on the action as well.

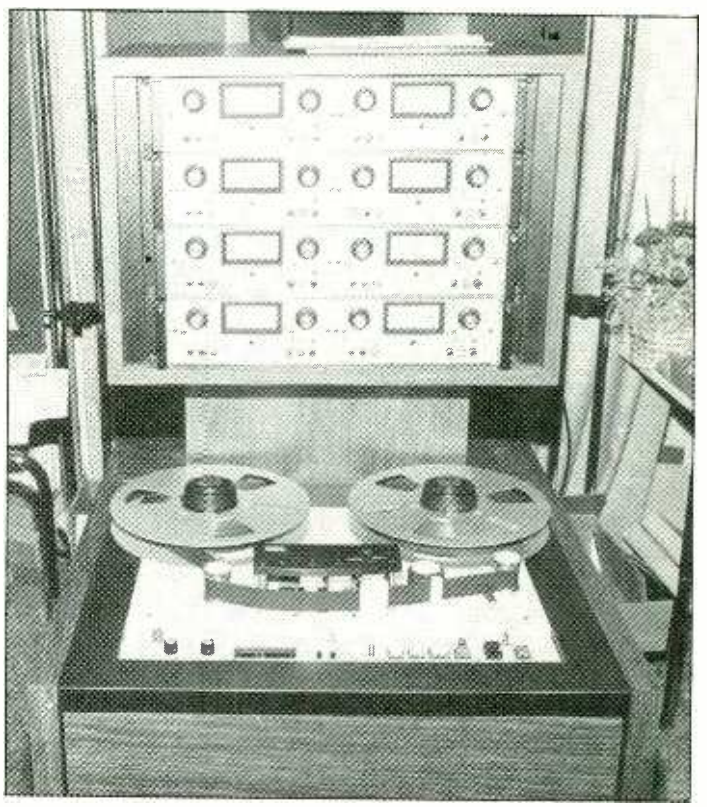
New publications shared a high degree of interest during the LA Convention, something which hasn't happened too much in the past. Apart from the fact that most sample issues are free, which wins immediate acceptance, the number of West Coast-based publications concerned with increasing the dialogue on recording technique is on the increase. One paper in particular *The Mix*, publishes a directory of Northern and Southern California listing nearly 120 four, eight, 16 and 24-track studios in the Bay Area of San Francisco alone. A goodly proportion of these studios are of the *Tascam*-type, but slickly presented in every way and doing landslide business. It is estimated that as many as twice that amount are in the Los Angeles/Southern California area, all variously equipped and mostly in the low-budget price range. Average rate is $25.00 per hour. This phenomenon certainly warrants further investigation, which will undoubtedly take place in future issues of STUDIO SOUND and its new sister publication, SOUND INTERNATIONAL.

It is worth pointing out that even though the bulk of equipment manufacturers are catering to the needs of the large studio, there is an ever-increasing movement underway to introduce equipment in the lower-price range to accommodate the budget studio. Such studios are at their peak in Los Angeles, but as for the AES in LA . . . Well, it was a yawn, a drink and a drive home. ■

The new model 927 *ddl from UREI offers four separate outputs with independent delay tune op to 127 ms on each output.*



The new reiativeiy-inexpensive JH-110A *eight track on 25.4 mm tape machine from MCI.*



The new Sound Workshop Series 1600 *20/16 console complete with* arms *(auto-recall mixdown system) designed to interface with the MCI* JH-50 *automation package.*

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REVOX

reviews

NEXT MONTH

We continue our power amplifier reviews with the Exposure IV, Harmon Kardon Citation-16 and the FM Acoustics 600A.

BGW 250C, Turner A500-VU, HH S500-D power amplifiers

Hugh Ford

Measurement of amplifier performance

Identical conditions were used for the measurements on all the amplifiers reviewed here but, as will be seen, the specification is such that the margin between test equipment and amplifier performance is in some instances non-existent. It follows that care is necessary when inspecting the performance found in the individual reviews.

These limitations are particularly related to the measurement of individual harmonic distortion and also twin-tone intermodulation distortion, which was done using two equal amplitude tones separated by 70 Hz. Fig. 1 shows the residual im distortion of the testgear when plotting the difference-frequency component 70 Hz above the higher frequency tone, which was swept between 200 and 200 kHz. Similarly, fig. 2 shows the residual second and third harmonic distortion of the testgear over the frequency range 20-20k Hz used for the individual amplifier tests. While the measurement of total harmonic distortion was undertaken using an instrument with a residual distortion of 0.002%, this measurement does not necessarily relate to the subjective effect of distortion. The ear finds the higher harmonics more objectionable and the instruments for measuring total harmonic distortion do not include any 'weighting' to account for this effect.

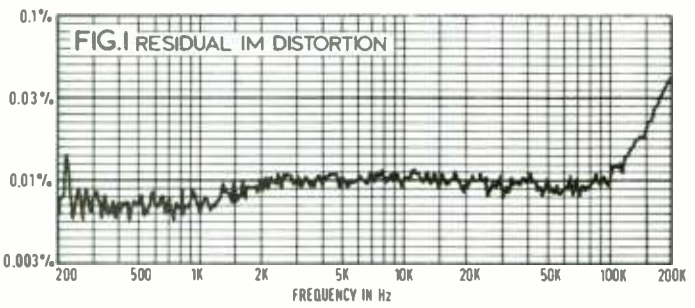
The overload recovery characteristics of the amplifiers were investigated by feeding the toneburst shown in fig. 3 to the amplifier. The lower amplitude 1 kHz tone drove the amplifier at half its rated power into 8 ohm, with the higher toneburst driving the amplifier into highly asymmetrical clipping. The duration of the overload burst was set to 20 ms with a repetition rate of 100 ms.

During all measurements the mains power to the amplifiers was stabilised at 240V ±0.5%. A very accurate digital voltmeter was used to measure the amplifier's output voltage into the resistive loads, which comprised 300W non-inductive resistors with a tolerance of ±0.5%.

Unfortunately the use of resistive loading does not properly simulate the presence of a loudspeaker since their impedances have sometimes large reactive components. But no two loudspeaker types are alike and it is impossible to overcome this problem. However, a reactive load comprising 8 ohm resistance in parallel with 2 μF capacitance was used for some tests (2 μF having a reactance of 8 ohm at 10 kHz).

Finally, I do not include the measurement of transient intermodulation distortion (tid) for two reasons: firstly there is no standard method; secondly there is evidence that twin-tone intermodulation tests correlate with tid measurements.

Hugh Ford



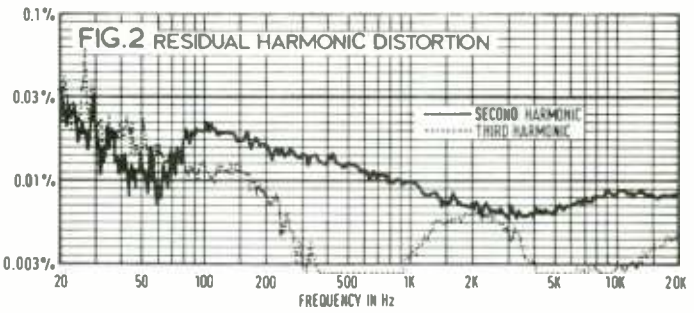
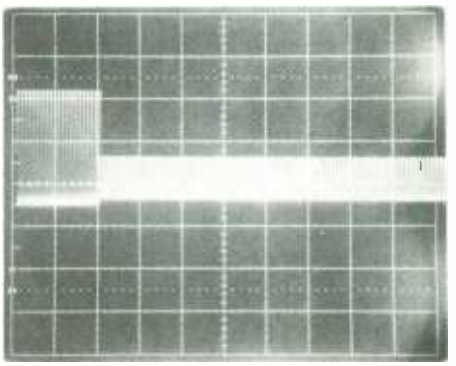


Fig. 3 Toneburst test.



64 ▶

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

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

SM59

Mellow, smooth, silent...

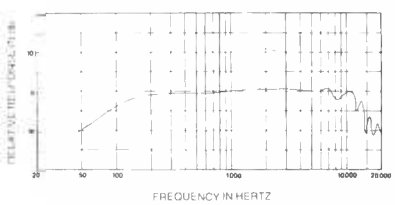
The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted for critical studio productions. In fact, you'll see it most often where accurate, natural sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response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

SM58

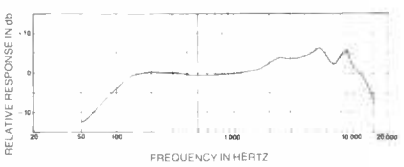
Crisp, bright "abuse proof"

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

Some like it essentially flat...



...some like a "presence" peak.



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BGW 250C Power Amplifier

Hugh Ford

Manufacturer's Specification
STEREO MODE—8 OHM
Power output: 100W average continuous power per channel.
Total harmonic distortion: less than 0.1% from 250 mW to 105W per channel.
Powerband (at rated power): 20-20k Hz.
Input sensitivity: approximately 1.5V required for full output.
Dampingfactor: greater than 500 at low frequencies.
STEREO MODE—4 OHM
Power output: 126W average continuous power per channel.
Total harmonic distortion: less than 0.15% from 250 mW to 190W per channel.
Powerband: 20-20k Hz.
Input sensitivity: approximately 1.25V required for full output.
MONO MODE—16 OHM
Power output: 230W average continuous power.
Total harmonic distortion: less than 0.1% from 250 mW to 230W per channel.
Powerband: 20-20k Hz.
Input sensitivity: approximately 750 mV required for full output.
MONO MODE—8 OHM
Power output: 251W average continuous power.
Total harmonic distortion: less than 0.15% from 250 mW to 360W per channel.
Powerband: 20-20k Hz.
Input sensitivity: approximately 600 mV required for full output.
GENERAL
Frequency response: +0 —0.25 dB, 20-20k Hz; +0 —3 dB, 2-65k Hz.
IM distortion: (60 and 7 kHz 4:1): less than 0.02% at rated power.
Input impedance: 47k ohm.
Rise time: 5 μs (indicating bandwith of 55 kHz).
Hum and noise: (20-20k Hz) 105 dB below rated power.
Power: 105-120V, 50-60 Hz at 5A maximum, or 210-240V at 2.5A maximum.
Turn-on: time delay relay turn-on; no switching transients or thump will appear at output.
Output protection: each channel is protected against shorts, open circuit operation, mismatched loads etc.
Overall protection: power line is protected with fast-acting circuit breaker. No fuses of any kind are used. Two thermal switches (one per channel) protect against over temperature operation. Controlled power bandwidth and slew rate protect tweeters and amplifier against excessive high-frequency operation.
Connectors: output standard 19 mm spacing, 5-way binding posts; input 6.35 mm phone jack, 3-pin *XLR*.
Dimensions (w x h x d): 483 x 133 x 44.5 mm.
Weight: 12.3 kg.
Price: £395.
Manufacturer: BGW Systems, 13130 South Yukon Avenue, Hawthorne, Ca 90250, USA.
UK agent: Webland Electronics Ltd, 129 Walham Green Court, Moore Park Road, London SW6 2DG.

THE *250C* power amplifier is typical in concept of the range of BGW amplifiers with overall protection being provided in the form of a fast magnetic circuit breaker. Only severe overload will trip the circuit breaker which operates in down to 20 ms, thus providing good loudspeaker protection. However, the breaker is not self resetting and hence has to be manually reset. In addition to this arrangement there are thermal sensors on each of the two large heatsinks. These did not operate while taking the measurements for this review, and it would appear that their protection is only required in either very high ambient temperatures or if the amplifier's convection cooling is severely restricted.

The form of construction is such that each power amplifier comprises a single printed circuit board mounted directly onto the heatsink associated with the six output transistors, the terminations of which solder onto the pcb. All wiring to the amplifier board is carried by an octal plug such that each amplifier can be readily disconnected and replaced if necessary. Servicing of the boards, however, is not eased by the lack of component identifications and of a layout diagram in the otherwise excellent owner's manual.

In addition to the two amplifier boards there is a further small pcb mounted in the base of the unit. This board houses a relay and a few associated components that effect the turn-on delay and also protect the load against excessive dc offset in the output.

Mechanically the two heatsinks form the

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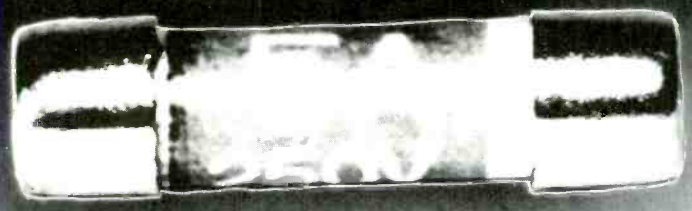
PROTECTION IS OUR BUSINESS



THE FUSE — a simple, inelegant solution

THE COMPEX — a more flexible, infinitely more elegant solution

The fuse is a very simple protection device which works, we think, a little too well. Because it would be highly embarrassing, not to say time consuming, to replace one on a big gig or during a heavy session. The **ADR Compex Limiter**, on the other hand, works equally as well — with the following bonus points:-

1. *The* **Peak Limiter,** *guaranteed not to overshoot by more than 2dB over threshold, 'resets' itself each time it operates.*
2. *The* **Compressor,** *set at 2:1 ratio will give a useful amount of 'subjective loudness' to punch programme through without increasing the chance of hearing damage at concerts.*
3. *The* **Gate** *will cut-out auditorium 'feedback' on open mikes during pauses.*

all this adds up to a better, more controlled, sound requiring minimal attention.

There are some pretty big P.A companies using ADR's elegant solution regularly on tours.....

.....shouldn't you be too!!

For ADR user list and details of the **F 760X-RS Compex Limiter's** variety of other uses write, phone or telex.

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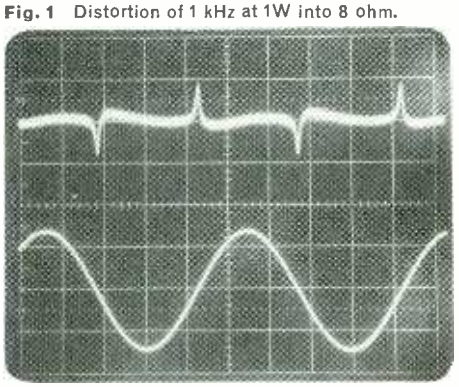
sides of the amplifier and bolt into a U-shaped tray which forms the front, rear and bottom of the amplifier. A U-shaped cover is secured to form the top and further sides which protect the heatsinks behind perforations, the front panel of the amplifier being a heavy alloy plate.

The magnetic circuit breaker, which also acts as the power on/off switch, protrudes through the front panel and has a nearby red 'power on' indicator. In addition there are the two potentiometer level controls on the front panel, and a red led clipping indicator associated with each.

Fig. 1 Distortion of 1 kHz at 1W into 8 ohm.



Signal inputs are at the rear of the amplifier and comprise two standard 6.35 mm unbalanced jack sockets. Also provided are two *XLR* three-pin sockets that become active when input transformers are inserted in the two covered octal sockets on the rear panel. The outputs are sensible in the form of banana sockets/terminals mounted on the standard 19 mm spacing. The rear-panel features are completed with a stereo/mono switch for bridge operation and a removable link that disconnects the amplifier earth from ground—plus the fixed mains power lead.

All controls and connections are clearly identified and the standard of construction—both electrically and mechanically—was to a high standard, giving a workman-like appearance both inside and out, the front panel being dimensioned for mounting into a standard 483 mm rack.

Power output and distortion

The output power into loads of 16, 8, 4 and 2 ohms was investigated with both channels driven—except with the 2 ohm load. The figures in **table 1** are well within the manufacturer's specification; the drive capability into 2 ohm is excellent with the magnetic circuit breaker operating only with this low load.

TABLE 1 OUTPUT POWER

Load	Output at onset of clipping	
	left	right
16 ohm	64W	65W
8 ohm	108W	111W
4 ohm	158W	162W
2 ohm	214W	214W

Total harmonic distortion was measured at the rated power output into 8 ohm and also at 1W output into either 8 ohm or 4 ohm (**table 2**). The total harmonic distortion at 1 kHz and 10 kHz was also measured with a 2 μF capacitor in parallel with the load. While the thd performance was good this is not the lowest distortion of amplifiers. As can be seen from **fig. 1**, the distortion of a 1 kHz signal at 1W into 8 ohm consists almost entirely of crossover distortion.

The rise of distortion with the lowering of output power is shown again in the plots of the individual harmonic distortion at 100W and 1W into 8 ohm; **figs. 2 and 3** show a substantial increase in the third harmonic at the lower output power. A similar pattern is found in the twin-tone intermodulation distortion at 100W and 1W peak equivalent sinewave output. This is shown in **figs. 4 and 5** which demonstrate a substantial increase in the intermodulation products above 2 kHz with 0.05% intermodulation distortion at 15 kHz and 1W output—a possible symptom of transient intermodulation troubles?

Measurement of the power bandwidth for 0.1% total harmonic distortion at half the rated output power into 8 ohm showed that

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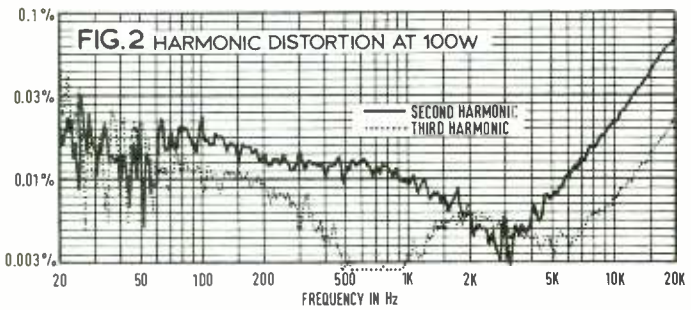

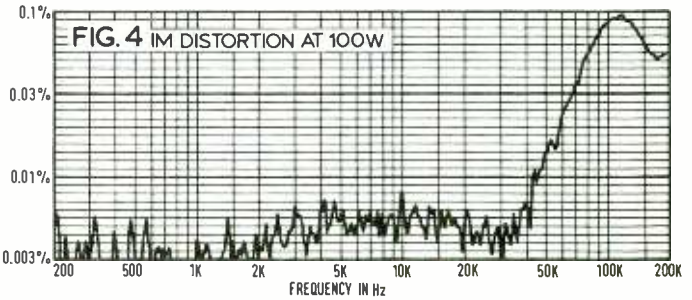

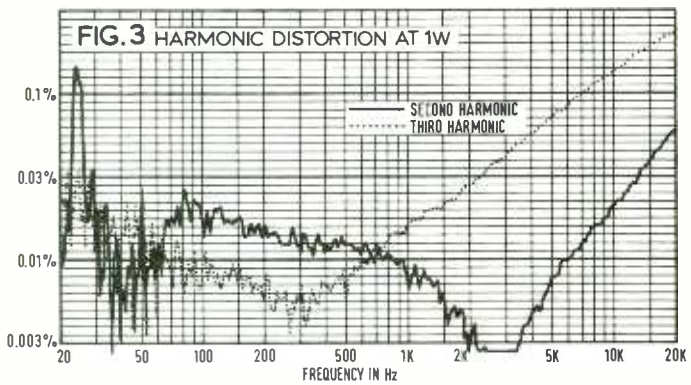

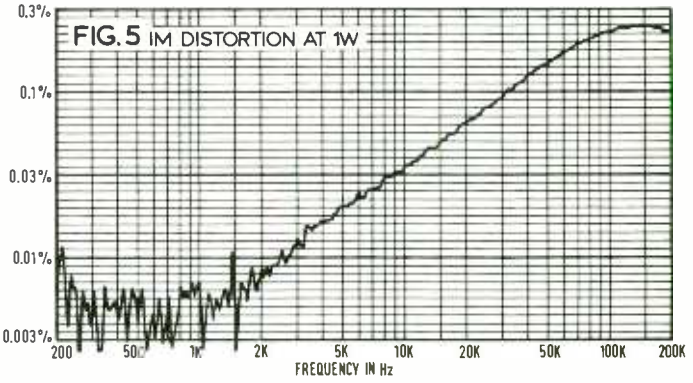

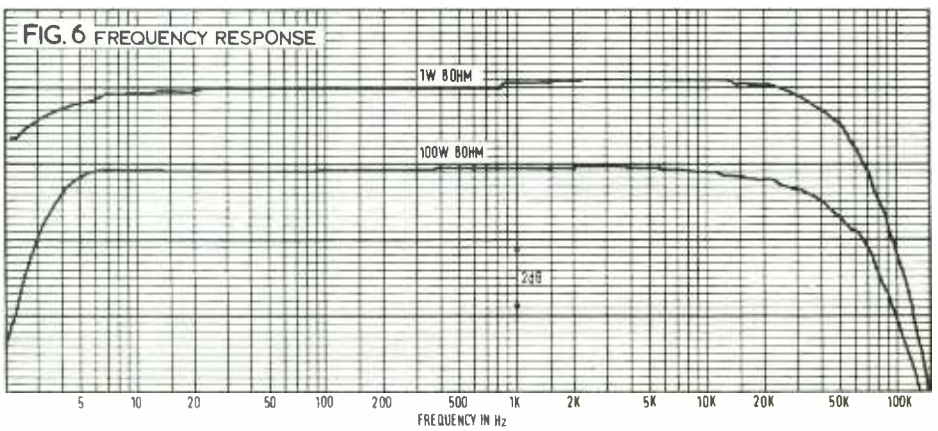

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this was good, with the bandwidth extending to 30 kHz for one channel and to 32 kHz for the other.

Frequency response and noise

The overall frequency response at 100W and 1W into an 8-ohm load is shown in **fig. 6,** from which it is to be seen that the two responses are virtually identical within the audio frequency band with the total deviation not exceeding 0.3 dB from 20 Hz to 20 kHz.

Measurements of noise in the output, relative to the rated power of 100W into 8 ohm, gave the results in **table 3,** which comply with the manufacturer's specification.

TABLE 3 OUTPUT NOISE

Weighting and meter	Signal-to-noise ratio	
	left	right
20 Hz to 20 kHz rms	104 dB	103.7 dB
A-weighted rms	112 dB	111.5 dB
CCIR-weighted rms	104.8 dB	104.7 dB
CCIR-weighted quasi-peak	99.7 dB	100.2 dB

Sensitivity and impedances

The maximum input sensitivity for 100W output into 8 ohm at 1 kHz with both channels driven was found to be identical for both channels at 1.42V; the individual input level controls have a full range such that the amplifier can be muted.

Measurement of the input impedance at 1592 Hz showed that it varied with the level control setting to a relatively minor degree, being 8.82k ohm in parallel with 450 pF at maximum gain and falling to 10.9k ohm in parallel with 80 pF at minimum gain. These figures are entirely satisfactory.

Measurement of the output impedance with respect to frequency gave **fig. 7,** which shows that the impedance is effectively constant up to 5 kHz and always satisfactorily low.

Other matters

Testing with squarewaves showed that the risetime was 4 μs with an associated relatively low slew rate of 12 V/μs when working into 8 ohm. The effect of paralleling the 8 ohm load with 2 μF is shown in **fig. 8,** which demonstrates a fairly large overshoot and a little ringing.

The effect of driving the amplifier into heavy asymmetrical clipping produced a well-controlled recovery, as is shown in **fig. 9.** At no time was there any sign of instability, the overall phase shift being minimal as is shown in **fig. 10.**

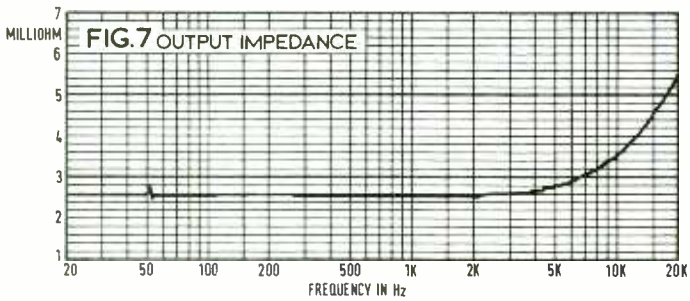
Crosstalk between the two channels was also found to be minimal at low frequencies but could well be bettered at high frequencies. This is shown in **fig. 11,** which demonstrates a crosstalk of −50 dB at 20 kHz or −59 dB at 5 kHz.

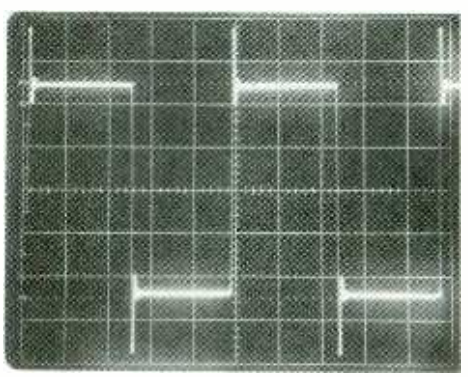
The dc offset at the output terminals was always very small and stable with a typical measurement being 0.8 mV and 3.2 mV for the two channels.

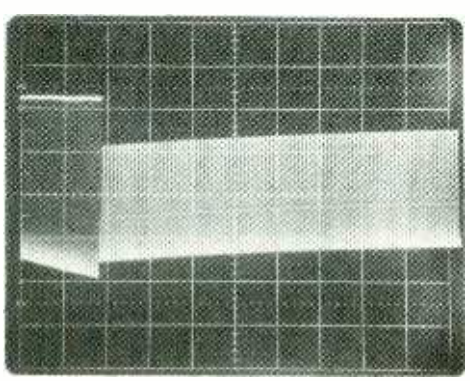
As a final point, the front-panel red led clipping indicators were investigated and found to be a practical indication of overload on speech or music. However, they are not very fast acting and have no hold circuit, it being found that five cycles of 1 kHz tone at clipping level were required to illuminate the indicators. But they failed to illuminate at all with a single cycle of sinewave clipped to the extent of being a squarewave.

Summary

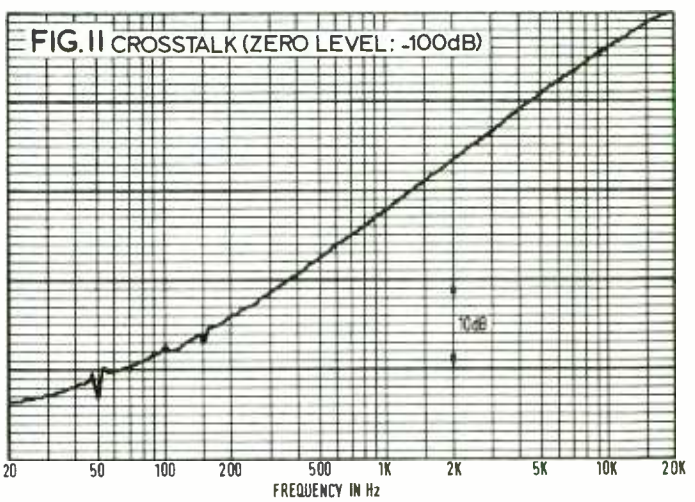
This is a well-made amplifier that gives the impression of being a reliable workhorse with a generally good performance. There are, however, quite a few amplifiers with lower distortion, and the increase in distortion at lower output power levels gives some cause for concern. ■







Left: **Fig. 8.** Squarewave into 8 ohm load plus paralleled 2 μF capacitor. *Below*: **Fig. 9.** Recovery from heavy asymmetrical clipping



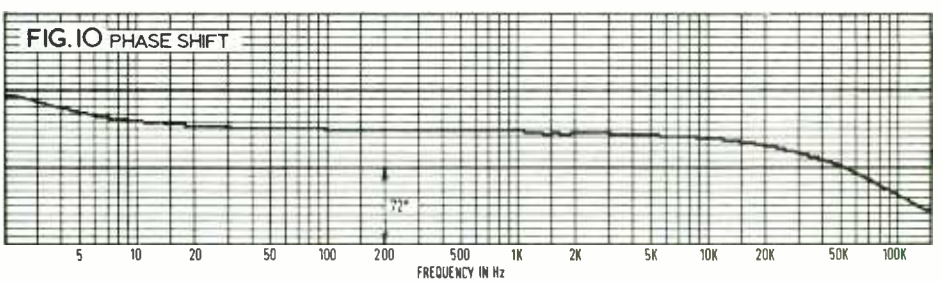
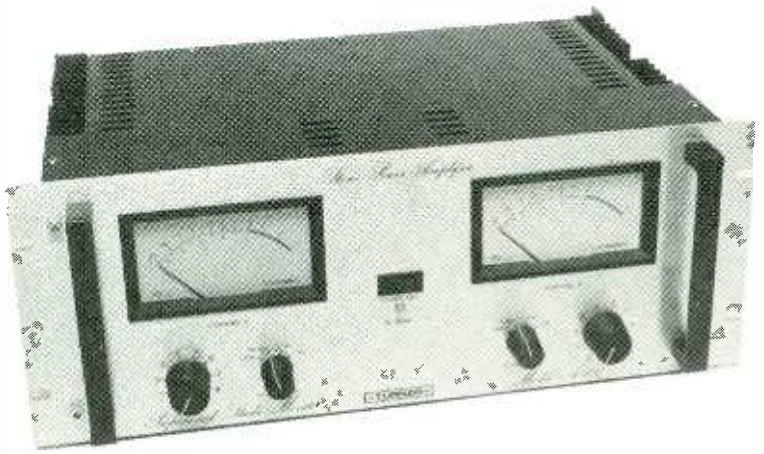


TABLE 2 TOTAL HARMONIC DISTORTION

Output power and load	Frequency	Resistor only		In parallel with 2μF	
		left	right	left	right
100W into 8 ohm	1 kHz	0.0055%	0.005%	0.0065%	0.006%
	10 kHz	0.04%	0.04%	0.038%	0.12%
	20 kHz	0.066%	0.073%		
1W into 8 ohm	1 kHz	0.02%	0.018%	0.02%	0.16%
	10 kHz	0.15%	0.12%	0.30%	0.18%
	20 kHz	0.22%	0.18%		
1W into 4 ohm	1 kHz	0.03%	0.026%	0.03%	0.026%
	10 kHz	0.23%	0.19%	0.38%	0.24%
	2zkkz	0.32%	0.25%		

Turner A500-VU power amplifier

Hugh Ford



MANUFACTURER'S SPECIFICATION

Power output: 100W into 16 ohm; 190W into 8 ohm; 340W into 4 ohm (1 kHz clip point).
Power response: ±0.1 dB, 20-20k Hz, 150W 8 ohm.
Frequency response: ±0.1 dB, 20-20k Hz, 1W 8 ohm.
Frequency bandwidth: —1 dB, 1-70k Hz, 1W 8 ohm.
Distortion (thd): <0.01% (typically <0.005%) 20 Hz, 150W, 8 ohm; <0.01% (typically <0.005%) 1 kHz, 150W, 8 ohm; <0.05% (typically <0.02%) 10 kHz, 150W, 8 ohm; <0.1% (typically <0.05%) 20 kHz, 150W, 8 ohm.
Distortion (im) (60 Hz—7 kHz 4:1): <0.05% (typically 0.02%) from 10 mW to 100W.
Hum and noise: >110 dB below 190W 8 ohm, averaged 20-20k Hz, unweighted.
Crosstalk: >100 dB below 190W 8 ohm, 20-20k Hz; >100 dB below severe clipping into 8 ohm.
Input impedance: 8.2k ohm ±7% 20-20k Hz, level control at maximum.
Output impedance: <8 milliohm, 20-400 Hz.
Damping factor: >2000 16 ohm; >1000 8 ohm; >500 4 ohm (20-400 Hz).
Load impedance: 3 ohm to infinity.
Rise time: 3.5 μs.
Slew rate: 10 V/μs.
Phase shift: —5° at 20 Hz, —12° at 20 kHz.
Input sensitivity: 1.97V ±2% for 190W into 8 ohm.
DC offset: <10 mV.
Power: 220-250V/110-125V, 50/60 Hz.
Protection-amplifier: amp is protected against input overload, short and open circuit by auto-resetting high-speed electronic circuitry. All stages are inherently current-limited to prevent chain destruction. Auto-resetting thermal cutouts protect against insufficient ventilation. High temperature indicator on front-panel displays this condition.
Connectors: input standard 6.35 mm jack (*XLR*-3 optional); output binding posts on standard 19 mm spacing for free wiring or 4 mm dual banana (pomona MDP recommended).
Weight: 21 kg.
Dimensions (w x h x d): 483 x 178 x 302 mm.
Price: £650; less vu meters £550.
Manufacturer: Turner Electronic Industries, 175 Uxbridge Road, Hanwell, London, W7, UK.

THE TURNER *A500-VU* is a stereo power amplifier capable of delivering almost 200W into 8 ohm, and therefore is well equipped for high-power monitoring or pa work. The amplifier is available with or without twin VU meters to the proper specification, as opposed to cheap and cheerful instruments which are all too common.

The front panel of the amplifier is designed for bolting directly into a standard 483 mm rack. However, as the heatsink cooling requires a vertical flow of air, units cannot be stacked one upon another without fan cooling (which is recommended anyway for 4 ohm operation). Two good carrying handles are fitted and provide protection for the front-panel controls. These comprise separate potentiometer gain controls and a vu meter function switch for each channel. These switches enable the vu meters to either monitor the input or the output at three zero-vu settings, such that zero-vu can be maximum output, 10 dB below maximum (NAB recommended setting) or 20 dB below maximum output.

The remaining front-panel control is the power on/off switch, which is illuminated red when power is switched on; in addition there is a white high temperature warning lamp that is illuminated if the amplifier cuts out due to excessive heatsink temperature, the resetting being automatic once the temperature has dropped to normal.

To the rear of the amplifier there is a 6.35 mm standard jack connector for each unbalanced signal input and a pair of banana sockets/terminals on the standard 19 mm spacing for each channel output. The mains power is supplied via an IEC standard mains connector and is fused. Similarly, there are fuses for the positive and the negative rails to each channel, all fuses being clearly identified in function and fuse rating.

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are mounted on finned heatsinks forming the larger part of the sides of the amplifier, the fins being well protected from mechanical damage. Internally each amplifier board is a plug-in pcb at the front of the amplifier, the only remaining electronics being mounted on a small board adjacent to the output terminals of each channel. The remainder of the space within the amplifier is occupied by a massive screened mains transformer and the electrolytic smoothing capacitors and bridge rectifiers. All cableforms are properly laced within the amplifier, the standard of construction is good but the wiring is not the neatest possible. However, the overall mechanical finish and presentation internally and externally is very good.

Power output and distortion

The available output power at the onset of clipping of a 1 kHz sinewave was investigated with both channels driven into 16, 8 and 4 ohm and with single channels driven into 2 ohm; the figures in **table 1** being well within the manufacturer's specification. The large drop in available power when reducing the load from 4 to 2 ohm suggests that some care should be exercised when selecting 4-ohm loudspeakers, because the actual impedance of some speakers at certain frequencies can fall to about half their rated impedance.

TABLE 1 OUTPUT POWER

Load	Output at the onset of clipping	
	left	right
16 ohm	117W	117W
8 ohm	208W	208W
4 ohm	340W	340W
2 ohm	115W	105W

Total harmonic distortion at 1, 10 and 20 kHz was measured at the rated power output of 150W into 8 ohm, and also at 1W into both 8 and 4 ohm. In addition the total harmonic distortion into the loads in parallel with a 2 μF capacitor was measured at 1 and 10 kHz (**table 2**). Overall the performance is excellent, the only mild exception being the high-frequency performance at high power into a reactive load. Examination of **figs. 1 and 2**, the individual harmonic distortion at rated output and at 1W output respectively, show that the second and third harmonics are at a very low level, with the less subjectively offensive second harmonic predominating. Furthermore, there was no sign at all of cross-over distortion.

As can be seen from **fig. 3** the CCIF twin-tone intermodulation distortion is extremely low in the audio band, rising sharply above 30 kHz when driving 150W peak equivalent sinewave into 8 ohm. At lower powers the distortion drops at the ultrasonic frequencies

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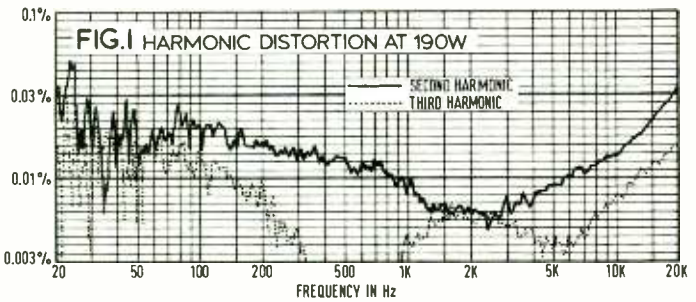
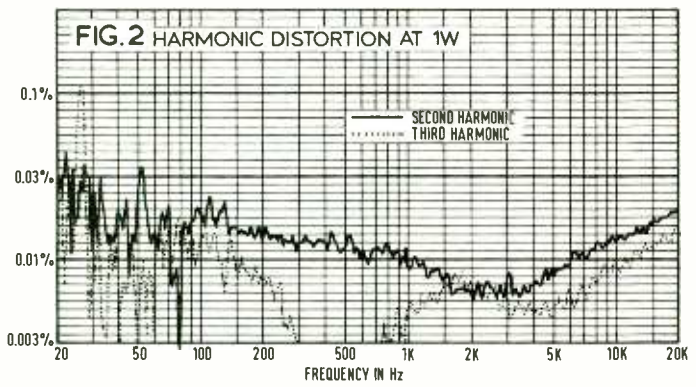
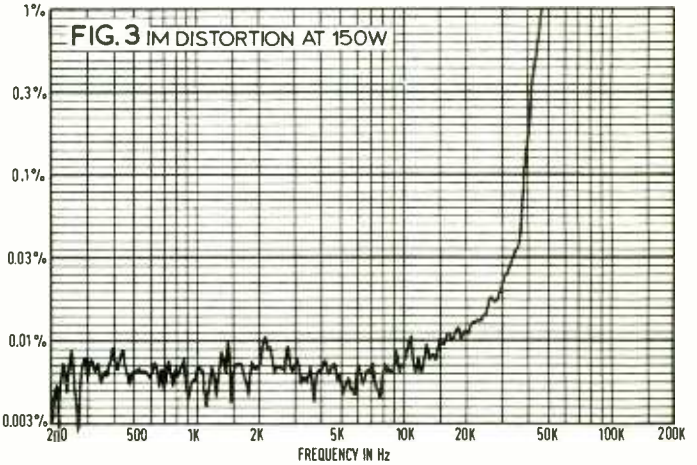
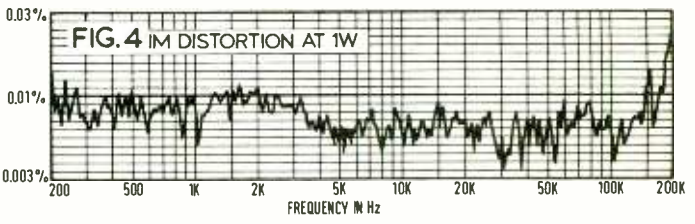
TABLE 2 TOTAL HARMONIC DISTORTION

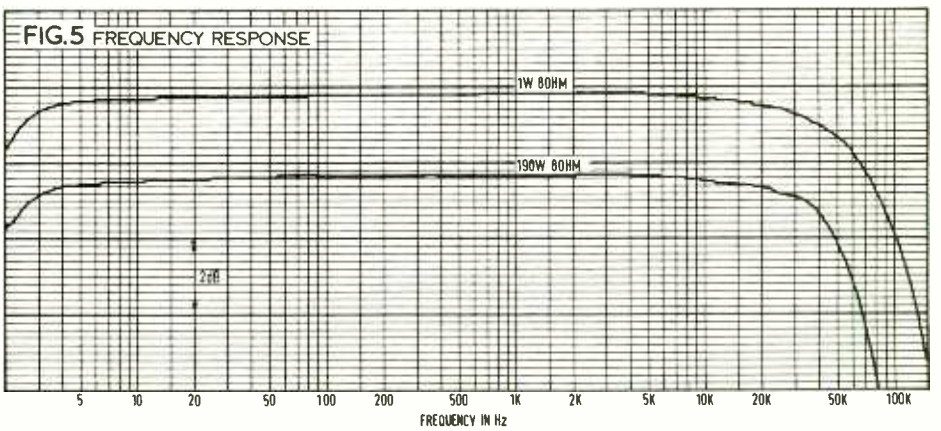
Power output and load	Frequency	Resistor only		In parallel with 2μF	
		left	right	left	right
150W into 8 ohm	1 kHz	0.004%	0.004%	0.004%	0.004%
	10 kHz	0.018%	0.02%	0.55%	0.9%
	20 kHz	0.042%	0.045%		
1W into 8 ohm	1 kHz	0.075%	0.065%	0.075%	0.065%
	10 kHz	0.029%	0.019%	0.05%	0.05%
	20 kHz	0.035%	0.015%		
1W into 4 ohm	1 kHz	0.0065%	0.006%	0.0065%	0.006%
	10 kHz	0.03%	0.011%	0.045%	0.015%
	20 kHz	0.045%	0.017%		











to give the situation shown in **fig. 4** at 1W output. Checking intermodulation distortion to the SMPTE method with a 70 Hz fixed tone, and sweeping the high frequency tone up to 20 kHz, showed that the distortion was less than 0.015% at the peak equivalent of 150W into 8 ohm and at lower powers.

The power bandwidth for 0.1% total harmonic distortion at half the rated 150W output was found to be the same for both channels, extending from 15 Hz up to 30 kHz —a good performance.

Frequency response and noise

The overall frequency response when delivering 1W into 8 ohm and also delivering 190W into 8 ohm is shown in **fig. 5**. This demonstrates that the performance is virtually identical at both power outputs, with the response extending from 20 Hz to 20 kHz +0, —0.4 dB.

The amplifier noise related to 190W into 8 ohm is shown in **table 3,** the noise with reference to 150W into 8 ohm being 1 dB worse.

TABLE 3 OUTPUT NOISE

Weighting and meter	Signal-to-noise ratio left	right
20 Hz to 20 kHz rms	106.8 dB	102.7 dB
A-weighted rms	116 dB	114.5 dB
CCIR-weighted rms	109.5 dB	109.5 dB
CCIR-weighted quasi-peak	105.5 dB	104 dB

Sensitivity and impedances

The maximum input sensitivity was found to be 2.02V for delivering 190W per channel into 8 ohm with both channels drive. The input impedance varied widely with the gain control setting, being 8330 ohm in parallel with 660 pF at maximum gain and increasing to 49.6k ohm in parallel with 210 pF at minimum gain. A further factor that affected the input impedance was the vu meter switching, the above values being with the vu meters *not* set to read the input. Being a rectifier instrument the vu meter has a complex impedance which shunts the input. Should the signal source impedance be high the vu meter may introduce significant distortion.

Calibration of the vu meter was such that zero-vu in the 'read input' condition corresponded to the input sensitivity for delivering 190W into 8 ohm, while in the 'output' position zero-VU corresponded to an output voltage equivalent to 190W into 8 ohm (or —10 dB and —20 dB with respect to this level).

As is to be seen from **fig. 6** the output impedance remains below 10 milliohms at frequencies below 1 kHz, rising in the common manner at higher frequencies.

Other matters

Measurement of the risetime showed this to be 3 μs with an associated maximum slew rate of 15 V/μs, there being no sign of ringing except when working into reactive loads. The result of feeding a 1 kHz squarewave into a load of 8 ohm in parallel with 2 μF is shown in **fig. 7,** which demonstrates a typical overshoot but with rather excessive ringing.

The effect of driving the amplifier at half power and then bursting it for 20 ms into heavy asymmetrical clipping is shown in **fig. 8**. It can be seen that the overload recovery is without troubles.

As can be seen from **fig. 9** the crosstalk between the two channels when one is driven at 190W into 8 ohm is remarkably good, hum components at a low level interfering with the plot. The overall phase shift is shown in **fig. 10,** the phase shift within the af band being negligible as was the dc offset at the output terminals.

As a final matter it was noted that the mains on/off switch failed during the review measurements and it is suspected that this switch does not have an adequate rating to handle the switch-on surge.

Summary

This is a well-made amplifier that offers a high output power at very low distortion coupled with a good dynamic range. It should therefore be well suited to studio monitoring purposes and other applications where a solidly built, high-power amplifier is required. ■

Fig. 7 Squarewave into 8 ohm load plus paralleled 2 μF capacitor.

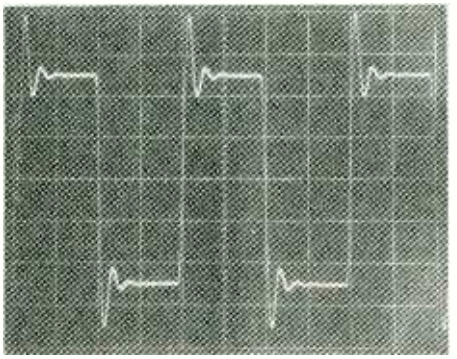
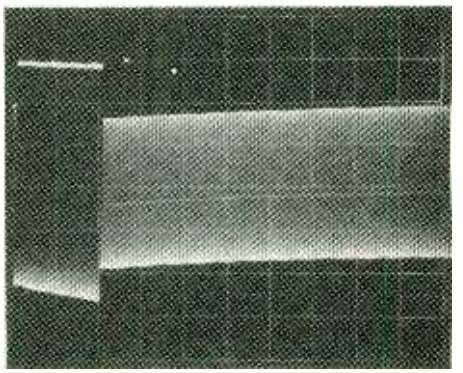
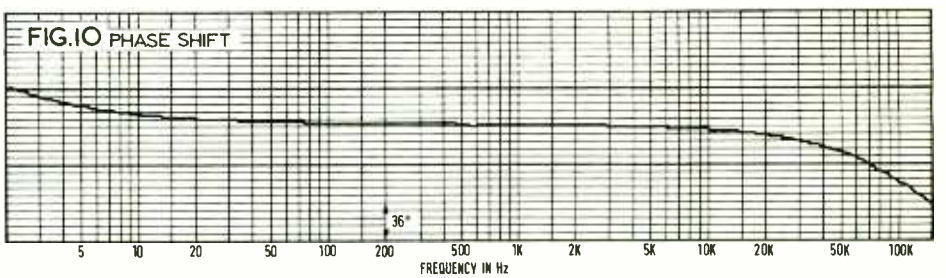
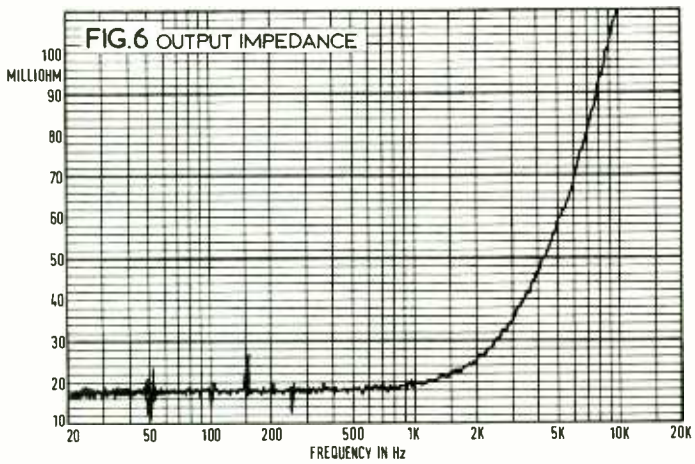
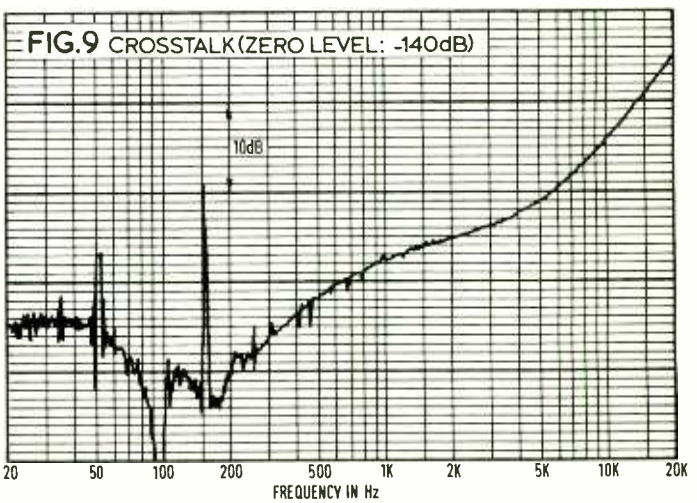


Fig. 8 Recovery from heavy asymmetrical clipping.









HH S500-D power amplifier

Hugh Ford

MANUFACTURER'S SPECIFICATION

Power output at clip point: 340W rms into 4 ohm; 210W rms into 8; 110W rms into 16.
Maximum power output: 500W rms into 2.5 ohm.
Harmonic distortion: less than 0.2% 10-10k Hz at all levels up to clip point. Typically 0.005% at 300W into 4 ohm at 1 kHz.
Intermodulation distortion (60 Hz-7 kHz 4:1): less than 0.02% from 0.1W to 200W into 8 ohm.
Transient intermodulation distortion: 'of a very low order; no measurement standards exist to date.'
Frequency response: ±0.2 dB, dc to 20 kHz at 1W into 8 ohm; ±1 dB, 10-20k Hz ac coupled.
Power response: +0 dB, —1 dB dc to 20 kHz at 180W into 8 ohm; +0 dB, —1 dB, 10-20k Hz ac coupled.
Stability: unconditionally stable into loads of all impedance characteristics.
Slew rate: 10V/μs.
Rise time (10%-90%): 10 μs deliberately specified.
Settling time: 20 μs maximum into 8 ohm and 0.1 μF in parallel.
Noise: 105 dB below 180W into 8 ohm 10-20k Hz.
Damping factor: greater than 300, dc to 2 kHz.
Output protection: short circuit, mismatch and open circuit protected; amplifier will drive completely reactive loads.
Input sensitivity: high sensitivity input 0.75V for 300W into 4 ohm.
Input impedance: 25k ohm gain control minimum.
System protection: thermal sensors shut the amplifier down if temperature rises due to a prolonged fault condition or fan failure; automatic reset after system cool down.
Connectors: inputs 6.35 mm standard jacks, 7-pin connector; outputs coloured binding posts.

BRIDGED MONO MODE

Power at clip point: 900W rms into 5 ohm; 640W rms into 8; 400W rms into 16.
Frequency response: ±1 dB, dc to 20 kHz at 1W into 8 ohm; ±1 dB, 10-20k Hz at 1W ac coupled.
Power response: ±1 dB dc to 15 kHz at 600W into 8 ohm; ±1 dB 10-20k Hz at 600W into 8 ohm ac coupled.
Intermodulation distortion (60 Hz-7 kHz 4:1): less than 0.05% from 0.1W to 600W rms into 8 ohm.
Damping factor: typically 150 dc to 2 kHz into 8 ohm.
Output signal: 70V; balanced line.
Slew rate: 20V/μs.
Input sensitivity: 0.75V for 600W into 8 ohm.
Weight: 18.2 kg.
Dimensions (w x h x d): 482 x 89 x 386 mm.
Price: £370.
Manufacturer: HH Electronic, Viking Way, Bar Hill, Cambridge, UK.

HAVING THE highest power rating of the amplifiers reviewed here, the HH *S500-D* employs an interesting form of construction. The amplifier is intended for mounting into a standard 483 mm rack, and is only 89 mm high. The cooling system is such that units can be mounted directly on top of each other—an ideal concept for public address work. The front-panel has the two potentiometer gain controls and an illuminated rocker-type power on/off switch. In addition there is an illuminated indication when the rear panel mono/stereo switch is set for bridge operation.

Inputs to the amplifier are in the form of 6.35 mm unbalanced jack sockets on the rear panel. These are duplicated on a 7-pin DIN socket that also carries ±62V dc power lines for feeding a pre-amplifier. Also at the rear are the amplifier outputs in the form of banana sockets/terminals on the standard 19 mm spacing. Finally there is an IEC standard mains-power connector and its associated fuse which, like all connectors, is properly identified.

The secret of the size of this amplifier lies in the design of the amplifier modules, which have the six output transistors mounted onto heatsinks that include a fin arrangement similar to a car radiator. Each module includes a miniature fan that blows air through this radiator arrangement when the heatsink temperature rises above about 63°C; it is this efficient cooling system that eliminates the need for massive heatsinks.

Power output and distortion

Initially the power output for the 1 kHz clipping point with both channels driven was investigated into load of 16, 8 and 4 ohm, in addition to the single channel power output into 2 ohm. The results in **table 1** are notably better than the manufacturer's specification.

TABLE 1 OUTPUT POWER

Load	Output at onset of clipping	
	left	right
16 ohm	118W	118W
8 ohm	214W	214W
4 ohm	361W	361W
2 ohm	495W	550W

The excellent performance into 2-ohm loads suggests that this amplifier will be happy to drive loudspeakers of any impedance. Although the performance in the bridge-connected mode was not investigated there is no reason to

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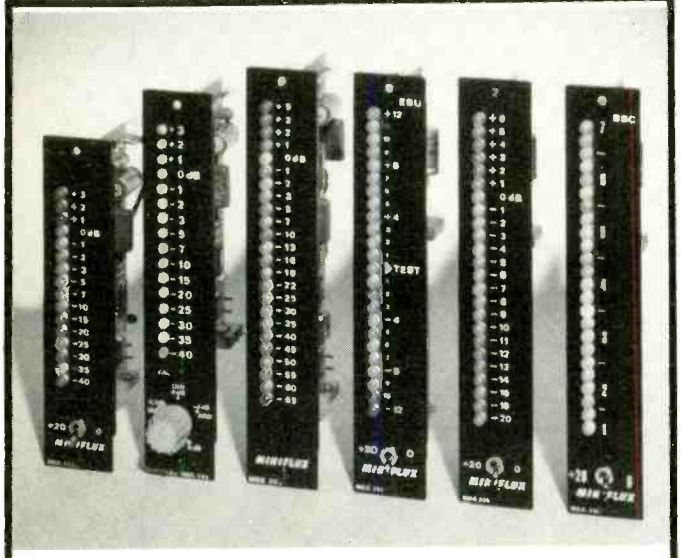

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doubt the published specification.

Total harmonic distortion was measured at the rated power into 8 ohm, in addition to the power of 1W into both 8 and 4 ohm. Further, the distortion at 1 and 10 kHz was measured with a 2 μF capacitor shunted across the load (**table 2**). In terms of total harmonic distortion these are likely to vary with the type of distortion meter used for the measurement. As shown in **fig. 3**, the distortion residual at 1 kHz driving 1W into 4 ohm, the distortion contains substantial crossover products. However, **figs. 1 and 2**, which are plots of the individual second and third harmonic products at respectively the rated output of 180W into 8 ohm and 1W into 8 ohm, show the same pattern as the total harmonic measurement.

Figs. 4 and 5 show the CCIF twin-tone intermodulation distortion at the rated output of 180W into 8 ohm peak equivalent sinewave and at 1W respectively. It can be seen that the distortion is very low at the lower audio frequencies, but rises in the upper audio range to about 0.03% at 20 kHz at both output powers. The overall observed distortion performance correlates with the power bandwidth for 0.1% total harmonic distortion at half the rated output power (90W/channel into 8 ohm), the bandwidth being from below

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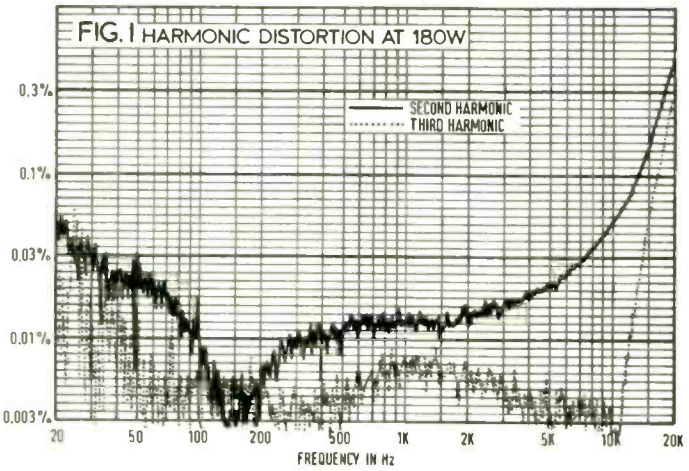
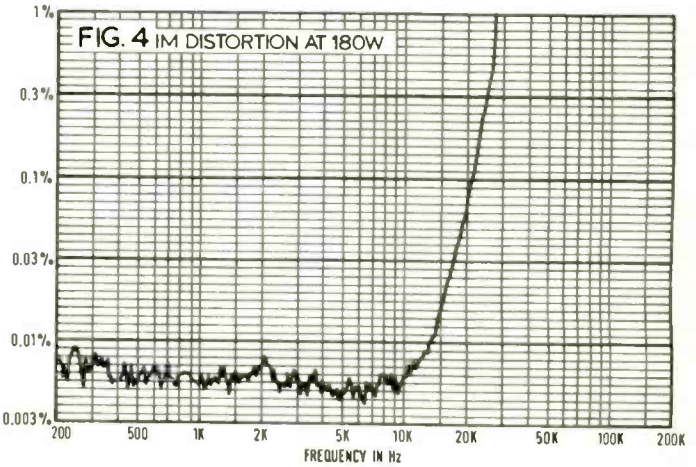
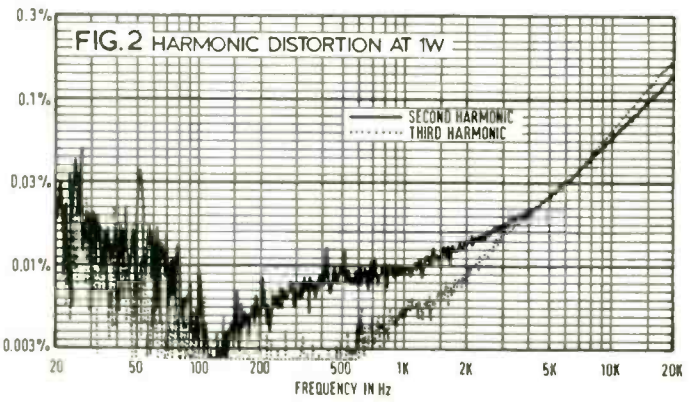
TABLE 2 TOTAL HARMONIC DISTORTION

Output power and load	Frequency	Resistor only		In parallel with 2μF	
		left	right	left	right
180W into 8 ohm	1 kHz	0.008%	0.005%	0.018%	0.019%
	10 kHz	0.085%	0.053%	0.15%	0.10%
	20 kHz	0.28%	0.11%		
1W into 8 ohm	1 kHz	0.015%	0.017%	0.018%	0.02%
	10 kHz	0.16%	0.12%	0.25%	0.17%
	20 kHz	0.31%	0.24%		
1W into 4 ohm	1 kHz	0.025%	0.025%	0.025%	0.025%
	10 kHz	0.25%	0.18%	0.35%	0.22%
	20 kHz	0.52%	0.36%		







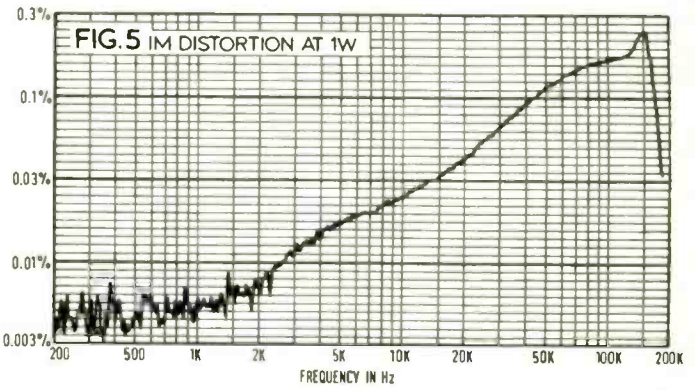
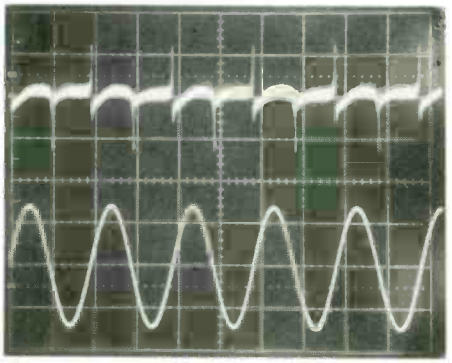
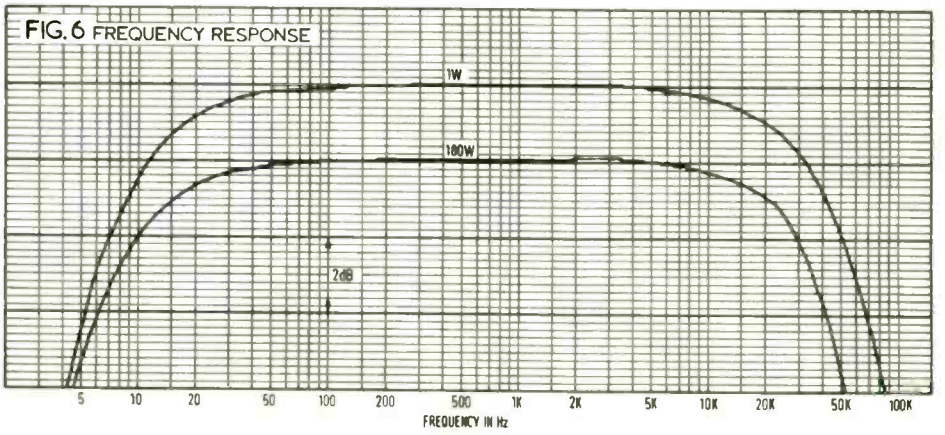


Fig. 3 Distortion residual at 1 kHz.





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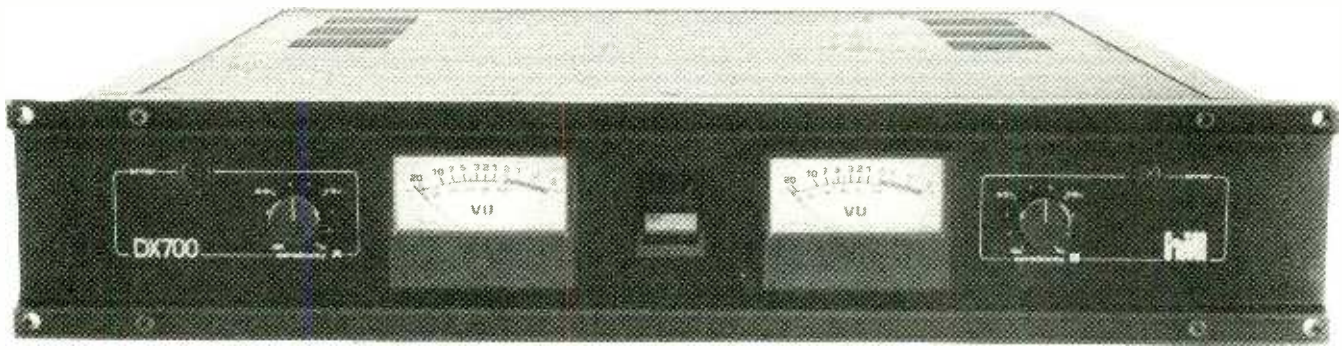

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10 Hz for both channels to 15 kHz for one channel and 22 kHz for the other.

Finally it was noted that the SMPTE-type im distortion using a 70 Hz tone with a variable tone up to 20 kHz in the usual 4:1 amplitude ratio did not exceed about 0.01%.

Frequency response and noise

Fig. 6 shows the frequency response at 1W output and at the rated output of 180W into 8 ohm, the two responses being virtually identical with −1 dB points at 20 Hz and 20 kHz. It should be noted, however, that for non-audio applications the amplifiers may be dc-coupled by inserting a link on the amplifier modules.

Output noise related to the rated output of 180W into 8 ohm was measured weighted and unweighted (**table 3**). While the weighted noise performance was good, some difficulty was experienced with hum in the unweighted measurement. It is possible that better figures might be obtained with different earthing arrangements.

TABLE 3 OUTPUT NOISE

Weighting and meter	Signal-to-noise ratio left	right
20 Hz to 20 kHz rms	95.6 dB	91.8 dB
A-weighted rms	110.8 dB	110.3 dB
CCIR-weighted rms	106.6 dB	105.8 dB
CCIR-weighted quasi-peak	97.5 dB	97.0 dB

Sensitivity and impedances

The maximum input sensitivity for delivering the rated output of 180W into 8 ohm was found to be the same for both channels at 823 mV, associated with an input impedance that varied fairly mildly with the gain setting. At the majority of gain settings the input impedance was 21.5k ohm in parallel with 330 pF. At maximum gain, however, the impedance became 15.3k ohm in parallel with a rather excessive 920 pF, which represents a significant load at 20 kHz. The relation between the output impedance and frequency, **fig. 7**, shows that the output impedance is more than adequately low at low frequencies and exhibits a typical rise above say 2 kHz.

Other matters

Squarewave testing showed that the risetime was 8 μs and the maximum slew rate 10V/μs, both of which are in basic agreement with the manufacturer's specification. The effect of driving squarewaves at 1 kHz into an output load of 8 ohm in parallel with 2 μF is shown in **fig. 8**. This displays a mild overshoot and minimal ringing; at no time did the amplifier show any signs of instability. Likewise the overload recovery was good. **Fig. 9** shows the amplifier being continuously driven at half power and then bursted for 20 ms into severe asymmetrical overload every 100 ms with a 1 kHz signal.

Some difficulty was experienced in measuring the crosstalk between the two channels, as there appeared to be a significant voltage drop between the earthy side of the signal input and the output terminal. However, **fig. 10** would appear to be a realistic plot of the crosstalk performance at full power output, the performance being excellent at low frequencies.

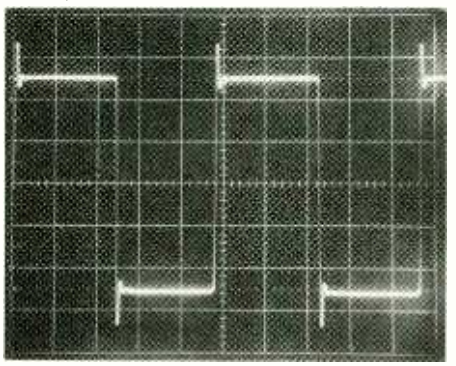
The final measurement was that of phase shift between the input and output. **Fig. 11** shows a phase shift of 36° at 20 kHz, which might be a significant factor for some applications.

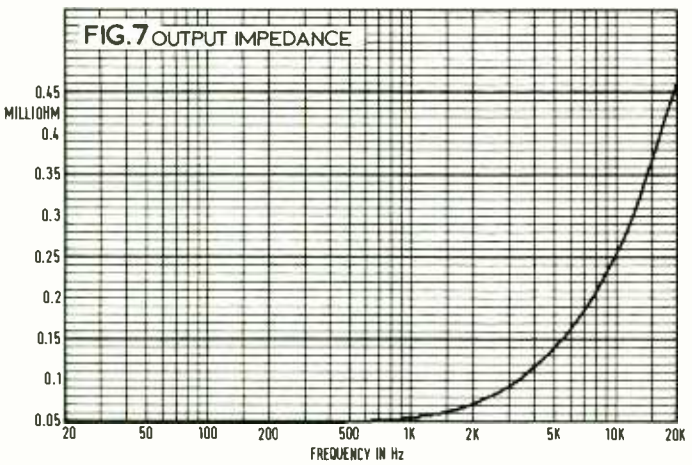
In operation the amplifier always ran cool, with the fans only occasionally coming into operation. While these fans were quiet (as fans go) it is felt that the noise could be excessive in a control room environment.

Summary

This HH *S500-D* amplifier offers a very compact unit with high power output at a very reasonable price. While distortion is not to the very highest standards to be found with modern amplifiers, there is really no cause for complaint in practical terms. The amplifier is to be strongly recommended for pa and industrial use, and certainly fits into the studio environment if mild fan noise is not going to be objectionable. One big advantage of this amplifier for pa use is that several units can be stacked into racks with no need for special attention to the heat dissipation—and this is not true of many amplifiers. ■

Fig. 8 Squarewave into 8 ohm load plus paralleled 2 μF capacitor.





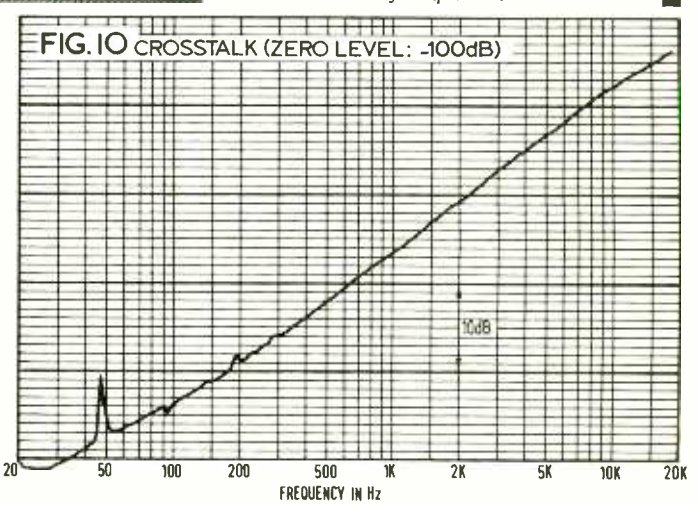
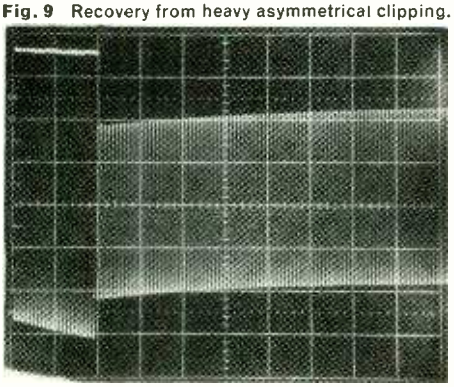
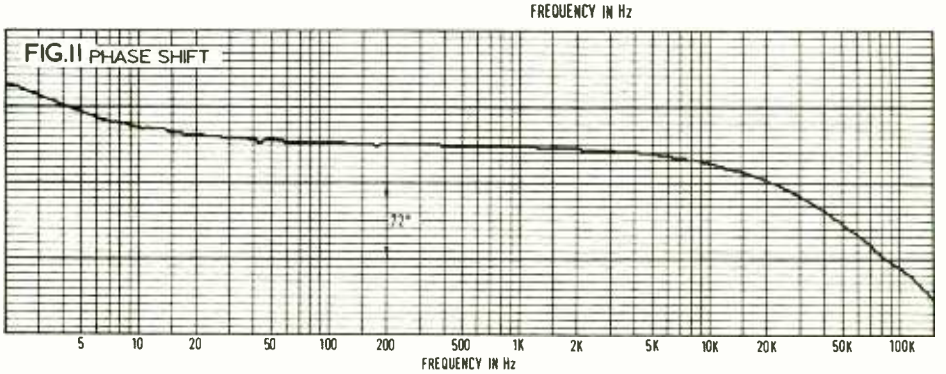


Fig. 9 Recovery from heavy asymmetrical clipping.





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Power Response	±0·1dB 20Hz-20kHz, 150W 8ohms
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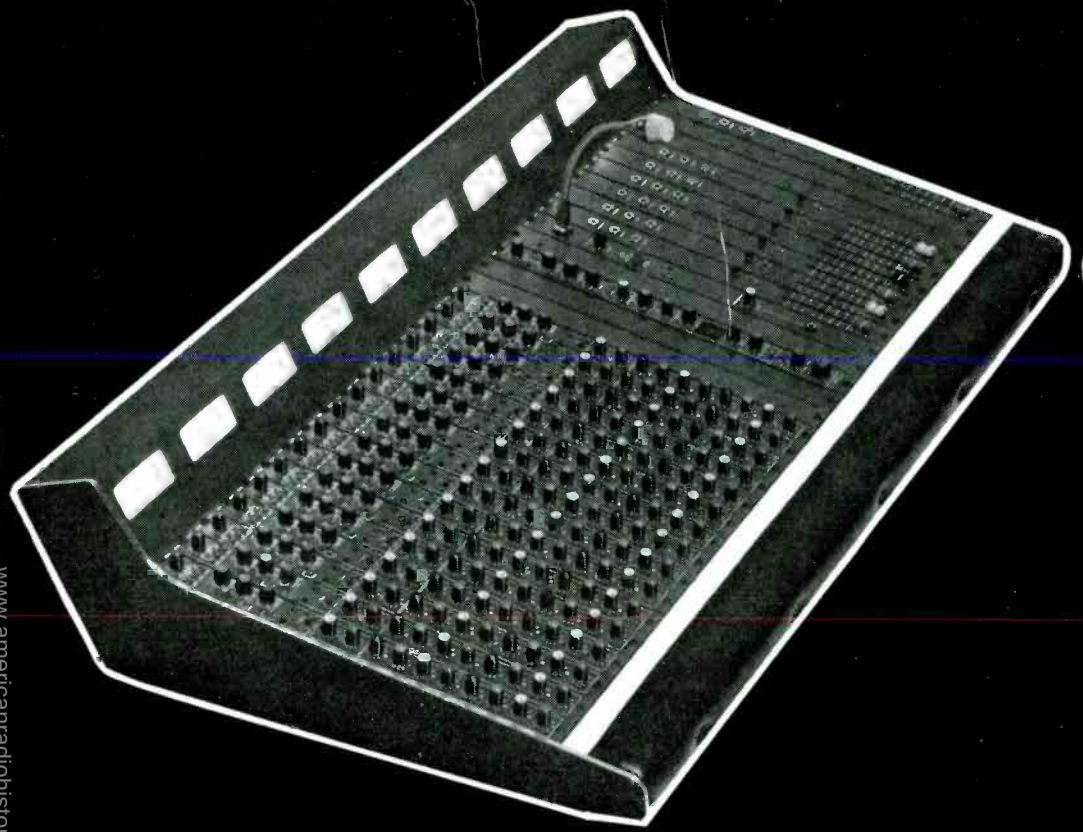

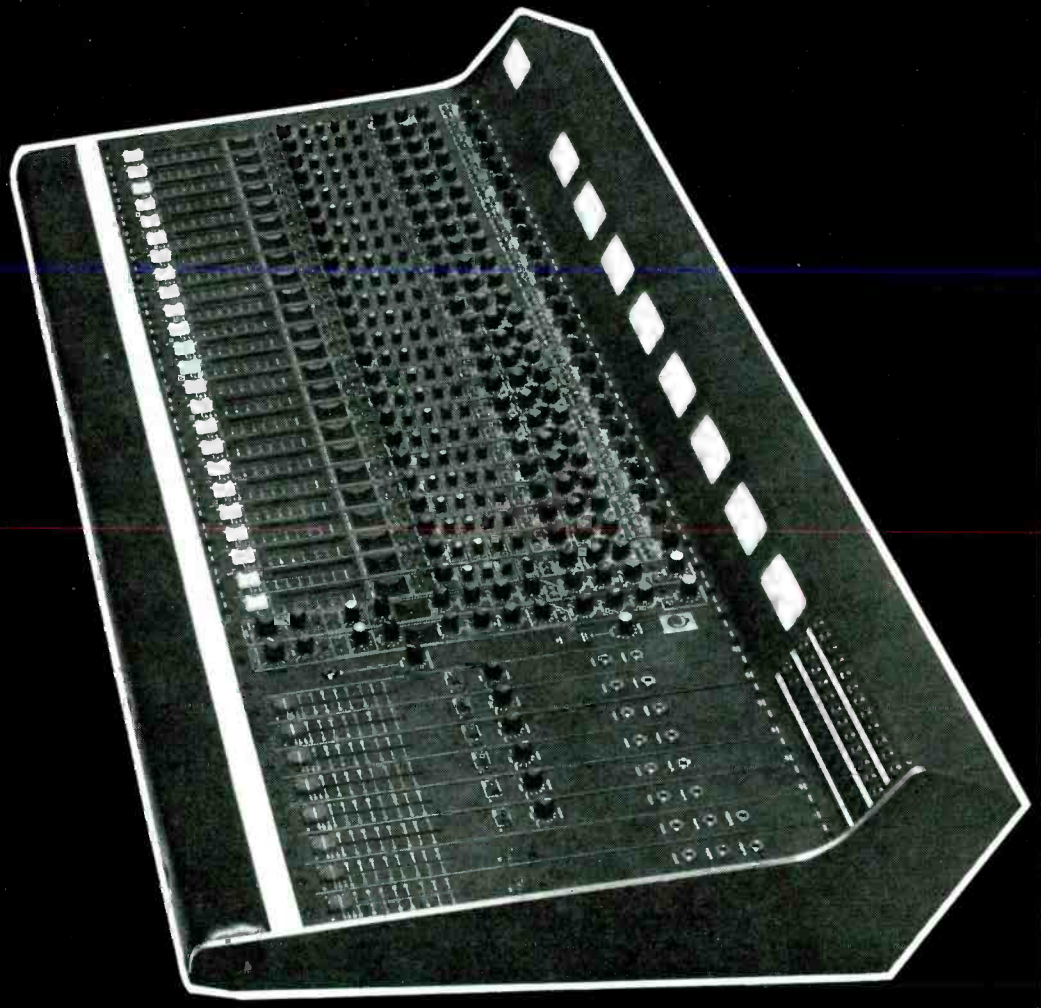

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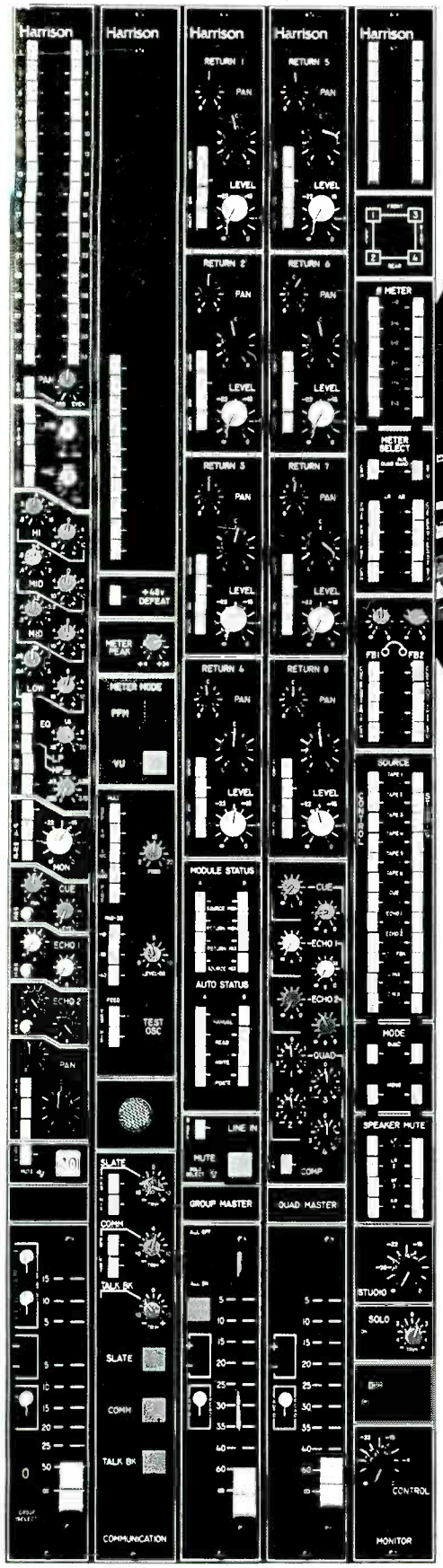

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