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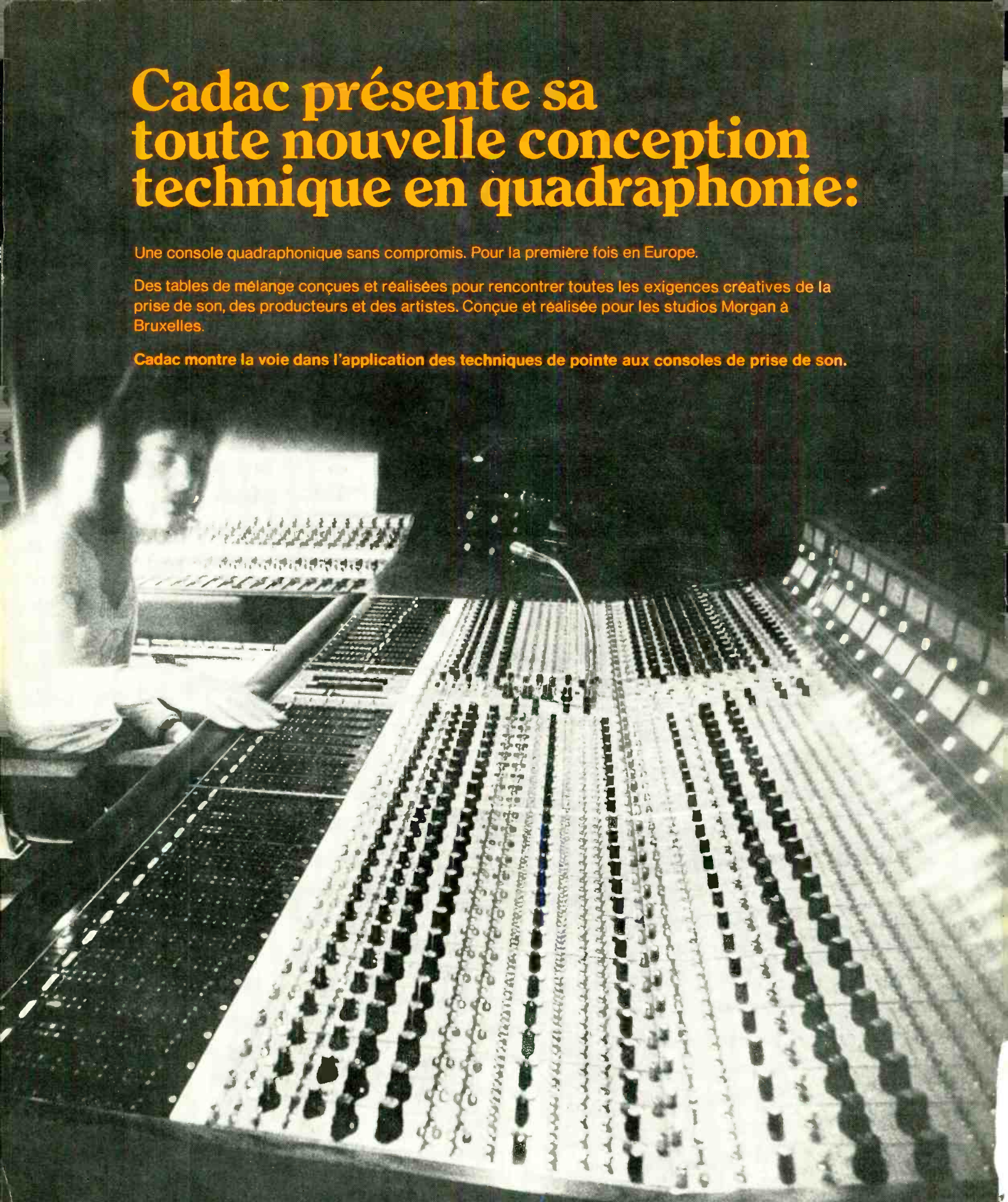

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JANUARY 1974 VOLUME 16 NUMBER 1

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FEATURES

COLUMNS

REVIEWS

CORRESPONDENCE AND ARTICLES
All STUDIO SOUND *correspondence should be sent to the address printed on this page. Technical queries should be concise and must include a stamped addressed envelope. Matters relating to more than one department should occupy separate sheets of paper or delay will occur in replying.*
Articles or suggestions for features on all aspects of communications and musical engineering will be received sympathetically.
Manuscripts should be typed or clearly handwritten and submitted with rough drawings when appropriate.

BINDERS
Loose-leaf binders for annual volumes of STUDIO SOUND *are available from Modern Bookbinders, Chadwick Street, Blackburn, Lancashire. Please quote the volume number or date when ordering.*

COVER PICTURE
Reproduced here from the 1723 Gabinetto Armonico, *the violino turchesco or 'spike-fiddle' employs a parchment soundboard and is found in countries from North Africa to Thailand.*

FROZEN OR UNFROZEN, inflation affects the recording industry just as seriously as it does other members of the community. In this particular case, one side-effect has been the increasing use in studios of audio equipment that was once considered essentially domestic. There is no need to embarrass manufacturers or their customers by spilling names; one has only to look for plastic tape decks, unchristian track widths, and low recording speeds. To be fair, performance standards of domestic audio equipment has generally risen over the past few years and the quality of a good household tape recorder, when new, can approach or even exceed that of an industrial workhorse. It is a mere trick of inflation that the best modern domestic recorders can now go as high as 150 per cent of the figure recently considered reasonable for a transportable studio machine.

With so many companies forced to use relatively cheap equipment, it should be remembered that very few 'semi-professional' designs can stand the 24-hour daily workload and the occasional hamfisted operator with which a true industrial device will cope. Nor is domestic equipment particularly easy to line up; in many household tape recorders, bias adjustment involves dealing with tiny presets that were never intended twice to see the light of day. At least one manufacturer used such trimmers as the main control potentiometers in a power amplifier, perhaps the ultimate depth to which he could descend.

Surveying monitor loudspeakers in this issue, we have derived no pleasure from the task of recognising true monitors from a limitless horizon of cheap and not-so-cheap 'hi-fi' squawkers. Curiously, the you-get-what-you-pay-for philosophy so closely applicable to mixers, recorders and amplifiers is largely irrelevant in the loudspeaker market. Apart from obvious exceptions around the top and bottom of the price scale, loudspeaker quality is largely unrelated to price. Sadly, the human brain can learn to compensate for almost any loudspeaker fault short of a loose drive unit. Unreasonable, perhaps, to suggest that the Audio Engineering Society or some similar body take steps towards recommending standard control room monitoring conditions; it might upset too many manufacturers.

SUBSCRIPTIONS
STUDIO SOUND, *published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. The journal is available without charge to all persons actively engaged in the sound recording, broadcasting and cinematographic industries. It is also circulated by paid subscription to manufacturing companies and individuals interested in these industries. Annual subscription rates are £3 UK) or £3.30 overseas.*
STUDIO SOUND *is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.*

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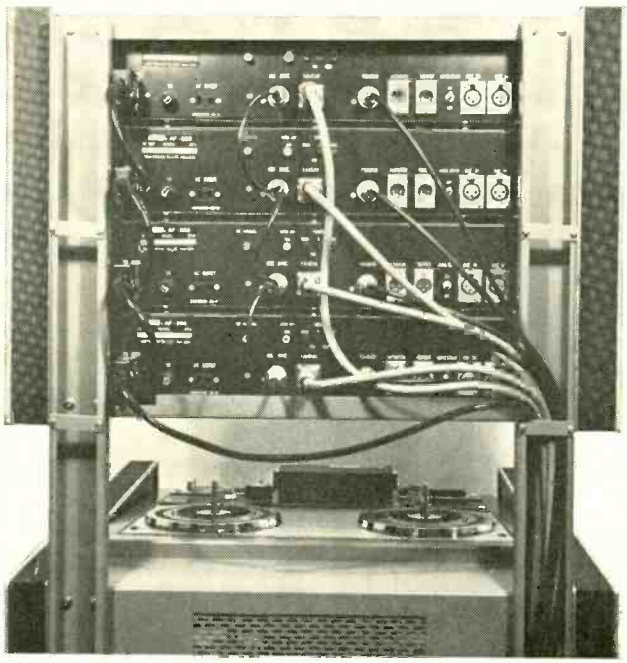
this is Otari



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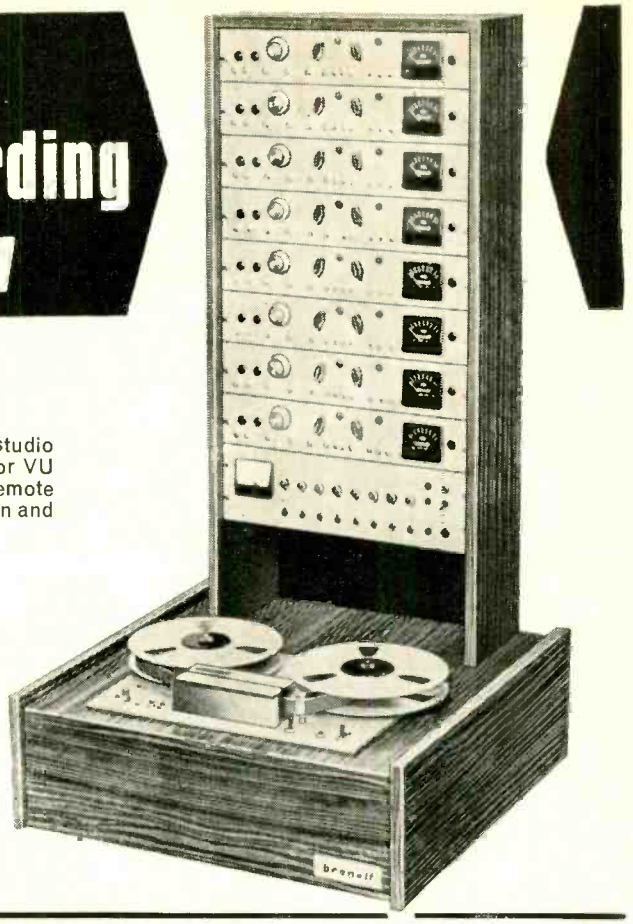

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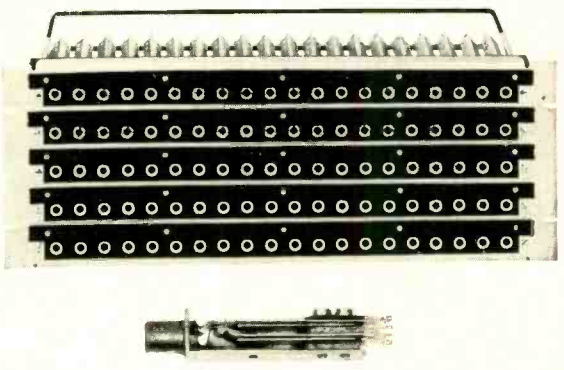

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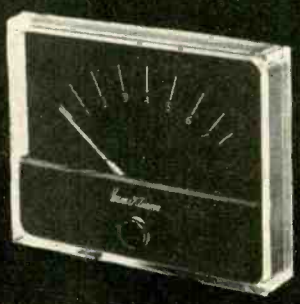

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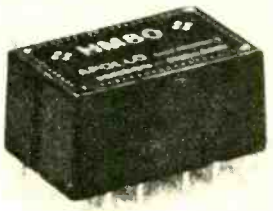

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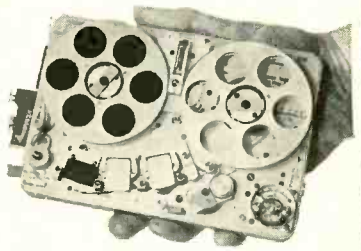

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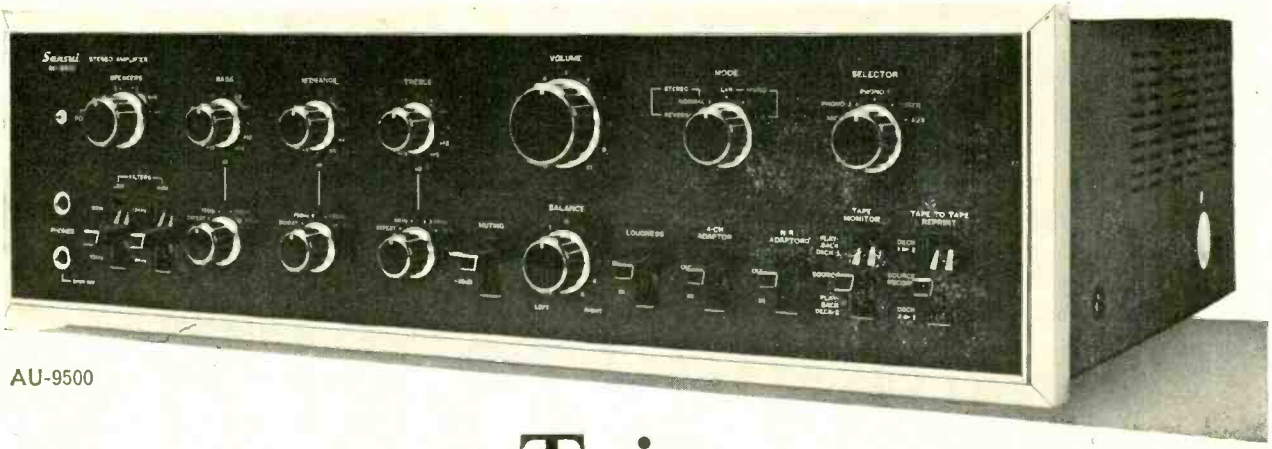

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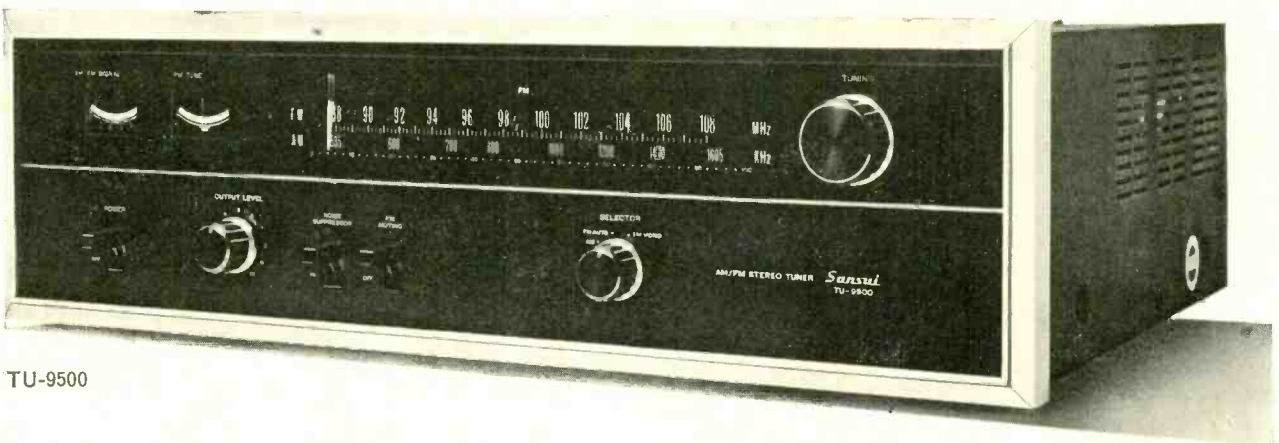

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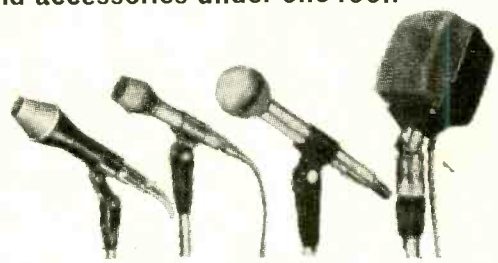

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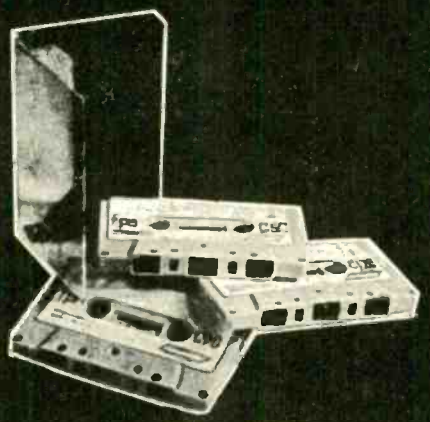

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HUGH FORD review
STUDIO SOUND Oct. 1973

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JOHN SHUTTLEWORTH
review
STUDIO SOUND Nov. 1973

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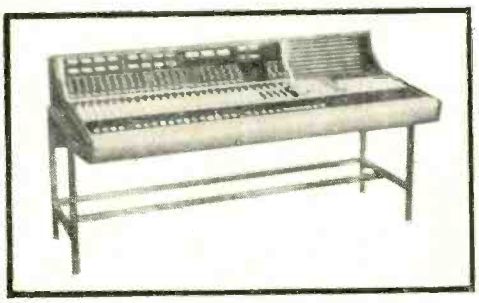

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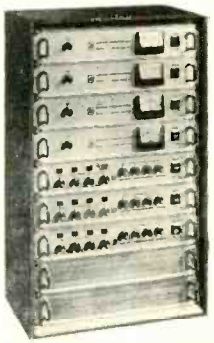

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Philips accept Dolby

Philips have become licensees for the manufacturer of the Dolby B system. This means that Philips will use Dolby B in their compact cassette players and that, probably, Philips and Phonogram will release cassettes in Dolby coded form.

Philips were regarded as the final obstacle to universal acceptance of the Dolby system, since Philips, the inventors of the compact cassette system, had devised their own noise reduction system, the Dynamic Noise Limiter. The DNL system had not been widely accepted, not because it was a poor system but because Dolby had made their system widely available before Philips had put their system on the market. Although the Dolby system was more effective as a noise reducer, DNL had the advantage that it could be used on any source material, as it was a replay-only system.

In addition, the DNL system only operated in the frequency range above 4k Hz. The principle was that, above this frequency, no musical instrument produced a fundamental, and that the energy of overtones and harmonics in quiet passages was minimal. Therefore high frequencies can be attenuated when the music becomes quiet.

Although Philips have not admitted as much, it seems likely that production of the DNL system will be cut back and, eventually, stopped.

At the Berlin Audio show Dolby showed tape replay equipment with their B system incorporated made by BASF, B & O, Dual, Elac, Grundig, ITT, Normende, Tandberg, Telefunken and Uher. CBS (UK) and EMI have announced that all new tape cassette and cartridge releases will be issued in Dolby encoded form.

Pay succeeds McGurk

BILL PAY will succeed Paul McGurk as Secretary of the British Kinematograph, Sound and Television Society in January, 1974. Since 1966 he has been advertising manager and editorial assistant on the BKSTS Journal.

Mr Pay has spent his working life in the film and television industries apart from war service as a bomber pilot in the last world war. Most of his career has been spent with the London Office of Quigley Publishing of New York. In 1963 he was appointed managing director of Quigley and Burnup Services Ltd, a public relations firm. Mr Pay has been closely involved in the organisation of the BKSTS's three international conferences.

The BKSTS have released details of their fourth international exhibition and conference. The first three were held in 1969, 1971 and 1973. The next, *Film 75*, will take place at the Royal Lancaster Hotel, London, between Monday, June 23 and Friday June 27. *Film 73*, say the BKSTS drew over 1,000 delegates from 35 countries.

Research into four channel

A RESEARCH project on four channel sound, sponsored by the National Research Development Council, has been carried on secretly since 1970. The work was carried out in conjunction with the Department of Applied Physical Sciences of the University of Reading.

The results of the research, revealed in a statement by IMF Ltd., who were also involved in the project, is a sound recording and reproduction system which 'provides for the pre-determined distribution of sound from all directions. Unlike conventional stereo, sounds that originate from behind, around and above may be reproduced via multiple speakers.'

The statement mentions that a number of systems have been proposed to provide four channels sound, including CBS *SQ* and JVC *CD4*: 'The intention is to retain all the commercial advantages of employing these established media whilst nevertheless imparting more information than would be conventionally expected of them... The scientific impossibility of encoding and decoding four independent channels through two channels brings considerable compromise. However, it is possible for two channels to carry full information about the direction of sound, as research at Reading University shows. The JVC *CD4* system, by contrast, is specifically a method of frequency modulating the two channels of a conventional stereophonic lp record so as to provide four separate channels. This leaves open the manner in which these channels are to be employed and the NRDC system can provide for using these channels in an optimum way...'

The statement says that the NRDC system is a phasor matrix system fully compatible with conventional stereo playback.

The research project has been carried out in secrecy and patents have been applied for. We understand that Bob Auger, of Granada Recordings, was involved in the project.

IMF say they hope to demonstrate the NRDC system throughout the Sonex exhibition at Heathrow in March, 1974. 'We intend that this will demonstrate those aspects of the system which allow the faithful reproduction of natural ambience, its versatility as well as its compatibility...' Sonex 74 will be held at the Post House, Heathrow Airport, London from March 27 to 31, 1974.

Disc jockey Dave Cash in Capital Radio's main control room. Installation by Rediffusion Industrial Services.

Inter Navex dates

THE INTERNATIONAL Audio Visual Aids Conference organised by the National Committee for Audio Visual Aids in Education, will be held from July 16 to 19, 1974, at Olympia. Further details from Mr John Northover, Exhibition Organiser, Inter Navex 74 office, 33 Queen Anne Street, London W1M 0AL.

Orders

NEVE REPORT they have sold consoles in Bulgaria, Romania and Australia. At the Plovdiv International fair in September they say they sold nearly all the saleable items on the stand, including an S16/4 to Bulgarian Radio and Television.

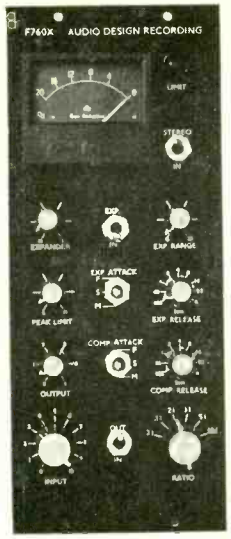
Electronum, the Romanian buying agency, have ordered a 24/8 console for music recording and sound effects in Bucharest's Congress Hall. They also ordered a rack containing microphone amplifiers and a patch bay. Romania's recording studio, Electrecord, use a Neve console. The Congress Hall desk will be delivered in December and the rack in March, 1974.

At the International Radio and Electronics Engineering convention in Melbourne Neve shared a stand with Link Electronics, Prowest and Dynamic Technology. Neve report contracts with ATN channel seven and ATV channel O Melbourne and that they are negotiating contracts with other Australian broadcasting companies.

Neve say that Australia is now one of their biggest export markets.

Shepperton have ordered a Neve console. Neve say that the order is expected to be the first of two. The desk will be for post-syncing, looping and dubbing in Shepperton's RCA dubbing theatre. There are

26 ▶



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SS3

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VITAVOX SAY that, after their decision to exhibit in the North of England after an absence of 20 years, they secured orders for slot speakers, *B50* microphones and power range speakers. The exhibition was the *PA73* exhibition of public address and allied equipment, which was organised by the Association of Public Address Engineers and took place at the Parkway Hotel, Leeds on October 31, 1973.

A NEW company, Vid Com Ltd of New Zealand, have contracted with Viacom International to provide daily satellite transmission of the Commonwealth Games for Australian commercial tv stations. Vid-com, an independent colour tv production company, say they are one of only two production companies in the world with direct coaxial transmission lines to a broadcast satellite station.

Mr Harvey Glick, the firm's managing director, said that the company would operate in all levels of production from broadcast to cctv and videoplayer.

EMI Profits

EMI MADE profits of £27,300,000, compared with £18,300,000 in the previous year, a jump of half. Before the figures were announced towards the end of October, estimates had put the figure at around £26,000,000.

The company's Capitol subsidiary have recovered from a loss of £5,000,000 in 1970 to profits of £3,000,000 in 1972. EMI Electronics improved from £1,400,000 to £5,400,000.

Midem dates

MIDEM *74* is fully booked, say the organisers. All the 3,500 m² of exhibition space and the 350 offices have been taken. The exhibition and festival, the eighth International Record and Music Publishing Market, will be held in Cannes between January 19 and 25 at the Palais des Festivals.

For the first time, registrations have been made by Togo and Morocco. Registrations by delegates from many countries have increased substantially: Spain's total is up 70 per cent, Italy's is up 40 per cent, USA and Japan up 30 per cent each, Germany are sending 20 per cent more delegates and Great Britain ten per cent more.

Quad Eight award

THE ACADEMY for Motion Picture Arts and Sciences have nominated Quad-Eight Electronics in four major categories for scientific and technical awards. In the Music, Sound and Production categories the Burbank Studios' Quad Eight scoring console system has been nominated and in the other category, Editorial Achievement, the console at Samuel Goldwyn studios was nominated.

Video survey addendum

WE HAVE received some additional price details from EMI, whose type *2005* colour broadcast camera was listed in our September survey as costing £19,800. The company point out that this inclusive price includes numerous facilities and extras which many users will not require. Therefore EMI have given a price for the basic camera, equipped with auto-centering, of £14,000 which excludes lens.

Teac distributor

IN OUR November survey of industrial tape recorders we stated that the agents for Teac of Japan were Industrial Tape Applications. We have received the following statement from Acoustico Enterprises Ltd. 'We would like to make known to your readers that Industrial Tape Applications of Eton, Windsor, are not the sole distributors of Teac's *A3340*. [They are] merely one of our many customers who can supply our machines. We, Acoustico Enterprises Limited are the sole United Kingdom distributors for Teac's range of tape recorders and electronics'.

Acoustico's address is Unit 7, Space Waye, North Feltham Trading Estate, Feltham, Middlesex TW14 0TZ. Their telephone number is 01 751 0141/4.

IBA censorship?

MR Woodrow Wyatt MP is angry at what he calls censorship by the IBA. He complains that passages from his programme about communism in Great Britain, *The Red Under the Bed*, were cut.

Among the passages were such statements as: 'So long as Britain stays a democracy the communists can never win a parliamentary election. But let them capture the unions by fair means or foul and they capture the Labour party,' and 'Every sensible person knows that communist and extremist leaders of a union don't represent what ordinary members feel about life and politics'.

Mr Wyatt said: 'There is a lot of left wing influence in television and the IBA feel they have to be careful not to upset certain people. I think that's why my programme was cut.' Mr Wyatt did not say who these 'certain people' might be.

In a letter to *The Times* following Mr Wyatt's complaint, made after the programme had been broadcast, Mr J. Weltman, head of programme services at the IBA said that Anglia Tv had discussed the programme with IBA staff before it was offered for transmission. He said that such discussions between companies and Authority staff were normal for any programme about political or industrial controversy, or current public policy.

'The authority has a duty given to it by parliament to ensure that all such matters are presented with "due impartiality" . . . It is not in our opinion "due impartiality" when the presenter (or link man) of a programme offers his own opinion as if it was fact. Statements that begin "Every sensible person knows that . . ." (to quote one of Mr Wyatt's examples) are familiar devices for offering opinion without in fact discovering the views of "all sensible people". The BBC had to switch a programme called *Matter of Opinion* from a British Legion Headquarters to their Aberdeen studio because the British Legion had banned MP William Hamilton from their club. The British Legion club, at Banchory, had banned Mr Hamilton, MP for West Fife because of his views on the monarchy.

The programme was broadcast on the night of princess Anne's wedding. During it Mr Hamilton said: 'Both princess Anne and Mark Phillips should realise the country is in a bad way and pay for their own honeymoon.' No young couple should expect the taxpayer to foot the bill for their wedding.

In an interview on a previous evening, Anne had said the cost of the wedding was not her or her husband's business.

Local Radio

THE IBA have invited applications for the contracts to run commercial local radio stations in Plymouth and Sheffield. The closing date for these applications is January 11, 1974.

Contracts have already been awarded for stations in London, Birmingham, Manchester, Glasgow, Swansea and Tyne and Wear. Applications to run stations in Edinburgh and Liverpool are now in; the IBA received four applications to run the station in Edinburgh and four to run that in Liverpool.

The IBA say the population coverage in Plymouth will be about 280,000, compared with 660,000 for the station at Sheffield, which will include Rotherham. The Authority have set the rental for the Plymouth station at £15,000 in the first year, £17,000 in the second and £18,500 in the third year. The corresponding figures for Sheffield are £36,000, £39,500 and £44,000.

Plymouth radio will transmit on 96 MHz vhf from Plympton and 261m medium wave from Plumer barracks. Sheffield will transmit on 95.2 MHz from Tapton Hill for Sheffield and 95.9 MHz from Rotherham. For medium wave the station will transmit on 194m from Skew Hill.

The towns for which tenders for local radio stations have not yet been invited are Bournemouth, Blackburn, Bradford, Brighton, Bristol, Cardiff, Coventry, Huddersfield, Ipswich, Nottingham, Portsmouth, and Wolverhampton.

Meanwhile BBC Radio London, Capital Radio and London Broadcasting have asked the Greater London Council if they can transmit live broadcasts of question time at GLC meetings. The three stations have also asked if recordings of both question time and debates can be made for later transmission. Live broadcasts of debates are not thought feasible, not because of any objections by the GLC but because these would present programming problems.

A spokesman for the GLC told STUDIO SOUND that the initial approaches had been made jointly by the broadcasting authorities. The plan was still being considered a decision was expected before Christmas.

Under the Local Government Act the press and public will be admitted to committee meetings of all local councils from April 1974 onwards, although the GLC have allowed such visitors since November 21, 1973. Committee meetings will not be broadcast, however, although the GLC say that, to their knowledge, they are the first council to allow the broadcasting of any council proceedings.

The move reflects a general tendency on the part of the GLC to involve the population of London more in local government. Stephen Haseler, chairman of the GLC's general purposes committee said in November that he and his colleagues wished to increase public awareness and to draw public attention to improving the lot both of London and the people who lived and worked there.

As one GLC man said about the broadcasts: 'The government won't do it and here we are, only across the river from them, beating them to it.' If the broadcasting of even a small part of the doings in GLC meetings is allowed it is bound to lead to requests for similar facilities to be offered in other towns where there are local radio stations. If the broadcasts are successful, not least from the point of view of the members of town councils, it is thought unlikely that a future Government will be unable to resist any longer the calls for the broadcasting of debates in parliament.

Wedding

THE BBC's coverage of princess Anne's wedding was received in 22 countries. The BBC would not say how much revenue they would get from the broadcast: 'We can't discuss it at the moment".

The BBC, whose coverage cost them at least £40,000 according to one report, had 50 colour tv cameras in use and 15 outside broadcast units. 12 miles of television cable were used and 680 kW of floodlighting, this the day after the Prime Minister had declared a state of emergency.

The day after the wedding the electric heating of churches, chapels, and other places of worship was banned by law.

The number of people who turned up to line the route is indeterminate. *The Times* said tens of thousands, the *Daily Telegraph* 45,000, the *Daily Express* nearly 50,000, and the *Guardian* 10,000. Earlier in 1973 a rally to campaign for changes in the Abortion Act had attracted a crowd of 55,000, according to *The Times*, of whom few would have been tourists.

On November 11, Radio 4's *The World This Weekend* broadcast an interview in which it was said that the BBC were giving a barbecue at Great Somerford on the night of the wedding. The programme presenter made no attempt to correct the impression that the BBC were organising the event. A *Daily Telegraph* report said the BBC were also holding a buffet lunch there. The BBC told STUDIO SOUND that both these reports were untrue. The barbecue menu included roast suckling pig. In the radio interviews a villager had said the money could have provided amenities for Great Somerford's young people.

PATENTS

THE FOLLOWING list of Complete Specifications Accepted is quoted from the weekly *Official Journal (Patents)*. Copies of specifications may be purchased from the Patent Office, Orpington, Kent BR5 3RD.

October 3
1336827 Criscuolo.
Head for musical instrument.
1336990 British Broadcasting Corporation.
Colour cameras.
1337180 Sony Corporation.
Image pickup tube.
1337251 EMI Ltd.
System for producing an image of an object.
1337254 Plessey Co Ltd.
Speech analysers and synthesisers.
1337264 Mitsubishi Electric Corporation.
Video information recording and reproduction.
1337373 Vidder, H.
Wind instrument.
1337397 Nippon Victor KK.
System for recording and/or reproducing four channel signals on a disc.
1337560 Thomson-CSF.
Variable gain low-noise amplifier.

October 10
1337976 British Broadcasting Corporation.
Protective shield for an aerial.
1337993 Fuji Photo Film Co Ltd.
Method of magnetic recording.
1338136 Saint-Gobain.
Transparent panel provided with an antenna.
1338387 Vockenhuber, K. and Hauser, R.
System for deriving television signals from holographic and non-holographic records.

October 17
1338578 Canon KK.
Magnetic recording-reproducing device.
1338723 Communications Satellite Corporation.
Digital speech compression.
1338933 Philips Electronic & Associated Industries Ltd.
Cassette for a strip-shaped record carrier.
1339091 International Business Machines Corporation
Bidirectional magnetic head for use with magnetic tape drives.
1339276 Westinghouse Electronic Corporation
Reverse direction tape translation.

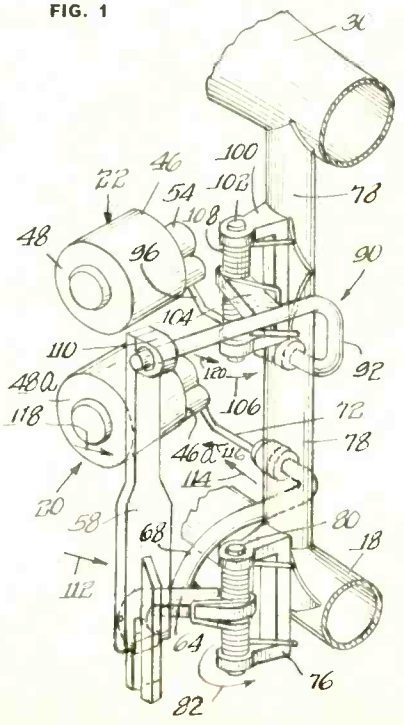
October 24
1339415/6 Ampex Corporation
Magnetic head and method of manufacture thereof.
1339791 TDK Electronics Corporation.
Electro-magnetic wave attenuators.
1339959 RCA Corporation.
Information storage system employing optical entry and removal of information.
1340083 Matsushita Electric Industrial Co Ltd.
Magnetic recording and reproducing apparatus.

October 31
1340228 Kohka, KK.
Cine-camera with simultaneous optical sound-recording device.
1340240 Sony Corporation
Magnetic recording and reproducing apparatus.
1340401 Badev SA.
Indicator of harmonies and of musical transpositions.
1340455 Sony Corporation.
Magnetic recording and/or reproducing apparatus.
1340510 Westinghouse Electric Corporation.
Signal variation enhancement system.
1340626 Compagnie Industrielle Des Telecommunications Cit-Alcatel.
High speed intermittent tape drive.
1340662 United Aircraft Corporation
High voltage amplifier.

Musical plumbing

THE LEBLANC Corporation in BP 1,294,029 suggest new valve constructions for bass trombones which are supposedly more easily manipulated by the player. Bass trombone valve manipulation hitherto required the use of two or three actuating devices and thus the use of two or three fingers. What Leblanc now suggest is a bass trombone valve arrangement which requires the use of only one finger or thumb for manipulation of all the valve assemblies. This they achieve with what they call a unitary actuator connected to a pair of conventional valves and capable of operating either both valves together or one of the valves separately.

FIG. 1



Usually the valves will be rotary, spaced apart but with parallel axes of rotation. In **fig. 1** the patent shows such valves at *20* and *22* together with a thumb lever mechanism and a bottom portion *58*. When the operator presses his thumb against *58* in the direction of the arrow *112*, the link *64* will rotate about pivot *80* and move the link *68* in the direction of the arrow *114*. Simultaneously link *72* moves as per arrow *116* to operate the valve *20*, all without any effect on the upper valve *22*.

If the player wants to operate both valves at the same time, he simply moves his thumb slightly up to the region *118* and pushes the lever *58*. This operates valve *20* as before but also bodily moves the free end of a link *92* (which has a slide bushing and previously remained stationary) in the direction of the arrow *120* to drive a link *96* and operate the valve *22*.

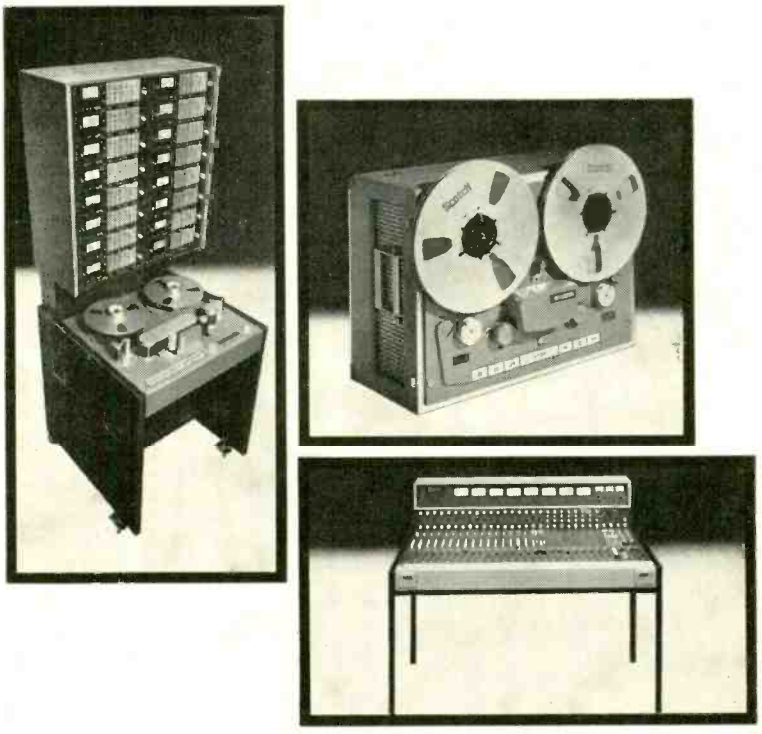
Cassette winding machine

THE STANDARD procedure when winding tape onto cassettes is to start with two lengths of leader tape attached to the hubs, attach the tape to one of the leaders, wind the required amount of tape onto the hub, and splice the end of the tape onto the other leader. King Instrument Corporation (BP 1,271,042) claim to reduce the time, labour and cost involved in doing this. The machine is an incredible combination of mechanically operated sequential switching which would take the most economic writer pages to describe. The tape is sucked round various channels, held and spliced by motors which operate on compressed air. It does automatically that which previously was done by hand, except that the leader tape has to be pulled out of the cassette before it is placed in the machine.

Damping materials

THE TECHNIQUE of damping mechanical oscillation on a small scale is very pertinent to the art of stylus mounting. Resonances must be damped without spoiling frequency response or sensitivity. Previous damping materials have been silicone pastes with a viscous silicone oil and filler or a rubbery elastic moulding. The problem with pastes is that they tend to deteriorate and the rubbery moulding media tends to increase the necessary tracking weight.

In BP 1,288,978, Telefunken disclose details of a solid damping medium which is the polymerisation product of a cold curing silicone rubber, a hardener for the rubber, a silicone oil with very low viscosity, and a filter. The point of the invention is that the hardener affects only the silicone rubber, which is initially a liquid and is converted on hardening into a solid silicone polymer. The reaction product thus contains the silicone oil trapped in a framework of polymerised silicone rubber but unchanged.



STUDER

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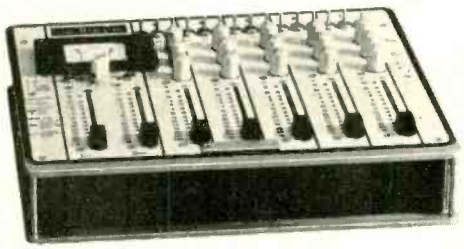
STELLAVOX AMI

By Angus McKenzie



MANUFACTURERS' SPECIFICATION

Five identical inputs each having:
Balanced line input: Up to 10V at 200Ω.
Switch for using: Dynamic microphones, 12V phantom powered capacitors, or AB parallel fed capacitors.
Bass cut switch: —3 dB at 120 Hz; —20 dB at 30 Hz.
Presence filter switch (broad): +8 dB at 5k Hz, +3 dB at 3.8k and 6.5k Hz.
Bass control: ±18 dB at 40 Hz.
Treble control: ±18 dB at 10k Hz.
Main slide pot: +15 to —60 dB, length 5.7 mm.
Panpot: Feeds progressively to both pots.
Frequency response: (overall): 20 to 20k Hz ±1 dB.
Harmonic distortion (total): 0.1% at 1k Hz and 0 dB.
Intermodulation (50/3000/4:1): 0.1% at full level.
Temperature range: —20 to +70°C.
Noise level: —124 dBm (mic inputs, 200Ω).
Dimensions (overall): 80 x 215 x 270 mm
Weight: 3.2 kg without batteries.
Basic price: £792.
Manufacturers: Stellavox G Quellet Eng,—E?Z 2068, Hauterive/NE, Switzerland
Agents: AV Distributors London Ltd, 26 Park Road, Baker Street, London NW1 4SU.

AT FIRST glance it would appear that the Stellavox mixer type *AMI* satisfies an important need for a miniature professional portable mixer that can be easily taken out with its companion recorder to locations where normal studio equipment would be unsuitable. The facilities provided are very extensive, and have been detailed exhaustively in Hugh Ford's review. As it has been produced in the past, however, the mixer falls short of professional requirements in many ways, some of which are serious, others merely inconvenient. Fortunately, after I had indicated where the serious faults were, Bob Woolford redesigned parts of the circuit and put many of them right, and it is likely that the manufacturer will be incorporating Mr Woolford's modifications in later models.

Before I even attempted to use the mixer for recordings I checked the input clipping levels and all operational levels throughout. I found with amazement that full output from the mixer was not available at low distortion for input levels at the microphone sockets above —48 dBm, since reducing the channel gain controls in order to increase feedback, thus reducing input clipping, also had the effect of reducing the available drive to the master gain controls and thus to the output. The manufacturers recommend that the master gain controls should be used flat out, and indeed it was not really possible to use them in other than this position since they too alter feedback as well as altering gain passively. Each fader has two sections, one following the previous stage and altering gain passively while the other section, working in tandem, increases feedback as the fader is pulled down. A microphone input level of —28 dBm into the mixer, for example, would only give a very low output level, totally insufficient to drive external equipment and in any case causing almost no deflection of the modulometers.

Mic preamp

The microphone preamplifier is almost identical in design to that in the tape recorder, and therefore suffers from the same faults, i.e. too low an input impedance when the mixer is switched to the phantom power position; this position can be used not only for phantom power capacitor microphones but also with moving coil and ribbon types. The input stage is rather more noisy than it should be, partly because of the resistive loading, and therefore dynamic type mics can only be used satisfactorily for recording fairly high volume level sounds. As with the tape recorder, however, a preamplifier is available with 20 dB gain to enable quieter sound levels to be recorded, such as speech, without preamplifier hiss becoming objectionable. It was useful to be able to switch between phantom and A/B powering, but some microphones did not like the presence even of conventional phantom powering, a typical example being the AKG *D202*, some samples of which crackle quietly and continually despite working perfectly into unpowered circuits.

The line input to the mixer was also affected by the feedback type channel gain controls and the input clipping level varied enormously, dependent upon the channel gain in use. It was indeed possible to put high levels into the line input of the mixer, but unfortunately it was not possible to get them out again at high level without very severe distortion. On the other hand lower levels proved to work satisfactorily. It was thus found necessary to pad down high input levels externally, but by so doing the input noise level of the mixer became noticeable. I could not at first understand why the importer supplied me with some external pads for use with the Schoeps microphones, which are A/B powered from the mixer. These pads allow the A/B powering to go through to the mic without attenuation while padding the audio signal entering the mixer. It seems a little ridiculous to me that all input levels have to be adjusted externally in order to achieve a relatively narrow available working level into the preamp.

The bass and treble controls worked quite normally, as did the high pass filter and presence switches. The pan pot law was found to be extremely smooth, left to right panning being available independently on each of the five input channels. From my point of view the complete mixer was designed back to front, the master gain controls being on the left whilst input channel one is on the extreme right. While I did not object so much to the master gain being on the left I find it most annoying that the input channels were designed from right to left; I also feel that two input channels should have had their controls either ganged or very close together, thus allowing them to be brought up easily and accurately as a stereo pair. Similarly the two master gain controls, I feel, should have been positioned closer together. The master gain control is graduated such that the nominal 0 dB position is some way down from maximum. I cannot see, however, that the controls would be used in other than flat out position which would be equivalent to +15 dB as read on the other faders. The line output section would appear to have at least 12 dB too little available gain since, as previously explained, maximum output from any one channel of the mixer cannot be obtained unless the master gain is fully up. If, however, peak levels from several channels are contributed to the output level it is possible to use the master fader a few dB lower than maximum. Automatic gain control is available on channels four and five and, with this switched in, the channel gain controls become limiting threshold controls. The limiting function appeared to work reasonably well, and the circuitry is very similar to that in the tape recorder.

The charger power supply referred to in the tape recorder field trial can also be used with the mixer both to recharge the accumulators and to mains power the equipment but, on the balanced line outputs, the hum level produced was quite intolerable. However, the hum on the normal unbalanced outputs that would be used with the tape recorder etc. is low enough to be acceptable. A tone button is incorporated which gives a constant level of 0 dB on the modulometer, which was however rather distorted. This distortion was found annoying since it was not possible to check external for distortion but only for level setting.

Fixed lid

The lid is not detachable, which can be very annoying when the mixer is to be used in a confined space. All the input and output sockets are easily accessible, but I would like to see the addition of a normal stereo headphone jack on the front panel together with a monitoring level control, rather than the external fixed level available on the five-pin locking DIN socket.

Provided that all the limitations were overcome the performance was quite satisfactory,

with relatively low distortion, and quiet operation of controls.

As a result of these rather severe criticisms Bob Woolford modified the negative feedback portions of the channel gain controls in such a way as to give not only improved input clipping levels but the availability of higher channel output levels for high input signal levels. Also the line input circuitry was modified to give the same effect. He also increased the available gain after the master gain control allowing this to be used with approximately 10 dB of gain in hand. The total available gain of the mixer however unfortunately became only 66 dB which, while being ample for capacitor microphones and line inputs, was insufficient to allow dynamic types to be used for speech and other relatively quiet sounds. Not very much safety margin is available in the output amplifier because of the low rail voltage available from the accumulator cells and some types of very sharp transient sounds which may have their peak level not fully indicated by the modulometer may be clipped in rather the same way as in the tape recorder. In general, however, the modulometers behaved extremely well.

It seems difficult to justify the very high price of the mixer in terms of the performance even if all the important defects are remedied. It is possible that if the manufacturers were to redesign the equipment and considerably lower the price the product could become a winner. As it stands, however, its applications are rather limited and highly specialised. I get the impression that many of the deficiencies in the design might have been overcome at an early stage if prototypes had been tested thoroughly on location recording when many of the points I have raised would have been noticed. The importers have told me that as a result of Mr Ford's findings and my own they are prepared to modify existing models and also to supply the modifications in new equipment. As with the tape recorder the lid can now be supplied with a hinge which allows it to be removed. In these circumstances I can recommend the mixer where weight and size has to be kept to an absolute minimum but where extensive facilities are of importance.

As a final word of warning, the lid is locked by a magnetic clutch using a small but extremely strong permanent magnet. This could possibly damage masters stored in transit very close to the mixer.

Just before completing the field trial we looked further into the poor hum performance of the power supply, and found that the balanced line output stages drew their ht from the raw voltage provided by the power supply rather than the regulated internal supply. Whilst the balanced output stage is satisfactorily driven from the internal accumulators it cannot be used successfully with an external power supply as it stands at the moment.

DIARY

Saturn, Worthing. Andy Cowan-Martin says Saturn have been busy lately with sessions by a band called Ducks Deluxe for RCA. The producer was Dave Bloxham. Andy told me Ducks Deluxe were one of RCA's new super bands and that they had made a single now out called *Coast to Coast*, and an album. Robin Cable of Trident Audio Productions came down to produce Colin Scott sessions and the studio has been kept busy with a lot of smaller sessions. I asked Andy if he was still happy with his desk, a Triad B, to which he replied that he thought it was worth twice the money. Can't be bad.

Advision, London. A mass of stuff yet again from the Gosfield street studio. To anyone who wonders how Advision, Marquee and so on appear in this column month after month my reply is that they let me know what they're doing.

As usual Advision have had a lot of film dubbing work, including a series of 13 commercials for Pearl and Dean International. The ads were for Chrysler. Seven of them were shot in Switzerland and six in Japan. Altogether the work involved 52 versions, one each in English, French, Arabic and Spanish. The producer was Steve Gore, and post production was by Rank and Quartet Films.

DIARY

by John Dwyer

LORNA COATES and John Fay opened **Speech-Plus Recordings** on July 1, 1973. The building had been finished since April 10 but in between they were busy doing the acoustics, most of the wiring, the carpeting and the decoration themselves.

Lorna Coates, the studio manager, is an Australian. She spent 15 years at Stage Sound and for the last three or four she was studio manager. After that she spent two years at Students' Recordings of Newton Abbot, where she was recording for filmstrips with tape commentaries and recordings of books and other published works.

SPR's technical manager, John Fay, had also spent a short period at Stage Sound, where he met Lorna, but for six years his main interest has been Lander Electronics.

John started Lander, who make custom build studio equipment, and the firm now share premises with SPR. He spent six years at EMI. After that he spent six months at Advision and then six months at Stage Sound. As a sound engineer, John has worked on Son et Lumieres at Blenheim Palace, York Minster, Hampton Court, St Paul's, Canterbury Cathedral and Warwick Castle, among other places.

John Fay said he needed contacts, and Lorna was considering coming back to London, so they decided to go into business. They told me they started planning the operation in August last year, when they began to look for premises. They say they found plenty of industrial premises but nothing that would have been suitable to make into a recording studio. Eventually they put an ad in the *Evening Standard*. They say they had an immediate response which yielded their present place at 32 Pages Walk in Southwark.

The building is an 18m by 12m factory unit. On March 9 the builders moved in. 'We were able to build exactly what we wanted,' Lorna said, 'except for a couple of fire doors.' What they have done is to build a brick box in the middle of the floor, and there is a corridor right round the studio. This means that no noise can penetrate either from the road or from adjoining buildings. While I was in the studio I certainly heard nothing I shouldn't have, a rare experience. I should mention that there is 50 mm of sand on the roof.

Lorna and John did the acoustic treatments themselves. They told me there's a 33 cm thick double cavity filled with Rockwool all round the studio. One wall has been left bare and has proved useful for picture projection. A curtain can be drawn across it. The carpet on the studio floor can be rolled back if required; for instance to record footsteps on concrete.

They had a tough time with the fire officer, Lorna said, and the result of his diligence is a double door in one wall of the studio which leads to what will be a tape and microphone store and two tape copying and editing rooms. They plan the tape copying rooms to be 5.5 by 3 m and 3.7 by 3 m. About the present studio John said: 'It's large enough for doing things that other speech studios can't do. We can record anything from one man to a cast of about two dozen. The studio is large enough for music recording—light music, small groups and for advertising jingles—but not pop. The market we are in fills the gap where one man studios end and music studios begin. We have pulsing facilities for audio visual work—one of the best sets of pulsing facilities anyone's got.' I'll describe those in a moment.

There are ten mic lines from the studio and there is stereo playback into it, with two headphone foldback circuits. The microphones used are two *U77*, two AKG *D202* and two STC *4038*. John has decided to standardise on Leak *600* speakers, and these are in the control room and the studio and will eventually be in the dubbing rooms. 'We had to get our priorities right, and that meant getting cheaper curtains and good equipment. I think they're the best speakers for speech.'

The control room is 7.6m long and 3m high. Since SPR do mainly two track work the mixing desk has only taken up a part of one corner. The rest is desk space and tape machines built into desks at the back. 'It needs to be big,' John told me, 'because in speech work you've sometimes got three editors, four publishers, and so on and there are scripts all over the place.'

John built the desk himself. It has all the things you'd expect to find on a desk as well as one or two extra things. There are ten inputs and four outputs, though as yet the studio is only equipped for stereo. Any channel can be routed to any track or to a pan pot. There are two foldbacks, treble and bass controls, variable boost at 2, 4, 6 and 8k Hz, eq in and out switch and two echo send outlets. There is an Audio Design *F760N* compressor and one switch routes the limiters, tape delays and loops to a patch panel. Any of the 10 mic channels can be panned to groups one and two. Announcements can be made on to tape or a built-in tone oscillator can be injected for line-up onto the output groups. All the outputs appear at all the inputs of the tape machines so no jacking is necessary.

There are eight stereo tape or gram positions which can be monitored, or 16 mono positions can be selected. The levels of these are identical. If the monitor switch is in the line out position the output of any of eight tape machines can be selected. The two foldbacks can also be injected on to the speakers.

There is pfl on all channels. Apart from the normal monitor position, on one of the monitor output lines it is also possible to monitor a number of inputs and outputs: two foldback outputs; two echo send outputs; two echo return outputs; two studio playback outputs; an oscillator; and a pulse output circuit. The talkback outputs have level potentiometers.

All the machine positions are remotable. There is a drop-in facility which can be operated by pressing button edit. Any or all of the eight machines can be used in this way. The machines to be dropped in are selected and put into play then the record button is pressed at the right point. For echo John has modified a Grampian spring unit to give echo only, not echo plus signal.

The tape machines, all two-track, are a Bias and four Revoxes—two high and two low speed. The Bias has ferrite heads and all of them have selected erase. There are also three Garrard Stereo gram units, fitted with Shure cartridges, and six Philips cassette recorders. Ten tie lines have been installed for future use and these come out on the jack bay.

The oscillator and pulsing facilities are particularly interesting. The pulses can be operated from the desk, from the producer's table or by the commentator in the studio. The length of the pulses can be varied from 0.1 to 0.6. The output comes up on the desk and can be injected into any of the output groups.

There are two types of pulse: a rounded pulse in which the volume of the pulse rises then dies away; and a relay-operated square pulse which clicks in and out. The rounded pulse is click-free and, for this reason, is usually used on audio tracks, besides which it's a great deal more pleasant to listen to. The pulsing system can be used to clean up pulses from a tape on which the pulses are noisy or ill-defined. There are two oscillators each of which can be switched to one of eight frequencies, and the two oscillators can be mixed together at differing frequencies.

As I've already said, Speech-Plus Recordings are in Southwark. With all the hard work they've put in they deserve to succeed and somehow I think they will. They're due east of Picadilly, though there's a river in the way. Pages Walk is about where the Old Kent Road joins the New only don't go over the flyover. The telephone number is 231 0961/2.

Beale at Konk

Roger Beale has worked at Olympic, Island and CBS. Now he is in charge of **Konk**, the Kinks' new recording studio in Hornsey. They have taken over what used to be an old tobacco and confectionery warehouse and, as that implies, there is plenty of room.

Roger described it as 'three buildings in one'. On the ground floor there is a drive-in loading bay and a billiard room. A bar is under construction and they have plans to build a second studio. The offices of Kinks productions are upstairs.

The control room monitors are Altec drivers in Cadac cabinets. The desk is a standard Neve with 16 inputs and 16 groups. There are, however, eight output faders; each fader operates on one of two output groups. The meters are VUs, good big ones, but Roger told me he wanted to change them for vertical ppms.

The machine is a 16 track *MM1100* with search and cue. At the time of my visit Roger was

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WHO'S WHO IN SOUND

AIR STUDIOS

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PETER SULLIVAN:
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GEORGE MARTIN:
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JOHN BURGESS:
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"There are 32 input channels mixing down to 24 groups for multi-track recording."

Who's Who in sound know what's what when it comes to a sound recording system. Only the best is good enough for AIR Studios. Which is why they chose Neve. This 32 input, 24 track quadrophonic music recording console was specially designed to fit AIR's most advanced studio at Oxford Circus. It looks magnificent. The results speak for themselves.

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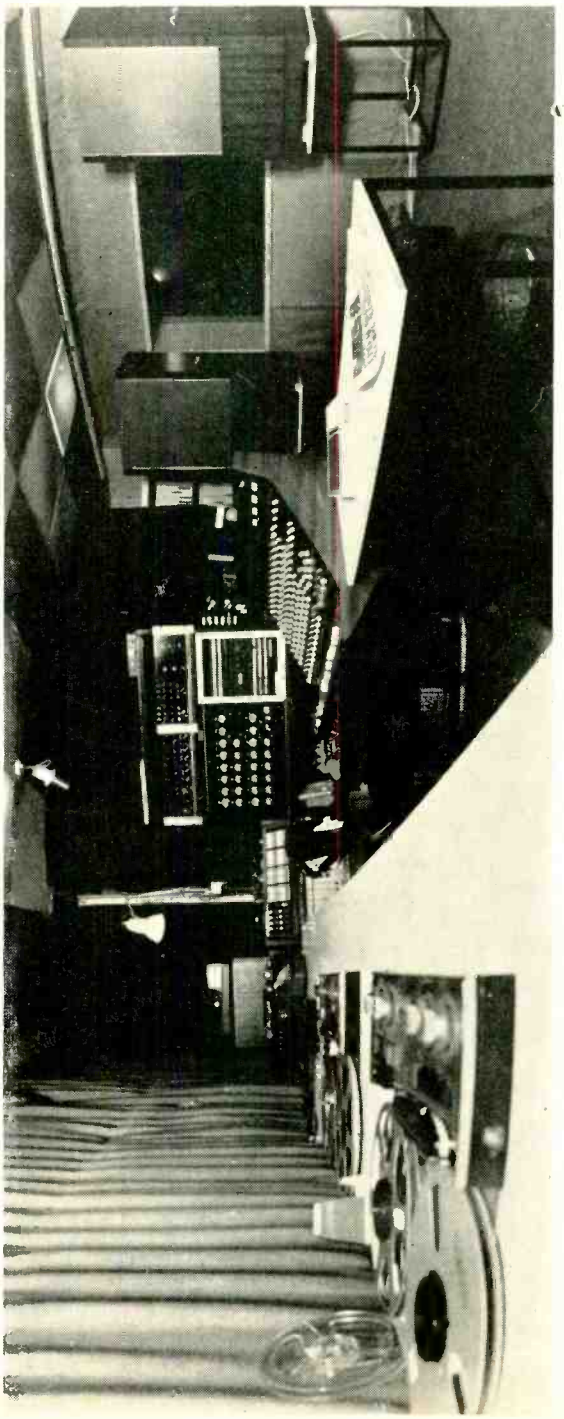
Gooseberry control room



waiting for a remote control unit which would be put into the desk.

The rack holds a couple of Dolby 361 units and an *M16* as well as six HH amps for foldback, studio playback and so on and a power supply. There are two foldbacks arranged in the usual two mono or one stereo. The cans are mostly Beyers, with a few AKGs. There is also an Ampex stereo *AG440* and a Revox Konk have modified for variable speed, phasing and tape delay.

The microphones are the usual Neumanns, AKGs and an assortment of others. 'We want some more *D202s* and we're thinking of getting a couple of Kepexes. A ring modulator will go into that empty panel at the end of the desk.' Another machine they have is an Akai cassette job for copies.

The studio acoustics are on the live side, but they have an area at the back which is extremely dead. Areas like this can be very effective if the conditions are right and, as I've seen at Anvil, need not be closed in at all. At Anvil the deadness is partly achieved by the dead area's opening out onto a much larger area. At Kink the dead area is at one end of a much smaller studio but, since there are no parallel surfaces in the main studio there are still no echoes. It's one of those arrangements that looks as if it shouldn't work but does—very effectively—and makes those who go by rulebooks look rather silly.

Konk have three microphone input panels with 16 mic inputs on each. In the wall under the control room window and on the wall opposite, in the almost anechoic area, there are feeds for the foldbacks and playback. There is a large 4.6m square echo chamber in the basement and a large EMT stereo plate. The chamber has up to four returns.

Konk's rates are a flat £20 an hour and there are no overtime charges. The studio began operating in June, and the Kinks finished an album there in August. The phone number is 340 7873. I consider it one of the neatest studios I've seen.

Gooseberry control room

The last time I went round to Gooseberry the control room was so small the engineers had round shoulders. Gooseberry's studio area was in two sections separated by a sliding door fitted with double glazed windows. Peter Houghton, the owner, said then that he usually put rythm on one side and piano, brass and reeds on the other. The control room, a pantry-sized pip on the floor plan, could only be reached by crossing the studio floor.

Not any more. Now the sliding door has been replaced by a wall with a window in it and behind it a new control room occupies what used to be half the studio. The old control room is used as a vocal booth, and artists record in the larger area in front of it.

Altogether the new arrangement represents quite an improvement; since the change was made engineers Ron Eve and John Ward have been known to make sudden

movements of the head without giving producers a black eye.

Obviously the studio will not now take as many musicians as it used to; it will take about seven. But the improved conditions for producers must mean that business won't suffer. Peter has taken the precaution of putting extra mic and foldback points out in the hall and he said that a couple of extra brass could be put in the control room if necessary.

Improved monitoring

The control room monitoring has been improved with the installation of two Tannoy Red drivers in Lockwood cabinets. Gooseberry is an eight track studio: 'A lot of two and four track work used to come in but we've had to turn away a lot of the small work.' The mixer is a Richardson 14/8 and the tape machine is a Brenell eight track with Richardson electronics. Other equipment includes four Audio & Design companders, four equalisers in the desk and four extra, one phaser unit and three Astronic graphic equalisers which can be patched into any channel. There are now two separate foldbacks.

Like most studios, Gooseberry have been busy in the last few weeks. The week before I came in they had done a 28 hour session with an Icelandic group called A Little Bit, produced by Jonas Jonsson. Gerry Rafferty and Joe Egan produced Stealer's Wheel sessions. Peter said Gerry had been coming down to Gooseberry for about three years now. Andrew Oldham was also on Gooseberry's list of clients, as were Dave Dee, who had been producing for Atlantic, Lou Reed, who had come in for rehearsals, and Mike Stoller, who had been arranging. Gooseberry had just released an album of Indian music by Ranjit Kaur and Mohammed Siddique for Oriental Records. While I was talking to Rone and John someone phoned to book a six hour eight track session. If you want to do the same phone 437 6255.

Muff Murfin and Wally Exall opened their studio at the **Worcester Music Centre** at the beginning of September. On the way there I noticed a blue plaque which said: 'Near this spot above the family music shop Edward Elgar lived as boy and man in the years 1866 to 1879'.

Muff and Wally have a music shop there now, though they don't pretend they'll ever be as famous as Ted Elgar. They have a concession in the large Russell and Dorrellstore in Worcester's shopping precinct. They sell records, organs, pianos

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and other musical instruments, as well as being the local agents for Revox.

Wally Exall had always wanted a studio. 'He dropped so many hints,' said Muff. 'Eventually he went on holiday and when he came back he'd got one.' Muff had had £5,000 worth of work done while Wally was away.

Muff retired from teaching seven years ago; he met Wally in 1965, and they set up an entertainment agency. 'The trouble, surprising as it may seem, was that dole money went up:' According to them, there was more money on the dole than there was making music, so musicians were less eager for work.

Wally had started life as a radio and tv engineer. Then his firm was taken over by J. Moody, who ran a music business and a tv and radio business. Wally moved over to the music side of the business and Moody sold it to Wally in October 1968. According to Wally: 'Muff looks after the sliders: I look after the till.'

The studio has been built directly under the organ showroom. All the shops in the shopping precinct can load from a sort of miniature Mersey Tunnel underneath the precinct, so the studio is easily reached from this road. When the back door is opened a ramp leads directly to the studio door.

The studio is 6.1m long by 2.7m wide and 4.6m high. Off it is a smaller area which they will use to build a drum/vocal booth. The roof is concrete and it seemed to me to transmit a fair bit of structure-borne noise. I heard knockings while I was down there and I thought they were heels on the pavement above. Muff assured me, however, that they were building workers next door. I did hear the noise of an organ coming from upstairs. There must also be an earthing problem somewhere for I heard a bad hum in the control room. While Muff and I were in the studio, bass thumps came from the control room as the other engineer, Gary Sharman, played some tapes for clients.

They have a Scully four track machine they bought from Ron Lee's Birmingham studio when he went eight track. There are three Beyer mics, three AKGs, two Calrecs and some Eagles: 'We've tried the Eagles out even on bass. They're only £29 and we're thrilled to bits with them.' Muff told me the studio could also do direct injection. The power amplifiers are Emmex, a firm started by Wally and Muff which derives its name from their two names. Emmex also made the speaker cabinets which house the JBLs. The headphones they use in the studio are Koss Pro *5LCs*. The mixer is the excellent little Audio Developments portable four track job.

Muff said they wanted to develop local talent: 'We want to encourage them, so we offer people three hours for two hours' money. The first session is usually a waste of time anyway.' Many of the studio's clients are local people who reckon little Cyril is another Donny Osmond. Wally and Muff go out around Worcester to find talent and they also record school concerts and encourage the schools to have a few hundred records pressed. Muff told me they shunt the recording gear around in two horse-boxes. 'There are no running costs,' said Wally, 'and all you need is a tow-bar. A good horse-box costs you £240.' Makes sense to me.

Back in the studio there have been sessions for Emperor Rosko—a friend of Muff's, Daniel Boone, Stuart Henry and Dave Cash. Muff told me EMI wanted to book time and that an engineer from Island had been down to have a look at the studio.

Muff himself is quite a talent. He lugs a portable disco around to about four discos a week and does about two vocal sessions; he has done some of the cover versions on Marble Arch. Muff told me he was also the voice of the old man down the sewer often heard on Rosko's show. He is a member of a local band, the CMJ, who have recorded cover versions and party albums. With all this he runs dances and parties for the rest of the Russell and Dorrell staff; organ and piano shows; and is president of the Worcestershire Basketball League.

It seems to me that the potential in Worcester is excellent particularly if, as Wally and his partner hope, local radio comes to town. I am sorry I have had to qualify my enthusiasm for what they're doing by mentioning some of the technical funnies in the studio but it is a pity, is it not, to have the thing less than right. There's nothing wrong there that can't be easily fixed, and, if they want a foot in the local radio door, fixed it will have to be. Still, they have plenty of time.

R. G. Jones are one of the oldest-established studios in London; it was once suggested to me by an engineer who once worked there that the founder of the studio was a man worthy of a STUDIO SOUND profile all to himself. That, too, is on the cards. With the expansion of Studio Sound staff we may yet improve our coverage and do a series of profiles of prominent people in the industry.

If any of you have any ideas as as to who should appear in any future profiles I would be glad to hear about it, either in writing or by phone.

Meanwhile, R. G. Jones have written to say that their plans for 16 track are going ahead and that the builders began to put up a new new control room on November 17. The new 24/16 desk will be another Neve, and it is due to be finished before mid-January. 'Full Dolby facilities, a new 24 track 3M recorder with a 16 track head will pave the way for 24 track recording in six to eight months, if not sooner.'

R. G. Jones will charge £19 per hour if paid at the end of a session. 'The studio accommodates up to 35 musicians and is, at present, heavily booked with eight track, still at £12.50 per hour. The present hit record *My Coo-ca-choo* by Alvin Stardust was put down by our engineer Gerry Kitchingham.' Robin also mentioned that they were selling their mono Neumann disc-cutter. If you're interested in buying that or booking a session phone Robin on 01 540 4441.

I promised Robin a long time ago that I'd do a full report on his studio and I swear on Mao Tse Tung's Book of Christmas Crossword Puzzles I'll do just that. All I need is time—it's only 18 months now, after all.

Tony Visconti has written to say, among other things, that he's nearly finished building a 16 track studio. The above sounds as if I'm trying to give the impression I know the guy; in fact I think I met him once at Marquee. Still you aren't interested in my social deficiencies, are you, reader?

'Some of our equipment consists of an MCI 16 track recorder, a customised Triad mixing console, Klein & Hummel *O Y* monitoring speakers, an Eventide digital delay device and lots more. The studio will be in our new house which we will be occupying shortly.' Tony's Good Earth Productions produce T. Rex, Mary Hopkin, Carmen and many others. He has probably been in more studios than Dickie Nixon has lost tape spools, so he knows what he wants. Most probably, that studio will be an all right thing.

Talking of **Marquee,** where Tony Visconti has done much of his work, in the past month T. Rex have recorded an album; Peter Noone did likewise produced by Tony Atkins and engineered by Geoff Calver; Desmond Dekker had a new single produced by Tony Cousins; engineer turned producer David Baker produced a Sleaz band album engineered by Will Roper; Strider recorded a single with Chris Beckwith; Marquee Artists Management's own band, Mahatma, now appearing in *Decameron* 73, recorded their own album; other artists include Canton Trig, produced by Paul Brett, and George Serghe; NBC tv recorded David Bowie, Carmen, the Troggs and Marianne Faithful.

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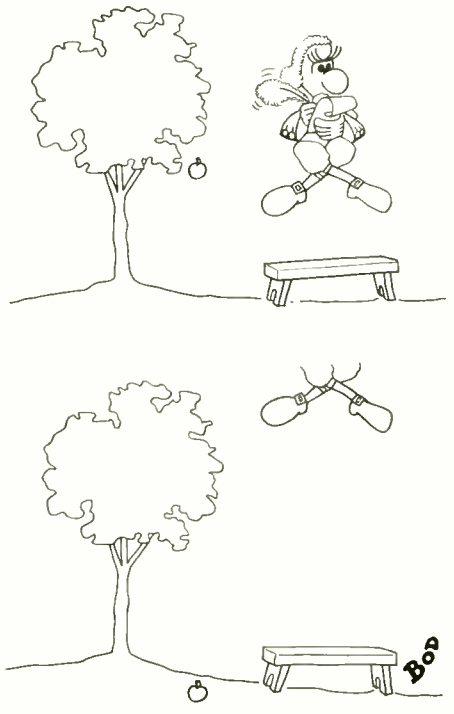

by Roderick Snell

SONY VIDEO ROVER

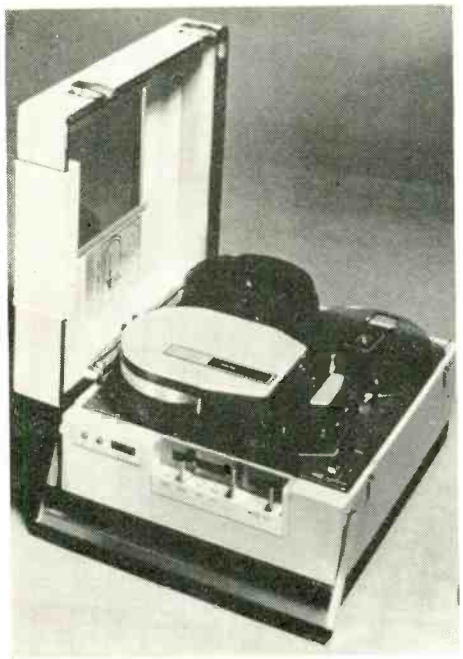

FIG. 1

THE SONY *AV-3420CE* reviewed here has been released with two companion mains vtrs, the standard *AV-3620CE* and the *AV-3670CE* with electronic editing; these latter models will be covered in a later review. In Japan and the USA the *AV* series have been available for some time in versions conforming to the EIAJ/1 standard compatible with vtrs made by National Panasonic, Sanyo, Ikegami, JVC and Toshiba. The other manufacturers (Sanyo, Shibaden, Ikegami, JVC and National in historical order) have been supplying vtrs in Europe modified for CCIR 50 Hz use, according to an agreement covered in the formal document *No. 5* issued by the Electrical Industries Association of Japan Technical Committee, made in March 1971. In fact Sony themselves have sold machines conforming to this in Australia (which also has a 50 Hz field rate and uses CCIR tv standards), but the main disadvantage of this modification is the reduction in resolution from 300 lines to 240 lines. The reason for this reduction is the slower writing speed. In order to avoid this loss, and for their European EIAJ range not to have inferior resolution to their established *CV2100* series vtrs, Sony have taken advantage of their new high coercivity tape developed for the *U-Matic* cassette system, and with this oxide formula on 12.5 mm tape can raise the fm carrier range to 5.2M Hz, gaining a horizontal resolution in excess of 300 lines. The electrical modifications for this are relatively simple and do not raise the cost of the recorder, but the performance specified relies on the use of Sony's own tape, which costs about 18 per cent more than their iron oxide type although this increase is hidden by Sony's policy of supplying less high energy tape on each reel. For example, an 18 cm reel of iron oxide tape contains 710m, and costs the same as 600m of high energy tape on the same size reel. There have been differences in carrier frequency amongst the other European EAIJ/1 vtrs, the lowest being 2.8M to 4.2M Hz, and the highest 3.2M to 4.6M Hz, but tape interchangeability between these has always been satisfactory with never more than a slight degradation in signal-to-noise ratio. Sony's change is far greater and any recording on iron oxide tape made on a 'low band' vtr will suffer a loss in signal-to-noise ratio of between 3 and 7 dB when played on one of Sony's high band models. Of the several tests done in this direction, noise was between 36 and 38 dB p-p/rms so, although not perfect, the recording can always be *used*. In the other direction one can obtain stable pictures in most cases but the Shibaden *SV610* series, for example, will play most Sony programme material with a 39 dB signal-to-noise ratio but test cards and video sweeps overload the head amplifiers and give black streaking. The Ikegami *TVR321* is the best in this respect (see review in STUDIO SOUND September 1973) and it replays Sony tapes including test signals, with a resolution of 300 lines and 40 dB s/n.

The EIAJ *mechanical* format has been closely adhered to in all the vtrs tested so far. The electrical problems of compatibility will hopefully be only a short-term nuisance as manufacturers will make switchable machines in the future. In the meantime, the more technically competent suppliers will have to modify the equipment to suit individual users' needs.

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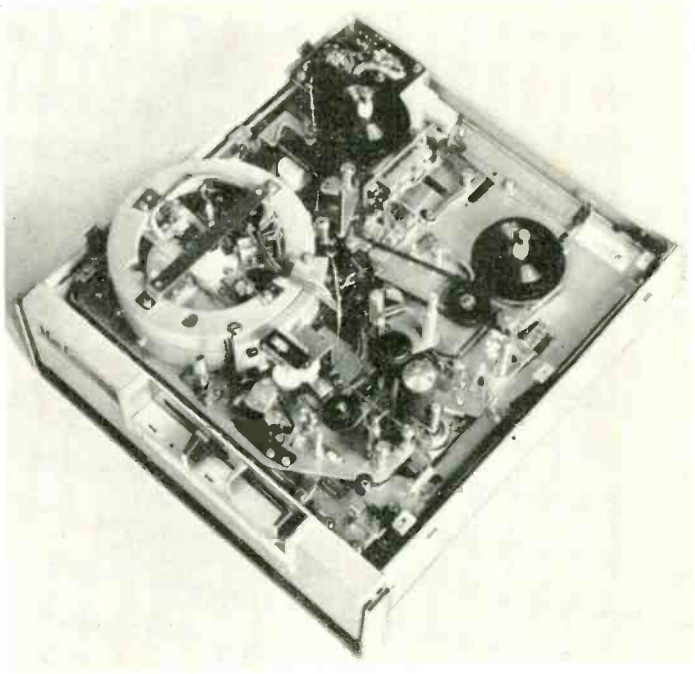


FIG. 2

Recorder:
Horizontal resolution: more than 300 lines
Video bandwidth: 3.8M Hz, –20 dB
Signal-to-noise ratio: more than 40 dB
Audio frequency response: 100-10k Hz
Audio S/N: better than 40 dB
Tape Speed: 163.22 mm/sec, within 0.2 per cent
Recording time: 30 minutes with V-60H tape
Reel size: 13 cm max.
Dimensions: 280 mm wide x 157 mm high x 295 mm deep
Weight: 8.5 kg complete

Camera:
Tube: 17 mm separate mesh vidicon.
Scanning: 2:1 interlaced when driven from *AV-3420CE* recorder
Horizontal resolution: more than 400 lines
Signal-to-noise ratio: better than 40 dB
Auto sensitivity range: 300-100,000 lux
Viewfinder: 1.2 in crt
Size: 71 mm wide x 125 mm high x 210 mm deep
Microphone: omni directional electret type
Weight: 2.8 kg
Lens: VCL-1206 f.2 6:1 zoom

The *AV-3420CE/AVC-3420CE* system was the first of the high resolution CCIR 12.5 mm recorders to appear in Britain and those who have used 525 line equipment will recognise it as the European version of the *AV-3400* which first appeared in the USA in 1971. Like the other new battery portables but, unlike Sony's earlier *DVK 2400 ACE* (field tested by David Kirk in November 1971) which it supersedes, the recorder has built-in playback facilities which can either feed a conventional monitor or, in the field, can replay into the crt viewfinder in the camera with sound through an earpiece. Recorder and camera are operated from 12V dc, either from the internal rechargeable battery or direct from the *AC-3420CE* combined charger and power supply. Audio and video levels are automatically set, which is quite satisfactory for vision, but it is a pity that, with the separate microphone input, the simple audio agc cannot be overridden. Despite its small size and consequent limitation to 13 cm reels, most of the other facilities found in the larger mains operated machines are included: fast wind in both directions, audio dubbing, still frame and true elapsed time indicator.

This last feature is rare in any non-broadcast equipment, be it for sound or vision, and with its indication of minutes and tenths of minutes, is driven from the secondary pinch wheel via two small coupling belts visible in the top deck picture (**fig. 2**). This figure also shows the mechanical construction which, in the interest of lightness, uses a 16 swg aluminium tray, with the critical tape guides and drum on a 14 swg sub-chassis. This appeared to be less rigid than one would have liked, and careless maintenance could easily bend a guide out of alignment, but tests on the review machine and a well used hire recorder showed both to be exactly true to the EIAJ/1 format.

An unusual system of two motors is used for the transport and scanner, with a subsidiary motor for playback and a relatively powerful main motor for the main functions. These motors are fed from a system of servos in which the 31.25k Hz crystal master oscillator is divided down to 50 Hz, which is used to lock both scanner and capstan in the record mode and the capstan alone in replay. Together with the double pinch roller system (**fig. 3**), in which the capstan drives the tape into and from the drum and fixed heads, low wow and flutter and a speed accuracy on replay of 0.2 per cent are achieved. The signal processing electronics are also fairly comprehensive, with a high frequency 'squelch' type noise reducer and separate drive amplifiers and playback amps for the two heads, making adjustments more complex but giving better results. One old fashioned touch is the use of slip rings and brushes for coupling the video heads; most designs now use rotating transformers in the interests of reliability.

In use, the electret microphone in the camera was a slight improvement on the dynamic type in the *VCK2400CE* camera and the zoom lens (made by Canon) now has a 6:1 ratio. A single lever controls the tape motion, with a separate record lever and small knobs on the deck top panel for sound dubbing and still frame. The four positions of the tape motion lever are

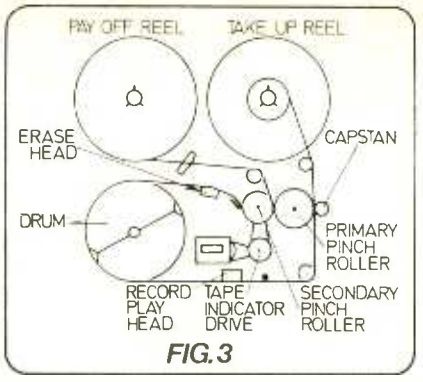


FIG. 3

fast forward, play, stop and rewind. This means that, in going from fast forward to stop, the lever has to jump through the play position before tape damage is done. This seems to work in practice and tapes were never damaged but the tape did spill if the lever was moved too slowly. The Sony specification implies only 30 minutes use per battery charge but we measured 50 minutes on continuous record, and 75 minutes without the camera. The recharge cycle took six hours against the specified eight.

Still frame performance was as good as that of most other EIAJ format vtrs, and definitely better than the *CV2100*. This is for two reasons: firstly the lower linear speed means that the change in video track angle is smaller on still frame. Secondly, having the head switching point seven lined before vertical blanking reduces instability on the monitors. The tape timer was accurate to within 4s in five minutes (the linear speed being within the 0.2 per cent claimed) and the rewind was faster than most other battery driven vtrs. Due to the technique of locking both camera and recorder to the crystal oscillator, self edits between camera 'takes' are not quite so good as those from the earlier Shiba and Sony portables, there being up to 500 ms of disturbance on replay. But, when used with the electronic editing recorders now available, this is no longer so important. Tracking accuracy was very good and the preset control did not need adjusting when replaying tapes made on several other machines. Lacing the tape was easy by vtr standards with most of the wrong options being prevented by plastic mouldings.

Audio performance

Sound performance was good for a mains vtr and exceptional for a portable with the −3 dB points being at 55 and 14k Hz. The noise at 47 dB below 32 mm/Wb was high frequency hiss without video breakthrough. Stability was

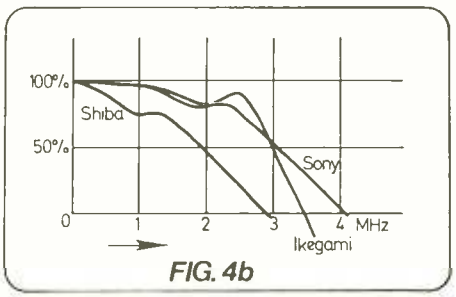


FIG. 4b

equally good, with DIN weighted peak wow and flutter of only 0.14 per cent throughout the reel. This speed constancy is probably due to the combination of crystal locked servo capstan drive and double pinch roller system. A Sony *ECM 21* electret microphone was used for the sound tests and the agc system became operative with input levels greater than 100 μV.

Video performance was equally good, with noise at −42 dB pp/rms adequate if not the highest, a limiting resolution of 330 lines or just over 4M Hz, and a −6 dB point of about 3.3M Hz. This increased resolution is the biggest difference between this series and the other EIAJ/1 models using iron oxide tape. **Fig. 4** shows a comparison between a 1972 vintage Shibaden *SV610* and a 1973 Ikegami *TVR321E*. The signal-to-noise ratio must be taken into account when making such comparisons. This extended hf response has been gained with only a small amount of moire patterning above 2.5M Hz, as was seen from a full amplitude line rate video sweep. We were lucky to be able to combine a field test with this review, having taken a well used hire machine to eastern Europe for some visual reporting. Inspection showed this recorder to have had a good deal of use, probably some hundreds of hours. The performance was inferior to the review model but still within specification, with a limiting resolution of 300 lines and noise at −41 dB p-p/rms. The batteries showed the greatest sign of ageing and would only record for about 35 minutes continuously which, with time for setting up the shots, only allowed about 20 minutes actual recording. Carried on the shoulder, the recorder soon became uncomfortable on account of its rectangular shape and 8.5 kg weight. It was found that altering the straps of the carrying case to allow the recorder to be carried on the back like a rucksack enabled the system to be used for hours without trouble.

Having commented on the possible weakness of the chassis, we carried out an unplanned shock test on the system. This consisted of driving a new Triumph *Dolomite Sprint* into a Russian delivery van at about 30 km/h; both car and video camera were written off and the reviewer gained a few stitches and a slightly modified profile. Careful checks to the recorder after the event showed that the tape path and tracking had remained true.

Conclusion

Although future 12.5 mm machines from Sony's competitors may well have to be switchable between chrome and iron oxide tape in the same way as Philips audio cassettes, this series has the sharpest pictures of any 12.5 mm recorders currently available albeit at the cost of incomplete compatibility with other models. Where monochrome open reel recording is being done, and where no tape exchanges are planned, this does not matter. But if off-air or studio colour recording is needed, one will have to use vtrs from other manufacturers and in this case the Sony *AV-3420CE* had best be used as its own playback machine. Resolution and compatibility apart, the recorder is slightly heavier than its competitors but offers a better playback performance and so can be particularly recommended where it is to be used for playing back its own recordings into the tv system.

Gallium arsenide light-emitting diodes (leds) have already established themselves in the recording industry as, for example, alternatives to moving coil meter mechanisms in signal level indicators. But it is not widely realised that some leds can emit relatively high intensity light outside the visible spectrum. Suitably mounted and modulated, these can form the basis of a cableless optical communication link between a tv camera and a video recorder. Other possible applications include a multichannel cableless link between a concert hall multimicrophone terminal and a distant control room.

Designing an opto-electronic communication link

By JEAN-CLAUDE CHAIMOWICZ

Leevers-Rich Equipment Ltd.

THREE HUNDRED and thirty million Megahertz; a mere 700,000 times that of an uhf tv carrier! Such is the frequency of the electromagnetic radiation used as a vehicle in the 'short hop' optoelectronic transmission system described below.

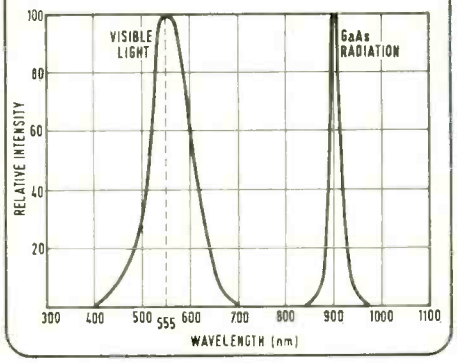
What is 'optoelectronics'? We shall define it as a technology based on the use of semiconductor produced, or laser produced, radiation, whether visible or not. In common with many other optoelectronic systems, the linkage described here uses an infra-red non-laser radiation of 900 nm wavelength (**fig. 1**). For simplicity's sake, this invisible, redder-than-red radiation will be called 'light'*. Clearly (though not visibly) we are here in a less familiar part of the spectrum. Far away from vhf, uhf and microwaves, no longer in the land of the metre or the province of the centimetre—yet not quite in the realm of the rainbow.

Many applications of optoelectronics have either penetrated the field of sound and vision already or have been discussed in journals. Philips Video Discs, numerical displays, panel indicators, red column ppms, contactless signal couplers, stop/start tape detectors; all these are being covered more and more frequently in the technical press. With the exception of holography, all these applications rely on the fact that a p-n junction of gallium arsenide compound, when suitably biased, produces an easily modulated infra-red or visible radiation (1).

Properly housed, the junctions are made into light emitting diodes (leds). Radiated power levels are low, usually in the sub-milliwatt range. This probably explains why I am so often asked how a system built around 'a little led' can transmit information over useful distances? Many of those who ask this question are unaware of the fact that leds producing invisible radiation convert electricity into light more efficiently, and handle higher power levels, than their younger and more conspicuous sisters, the red, green or orange visible leds.

Well before the inclusion of phosphorus made gallium arsenide diodes into red lamps and displays, these devices were producing a most useful, though totally invisible radiation at 900 to 950 nm. And they still do so, performing quietly, invisibly, reliably and lastingly in such fields as research, industry, security and data transmission. One of these emitters at each terminal is used in a telecommunication application. 'Choose the right led for the job' provides the first answer to our enquirers. The second answer is: 'Preserve and use wisely what little radiation you have'. In practice, this means careful design of both the transmitting and receiving optics, a thoughtful choice of optoreceiver and meticulous care in designing its coupling to the amplifier.

FIG.1 POSITION OF THE RIGHT HAND CURVE SHOWS THE EMITTING SPECTRUM OF THE GALLIUM ARSENIDE DIODE.



So much so for optoelectronics. And now what can the equipment based on it do, how does it work, and who on earth wants it?

The system described here provides means for relaying a complete television programme —both sound and vision—over distances of some 30 to 60m in a clear line of sight. It also provides means for two-way voice communication between the terminals. This speech link, a 'true' duplex using telephone handsets, is intended as a service channel for the operating crew.

How the optoelectronic television linkage (otvl) works will be explained in a few moments but who wants it can be detailed immediately: those users of video recorders, television cameras and video monitors who, in the course of their duties wish to interconnect their equipments across short distances that could not easily be spanned by wire. Waterways, railway tracks, sports tracks and public roads are obvious examples. Applications come under two main headings: Permanent (teaching establish-

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Television camera feeding optical transmission terminal.

* λ red = 700 nm. 1 nm. = 10^{-9}m.

ments, hospitals, etc) and temporary (outside broadcasts, civil engineering, etc.). Both will be discussed in the closing chapters, together with exploitation problems such as alignment, ambient light and the influence of the weather.

Anatomy and physiology of an otvl

Each terminal consists of three basic elements: An optohead, a kind of an optoelectronic transmit/receive 'antenna' (see **fig. 2**). A control unit with handset. A programme origination/presentation box, typically a video tape reproducer and monitor.

The terminals are interlinked by means of modulated light beams in the following order: Beam A for carrying the outgoing programme (vision and sound), as well as the outgoing service speech, and beam B for carrying the incoming service speech.

Shown in **fig. 2** are a vtr in the role of a programme origination box and a tv monitor as a programme presentation box. The vtr could be replaced by a television camera, the monitor by a vtr; off-air programmes could be relayed for remote recording. Many other permutations are conceivable, some of which will be discussed later.

The intelligence separation is in the frequency domain. The total 7.5M Hz bandwidth of the system is allocated like so: one broad and two narrow bands are used by beam A. The 330,000G Hz light carrier is intensity modulated by all three and care is taken to avoid intermodulation. The broad band accommodates the video signal, complete with line sync and image sync pulses, taking up 3.5M Hz. The narrow bands use what could be called double modulation: one optoelectronic (at the rf carrier frequency) and one electronic (at the intelligence frequency). For example, in the narrow band Three (**Table 1**) the light is intensity modulated by a 6.5M Hz rf carrier which in turn is amplitude modulated by the service speech. Beam B uses one narrow band centred on a 7M Hz rf carrier. Here, the amplitude modulation is produced by the 'answering' service speech, resulting in approximately 4k Hz sidebands. **Table 1** sums up the situation.

The Terminals

Optoheads One and Two are identical. Each contains a light sending gun, a light receiving gun, and a sighting telescope. The send gun is factory collimated so that no refocusing for varying distances is necessary in the field. The receive gun is equipped with an infra-red filter, cutting down the amount of incident visible light which otherwise impinge on the optoreceiver (2). Although pre-collimated for 'all distance' work, the receive gun, unlike the send, might in some cases produce marginally better results when re-focused in-situ. Facilities for achieving this are provided. Both guns use 63 mm objectives with f2.4 and f1.25 apertures respectively. Each can be individually azimuth and site pivoted within $\pm 8°$ by a mechanism permitting simultaneous aiming. Each optohead has a certain amount of electronics associated with its led or optoreceiver, respectively. Connections to control units are by coaxial cables.

The programme origination terminal (**fig. 4**) consists of a control unit and an optohead. The control unit takes in the programme, picture and sound, as well as the outgoing service speech. It processes them in the circuit boards shown so that they are readily acceptable by the signal frequency driver of the light send gun which in turn puts them out into the air. The receive gun simultaneously picks up the incoming service speech. After a preamplification, the service signal is digested by the separator, carrier amplifier, detector and audio amplifier boards prior to reaching the service handset. The ancillary signal source shown is used for optical alignment. The programme presentation terminal (**fig. 5**) is a logical mirror reflection of the origination terminal. The drawing and its caption will be found self-explanatory.

The structure of the control units is based on the modular principle. In the application described, both units use six-plug-in boards each but spare room is provided for additional or entirely new boards which might be required in different applications.

Applications

The application which triggered off the project was in a teaching establishment. The vtr had to remain centrally located in building A while the teaching programme had to be presented in a lecture theatre part of building B. Though only a few decametres apart, the two buildings were separated by a paved concrete and busy road, making buried cables too expensive and surface cables obstructive. When considering the price of burying cables, one must bear in mind problems such as cable quality, bandwidth, attenuation and longevity. Cable inlets and outlets, searches for electricity, gas, water, telephone and other underground installations, and finally cable protection all add to the cost of cable links. Legal problems may also arise in some cases. In the above applications, an optical link has the additional advantage of presenting a certain degree of mobility. The same remark applies to surveillance cctv applications, for example in large retail stores.

So, in the first group of applications we have university-school-hospital or office compounds in which inter-building cables would be obstructive, uneconomic, highly impractical to lay or outright illegal. While endowed with a certain degree of mobility, the installations in this group are basically fixed.

External mobile otvl applications form the second group. Outside broadcasting, civil engineering, and fire fighting are obvious examples and it is not difficult to imagine more exotic possibilities. Here the temporary nature of the operations completely rules out the buried cable, while its recurring character causes excessive wear of reeled surface cables. In civil engineering and fire fighting, cables impede movement and reduce safety.

TABLE 1

Subject	Light modulating frequency	
Programme video	0 to 3.5M Hz	Beam A
Programme audio	6M Hz plus sideband	Beam A
Service speech out	6.5M Hz plus sideband	Beam A
Service speech in	7M Hz plus sideband	Beam B

Intelligence separation in the signal frequency domain. Narrow channels use double modulation. For example, in the case of channel Three the 330,000G Hz light carrier (not shown) is intensity modulated by the 6.5M Hz rf carrier which in turn is amplitude modulated by the service speech.

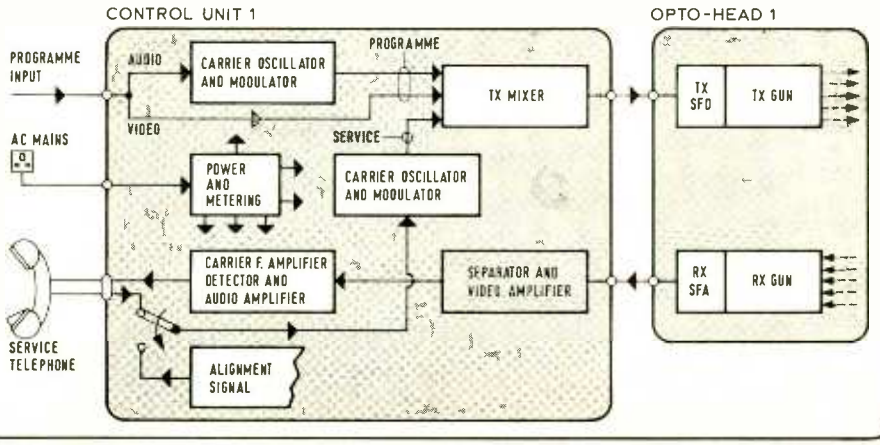
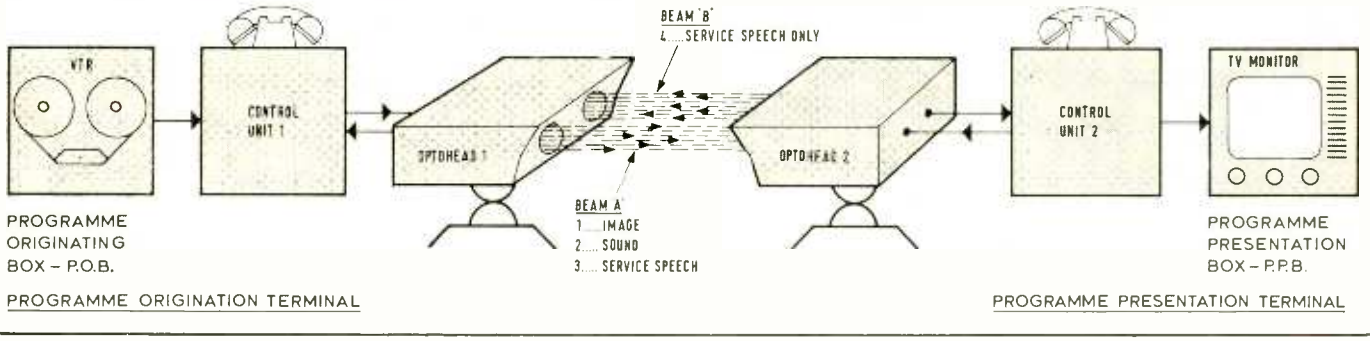


FIG. 3 PROGRAMME ORIGNATION TERMINAL. CONSISTS OF A CONTROL UNIT AND AN OPTOHEAD. THE C.U. TAKES IN THE TV PROGRAMME-PICTURE AND SOUND-AS WELL AS THE OUTGOING SERVICE SPEECH, PROCESSES ALL THREE AND FEEDS THE TX HALF OF THE "ANTENNA" (OPTOHEAD). IT ALSO PROCESSES THE INCOMING SERVICE SPEECH SIGNAL PICKED OFF BY THE RX HALF OF THE "ANTENNA" IN ORDER TO VOICE POWER THE SERVICE HANDSET. THE ALIGNMENT OSCILLATOR IS SHOWN BUT THE SIGHTING TELESCOPE IS NOT.

FIG. 2 EACH TERMINAL CONSISTS OF THREE BASIC ELEMENTS. THE TERMINALS ARE LINKED BY TWO BEAMS OF I-R MODULATED LIGHT: BEAM 'A' TRAVELLING FROM LEFT TO RIGHT AND BEAM 'B' TRAVELLING FROM RIGHT TO LEFT. FOUR CHANNELS OF INFORMATION ARE ACCOMMODATED. APPLICATION SHOWS VTR/TV LINKAGE.



Bearing in mind outdoor requirements, all OTVL circuits have been designed to work on 12V dc. Obviously, the vtr programme source depicted in **fig. 2** can be replaced by a tv camera and the presentation monitor can be replaced by a vtr or a microwave transmitter. Interesting variations on a theme are possible here, including remote recording off air, simultaneous translation of a commentary, and dubbing for re-editing.

The modular construction of the control units lends itself well to a wealth of novel frequency band allocations within the bandwidth available. The entire bandwidth can either be used for a totally different purpose or be split into a series of narrow channels. Thus, instead of video plus two audio channels, one can have several dozen purely audio channels, several hundred telemetry channels, or one or more computer data links (two way if desired).

The 40 second alignment

With a little practice, the alignment of optoheads can take less than 40 seconds. In fixed installations, each optohead is permanently secured and the initial aiming is by means of azimuth and site pivoting of the optoguns inside the optohead enclosure. In mobile installations, the pan-and-tilt of the supporting tripod can be used first, for a preliminary line up. In both cases sighting telescopes are used for coarse visual alignment, with fine alignment by electronic optimisation. One of the signal carriers is modulated by means of a built in audio oscillator and the intensity of the received signal is monitored both aurally and visually by the receiver speaker and ppm. Gun pivoting points are judiciously chosen so as to permit simultaneous adjustments of both terminals.

Although the programme presentation terminal has its own ancillary oscillator for channel four, an interesting provision has been made for 'boomeranging' the incoming alignment signal to the output terminal.

The second pair of guns presents hardly any problems once the first pair have been aligned, as considerable excess gain is available in what amounts to an essentially narrow bandwidth high gain linkage.

Range

The equipment has been designed for distances of up to 30m. A safety margin exists. By optimising all the controls, the range can be extended to 60m in clear weather. Variable distance work of mobiles or semimobiles is taken care of by an 'all-distance' precollimation of the guns in the factory, as already stated. In fringe range operation, however, a minor axial 'imaging' readjustment of the RX gun may help in squeezing out a few more precious nanowatts from the sending led.

When the system is to be used for telephony only, a 600m range can be achieved. For a further range extension at equal bandwidth, better optics, more elaborate modulation methods and individually selected extra-low noise input transistors would have to be used. The chief enemy of long distance optical links in free space is neither atmospheric scatter nor absorption but beam spread. Although experiments have proved it possible to transmit a tv picture over some 50 km (3), to achieve more than 3 km in free space commercially one would have to use a laser light source and pulse modulation techniques. By doing so, both power level and directionality are enhanced enormously. Guided propagation optoelectronic telecommunications have a still greater potential and, faced with today' 5 dB/km attenuation figures in some fibres (4, 5), I feel it safe to anticipate city-to-city fibre-repeater linkages with enormous information carrying capacity within a decade or two. This, however, is another story . . .

Weather

With an atmospheric attenuation of 25 dB/km, in the case of rain, there is little to worry about for equipment designed to work over 30m. Fog and snow would also be detrimental for distances some ten times greater. While it has been reported that rain drops of most sizes produce an audible shot in audio work, no evidence is available at the time of writing as to its effect on a tv picture. It should

66 ▶

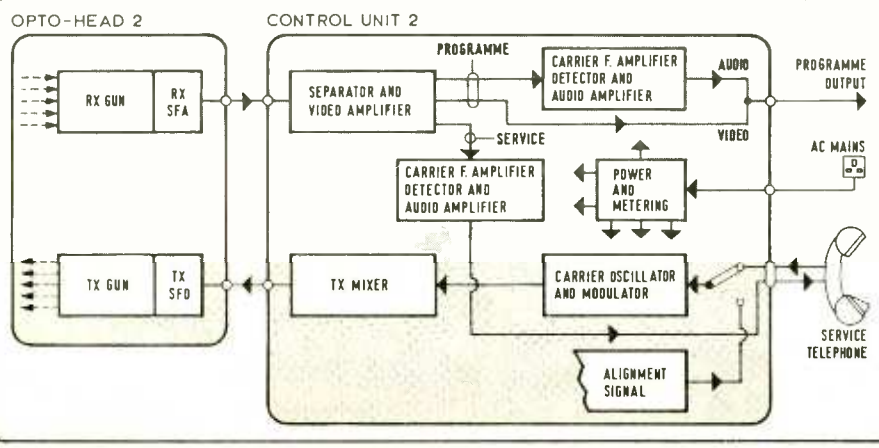


FIG. 4 PROGRAMME PRESENTATION TERMINAL. CONSISTS OF A CONTROL UNIT AND AN OPTOHEAD. THE CONTROL UNIT PUTS OUT THE TV PROGRAMME – PICTURE AND SOUND – AS WELL AS THE INCOMING SERVICE SPEECH, HAVING SEPARATED AND ADEQUATELY PROCESSED THE THREE SIGNALS PICKED OFF BY THE RX HALF OF THE "ANTENNA" (OPTOHEAD). IT ALSO IMPRINTS ONTO ITS RF CARRIER THE OUTGOING SERVICE SPEECH BEFORE IT IS TAKEN OUT AND BEAMED OUT BY THE TX HALF OF THE "ANTENNA". ALIGNMENT CAN ALSO BE BEAMED OUT AND DIVERTED ONTO THE PROGRAMME ORIGINATION TERMINAL. SIGHTING TELESCOPE NOT SHOWN.

Starting a Studio

BY IVAN BERG

IN APRIL 1973, after three months hard work, Ivan Berg Associates four track recording studio opened for business in Hampstead. Being basically a writer/producer, I must admit to having had at the outset a somewhat sketchy knowledge of electronics and recording. My previous experience of recording studios had been purely as a producer, a job where only rudimentary technical knowledge is required. However, with 60 educational programmes and several TV and radio programmes, plus a film or two behind me I felt a recording studio of my own would not only compliment my work, it would also be capable of providing other sources of income.

Before deciding to go ahead with the project, the viability of the studio had to be considered. A new recording studio operating on a hire only basis seemed risky; competition was keen, equipment and operational costs would be high and skilled engineers would have to be employed. A full scale studio was therefore discounted. The best areas of operation seemed to be:

1. Creation and production of stereo documentary, drama and children's audio programmes, for licensing deals.
2. A stereo programme production service.
3. A reel and cassette copying service.
4. Demonstration tapes for musicians and pop groups.

Having defined the areas of activity, and being reasonably confident of the business potential, the major problems of premises, building work, equipment and installation had to be dealt with. Two friends operating a contract cleaning company at mews premises in Hampstead became partners in the studio enterprise and provided 17 m^2 of ground floor accommodation and 8 m^2 of office space. The area was just large enough to provide a 3 x 2 m control room and a 4.2 x 3 m studio; not large but certainly adequate for the business envisaged.

Building work, soundproofing and internal acoustic treatment were carefully worked out. A cavity breeze block wall was built to separate the control room from the studio and a 1.2 x 0.75m double glazed counterweighted sliding window was made and fitted. From an operational viewpoint this was probably a luxury item and was incorporated mainly for ventilation. The soundproofing and acoustic treatment were combined: 50 mm battening was glued to the wall with rubber insulating blocks, and hardboard panels were faced with 36 mm layers of fibreglass on both sides, with the internal face covered with hessian and buttoned for a decorative and acoustic effect. The ceiling was lowered by 30 cm and treated in the same way. Three layers of fibreglass were laid in the ceiling void to dampen any floor-borne noise from the first floor of the building. The floor was triple felted and carpeted.

Electrical supply was straightforward. Fortunately the building had a three phase supply and only two were in use. A single ring was employed to supply all power requirements for the studio and control room, while the lighting and ventilation came from a phase used in other parts of the building. Two slow running fans, well baffled to reduce noise, were installed and these ventilate the area at a rate of ten air changes an hour. The two studio windows were triple glazed.

Acoustic tests showed the studio to be remarkably 'dead'. Low frequency structure borne noise 27 m away does penetrate from time to time, mainly below 40 Hz from traffic rumbling along Finchley Road, but is fairly easily filtered out.

None of the work was structural in nature; the area was already designated as 'light industrial' so there were no problems with planning permission. The work was carried out by the partners with the help of some direct labour, and completed in four weeks. Cost? Around £1,000.

With a limited budget, the equipping of the control room and the installation itself had to be well thought out. From the outset it had been decided that the studio should have a four track capability. This would be important for the demo work and would greatly speed the production of the stereo programmes. For an operation with little money, the Teac *A3340* four channel tape machine wins hands down over its competition, both on price and tape economy, using 6.25 mm tape instead of the conventional 12.5 mm. From a performance viewpoint the machine is excellent. Signal-to-noise ratio using high energy low noise tapes like 3M *206* and Zonal *Spectrum* is better than 60 dB at 38 cm/s. The Teac was ordered.

In view of the different operational requirements, the installation had to be very flexible. An example of this was the need for high quality real-time stereo cassette and open reel copying, both as a source of income and for the copying of masters and demonstration samples of the programmes.

The studio had to be capable of recording on two or four tracks, mixing at least eight original signals, reduction to stereo or mono, convenient editing, disc playing, foldback, studio talkback, reverberation and tape echo, and reliable monitoring.

The final list of equipment needed to provide all these functions was daunting. Selection involved shopping around and numerous telephone calls. There were problems of delivery on some of the items, so second choices had to be made. Delivery was eventually taken of:

One Teac *A3340* tape machine.

Two Revox *A77* tape machines (38 and 19 cm/s) and (19 and 9.5 cm/s).

Seven Sony *TC122* cassette recorders

Two Garrard *AP76* record decks with *G800E* cartridges.

One JVC *4VN880U* four channel integrated 110W amplifier.

Two Allen & Heath *Mini* mixers and power supply.

One JVC stereo spring reverberation amplifier.

One Eagle 10W stereo amplifier (for talk-back and foldback).

One Lasky Dolby *B* processor.

Six AKG *D190* microphones.

One AKG *D202* microphone.

Two Shure *Unisphere* microphones.

Eight microphone stands.

Eight *AR7* loudspeakers (four in control room, four in studio).

One *DJ101* Six-channel mono mixer for foldback mixing and preamplification.

One Wal bulk tape eraser.

Eagle tape head degausser.

300m single core coaxial microphone cable.

100 jack plugs and sockets.

100 phono plugs.

From the operational standpoint, the decision to take *all* inputs and outputs to a patchboard proved to be vital. It involved quite a bit of plumbing but has made the studio more than usually flexible. Signals can be routed in a virtually infinite number of ways. The only 'wired in' items are the two record decks but even the signals from these can be routed from the amplifier tape outputs into practically every other piece of equipment. Matching was much less of a problem than envisaged and no attenuation other than that provided with the equipment proved to be necessary. The installation is neat and well designed for ease of operation. The original Allen & Heath *Mini* mixers were changed after two months for the 8/4 Allen & Heath *Quasi* mixer ; mainly for reasons of flexibility and greater front end headroom.

Despite the use of single core coaxial cabling, the system is remarkably free from hum and rf interference.

With a four-channel Teac, mixer, amp and four-channel monitoring the studio was already set up for Quad record and playback. All that was required to complete this facility was the addition of a quadraphonic panpot.

The completed studio is capable of carrying out efficiently all the functions for which it was planned. The simplest services offered are real-time tape and cassette copying, and original music and speech recording for demo and master tapes.

Copying can be from cassette to cassette, reel to cassette, cassette to reel, and disc to reel or cassette. Cassettes and tapes can be Dolby *B* processed. Up to seven cassettes and two reels can be copied at the same time. Original recorded material can be equalised and the cassette decks receive a mid-range and hf boost through the Allen & Heath mixer. The *TC122* Sonys employed have automatic gain controls and limiters and are therefore ideal for copying.

For original recording in the studio, eight inputs feed the mixer via the patch board. There are four direct mic inputs to the Teac and two to one of the Revox machines. In theory 14 inputs are available but the usual requirement for demo work is between six and eight. Most electric instruments can be fed into the mixer's line inputs. Incoming signals can be routed to any of four outputs and the mixer has three band equalisation, foldback and echo send/return (with two band eq). The four outputs are fed to the Teac and then routed via Teac outputs to one of the four channel amplifier inputs.

For reduction, the Teac outputs are routed to the mixer and outputs One and Two feed the high speed Revox. This signal can then be routed to the amplifier for monitoring and the amplifier's two channel tape output can feed the second Revox. The output of this machine can then be routed back to the mixer for the signal to be equalised for cassette, thence from mixer outputs Three and Four to the Dolby *B* processor and on to the seven cassette decks. By taking a feed from the output of one of the cassette decks to the four channel tape input on the amplifier, it is possible to monitor the cassette input too.

From this it can be seen that, while reduction from a four-track master is underway, an extra first generation tape copy and seven first generation cassettes can be made. Quite an unusual facility.

Since the beginning of April, a 25 mm single column advertisement in *Melody Maker* has produced a reasonable volume of demo business. However, this twilight area of the recording business is remarkably competitive. No less than 14 demo studios advertise regularly in that publication. The hourly rates are low, many studios probably operating on a bread-line basis and having constantly to offer more for less. Some studios offer a four track rate of around £4 an hour which includes a wide range of musical instruments. I have installed a Bechstein upright piano and offer a four-hour demo session at £16. There certainly doesn't seem to be a fortune to be made here. The demo sessions (which take place mainly during the evenings and at weekends) subside the overheads but it would seem unwise for anyone to consider that scene as a sole source of income.

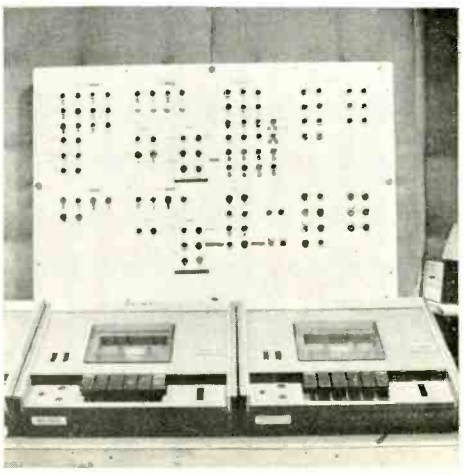
I am convinced that the growth of this business lies in the area of high quality stereo programme production. In May the Associates began to form. Using friends and contacts, I eventually gathered a group of six actors, writers and directors, as the nucleus of a production unit. They all work on a free-lance basis.

The system works well. In June, a 40 minute children's tape of Hans Andersen stories for release on cassette and eight track cartridge was produced for International Artists. This was followed by a 50 minute stereo documentary on the life and work of Albert Einstein, produced as a pilot for an ambitious series of programmes called *The History Makers* intended for a licensing on cassette and cartridge. The possibility of selling the series for radio as well was considered.

In July and August, an 80 minute dramatised stereo version of *The Perfumed Garden* was produced for International Artists' new label Stream Records. This was a complex 'cast-of-thousands' production with an original music score; quite beyond the facilities of our four track set up. The production was made at the new 16 track Weir Sound Studio, also in Hampstead. All 16 tracks were used and the reduction had to be as tightly cued as a live performance.

At the time of writing, we are engaged in a double album dramatisation of *Fanny Hill* and the production of the *Commando Keep Fit Course* in collaboration with *Sunday Times*. This is due for release in November. In North America the growth of this market has been phenomenal. 16,000,000 spoken word tapes will be sold during 1973. This figure compares with 26,000,000 music tapes during the same period.

What are the lessons to be drawn from the story of this new enterprise? It certainly seems that, considered on its own, the building and operation of a small four track recording studio is not a viable commercial proposition. The eight and 16 track studios have virtually secured the commercial music recording market. The small four track outfit could in theory provide an inexpensive service for the production of master tapes by solo artists and folk groups, whose music does not require the sophisticated treatment available in the bigger studios. And, with the aid of low noise tape and machines like the Teac and Revox, recording quality can be of a very high order indeed. From a practical standpoint, the installation has been virtually trouble free. The only faults to develop so far have been on a tweeter on one of the Acoustic Research 7 loudspeakers and two dry joints in the patch board; all three easily discovered and rectified. More than 1,000 cassettes have passed through the Sonys without trouble, and the total running time of the system has now passed 1,000 hours.



WHAT'S HAPPENING AT CAPITAL?

By Adrian Hope

IF YOU WERE hoping that this would be a guided tour of Capital Radio's Euston Tower studios complete with technical details of all the equipment there, now is the time to stop reading.

But if you are interested in the future of commercial radio in this country, then what came out of my abortive attempt at doing a feature on Capital Radio may provide some food for thought. For if first impressions of what the future will bring are correct, commercial local radio on fm (especially in stereo) looks like being very local indeed.

Capital started 'Calling You' at 05.00 on Tuesday October 16. For weeks before that, rumours had been filtering out of the Euston Tower area to the effect that if Capital got on the air on time it would be a miracle. It seemed that important equipment was not being delivered, building was behind schedule, and the station premises were as about as ready for the Audio Fair was on Trade Day this year. And you can't get much less ready than that.

But the miracle happened and Capital did get on the air on time. And they did start putting out some lively programmes. Even so, the general impression of anyone listening was the whole thing was held together by pieces of frayed string that kept breaking. The staff seem willing privately to admit just that. Even the disc jockeys admit over the air that they are working in unfinished studios and it seems that at least one studio is acoustically unsatisfactory and will have to be rebuilt. Also, anyone listening to the station must have heard the phone call-ins fall apart at the seams and records played in the oddest of fashions. But all this should not matter. The British as a nation are always willing to rally around anyone struggling against adversity and we adore the happy amateur having a go. It's probably all something to do with the Blitz spirit and no one gets more sympathy than a performer who is out front being roasted by technical hitches. By this token there was only one thing about Capital's opening month that really bothered me—that was the atrocious stereo signal I was receiving. Despite the fact that my recently checked roof aerial system (fairly high on the hill near Hampstead Heath) could receive all BBC national programmes beautifully in stereo and several BBC local stations in mono, all I can get from Capital is a sea of hiss in which their programmes flounder miserably. A colleague down the road with a very sensitive tuner soon found he needed a far better aerial system to receive Capital than any other station, foreign stations in stereo coming through louder and clearer than the 'round the clock radio station in tune with London'.

To be honest, I had not realised until the station first came on the air that it would be transmitting in stereo. The advance publicity all talked of 539m on the medium wave and 95.8M Hz on vhf, with no mention of stereo. So when on that first day my stereo beacon lit up on 95.8, and I heard for the first time British commercial radio in stereo, I assumed that what I was receiving was a test transmission. I phoned the engineers and they seemed surprised that I had not realised that Capital was to be a virtually all stereo station. I asked about the hiss and was told that there were technical problems which would soon be sorted out between Capital and the IBA. So I wished them good luck with the station (which I welcome as a rival for the BBC on the assumption that competition makes for improvement) and went back to listening. Several weeks later, with the Capital disc jockeys more and more frequently encouraging their audience to listen in stereo, I asked the Capital Press Officer if I could come down to Euston and look, talk and listen. It was made clear to me right from the start that there would be no chance of my getting into any studio, sitting in the control box of any programmes, or seeing much of the equipment, because the building was still going up around the staff and gear. But I was promised an interview with Gerry O'Reilly, Capital Radio's chief engineer.

On the appointed day I trotted off down to Euston with my list of burning questions, mostly designed to publicise Capital's side of the problems they were obviously having. But first impressions proved to be pretty well indicative of everything that followed. Visitors at the impressive front door in Euston Road were still being directed round the corner to the fire exit up which they climbed to the first floor studios. (In all fairness, though, the Capital fire exit is more impressive as a staircase than the front entrance to many other radio stations.) The security guard checked out who I was and phoned through to O'Reilly's office. It soon emerged that I was not expected, and his diary was empty for the morning. The Press Officer had efficiently fixed me an interview but rather less efficiently failed to fix it with the man in question. And I was told the man in question had answered the call of managing director John Whitney. So, I waited for an hour and a half while Messrs Whitney and O'Reilly said what they had to say to each other and then gave up, leaving my telephone number. 24 hours later I had still not heard again from anyone at Capital. Well, that's one way to run a business.

But what I saw and heard while I was there gave me an idea of the teething problems that the station is suffering. The building is designed as a central rectangle of studios with rectangular corridor running round them and another rectangle of offices outside that. The general appearance is plush but still very unfinished. Paint pots and ladders abound. The rooms are all unlabelled and only a makeshift red light prevented anyone from stumbling into an on-air studio while searching for the gent's loo.

While I sat out my 90 minute wait there

Gerry O'Reilly

was a continual stream of worried people passing through the office. Suited men talked money and engineers in jeans dictated memos like 'Engineers must watch the dj at all times. The only way to achieve a tight programme is to have total audio-visual contact at all times'. Apparently a few djs had been giving finger cues for commercials to engineers who had been looking over their shoulders at the time. Someone popped in looking desperately for long playing broadcast cartridges because his supply had been used up by someone putting records on them. Someone else worried about where the 'telephone apology' cartridges kept disappearing to. In between, I learnt by heart the folder of official Capital press releases and am now an expert on where Sean Kelly was born, what Peggy Mount did in repertory, and where Dirk Bogarde keeps his own personal record library. (You can relax, I won't bore you with all that.)

Before leaving, I explained to an assembled few that the pressing purpose of my visit had been to sort out why stereo reception was so poor. The general concensus of unofficial opinion seemed to be that Capital were well aware that stereo reception was poor and that it was all the IBA's fault. An accountant argued that it was therefore not Capital's problem. Incidentally, one ad agency at least is already wondering why it can't listen to its own commercials in stereo.

In an effort to find out what kind of equipment was being used at Capital behind those closed doors, and just whether and how the IBA were to blame for the transmission problems, I contacted Neve (who were responsible for supplying the station consoles) and the IBA themselves. Neve supplied five desks to Capital, the biggest being a 16/4 console for the music recording studio, with an eight track monitor system so that it can be used with an eight track recorder. Also supplied was a 10/2 *BCM10* and a 12/2 portable sound mixer. This latter has a power supply with two monitor amps. Also supplied by Neve were two stereo radio consoles made by Neve to the design of consultant David Whittle. Neve confirm that all their equipment was supplied by, or before, the agreed delivery dates so it looks as if the problems at Capital have been due to other late orders, late deliveries, or building problems. One shudders to think what equipment like those Neve desks must have suffered if they were delivered to a building with sand and cement dust still in the air.

The IBA's immediate reaction to my suggestion that stereo reception of Capital in London was tricky was that it was 'the first we have heard of it'. Subsequently, however, the IBA did agree that they had received some complaints although these had all turned out to have been from listeners outside the intended service area of the transmitter.

The Capital transmitter is not only sited at a different location from the BBC transmitters (on which many roof top aerials are beamed) but is putting out the remarkably low transmission power of only 2 kW. This is a particularly sobering figure when you remember that BBC Radio London is put out at 16.5 kW. The intended range of Capital is 16 km from the Croydon transmitter (the same mast as the ITV transmitter) and, of course, by transmitting from Croydon less power is needed to cover London than is needed from Wrotham. Simple fm radio aerials have a fairly wide beam width (40° to 60°) so, for some people, the angular difference between Wrotham and Croydon is not crucial. So, although Capital stereo in central London can be good, once one moves out towards the edge of the 16 km limit the low Croydon signal strength and the angular difference between Wrotham and Croydon can easily combine to undermine decent stereo reception.

I put the obvious question to the IBA—Why not site the IBA transmitters at Wrotham and use more power? The official answer is that it would all cost more in terms of transmission power, the probable need to erect new masts and the need to hire more Post Office land lines. As a result, they have blessed the likes of me with the need to pay an aerial fitter to re-site my aerial to a compromise line of sight half way between Wrotham and Croydon. In fact I shall do no such thing. I just shan't listen to Capital.

If this pattern repeats itself all over the country, commercial radio will have problems. The IBA confirm that commercial radio was originally intended to be more local than BBC radio. Fair enough. But how local is local and what kind of powers are to be involved? The basic guiding principle is that the limit of field strength is to be 1 mV per metre at the edge of the intended reception area.

That is not quite the end of the story. There is one other interesting side issue. In the USA several local fm stations are already using Dolby *B* compression during transmission. The point of this is not only to provide improved signal-to-noise ratio but also to allow a reduction of the pre-emphasis time constant to 25 μs, which in consequence allows an increased mid band modulation level. The signals received can either be Dolby *B* de-coded (to give a total signal-to-noise ratio improvement of 12 or 13 dB) or listened to still coded. It seems that, with transmissions having B compression and a 25 μs time constant, an ordinary fm receiver (without Dolby *B*) still receives a compatible signal with the benefit of the increased modulation level which can be used on transmission. I checked with Dolby as to whether or not there was any likelihood of our seeing this used in Britain. They confirm that they have never made approaches to any broadcaster with the object of actually selling the use of Dolby *B* on transmission. What they have done, however, is to make equipment available for experimental purposes, especially in the USA, where as a result it is now being used by some stations on a full time basis. This is because the American FCC allows the use of compression in the fm bands. Dolby have now withdrawn from sale their standard *B* type encoders and are replacing them with units combining pre-emphasis and encoding. Dolby believe that reception and transmission of *B* type 25 μs signals can give substantial improvements, especially on stereo transmissions. Perhaps Dolby encoded broadcasting could be the saving grace of Britain's commercial radio stations. That was of course one of the questions I had intended to ask Gerry O'Reilly when I didn't see him.

Survey: Power amplifiers

ACOUSTICAL
Acoustical Manufacturing Co Ltd, Huntingdon.
Phone: 0480 2561/2.

Quad 50E

See page 56.

Quad 303

Frequency response: 30 to 35k Hz −1 dB into 8Ω.
Output power: 2 x 45W.
Output impedance: 0·3Ω in series with 2,000 μF and 6 μH.
Input level: 500 mV rms for 30W into 16Ω.
Input impedance: 22 kΩ in parallel with 60 pF.
Crosstalk: 60 dB (30 to 10k Hz, 1 kΩ input load).
Stability: Unconditionally stable.
Power input: 100 to 125 or 200 to 250 V, 50 or 60 Hz, 40 to 200W depending on signal level.
Hwd dimensions: 159 x 120 x 324 mm plus connectors.
Weight: 8·2 kg.

AMCRON (USA)
Agents: Macinnes Laboratories Ltd, Carlton Park Industrial Estate, Saxmundham, Suffolk IP17 2NL.
Phone: Saxmundham 2262, 2615.

DC300A

See page 60.

D-150

Power output: 2 x 75W into 8Ω.
Power bandwidth: ±1 dB, 5 to 20kHz at 75W rms per channel into 8Ω.
Frequency response: ±1 dB 20 to 20kHz at 1W into 8Ω.
Hum and noise: 110 dB below 75W rms output.
Damping factor: Greater than 200 from zero to 1kHz into 8Ω.

Load impedance: 4 to 16Ω (complete stability with any load).
Input: nominal 25 kΩ, screwdriver adjust on rear; input sensitivity 1·2V for full output.
Price: £216.

D-60

Frequency response: ±0.1 dB, 20 to 20kHz at 1W nto 8Ω, ±1.2 dB.
Power response: ±1 dB, 5 to 30 kHz at 30W both channels (rms into 8Ω).
Power at clip point: Typically 41W rms into 8Ω, 64W rms into 4Ω.
Total harmonic distortion: Below .05% at 30W into 8Ω.
Slewing rate: 6V per μs.
Load impedance: 4Ω or greater. Stable with all speaker loads.
Input sensitivity: .775V ±2% for 30W into 8Ω.
Input impedance: 25 kΩ.
Dc output offset: 10 mV or less.
Load protection: Short, mismatch and open-circuit proof.
Power requirements: 50 to 400 Hz ac on 120V or 240V ±10%. Draws 15W or less on idle, 120W at 60W output into 8Ω.
Heat sinking: The entire amplifier is used as a heat sink. Front panel extrusion acts as a heat sink along with the chassis covers.
Controls: Two input level controls on front panel with power switch and pilot light.
Price: £112.

APOLLO
Apollo Electronics, 96 Mill Lane, West Hampstead, London NW6.
Phone: 01-794 8326.

PA.10 Plug-in monitor module.

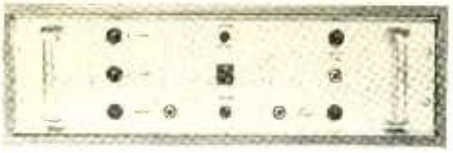
Frequency response: 20 to 20k Hz (+0.5 dB).
Input impedance: 27 kΩ unbalanced.
Input sensitivity: 0dB (770 mV rms).
Maximum input level: +19 dBm (7V rms).
Output source impedance: 0.2 Ω unbalanced.
Terminating impedance: 8Ω.
Maximum power output: 12W (8Ω load).
Total harmonic distortion: 85 dB (10W into 8Ω load).
Operating voltage: 32V ac.
Current consumption: 600 mA approx.
Dimensions of front panel: 190 x 45 mm.
Depth (including mating connector): 142 mm.
Weight: 630 gm.
Connector: 16 way DIL plug with gold-plated contacts.

AREAC
Areac Ltd, Summit Gardens, Halesowen, Worcs.
Phone: 021-550 2868.

Model 100

80W rms stereo amplifier with master gain on each channel. Input equaliser modules available.

Above: Quad *303*
Left: Amcron *D-60*



Left : Audix *Studio* and *PA*.

AUDIX
Audix BB, Stansted, Essex.
Phone: 027971 3132/3437.

Studio series

Seven amplifiers comprising *1X15*, *1X30*, *1X80*, *2X15*, *2X30* and two versions of the *2X80*, one with crossover at input. These are 15, 30 and 80W amplifiers suitable for rack mounting or free standing.
Sensitivity: 200 mV for maximum output.
Noise: 95 dB below maximum output.
Power bandwidth: 5 to 35 k Hz at rated output into 8Ω.
Frequency response: 20 to 20k Hz −0.5 dB at full power.
Distortion: 0.05% at 1k Hz, 0.2% at 10k Hz from 200 mW to maximum power.
Power input: 110 to 120 V or 210 to 250V ac, 50 or 60 Hz.

PA series

Range of five power amplifiers; the *PA18*, *PA25*, *PA80*, *PA120* and *PA200*. Output wattage designated by model number. Specification relates to *PA200*.
Output impedance: 100V line.
Distortion: 0.4%, 1k Hz at rated output.
Frequency response: 30 to 16k Hz, 3 dB below rated output to 100V line.
Sensitivity: 200 mV for rated output.
Input impedance: 5 kΩ.
Signal-to-noise ratio at rated output: 90 dB.
Height: 133 mm.
Weight: 14 kg.

C.B. ELECTRONICS
C.B. Electronics Ltd, 23 Halford Road, London SW6.
Phone: 385 4774.

CB200

1 x 200W into 8Ω or 2 x 100W into 4Ω.

CB400

4 x 100W into 4Ω.
2 x 200W into 8Ω.
Power bandwidth: 20 to 60k Hz.
Input sensitivity: −10 dBm.
Hum and noise: Better than 90 dBm below maximum output power.
Distortion: less than 0.1% at all levels.
Dimensions: *CB200*: 88 x 430 x 347 mm; *CB400*: 132 x 430 x 347 mm.
All inputs and outputs are via Cannon connectors.
Price: *CB200*: £160. *CB400*: £220.

CHYMES
Chymes Audio Electronics, 320 Barkham Road, Wokingham, Berks.
Phone: Wokingham 1970.

Stereo units with power ratings of 200 and 400W rms in the two basic versions available. Multiples of these may be assembled into rack/cabinet mounts to special order. The power bandwidth extends to more than 25k Hz at maximum output. Built-in load line limiting included together with open circuit protection. High stability with resistive or reactive loads together with reactive load fault protection. Input impedance is 18 kΩ and full load is developed into 4Ω. Total harmonic distortion is typically 0.4%. Total harmonic distortion is typically 0.4% at maximum output and signal-to-noise ratio is typically +78 dB. Metal cabinets are available together with a variety of input modules including a comprehensive discotheque mixer at additional cost. The chassis versions of these units cost £79 for the 200W and £147 for the 400W.

ELECTROSONIC
Electrosonic Ltd, 815 Woolwich Road, London SE7 8LT.
Phone: 855 1101.

ES1253: Stereo 30 + 30W rms into 8Ω. 0 dBm balanced input.

ES1254: Quadraphonic 4 x 30W into 8Ω. 0 dBm balanced input.

Power response: 40 to 40k Hz ±0.5 dB.
Input impedance: 2 kΩ balanced.
Hum and noise: 88.5 dB below rated output into 8Ω.
Distortion: 0.1 Ω at any frequency for powers below 25 W into 8Ω.
Stability: Unconditionally stable.
Basic price: £66 (*ES1253*).

GRAMPIAN
Grampian Reproducers Ltd, The Hanworth Trading Estate, Feltham, Middlesex TW13 6EJ.
Phone: 894 9141.

Series 7

Power unit: Double wound mains transformer with electrostatic screen. Silicon bridge rectifier giving positive and negative supplies with smoothing by long life electrolytic capacitors.
Rated source impedance: 600Ω.
Input impedance: 10 kΩ (for bridging 600Ω line).
Rated source emf: 1V rms
Minimum source emf for rated output: 0.8V rms with output control at maximum.
Rated output voltage: 100V rms.
Rated output power: 100W (50W version available).
Stability: unconditionally stable with open circuit or any passive load. (BS 3860: 1965).
Effective frequency range: 100 to 10k Hz −1 dB; 50 to 15k Hz −3 dB, with rated input signal.
Total harmonic distortion: 0.5 Ω at rated output at 1k Hz.
Signal-to-noise ratio: 70 dB including hum.
Operating temperature range: 0 to 50 C.
Dimensions: 483 x 133.3 x 320 mm.
Weight: 18 kg.
Price: £128 basic.

H H ELECTRONIC
H H Electronic, Industrial Site, Cambridge Road, Milton, Cambridge CB4 4AZ.

TPA 25D & TPA 25D-M

Maximum power output: 30W rms into 15Ω; 45W rms into 7.5Ω; 75W ms into 4Ω.
Power frequency response: ±0.2 dB 20 to 20k Hz into 15Ω (full output).
Total harmonic distortion: Less than 0.1%, 20 to 20k Hz at 25W into 7.5 or 15Ω loads.
Input sensitivity: 500 mV for full output down to 100 mV for full output (to customer requirement).
Input impedance: 15 kΩ, gain control maximum.
Signal-to-noise ratio: 100 dB ref full output into 15Ω (20 to 20k Hz)—rack mounting version.
Bench standing version and plug-in module: 80 dB ref as above.
Damping factor: 200 with 15Ω load; 100 with 7.5Ω load.
Slewing-rate: Not less than 10V per µs.
Operating temperature: +50 C without forced ventilation.
Price: £34 basic (*25D-M* £38).

TPA 50D

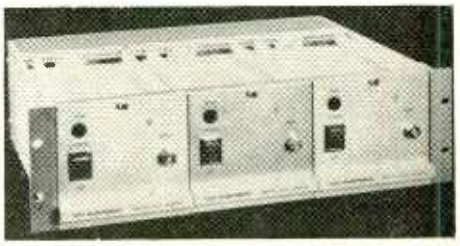
Maximum power output: 60W rms into 15Ω; 80W rms into 7.5Ω; 100W rms into 4Ω.
Power frequency response: ±dB 20 Hz to 20k Hz into 15Ω at full output.
Total harmonic distortion: Less than 0.1%. 20 Hz to 20k Hz at 50W into 7.5 or 15Ω load.
Input sensitivity: 600 mV for full output down to 100mV for full output to customer requirement.
Input impedance: 15 kΩ gain control maximum.
Signal-to-noise ratio: 100 dB ref full output into 15Ω (20 Hz to 20 k Hz).
Damping factor: 200 with 15Ω load: 100 with 7.5Ω load.
Slewing-rate: Not less than 10V per µs.
Operating temperature: +50°C without forced ventilation.
Dimensions: 483 x 89 x 305 mm (rack); 439 x 89 x 305 mm (bench).
Weight: 9 kg approximately.
Price: £53.

TPA 100D

Maximum power output: 200W rms into 4Ω; 120W rms into 7.5Ω; 100W rms into 15Ω.
Frequency response: Reference 1W output at 1k Hz, 8 or 15Ω load. −0.5 dB at 5 Hz, −0.5 dB at 20k Hz.
Total harmonic distortion: Less than 0.2% at any level up to 100W into 7.5 to 15Ω, 20 to 20k Hz. Typically 0.05% and 1 k Hz.
Input sensitivity: 0.775V or 0.250V for 100W into 15Ω at full gain, 600Ω load; 100 with 7.5Ω load.
Operating temperature range: −25 to 50° C.
Dimensions: 483 x 89 x 305 mm (rack). 439 x 89 x 305 mm (bench).
Price: £79.

48 ▶

HH *TPA 25 D-M*



SURVEY: POWER AMPLIFIERS

MARANTZ
Agents: Pyser-Britex (Swift) Ltd, Fircroft Way, Edenbridge, Kent.
Phone: 0732-71 2434.

250

Total rms continuous power (both channels *driven*, at rated distortion, 20 to 20k Hz): 250W into 8Ω (125W per channel).
Total harmonic distortion: At or below rated power, 20 Hz to 20k Hz, less than 0.1%.
Intermodulation distortion: At or below rated power for any combination of two frequencies, 20 to 20k Hz, less than 0.1%.
Frequency response: 1W: ±5 dB 2 to 100k Hz; ±0.1 dB 20 to 20k Hz.
Total noise: Better than 106 dB below rated power into 8Ω.
Input sensitivity: 1.35V for rated power.
Input impedance: 100 kΩ.
Damping factor: Greater than 100 at 8Ω.
Semiconductor complement: 11 transistors; 18 diodes.
Price: £329.

500

Power output (total rms continuous power, both channels driven at or below rated distort 20 to 20k Hz: 1 kW into 4Ω (500W/channel).
Total harmonic distortion (at or below rated output 20 Hz to 20k Hz): less than 0.1%.
Input sensitivity: 1.75V for rated power.
Input impedance: 100 kΩ.
Number of semiconductors: 54 transistors, 11 diodes.
Price: £775.

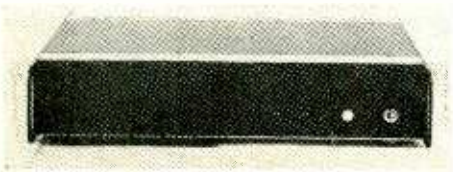
NAIM AUDIO
Naim Audio, 15 Churchfields Road, Salisbury, Wiltshire.
Phone: Salisbury 3746.

NAP 200

Power output (continuous): 2 x 100W.
Transient: Power handling in excess of 250W per channel.
Frequency response: 10 to 20k Hz within 1 dB.
Rise time: 5 µs.
Harmonic distortion at 10W: All frequencies typically 0.002%. At 50W all frequencies less than 0.02%.
Sensitivity: 1.6V.
Input impedance: 22Ω.
Signal-to-noise ratio: 100 dB.
Operating temperature: 0 to 50°C.
Mains supply: 120V or 240W nominal.
Hwd dimensions: 75 x 430 x 300 mm.
Price: £140.

NAP 160

Similar to the NAP 200 but does not have a fully regulated power supply, hence continuous power 80W per channel.
Signal-to-noise: 85 dB.
Signal input: locking DIN.
Price: £95.



OEM 80

Single channel version of *NAP 60* in chassis form as fitted to the *NAM 802* speaker.
Price: £60.

NEVE
Rupert Neve and Company, Cambridge House, Melbourn, Royston, Herts.
Phone: 0763 60776.

15W 2P

Comprises two 15W power amplifiers and a separate 24V power supply mounted in an 88 mm high frame suitable for a 483 mm rack or as a free standing unit. Construction is modular to allow individual units to be removed from the front of the rack. The power supply has enough output to operate the Neve *PSM* range of portable mixing consoles or the *BCM10/2*.
Input: 10 kΩ bridging, balanced, floating.
Sensitivity : variable with preset from −8 to −6 dBm at 10W into 8Ω.
Frequency response: 20 Hz to 20k Hz ±0.5 dB to 15W.
Distortion: 0.1% max over 20 to 20k Hz at 5W output into 8Ω.
Noise : less than −90 dB referred to maximum output.
Crosstalk: 70 dB between amps.
Power supply : 24V at 3A, short circuit and overload protected.
Power supply noise : −75 dBm a 1.5A and −65 dBm at 3A.
Mains input: 110 to 240V at 50/60 Hz.

RADFORD
Radford Electronics Ltd, Bristol BS3 2HZ.
Phone: 0272 662301.

60W

Output power: 60W into 4 to 8Ω.
Distortion : 0.05% at 1k Hz, 60W into 8Ω. Typically 0.01%.
Amplifier output source impedance: 0.25Ω in series with 2,200 µF and 2 µH.
Power bandwidth : 25 to 50k Hz −1 dB.
Hum and noise: 100 dB below 60W.
Crosstalk: −60 dB, 30 to 20k Hz.
Sensitivity: 1V rms for 60W output into 8Ω.
Hwd dimensions: 120 x 420 x 240 mm.
Weight: 8.2 kg.

RODEC
Manufacturers: S. A. Beglec N.V, Houba De Strooperlaan 718, 1020 Brussels, Belgium.
Phone: 02 795448.
Agents: Keith Monks Audio Ltd, 26-30 Reading Road South, Fleet, Nr Aldershot, Hampshire, England.

Left : Neve 15W2P

1572

Rms power output (both channels at 4Ω): 2 x 60W; both channels at 8Ω = 2 x 20W; both channels at 16Ω = 2 x 30W.
Harmonic distortion: 40 to 12.5k Hz = less than 1% at rated output. Intermodulation = less than 0.5% at rated output −3 dB.
Power bandwidth: 32 to 32.5k Hz, −0.5 dB.
Input: 0.77V/27k Ω asymm.
Channel separation: 66 dB.
Signal to noise ratio: 90 dB.
Weight: 8.7 kg.

SPENDOR
Spendor Audio Systems Ltd, Kings Mill, Kings Mill Lane, South Nutfield, Redhill, Surrey RH1 5NF.
Phone: Nutfield Ridge 2554.

M208

Power output: 20W at 0.25Ω in series with 1,600 µF.
Load resistance: 8Ω nominal.
Input level for maximum output: 500 mV into 16 kΩ in parallel with 10 pF.
Voltage gain: 29 dB.
Distortion: Typically 0.1% to within 1 dB of full power (60 to 10 k Hz).
Hum and noise: —90 dB ref full power output volts.
Frequency response: 22 to 30 kHz —1 dB.
Power response: 24 to 20k Hz —1 dB.

M508

Specification as for *M208* except:
Power output: 50W at 0.1Ω in series with 2,500 µF.
Voltage gain: 32 dB.
Frequency response: 18 to 30k Hz −1 dB.
Power response: 20 to 20k Hz −1 dB.

SUGDEN
J. E. Sugden & Co, Carr Street, Cleckheaton, Yorkshire BD19 5LA.
Phone: 09762 2501.

P51

Input: 500 mV into 300 kΩ.
Frequency response: 30 to 20 k Hz ±0.75 dB.
Distortion: 0.05% into 8 or 16Ω just prior to clipping.
Signal-to-noise ratio: 90 dB with 4.7 kΩ input load.
Output: 2 x 45W rms into 8Ω.

STUDER (Switzerland)
Agents: F. W. O. Bauch, 49 Theobald Street, Boreham Wood, Hertfordshire.
Phone: 01-953 0091.

40W

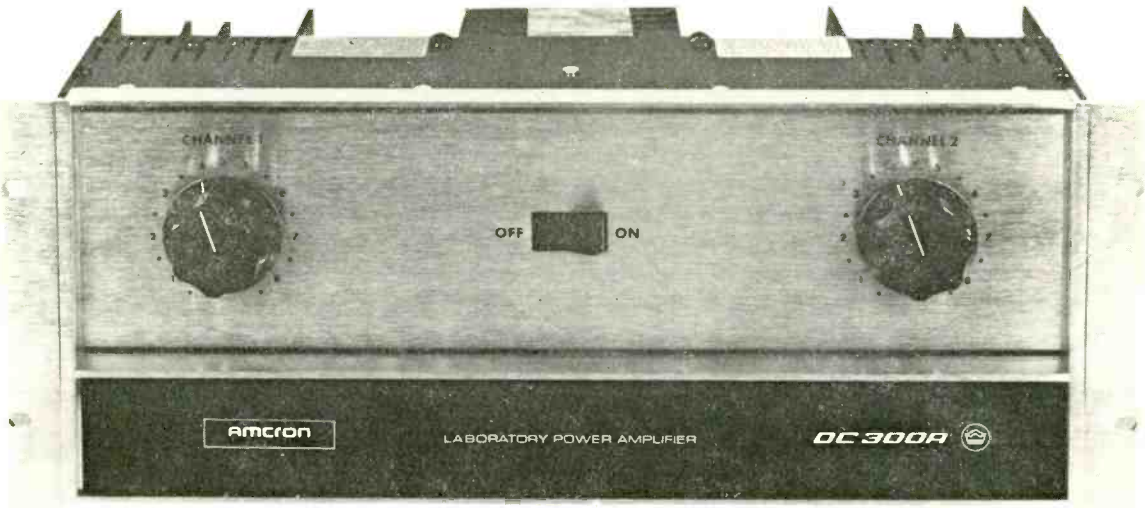
Input: 40 to 400 mV at 5 kΩ (single ended) or 10 kΩ (differential).
Frequency response: 30 to 15k Hz −1 dB.
Distortion: 0.1% at up to 40W, 1 k Hz.
Signal-to-noise ratio: 85 dB (40 mv input) at 20k Hz.
Output: 40W into 4Ω, 25W into 8Ω, unbalanced.
Source impedance: 0.1Ω at 1k Hz.
Power input: 1.5A at 55V dc.

amcron

DC 300A

"STATE OF THE ART"

POWER



The DC300A succeeds the famous DC300 power amplifier, and continues Amcron's tradition of leading the world in power amplifier design. There are no fancy gimmicks, or fragile meters on the DC300A, just plain, solid, functional design. Each channel will give up to 500 watts rms, Intermodulation Distortion is typically below 0.01% (and that's low), and the amplifier can handle loads as low as 1 ohm. Damping factor is above 1000 up to 300Hz into 8 ohms, and this explains why the DC300A controls **any** speaker so well. Equally important, of course, is the fact that the DC300A will continue to deliver night after night after night. This is, as everyone knows, why AMCRON has such a high reputation for Reliability. Jethro Tull, Sadlers Wells, Covent Garden and Elton John chose Amcron because they know it will meet their exacting requirements. All Amcron amplifiers carry a full 3-year warranty on parts and labour. If you are building a new rig, installing new monitoring in your studio, or simply require a status symbol, then you can do no better than choose AMCRON — The State of The Art.

Our London stockists for all AMCRON equipment are REW (Audio Visual) Ltd., 146 Charing Cross Road, London WC2. Tel. 01-240 3883, and also at 10-12 High Street, Colliers Wood, London SW19. Tel. 01-540 9684.

or Direct to sole agents:

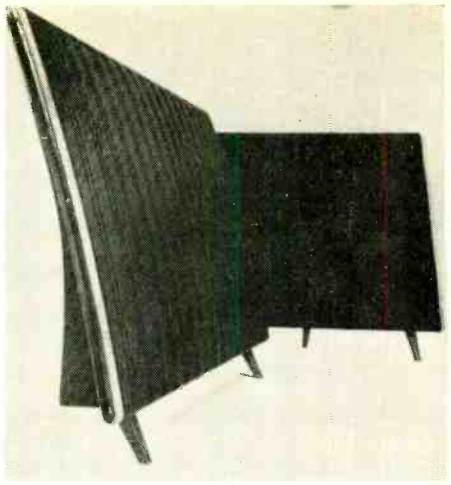
MACINNES LABORATORIES LTD.
MACINNES HOUSE, CARLTON PARK INDUSTRIAL ESTATE, SAXMUNDHAM, SUFFOLK IP17 2NL
TEL: (0728) 2262 2615

Survey : Monitor loudspeakers

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

Quad Electrostatic

Maximum Output: 100 dB ref. 0.00002 N/m^2 from 70 to 7k Hz.
Bandwidth: 45 Hz to 18k Hz, attenuation outside band being asymptotic to 18 dB/octave.
Dispersion: 70° horizontal, 15° vertical.
Impedance: 30 to 15Ω from 40 to 8k Hz, falling above 8k Hz.
Ac voltage range: 100 to 120V, 200 to 250V, 50 to 60 Hz.
Weight: 16 kg.
Hwd dimensions: 788 x 880 x 280 mm.
Price: £54 (trade), £72 (retail).
Specification 1.8m on axis in free space, 93 dB ref 0.00002 N/m^2 in frequency range 50 Hz to 10k Hz.



ACOUSTIC RESEARCH (USA)
Agents: Acoustic Research International, High Street, Houghton Regis, Bedfordshire.
Phone: Dunstable 603 151.

LST

Sensitivity: 89.5 dB spl average, ±1dB, with back against rigid wall.
Efficiency: 0.8% average.
Unit complement: 304 mm bass, four 38 mm mid and four 19 mm treble.
Phasing: Positive voltage applied to terminal 2 causes woofer diaphragm to move forward (out of cabinet).
Hwd dimensions: 508 x 689 x 248 mm.
Weight: 40.5 kg.
Price: £200.

ALTEC (USA)
Agents: Acoustico Enterprises Ltd, 6-8 Union Street, Kingston on Thames, Surrey.
Phone: 01-549 3471.

A7-8

Power rating: 50W continuous.
Impedance: 8Ω.
Crossover frequency: 800 Hz.
Speaker components: *416-8A, 817-8A, 811B, N801-8A.*
Hwd dimensions: 1,067 x 762 x 609 mm.
Price: £250.

878A

Power rating: 60W continuous.
Impedance: 8Ω.
Crossover frequency: 800 Hz.
Hwd dimensions: 762 x 685 x 483 mm.
Price: £250.

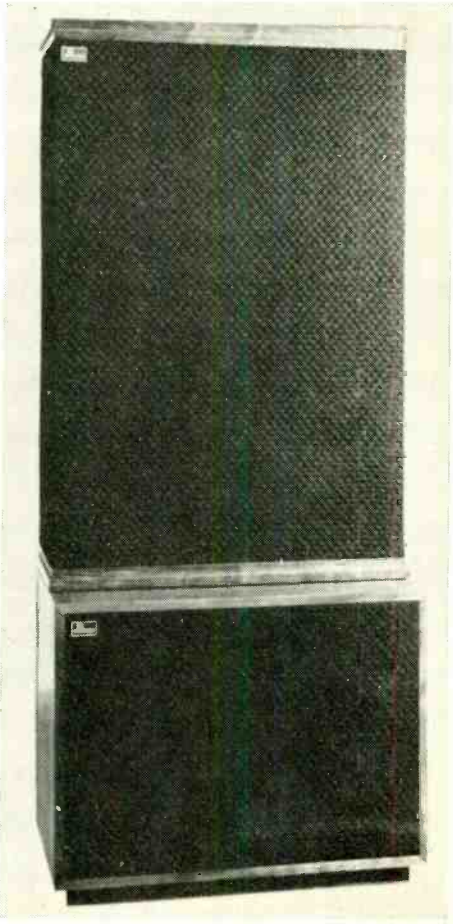
874A

Power rating: 60W continuous.
Impedance: 4Ω.
Crossovers: 500 and 4k Hz.
Hwd dimensions: 650 x 295 x 300 mm.
Price: £140.

AMCRON
Agents: Macinnes Laboratories Ltd, Carlton Park Industrial Estate, Saxmundham, Suffolk IP17 2NL.
Phone: Saxmundham 2262, 2615.

ES-224 electrostatic

Drive units: Two 254 mm, 24 *HF150*.
Crossover: 350 Hz.
Power capacity: 150W.
(Supporting range of smaller models; details on request.)



Top right: Quad *Electrostatic.*

BOWERS & WILKINS
Bowers & Wilkins Electronics, Meadow Road, Worthing, Sussex.
Phone: 0903 205611.

DM2A

Three unit system comprising *DW200* bass/mid, *HF1300* treble and 25 mm hf transducers.
Power rating: 60W continuous sinewave.
Sensitivity: 7W produces 95 dB spl at 400 Hz.
Frequency response: 65 Hz to 20k Hz ±3 dB.
Hwd dimensions: 644 x 352 x 354 mm.
Weight: 23 kg.
Price: £63.20.

DM4

Three unit monitor comprising Bextrene bass/mid, *HF1300/2* treble and 19 mm plastic domed hf transducers.
Sensitivity: 3.6W (8Ω nominal impedance) produces 95 dB spl at 1m.
Hwd dimensions: 531 x 254 x 255 mm.
Weight: 11 kg.
Price: £45.

DM70

Power rating: 25W continuous sinewave.
Frequency response: 40 Hz to 20k Hz ±5 dB.
Impedance: 8Ω nominal, rising to 25Ω at 1k Hz. 4Ω minimum at 20k Hz.
Units: 330 mm bass radiator and 11-module electrostatic (400 Hz upwards).
Hwd dimensions: 808 x 815 x 382 mm.
Weight: 48.5 kg.
Price: £177.25.

CADAC
Cadac (London) Ltd, Lea Industrial Estate, Batford, Harpenden AL5 5EL.
Phone: 05827 64351.
Telex: 826323.

Sound reproduction system

A Bi-amplified sound reproducing system designed in conjunction with the research laboratories of RCA Studios, Rome, for use as control room monitors in music recording studios. The power amplifiers are included as part of the complete system.
Hwd dimensions: 1,981 x 1,016 x 610 mm.

CELESTION
Rola Celestion Ltd, Ditton Works, Foxhall Road, Ipswich, Suffolk IP3 8JP.

Ditton 66

Power rating: 80W (DIN specification).
Impedance: 4Ω minimum.
Crossovers: 500 and 5k Hz.
Units: Two 304 mm bass, dome-type mid and *HF2000* hf.
Price: £110.

DECCA
Decca Special Products, Ingate Place, Queenstown Road, London SW8.

London

Power capacity: 25W nominal (DIN 45-573).
Impedance: 8Ω.
Internal capacity: 39.25 litres.
Crossover: 1.6k Hz (12 dB/octave low pass, 18 dB/octave high pass slope).
Hwd dimensions: 574 x 354 x 281 mm.
Price: £72.

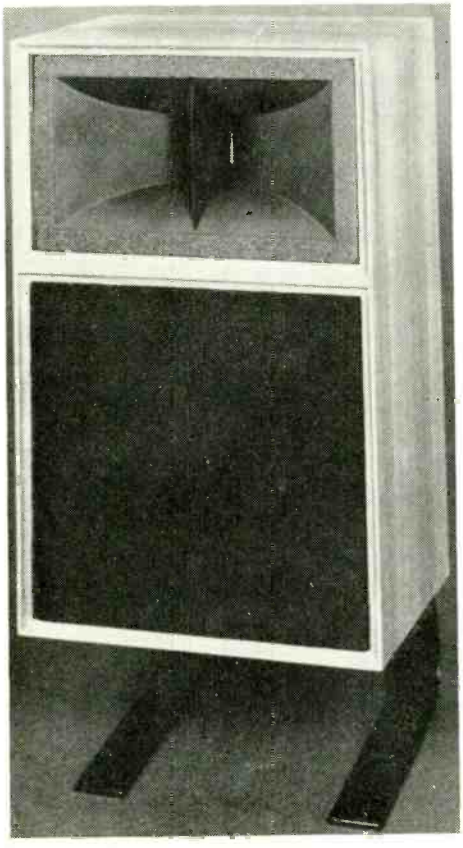
ELECTRO-VOICE (USA)
Agents: Gulton Europe Ltd, The Hyde, Brighton BN2 4JU.
Phone: 0273 66271.

Sentry 1A

EIA sensitivity: 48 dB.
Spl: 110 dB (1.2m on axis, 20W).
Impedance: 8Ω.
Power capacity: 20W.
Hwd dimensions: 552 x 940 x 419 mm.
Weight: 38 kg.
Price: £170.

Sentry 2A

EIA sensitivity: 48 dB.
Spl: 110 dB (1.2m on axis, 20W).
Impedance: 8Ω.
Power rating: 20W.
Hwd dimensions: 813 x 508 x 330 mm.
Weight: 37 kg.
Price: £170.



Left: Amcron *ES-224*.

Right: Decca *London*.

270/50

Power rating: 50W.
Units: 305 mm bass, three mid and three treble.
Price: £100.

360/100

Power rating: 100W.
Units: Two 305 mm bass, four mid and four treble.
Dispersion: 270° when against wall; 360° 1m from wall.
Dimensions: 1,145 x 475 x 380 mm.
Price: £157.50.

Sentry 3

EIA sensitivity: 48 dB.
Spl: 113 dB (1.2 m on axis, 50W).
Impedance: 8Ω.
Power capacity: 50W.
Hwd dimensions: 876 x 724 x 521 mm.
Weight: 70.8 kg.
Price: £485.

Sentry 4A

EIA sensitivity: 52 dB.
Spl: 117 dB (1.2m on axis, 50W).
Impedance: 8Ω.
Power rating: 50W.
Hwd dimensions: 1,290 x 705 x 523 mm.
Weight: 68 kg.
Price: £380.

FERROGRAPH
Ferrograph Co Ltd, Auriema House, 442 Bath Road, Cippenham, Slough, Bucks SL1 6BB.
Phone: 062-86 62511.

S1

Bandwidth: 45 Hz to 20k Hz ±3 dB.
Power rating: 100W peak (25W continuous sinewave).
Impedance: 8Ω (6Ω minimum over audio range).
Crossovers: 400 and 3.5k Hz.
Units: 330 x 241 mm bass, 102 mm mid, and 25 mm treble.
Hwd dimensions: 640 x 350 x 440 mm.
Stand height: 370 mm.
Weight: 25 kg (cabinet): 2.7 kg (stand).
Price: £95.

IMF
IMF Electronics, Westbourne Street, High Wycombe, Buckinghamshire.
Phone: High Wycombe 25166.

Professional Monitor

Power rating: 100W programme.
Efficiency: 50W produces 100 dB spl (pink noise, 1m on axis).
Nominal impedance: 8Ω.
Crossovers: 375 Hz, 3.5k Hz (±2 dB adjustment over mid and treble).
Units: 330 x 241 mm bass, 152 mm mid, 44.5 mm treble and 19 mm hf.
Dimensions: 1,067 x 444 x 502 mm.
Weight: 64 kg.
Price: £350.

MONITOR LOUDSPEAKER SURVEY

KEF

KEF Electronics Ltd, Tovil, Maidstone, Kent ME15 6QP.
Phone: 0622 57258.
Telex: 96140.

5/1AC

Spl: 112 dB (ref .00002 N/m^2, 2m on axis).
Harmonic distortion: Less than 1%, 50 to 15k Hz.
Impedance: 10 kΩ balanced or unbalanced line bridging.
Sensitivity: 775 mV for full output.
Signal-to-noise ratio: 90 dB.
Hwd dimensions: 890 x 510 x 440 mm.
Weight: 45 kg.

104

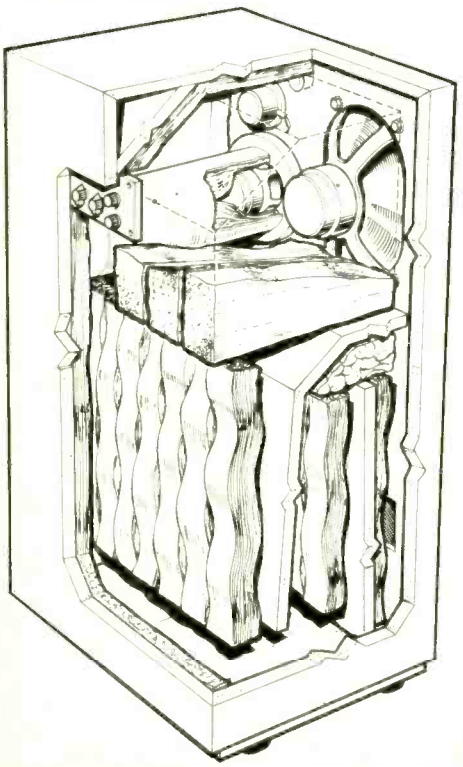
Frequency response: 50 to 20k Hz ±2 dB (1m on hf unit axis).
Harmonic distortion: Less than 1%, 100 to 30k Hz (ref 96 dB spl at 1m, 400 Hz).
Impedance: 8Ω nominal.
Sensitivity: 12.5W produces 96 dB at 1m, 400 Hz.
Hwd dimensions: 630 x 330 x 260 mm.
Internal capacity: 35.5 litres.
Price: £68.50

KLEIN & HUMMEL

Klein & Hummel, 7301 Kemnat, Stuttgart, West Germany.
Phone: Stuttgart 253246.
Agents: F. W. O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire.
Phone: 01-953 0091.

OY

Bandwidth: 40 to 16k Hz ±2 dB (measured with third-octave white noise).



Spl: 107 Phons at 1m.
Self noise level: 10 Phons at 1m.
Dynamic range: 90 dB.
Dispersion angle: ±30°.
Rise and decay times: 10 ms at 60 Hz, 5 ms from 100 Hz, 2 ms from 500 Hz, 1 ms from 1k Hz.
Total harmonic distortion: 1% (mid range).
Crossovers: 500 and 8k Hz (electronic); 500 and 6k Hz (acoustic).
Amplifiers: Integral 2 x 30W
Dimensions: 483 x 305 x 229 mm.
Weight: 20 kg.
Price: £245.

OZ

Bandwidth: 40 Hz to 16k Hz ±2 dB.
Spl: 110 Phons at 1m.
Self noise level: 10 Phons at 1m.
Dispersion angle: 140° at 4k, 100° at 10k, 80° at 12.5k Hz.
Distortion: 1% (mid range).
Crossover frequency: 800 Hz.
Amplifiers: Integral 2 x 30W.
Hwd dimensions: 700 x 900 x 420 mm.
Price: £693.

LOCKWOOD

Lockwood & Co (Woodworkers) Ltd, 63 Lowlands Road, Harrow, Middlesex.
Phone: 422 3704.

Major

Nominal impedance: 8 or 15Ω (Tannoy unit) or 16Ω (Altec *604E*).
Maximum recommended amplifier power: 50W programme.
Dimensions: 1,144 x 712 x 450 mm.
Weight: 45 kg (66 kg with internal Quad *50E*).
Price: £210.

NAIM AUDIO

Naim Audio, 15 Churchfields Road, Salisbury, Wiltshire.
Phone: Salisbury 3746.

NAM 402

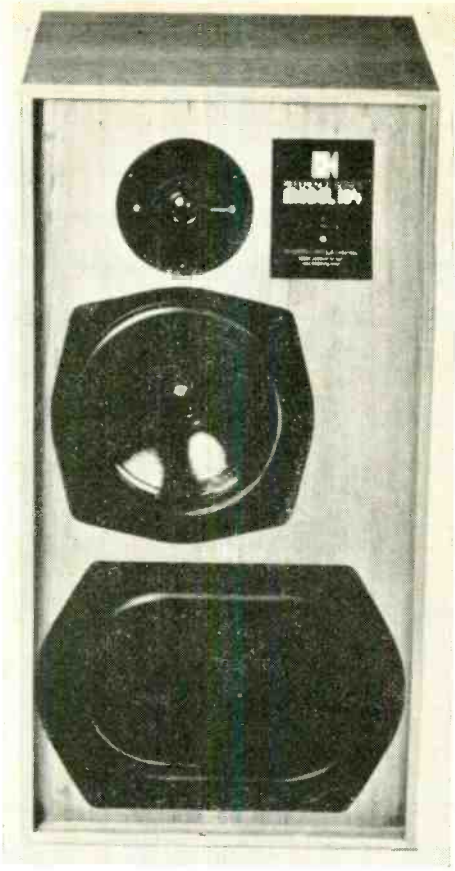
Power handling: 40W programme.
Frequency response: 40 to 20k Hz ±4 dB.
Minimum impedance: 7Ω.
Bass unit: 200 mm plastic coated.
Treble unit: 25 mm plastic coated, fabric dome.
Sensitivity: 8W for 96 dB spl.
Peak spl: 106 dB.
Hwd dimensions: 610 x 343 x 305 mm.
Weight: 14.5 kg.
Price: £60.

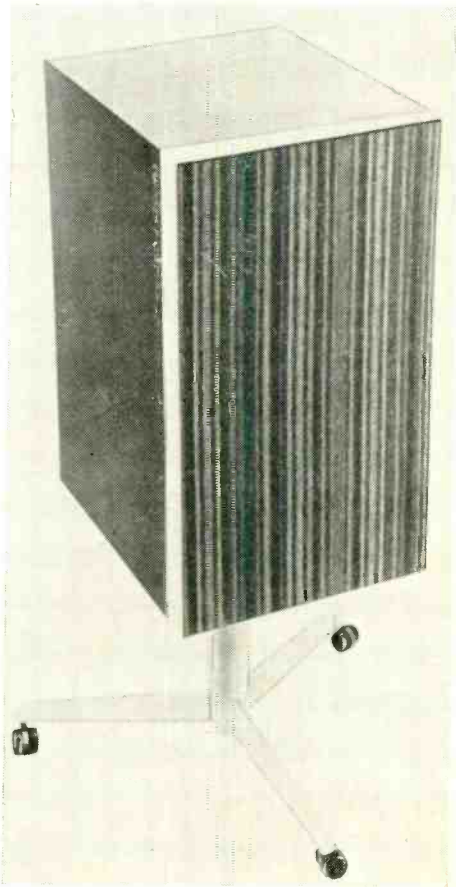
NAM 802

As above but fitted with 80W dc couple power amplifier with similar specifications to the Naim audio *NAP 160*.
Input: Balanced line bridging.
Input sensitivity: 1.4V (again preset at maximum)
Price: £125.

NAM 502

As above but fitted with 40W amplifier.
Price: £90.





Left: IMF *PM*.

Top right: KEF *104*.

Right: Ferrograph *S1*.

MONITOR LOUDSPEAKER SURVEY

RADFORD
Radford Audio Ltd, Bristol BS3 2HZ.
Phone: 0272 662301.

90/50
Power rating: 50W.
Units: 305 mm bass, two 76 mm mid and two 25 mm treble.
Dimensions: 535 x 305 x 230 mm.
Price: £52.50.

180/50
Power rating: 50W.
Units: As *90/50*.
Dimensions: 760 x 345 x 265 mm.
Price: £75.

ROGERS
Rogers Developments (Electronics) Ltd, 4-14 Barmeston Road, London SE6 3BN.
Phone: 01-698 7424/4340.

BBC Monitor
Bandwidth: 40 Hz to 25k Hz ±3 dB.
Power rating: 25W programme.
Impedance: 15Ω standard. Eight and 25Ω to order.
Units: Three.
Hwd dimensions: 635 x 305 x 305 mm.
Height including stand: 940 mm.
Weight: 16 kg.
Price: £77.

SPENDOR
Spendor Audio Systems Ltd, Kings Mill, Kings Mill Lane, South Nutfield, Redhill, Surrey RH1 5NF.
Phone: Nutfield Ridge 2554.

BC1
Frequency response: 60 Hz to 14k Hz ±3 dB.
Power capacity: 40W programme.
Nominal impedance: 8Ω.
Units: Spendor 203 mm bass (plastic cone). Celestion *1300* treble and ITT *4001* hf.
Recommended amplifier: Spendor *M208*.
Hwd dimensions: 635 x 299 x 304 mm.
Weight: 14 kg.
Price: £66 basic.

BC1A
Specification as *BC1* but with integral 20W power amplifier.
Price: On application.

BC2
Specification as *BC1* but with 50W programme power rating.
Recommended amplifier: Spendor *M508*.
Price: £73.50 basic.

BC2A
Specification as *BC2* but with integral 50W power amplifier.
Price: On application.

BC3
Frequency response: 50 to 14k Hz ±2.5 dB.
Power capacity: 70W peak programme.
Nominal impedance: 8Ω.
Units: Spendor 304 mm (plastic cone), Spendor 203 mm (plastic cone), Celestion *1300* and *2000* hf.
Hwd dimensions: 800 x 394 x 394 mm.
Weight: 34 kg.
Sensitivity: +2.5 dB ref 1 dyne/cm²/1V applied.
Maximum spl: 105 dB.
Input connector: four-pin *XLR*.
Price: £136 basic.

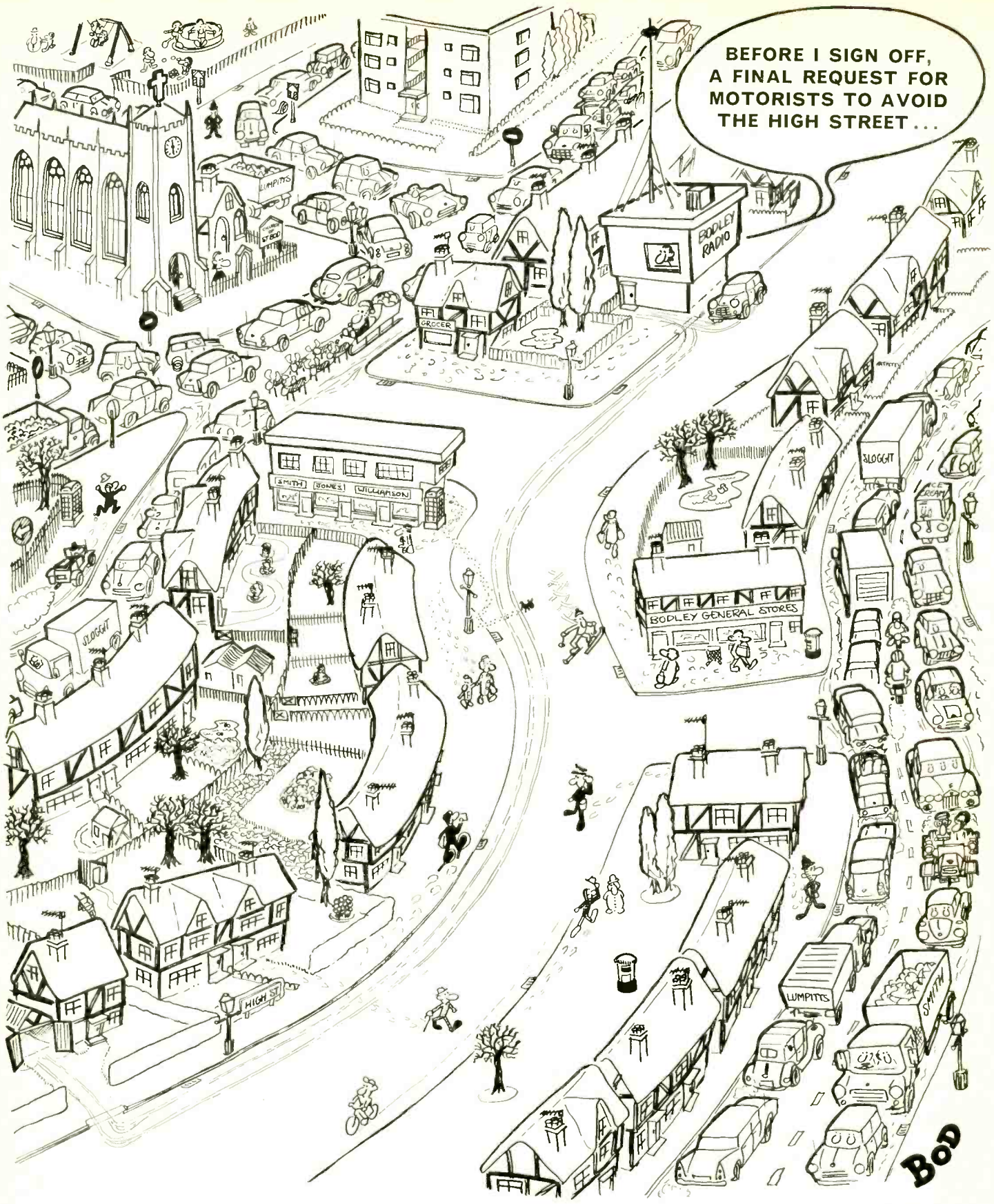
TANNOY
Tannoy Products Ltd, Norwood Road, West Norwood, London SE27 9AB.
Phone: 01-670 1131.

GRF (Corner)
Bandwidth: 30 Hz to 20k Hz ±3 dB.
Drive unit: 380 mm Tannoy *Gold*.
Power rating: 50W program.
Average conversion efficiency: 10%.
Dimensions: 1,070 x 483 x 600 mm.
Price: £170.

LATE ENTRY

JBL (USA)
Agents: Feldon Audio, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4314.

Range of high power loudspeakers. No data received.



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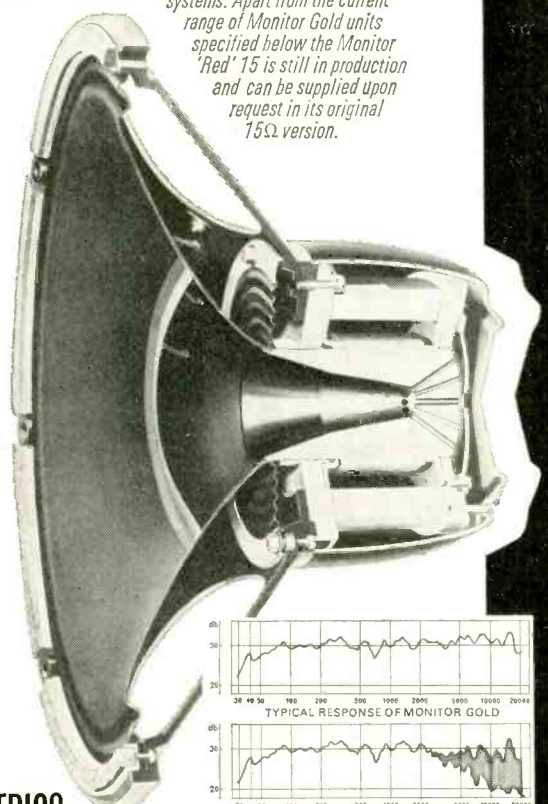
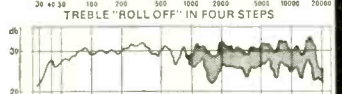


TYPICAL RESPONSE OF MONITOR GOLD

TREBLE "ROLL OFF" IN FOUR STEPS



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TECHNICAL SPECIFICATIONS			
	FIFTEEN	TWELVE	IIILZ
Frequency Response	23-20,000 Hz	25-20,000 Hz	27-20,000 Hz
Polar Distribution	—4dB at 10,000 Hz	—3dB at 10,000 Hz	—2dB at 10,000 Hz
for 60° inc. Angle			
Power Handling Capacity	50 watts*	35 watts*	25 watts*
Impedance Via Crossover Network	8 ohms (5 ohms min.)	8 ohms (5 ohms min.)	8 ohms (5 ohms min.)
Intermodulation Products	less than 2%	less than 2%	less than 2%
Bass Resonance	25 Hz	28 Hz	30 Hz
Crossover Frequency	1,000 Hz	1,000 Hz	1,200 Hz

* Depending on type of enclosure.

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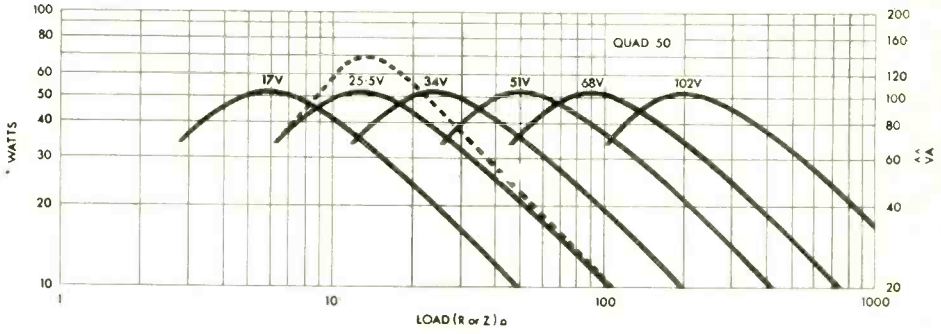
QUAD 50E POWER AMPLIFIER

By Hugh Ford

FIG. 1



——— POWER OUTPUT v RESISTANCE FOR VARIOUS OUTPUT CONNECTIONS
- - - - - - - VA FOR REACTIVE LOAD. 25.5V CONNECTIONS OTHER CONNECTIONS SIMILAR

MANUFACTURERS' SPECIFICATION

Power into load: See fig. 1. Maximum power transfer at 5.8, 12.5, 23, 50 and 200Ω.
Power response: —1 dB at 30 and 20k Hz referred to 50W.
Distortion with unrestricted bandwidth: 40 Hz 0.35% at up to 50W. 1k Hz 0.1% at up to 50W. 10k Hz 1.0% at up to 50W.
Output source impedance: 0.5Ω in series with 25 μH for 5.5Ω connection. Others in direct proportion.
Hum and noise: 80 dB referred to full output.
Frequency response: Unbalanced input: 30 to 20k Hz —1 dB referred to 1k Hz. 600Ω bridging: —2 dB referred to 1k Hz.
Input level: 500 mV for full output, balanced or unbalanced. Preset adjustment for higher levels.
Input impedance: Unbalanced: 14 to 50k Ω depending on preset gain. 600Ω bridging: greater than 14k Ω in parallel with 50H.
Stability: Unconditionally stable with any load.
Power input: 110, 120, 220 or 240V, 50 to 60 Hz. 24 to 150W depending on signal level.
Manufacturers: The Acoustical Manufacturing Co Ltd, St Peters Road, Huntingdon.
Price: £52. Input transformer £4.65.

THE MECHANICAL construction of the Quad *50E* is very similar to that of the Quad *303* power amplifier, either of which I feel would be quite safe being carted round in a car or falling on a studio floor. The entire rear of the amplifier is taken-up by a very solid heatsink which is combined with a protective cover over the output transistors so that no live parts can be accidentally shorted. At the front of the amplifier there is also a solid casting which protects the components mounted on the front panel. Between this front casting and the rear heatsink is a good solid casing which can be removed relatively easily for servicing. Inside the case and bottom cover, the majority of the components are mounted on a good quality printed board which can be hinged from within the case in order to gain access to the components.

The front panel houses the main voltage selector, which is of the rotary plug-in type, a pilot lamp, a socket for incoming mains, and the mains fuseholder. The latter is not identified with the fuse value, for which one has to search the instruction book, but in other respects the inputs and outputs are clearly labelled. The input to the amplifier is connected by an eight way Painton socket which gives access to the unbalanced input as well as to the fully floating and balanced transformer input which can be used when the optional extra input transformer is fitted. One further facility on the input socket is a dc output at around +38V from which about 100 mA may be drawn for operating auxiliary equipment.

On the output end is a 20 position Painton socket fed from some eight completely separate windings on the output transformer. The point of this large number of windings is to enable the amplifier to drive its rated 50W of power into any load between 4Ω and 200Ω.

For normal studio use, these input and output arrangements are rather tiresome because the standard *XLR* connectors will naturally not fit the special input connector. Also, when wiring-up the amplifier output plug for a 4Ω or 8Ω load, it is necessary to connect some 12 links with the free connector in addition to the loudspeaker leads.

Lastly, on the front panel is the screwdriver operated gain control which is calibrated from 0 to 10 and operates directly across the unbalanced input.

Circuitwise the amplifier is fairly conventional. The signal, either from the unbalanced input or from the optional balanced and centretapped input, is applied to the base of the input transistor via the gain control and a dc blocking capacitor. Feedback from an auxiliary winding on the output transformer is applied to the emitter of this *BC109* input transistor, the collector of which drives a Darlington pair phase splitter which in turn is ac coupled to the drivers and output transistors that feed the output transformer. The operating point of the output stage is adjusted by two preset resistors and is maintained with respect to temperature by means of feedback from a thermistor mounted on the heatsink. The output stages are protected against overload by limiting diodes and also by sampling the driving current to the output transformer and removing the drive if it becomes excessive.

Output power and distortion

As can be seen from **fig. 1,** which is taken from the manufacturers' literature, there are five different recommended combinations of the output transformer's secondary windings which provide optimum power transfer into 5.8, 12.5, 23, 50, 85 or 200Ω. Because the vast majority of modern loudspeakers have a rated impedance of 8Ω, the major part of this review was done using the 5.8Ω configuration of output transformer taps which is the optimum for either 4Ω or 8Ω loudspeakers.

Under these conditions, the output clipping point of the Quad *50E* corresponded to the following output powers and input sensitivities:

Load resistance	Output power (1k Hz)	Input sensitivity (bal or unbal)
8Ω	47.5W	580 mV
4Ω	54.8 W	460 mV
2Ω**	27.4W	260 mV

**Below recommended load in specification

The above figures for output power generally conform to the curves given in **fig. 1,** but perhaps it would have been more

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appropriate if the manufacturer had called this a 45W amplifier, not that this makes any practical difference when its output is used for audio purposes. As is to be expected, the available output power varies with the incoming mains voltage so care was taken during all power measurements to run on precisely the nominal mains voltage. Third harmonic distortion was measured at various power levels on 40, 1k and 10k Hz into loads of 8Ω and 200Ω using the appropriate output transformer tap arrangements with the following results which are generally to specification:

Power into 8Ω	Third harmonic distortion		
	40	1k	10k Hz
45W	0.21%	less than 0.04%	0.22%
4.5W	0.08%	0.07%	0.14%
450 mW	0.13%	0.11%	0.30%
45 mW	0.10%	0.06%	0.11%
4.5 mW	0.10%	less than 0.04%	0.06%
Power into 200Ω			
50W	0.12%	0.06%	0.22%
5W	0.08%	0.08%	0.25%
500 mW	0.16%	0.14%	0.44%
50 mW	0.11%	0.07%	0.11%
5 mW	0.11%	less than 0.04%	less than 0.05%

Investigation into the intermodulation distortion by the SMPTE method revealed a similar pattern to the above with the amplifier operating into an 8Ω load and **fig. 2** shows the waveform of the input test signal together with the generated distortion products which had a similar waveform at all power levels. The following table gives the actual intermodulation distortion figures at various power levels into an 8 ohm load:

Power into 8Ω (equivalent sinewave power)	SMPTE intermod distortion
45W	0.25%
4.5W	0.19%
450 mW	0.21%
45 mW	0.21%
4.5 mW	0.10%

Operation of the amplifier into reactive loads failed to produce any signs of instability and even applying very fast pulses into a load of 8Ω in parallel with 2 μF did not do anything particularly untoward, as shown in **fig. 3** of the resulting output voltage waveform. Working with a fast pulse into a resistive load of 8Ω the slewing rate of the output waveform was measured at 5 V/μs.

Further testing with a wide variety of tone bursts did not show any signs of deterioration of the burst waveform and recovery from overload after high amplitude bursts was without long term effects.

Frequency response and noise

As has already been seen from the distortion figures, the power response is extremely flat. The following table is the frequency response at 4.5W into 8Ω, showing the response to be well within specification

FREQUENCY RESPONSE (4.5W into 8Ω)

Frequency (dB)	Output
40 Hz	—0.5
63	—0.2
125	0
250	0
500	0
1k	0
2k	0
4k	—0.1
6.3k	—0.2
8k	—0.2
10k	—0.3
12.5k	—0.4
14k	—0.5
16k	—0.6
18k	—0.7
20k	—0.8
30k	—1.5
40k	—2.3
50k	—3.2

and only +0-1 dB from 30 to 22k Hz, falling to -3 dB at 40k Hz. Virtually identical results were obtained using the balanced transformer input, which offered the same input sensitivity with a common mode rejection of 25 dB up to 1k Hz, falling to 21 dB at 20k Hz. The sensitivity for rated output, as is only to be anticipated, varied with the amplifier load, being probably at its worst with 8Ω loads at 580 mV for 50W output.

Amplifier noise far exceeded the manufacturers' specification of 80 dB with respect to 'full output'. The measured hum and noise ('A' weighted) was virtually the same with the inputs open circuit or short circuit, at -103.5 dB(A) with respect to 50W into 8Ω. Unweighted noise was masked by hum products, which in fact increased when the unbalanced input was shorted but still remained at a completely satisfactory level as follows:

Hum frequency	Level below 50W
50 Hz	—109 dB
100 Hz	—88.5 dB
150 Hz	—108 dB

Other aspects

The input impedance at the unbalanced input and at the transformer input were almost identical and both depended upon the setting of the gain control. At minimum gain the input impedance was 46 kΩ, falling to 16 kΩ at maximum gain. These impedances are quite suitable for bridging 600Ω and lower impedance lines but the variation in input impedance must be borne in mind for other applications.

At the other end, the output impedance with the transformer tappings set for minimum output impedance was 0.49Ω in series with 22.9 μH which is very close to the specification but perhaps offers a rather small damping factor for some loudspeakers.

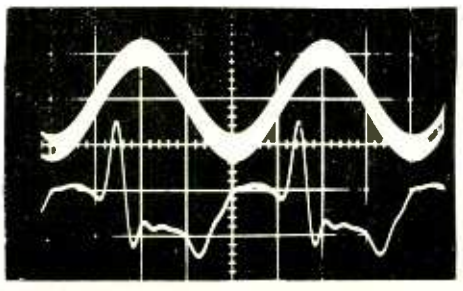
Summary

Before proceeding with my impressions of the *50E*, I should like to thank Quad for making this review possible as the sample amplifier was lent by them at extremely short notice and was delivered to my laboratory in the early hours in the morning. This is typical of the really excellent service offered by Quad who my acquaintances and I have always found to be extremely helpful.

Reverting to the *50E*, I have no complaints about it meeting its specification, other than being slightly down on power into some loads; in fact it exceeded specification in the majority of parameters, especially with respect to noise. So far as its applications are concerned, it is undoubtedly a very versatile laboratory amplifier for industrial purposes and in this sphere it has much more to offer than the Quad *303* and most other solid state amplifiers. However, I must admit that I was rather disappointed in its performance as an audio amplifier and, had I taken the trouble to read its specification in detail, I should have realised that its performance is not up to that of the Quad *303* and similar amplifiers from the point of view of a high quality monitoring amplifier. In fact the Quad *303* is capable of delivering 45W into 8Ω with far lower distortion than the *50E*, and that is 45W per channel with both channels operating. It therefore would appear that the Quad *303* is a far better bargain as a high quality monitoring amplifier and, having used two of them in my laboratory for several years, I can vouch for its performance.

On the other hand, where it is required to drive into loads varying over a wide range of impedances, the *50E* is a reasonably priced amplifier which is completely stable. It is both electrically and mechanically robust and offers a more than adequate performance for many applications. **Hugh Ford**

FIG. 2



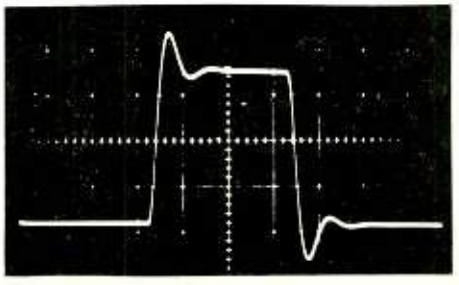
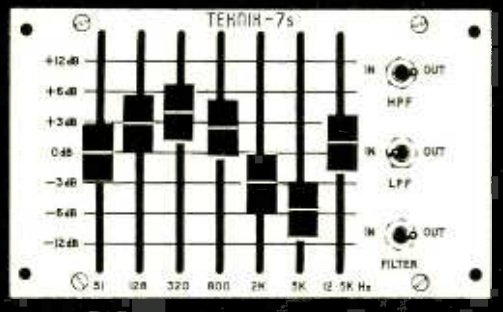


FIG. 3



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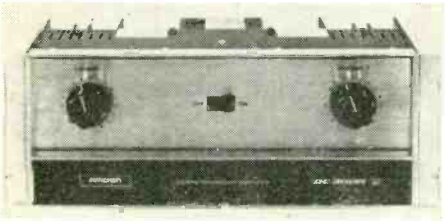
AMCRON DC300A POWER AMPLIFIER

By Hugh Ford



MANUFACTURERS' SPECIFICATION

Frequency response: ±0.1 dB dc to 20k Hz at 1W into 8Ω, ±1 dB zero to 100k Hz

Phase response: +0, —15° zero to 20k Hz, 1W into 8Ω.

Power response: +1 dB, —0 dB dc to 20k Hz at 150W rms into 8Ω

Total output IHF: Typically 420W rms into 8Ω, 800W rms into 4Ω

Power at clip point: Typically 190W rms into 8Ω, 340W rms into 4Ω per channel

Intermodulation distortion (60 to 7k Hz 4:1): Less than 0.05% from 0.01W to 150W rms into 8Ω, typically below 0.02%. Less than 0.01% at 150W (60 to 7k Hz)

Damping factor: Greater than 200, zero to 1k Hz into 8Ω

Hum and noise (20 to 20k Hz): 110 dB below 150W rms output (unweighted typical 122 dB)

Slewing rate: 8 V/μs (S-R is the maximum value of the first derivative of the output signal)

Load impedance: Primarily used at 4Ω or greater; maximum power at 2.5Ω, lower impedance affects only maximum power; will drive a completely reactive load without adverse effects

Input sensitivity: 1.75V ±2%, for 150W into 8Ω

Input impedance: Nominal 100 kΩ, 10 kΩ at full gain

Turn-on: Instantaneous

Output protection: Line voltage is independently fused. Thermal switches in ac line protect against overheating caused by insufficient ventilation. Controlled-slewing-rate voltage amplifiers protect against rf burnouts. Input overload protection is furnished by internal resistance at inputs of amp

Power supply: 1 kW transformer with heavy heat-sink high-current diodes and computer-grade filter capacitors storing over 48 joules of energy. Two regulated supplies for complete isolation and stability

Power requirements: Requires 50 to 400 Hz ac with adjustable taps for 120, 128, 240, 248 and 256V ±10% operation. Draws 40W or less on idle, 500W at 300W output into 8Ω per channel.

Heatsinks: Massive black anodised heatsinks are thermally joined to chassis, thereby utilising the entire amplifier as a heatsink.

Chassis: All-aluminium construction for maximum heat conduction and minimum weight. Heavy aluminium front panel is a single extrusion

Controls: Heavy-duty independent input level controls are on front panel. Non-interacting dc balance controls are mounted behind front panel

Connectors: Input—6.25mm phone jacks. Output—Colour coded binding posts. Ac line—Three-wire (Grounded) male connector on 1.5m cable

Dimensions (whd): 438 x 178 x 248mm

Weight: 20.4 kg

Finish: Bright-anodised brushed-aluminium front-panel

Price: £376 trade. £470 plus VAT retail.

Agents: Macinnes Laboratories Ltd, Carlton Park Industrial Estate, Saxmundham, Suffolk

THE AMCRON *DC300A* power amplifier is an improved version of the Crown *DC300* power amplifier which was reviewed in April 1972 STUDIO SOUND. Not only does the new version have the capability of operating into completely reactive loads, it also features modified protective circuitry together with twice the number of output transistors. In addition, the input stages now feature integrated circuits and the overall distortion has been further reduced to such an extent that even intermodulation distortion was below my capabilities of measurement of 0.002 per cent at most output levels, which would correspond to a harmonic distortion percentage somewhere in the fifth decimal place!

Circuitwise the *DC300A* is dc coupled throughout with three basic feedback loops to maintain dc stability in addition to a number of capacitors for high frequency compensation. The input amplifier is a low noise integrated circuit before which are the only amplifier presets which total two offset controls per channel for adjustment of the dc offset. The output circuitry uses a class AB + B technique such that driver transistors handle small loads and the four pairs of output transistors per channel handle the high power requirements. Full amplifier protection against short circuits or excessive dissipation is provided by two protective systems — thermally activated switches on the heatsinks which open-circuit the incoming mains supply in event of excessive temperature rise plus a circuit which acts as a current limiter at audio frequencies or a VI limiter at lower frequencies.

Mechanically the amplifier is of solid construction but the styling is reminiscent of heavyweight valve equipment and can hardly be described as modern by present day standards. The front panel is of heavily brushed aluminium and houses the two black gain control knobs in association with an arbitrary calibration, plus the illuminated rocker type power on/off switch. The amplifier is provided with normal rack mounting slots and is clearly intended for rack mounting rather than portable use because the massive heatsinks at the rear could be easily damaged in transit. Between the heatsinks are the two 6.25mm two pole jack inputs and the two pairs of rather inacessible output terminals. However, the output terminals will accept standard 19 mm spacing pin connectors and also have holes for inserting bared wire; while they are difficult to tighten by hand, they have hexagonal heads which can be readily attacked with pliers. The remaining features to the rear of the amplifier are the fixed mains input cable and the mains input fuseholder. The two latter features unfortunately meet the requirements of two of my pet hates: it is impossible to find-out the main voltages for which the amplifier is wired without delving within its guts, and there is no indication of the current rating of the mains fuse; this makes the maintenance engineer grab the nearest hairpin!

Having said my piece on the more basic aspects of the *DC300A*, I need not trouble you with the results of measurements of the amplifier. Its performance is absolutely superb, as is the detail in the instruction manual which among other details contains some 14 graphs of the amplifier's performance.

Output power and distortion

During the amplifier measurements, great care was taken to keep the incoming mains voltage constant as drawing the extra 800W or so when the audio was turned full up tended to shift the incoming mains voltage by a small amount which would be enough to invalidate power measurements. Also, it was of course essential to use very potent and accurate load resistors as accurate resistance boxes capable of dissipating the potential power in the order of 700W are a rare animal. Fortunately, some time ago I built a 1 per cent accurate load box containing four 1 per cent 4Ω resistors mounted on massive heat sinks with forced air cooling, the box being rated at 1.2 kW continuous loading.

Using this box, the clipping point of the *DC300A* was found to be 361W into a 4Ω load at 1k Hz with one channel driven; with both channels driven this fell to 306W per channel. With an 8Ω load, the potential power fell to 210W at the clipping point, the amplifier being voltage limited for load impedances above 2.5Ω. Identical clipping points were found at 100 and at 10k Hz.

Harmonic distortion was incredibly low, the 0.1 per cent third harmonic point occurring at just over 200W into an 8Ω load at both 1k and 10k Hz. Much easier to measure is the intermodulation distortion, as this measurement does not rely on low distortion oscillators and complex filters that would be required to get anywhere near the Amcron specifications which suggest harmonic distortions in the third and fourth place of decimals below 100W output per channel.

Intermodulation distortion was measured by the SMPTE method using 50 and 7k Hz tones in the voltage ratio 4:1, which method tends to give a distortion percentage around four times the harmonic distortion when measuring equipment which is not frequency sensitive. The following results on the *DC300A* were quite astoundingly good:

Power out into 8Ω (both channels driven)	Intermod Distortion Left	Right
150W	0.003%	0.002%**
15W	0.002%**	0.002%**
1.5W	0.002%**	0.003%
0.15W	0.004%	0.005%
0.015W	0.009%	0.009%

**0.002% is the residual distortion in the testgear and is likely to correspond to something in the order of 0.0005% harmonic distortion

Fig. 1 shows the equally impressive power response at 150W per channel extending within ±0.1 dB from dc to 30k Hz, falling to

POWER RESPONSE (150W into 8Ω)

Frequency	Output (dB)
40 Hz	+0.2
63	+0.18
125	+0.1
250	+0.1
500	0
1k	0
2k	—0.1
4k	—0.3
6.3k	—7

62 ▶

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AMCRON DC300A REVIEW

-3 dB at 45k Hz. As is only to be expected, square waves and pulses are amplified without any suggestion of droop or tilt. Working into resistive loads, there is no sign of ringing and the output slewing rate was measured at 7V/μs. The extremely severe test of feeding the output into a 2 μF capacitor in parallel with 8Ω produced the waveform shown in **fig. 2** which indicates that, while there is some overshoot, there is no sign of any instability.

Other unkind tests such as shorting the output did not produce any untoward results and running the amplifier at full power with limited ventilation only proved that the thermal trips on the heatsinks temporarily disconnected the mains power.

While the heatsinks became too hot to touch before the thermal trips operated, the dc drift introduced was minimal. When cold, the dc offsets on the two channels were -2.3 mV and -1.7 mV and they increased to only -5.5 mV and -3.4 mV just before the thermal trips operated. Similarly, any drift in gain during the thermal cycle was certainly less than 0.1 dB.

Frequency response and noise

As has been seen, the power response at 150W extends to 45k Hz but the response at 5W shown in **fig. 3** is within ±0.1 dB from dc to 30k Hz and meets the -3 dB point at 90kHz, this being under the worst conditions from the point of view of the gain control settings.

FREQUENCY RESPONSE (5W into 8Ω)

Frequency	Output (dB)
40 Hz	+0.1
63	+0.1
125	+0.1
250	0
500	0
1k	0
2k	—0.1
4k	—0.6
6.3k	—1.6
8k	—2.4

It can only be expected that this large bandwidth has some effect upon the amplifier noise but even then, as can be seen from the following figures the noise performance is very good.

Measurement condition (maximum gain)	Noise reference 150W Left	Right
2 to 200k Hz	—113.5 dB	—113.0 dB
20 to 20k Hz	—117.5 dB	—117.0 dB
'A' weighted	—122.5 dB	—121.0 dB

In addition to the above noise figures, the crosstalk performance was also to a very high standard. **Fig. 4** shows the result of running one channel at 150W output into 8Ω with the other channel not driven and with its input open circuit. It is to be seen that crosstalk is below -100 dB at frequencies up to 8k Hz and that even at 20k Hz crosstalk is at -92 dB with respect to 150W output. The output at 150 Hz in **fig. 4** should be ignored as this is purely the result of not taking particular precautions against hum during this measurement. In practice, all hum components are well below noise.

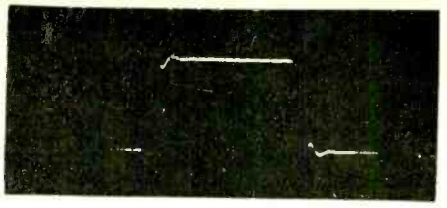

FIG. 1

CROSSTALK (150W into 8Ω, 3rd-octave filtered)

Frequency	Output (dB)
40 Hz	—105
63	—107
125	—109
250	—111
500	—114
1k	—117
2k	—114
4k	—108
6.3k	—104
8k	—100
10k	—97
12.5k	—96
14k	—95
16k	—93
18k	—92

Other aspects

The input and output impedances were measured at 1.592k Hz, the results being an output impedance of 0.0045Ω in series with 3 μH and an input impedance which varies according to the gain setting as follows:

Gain setting	Input impedance
Minimum	108.6 kΩ and 48 pF
Middle	60 kΩ
Maximum	8.865 kΩ and 159 pF

The variation in input impedance is perhaps rather large for some applications, and is brought about by the fact that the gain control is directly connected to the input. This does, however, have the advantage that the input overload limit is effectively infinite but the law of the gain controls was not particularly convenient. **Fig. 5** shows how the sensitivity of 1.7V rms for an output of 150W into 8Ω at maximum gain is reduced as the gain control is rotated; while the useful range of about 28 dB is realistic, the control law over the upper 10 dB is much too coarse.

GAIN CONTROL LINEARITY

Rotation units (clockwise)	Output (dB)
1	—27.5
2	—24.5
3	—22
4	—18
5	—16
6	—12.5
7	—6
8	0

The final item of interest was the tone burst performance. A wide variety of long and short bursts and an equally wide variety of frequencies were amplified without any detectable distortion or evidence of any dc shifting in the operating point.

Summary

From the purely electrical performance measurement, I have no hesitation in stating that this is the best amplifier that I have ever had the occasion to measure. While it is not recommended by its manufacturers for industrial use at high powers above 20k Hz, it certainly has potential for driving vibrators and similar applications, as well as the normal studio monitoring and public address applications where it must be one of the best amplifiers available.

The only criticisms that I have of the electronics are directed at the gain controls which have a poor law and give a wide variation in input impedance. Other than very personal criticisms, I do feel that some indication of the correct value of mains fuse and the operating voltage should be given clearly adjacent to the fuse and mains input. **Hugh Ford**

Postscript

Readers may be interested to know where to obtain high power resistors suitable for loading amplifiers such as the Amcron *DC300A*. The type I use is manufactured by the CGS Resistance Co. Ltd. of Marsh Lane, Gosport Street, Lymington, Hants. (Phone: Lymington 3282). Their type *HSC300* is an aluminium housed resistor for chassis mounting and is rated at 300W when on a substantial heatsink. Values available range from 0.1Ω to 22KΩ with available percentage tolerances of ±5, 3, 2, 1, 0.5 and 0.25. The cost of the 1 per cent tolerance is about £6 each.

BOWERS & WILKINS DM2 LOUDSPEAKER

By J. Shuttleworth

THE BOWERS & Wilkins *DM2* is a small monitor loudspeaker measuring 340 x 352 x 650 mm. It has three drive units with a 152 mm bass/mid range with a *Dextrene* cone which has been coated with, in the manufacturers' words, 'critical damping compounds'. This is some sort of dope: probably *Plastiflex*.

A Celestion *HF1300* is used for the upper mid frequencies, in common with other high quality speaker systems, and there is a 19 mm plastic dome super tweeter extending the response to above 20k Hz. The crossover is designed to attenuate the units at 18 dB/octave and operates at about 3k and 14k Hz.

The acoustic loading of the 1f unit is by means of an eighth wave acoustic line which act rather as a cross between a transmission

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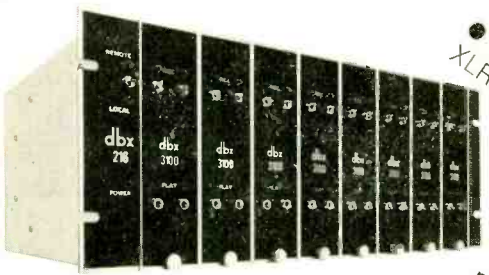

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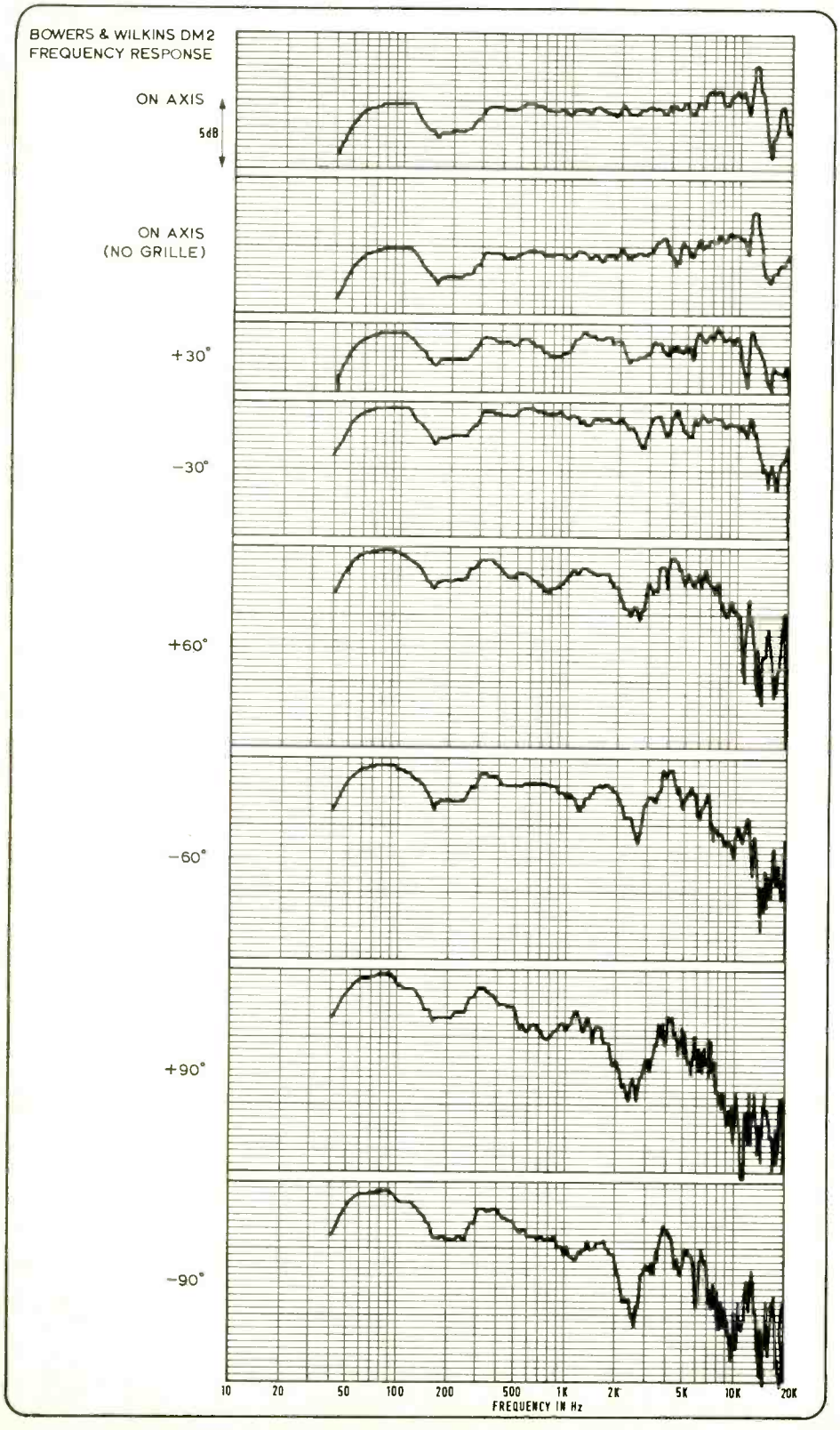
line and a bass reflex. The labyrinth is lined with absorbent materials of different densities so as to absorb sound of different frequencies radiated from the rear of the cone. The lowest frequencies, however, are not absorbed and reinforce the sound from the cone when they reach the port at the bottom of the cabinet. The *DM2* is very well made and comes with an unusually informative instruction manual. This includes curves taken on B & W equipment in B & W's own test chamber.



The cabinet is made of 750 density 19 mm chip board with a 25 mm baffle and is extremely rigid. Finish is in a choice of teak, walnut, rosewood or satin white. The review pair were in white with matt black stands and grille.

The *DM2* is rated for use with amplifiers of up to 60W output and the first test given the review pair was to use them for reproducing electronic music at high level in a concert hall, where they were fed successfully by 60W amplifiers.

My usual test tape was played through the *DM2* pair with the following results.

Choir: Clean clinical sound, a little over bright, but good presence and no coloration.

Musical box: Very clear pleasing sound.

Organ: Very pleasant and natural. Good deep bass but the sound not quite as 'full' as the original.

Folk singer with guitar: Excellent reproduction of guitar. Voice natural and uncoloured but with a very slight 'edge'.

Dance band: Percussion reproduced with excellent realism and other instruments well defined with a pleasing and accurate sound.

Piano concerto: Good string sound. Piano bright and pleasing, very close to the original.

Wind quartet: Instruments clear and well defined with excellent reproduction at the 'top end' but not as 'full' as the original.

Speech: Clear and uncoloured. Very close to the original.

Full Orchestra: Climaxes handled well. Excellent transient and deep bass response.

The *DM2* speakers were used during a recording session so that live/recorded comparisons could be made. They were found to be uncoloured and close to the original except that the 'fullness' of the original sound was again not quite reproduced and balancing on these speakers tended to produce recordings with too much reverberation when played on other monitors.

It is essential that a speaker's frequency response should be as flat as possible and that any deviation at the top end should be a fall, not a rise. The test carried out so far indicated that the *DM2*, excellent as it was, probably had a slight rise in response at the top end and the measured curves confirmed this. The dip in frequency response around 200 Hz may be just before the absorbent material leaves off and the bass reflex takes over. If this is the case, it should be easily corrected.

Because of the power handling and tight control of bass, the *DM2* is excellent for monitoring Pop. The curves are reasonably smooth in the crossover regions, indicating careful crossover. My organ and percussion recording, known to one manufacturer as a 'speaker destruction tape', was handled easily by the *DM2* with no signs of distress—a feat achieved by few other speakers. The curves taken with and without the grille in place show that the material has been carefully chosen and is about as acoustically transparent as any I have tested.

The speakers are supplied in pairs with the units in a vertical line (which is necessary) but off centre (which is not). Curves were taken at 30°, 60°, and 90° off axis on both sides of the cabinet with the results shown. The curves

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HIGH QUALITY STUDIO AMPLIFIER

SPA60

Since valve amplifiers went out of fashion some quite bad transistor amplifiers have appeared with the result that some engineers are still doubtful about transistor amplifiers generally. Radford made very good valve amplifiers and has been very concerned not just to equal the performance of valve amplifiers, but to exceed it.

The SPA60 is a dual channel power amplifier of true complementary symmetry design having virtually zero crossover distortion and very low harmonic distortion up to waveform clip level. It is rated at 60 watts average continuous power per channel into any impedamce from 4 to 8 ohms. Loudspeakers have a varying input impedance and phase angle with frequency but in most high quality loudspeakers the impedance does not fall below 5 ohms. The SPA60 is able to maintain its maximum output voltage at 5 ohms which is equivalent to approximately 90 watts. Loudspeakers provide the quoted response characteristic when driven by a constant voltage at all frequencies at the terminals. If the amplifier is unable to maintain a constant voltage at varying impedances, selective overloading with frequency and transient colouration will occur if the amplifier is driven near clip level. A reduction in the drive to eliminate overlaoding will reduce the rating of the amplifier to the power it can deliver into the lowest impedance of the loudspeaker. Valve amplifiers do not have protective circuits to limit power output and have a broad power/impedance curve.

Another weakness of most transistor amplifiers is the inability to drive a complex load impedance such as a frequency dividing network using ferrite or iron cored inductors. The charge energy from the amplifier to the network is returned to the amplifier in the form of sharp spikes which charge the supply rail and can break down the output transistors. These spikes also arrive at the high frequency drive unit producing a cracking sound as though the amplifier were overloading. The SPA60 incorporates a special design feature which completely eliminates this effect.

These weaknesses in transistor amplifiers together with bad crossover distortion and other design faults too numerous to mention have shown transistor amplifiers to be not always what they are imagined to be.

The SPA60 amplifier is unconditionally stable and safe with any form of output load of any phase and impedance characteristic from short circuit to open circuit and is therefore able to drive transformers. Under working conditions with conventional input sources the amplifier does not exhibit any undesirable inherent characteristics when driving any type of loudspeaker. Its near perfect performance makes it suitable for comparative testing of input sources, loudspeakers and other amplifiers. The presentation is a low format suitable for shelf mounting. The front fascia is an extruded aluminium section fitted with an etched anodised front panel on which the characters are screen printed.

It is available as a standard model; with L.E.D. peak overload indicators (A model); with 10k ohm line bridging transformers (B model), and both facilities (AB model). A descriptive leaflet giving full specification details is available upon request.

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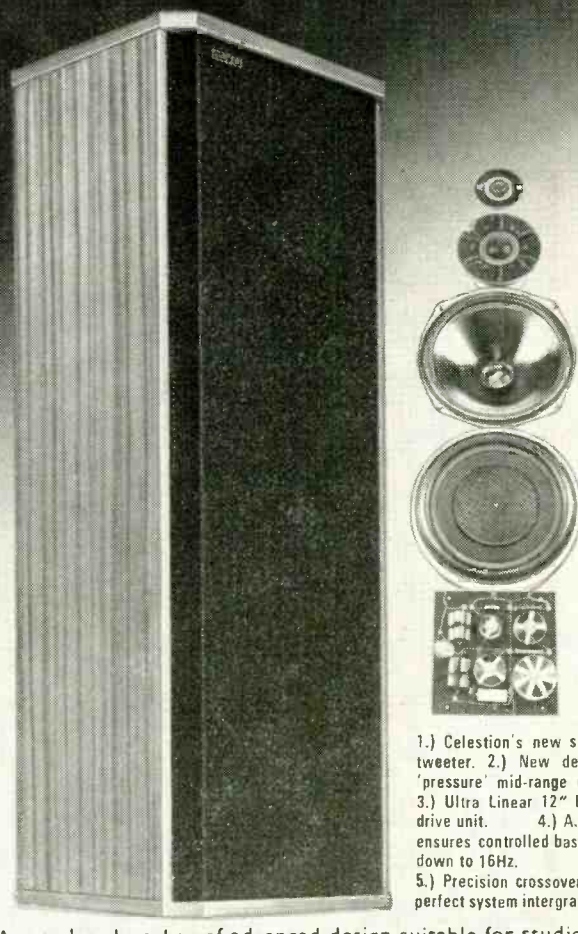

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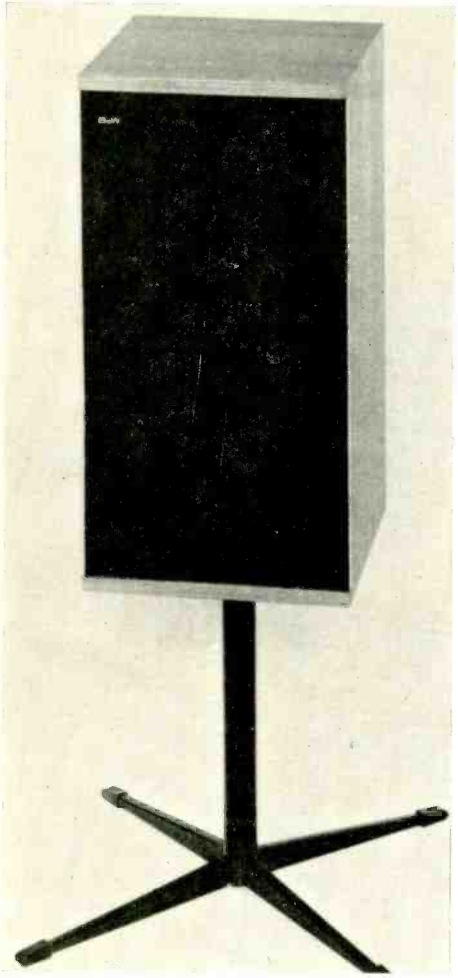
■ B&W DM2 REVIEW

suggest, as anticipated during the listening tests, that the *DM2* would give better results with a little top cut on the amplifier and with this frequency correction most of the reservation made earlier disappear and the speakers give an excellent account of themselves.

I would suggest that B & W give some consideration to readjusting the balance to give less top and a higher output at 200 Hz but, even as it is, the *DM2* is an excellent speaker and can be highly recommended.



■ OPTO-ELECTRONIC LINKS

be safe to predict that weather-caused discontinuity of an otvl as described is likely to be of the order of 1 per cent to 3 per cent. In this respect it is fair to remind the reader that many otvl applications would be cancelled in extremely bad weather (typically sports events and civil engineering). Other cableless linkages (even microwaves) are also dependent to some extent on weather conditions.

Microwave and laser competitors

Other types of cableless tv linkages exist. They are microwave or gas laser based. Of the three, the optolink discussed here has the shortest range. It is, however, far less bulky and far less expensive than a microwave link. Compared with the laser link, the ctvl is cheaper, absolutely safe and not prone to fading through the so called 'beam dancing effect' caused by hot air turbulence. Finally it does not suffer from a strong, surprisingly widely spread anti-laser prejudice, probably born from fear of eye damage.

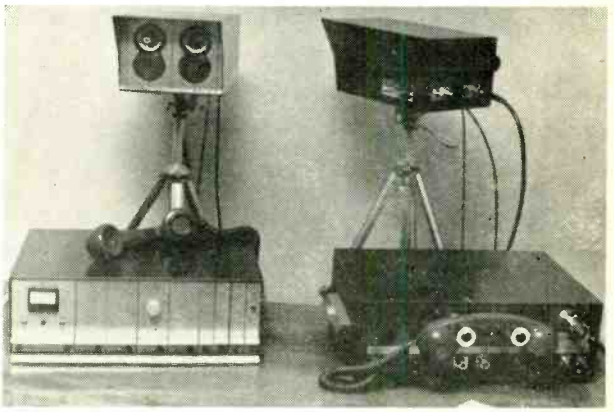
Conclusion

The extraordinarily high frequency of optical carriers gives them intrinsically an enormous modulation bandwidth. With it comes an enormous information carrying capacity. Optical communications, possible today thanks to compact, easy to modulate semiconductor light sources, fast optoreceivers and low loss light guides are only beginning to merge from research and development laboratories.

The development of an optoelectronic linkage for 'short hop' transmission of television programmes in free space has been more than 'an exercise in optical communications' for Leevers-Rich. It resulted in a commercially valid piece of equipment invaluable in situations in which interconnecting VTR's video cameras and tv monitors evokes 'jumping rather than clinging'. Even though the jumps are modest hops for the time being, anticipated applications are many, both permanent and temporary. This is particularly so as the available bandwidth can be split in a variety of ways and allocated to a score of functions not only within the field of television but also quite outside it.

References

1. Chaimowicz, J. C. A. 'Semiconductor light source for industry' and listed bibliography, *Product Design Engineering* October 1965, page 59.
2. Chaimowicz, J. C. A. 'Immunity to daylight', *MCP Electronics World*, No 2, vol 2, page 6.
3. Keyes, R. J. and Quist, M. *et al.* 'Optoelectronic devices etc' (Weber Editor), McGraw Hill, page 86.
4. Kane, G. 'What's ahead for optical communication?' Optical Spectra, October1972, page 24.
5. Gambling, W. A. 'Glass fibres for communication electronics and power, December 1972, page 446.



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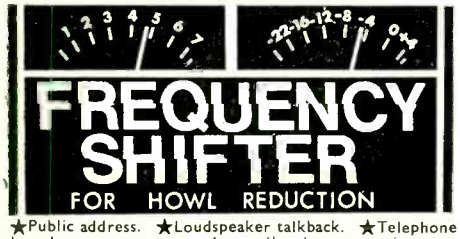

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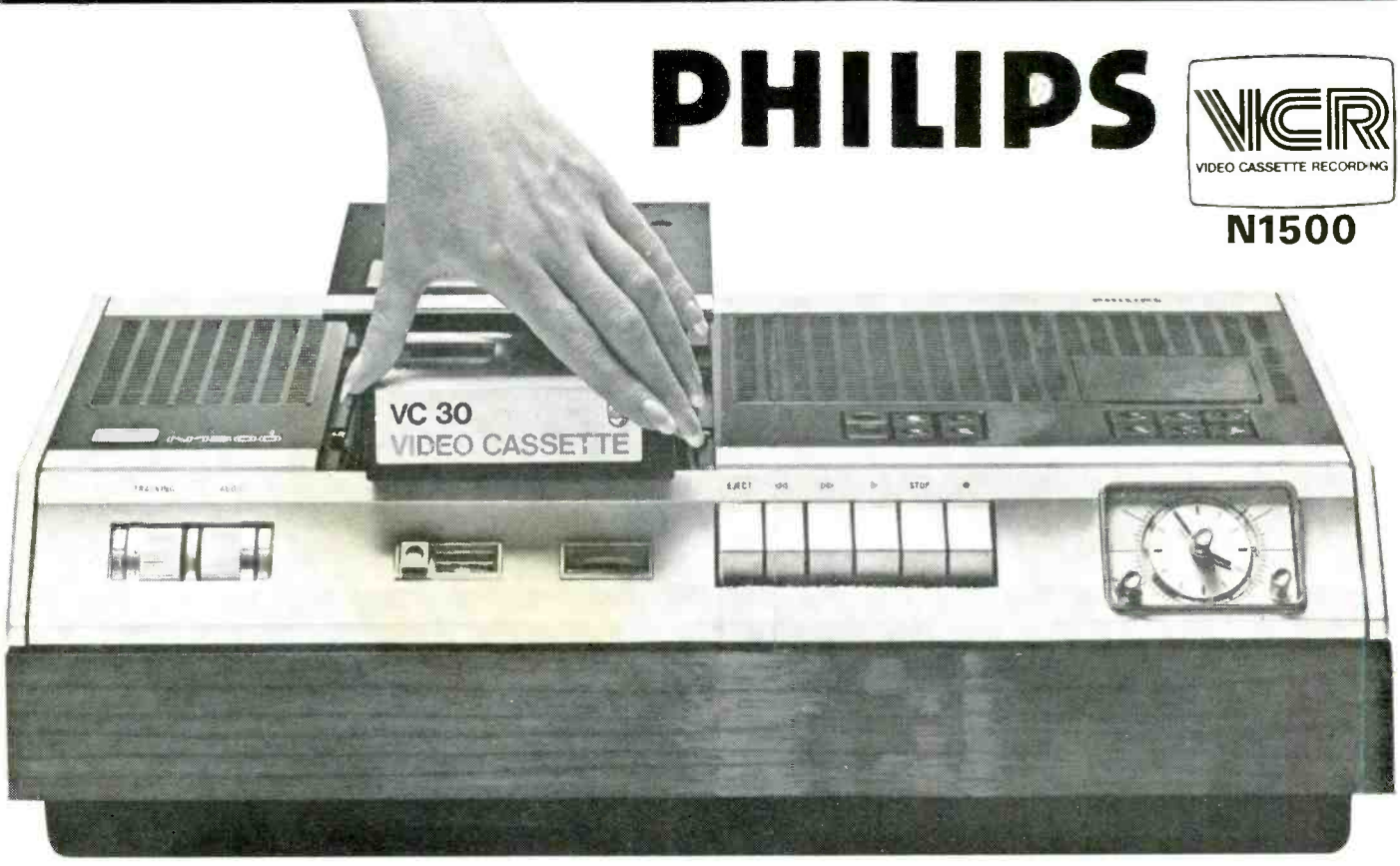

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