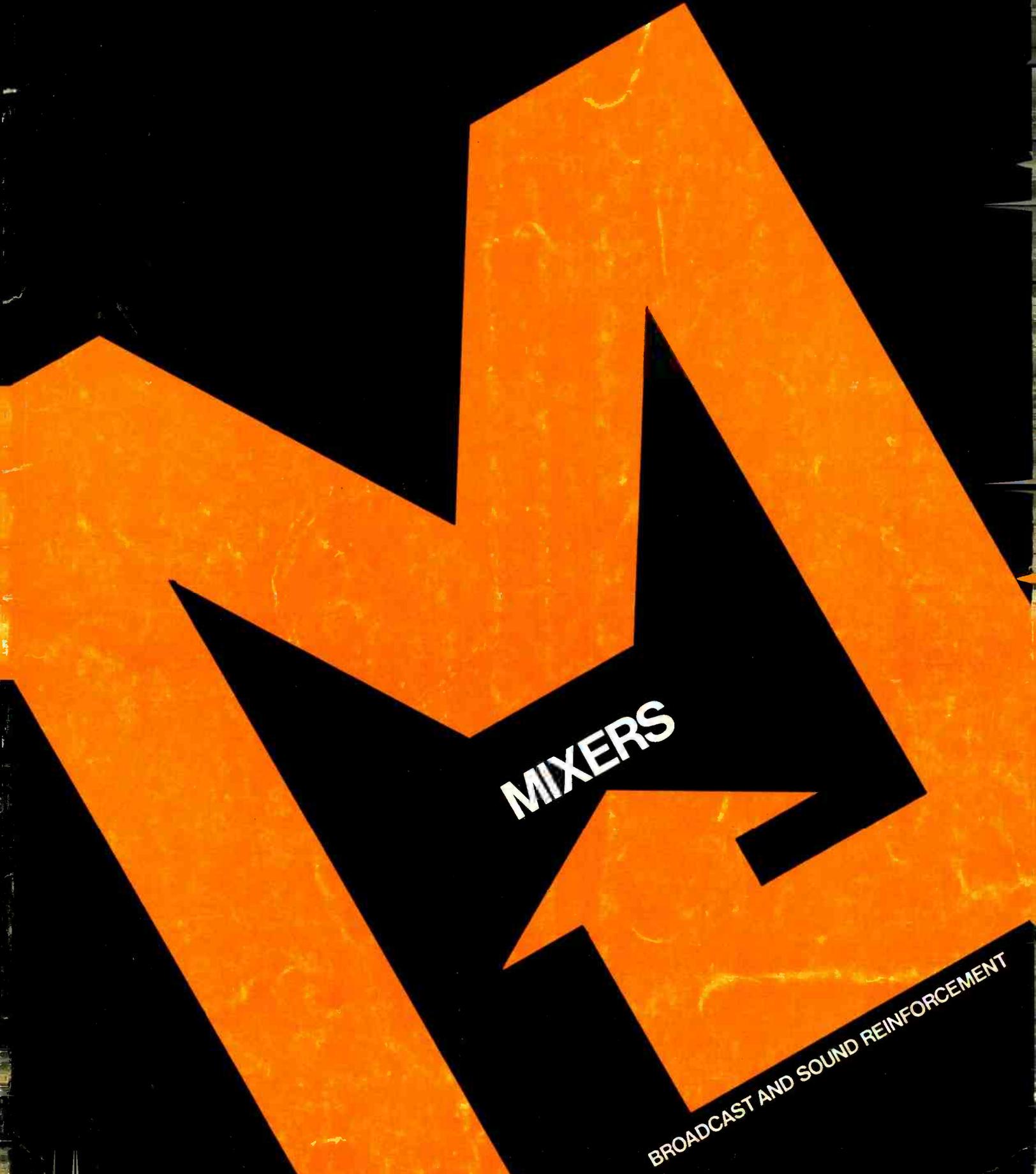


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 Telex: 847708
 Telegrams: Aviculture Croydon
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STUDIO SOUND is published on the 14th of the preceding month unless that date falls on a Sunday when it appears on the Saturday.

SUBSCRIPTIONS
 All enquiries to: Subscription Dept, Link House, 25 West Street, Poole, Dorset BH15 1LL. Poole (02013) 711171.

DISTRIBUTION
STUDIO SOUND, published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. It is available without charge to qualified readers; these are directors/managers, executives and key personnel actively engaged in the sound recording, broadcasting and cinematograph industries in any part of the world. Non-qualifying readers can buy *STUDIO SOUND* at an annual subscription of £7.60 (UK) or £7.20 (Overseas), Express (air mail) as follows (extra charge over paid or free subscription): Argentina (B), Angola (B), Australia (C), Austria (X), Barbados (B), Belgium (X), Bermuda (B), Botswana (B), Brazil (B), Bulgaria (X), Canada (B), Chile (B), Colombia (B), Cyprus (X), Denmark (X), Finland (X), France (X), Ghana (B), Greece (X), Holland (X), Hong Kong (B), Hungary (X), Iceland (X), India (B), Indonesia (B), Iran (A), Israel (A), Italy (X), Jamaica (B), Japan (C), Kenya (B), Lebanon (A), Malawi (B), Malaysia (B), Mexico (B), Monaco (X), New Zealand (C), Nigeria (B), Norway (X), Peru (B), Philippines (C), Poland (X), Portugal (X), Rhodesia (B), Rumania (X), Singapore (B), South Africa (B), Spain (X), Sri Lanka (B), Sweden (X), Switzerland (X), Tanzania (B), Thailand (B), Trinidad (B), USA (B), Virgin Islands (B), West Germany (X), Yugoslavia (X), Zambia (B).

ONES
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 B £18.84 (12 Issues)
 C £22.56 (12 Issues)

INDERS
 Loose-leaf binders for annual volumes of *STUDIO SOUND* are available from Modern Bookbinders, Chadwick Street, Blackburn, Lancashire. Price is £2.00 (UK and overseas). Please quote the volume number or date when ordering.



Total average net circulation of 8899 per issue during 1975. UK: 5689 overseas: 3210. Total average net circulation of 10 030 for January 1976. UK: 6003, overseas: 4027

studio sound

AND BROADCAST ENGINEERING

It's never an easy job to review studio hardware since a purely technical appraisal rarely tells the whole story. Often, the greatest difficulties occur at the outset when trying to decide what aspects are of real importance, rather than those dealing purely with specmanship. Consumer audio doesn't pose the same problem: its only task is to reproduce a basically immutable signal to the satisfaction of the listener. For the reviewer's part, he has to decide quantitatively and subjectively the efficacy, a comparatively simple procedure.

The foregoing serves to illustrate the fundamental difference between consumer and professional audio gear. The former provides a single function while the latter should offer a totally creative tool whereby lateral implementation is an essential feature.

When reviewing studio hardware, one of the most important requirements is to assess product suitability within the recording chain as a whole; amps and volts on their own give little indication as to how the review sample will help an engineer/producer. These gentlemen simply wish to know what new options a particular piece of equipment offers: only the maintenance engineer is really interested in heavy technicalities because these could well affect his overtime payments. However, a technical approach must be considered—a heterodyne synchronised sound inverter with a headroom of only +10 dBm will completely rot a biofree emission stabiliser requiring an input level of +20.

This issue, we consider broadcast and sound reinforcement mixers; January deals with studio mixing consoles. To each we have taken a different approach regarding the problems of review. The requirements of pa are fairly straightforward in that a mixer should provide adaptability of interface coupled with a fairly simple routing arrangement. Naturally, the monitoring should provide sufficient unanimity to enable lining up without '1, 2, 3, testing etc'. This implies that meter and headphone should inspire confidence.

Reviewed equipment must be assessed sympathetically. Pa mixers require greater technical discussion since the equipment with which they are used exhibits a greater variability of input source. For instance, they often have to work with cassette machines, balanced mics, unbalanced mics, low priced echo unit, guitar direct injection and turntables. The resulting examination of the hardware review deals with such topics.

For studio models, different criteria are involved. Channel equalisation becomes important because overall adjustment is insufficient. The patch bay must encompass every combination without recourse to hard wiring; intermode switching (as between source and line) should be accomplished at the push of a button. Therefore, we thought it more beneficial if Keith Slaughter canvassed recording engineers' opinions of the equipment they used rather than offer a technical appraisal in our usual fashion. If operational deficiencies are apparent, we have chosen to rely on people's ears rather than reviewers' instruments.

Perhaps, this is the way it should always be.

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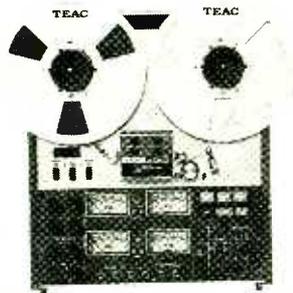
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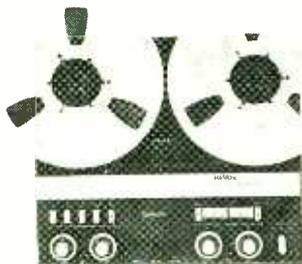
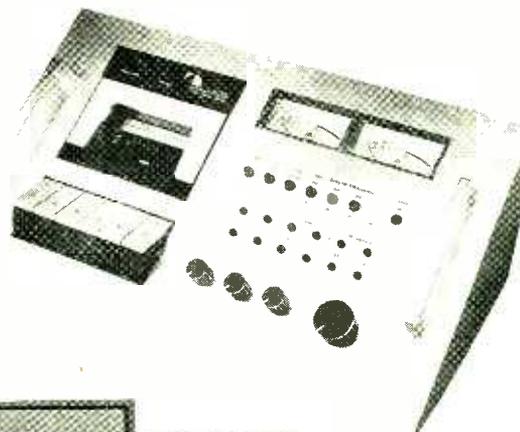
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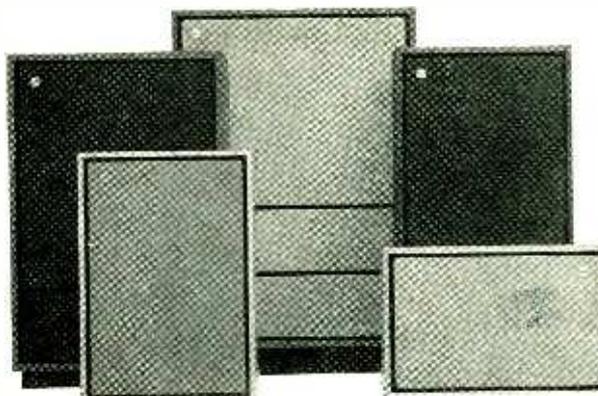


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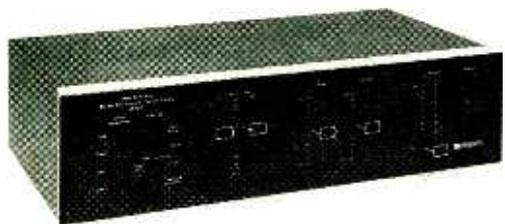
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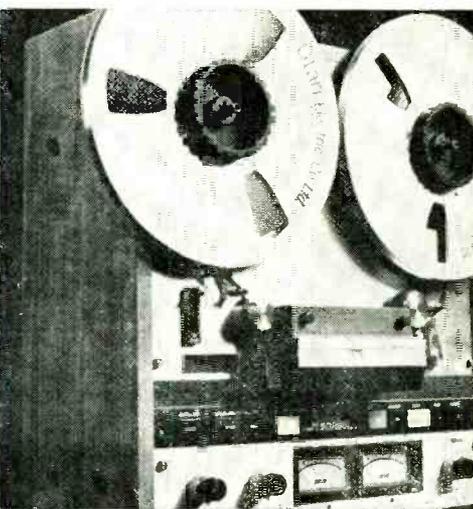
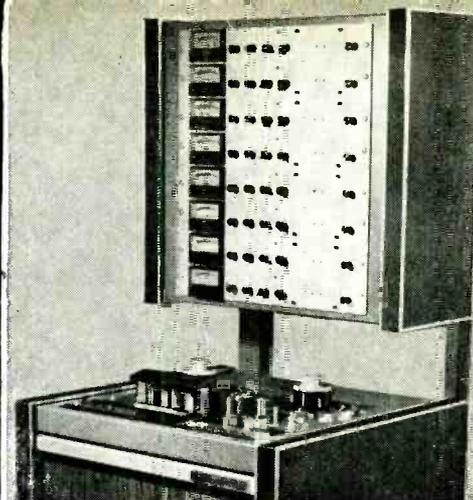
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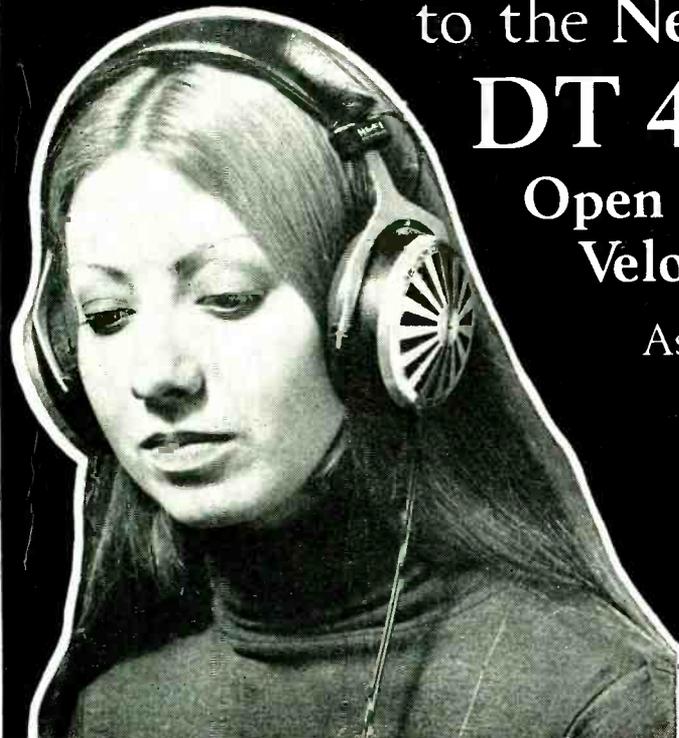
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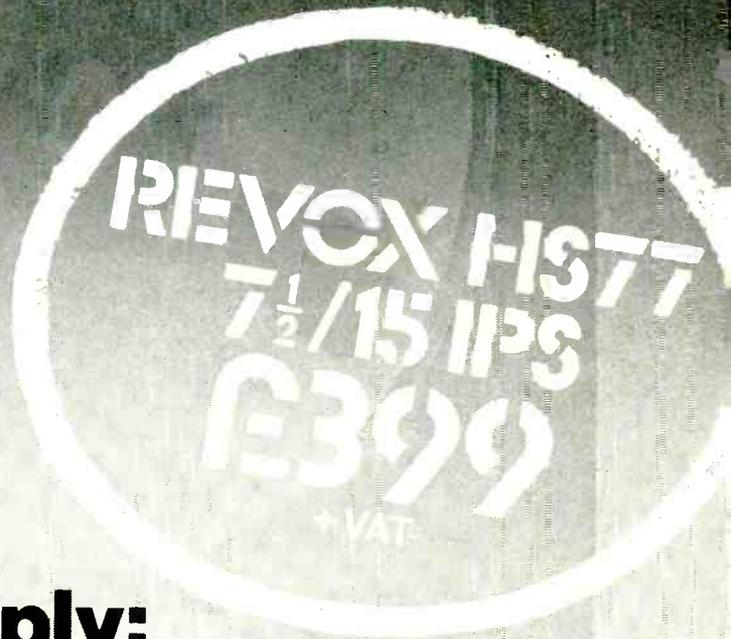
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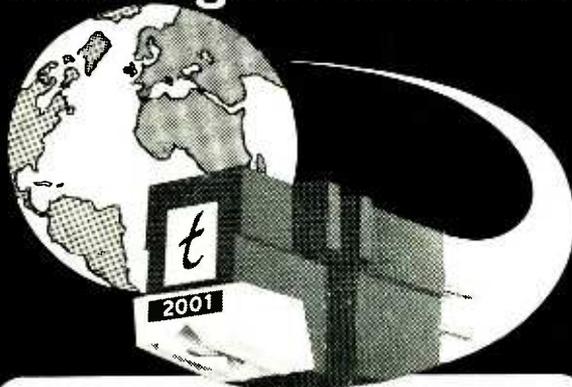
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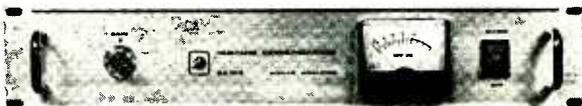
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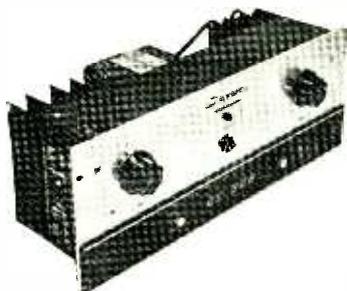
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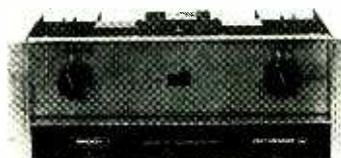


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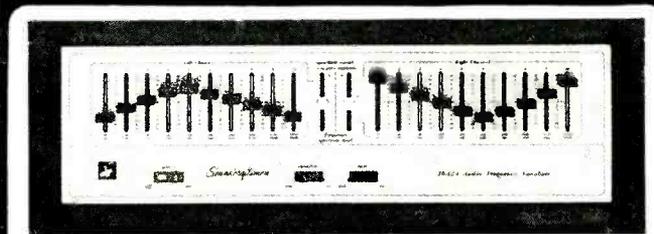
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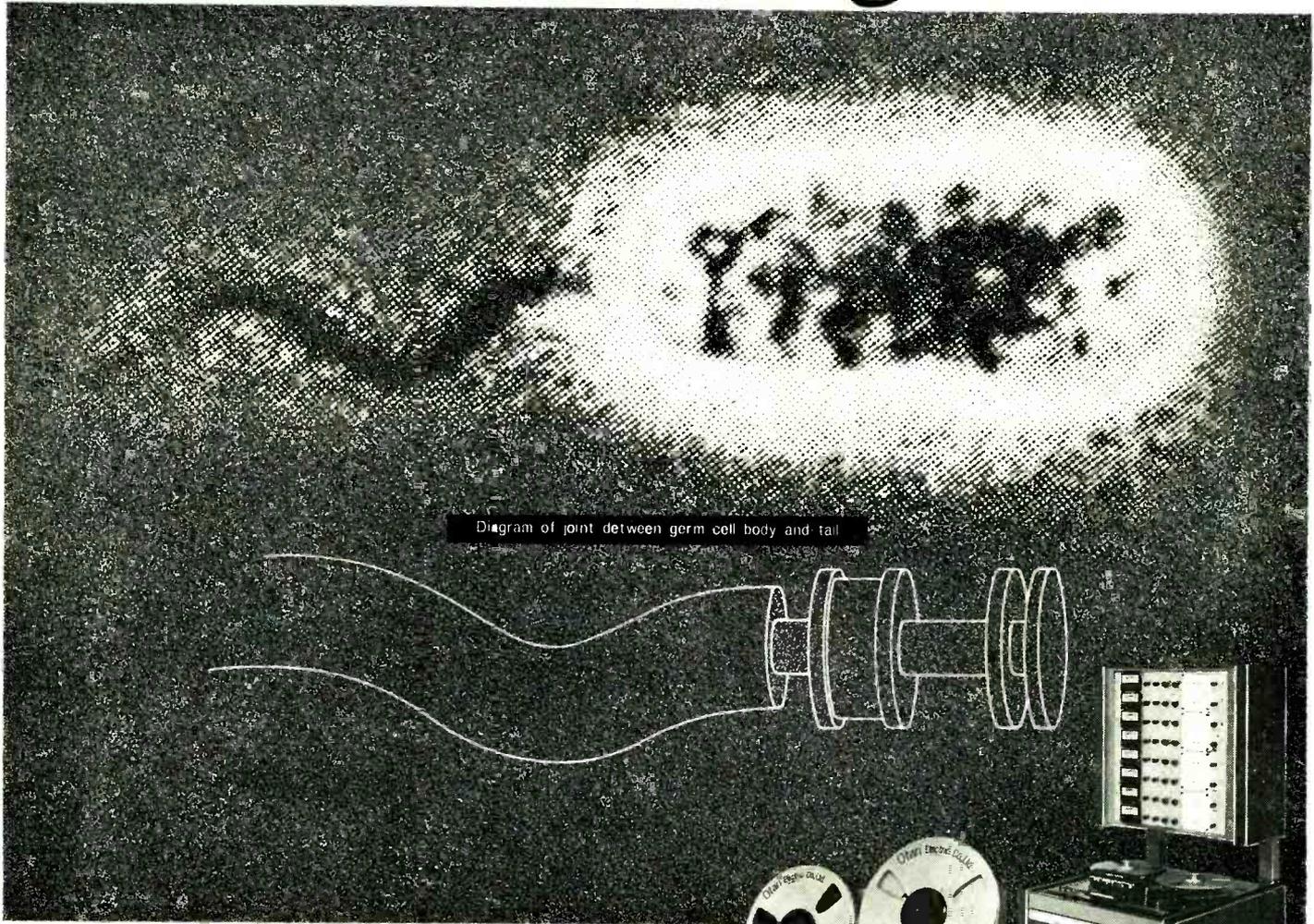


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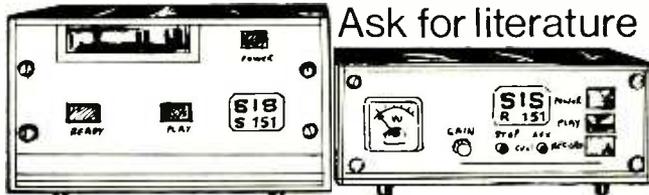
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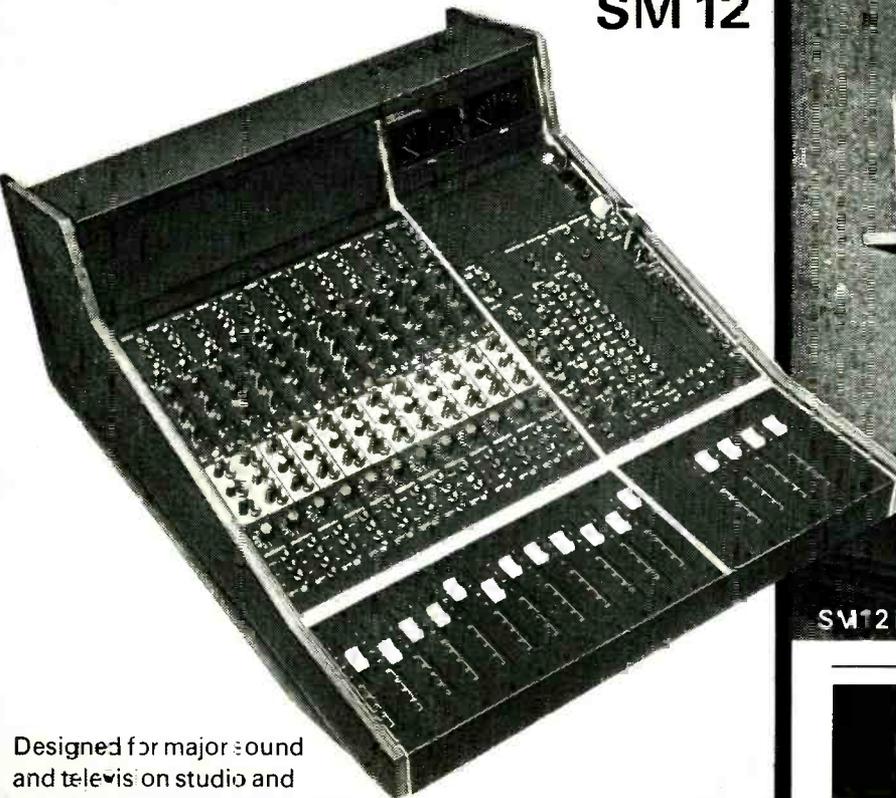
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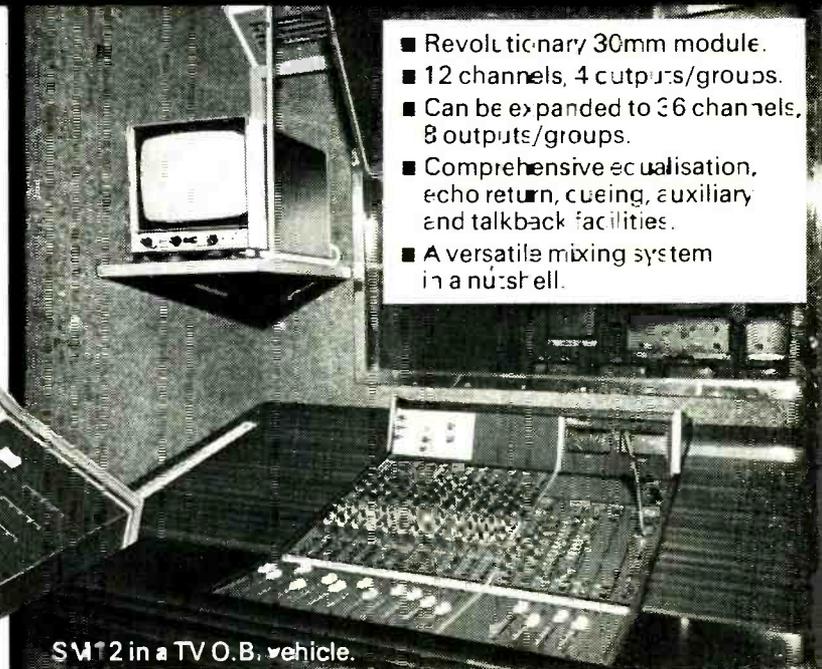
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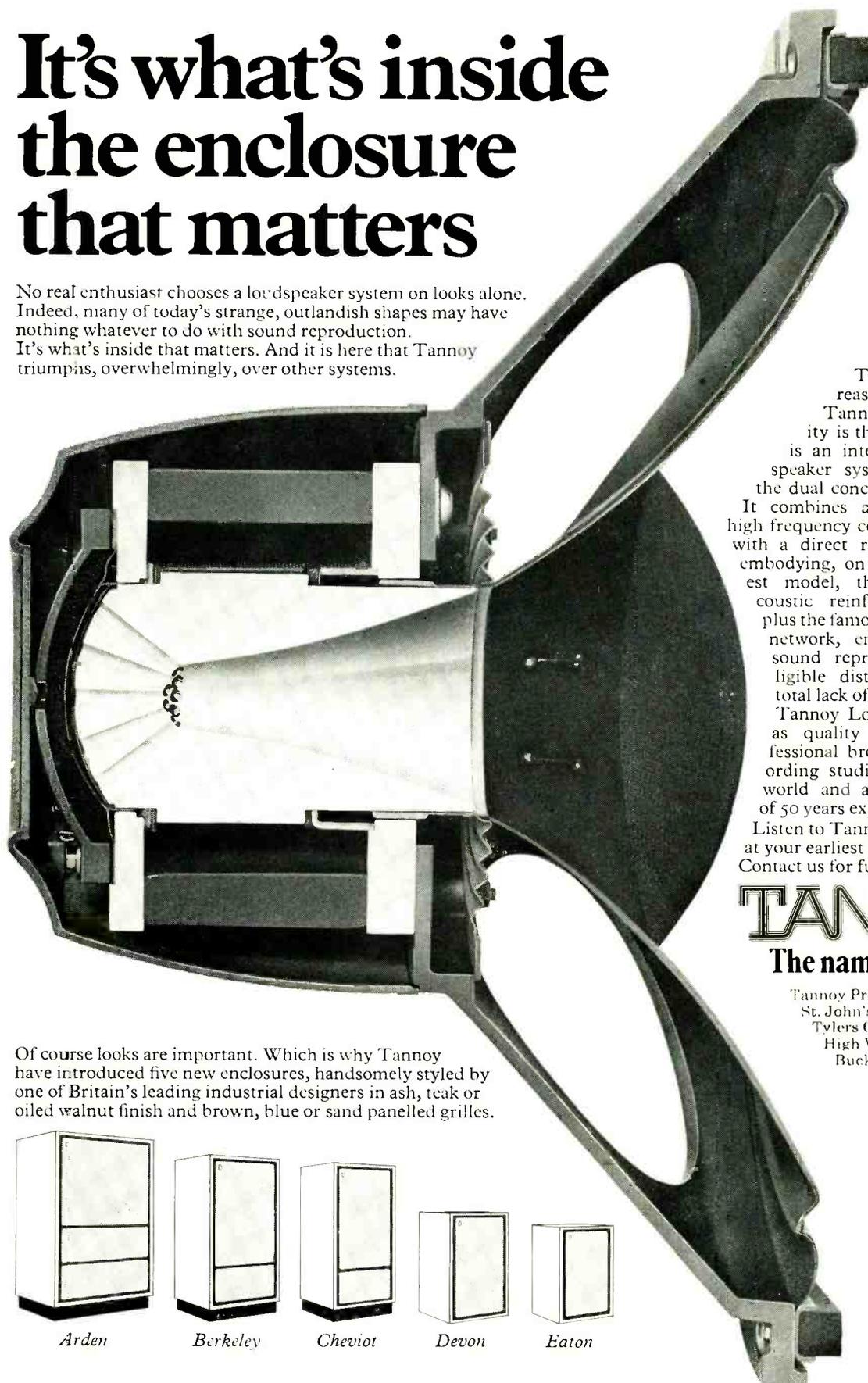
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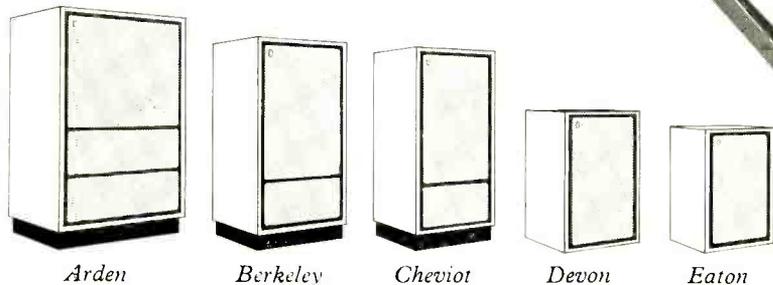
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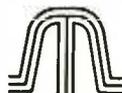


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< 0.1% THD at line levels for
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FREQUENCY RESPONSE:

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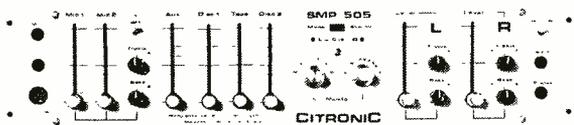
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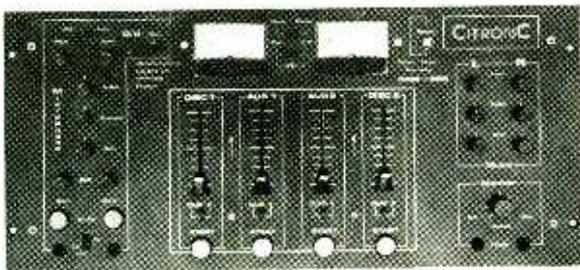
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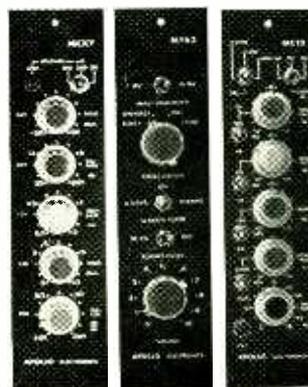
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Features include tape motion sensing, servo-controlled capstan and constant tape tension – all with full logic control, for the protection of machine and tapes. For example, switching from fast rewind to play results in a fast but smooth

changeover without a hint of snatch.

There are five basic models, providing a choice of mechanical configurations and electronic facilities. Specifications for all models are conservatively rated, and minimum maintenance is required to keep the machines in peak condition.

The October 1976 edition of "Studio Sound" has a 5-page evaluation of a Studio 8 recorder. Hugh Ford, summarizing his comprehensive report, commented,

"The Ferrograph Studio 8 is by many standards a very cheap studio machine, but its performance and general facilities are by no means in the 'cheap' bracket. Performance figures quoted by Ferrograph do not do justice to this recorder, which is capable of making full use of the latest low noise and high output tapes."

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Ferrograph Studio 8 the broadcast tape recorder with proven reliability.

IBC 76

The International Broadcasting Convention is becoming an increasingly important feature of the international broadcasting scene; not, perhaps in the same way as the NAB convention in Las Vegas since the latter can be guaranteed to draw delegates from the vast catchment area of American commercial radio. This prevents tv swamping either the lectures or the accompanying show. For the IBC, a biennial event, which took place towards the end of September, television was the main theme. Although sound is an integral part of tv production, it seems distinctly a poor relation and was represented accordingly. There were about nine exhibitors who dealt principally with sound engineering (see preview *STUDIO SOUND*, October, p32) but this was a very small proportion of the overall exhibition.

There are few exhibitions which can be described as 'fun' but most are comfortable and occasionally enjoyable. For instance, the APRS show is a fairly hard sell exercise but retains a friendly atmosphere in spite of the large size, larger than the IBC show. However, the latter is not a friendly show, an opinion that was only mildly influenced by the totally indifferent attitude of the official Press Office—a well heeled organisation that seemed to spend most of its time pushing parma ham and appellation controllée claret into its collective face to the exclusion of other duties. Sour Gripes aside, there wasn't much laughter around the stifflingly hot exhibition.

It had little to do with the volume of goods being sold since

the Arabs were reported to be spreading the petrodollars around like there was no tomorrow. One imagines that if they continue spending our 81p for 4-star at the rate they are, there will eventually be one tv broadcast network, ten *Sea Cat* missiles, five *Churchill* tanks and a camel per capita for the entire population of Qatar. No, people did a lot of business at the IBC 76. For example, Pye TVT sold eight *Triax* colour cameras, manufactured by Philips, to the massive ABC-TV broadcasting network and that's a lot of business. People in video broadcast engineering are simply a rather humourless race of grey suited perspiring gentlemen who spend our licence fees with a detachment that has to be seen to be believed.

Humanity aside, there were one or two other aspects of the show that were interesting, but hardly at all in the audio field. The Thomson CSF *Microcam*, a small, lightweight tv camera which looked about the same size as a 16 mm conventional film camera, opened new possibilities in electronic news gathering. It is intended for operation by a two man team from back pack relay or small mobile tv truck. When used with a mobile vtr, news can be as immediate as the time taken to bring back the video tape from the recording location to the news room. With a suitable truck mounted microwave link, news can be live in much the same way as radio cars provide live news coverage. The surprising thing is that these small cameras cause very little deterioration in picture quality.

All around the exhibition were

reminders that 1984 is only six years away . . . Orwell could easily have had a conceptual part in *Ceefax*, *Oracle*, *Viewdata* or the collective *Teletext*. Monitors gratuitously supplied information on the state of the £, the stock market, the weather etc, page selectable through a calculator style keyboard. *Oracle/Ceefax* have been operational for a considerable period—the BBC employs 15 journalists full time on *Ceefax*—but it took the IBC to bring out the realities and the omens for this particular audience of one. The source of this potentially widely disseminated information rests with large, anonymous public bodies who rarely answer to a democratic voice. At the moment, the idea is good and deserves success but it should have its watchdogs.

On the audio side, FWO Bauch showed a new tape recorder, the *B67*, based on the *Revox A700* transport. It replaces the *A67* and offers additional features such as a balanced interface, better editing facilities and a digital tape timer. Mike Bauch stated that the new machine will sell for about 10% more than the model it replaces. The full range of *Revox* consumer products were on the same stand.

The BBC engineering department gave a demonstration of a new radio microphone system which claims to eliminate fading and noise altogether. Basically, it operates by summing the outputs of four receivers which have their aerials placed at strategic points around the stage/studio. This is not the same thing as diversity switching whereby the audio output is switched to the receiver with the highest signal-to-noise ratio. It actually combines the audio outputs of all four in such a manner as to constructively increase the signal-to-noise higher than that of any individual set. Further, since summing is a continuous process, there can be no switching noise in the output. The gentleman from the BBC walked off with the microphone around the show, muttering things about large fun bags on the *AKG* stand, while people listened

to the roving commentary through headphones connected to the receiving system. Very impressive indeed; not even the slightest trace of fading. Production licences are under discussion with two unnamed manufacturers. **Frank Ogden**

New studio

Earmark Sound Recording Studios of Philadelphia, USA recently opened its doors 'sparked with optimism and backed with a complete range of facilities'.

Located in the heart of the city centre at 2225 Spring Garden Street, Earmark claims to be the only studio in the area to offer synchronised projection facilities for use in motion picture scoring. It was built by Steve Bruno who has worked in quite a few studios around the world including *Electric Lady*, New York; *Thundersound*, Toronto, and *AIR*, London. Earmark is 16 track and follows very much a European design with regard to the high separation attainable. Not much information is available at the time of writing but other attributes are said to include a 57 year old Steinway and a not so old Tannoy based monitoring system.

New brochure

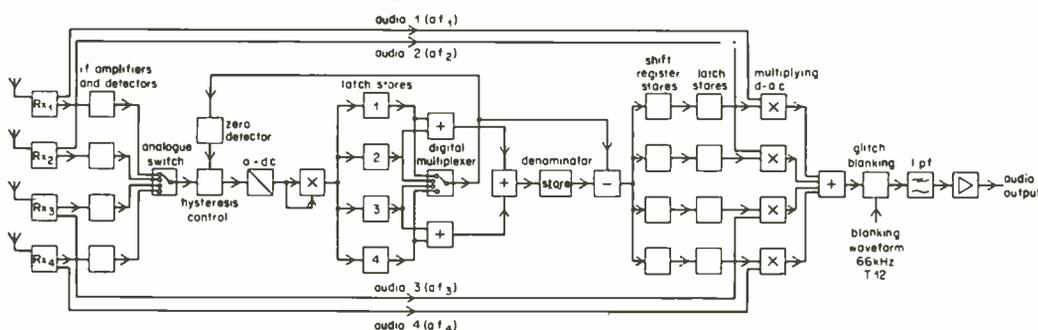
Fidelipac, the cartridge manufacturer, has brought out new pamphlets containing the latest details of the company's product range. This includes normal and extended play cartridges, the new *master cart* which claims very low phase aberrations, storage racks and splicing accessories. Fidelipac, 109 Gaither Drive, Mt Laurel, NJ 08057, USA. Phone: (609) 235 3511.

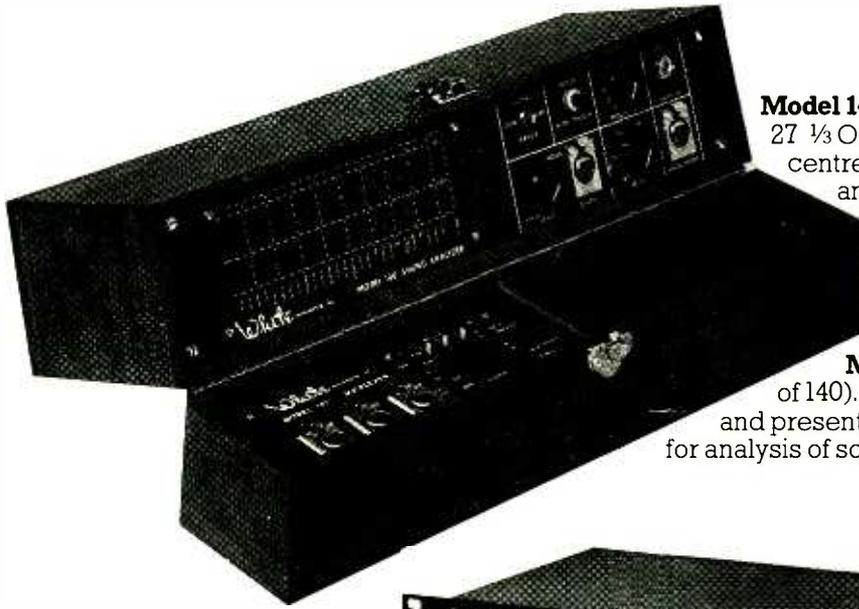
Happy psophometry

A psophometer is an instrument which measures signal-to-noise ratios and B&K make one. The new *2129* is intended for applications in telephone and radio communications; it offers both subjective and objective determination of signal-to-noise ratios in channels which use the ear as the final receiver. The specification for the instrument complies with international standards CCITT-P.53 and CCIR-468-1 for psophometric measurements.

B&K Laboratories Ltd, Cross Lances Road, Hounslow TW3 2AE. Phone: 01-570 7774. 24 ▶

Radio mic diversity receiving system—block diagram





Model 140 Acoustical Analyser.

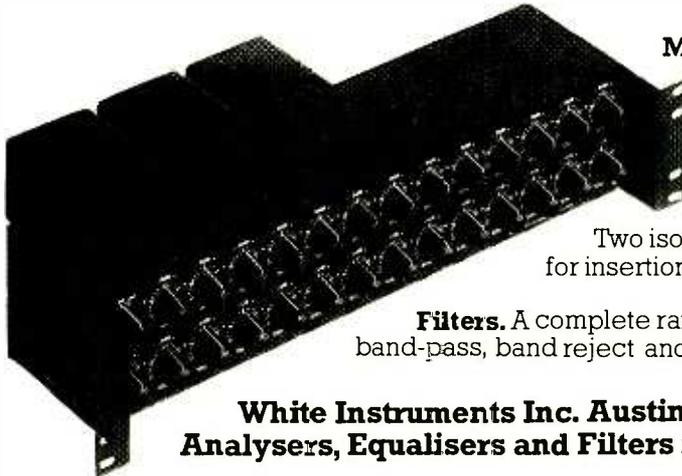
27 1/3 Octave double-tuned filters on ISO centres from 40Hz to 16kHz and broadband indication of db SPL reading out on a matrix of 319 LED's. Built in pink noise generator for system excitation.

Model 141 Micplexer (shown in lid of 140). Multiplexes three microphones and presents single output signal to a Model 140 for analysis of sound field.



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Milan show

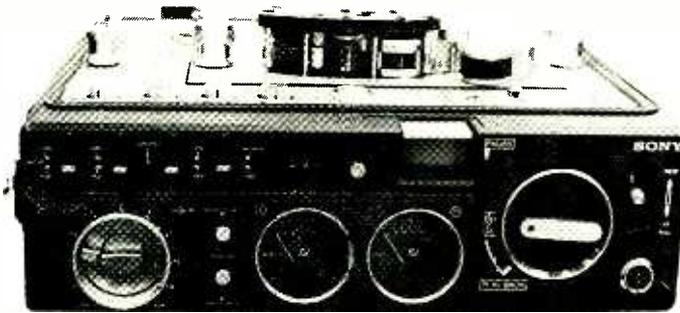
This year's Salone Internazionale della Musica e High Fidelity, which took place at the beginning of September in uptown Milan, Italy, was the 10th to be held and as yet the largest, being about 70% larger than last year's. Everything about it required a superlative to describe it. Greatest—like the number of stands which required about two days of hard walking to get around. Most spacious—in spite of the prodigious number of exhibits, it wasn't cramped even in the most crowded aisle. Sores— as in aching feet. Most efficient— everything was clearly laid out with adequate directions. Best eats— absolutely no exhibition special sandwiches curling up at the edges to offer a preview of what's inside: the restaurants were a gourmet's paradise at minimal expense, at least compared with Earl's Court.

The show has two basic divisions: musical instruments and amplification and high fidelity. There is a further subdivision. The consumer audio side has part of a pavilion devoted to communications and cctv, video recorders etc.

Housed in a single, vast pavilion, the musical instrument and amplification division truly represented a complete spectrum, displaying all the hardware required for every application from symphonic orchestral to heavy rock. The show boasted all types of instruments including the World's greatest pianos such as Bechstein and Bösendorfer ranging to several makes manufactured in the Soviet Union. Although the finest examples of the former had *Non Toccare* notices covering their beautifully polished exteriors, a clandestine plonk or two demonstrated exactly what the £6000 plus price tags meant compared with ordinary pianos, although the most expensive Yamahas possessed a beautiful timbre coupled with good action at about half the price.

The display of brass and woodwinds probably was as large as that exhibited at the Frankfurt Fair with a very strong contingent coming from behind the iron curtain as is always the case with these types of instrument. China, in particular, would appear to be an increasing source of lower priced instruments ranging from brass to classical guitars although all the usual manufacturers were represented.

Italians have always been closely allied to the production of live music, with probably more musical instruments per capita than any other country in the world with the



Sony report open reel machine (no relation)



Laboacoustica-agents for Neve and others in Italy

exception of Eire and the States. It is for this reason that there are so many Italian manufacturing firms producing high quality pa and sound re-inforcement hardware. Generally, it leads its particular market; for instance, pa equipment for rock music usually incorporates some sort of fairly advanced loop echo unit using a pinch wheel and a cartridge/bin tape carrier integrated into the stage mixing desk. Further, it normally incorporates at least two foldback lines even in the down market equipment. Davoli provides

a good example of this. Sound systems are very user oriented. Whereas a large percentage of UK and US pa firms suffer some degree of identity crises—they usually state their mixing desks can find applications in small recording studios—the Italians make no such promises. Their equipment is purpose-built for sound re-inforcement only and, as such, does the one job better.

It would appear that every country with an audio industry of any degree has a massive front line of amplifier and speaker manufac-

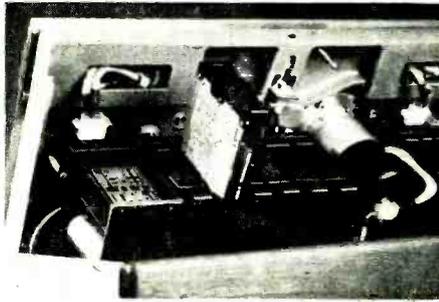


turers, each claiming success in the quest for the Holy Grail of sound ideal. It isn't really clear why this should be; by far the largest section of the show catalogue—and the show—was devoted to noise transducing products from many different sources, the majority of which were rather obscure. Unfair? Try these . . . Cabotron, ESL, Horugel, Lectron, Limec, Mac, Mack etc, etc. The proliferation must have something to do with the fact that most amplifiers and speakers are low in technology and high in subjectivity. This isn't intended as a criticism but simply as an explanation. The electronics of amplifiers are well known and available to everyone which means that they provide few problems in manufacture. Similarly, loud-speaker cabinets (few pa companies manufacture their own drive units) have about as much technology as a teak table. There are exceptions, such as those which have been designed subject to vibrational analysis but they rarely occur within pa equipment. Still, they generally fulfil their function and the punters seem happy enough.

On the consumer side, Milan didn't offer much that hadn't been seen before, although one could be forgiven for thinking that the reason had something to do with people running out of ideas for variations on a basic record player. For instance, you wouldn't believe what they did to a simple thing like a tuner amplifier, a well-known German make actually built in Italy. They gave it no less than six vu meters, added more eq facilities than the average disc cutting console, a battery of leds which defied purpose (the inscriptions were in German) and a digital readout of the reception frequency which probably also told the time in Tokyo. All very wonderful but rather unnecessary.

There was little evidence for the second coming of the quadraphonic revelation which, in the past, has managed to arise. Phoenix like, from the ashes of promoters' dreams, just in time for the big show. Exhibitors dismissed quadraphonics with a 'no public interest so why bother to show' attitude. At least one prominent licensee to the big four simply said: 'Quad. Quad? I tell you what . . . I show you some direct drive turntables . . .' It summed the current situation well.

One manufacturer, Sony, displayed domestic recording equipment using the recently unveiled *Elcaset*. Looking like an overgrown compact cassette transport, it appeared both in a music centre as well as in cassette recorder for-



Quartz precision. What it's done for watches, it does for the F400



In timekeeping, quartz accuracy is measured in millionths of a second. That's precision.

Now, with the F400 from Schlumberger, quartz precision comes to professional tape recording. Because the F400's DC drive motor is crystal-slaved and phase-locked, setting new standards of stability in tape transport speeds. Better, in fact, than 0.02%. With stability like this, the necessity for a speed control is eliminated.

The slave facilities make the F400 ideal for integration into computer-controlled systems. The DC drive makes possible a wider range of speeds; forward and reverse tape transport; and easily

controllable acceleration and deceleration.

Other features include modular construction of both mechanical and electrical components for easy maintenance, and hard-tipped long-life magnetic heads.

So when it comes to the latest technology in professional tape recording, think quartz. Think precision. Think F400.

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NEWS

mat. The price was not revealed. The same company also showed a Chinese(?) copy of a Nagra *IVS* even down to that erstwhile unique vu metering which provides so much information on the original. Even the most frantic hand waving on the part of the Italian Sony representative couldn't convey the machine's genre or capabilities but that's the ongoing hassle of non-English shows. **Frank Ogden**

Ferrograph machine

The recently introduced *Logic 7* machine incorporates several new features to what is basically a consumer recorder. Principal update concerns the use of logic circuits to control tape handling, preventing spillage etc. To do this, it employs tape motion sensing and fluid damped tension arms.

The machine is equipped with a four digit mechanical counter and a variable spooling control enabling speed adjustment from fast forward to fast rewind at the turn of a single knob. Leds indicate transport status while function buttons can be duplicated on a remote control. The signal switching allows sound on sound and echo.

Wilmot Breedon Electronics, Durban Road, South Bersted, Bognor Regis, Sussex PO22 9RL. Phone: 024 33 25811.

AKG UK boss to go

Peter Eardley, the miniscule microphone supremo, is to leave AKG UK at the end of the year to pursue unrelated photographic interests of an unspecified nature.

Eardley was introduced to the parent company through his father's company which distributed a number of electronic products in the UK including AKG equipment. He started selling their microphones in 1962 and from there became more involved in the entertainment business. Trade increased culminating in the formation of AKG UK in 1969. Since then, business has multiplied 800%.

He is probably best known in the industry for deploying ladies with enormous titties as sales aides at the various trade shows.

Broadcast modules

Modular Audio Products has recently introduced two modules to its range of console mounting units. The *STL 22* (stereo line in-



The new Ferrograph logic 7 showing push button controls and open face head blocks

put) and the *STM 22* (stereo mic input) can be assigned to a stereo output buss either left or right, combined or mono. They incorporate plastic faders, on/off switch and left/right level controls. Either unit requires a cut out 32.3 x 3.8 cm. They occupy a depth of 9.6 cm. Units are said to comply with NAB specifications for equipment in the signal path.

Sylvan Ginsbury (UK) Ltd, 108 High Street, Strood, Rochester, Kent ME2 4TR. Phone: 0634-721484.

inadvertently left out a listing for Sound Research Laboratories Ltd. They have recently written to us to tell of their existence and admit to being 'slightly peeved' at the omission.

Naturally, we attempt to make our surveys as comprehensive as possible but we aren't omniscient. We would therefore ask that those people who provide services likely to be a subject for our surveys to write in (address p3) requesting a special features list. This list gives advance warning on survey subject matter.

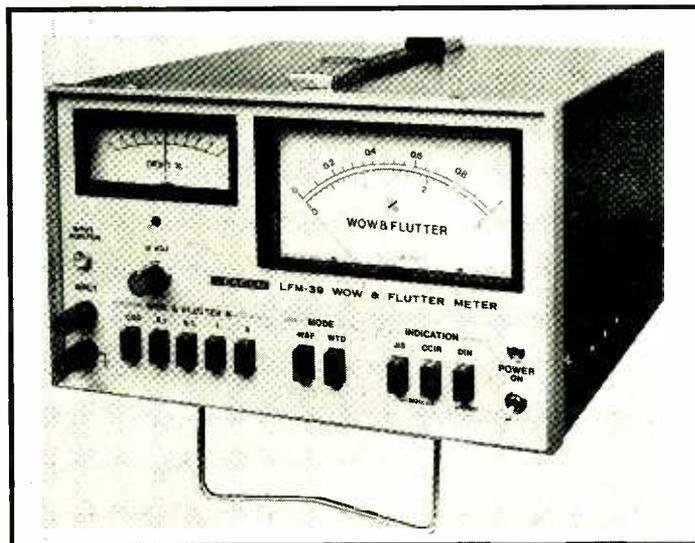
Sin of omission

Still on the topic of surveys, we gave incorrect details in the *Stellavox* entry of the tape recorder survey, October 76.

Sin of omission

In the survey of studio consultants —STUDIO SOUND August 76—we

Leader LFM-39 wow and flutter meter



Principally, we quoted the UK agents as AV Distributors of London. This company no longer has any connection with Stellavox. The new agents are: John Page Ltd, 169 Oldfield Lane, Greenford, Middlesex UB6 8PW. Phone: 01-578 0372.

Further, the quoted data should have been updated as follows:

Equalisation: NAB or DIN to order.
Head type: interchangeable including either pilotone or synchrotone.
Tape speed: 38, 19, 9.5 cm/s and external control.
Wow and flutter: 0.07% DIN at 19 cm/s weighted.
Microphone connectors: Cannon male or female.
Optional extras: many including large spool adaptor, synchroniser and 50/60 Hz quartz pilot generator.
Price: basic machine costs £1650 (\$3598).

Automatic test equipment

Mellotronics Ltd has announced an agreement, in principle, to manufacture and market automatic audio test equipment (AATE) from IBA designs. The agreement also includes an initial order from the Authority.

AATE has been designed to carry out high speed tests on the basic parameters of music land lines for radio and broadcast communications, and to produce a quantitative record of the state of the circuit. A readout provides real time measurement of frequency response and signal-to-noise ratio. Mellotronics Ltd, 35 Portland Place, London WIN 3AG. Phone: 01-637 0962.

Wow and flutter meter

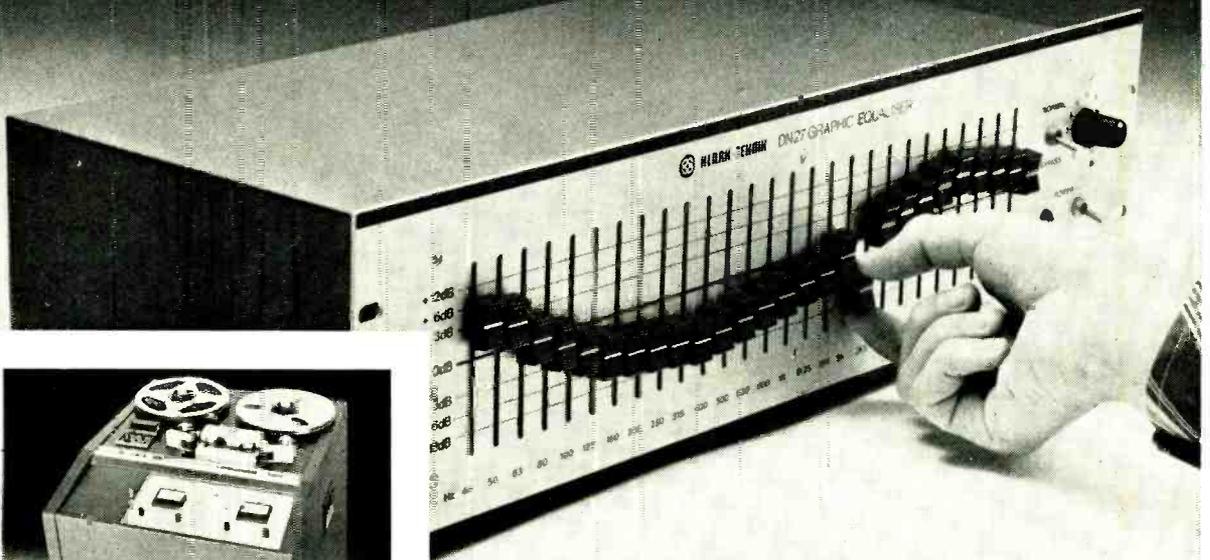
The latest model from Leader provides simultaneous measurement of wow and flutter as well as drift. Designated the *LFM 39*, it provides full scale deflection readouts from 0.03 to 3% from a rest frequency of either 3 kHz (CCIR) or 3.15 kHz (DIN). Overall accuracy is quoted as being within 5% of full scale with or without switchable international weighting standards. Leader Electronics Corporation, 2-6-33 Tsunashima Higashi, Kohoku-ku, Yokohama, Japan. UK: CE Hammond & Co Ltd, 111 Chertsey Road, Byfleet, Surrey KT14 7LA. Phone: Byfleet 41131.

Compressor limiter

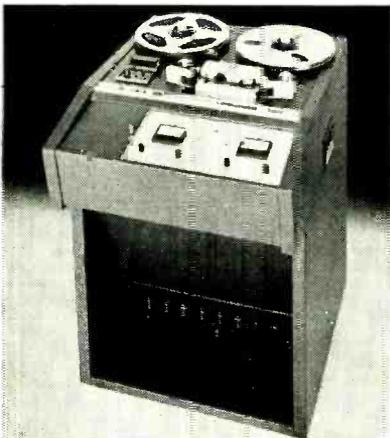
The stereo *418A* compressor limiter

At the BBC, Thames Television, Capital Radio, Granada,
Air Studio, Rockfield, Decca, EMI & Strawberry...
they have...

PERFECTION AT THEIR FINGERTIPS



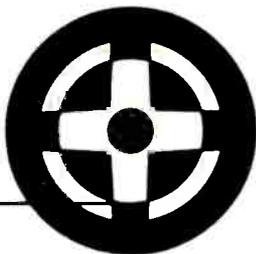
Illustrated is our **DN27** Third Octave 27-band **Graphic Equaliser**. Also available is our **DN22**, dual-channel, 11-band unit. Both have many technical plusses which our literature describes.



Illustrated is our **SM2S Stereo Tape Recorder**. Also available are **SM2T** (Twin Track) and **SM2M** (Full Track). Their many superior features include: no high voltage on deck, servo-controlled D.C. spooling motors, variable spooling control and twin varispeed servo capstans.

It's not surprising to find our equipment with these and many other users: after all, we are technically superior - as both operator and engineer can testify, and you may be surprised to learn that we are no more expensive.

This perfection can be yours. Give us a ring !



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NEWS

from Orban Parasound, using a program controlled attack and release mechanism, is said to operate subtly 'without the necessity for critical manual adjustment'.

The 418A is a complete limiting system consisting of a pair of stereo ganged compressor limiters followed by a high frequency limiter with four user selectable time constants selected by a front panel switch. The latter facility is said to enable tailoring of the characteristics to suit the following process such as disc cutting, tape and cassette duplicating. The unit is supplied in a 48.3 cm rack and sells for \$950.

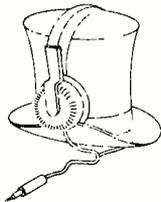
Orban/Parasound Inc, 680 Beach Street, San Francisco, Ca 94109, USA.

Phone: (415) 673 4544.

UK: Scenic Sounds Equipment, 27/31 Bryanston Street, London W1.

Phone: 01-935 0041.

Orban Parasound 418A



**Distinguished
Engineers'
Audio
Federation**

The 1976 DEAF Awards Dinner will be held at the Royal Garden Hotel, Kensington in London on December 9, 1976.

'As well as a spectacular cabaret and fabulous 5-course Christmas dinner, there will be a champagne reception and dancing to the sound of the Pasadena Roof Orchestra. Raffle prizes include a weekend in Paris for two, a Philips vcr and a Revox A77; and during the evening there will be the first ever DEAF Awards ceremony'.

'The aim of the evening is to raise funds for deaf kids—either to obtain a much needed technological aid or maybe to give deaf

children a happier Christmas and increased opportunity in 1977'.

Tickets are available at £12.50 each from: DEAF, Beaumont House, Heronsgate, Hertfordshire, England.

Sun Recording Services Ltd, 34/35 Crown Street, Reading, Berks RG1 2SN.

Phone: 0734-595647.

Zoom cheap mixer

Cheap, it most certainly is; six channels of audio mixing from Zoom Television Ltd cost a mere £120. For this, you get a basic mixing capability with headset monitoring, vu meter, pfl and mains or battery operation. Naturally the unit is mono and lacks any kind of eq network but fits in a standard rack. The manufacturer claims applications in general audio and cctv work.

Zoom Television Ltd, Pinewood Studios, Iver Heath, Bucks SL0 0HN. Phone: Iver 654044.

Ortofon taken over

Harmon International, a group which includes Harmon/Kardon and Tannoy Loudspeakers, has recently announced, at the Chicago Consumer Electronics show, the takeover of Ortofon Manufacturing A/S.

Manufacture and marketing of Ortofon professional products (mostly disc cutting equipment) remains unaffected. Some consumer products, marketed by Metro-sound Ltd, will no longer be manufactured; these include the loudspeaker range.

Important Notice re Martin Audio—Video Corp.

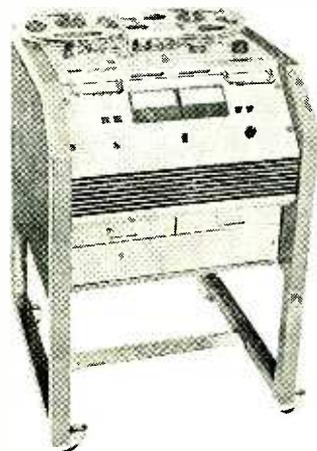
Readers should note that the address given in the advertisement which appeared in the November issue page 69 for Martin Audio-Video Corp should read 320 West 46th Street, New York, NY 10036 USA and not 302 East 46th Street as stated. Martin Audio-Video wish to apologise for any confusion caused.

Cassette labels

We have been asked to draw attention to a new service being offered by Sun Recording Services duplicating plant. They now claim to offer a fast turn around on small printing runs of cassette labels 'at very attractive prices'.



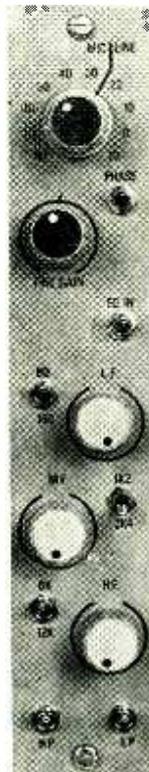
**SOUND
SENSE
IN
'77**



Excellent performance, ruggedly reliable and economically priced, what could be more sensible these days. A demonstration is just a phone call away. Contact the United Kingdom's largest and most experienced manufacturers of professional recorders.

LEEVEES-RICH Equipment Limited,
(Incorporating Bias Electronics)
319 Trinity Road, London SW18 3SL. 01-874 9054
Cable: Leemag London SW18
Telex: 923455

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DMM Modular Mixers.

Illustrated Type 301 input equaliser channel. Up to 32 inputs with 3 or 5 band switched equalisation into 4, 8 or 16 outputs. Many auxiliary facilities are available. Modules 38mm x 203mm build into compact versatile consoles for all applications.



CMM Modular Mixers

Illustrated Type 101 input module. Complete system design using a large range of standard modules 56mm x 133mm. Built to the same high performance specifications as the DMM range. Primarily designed for rack mounting, also available in desk or portable form.

ALLINGTON AUDIO DEVELOPMENTS

794 (A2) Mansfield Road,
Nottingham. Tel. (0602) 624910



Fully professional Studer quality at affordable prices

The new generation of professional STUDER tape recorders is designed for the use in broadcasting, television and recording studios as well as theatres and scientific laboratories. The low-cost STUDER A67 includes a wide range of modern features:

3 servo controlled AC motors – Crystal controlled capstan servo – Variable tape speed (2½" . . . 22½") with external frequency – Tape tension control during all operating modes – Control logic with memory – Illuminated push buttons – Remote control of all tape transport operating modes – Automatics for continuous program – Mechanical counter, indicating Min & Sec – AC-Mains supply 50 or 60 Hz, 110 . . . 250 Volts – Opto electronic end of tape sensor – Head block with aluminium die-cast frame –

Tape lifter, may also be operated manually – Long life heads – Audio electronics module with plug-in cards in front of tape deck – Playback, record and bias amplifier boards have all necessary adjustments accessible from the front of the recorder – Switchable for equalization CCIR or NAB – Optional: VU-Meter/panel with peak indication (LED) – Head phone jacks – Available with or without VU-panel, as portable or console version or as chassis for 19" rack mounting – ½-inch, 4 track version in preparation.

STUDER

STUDER INTERNATIONAL AG
Professional Audio Equipment
CH-5430 Wettingen, Switzerland

F.W.O. BAUCH LTD. 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ Telephone: 01 953 0091

For whom the decibel tolls

TIM FOSTER

The controversy over amplification in 'musical' theatre has been gently rising over the last few years, and the advent of the rock musical has been nothing but a catalyst in this controversy

WE have reached a situation where people who don't like rock music are going to see rock musicals in the theatre and coming out complaining that they don't like the thing without which rock music can't live—amplification!

My work in theatre sound falls into a strange no-man's-land, between the highly controlled situation of a recording studio and the frenzied and very rarely successful rock concerts; and is financially the poor relation to them both.

With quality hi-fi systems readily available to those members of the public who are also theatre-goers I have found that I increasingly have to justify the methods now employed on large scale rock musicals. It has taken years for theatre managers and safety organisations to accept the control desk position 'out front'. Having won this battle we are now open to the bombardment of comments and suggestions from members of the audience as they pass the desk on their way out at the interval or at the end of the show. It is these comments and criticisms that prompted me to set down on paper the reasons for doing things the way we do. Sound in the theatre is still very much in its infancy and there is very little money to run experiments, or even to use enough of the right equipment.

The show on which the majority of this article is based is the *Black Mikado*—a rock musical that over the last 20 months has been on the road, in the West End, on to Paris, South Africa, and has just finished touring again. It is a typical example of a show with rock music (inherently loud) which will play to an audience that would, in general, never go to a rock concert. There the problems begin . . .

It seems that the theatre and producing managements (and the audience) are really trying to hide the fact that the music they are dealing with has 'grown up' and been composed with electric instruments and microphones in mind. No-one in normal circumstances would try to pitch an unamplified voice against, say, an electric guitar . . . or would they? The brief to the sound team on the *Black Mikado* was that we were to have an 8-piece band (three brass; guitar; bass; keyboards and two percussionists), nine principal singers, a chorus of sixteen, ' . . . and by the way, we don't want to see any mics on stage!'

So it was decided to use radio mics for the soloists and that a member of the stage management would have to spend the show moving the transmitters from one singer to the next. The Home Office transmission allocation of frequencies for theatre use is very tight indeed (from 174.1 MHz to 175.0 MHz). It is only possible to run (safely) two of the higher quality wideband variety together without cross-interference within this bandwidth.

Perhaps this is a good opportunity to point out that this

frequency allocation is ridiculously small. Theatre directors are often asking for more radio mics to be used in a show but they just cannot be supplied without breaking the law. I feel that this tight allocation could be sensibly widened, particularly as the transmitters have such a short range. At the moment we are only adding to the problems of using radio mics by introducing a whole series of quick changes, operationally and remedially, not envisaged by the transmitter designers—fiddly connectors, fragile cables, etc.

However, by comparison with hand-held mics, tie-tack radio mics are barely noticeable on-stage and are no visual or physical distraction to either the singer or audience; but the price paid for these advantages is quite high for all concerned in the production. Since they have to be worn on the chest, radio mics must be omnidirectional, and when used in close proximity to the associated speakers it is often quite a battle to squeeze the required level out of them. This not only causes problems for the audience side of the footlights but makes monitoring (that fateful word) for the band very difficult and low in level, and for the singers virtually impossible. Musicians more used to studios or rigs using hand-held mics often need a great deal of pacifying!

As the bands were on-stage, headphones were visually unacceptable so they had to return to the classical musician situation where he or she can only hear the person playing on either side. The *Black Mikado* band had not worked in the theatre before and so had all this to learn as well as arranging the music while we were still touring.

But not many musicals have the great advantage of a ready-formed band as on the *Mikado* and while there was the problem of their never having worked in the theatre before, the tightness in playing made balancing much easier and certainly more enjoyable. This quality of band sound can only come from musicians who regularly play together, and although the complete band was only formed five or six months before the show, some of the musicians had been playing together for eight years. Usually musicians only come together three or four times before the first public performance and even after that the group will rarely be the same combination throughout the run of the show.

Furthermore there was no conductor on the *Mikado* but every player was so fascinated with the feel of the music that with a good deal of eye contact they could hit every cue as well as a conducted band, or even better. We had only eight musicians—

The proximity of the singer (right) to the on-stage band indicates the separation problem.



obviously with a larger number the intimacy of playing will be lost. However it still takes time to convince a band that you are doing justice to their music and that you can be trusted on the desk.

With the energetic dancing involved in the show the radio mics took quite a beating and inevitably 'died' from time to time. And when they go wrong they do so with a vengeance—crackle, hiss, the lot! There is that awful empty feeling that every sound engineer with problems must know—of all the eyes turning on you as if to say 'Well come on then, sort it out'. Unlike film and recording it is not possible with a continuous musical play to halt the action until faults are remedied—we just have to sweat it out until the singer goes off-stage and can have the offending accessories replaced.

There are quite a number of problems in using radio mics but I am convinced they were the right choice for this particular show. They have been greatly improved over the years—the only problem being availability. We have to thank the broadcasting companies for monopolising the radio mic firms to such an extent that a two-year waiting list exists on the better systems.

Solo singers more or less dealt with, I shall move on to the chorus section of the cast. This I feel was probably the weakest part in the sound of the show—it is on many shows. The normal method of miking is to use a row of cardioids across the front of the stage (float mics) and odd gun mics dotted around the set. A good, if slightly hollow, level of reinforcement is possible but with the band on-stage we were picking up as much of them as the singers.

Various experiments were carried out. A favourite theatre technique at the moment is to tilt the float mics down on to the floor to pick up the reflected sound. This is a total misunderstanding and misapplication of a technique developed by Shure in the States to alleviate phase problems. Hanging gun mics directly over the acting area gives much better separation between the band and chorus but they have to be so low that they became visually unacceptable. We decided on the compromise of the first method and, where 'plotting' permitted, used available radio mics on one or two members of the chorus. This helped a great deal but was in no way a complete solution, so the problem presents a challenge on future shows.

Something that theatre audiences are not yet accustomed to is seeing the singer in front of them and hearing his voice from a big speaker tower on their left. A great number of theatre sound consultants merely amplify the vocals, leaving them very disjointed from the band sound which subsequently lacks any brightness.

For the musicians there were 18 close mics of which the majority were condenser types, all phantom powered from the desk. The bass guitar was also directly injected into the desk, and a warm, but tight, sound was achieved by blending the di with the mic. Each of the musicians had a chance to listen to the sound of his mic and in some cases chose the mic he wanted to use. For instance, the *C12A* would seem to be an expensive mic for a bass drum, but

When 'Three little maids from school are we' becomes a strip number, the positioning of radio mics becomes a problem.



On stage band miking

as the drummer didn't want to lose the front skin we tried everything available to get the sound *he* wanted. A great deal of importance was attached to this question of reproducing the sound the musicians wanted—they knew exactly how important the mic positioning was and were very conscious of checking and moving mics. In the theatre, and possibly some studios, there is a tendency for engineers to produce the sound they want without consulting the musicians who are actually producing it. Hypercardioid mics were particularly useful, as the brass players were often using different, delicate instruments—flutes, rattles, bells, etc. The character of the music was very dry and so, apart from reverb for spot effects, it was left that way.

To close mic the band and bring the instruments forward to blend with the voices means that the whole sound is coming from one source. This is obviously desirable from a balance point of view but as soon as there are mics on the band the 'it's too loud' objectors think that the volume of the show is entirely in the operator's hands. While the latter may be true in a rock concert situation, the type of rig used in the theatre means that the volume is basically set by the musicians. All the operator is doing is balancing the voices against the level given by the band. With a live performance there is still a tendency among musicians to assume that if there is a mic on them they can't be playing loud enough, so they turn-up or blow harder. This spoils the balance as the offending instrument then has to be dropped from the mix to avoid it drowning everything else.

After a few performances in the same theatre the level and the balance settle down to whatever the norm is going to be for that particular show. Occasional disturbances happen when, say, the trumpeter '... had a friend in last night and he says he couldn't hear me, so tonight I'm going to play harder ...'. The friend may have come on a night when the operator was trying to deal with an obstinate radio mic or perhaps was just having an 'off night'. If a performer on-stage has such a night it is generally accepted: somehow it appears that a technical operator is never allowed to be below par.

All the stage mics were tied to the mixers at the back of the stalls through a 'tripe' of single cables rather than multicore. On long term installations the cable run has to take fairly odd routes and the flexibility of this tripe of cables makes for much tidier hanging and is very much less susceptible to thyristor lighting control noise. The desk's position at the back of the stalls is a comparatively new innovation for the theatre and still causes many arguments with theatre managers. There was so much indecision 32 ▶

FOR WHOM THE DECIBEL TOLLS

over this position on the *Mikado* that we were still plugging up an hour before the first public preview!

While there was a slight acoustic problem with the overhanging balcony the present safety regulations prevented us from siting the desks in the middle of the audience. These regulations also limited the positioning of speakers so big scaffolding towers either side of the stage had to be built causing fairly major structural alteration to the proscenium arch to accommodate the required stabilisation. Further limitations were imposed by the false stage projecting into the front row (it was almost within arms reach of the front row so that any consideration of positioning speakers in the 'orchestra pit' area was totally eliminated). The proscenium arch at the London theatre (the 'Cambridge') was too high to make speaker positions above it useful. It has been shown that the ear is almost as sensitive to vertical displacement as it is to horizontal, and therefore speaker positions above the proscenium arch would only increase the disjointed effect discussed earlier.

As the upper balconies of the theatre were so far back, the mix was split vertically as well as horizontally. Separate amps enabled us to give more power to the speakers serving the upper parts of the auditorium. We found also that it was only necessary to use long-throw mid horns in these upper areas for vocals. The smaller cabinets housing mid-range cones and hf units gave sufficient clarity and level for the short throw to the back of the stalls. As the power amps (*DC 300As*) were never over-driven cooling fans were not necessary, so the amps could be tucked under the desk and were thus readily accessible in emergency. Two of the four main output groups of the desk carried the vocals and were fed to four power amplifiers to give left and right, up and down flexibility. Groups three and four masters carried all instruments.

Having split masters for vocals and instruments made it possible to change a whole balance very quickly to the next. And as the monitoring arrangements had to be very simple we were able to use the spare auxiliary groups as sub-groups within the mix. The percussion and the general vocals were submixed in this way and these two sections came from the secondary desk, the vocal submix going via a graphic equaliser for eliminating resonances of the building and thus gaining more level before feedback.

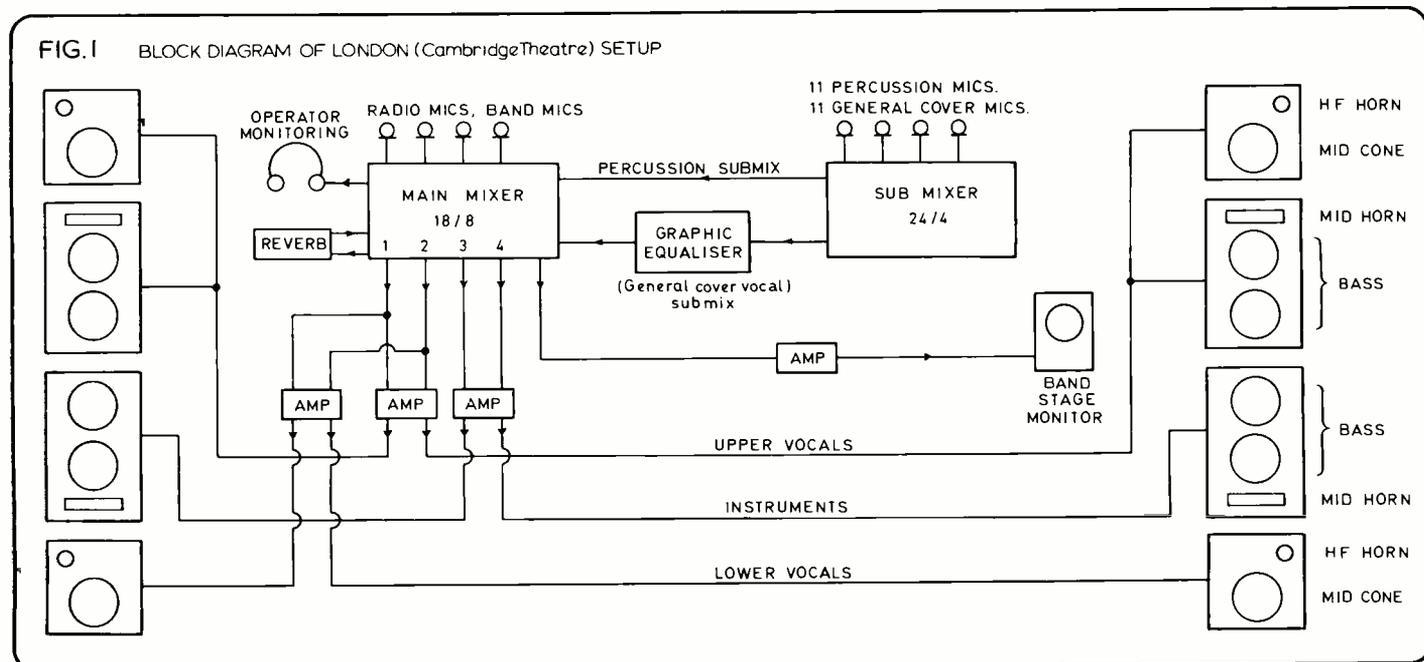
The custom built desk, apart from phantom powering and extensive auxiliary three-band groups, also provided full equalisation on all channels and on the outputs. Eq on the outputs is very handy for taking the edge off everything when confronted with a 'thin' house, or to brighten things up for a full, humid auditorium.

Furthermore, the desk was built with a spacious layout, giving quick access to the right controls in dim lighting conditions.

One really unfortunate feature of a commercial musical is that if it is a success the operator is in for about 400 performances for every year the show runs. It takes a while to get to know all the details of the show by heart since there is no time to look at a plot sheet. After that the most difficult part of the work is to keep all the details there. I set myself a limit of six months for the *Black Mikado* but after only four I was so used to the show that some nights nothing sounded right whatever I did! Through this conditioning I had to develop the ability to come to the show afresh each night. This is easy to do when changing theatres every so often, thus having the challenge of a new acoustic, but the same show in the same theatre night after night becomes tiring. Ideally there should be two or even three operators trained from the beginning of the show so they can work in rota without the quality of the sound suffering. But for the time being there just isn't the money to afford this luxury.

'I can't hear the words', is the most frequent complaint from audiences. Theatre sound engineers, including myself, have been very defensive about this comment. Listening to grand opera choruses on stage or even on record it is often impossible to distinguish words. No-one seems to mind about this and they certainly seldom complain. Put sound on a show and there's someone to complain to. There is the feeling from some members of the audience that it has to be the fault of the sound man that they can't hear the words. I have often tried to point out that lack of clarity can be due to a number of things including bad enunciation, bad musical arrangements, no internal balance, thoughtless choreography, etc; but people are difficult to convince and would sooner just blame the amplification. It is a shame when the operator has to do all the justifying, especially when he knows that he doesn't have the backing of a lot of people on the production—they may well not know what they are talking about and still be critical. On one occasion a top management lady rushed up to me on-stage during a band call to tell me that the band was much too loud and would I turn it down. I had to tell her that the desk was switched off which obviously caused some embarrassment. However she didn't pester me again.

Back to the audience—apart from giving a few reasons for the sound being the way it is one cannot go into details of major problems without being disloyal to the production. Problems like the choreographer who points his chorus upstage where the management has not afforded more mics, saying 'It's your problem, you sort it out'. To add insult to injury his assistant chimes in with 'Oh, there's always a sound problem on musicals', without ►



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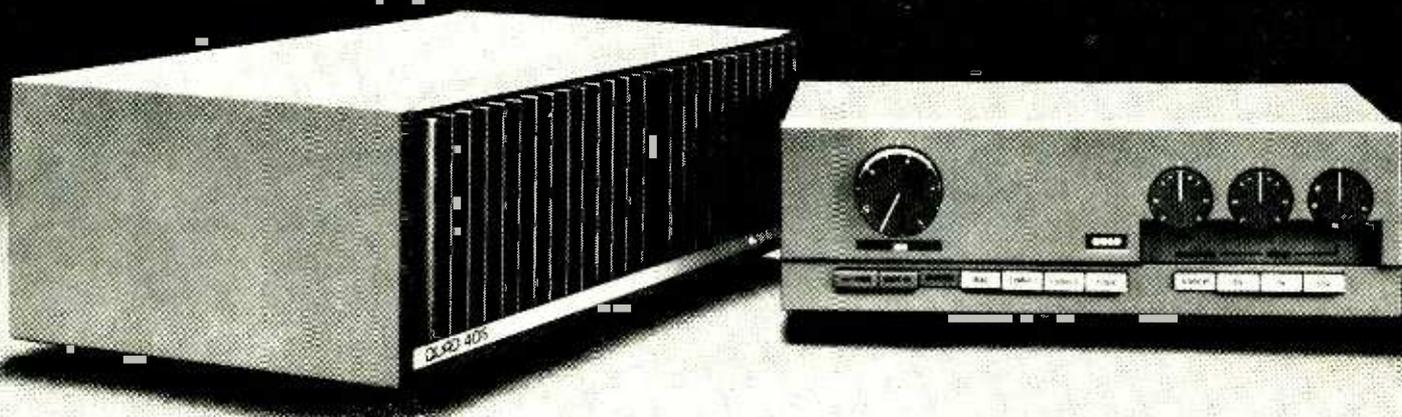
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books

Borwick (ed): *Sound Recording Practice*. Hardback, 440 pages. Oxford University Press, 1976. UK: £16, US: \$34.50 (approx).

Eargle: *Sound Recording*. Hardback, 328 pages. Van Nostrand Reinhold, 1976. UK: £12.90, US: \$21.41.

Runstein: *Modern Recording Techniques*. Paperback, 368 pages. Howard W. Sams/Bobbs-Merrill, 1974. UK: £6.35, US: \$10.95.

Owning up time is with us again with this latest collection of books aimed at filling the yawning gap that confronts anyone wishing to learn about recording techniques and associated fundamentals. It's no accident that it's a hard gap to fill; that is due to the structure of the industry itself. How did you learn your engineering? Which came first, knowledge of how or why?

Do you think it would have helped or hindered to have approached the subject from the ground up, rather than the usual practical way? I don't know. Everyone involved has made tea

Modern Recording Techniques, first published in 1974, professes 'to introduce the reader to the equipment, controls and techniques used in modern studio recording'. The chapter headings group in the usual way, with only the first 40 pages devoted to fundamentals; other basics are introduced as needed in the relevant chapters. The approach is immediate and realistic, with equipment model numbers quoted and photos given (with such a small industry and limited range of equipment manufacturers it isn't possible to generalise into non-brand description, as another writer elegantly demonstrated when asserting that in noise reduction systems 'the frequency range is split into several parts'. This spurious rigour is best avoided).

In many respects, Runstein's presentation of the information resembles the way it comes at you in a practical situation: rather disorganised. An example is the section on studio session procedures. Although these are hardly thesis material, they are regular and tight; studios may vary, but there is a definite order to the way any engineer goes about his work, based on his particular preference and experience.

and gone for the sandwiches at some stage in their career, and that still remains the only way to receive a thorough grounding: by working upwards in a professional environment. The recording industry has grown so fast that attempts at conventional educational training cannot keep pace. There is no graduate entry into the recording industry, despite the assertions of various courses, particularly American. In many respects, the opposite holds good: there is a suspicion of any sort of learning among many engineers, a kind of inverse academic snobbery which is probably a fair reflection of some unfortunate post-graduate assumptions. But this should not obscure the need for fundamental knowledge of the kind these books aim to provide.

Two of these books have a vested interest in academia: Runstein is associated with the Recording Institute of America, as an instructor, and Borwick overlords the only full time British course in recording, at the University of Surrey. Ironically, though, Eargle's recently published work is the most thorough and rigorous to date, and would form a much better basis of an enlightened course on techniques. There are points of departure between all three, which are best brought out individually.

The chapter here could easily have demonstrated the value and application of tight session procedures, but instead it acts as an afterthoughts section embracing drum tuning and diagrams of 'take sheet' and 'track log'. It's a pity that such ideas occur on page 232, whereas page 70 contains the only (limited) references to drum miking.

The disorganisation is linked with some rather sloppy background theory which would be reasonable enough as rough verbal description, but doesn't make it when in print. On the very first page: 'the waves are converted into electrical impulses . . .' (my italics). When describing fundamentals that isn't good enough. On page 26 he gets confused between amplitude and modulus of amplitude in talking about phase cancellation: ' . . . interfere destructively at other points, resulting in a more negative amplitude at those points . . . '. If you're covering basic physics, it must be right, otherwise the newcomer trying to pick a logical way through unfamiliar territory will be thrown by anomalies.

It's unfortunately too easy to pick holes in what could be a very useful book if the editing

were more self-critical. The following sort of statement is a classic of someone struggling to assume an impressive scientific pose. Taken from the chapter on tape machines: 'The theory of tape recording is based on relating physical lengths of magnetic tape to periods of time. By playing back each section of a length of tape at the same speed at which it was recorded, the original rhythm and duration of each sound, and the spaces between sounds are preserved. The best way of ensuring that the time spectrum remains unchanged whenever the tape is played is to record and play it back at a constant speed.'

Sometimes, he's simply wrong. Tape isn't stored tail out 'to save time', or to reduce the amount of print through, which is independent of the wind; it's to ensure rewind just prior to playing, so that short-term print is reduced. In the same chapter he asserts that splicing between sections recorded at beginning and end of reel will show frequency shift due to varying tape speed. Clearly a case for a new elastic band; yell at maintenance again. It's blunders such as these which sink what could, with a bit of sharp reappraisal be an extremely useful and valuable book for the novice. Hopefully, a second edition will do this

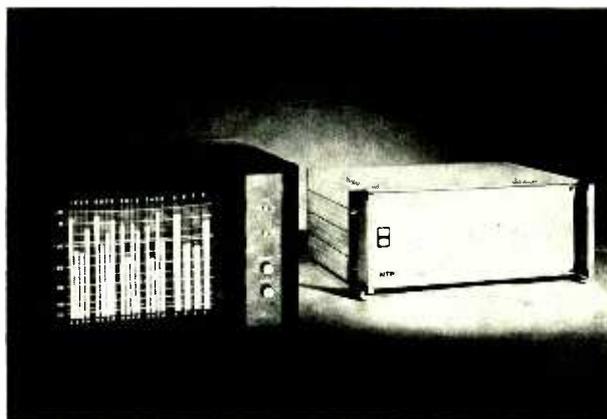
A similar rather awkward academicism causes some trouble in Borwick's book. The principal difficulty is that it is packaged, presented and edited in the manner of a heavyweight scientific textbook, an OUP speciality. It's nothing of the sort, for music recording is not about heavyweight scientific disciplines. Rather, the book is a collection of assorted essays by UK based figures. In attitude, it is as parochial as Runstein and his US basis. During reading 440 pages I became alarmed at the dullness of the industry I'm involved with, something that I hadn't noticed before.

The 25 chapters are written separately by specialists in and around the industry, and inevitably vary in content. One regret is that the difference between authors was not accentuated more. Personality surfaces only occasionally above the bland textbook surface: John Keating's chapter on *Popular Electronic Music* is a welcome breath of fresh air, but, paradoxically, an odd choice of subject when no other singular case histories are covered. There are enough top rate records around from literate engineers and producers which would more than merit inclusion.

Overall, the balance between sections is curious, and reflects rather old-time attitudes. For example, the *Techniques* section proceeds as *Speech and Drama* (19 pages), *Classical Music* (19), *Synthesised Music* (14), *Location Recording* (11), *The Role of the Producer*, by John Culshaw (7), *Popular Music* (17) and *Popular Electronic Music* (17). This unrealistic balance does not afflict the *Equipment* section, whose writers are more largely involved with bread and butter pop recording. An underlying attitude is suggested by occasional inverted commas around 'pop', as if this was a phenomenon which had only just arrived.

The bias of the book is, inevitably, in the technical direction. This section to some extent incorporates, when well written, reflections of practice and requirement, and there is little of the mistake made in Runstein's book in presenting 'rules' of design rather than showing

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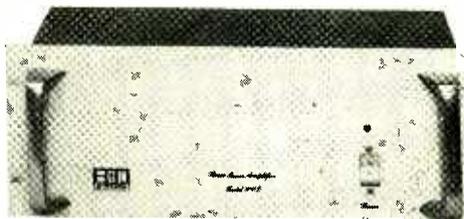
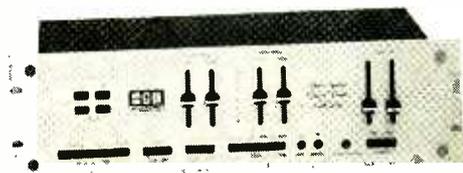
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BOOKS

the growth of technicality to demand. Particularly thoughtful is the chapter on mixing, from Richard Swettenham of Helios, although the automation section was inevitably out of date as soon as the book was published. There are more insights into console operation in this chapter in the form of throwaway remarks than appear anywhere else in the book—as was mentioned before, practical aspects of multi-track operating are crammed into Pete Tattershall's chapter which, curiously, is shorter than Derek Taylor's *Speech and Drama*.

The book is far from being as rigorous as its format implies; there are occasional mistakes such as confused definition: 'The use of twin-conductor cables is referred to as balanced line working, to distinguish it from the single core screened cable which uses the screen as the return wire of the circuit, and is called unbalanced.' (Balanced and unbalanced refer to the electrical termination; unbalanced working with twin core is possible.) Fig. 18-2 and the accompanying discussion should show bass harmony central instead of split (as in a half left plus half right pan, which is a long way around to finding a centre image). In the brief section on noise reduction systems, nearly a page about the Dolby system is concluded with a single sentence: 'Dbx and Burwen noise reduction systems have their own problems' and that's it; another unbalanced line.

The biggest value lies in that writing which emphasises the range of choice of technique rather than presenting a limited personal approach as if it were a law of physics. To the book's considerable credit, there is little of this widespread crippling attitude; there is much you might disagree with, but that is the nature of the business, and that's what keeps it growing. There's a lot of good practical sense, although it might pass unnoticed if it isn't the starting point of a discussion. The multi-author approach seems ideal for a broad presentation, with the reservation that some writers

seem to have been cramped unduly, and one suspects that particularly busy people would have benefited from a few days' full time attention with the aid of a dictation machine and guiding editor. With all its faults it remains the best English book on the subject, largely replacing the old BBC and hi-fi freak attitudes which still crowd the shelves. At the price though, it's probably more commercially viable to ask the boss.

Despite its non-academic alignment, John Eargle's book is by far the strongest candidate for use as a teaching basis. Eargle's style is very readable and exceptionally well organised; this means that a subject is seen to grow in a logical way in contrast with Runstein's piecemeal construction. While techniques are only touched upon where appropriate to equipment design and operation, it's clear that practical aspects underline the assumptions.

Although the blurb claims that the treatment is graphic and non-mathematical, this is not true: there is much reliance on conventional symbolism without the associated explanation, for example when discussing small increments (Δ). However, the presentation is so lucid that no one with a couple of years' secondary school maths will have any trouble. Much of the writing is condensed and pruned of superfluous wording, so that learning from it is necessarily a slower process than that from a chatty *Studio Sound* or *REP* article. This is simply a reflection of the volume of information that is offered.

The first line says it all: 'The dedicated recording engineer ultimately becomes his own best teacher.' The tone throughout is of making fundamental information available, and presenting alternatives where appropriate, rather than handing down stone tablets of common practice (which unfortunately can so often be the case in personal teaching through an engineer/tape op relationship).

One-third is devoted to *Physical Aspects of Sound, Psychoacoustics, Stereophonic Sound and Quadraphonic Sound*. The section on

microphones contains the most lucid and thorough discussion on polar characteristics and applications that I have ever seen, and is of practical interest from other points of view such as random energy efficiency and impedance levels. Loudspeaker monitoring concentrates more on technicality, which is unfortunate in such an unsettled area, although the parameters of loudspeaker design are clearly laid out.

One of the most useful chapters is that on *Audio Control Systems*. The desk is the focus for the novice's terror; here, the different functions are dealt with consecutively and from an ergonomic point of view. There is little mention of electronics, the approach being the black box one of treating the unit in sections, each of which has certain characteristics of noise and distortion as well as the standard input and output parameters, and discussing the best way to organise them. Particularly enlightening are the three diagrams illustrating noise, dynamic range and headroom through consoles set up in different ways, right through from mic to tape line in. The descriptions of the Allison and Quad/Eight automation systems are the best I've seen anywhere. Neve and API miss out, as do the numerous later manufacturers interfacing with the Allison programmer. A similar clear writing underlines the *Signal Processing* chapter where the standard devices, so often a source of wordy confusion, are given straightforwardly. Sometimes there is over-emphasis of practical generalisations. For example (p241), boosting an acoustic guitar 'between 100 and 300 Hz' to 'add fullness' is the opposite of what normally happens with close miking, although other instruments readily benefit. However, these remain minor niggles.

This is easily the best book on the technical side of recording available in English, thoroughly recommended as a basis to complement the paramount practical requirements. All that is needed now is a book written from the production viewpoint as a companion volume.

Michael Thorne

FOR WHOM THE DECIBEL TOLLS

appreciating how much he could do to alleviate it. One can hardly tell the audience that the lead singer refuses to take off her good luck charm even though it's clanking against her mic! The singer who has a bad throat and has asked you to push his mic a bit harder, not realising the increased risk of feedback if you do so. And whose fault is it if there is feedback?

As well as the responsibility for pr work with the audience there is also that to the show itself. If the sound operator is absent from the show for any reason it can be catastrophic and yet a musician who's on twice the salary can easily be covered if he doesn't make the show. The operator's job really falls between the interests of two of the show business unions so there is no big power to help up the wages and hence attract people willing to take on these responsibilities. The rewards are low, not only financially, but also in terms of respect from the managements and other members of the production. Even those managements who invest in the equipment are still sunk if they can't attract the people to drive it. At the moment they are still relying on those who do it for all the romantic reasons like 'love of the theatre' and 'the thrill of live performance' rather than financial gain. There are the odd nights when everything goes so exceptionally well that there is a real 'high' after the performance. The more frustrating nights are when a singer or musician hits a bum note and ruins an almost perfect balance. But something that the 'critics' should remember

is that the sound can only ever be as good as the performance on-stage.

Though out on a specialist limb sound in the theatre is just becoming something to be reckoned with. The live musical work is only half of it. A good knowledge of recording and reproducing taped effects is also part of the theatre sound engineer's work. I hope that it won't be long before broadcasting, recording and concert circles stop looking down on theatre sound as a poor relation and start to appreciate and learn from some of the extraordinary conditions with which we have to cope. ■

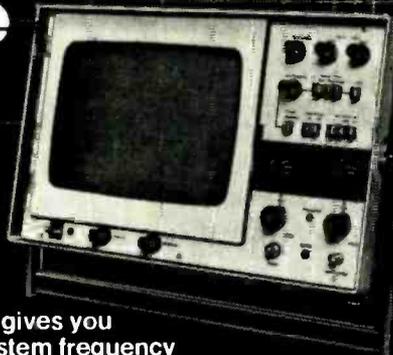
agony

One of the new, intuitive breed of independent producers was mixing down a rock single to the customary three minutes during which he edited in the same note twice, resulting in a solitary 5/4 bar.

Fair enough . . . artistic licence and all that; however, the cowboy didn't realise that this bar was different to any of the others. Now, session men don't suffer intuitive producers and mds gladly, especially if they're not being paid for it. And so it was that the producer invited audience reaction from these musicians who were working elsewhere in the building. 'Amazing' they smirked and 'really good' they said.

So with this seal of the approval he went off, smiling, to the cutting room to mastermind the operation. On the first run through, the engineer commented on the singularity of style. 'Oh you noticed' said the producer, spilling his coffee. ■

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Scotland...the brave

KEVIN BLACK

The Scots recording industry could cope, at least in theory, with material other than haggis music. The reason it doesn't is only partly connected with the regional nature of the problem.

THE Scottish recording scene resembles a slice of bread with mould on top. On the surface it is stale and unattractive, which gives one the temptation to fling it in the nearest garbage can. But underneath the bread is clean and fresh. All it needs is turning over to be shown some sunlight.

Which won't be easy in a country where the rain is a constant friend and the temperament of the natives leaves a lot to be desired. Scots, by nature, are dour, sullen characters who drink and fight a lot and are sunk deep in tradition. It's little wonder the Romans split the whole Celtic soggy, wet scene and flung up a wall just past the present English border.

So there's probably a message there; leave the Scots to get on with it . . . and when it comes to recording, some Scots are getting on with it; although a few are clinging desperately to tradition and all the tartan and haggis that goes with it.

Keeping alive the tradition of a country may be one thing, but at the same time it can be very restrictive; in fact, strangling. So steeped in tradition are the Scots that, no matter where they are, they think of the 'homeland' with the same melancholy helplessness that other patriotic people do. In Scotland, one record company does its utmost to keep tradition alive and at the same time gross a lot of cash.

Lismor Records of Glasgow have come a long way in a short time. In about three years they have arranged outlets for their haggis-flavoured albums in the US, Canada, New Zealand and Australia. They have even arranged for their records to be pressed in New Zealand. And the Lismor product is, as I say, a 90 per cent Scottish product.

In the countries I've mentioned Lismor have found a huge market of Scots exiles or people who claim to be descended from Scots and the very same people keep Lismor running happily to the bank every week. Although the Lismor label carries the music of the pipes and drums and Gaelic singers and tartan-clad artists to most corners of the universe, they are stifling the enthusiasm of the talent which seems to seep from beneath every grey stone of Glasgow and Edinburgh.

They seem reluctant to encourage Scots artists who are obviously into other forms of music. They've found a money-spinner and they handle with kid gloves anybody who shows the slightest hint of pining to produce material for the pop, rock or soul markets. With the result the aspiring writers and musicians in Scotland have to look beyond the Lismor offices in Argyle Street, past the shipyards of Clydeside to London.

Lismor does a wonderful job for Scots music, but it also strangles any flair, versatility or imagination which flowers on their own doorstep. Peter Hamilton, boss of Lismor, has made it plain he'd rather record a battered accordion playing *The Dark Island* on a 2 or 4-track than market a band which shows all the promise of Alex Harvey and Co. And the situation in and around Glasgow is pretty much the same bleak picture.

There are plenty of writers, plenty of bands. The music shops are full of kids getting themselves up to the ears in debt, just for the hope that maybe they will break it by sending tapes to London. Generally the Glasgow bands haven't the bread between them to pay for a session in a city which boasts only one 8-track studio.

Harry Margolis, the owner of Thor Studios, the 8-track in St Vincent Street, has a record label already formed. He's a bit more adventurous than Lismor; at the same time he's more cautious.

'The bands are what people want,' says Harry. 'I must attract the bands into my studio.'

Harry finds it hard to keep Thor ticking over. He's a musical director as well and plays guitar in his band at the weekends. During the week he arranges talent contests around Glasgow in an attempt to find a chart-busting artist. He hasn't yet. He's also searching for the right song and two songwriters are employed to pen the all-important number. When they do, Harry will

John Mackinnon



release it on his label and make damn sure the people of Scotland know about it.

He believes Scotland has the talent and he has the studio.

'I want to help create a recording industry in Scotland,' he says. 'Why should we run to London when we can do it ourselves.'

Why indeed? It's already been established that the Scottish music scene is very important to the rest of the UK; the commercial scene that is. Companies like Lismor could go on for years churning out native, ethnic products and make a fortune while never seeing the charts.

People like Harry Margolis want to make a stand and grab a slice of the national cake without moving from their seats. Harry's pretty sure it can be done. All it needs is to stop the flow of Glasgow bands to the south. The bands must be told there are studios in Scotland such as Thor; they have to be attracted to the Scottish studios and they must have faith in those studios. The London stars must be knocked out of their eyes!

That's why Harry Margolis is about the only guy in Glasgow searching for a sound. He just hopes he knows it when he hears it.

Over 40 miles away, in Edinburgh, the studios are a little more advanced. Hardly surprising really, as Edinburgh is considered the snooty city while Glasgow is 'wholesome' and down-to-earth.

There are two 16-track machines, REL and Craighall, but they have the same problems . . . the talent passes them by for

London. Abbey Road and Olympic seem to roll off the tongue better than REL or Craighall.

Craighall is used a lot for demos and for recording Lismor's ethnic porridge product. REL's Neil Ross is more far-sighted.

He and two friends formed Radio Edinburgh Ltd three years ago. The business has three sides; equipment installation, sound hire and a recording facility.

As Neil says: 'REL was set up entirely by ourselves and fast chat to a bank manager. We are probably the only solely-owned studio in Scotland. There's no sugar daddy elsewhere.'

By 1974 REL had gone 4-track, then they jumped to 16. The desk is a Tweed Audio (20 in, 8 out) and there are 8 and 16-track Ampex MM1100 recorders.

'Since we set up in Edinburgh several other studios have been built, but we haven't felt the draught of any strong competition. People seem to be finding their own markets.'

Among the many people who have used REL are the Bay City Rollers, who hired the studio for a week to lay down 15 numbers, shortly before cutting their first album.

'I do recognise that if we don't become an established, multitrack studio in 12 years, we won't ever. We've made the jumps from 4 to 16 correctly. Now we have to attract the people.'

'Take the people up here into rock for instance. Although Scots rock bands might do demos here, they want to get out and see the world and the big, flashy London studios.'

'We do more work for London bands than we do Scots. They love travelling up here and they get the same sound, the same vibes. Technically, there's no difference between here and any average London studio.'

'But our production suffers. Technically we in Scotland can get as good a sound as anyone, but we haven't got the producers. We have people who can produce 'Scottish' records, but not rock. That's virgin territory here.'

'Scotland needs a full facility studio. There's a huge market for it and I just hope REL is there first. Scotland needs a studio to handle 40 people at a time, to have 24 tracks, to have reception areas, to have mix-down suites, to boast the facilities anything London or America can offer.'

Neil also has visions of his own record label, but he knows that in order to survive REL Records will have to carry the very same Scottish music until the right song, band and sound comes along. Like Harry Margolis, Neil senses the untapped potential in Scottish musicians. He wants the Harveys, the Rollers, the Nazareths of tomorrow to be in his studio first.

Across the city at the 4-track Pan Audio, former fiddler John Mackinnon has big ideas. To date he's been churning out folk and ethnic material helped by the big-selling folk duo, The Corries.

But John wants firstly to jump to 16-track, in the former monastery, by next year and secondly be on the road to producing chart material. Yet again it depends on acquiring the right artist, song and sound.

John is halfway to achieving what he and all the others seek. His label has released an album, *The Dirtwater Fox*, from Mike Whellans, who has been on the folk scene for ten years. Mike has

Neil Ross



Pan Audio

produced an lp of folk, country and hard rock which must be considered the best album to come out of a Scottish studio. It amazes me to think what Mike could have done on 8 or 16 tracks.

The Dirtwater Fox is the most advanced lp to come out of Scotland, but its rock content will be frowned upon by those used to recording and producing haggis music. That's because they don't understand rock or pop. They'd rather leave it to London. No wonder Scotland is so far behind in the recording scene with narrow attitudes like these.

John Mackinnon and his directors at Pan Audio are putting a lot of faith into Mike Whellans' work. If the album breaks in Scotland and England you can be sure a lot more progressive material will be pouring from the Pan Audio Tweed Audio, most of it from local musicians who have been encouraged by the company's success.

And with two commercial radio stations to help out, Scotland's recording picture could be rosy; but the rosy glow will only come if the IFs along the line are systematically cancelled out:

If a Scottish record company shows the incentive to crash the national market; if the musicians recognise this and approach the company; if the bands, singers etc have the ability already shown by Billy Connolly, Rollers and Co; if the song is right; if the studio is competent enough to produce the sound a potential hit record deserves; if the plugging and promotion of the record can help break it, firstly in Scotland, to show the public and trade people that something is really bubbling underneath.

Outside of Thor, Craighall and REL, Scotland is short on multitrack studios. There are plenty of 2 and 4 tracks. Once everyone is at the 16 and 24-track standard, an industry in Scotland will begin to form. Then the home-grown record companies will begin to mushroom. Now we only have a handful, experimenting in Scottish, folk, country and a little pop. Music World Scotland in Glasgow deal with the latter, but still have to churn out Scots 'folk and traditional' to butter the bread.

Their experiments in the commercial market have been disappointing and an album they recorded this year with the Manchester band Airborne had little publicity and promotion in Scotland.

The country is ripe for the plucking. It will take time and a lot of money and hard work from those involved to raise the standard of recording. I personally believe another Liverpool eruption could happen in Scotland if the people concerned recognise what is happening. Everything possible must be done to stop the road to London being littered by our writers and musicians. The encouragement must be there for a start.

The majority of Scots writers and performers probably hate the haggis and pipes image that Billy Connolly has tried to shatter. He's done a great deal towards cracking the barrier but with companies like Lismor around . . . The sooner we fling off the shackles of tradition the better it will be for all of us.

I'm confident it will happen and when it does a lot of people will be telling the critics 'I told you so'. And one of the first to be told will be those in London who can't picture records, let alone hit records, being recorded and produced in Scotland.

But believe me they will!

Survey: broadcast and sound reinforcement mixers

While broadcast mixers are easily recognised, sound reinforcement mixers often work equally well in multitrack applications and vice versa. For the purposes of this survey, we have defined sound reinforcement models by the following criteria: they must be readily transportable, they must be robust and possess not more than four output groups. Further, they must be moderately priced.

ADASTRA (Japan)

Adastra Electronics Ltd, Unit N22, Cricklewood Trading Estate, Clarendon Road, London NW2 1TU.

Phone: 01-452 6288.

M104

6-channel with multiple combinations of hi and lo impedance. Four inputs for mics, one stereo input for riaa 50 kΩ gram cartridge. Battery powered. Price: £25.

ALICE (UK)

Stancoil Ltd, Alexandra Road, Windsor, UK.

Phone: 07535 51056. Telex: 849323 AEGIS G.

USA: CCA Electronics Corp, New Jersey.

Telex: 84-5200.

Canada: Caldwell Equipment Ltd, Toronto.

Telex: 06963645.

Japan: Taito Boeki Ltd, Tokyo.

Telex: J22498.

AM82B 2G

Four mic channels, five stereo channels with full radio facilities.

Price: £4240, \$7844.

AM console

With jackfield, space for turntables.

Price: approx £1300, \$2405.

AM2408B 2G

24-channel 8-group television mixing console complete with jackfield and normal facilities.

Price: £13440, \$24864.

STM6

OB mixer featuring two mic channels, two stereo gram channels (riaa or line), two stereo line inputs and off-air receiver inputs with mono and stereo outputs, pa, headphone and twin ppms.

Price: £465, \$860.

62/3

Sound re-inforcement mixer featuring six line/mic inputs with eq, post fade aux output and stereo line output, two vus, two limiters, better than 76 dB s/n, terminations standard jacks.

Price: £294.

40 STUDIO SOUND, DECEMBER 1976

10/4 (export only)

10-channel balanced mic inputs, echo send, fold-back, 3-band eq, four outputs plus stereo monitoring, four vu meters and limiters.

Price: \$1450.

ALLEN & HEATH (UK)

Allen & Heath Ltd, Pembroke House, Campsbourne Road, London N8, UK.

Phone: 01-340 3291.

USA: Audiotechniques Inc, 142 Hamilton Ave, Stamford, Connecticut. Agents in Canada, Belgium, France, Germany, Austria, Greece, Italy, Portugal.

Minimix

6-channel miniature mixer with one aux box, one monitor mix unit and six compressors.

Quasi

Supplied as either 8/4 or 10/2, unit mixer for portable and studio applications at level below 16/8.

ALLINGTON (UK)

Allington Audio Developments, 794 A2 Mansfield Road, Notts NG5 3GG.

Phone: 0602-624910.

DMM

Modular construction desk mixers; individual module size 38 x 203 mm. Mic pad, line input. Routing 302 for 4 or 8 channel output, 303 for 16 outputs. Eq offers three sections with ±15 dB of control range. Hi and lo pass included.

501

Equaliser with input preamp offering five band switched band eq.

CMM

Modular construction 56 x 133 mm. Takes up to 20 input modules; mounting options include either desk or transportable format.

101

This input channel includes hi lo pass filters with five frequency band equalisation etc suitable for use with up to 20 inputs.

ALTEC (USA)

Altec Corp, 1515 South Manchester Ave, Anaheim, California 92803, USA.

Phone: (714) 774 2900.

UK: Theatre Projects (Sound), 10 Long Acre, London WCE2 9LN.

Phone: 01-240 0955/01-540 2411.

Europe: Altec Sound Products Ltd, 17 Park Place, Stevenage, Herts SG1 1DU, UK.

Phone: 0438-3241. Telex: 825495.

1220A

Portable mixer/preamp with self-contained reverb. Ten lo Z, balanced inputs, plus one aux hi level channel for other devices. Each channel includes: level, bass, treble, es. Output may be monitored via two selectable channels. Each channel with independent vu prior to group mix buss; group vus also. Line and power polarity indicator for shock prevention, electronic crossover for biamp working and

peak limiter circuit. Modular construction. 91 x 61 x 28 cm. 28 kg weight.

AMEK (UK)

Amek Systems and Controls Ltd, Islington Mill, James Street, Salford, Lancashire M3 5HW, UK.
Phone: 061-834 6747.

X series

Modular mixers for either pa or 4-track recording. X1001 input channel has -125 dB noise referred to 200Ω source 20 Hz to 20 kHz. Thd 0.02%. X1003 output module noise fader down -85 dB, fader up input open circuit -80 dB. Standard mixers as follows: 8/4, 12/4, 16/4, 16/4/2, 8/2, 12/2, 16/2 and 20/2. Many options available for consoles.

M series

Designed primarily for multitrack use but sound reinforcement modules available which provide two or four outputs mixed down from groups. Full details next month.

API (USA)

Automated Processes Inc, 80 Marcus Drive, Melville, New York 11746, USA.

Phone: (516) 694 9212.

Rest of World: 3M Company Ltd.

1604

This console finds applications mainly in broadcast usage but others are envisaged. Using modular construction, desks are normally supplied with three stage eq which will nominally operate in either bell or shelf mode. Faders are illuminated, incorporating plastic tracks claiming long operational life. Routing typically comprises four submasters, x-y pan plus pre or post echo. -20 dB pad is standard. Assign module features led peak programme overload.

AUDIO DESIGNS (USA)

Audio Designs and Manufacturing Inc, 16005 Sturgeon, Roseville, Michigan 48066, USA.

Phone: (313) 778-8400. Cables: Audex.

Range of unit and modular systems based on the following audio modules: 301 noise suppressor; ADM 302 limiter; 660 spectrum analyser; ADM 560 Vue-Scan, tv monitor of up to 28 bars; 770 input module, with input attenuate, cue send pre/post, 3+4+4+3 eq in/out, input overload led and solo, with channel slider; ADM 1500/1501 eq similar.

BC Series

Stock consoles up to 16/4 formats, chassis with four vu meter display, for sound re-inforcement. Standard desk console \$2950.

BC-5 Series

Broadcast production consoles. Format up to 16 low level inputs or 28 high; four outputs with individual vu and monitor, es and return, flexible monitoring. Standard \$6425.

TV-32

Broadcast production console up to 32 input and four subgroups; 20 low level inputs or up to 104 high, echo return on both masters, metering of all group functions; machine controls; selective groups mic muting.

Price: standard \$18 725.

42 ►

System 5305

The no-compromise professional



When you're regarded as the professionals' professional, you can't afford to compromise. Sound engineers will recognize the Neve standards of reliability, quality and performance in our new System 5305.

They're always there. What's different is innovative desk styling, new control designs, more unit compactness, and a price that's right.

The 5305 is a complete console system intended for small, medium and large studios and mobile vehicles. You get super smooth slide faders, 3 different channel amp/EQ modules to choose from, 4 sub-groups with reduction to 2 outputs, echo and cue sends and a list of options not matched by competitors. Stock consoles have 12 to 20 input channels and 24, 32 or 36 inputs can be made to order.

Whether you're interested in Television, Stereo production, 4 track Recording, mixdown or Sound Reinforcement, you owe it to yourself not to compromise on quality.

Neve

The Sound of Neve is Worldwide

Rupert Neve & Co., Ltd., Cambridge House, Melbourn, Royston, Herts., SG8 6AU, England. Tel. Royston (0753) 50776 Telex 81381
Cables NEVE Cambridge

Rupert Neve Incorporated, Berkshire Industrial Park, Bethel, Conn. 06801, USA. Tel. (203) 744-6230 Telex 969638

Hollywood: Suite 616, 1800-N, Highland Ave., Hollywood, Ca. 90028
Tel. (213) 465-4822

Rupert Neve of Canada Ltd., 2721 Rena Road, Malton, Ontario, Canada
Tel. (416) 677-6611

Rupert Neve GmbH, 6100 Darmstadt Bismarckstrasse, 114 West Germany.
Telefon (06151) 81764

SURVEY: MIXERS

AUDIO DEVELOPMENTS (UK)

Audio Developments, Hall Lane, Walsall Wood, Brownhills, Staffs, UK.

Phone: 05433-5351.

Canada: Double Diamond Electronics Ltd, 200 Consumers Road, Suite 105, Willowdale, Ontario.

France: Studio Center, 3 Rue du Telegraphe, 75020 Paris.

Holland: Sound Techniques, Postbus 206, Alkmaar.

Norway: Siv Ing Benum, Boks 2493, Solli, Oslo 2.

Sweden: Jan Setterburg, Brevkortsgratan 11, 431 Molndal.

AD 007

8/4 portable unit with comprehensive eq, metering osc, two switched ppm's and compressors. Standard with short travel Ruwido faders, P&G 1520 or 1820 to special order. 12-channel extender unit available, connected via designated socket.

AD 031

8/2 'Micro Mixer'; two groups submixed to give third output; single ppm monitors all functions. Head-phone monitor outlet. If compressors required, fitting is in place of one mic channel. Faders and extensions available as AD 007, in corresponding versions.

Super Mini

Retains most of features of AD 007 and AD 031, but each module can be used as input or output, facilitating multitrack working. Led indication of module group status. Thus, a 20 module unit (between 19/1 and 16/4, for example) is less than £3000; P&G 1820 faders standard.

AUDIX (UK)

Audix Ltd, Stansted, Essex CM24 8HS, UK.

Phone: 0279-813132.

Canada: Philips, 200 Consumers Rd, Suite 105, Willowdale, Ontario.

B100

Series of consoles, associated switching and programme distribution systems designed for radio and tv. Fully modular, desks purpose built to provide wide range of custom assemblies from standard production items. Complete world wide installation and commissioning service.

Studio consoles from standard B101 10/2 to the 24/2 B102, with four additional subgroups. Vu/ppm metering for mono or stereo standard; multi-metering if required. B103 portable 12/2 uses same range of modules. Range of broadcast continuity systems and self operated radio studio consoles priced between £1500 and £8000, \$3300 and \$13 200. Backed by complete range of rack mounting equipment (distribution amps, switching matrices etc) for radio station custom packages.

Standard modules include mic/line input channels with comprehensive eq, routing, compressor/limiter, voice-over, stereo width, distribution, line amp, osc.

MXT-800

For studio and ob use, with up to 21 channels and 2/4 groups. Rack or table top mounting. Simpler facilities and format than B100 Series.

MXT-200

For installations requiring less stringent performance specifications, with compact arrangement, simple controls and low cost. Suitable ob.

MXT-1000

Suitable for studio and ob use. Transportable or free standing console with up to 20 channels and two or four groups. Features include compressor in each

mic circuit, 4-track monitor mix down in four group mixers.

Price: from about £1500.

AVAB (Sweden)

AVAB Elektronik AB, V. Hamngatan 1, 411 17 Goteborg, Sweden.

Phone: 031-112032/031-112034.

UK: MCI (Professional Studio Equipment) Ltd, 21 Claremont Square, London N1 9IX.

Phone: 01-278 2288

USA: Audiotechniques, 142 Hamilton Ave, Stamford, Connecticut 06902.

Phone: (203) 359-2312.

Audio Industries Corp, 1419 Nth La Brea Ave, Hollywood, California 90028.

Phone: (213) 851-4111.

Canada: Chromacord Corp, 2343 43rd Ave, Lachine, Quebec H8T 2K1.

ME 802S

Portable mixer for location recording. Inputs: eight mic line. Outputs: master A and B, tap 1 and 2, echo send and monitor A and B. Balanced in/out. For 220/110vac or internal nicad batteries. Ppm meters with led display, phantom feeding, stereo echo and tape return, 2 x 10-octave equalisers, xlr in/out connectors, mixer fitted in standard size brief case.

ME 802

Portable mixer for recording and pa. Fitted in brief case. Eight balanced inputs mic/line. Outputs: master A and B, tap 1 and 2, 2 x 10-band octave equalisers, xlr in/out connectors.

MP 532

Portable pa mixer, designed to meet the requirements for touring theatre companies etc. Inputs: five mic/line, two stereo tape and one stereo phono: With power amp 2 x 80W rms.

BOGEN (USA)

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

Phone: (201) 343-5700. Telex: 710-990 5047.

Range of basic mixer/preamplifiers with rotary level controls. Balanced or unbalanced inputs, either xlr or jack connectors, facilities for extending inputs with add on units. Also separate octave equaliser. Prices: \$130 to \$400.

Tech-craft range

Mixer/amplifiers for pa applications, some with rotary faders, others with sliders, vu meter. Also modules designed for mic or gram inputs.

CAMBRIDGE ELECTRONIC WORKSHOP (UK)

Cambridge Electronic Workshop, a division of Analogue Electronic Workshop Ltd, 4 Water Lane, Oakington, Cambridge CB4 5AL, UK.

Phone: 0223 3737.

High quality portable and installed desks for theatre use. Cue lights, show relay/communications facilities, ls switching, tape remotes. Standard 2- and 4-group models available. Standard 10/2 model provides ten input channels, separate line/mic sensitivities, hf, variable mid, lf, hi-pass filter, two aux send pre or post, pan pfl, two main, two aux groups with pfl, oscillator. Any group or input may be metered via pfl, also stereo and off-tape monitoring. Communications feed. Switching eight ls lines, jack bay, connectors locking din. Price: standard £1450.

Standard 12/4 model provides facilities as 10/2 except 12 input channels and six direct inputs all accessing two mono groups and four main groups. Mono groups normalised to main groups via quad pan pots. Illuminated ls switching for four power

amps. Foldback groups available to a maximum of eight.

Price: standard £2990.

CADAC (UK)

Cadac (London) Ltd, 141 Lower Luton Road, Harpenden, Herts AL5 5EL, UK.

Phone: 05827-64351. Telex: 826323, Cadac Harpenden. Cables: Cadac Harpenden England.

USA: Cara Pacific Sales Co, 3050-F Via Alicante Dr, La Jolla, California 92037.

Phone: (714) 452-0813.

Spain: Singleton Prods, Via Augusta 59, Desp 805, Edificio Mercurio, Barcelona 6.

Phone: 228 3800. Telex: 54015.

Italy: Ing Oscar Roje, 20147 Milano, Via Sant'Antalona 15.

Phone: 415 4141. Telex: 39202.

Finland: Into Oy, PO Box 153, Helsinki 10.

Phone: 90-11123. Telex: 12-1836.

South Africa: Tru-Fi Electronics SA (Pty) Ltd, PO Box 31801, Braamfontein Tvl.

Phone: 838 4930.

Japan: Kawamura Electrical Laboratory, No 34 Yarai-cho, Shinjuku, Ku, Tokyo 162.

Phone: (03) 260-0401. Telex: J22748.

Portable

Normally fitted 10 or 12 channels but available up to 21. Two or four group outputs. Version with full quad panning on all channels. Two es, two fb, pfl, osc, tb, standard monitoring. Both mic and line bridging inputs to channel separately gain adjustable. Five-band eq: hf shelving curves, three mid bell, and one lf shelving. Each band has frequency select/cut and booster control. Table top or stand versions. XLR fitted.

Broadcast

Standard 20-channel broadcast console under development. Custom facilities available.

Portable

Standard version available with 10 or 12 channels and two or four outputs, two echo sends, two fold-backs, pfl, oscillators fitted, separate mic and line inputs on each channel and a 5-band equaliser plus high pass filters.

Custom

Mixers designed for broadcasting organisations.

PA

Studio quality consoles for producing live sounds comparable with studio recordings. Each input channel has mic and line inputs, 5-band equaliser plus high pass filter, two prefade and two post fade auxiliary mixes and routing to six stereo sub groups with panning, plus main stereo outputs. May be built into fitted flight case if required.

CALREC (UK)

Calrec Audio Ltd, Hebden Bridge, Yorks, UK. Phone: (0422) 842159.

USA: Edcor, 3030 Red Hill Ave, Costa Mesa, California 92626.

Canada: Canadian Fidelity Sound Corp Ltd, 4237 Dundas St West, Toronto, Ontario MX8 1YC.

Italy: Laboratorio Elettro Musicale, Via Delle Rose 47048, S Giovanni in Marignano.

Phone: 0541 652 52.

Portugal: Tecla Sociedad Comercial de Discos Ltd, Rua Sousa Martins 5, 1º, Lisboa.

Phone: 56.04.05/56.28.50. Cables: Teclarecords.

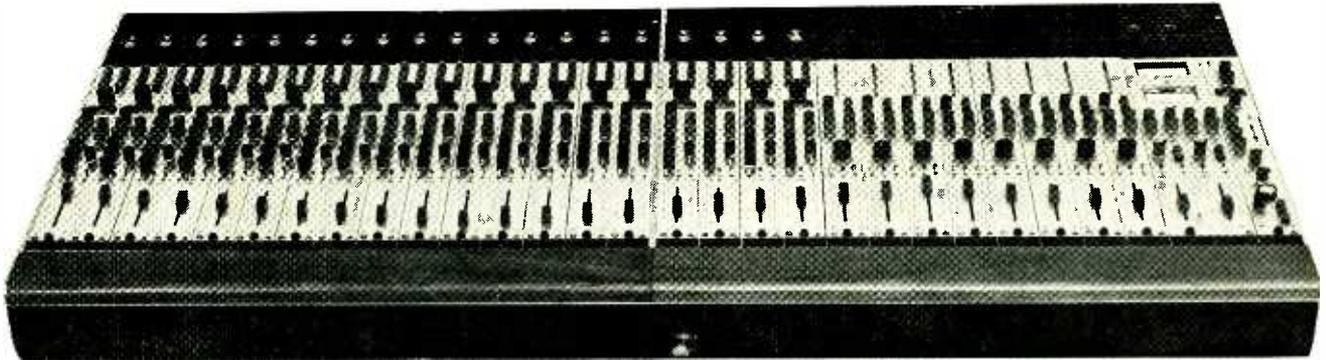
South Africa: Tru-Fi Electronics SA (Pty) Ltd, PO Box 31801, Braamfontein, Transvaale.

Phone: 838-4930.

Pakistan: Electronix, 21 Plot FT 2/24, Kurrie Rd, Freretown, Karachi-4.

India: Cinerama Private Ltd, Metro House, PO Box 44 ▶

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WITH THE TRIDENT FLEXIMIX SYSTEM your future expansion problems are solved from the moment you install. Fleximix isn't just another portable mixer which "locks you in" to the format you initially purchase. Fleximix is a carefully thought out expandable mixer which will meet your needs now and in the future. Any time you decide you need more channels you simply slot-in additional modules; if you run out of slots, just add another mainframe. Modules may be placed in any sequence you like. No factory rework is required and no rewiring necessary.

For as little as **£2080** (excl. VAT) you can start with a 10 input 2 group output format and subsequently build it up to a system with 10 mixed outputs, any number of input channels and 24-track monitoring. Additional mainframes may be either rigidly or flexibly coupled to the original system. Flight cases are available to accommodate any arrangement.

Fleximix is designed for high quality Public Address, Bands, Budget Studios and Theatre applications and many of its features are normally only to be found on expensive studio consoles.

A number of exciting new modules will shortly be available which will extend even further the system's versatility. These will include a Compressor/Limiter module, Quad Joystick module and Line Balancing module.

If you're looking for a new mixer you have just found it!

Write for details to:

**TRIDENT AUDIO DEVELOPMENTS
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**Sales Office: 112/114 Wardour Street,
London W1V 3AW.**

Tel: 01-734 9901/6

Telex: Tridisc 27782



Factory address:

**Shepperton Studios,
Squiresbridge Road,
Shepperton, Middlesex.**

Tel: Chertsey (09328) 60241

SURVEY: MIXERS

1232, Mahatma Gandhi Rd, Bombay No 1.
Phone: 293893/4. Telex: 011-4198. Cables: Super-sound.

New Zealand: Theatrelight Ltd, 104 Abel Smith St, PO Box 9366, Wellington.

Australia: Crest Record Co, 122 Chapel Street, St Kilda, Victoria 3182.
Phone: 91 3238.

Modular mixing desks, based on full range of standard units.

J Series

Stereo broadcast equipment, in three basic units assembled as required: channel unit with eq, gain, filter and route; groups unit for mixing and sub-routing; and monitor/output unit with line amp as appropriate.

K Series

Consoles for large studios, up to 32/4 format with up to four subgroups. Full eq and grouping on all channels, monitor with vu/ppm pfl/afll/compressor/limiters, osc, tb, phantom power provision.

CETEC (USA)

Cetec Audio USA, 13035 Saticoy St, North Hollywood, California 91605, USA.

Phone: (213) 875-1900. Telex: 910-499 2669.

UK: Cetec Systems Ltd, Sapphire House, 16 Uxbridge Rd, Ealing, London W5 2BP.
Phone: 01-579 9145. Telex: 935847.

Series 10

10/2 portable console with ten stereo input channels and ten switchable remote stereo inputs; comprehensive tb and cueing systems; stereo headphone output, remote tape controls; clock; two ps modules (remote) each of which handle requirements. Available in mono/stereo/quad forms with eq if desired.

Series 20

Live music console. Up to 30 inputs, four program outputs, mono output, stereo output, two fb, one es. Mic/line and optional switching for up to 48 additional remote inputs. Phase: solo; attenuate to 60 dB; group solo, echo return; programmable mute for four independent presets; three way eq on all inputs; led channel-on; illuminated vu for all outputs, ppm available; plug-in modular construction.

Series 2000

Available in formats of up to 32/24, based on the following modules: 712L nine frequency graphic eq/mic amp; 711L eight frequency eq/mic amp; 311L mic amp; SM-5 five channel switch push button; SML switch module lever, 24-channel.

Series 1204

For high quality recording, broadcasting, sound re-inforcement and film work. 12 mic/line inputs, wired 16; complete eight frequency eq with es and cue on each channel; four output groups with illuminated vu; four es. Tv version available similar 1204 standard with nine frequency eq, direct feed switching bypassing main buss; four mixing busses Sub 1, Sub 2, Aud and Pgm, usable for separate simultaneous mixes. Eight monitor mute switches.

Series III

Large scale, flexible console based on the following modules, up to 40/24 configuration: input module 24 illuminated push button assign; mic preamp pad/gain; graphic or three way eq; mute, solo; extensive pan in quad and stereo groups; es send automation control, and vca. Submaster attenuation; full and extensive multitrack monitor switching. Further system options include simultaneous quad/stereo/mono mix busses; automated joystick panners; automation encoder, decoder and interface wiring;

rough mix monitor and cue sends derived from input module.

AM4A

Small, modular desk, arranged as block housing and fitting plug-in modules. Standard Cetec modules are accommodated, giving wide flexibility according to specific operational requirement.

Further series of compact cabinet mixers is available varying from simple 8/2 downwards, in combinations of impedance, input type and connector.

CITRONIC (UK)

Citronic Ltd, 7 Market Place, Melksham, Wiltshire, UK.

Phone: 0225 702802.

MMP303

4/6-channel mono mixer/preamp for disco applications. Mic input with hf and lf, aux, disc 1 and 2, over-all level with meter.
Price: £65.

SMP505

6-channel stereo disco mixer/preamp with two mic inputs with hf and lf, aux tape and two disc inputs, left and right outputs each with lf and hf, monitor switchable to all channels, cans output.
Price: £120.

SMP606

6-channel stereo disco mixer/preamp with four stereo channels, automatic voice over on mic channels, illuminated remote start controls, vu meters for output and monitor.
Price: £251 (distributed by Roger Squire Ltd in UK).

CHILTON (UK)

Magnetic Tapes Ltd, Chilton Works, Garden Road, Richmond, Surrey, UK.

Phone: 01-876 7957.

USA: Freedom Electronics Inc, 3540 E Lake Street, Minneapolis, Minnesota.

Canada: Radio Service Inc, 2500 Bates Road, Montreal H3S 1A6.

Italy: Audio Consultante, Via Sabbatini 13, 41100 Modena.

Switzerland: Hi Fi Electronics, Idastrasse 3, 8003 Zurich.

Sweden: HZ Studio, AB Box 6099, 171 09 Solna.

South Africa: Tru Fi Electronics SA (Pty) Ltd, PO Box 31801, Braamfontein, Tvl, 2017.

Holland: Totaa Theater Techniek BV, Egelantiersgracht 30, Amsterdam.

Denmark: Conquist Recording Studios, Holtebakken 33, 2990 Niva.

Norway: Siv Ing Benum & Co, Boks 2493, Solli, Oslo 2.

Greece: Christos Lilis, 8 Enianos Str, Athens 104.

Germany: Amptown Sound Equipment, 2000 Hamburg 60, Alte Wohnr 20a.

M12/4 Portable

For recording, portable or pa applications. Channels include: balance mic/line with gain, hf and lf eq, subgroup with pre/post facility; pfl; pan; channel fader. Output panel includes line/monitor meter switch, aux master send/return, switchable osc, monitor and headphone gain controls each with tape/line/pfl selector. Different input modules optional; extension unit and multicable input socket for music balancing.

M10-2 Mark 3

Similar M12/4 series, with appropriately reduced output facilities.

CROSSROADS (USA)

Crossroads Audio Inc, PO Box 19871, Dallas, Texas 75219, USA.

Phone: (214) 526-1636.

Minipro

Concert sound re-inforcement mixer. 16 in, three out; balanced input; simple eq; prefade monitor mix buss; post fade echo/effects subgroup, master eq on main and monitor outputs; XLR connectors; two large vu meters.

Pcb construction; all controls rotary. Weight 14 kg approx, length less than 77 cm. Price \$1750.

CRYSLO (UK)

Cryslon Electronics Ltd, Unit 4, Berrington Road, Sydenham Industrial Estate, Leamington Spa, Warwickshire CV31 1PN, UK.

Phone: 0789-66282.

Complete manufacture, design, installation and after-sales service offered for theatres, film studios, local broadcast stations. Consoles manufactured range from small compact portables to multi-channel and multi-group studio facilities, as required. Stage manager systems, tb, cue, show relay and security systems. All ancillary items may be supplied. All console and rack systems built from standard range modules: mic amp, various eq, mixer, line amp, tone osc, power amp etc presented on standard front panel 177.8 x 50.8 mm; all plug-in fitting.

DUKANE (USA)

DuKane Corp, 2900 DuKane Dr, St Charles, Illinois 60174, USA.

Phone: (312) 584-2300.

13B465

Up to 16 input channels, to three output groups; overload indicator on channel and group; cue channel to monitor any combination in/out. Supplied with two large vu meters. Designed for mass audience facilities.

2A75B

Mixer-amplifier for pa and sound re-inforcement purposes. Five inputs, each taking mic/line/disc, three pad positions; balanced output. 2A75B is associated mic input expander, with five additional channels.

EAGLE (Japan)

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU, UK.

Phone: 01-903 0144. Telex: 922131. Cables: Eaglint Wembley.

Range of small mixers. Self-powered with two PP3 batteries.

FF 10

Designed for disco use: two stereo disc, one stereo tape and one mono mic input. Channel and master sliders. £34 plus vat.

FF 32

Seven channel stereo programme mixer and pre-amp. As FF 10 but with additional pfl. HA 10 headphone amp may be used in conjunction. £36 plus vat.

MP 12

6-channel stereo/mono mixer and preamp. Mic inputs switchable hi/lo impedance. £34 plus vat.

FAIRCHILD (USA)

Fairchild Sound Equipment Corp, 75 Austin Blvd, Commack, Long Island, New York 11725, USA.

Phone: (516) 543-5200.

UK: Jacques Levy Professional Recording Services, 6 Carlisle Mansions, Carlisle Place, London SW1.

Phone: 01-834 9248.

ICBM

Series of modular broadcast consoles and ic broad-

TOMORROW'S SOUNDS ON FOUR GREAT NUMBERS

Back in the mid-50's (remember Elvis and his Blue Suede Shoes first time round?) Scotch acetate 111 tape was standard for all magnetic recordings. By the mid-60's, 3M had introduced Scotch 202, the first low-noise polyester backed recording tape. It added 5 decibels to the dynamic range. To catch the Liverpool sounds, groups all over the country put Scotch 202 tape to good use.

Early 70's. Along came high output Scotch 206 mastering tape, 207 (the long playing version), plus Scotch 262. Sounds grew more fantastic. Stars like Rod Stewart had 3 more decibels to play around with.

Now Scotch 250 mastering tape has hit the decks. Up goes the dynamic range once more, to 78dB, allowing tapes to be driven harder and giving a signal clarity that hasn't been there before.

Next time Scotch professional audio tapes improve again, you'll be the first to hear. Till then, Scotch 250, 206, 207 and Scotch 262 tapes are like some of our greatest recording stars. Still very much around, with the same familiar numbers.

01-659 2323

(Extension 577)

And at

Birmingham (021-236 5077 Ext. 218)

Glasgow (041-332 9622 Ext. 206)

Manchester (061-236 8500 Ext. 216)

3M

3M and Scotch are trade marks.

3M United Kingdom Ltd., 3M House, Wignmore Street, London W1A 1ET.

SURVEY: MIXERS

cast modules (ICBM) including mic input module line and hi level input modules, remote input, out, put, monitor and communications modules. Metering via vu in console shell; wide format flexibility.

EMI (UK)

EMI Sound & Vision Equipment Ltd, 252 Blyth Road, Hayes, Middlesex, UK.
Phone: 01-573 3888. Telex: 22417.

Series 8100

Modular desks for broadcasting applications. Channel module 8020 contains two separate input circuits for either mic or line inputs. Group module 8021 again has two separate circuits with five outputs. Output module 8022 is driven from group modules or other sources with pfl, foldback and pa outputs. Echo module 8023 contains interface and control for EMT plate. Preview module 93432 is for selection of tv sources to a monitor. Compressor 8025 may be either wired in or patched as appropriate. Mid lift 8026 has presence circuitry. High level amp 8032 gives a group clean feed. Standard desks are assembled in 8, 16, 24 and 36 channels.

HARRIS (USA)

Harris Corporation, Broadcast Products Division, 123 Hampshire Street, Quincy, Illinois 62301, USA.

Phone: (217) 222-8200.

UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP.
Phone: 09322 43124. Telex: 928475.

Dualux 80

Dual channel monoaural console. Eight mixing channels, 18 inputs, allows control of am and mono fm from the same control point. Executive dual channel stereo/mono console, 26 inputs into 10 full channels may also be operated monoaurally. Dual channel capability allows control of fm stereo and mono am simultaneously.

Gatesway 80

Monoaural console. Eight mixing channels, 18 inputs. Stereo 80 console, 180 console, 18 inputs may be switched into eight stereo mixing channels to provide a large degree of flexibility that will satisfy any stereo requirement.

HELIOS (UK)

Helios Electronics Ltd, Brownells Lane, Feltham, Middlesex TW13 7ER.
Phone: 01-890 0087.

SB series

Standardised modular range of desks for stereo and mono broadcasting. Frame sizes to accept 12, 16 or 24 input channels. Free standing, table top or trolley formats with or without built-in jackfields. Mono and stereo outputs, choice of channel equalisers, meters and communications arrangements, space for four comp/limiters.

TM series

Designed for OB scanners, up to 36 channels in demountable blocks of 12 channels, eight subgroups plus simultaneous stereo and mono outputs. Facilities for 8-track recording, monitoring, metering and communications designed to suit each application. Wide choice of channel equalisers and desk-mounted ancillary equipment.

Custom series

Complete custom design and building facility for any mixing desk from smallest dj desk to largest light entertainment console. Special designs available for film dubbing desks, vtr transfer desks etc.

HH (UK)

HH Electronic, Industrial Site, Cambridge Road, Milton, Cambridge CB4 4AZ, UK.

Phone: 0223-65945/6/7.

USA: Audiotekniques Inc, 142 Hamilton Ave, Stamford, Connecticut 06902.

Phone: (203) 359-2312.

Canada: Paco Electronics, 45 Stinson Street, Montreal.

Phone: (514) 748-6787.

France: Techniques et Contemporaines, 6 Rue Monsigny, Paris.

Phone: 266 36 89.

Belgium: Delba Equipment SA, 28 Rue Bu, Pabelion, Brussels 5.

Phone: 376 6034.

Holland: A. Harges BV, Oude Gracht, Utrecht, Holland.

Phone: 31 61 44.

PM12/2

Portable 12/2 mixer for high quality pa or recording applications. Led output vus and electroluminescent lighting on controls. Channels include hi/balanced/lo, line gain, eq ± 16 dB at 40 Hz, ± 12 dB at 1.8 kHz, ± 16 dB at 15 kHz; fb and es; pan; monitor switchable pre/off/post fade; mute; sliders on channel, groups and subgroups. Additional echo return. Monitor output may drive cans, switchable between channels, groups and subgroups.

ICE (UK)

ICElectrics Ltd, 131/132 Blackdown Rural Industries, Haste Hill, Haslemere, Surrey.

Phone: 0428-2015.

Ice mono

6/1 mixer, preset for aux, mic 1/2 and disc 1/2/3. Overload capability 20 dB all inputs, output 760 mV. Bass/treble controls, headphone monitor. Tape socket. 13 x 50 x 11 cm.

Ice stereo

As mono machine but with aux and disc inputs ganged stereo faders. Tape output may be used as echo send/return. 13 x 50 x 11 cm.

ITAM (UK)

Industrial Tape Applications, 5 Pratt Street, London NW1 0AE, UK.

Phone: 01-485 6162. Telex: 21879.

France: Reditec, 27 ter Rue de Progress, 93107 Montreuil, Paris.

Belgium: IATA, Kerkstraat 16, 3020 Herent Wijnmaal.

10.4

Portable or studio desk for recording or pa. Modular construction in fixed format for high turnover/low cost. Facilities include: balanced mic/line input with gain; lo, mid, hi eq; es; fb; pan between groups 1/2 and 3/4; channel assign; fader; four limiters with led indication (variable); four monitor volume controls fed to stereo monitor output. Headphone socket; four echo returns. Connections via phone jacks. Weight approx 11 kg. Price £647 plus vat.

JBL (USA)

James B. Lansing Sound Inc, 8500 Balboa Blvd, Northridge, Cal 91329, USA.

Phone: (213) 893-8611. Telex: 674993.

UK: C. E. Hammond Co Ltd, Chertsey Road, Byfleet, Surrey.

Phone: 09232-41131. Telex: 262525.

Series of simple, high quality, rack mounted mixers.

5152

2/1 mixer/preamp, inputs switchable for unbalanced lo imp mics, lines or riaa mag phono, convertible to balanced, unique ducking feature allows remote

15 dB gain reduction of one channel for clear voice-over. Balanced output.

5306

8/1 mixer/preamp, six balanced lo imp mic inputs, two unbalanced hi amp line inputs convertible to balanced bridge or riaa mag phono. Overload indicators on mic inputs. Switched treble/bass controls, master gain, monitor gain, balanced output, single vu meter.

5308

8-channel mix expander unit for use with 5306.

KAJAANI OY (Finland)

Kajaani Oy Electronics, Nuuskatu 11, SF-87400 Kajaani 40, Finland.

Phone: 986-37311. Telex: 45148.

10EA series

Fully modular construction of aluminium on a strong steel frame. Console can be tilted on its support for easy maintenance. Each channel has three balanced inputs with phantom power on all mic inputs, separate gain controls for mic and line, Penny & Giles faders, comp eq, true power law pan pot with grouping via reed switches to three stereo groups or our mono. Logic controlled pfl with monitoring and main listening for complicated playback situations. Digital timer, large screen phase crt, telephone interview equipment and auto dj module. To supplement the console organisation a colour coded patchbay is available. Possible combinations of 6/2 to 24/2 + 4 + 4 with standard combinations.

LAMB (UK)

Lamb Laboratories, Lamb House, Church Street, London W4 2PB, UK.

Phone: 01-995 4551.

USA: Lamb Laboratories, 155 Michael Dr, Syosset, New York 11791.

Phone: (516) 364-1900.

3637 Cahuenga Blvd, Hollywood, California 90068.

Phone: (213) 867-1200.

PML422

4/2 portable mixer. Unbalanced mic inputs 200 ohm, line greater than 20k ohm; line out +10 dBm unbalanced. Two adjustable vu meters. Input sensitivity control, treble/mid/bass lift/cut; es; pan; stereo limiters switchable; pcb construction; linear sliders.

PML424

Identical with PML422 but configuration rearranged for dual use as four track mixer.

PML426

As others, but with six input channels only.

LANG (USA)

Lang Electronics Inc, 14 E 39th St, New York, NY 10016, USA.

Phone: (212) 725-8110.

Range of mixers and associated units for recording and broadcasting.

LMX3

8/2 mixer using rotary faders. Echo send and reinsert. Input switchable mic/line. Size: 13 x 50 x 18 cm. Weight approx 4 kg. Price \$750; mono version \$575.

LMX4

Five input mixer with subgroup routing and return. Single vu meter. Each channel with mic or line option. With one mic amp \$875.

LMX5

Similar LMX4 but incorporating 10 slave channels only. Output to be fed through transformer coupling

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MCI JH-500

THE
BUSINESS
MACHINE

Busy studios don't take long to figure out that the JH-500 Series is reliable money-making equipment that will keep them out front, outperforming all others.

You start out good, you end up good.



The Art of the States

MCI (PROFESSIONAL STUDIO EQUIPMENT) LTD.
MCI House, 54-56 Stanhope Street,
London NW1 3EX. Tel: 01-388 7867/8. Tx: 261116.

SURVEY: MIXERS

to mic input elsewhere. Power internal or external. With one mic amp \$875.

Also available: compatible eq and reverb units and extended versions of above.

MALATCHI (USA)

Malatchi Electronic Systems Inc, 3731 E Colfax Ave, Denver, Colorado 80206, USA.
Phone: (303) 321-3520.

Modular professional rack mount mixers and consoles for live sound reinforcement and recording. Any number of input channels with one, two, three or four and more output mix configurations. US top grade parts for 'reliability and highest performance'.

Installations include Wolf Trap Farm Park Theatre, Ford's Theatre and the White House in Washington's DC area, Entertainment Complex and Ebbett's Field in Denver.

MARCONI (UK)

Marconi Communication Systems Ltd, Chelmsford CM1 1PL, UK.
Phone: 0245 53221. Telex: 99201.

B1006

Modular sound console consisting of eight (or 12) channels with two groups, a monitoring module, a power supply module and a talkback module. Pfl and cue lamp circuits on all channels and groups, equalisers on all channels, hi pass filter, transmit/rehearsal facilities.

MARTIN (USA)

Martin, 320 W 46th St, New York, NY 10036, USA.
Phone: (212) 541-5900.

SLM-1020A

Compact 10/2 console. Channels switchable between line and balanced mix 200 ohm. Output 600 ohms balanced main groups, monitor 5k ohms unbalanced. Es 600 ohms unbalanced. Equalisers per channel at 50/100 or 200 Hz, and 3k/6k or 12k Hz. Separate channel pan. 27 x 39 x 19 cm overall. Weight approx 11 kg. Twin vu meters. Price fob NY \$2495.

SBC 82

Stereo broadcast console, similar specifications to SLM-1020A. Designed for broadcast/disco, ten inputs on five dual-ganged sliders, into two groups, with mono cue facility. May be used with 234 mic/line cards or 234PE phone eq cards. Price without input cards \$1649, with extra cards at \$50 each.

MAVIS (UK)

International Entertainment Services, 11A Sharpleshall Street, London W1, UK.
Phone: 01-722 7161/2/3/4. Telex: 27655.
USA: IES Inc, 3702 Astoria Blvd, Long Island City, NY 11103.

Minimax 12/2

Compact portable mixer with channel buss and master controls on left, right phones and subgroup return. Channel facility includes mic/line input with gain/trim pot; three range eq; es and fb bussing from each channel; channel fader. Headphone jack outlet for monitori..g.

Portable

15/4 mixer for mobile use. Channels with full eq with two additional high level aux input channels. Configuration may be as basic four track full range or two track split into three channels per track, in

conjunction with electronic crossover. Further subgroups for external echo and for two fully equalised monitor circuits. Phone jack output for headphone.

PAS 55/30

Comprises two wings similar 15/4 mixer unit above, but with group positions reversed in one instance. Central console incorporates four ppm meters and necessary switching and subgroup control. For use ss up to 30/30 recording/remix system. With extra stereo crossover, each wing may drive quad pa.

McMARTIN (USA)

McMartin Industries Inc, 4500 Sth 76th Street, Omaha, Nebraska 68127, USA.

Phone: (402) 331-2000.

UK: Lee Engineering Ltd, Ashley House, Ashley Road, Walton-on-Thames, Surrey KT12 1JE.

Phone: Walton-on-Thames 28783/4. Telex: 928475. Cables: Leetech.

B-800 Series

Modular, providing for push button selection of 27 input sources through eight mixing channels. Standard models B-801 mono, B-802 stereo, B803 dual mono, B-802-S1 dual stereo and B-802-S2 stereo-mono. First three channels lo mic; next four channels high level unbalanced aux sources; remaining channel hi level balanced. Special configurations as required. Step attenuators; 8W monitor amp modules; selective intercom/talkback; two panel vu meters.

B-500

Similar B-800 Series, with disc input modules available. Basic five channels input to one or two output channels.

Accu-five

Five channel 'mini-console' in 9 cm high rack unit. Accommodates up to 13 mic inputs, with hi/lo input level switching on three channels, monitor and cue facilities. All inputs transformer isolated; cue/talkback facility.

MIDAS (UK)

Midas Amplification, 87 North Grove, London N15 5QS, UK.

Phone: 01-800 6341.

Belgium: Louis de Potesta, Rue Th Decuyper 134, 1200 Brussels.

Phone: 771 30 63.

Two basic ranges of portable, mixing and studio systems.

Portable

For quality sound re-inforcement and 2/4 track recording applications. Based on following modules: PR 001 input/output module, mic/line optional, line gain and input attenuator 30 dB, 600 ohm balanced mic input; eq ± 16 dB at 50 and 15k Hz ref 1 kHz, ± 14 dB at 3.5 kHz, variable Q; two each fb and es normally pre and post; carbon track Ruwido fader; pan; pfl. PR 002 similar, but fitted P&G fader and extended eq; bass cut, presence at 1.5/3.5/7 kHz; subgroup route switches optional. PR 003 as PR 002, designed for recording; extra mute/channel switch/pan grouping. Output module PR 010 includes post-fader break points; PR 011 with line in/out monitor and amp. Fb and es/return module mixes and rein-serts. Tb, pfl, limiter and crossover modules available; jack field optional.

MILLBANK (UK)

Millbank Electronics, Uckfield, Sussex TN22 1PS, UK.

Phone: 0825-4166. Telex: 95505.

Disco III

Stereo sound mixer for custom dj consoles, two

disc, one stereo aux and single mic input. Bass/treble control, mic bass cut, comprehensive monitoring. Balanced outputs. Panel size 18.4 x 31 cm cutout.

MCC Mark III

Self powered mixer with 10 input channels and two output groups. Channels arranged two groups of five, fader only control. Pfl on each group and all channels, with stereo monitoring. Monitoring vu broadcast, vu peak reading or ppm. External battery or mains operation. DIN standard or XLR connectors. Rack mounting.

Musicmaster III

For use in discos, small theatres etc. Two section: one for stereo music reproduction, one for music pa (stereo). Pa section includes six channels with hi/lo Z input, pan, hi, lo, mid eq. Push button selection of channel monitor, balanced mic/unbalanced line, coarse sensitivity, es with gain, mute. 61 x 51 x 21 cm.

PAC-6M

Self-powered mixer with six input channels utilising Pac System preamplifiers. Provides facilities for microphones, tape/disc/live music inputs, warning indicators. Choice of user controls on each input. Rack or free standing construction.

MM (UK)

MM Electronics, French's Mill, French's Road, Cambridge, UK.

Phone: 0223 66559.

MP175

Twelve channel stereo console for recording. Semi-modular channels include mic/line switch, gain, four ban eq, fb, es, pan and channel slider. Master groups include return, es and fb master controls and vu metering. Size 72 x 39 x 8 cm, weight less than 3 kg.

WA600/2

Simple 6/1 portable mixer in case. Single es subgroups, two eq bands on each channel. Short sliders for both channels and groups, with single pot for echo return. Size 50 x 21 x 52 cm.

MUSTANG (UK)

Mustang Communications, 31 Nelson Street, Scarborough, Yorks, UK.

Phone: 0723-63928.

Abroad: distribution network being set up.

Range of mixers primarily intended for performance and may find studio application. Mixers available in rack or free standing format, with cabinets for racking also available. Delivery 'usually held below 10 days'.

MM Series

Modular options based on MM4 and MM6 four and six input mixers. Associated modules for mic hi/lo, mag/ceramic pu, high Z tape, balanced line etc. Prices (trade) range MM4 £55.02, MM6 £64.05, with extras around £5 per module. Compatible power amps offered, and range of lighting control.

MMA Series

As above, but with integrated power amplifier. 50W and 100W versions, adding approx £30 and £40 respectively to the price.

NEVE (UK)

Rupert Neve and Company Ltd, Cambridge House, Melbourn, Royston, Hertfordshire SG8 6AU, UK.

AMEK "M" Series is a comprehensive multitrack master recording system. Ergonomic design and superb electronics combine to make a totally creative console, at an undeniably sensible price.

Many formats are available, and the desk can be built with future expansion in mind. Quadrophony, alternative routing facilities, simultaneous multitrack and live sound, are no problem.

We also make a range of smaller desks ("X" Series) and a unique set of electronic crossovers, not to mention tailor-made lighting, stage monitoring and sound reinforcement consoles.

If you have a requirement in sound you think we can meet, contact us for rapid quotation and problem-solving service.

M Series short spec.

M2001 input
 Noise: -127dB (20Hz to 20kHz, 200 ohm source)
 Max. input attenuator in. +10dBm
 THD, at 1kHz, 0.02% at +10dBm
 Response, at +10dBm, 20Hz to 20kHz, +/- 1dB
 DESK:
 THD at 1kHz, 0.02% at +10dBm into 600 ohms
 Headroom +22dB above 0dBm into 600 ohms
 unbalanced

FRANCE: Francis LINON, 72 AVENUE LENINE,
 GENTILLY (161) 657 0812
 LONDON: (P.A. division) Ian JONES, HHB PA HIRE,
 16 WALLASEY CRESCENT, ICKENHAM,
 UXBRIDGE, MIDDLESEX
 RUISLIP (71) 73271

AMEK

SYSTEMS AND CONTROLS LIMITED
 2nd FLOOR, ISLINGTON MILL, JAMES STREET,
 SALFORD, LANCS M3 5HW ENGLAND
 (061) 834 6747

Nick FRANKS & Graham LANGLEY

M2001 Input Channel

Connectors:
 as required.
Overdub switch
 now fitted

Insertion points, in and out,
 GPO jacks.

Inputs:
 Microphone input balanced for
 200-600 Ohm microphones;
 Line input, unbalanced, 10k Ohms;
 Insert out, unbalanced, low impedance;
 Insert in, unbalanced 10k Ohms.
 Insertion points are buffered, pre-fader.

Channel controls:

Microphone amplifier:
 Rotary gain control, giving a channel
 sensitivity of 20 to 60dB in the mic.
 position; -20 to +20dB in the line
 position.
 Mic/line input select switch;
 Attenuation switch with 20dB pad;
 Phase switch.

Equalization:
 Equalization in/out switch;
 HF: +/- 18dB shelving, at 3 frequencies:
 6kHz, 10kHz, 15kHz
 Low pass filter at 15kHz, 10kHz,
 and cancel;
 MF: +/- 14dB, peak and dip, at
 3 frequencies: 2kHz, 2.8kHz,
 5.6kHz
 Low or High Q (4dB/ and 8dB/octave);
 MF: +/- 14dB, peak and dip, at
 3 frequencies: 350Hz, 700Hz,
 1.4kHz
 Low or High Q (4dB/ and 8dB/octave);
 LF: +/- 18dB shelving at 3
 frequencies: 40Hz, 80Hz, 160Hz.
 High pass filter at 40Hz, 80Hz,
 and cancel;

Auxiliary bussing:
 2 separate foldback level controls,
 pre-fader;
 2 separate echosend level controls,
 with pre/post switch for both controls;

Routing:
 Panpot with 2 thumbwheel switches
 on each channel, for up to one of
 16 outputs on each switch;
 Channel in/out switch with LED
 indicator;
 Channel overload indicator (pre-fader,
 post insert), peak-detecting LED set
 to trigger at +8dBm;

Monitoring:
 Pre-fade listen/after fade listen (solo)
 by switch.



SURVEY: MIXERS

Phone: 0763 60776. Telex: 81381.

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

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

Hollywood: Suite 609, 6255 Sunset Blvd, Hollywood, Ca 90028, USA.

Phone: (213) 463-4822.

Canada: Rupert Neve of Canada Ltd, 2721 Rena Road, Malton, Ontario, Canada.

Phone: (416) 677-6611. **Telex:** 06968753.

Germany: Rupert Neve GmbH, 6100 Darmstadt, Bismarckstrasse 114, West Germany.

Phone: 06151 81764. **Telex:** 0419581.

5002

Audio control console for television or sound broadcasting featuring 24 inputs, four main groups, two main outputs, two clean feed outputs, three aux groups, four echo groups, pfl, two ppms, telephone effects unit, four limiter/compressors and transmission/rehearsal facilities.

5004

Sound control console for broadcasting featuring 20 inputs, four groups, two main outputs, one reverberation send group, two reverb return inputs, fold-back, talkback mic, oscillator, two ppms (or vus), transmit/rehearsal facilities.

5301

Compact desk for obs or studios where space is at a premium, featuring 20 inputs, four groups, two main outputs, four aux groups, solo, two ppms, talkback, line-up oscillator, transmission/rehearsal facilities.

5302 Melbourne

Broadcasting and recording console for mono and stereo programming and stereo recording featuring 12 inputs, two groups, with clean feeds, two aux outputs, cue, two ppms (or vus), line-up oscillator, talkback studio light or cue keys.

5303

Presenters sound console for broadcasting featuring four mic inputs each with eq, limiter and fader, four high level stereo inputs, two high level stereo inputs combined with six separate stereo inputs, one high level mono input, one stereo clean feed input channel, stereo and mono outputs, stereo monitor on cans, reverberation groups and returns, solo facilities, three vu meters (or ppms), two voice over units, reverse talkback, cue lights and transmission warning lamps.

5304

4-buss console for broadcast and music recording available in frames wired for 12 or 20 channels but may be extended.

5402 CRC

Comprehensive radio console for presenter operation (or sound re-inforcement), which is wired to accept 12 mono or stereo channels and equipped with ten mixing busses accessible from all channels.

5422

Suitcase console with eight channels and two busses which may be either battery or mains powered.

Neve also manufacture specials such as a suitcase OB console with comprehensive monitoring including a control line telephone.

PARTRIDGE (UK)

Partridge Electronics Ltd, 23-35 Hart Road, Benfleet, Essex SS7 3PB, UK.

Phone: 03745-3256.

Range of mixers for various scale operations in broadcast and recording between 5/1 and 24/8 formats. Wide range of possible design and con-

figuration based on the following modules: preamp combinations from lo Z balanced mic to disc, with gain and hi, lo boost/cut; virtual earth mixer; eq with mid control also; compressor/limiter with input gain, threshold and recovery controls; autofade; monitor; selection of groups and subgroups; fb, es, pan; lineup osc; tb. Wide range metering as required. Wide range of standard chassis frames.

Mini

5-channel mini mixer in 5/1 format. Meter switchable, single bass/treble and gain controls.

PEAVEY (USA)

Peavey Electronics Corp, 711 A Street, Meridian, Mississippi 39301, USA.

Phone: (601) 483-3565.

1200

Self-contained, portable mixer for recording and sound re-inforcement work. 12 channels each including: balanced, low Z mic inputs, unbalanced high Z line inputs switchable, input/line attenuate, high/low eq on all channels, stereo pan, three sub groups switchable pre/post, channel slider. Sliders on master groups, with master eq low/mid/high; effects master, return with pan; reverb master, return with pan; balanced output with illuminated vu metering, adjustable. Price \$949.

PHILIPS (Holland)

Electro-Acoustics Division, NV Philips Gloeilampenfabrieken, Eindhoven, Building SAQ 11, Netherlands.

Phone: (040) 733793/732646. Telex: 51121.

UK: Pye TVT Ltd, Coldhams Lane, PO Box 41, Cambridge CB1 3JU, UK.

Phone: 0223 45115. **Telex:** 81103.

LDC25 & LDC15

20 and 12-channel versions respectively with two output/aux and two output/monitor channels. Channels feature hf, mid and lf boost and cut, pan, two aux send busses and pfl. Groups feature re-injection. Intercom module contains operational intercom and slating circuits, vu meter supplied as standard.

PHILIPS

Electro-Acoustics Division, NV Philips Gloeilampenfabrieken, Eindhoven, Netherlands.

Phone: (040) 732904. Telex: 51121 PHTC NL.

UK: Pye Business Communications Ltd, Cromwell Road, Cambridge CB1 3HE, UK.

Phone: (0223) 45191.

USA: Philips Audio Video Systems Corp, 91 McKee Drive, Mahwah, New Jersey 07430.

Phone: (201) 529-3800.

SM4

Modular range of units for flexible set up of custom systems, intended primarily for pa and theatre area as well as 'semi-broadcast' use; with associated power amps.

Modules include the following, with more to be introduced subsequently: *LBB 1140* mixing preamp, various inputs for pick up, music, mic and line, bass/treble ± 14 dB, vu meter; *LBB 1142 50W* mixing amp, as preamp with amp; *LBB 1102 50W* power amp; *LBB 1143 100W* mixing amp; *LBB 1103 100W* power amp; *LBB 1104 200W* power amp; amp/attenuator *LBB 1151/01*; *LBB 1151/02* tone control amp, hi/mid/lo boost and cut; filters *LBB 1151/03*, as tone control amp before but with sliding frequency for anti-resonance treatment; *LBB 1151/05* simple comp-limiter; *LBB 1151/06* gong/chimes/alarm unit; am and fm tuner modules; control desks for small desk installations; sliders, vu module and mains control; signal push button module; five button, also available with illumination.

PYE (UK)

Pye TVT Ltd, Coldhams Lane, Cambridge CB1 3JU, UK.

Phone: 0223-45115. Telex: 81103.

SM8

Eight input channels selectable from three input channels: mono mic/line, stereo disc or stereo hi level. Channels include sensitivity, pfl, es, fb, pan. P&G faders standard. Custom version with switching for up to 48 sources. Talkback may be used externally if required. Eq ± 8 dB at 3/5/8 kHz and 60/120/240 Hz and ± 10 dB at 0.7/2.4/4 kHz. Fader backstop switches accessible for cue or machine start. Mono output from normal two groups working. Wide range monitoring and flexible switching, with interlock of talkback.

SM12

Compact 12/4 portable/studio/job mixer based on narrow 30 mm modules. Channels include: mic/line; pan between predetermined groups; eq ± 15 dB at 30/60/120/240 Hz, 0.5/1/1.4/2.4/4/7 kHz and 2/3/5/7/10/15 kHz; three subgroups pre/post each feeding one of two busses; phase; afl and pfl. Comprehensive group and channel monitoring. Master and appropriate return controls for echo and aux. Comprehensive tb.

QUANTUM (USA)

Quantum Audio Labs Inc, 1905 Riverside Dr, Glendale, California 91201, USA.

Phone: (213) 841-0970.

QM-8A

Compact 8/4 console for use in studio pa, sound re-inforcement and mobile. Channels include: balanced mic/line switch; mic attenuate; boost/cut at 50/200 Hz and 3/10 kHz; output assign to any of four busses or pan between 1/3 and 2/4; two es; conductive plastic faders. Full monitor and group outputs; tb; echo return; quad master attenuator; submaster control, for individual output buss; headphone cue system; large vu meters; headphone cue system. Price \$2599.

RAC (UK)

Rugby Automation Consultants, 19 Freemantle Road, Rugby, Warwickshire CV22 7HZ, UK.

Phone: 0788-810877.

Benelux: Sound Techniques, Postbus 206, Alkmaar, Netherlands.

Specialists in manufacture of smaller custom mixers, majority less than 16 channel input. Many sold to hospital radio networks requiring simple mixer but with relatively specialised facilities.

As well as standard studio console arrangement build may be sloping-front or rack mounting. Circuits available separately as plug-in modules, with a range of 38, with application in studios, hospital radio, schools, colleges, av systems and pas as well as extension and modification of existing equipment. All mixers constructed on pcb system.

Delivery times 'normally between six and eight weeks'. Price example: 8/2 mixer with balanced XLR in, es, treble/bass eq on all channels, ppm on output and console-built requires around £450.

RAINDIRK (UK)

Raindirk Ltd, 33A Bridge Street, Downham Market, Norfolk.

Phone: 03663 2165/3617.

Broadcast

Minimum 8/2 with extra input channels as required. Balanced throughout. Mic/line, phase, treble/mid/

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How we got our great reputation without advertising.

Until now, we haven't had the nerve to advertise our 16 into 2 mixer.

To be honest, we've found its popularity embarrassing.

People love its reliability, and the way it does everything they want without costing the earth.

And they've been buying so many that we've scarcely been able to keep up with the orders.

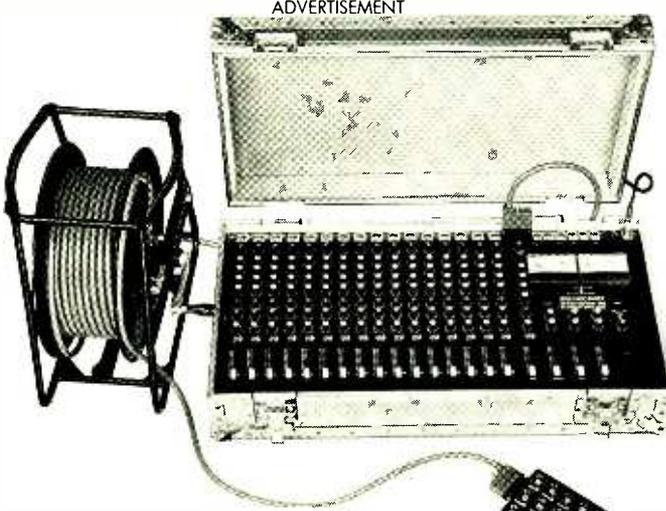
Fortunately, we've grown a lot recently. We're big enough to keep ahead of orders, which means that at long last we can supply them from stock.

So we've decided to live dangerously and start advertising.

Soundcraft Electronics Ltd
5-8 Gt Sutton Street
London EC1V 0BX England
Tel 01-251 3631
Grams Soundcraft LDN EC1

STOP PRESS. LINE INPUT AND LED PEAK INDICATOR STANDARD ON EACH INPUT CHANNEL.

ADVERTISEMENT



Specifications:
Mic input 200 Ω .
Input attenuation infinitely variable.
Max gain 70dB.
4-band equalisation 60, 250, 3k, 15kHz.
Channel switching off/on/prefade listen.
Foldback, echo and pan on each channel.
Input noise -125 dBm.
Total harmonic distortion $<0.1\%$ @ 1kHz.
Crosstalk better than 65dB.
Max output level $+20$ dBm (≈ 8 v rms).

Output control:
2-band equalisation on foldback and masters.
Left and right master, and foldback faders.

Echo control:
2 mixed inputs
4-band equalisation
Echo to foldback
Pan and channel switching
Monitoring:
Two 5" VU meters switchable to display master, foldback or prefade.
200 Ω headphone output similarly switchable.

It comes built into a Cripple Creek flight case, and there is an optional multicore and stage box.
A 12 into 2 version is also available.
Write to Soundcraft direct or to the local agent as listed.



SOUNDCRAFT
ELECTRONICS LIMITED

USA
Franchised dealers—write for details.

Canada
Franchised dealers—write for details.

Netherlands
Selectronic BV, Sluisplein 3-4,
Ouderkerk aan de Amstel
Tel (02963) 3838.

Sweden
Ing. Jan Setterberg,
Förstävsgatan 1,
S-431 36 Mölndal.
Tel (031) 13 02 16/87 58 93.

Germany
Franchised dealers—write for details.

Belgium
Delta Equipment, Rue de
Calevoet 112, 1180 Bruxelles.
(02) 376 60 34.
SED, Rue Bora, 146,
1070 Bruxelles. Tel (02) 522 70 64.

Switzerland
Professional Audio Systems,
4132 MuttENZ, Kappeliweg 41.
Tel 061/41 51 56.

Australia
Klarion Enterprises (Pty) Ltd,
P.O. Box 379, South Melbourne,
Victoria 3205. Tel 61 3801.
Cables Klarionmelb. Telex 34732.

South Africa
Tru-Fi Electronics S.A. (Pty) Ltd,
P.O. Box 31801, Braamfontein,
TVL 2017. Tel Johannesburg
838 4930.

Japan
CMC Inc., Kasumi Building
No 503, 21-20 Nishi-Azabu,
3-Chome, Minato-ku, Tokyo 104.
Tel 03 404 6527.

SURVEY: MIXERS

bass boost and cut, 5-frequency hi pass filter, foldback and buss selection via pan, talkback, Waters faders, vu/ppm metering.

RAMKO (USA)

Ramko Research Inc, 11355 Folsom Blvd, Rancho Cordova, California 95670, USA.

Phone: (916) 635-3600.

International sales: Telesco International Co, 1 Dupont Street S, Plainview, New York 11803, USA. Phone: (516) 433-6210.

Range of single channel (SC) and dual channel (DC) mixers. All units: height 20 cm, with horizontal led meters and touch pad controls, lighted, on all input, solo and mute and selection switches—no moving contacts. All solid state switching; self contained monitor and cue amps; mono mix outlet on all stereo consoles; cue on all channels; mute select via plug-in jumper wires. Inputs selectable: hi/lo level, 250 ohm balanced, or 100k ohm balanced bridging. Prices (numbers indicate channel content): SC-5M \$605; DC-5M \$742; DC-5MS \$979; DC-8M \$1199; DC-8MS \$1760. Two year guarantee on parts and labour.

Series 35

Separates controls from audio functions via dc remote control. Range includes eight channels mono, dual channel mono, stereo, dual channel stereo and combinations, two units parallel for quad; 'fail safe' power supply. Distortion quoted as 0.3% or less, with -124 dBm equivalent noise on low level channels. Prices start at \$1200.

RICHARDSON (UK)

J. Richardson Electronics Ltd, 57 Jamestown Road, London NW1, UK. Phone: 01-267 0723.

Eight channel mixer

For portable or studio use, in cabinet form and 8/2 format. Channel and group sliders, groups select, mic pad on floating 600 ohm input. Ppm metering. Price £400.

Discotheque mixer

With mic, two aux, gram 1 and 2 inputs; master and cue outputs. Tone controls and twin vu metering. Monitoring and sound/light outputs provided. Price £250.

MC6000

Modular system offers compact system to appropriate requirements. Channel facilities include line/mic and gain, hi pass filter, three band eq, three mid range mid frequencies selectable, es and two fb, four output groups, ppm switch, 10 cm fader with auxiliary and alternative modules for monitoring and line outputs.

RICHMOND (Canada) EDCOR (USA)

Richmond Sound Design Ltd, PO Box 65507, 1234 W 6th Ave, Vancouver, BC V5N 5K5, Canada.

Phone: (604) 736-7207. Telex: 04-54667 CAN-BASE VCR.

Edcor, 3030 Redhill Ave, Costa Mesa, Ca 92646, USA.

Range of theatre, mixing and portable consoles, modular design and array as required. Visual cueing system available. Voltage controlled channel amplifiers enable vc bussing on certain models.

88/816/1224

Theatre sound consoles in 8/8, 8/16 and 12/24 formats respectively. Various facilities, but all with internal ps, pcb plug-in circuitry and patch bay.

52 STUDIO SOUND, DECEMBER 1976

Aside from normal options, features include led indicators showing presence of low level signal in output channels, complementing normal vu display; 8 x 8 illuminated push button in/out switching matrix; 'Auto-pan' facility for semi-automatic crossfade; 12 phone jack connectors for instantaneous conversion to computer memory capability. Prices \$3630 to \$3300.

124/164/204/244/82/122/162/202

Mixing consoles with two and four groups output; channels variable as indicated by designation. Channel includes cue, es, three frequency eq, fb, input attenuator, monitor, echo return levels, pan. Masters on all subgroups. Vu meters and led overload indicators on output or playback channel. Prices \$6500 to \$10100.

M82 series

Portable stereo mixing systems with eight, 12 and 16 inputs with use of extender chassis. Balanced line input, 0-60 dB attenuator, ±15 dB at 50, 1.5k and 10k Hz; fb, es, pan; cue push button. XLR input connectors, 6.25 mm output via phone jack. 74 x 34 x 11 cm. Chassis on 14 ga steel. Prices (dollars Cdn) from \$1200 to \$2000 (basic). Extenders from \$550 to \$800.

SCHLUMBERGER (France)

Schlumberger Instruments et Systemes, Centre de Rueil, 296 Ave Napoleon Bonaparte, 92503 Rueil, Malmaison, France. Phone: 977 92 23. Telex: 26649 Labophy F.

Range of consoles from small portable units to extensive multitrack configurations, produced on a large scale.

UPS 4000

Modular construction, based on die-cast alloy chassis plugging into cast modular frame; console may be tilted on its support. Modules interchangeable *in situ*. Electronics use ics widely; group routing via fet switching, grouped on plug-in mother boards; modules interconnect by mother board, reducing wiring demands.

Any system configuration supplied using combinations of following principal modules: input, with four balanced inputs, mic/line gain, hi pass filter; eq, with boost/cut, eg Baxandall characteristic ±12 dB at 60 and 10k Hz, or presence at 0.7/1.2/2.8/4/56 kHz ±12 dB in 2 dB steps; band pass 24 dB/octave at 100/250/500 Hz and 4/6/8 kHz; routing module; auxiliary outputs, two es and two fb, both pre/post; echo return with gain to main group bussing; output amp balanced; limiter/compressor, 'limiting function -10 dBm' with 25 dB headroom, threshold variable over 20 dB range, variable attack and release; fader with mute and pfl; mic to amp with limiter; tb return, with two amps for various pfl and monitor functions. Automation facilities available oriented for use in broadcast or recording environments.

VLR 401

Intended for reporting applications and small sound installations. Four input channels, two line inputs, mono output and dry battery or external power supply. It also offers headphone monitoring, alignment generator and vu meter. It claims to meet ORTF specifications for equipment in the signal path.

UPS 1602

This mixer is designed for control room applications in broadcasting, motion picture, theatre, educational and audio visual applications. Comprises six balanced mic/line inputs, two outputs, input pad, hi and lo eq, talkback and pfl, internal power supplies and optional remote control facilities on each channel. Headphone and vu monitoring is standard.

UPS 2104

Full broadcast mixing console featuring 40 sources switchable to ten input channel amplifiers with four output groups. Uses extensive diecastings and modular construction to create a particularly robust design. Full foldback and echo buss facilities etc are incorporated.

UPS 2124

As 2104 out with 48 sources switchable to 12 input channels.

SELA (Sweden)

Svenska Elektronik-Apparater AB, Fact, S-12206 Enskede 6, Sweden. Phone: 08/94 02 70.

Range of mixers for film industry and Nagra recorders.

2880-BT

4-channel mixer designed specifically for use with Nagra portable tape recorders from which it obtains power. Each channel accepts wide range of balanced mics and provides dialog filter, lf and hf in each channel, rotary faders, line outputs which may be used for cans.

2880-ST

8-input portable mixer with two groups, balanced input with phantom powering, hi-pass filter, lf and hf equaliser, auxiliary send (or echo), two returns into groups, line-up oscillator, two ppms, power supply which also powers Nagra and phantom mics.

2880-IS

Minimixer for professional applications, six mic inputs, and which will operate directly from Nagra recorders, balanced inputs, phantom powering, roll over filter.

SENNHEISER (FDR)

Sennheiser Electronic, 3002 Bissendorf/Hann, West Germany.

Phone: (05130) 8011. Telex: 0924623.

UK: Hayden Laboratories Ltd, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW, UK. Phone: 02813 88447.

M101

Portable mono mixer with four channels designed for use with Nagra or similar. Battery powered from twin 9V batteries, each channel with bass cut, equaliser on output, tone generator, vu meter.

SHURE (USA)

Shure Bros Inc, 222 Hartrey Ave, Evanston, Illinois 60204, USA.

Phone: (312) 328-9000.

UK: Shure Electronics Ltd, Eccleston Road, Maidstone ME15 6AU, Kent. Phone: 0622 59881.

Range of mixers for pa and related work.

M68 Series

Simple 5/1 mixer systems, with level only channel control; mic input on four channels, aux on fifth; mic switchable hi/lo Z. Units may be ganged via aux input. Various connectors available. 7 x 27 x 13 cm. From £73.20.

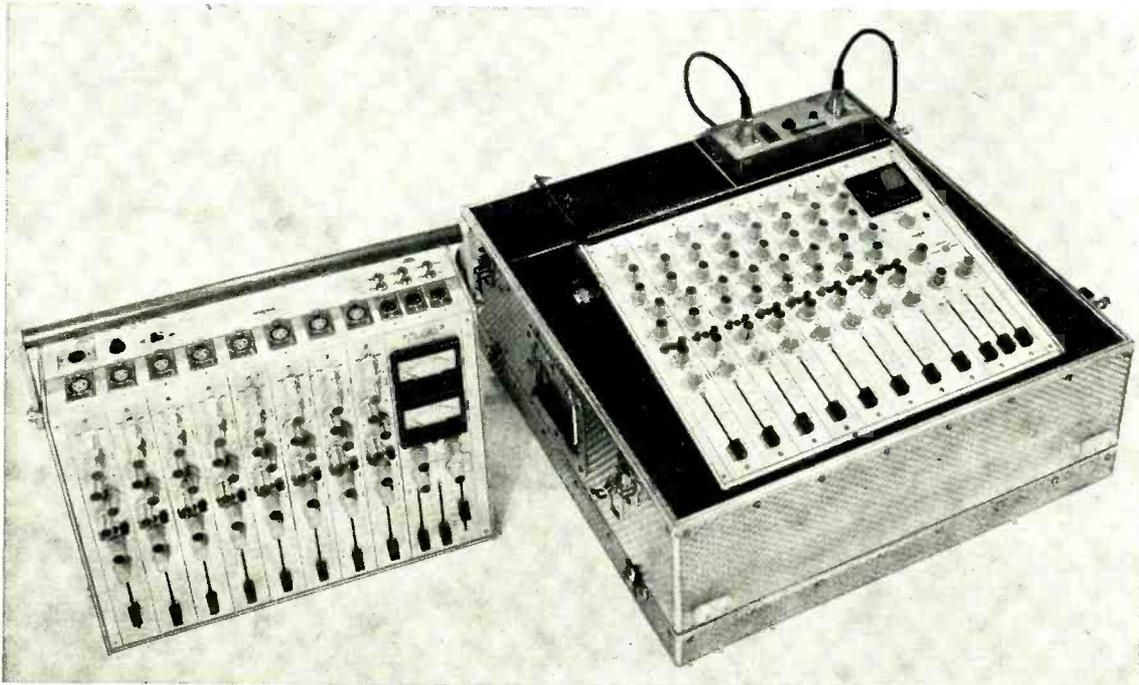
M688 Series

Stereo mic mixer similar M68 series but with two group outputs. Four mic inputs switchable left/right plus stereo aux input. Single pan on mic channel four. Units may be ganged as before. 7 x 27 x 17 cm; weight approx 2 kg. Price £93.

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PORTABLE MIXERS TRAVEL THE WORLD



AUDIO DEVELOPMENTS are the specialists in portable mixing consoles which offer studio quality away from studio conditions. We offer a range of ruggedly built battery operated mixers which give professional results to match the world's best portable recorders, combining excellent specifications with small size and weight. To emphasise the portable aspect the illustration shows our MICRO mixer teamed up with the case, specially built for it by SAMCINE. This elegant weatherproof case enables the mixer to withstand even the rigours of air travel and provides convenient permanent storage for the mixer and accessories.

For full details of the whole range from 6 into 2 to 24 into 4, together with the many available options which cater for specialist needs, write or telephone to the factory or to our agents listed below.

M. R. Drott,
Johannessgasse 18,
A-1015 Wien,
Austria

Studio Centre,
3 Rue Du Telegraphue,
75020 Paris,
France

Dr. W. A. Gunther,
Ingenieurburo SIA,
8702 Zollikon, Zurich,
Seestrasse 49-51 **Switzerland**

Laboacustica,
Via Muggia 33,
00195 Roma,
Tel: 3595506/
386867,

Italy
Sound Techniques,
Postbus 206,
Almaar,
Holland
Kinovox,
Industrivej 9,
DK 3540, Lyngø.
Telephone: 03 18 76 17
Denmark

Phillips Electronic Industries Ltd.
200 Consumers Road, Suite 105,
Willowdale, Ontario,
Canada

Siv Ing Benum and Co.,
Boks 2493,
Solli, Oslo 2,
Norway

AUDIO DEVELOPMENTS
HALL LANE, WALSALL WOOD, WALSALL, W. MIDLANDS, WS9 9AU
Telephone: Brownhills 5351/2/3 (STD Code 05433)

SURVEY: MIXERS

M67

Simple 4/1 mic mixer, 600 ohm input, fourth channel switchable line, bridging or 600 ohms, 7 x 27 x 18 cm; weight approx 2 kg. Price £130.08.

M675

Similar M67 but with disc and line inputs; cue on all inputs switchable; internal speaker, headphone outlet or line feed for monitoring. £118.20.

SIEMENS (FGR)

Siemens Aktiengesellschaft E643, 7500 Karlsruhe 21, PO Box 21 1080, Federal Republic of Germany.

6/2-channel mixer for tv, radio and film studios. Uses *Sitral* plug-in modules and provides six input channels each with two mic and two line inputs, two group channels, two output group channels, one effects channel. Two equalisers are installed which may be switched into any channel or group. Pfl is installed with a ls and two ppms for monitoring.

SONIFEX (UK)

Sonifex Sound Equipment, 15 College Street, Irthlingborough, Wellingborough, Northants NN9 5TU.
Phone: 0933 650700.

B1000

6-channel monophonic transportable mixer with flat scale fader, pfl, lf and hf eq, echo send, gain, switched mic/line, balanced inputs and outputs at Cannon connectors, comprehensive metering, switched, headphone monitor jack.

B2000

10-channels each with flat scale fader, lf, mid and hf eq, echo send, foldback, group panning, channel cut, switched mic/line with gain control. Balanced inputs and outputs at Cannon connectors, two groups with independent monitor outputs, echo send output, foldback output, echo return input. Two vus or ppms switched to inputs or outputs selectively. Headphone monitoring through meter select switch to phone jack.

SONY (Japan)

Sony Corp, PO Box 10, Tokyo Airport Post Office, Tokyo 149, Japan.

UK: Sony (UK) Ltd, 219 Bath Road, Slough, Berks. Phone: Slough 34611. Telex: 847122.

USA: Sony Corp of America, 9 W 57th Street, New York, NY 10019.

Phone: (212) 371-5800.

Europe: Sony Overseas SA, Baarerstrasse, 59 CH-6300, Zug, Switzerland. Central point for more local European information.

MX650

6/2 portable mixer with mic, line and phono inputs, two panpots, twin illuminated vus, osc and headphone socket.

MX 510

5/2 portable mixer with mic, line, phono inputs, one panpot, two vus and headphone socket.

MX 8

Simple passive 6/2 mic/line input mixer.

SOUNDCRAFT (UK)

Soundcraft Electronics Ltd, 5-8 Great Sutton Street, London EC1V 0BX, UK.

Phone: 01-251 3631.

USA: Systems and Technology in Music, 2025 Factory Street, Kalamazoo, Michigan 49001, USA.
Phone: (616) 382 6225.

Sixteen into Two

Sound re-inforcement console built into aluminium freight case. 16 inputs each with XLR (200Ω), attenuator, hf, mid and lf eq, foldback, echo send, pan, and channel on/off/monitor. Metering on vu and cans. Ready wired to accept multicore cable for stage distribution of mic inputs, left and right outputs and foldback.

Price: £1000, \$2995.

Twelve into Two

Similar to above but only 12 channels.

Price: £750, \$2300.

SOUNDEX (UK)

Soundex Ltd, 728 High Road, Leytonstone, London E11 3AJ, UK.

Phone: 01-539 4347/2437.

Studio series

Six inputs into two groups, each channel has balanced input, pfl, slider fader, eq. Foldback and remote starts available extra. Ppm monitoring, line-up oscillator. Various permutations of XLR, din connectors and ppm/vu metering.

Price: £410 with XLR and ppm.

Unimixer 4S

Designed for one stereo mic pair and two spot mics each with pan to the stereo outputs. Metering is vu or ppm to order. Inputs are all balanced for lo imp mics. Choice of XLR or jack connectors.

Price: £186.30 with XLR and ppm.

A new range of 4-1, 5-1, 7-1 mixers for cctv, film, units, hosp radio etc has just been introduced. They feature shallow control panels for flush mounting into desks, separate electronics, and ppm display, 7-1 production mixer with foldback, pfl, remote start/cue and ppm £249. Includes power supply and balanced mic inputs.

SPHERE (USA)

Sphere Electronics, 20201-A Prairie Ave, Chatsworth, California 91311, USA.

Phone: (213) 349-4747.

Standard and custom mixers for various applications including recording and broadcasting.

Alpha Series

Consoles designed primarily for radio and tv broadcast production. Alpha B is stereo broadcast console, Alpha T for tv. Alpha T and 11 are portable, with full facilities in small format for smaller stereo and quad recording situations. Features include long throw faders, solo, mic/line selection, switchable pad, es and return, cue mix, pan, quad output option, tb, slate option, monitor, osc. Consoles also available custom for sound re-inforcement. Optional extra module is 900 graphic in channel fitting, nine frequencies.

STELLAVOX (Switzerland)

Stellavox, 2068 Hauterive, Neuchatel, Switzerland.

Phone: 33 42 33.

UK: AV Distributors (London) Ltd, 26 Park Road, Baker Street, London NW1 4SH.

Phone: 01-935 8161.

USA: Hervic Electronics Inc, 1508 Cotner Avenue, Los Angeles, California 90025.

Phone: (213) 478-5086.

AMI 48

Five inputs for 12V AB or phantom powered capa-

tor mic, 48V capacitor mic, dynamic mic. XLR or Preh connectors. Bass roll-off, bass/treble lift/cut, pan, 20 dB pad each input. Pfl, individual post-fade outputs. Switchable stereo compressor on two channels, limiters with led indication on each input. Stereo limiters with led indication on master group outputs. 880 Hz line up osc. Two illuminated ppm meters. 8 x 21 x 27 cm, weight 4.3 kg. Price £1095.36, with limiter £1845.76.

STUDER (Switzerland)

Studer International AG, CH-5430 Wettingen, Switzerland.

Phone: 056 2687 35. Telex: 53682 audch.

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

Phone: 01-953 0091. Telex: 27502.

USA: Willi Studer America Inc, 3916 Broadway, Buffalo, New York 14227.

Phone: (716) 681-5450. Telex: 91-9138.

Canada: Willi Studer Canada Ltd, 14 Banigan Dr, Toronto, Ontario M4H 1E9.

Phone: (416) 423-2831. Telex: 06-23310.

France: 12-14 Rue Desnouettes, F-75015 Paris.

Phone: 533 58 58/9. Telex: 24744 F audifra.

089 Mk II

Intended for mobile and truck working as well as static studio operation. 12 input channels each with: line/mic/osc switching; phase; fine and coarse attenuator; variable Hz hi and lo pass filters; 80 Hz ±8 dB, 8 kHz ±8 dB, 0.4/0.7/1.2/2.3/3.9/6.8 kHz ±9 dB; two or four es/tb subgroups; mute. Also: filter modules, combination hi/lo pass with variable frequency and roll-off; stereo reverb similar channel module; and compressor/limiter ganged for stereo, variable compression and release, compression meter indication. Monitor selection all groups, subgroups and returns; tb. Two submasters for reinsertion. Two ppms, vu available if required. Break points on rear mounted jack bay.

189 Quadro

For stationary and mobile applications up to 16/4 mixdown and recording. Channels similar 089, with vu or ppm indication on each channel as well as group masters. Two versions, with 16 channels and 16 monitor or eight channels and eight or 16 monitor. Facilities similar 089, with corresponding extension for quad working. Comprehensive groups selection and quad pan joysticks on every channel.

THEATRE PROJECTS

Theatre Projects Services Ltd, 11/13 Neals Yard, Monmouth Street, London WC2.

Phone: 01-240 5411.

Rest of World: contact direct.

The company describes its product line as a three-tiered, interlocking range of modular mixers featuring the ability to use *mini* desk input modules in the concert mainframe as an input submixing system. This, along with side by side operation of *concert* and *studio* modules allows an economically optimum configuration to be provided to meet the variety of control requirements encountered in public entertainment. Special modules are available for theatre requirements including a loudspeaker switching module, output routing module with two presets, and tape start modules for commonly used machines.

Mini series

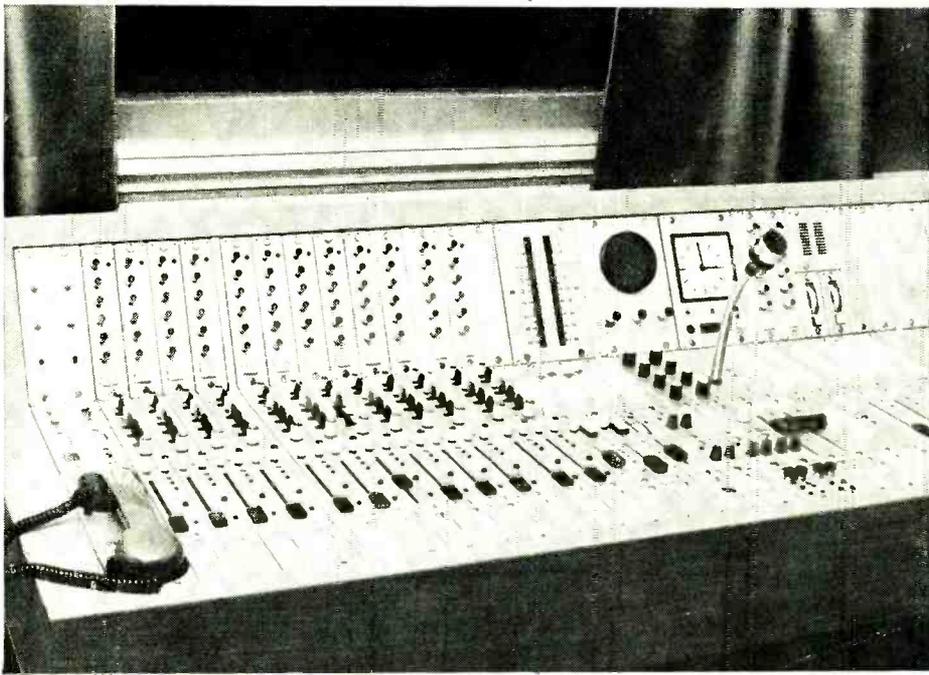
Channel input module with balanced mic, unbalanced line and hi and lo shelves.

Channel fader module with one or two aux sends, up to three illuminated routing selection switches, pfl and plastic faders.

Group mixing and output module with monitor level, monitor pan, aux return and plastic fader.

Aux/monitor module with aux send, monitor and pfl master controls, etc.

Typical price for a 10/2: about £820.



Why not

come to the broadcast console specialist first?

We build standard and custom audio mixing consoles to the most exacting requirements for radio and television studios.

Our range of special purpose modules are designed to provide the unique facilities you need.

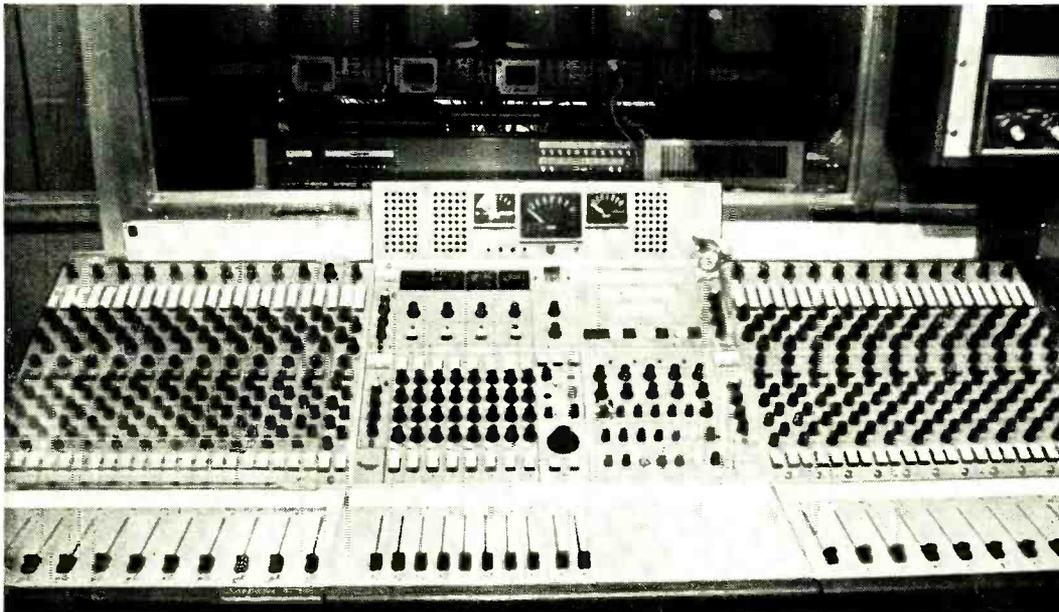
KAJAANI OY

ELEKTRONIIKKA

Nuaskatu 11, 87400 Kajaani 40, Finland
Telephone 986-37311. Telex 45148

Whether you want one module, a complete console or more. Come to us and find out what you have been missing—until now.

HELIOS CONSOLES FOR BROADCASTING



Illustrated: TM Series console for OB scanners.

The Helios design and building facility caters for all broadcasting, music and film dubbing requirements. For your next console, contact Helios and free yourself from catalogue compromises.



HELIOS ELECTRONICS LTD.

**BROWELLS LANE, FELTHAM, MIDDLESEX, TW13 7ER,
ENGLAND**

Telephone: 01-890 0087/8/9

SURVEY: MIXERS

Concert series

Input module as *mini* except with parametric middle eq and overload led indicator.

Group module incorporates led ppm or vu meter and eqed echo returns etc.

Typical price for a 12/4: about £2280.

TURNER (UK)

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

TPS 16/2

Portable and compact non-modular mixer series intended for live mixing and location recording. Channel controls include: 30 dB pad, sensitivity variable -60 to -20 dBm on 600 ohm balanced line; eq ± 15 dB at 10 kHz, ± 16 dB at 0.7/1.2/2.4/3.8/5.6/7 kHz and ± 15 dB at 100 Hz; pre/post on two subgroup sends, level variable; pan; pfl; P&G type 1820 fader. Subgroups out and remaining channels are mixed, output controlled by faders.

Mixer incorporates active filters for feeding multi-amp configuration, 30-500 Hz, 500-4k Hz and 4 kHz upwards (frequencies given are -3 dB points). Additional output for stereo tape or aux pa is independent of main faders. Eq available for echo send/return. Flexible tb system; two vu meters switchable across all group and subgroup outputs and two subgroup returns; also pfl selection appears on meters when routed in.

Optional extras include multiway cable, connectors and XLR stage box; cans; variations in cross-over; subgroups may be switched to provide four group output; breakpoints (phone jack); ppm metering. Mixer is in metal case for transport.

TWEED (UK)

Tweed Audio Electronics, Rosewood Industrial Estate, Kelso, Roxburghshire, Scotland.

Phone: 05732 2983.

Italy: Exhilo Italiana, 20052 Monza Via F Frisis 22, Italy.

Phone: 039 360021.

B1302

Broadcast mixer with four mic channels each with gain, lf and hf eq, two aux outputs, pfl and pan; one presenter mic channel with limiter and voice over, two stereo gram channels, six stereo high level inputs with eq and balance, comprehensive monitoring for off-air mf and vhf, station output, pfl, mixed programme/talkback, desk output and radio car etc. Four ppm reading left, centre, right and ancillary are fitted and script space for presenter provided. Price: £4472, \$7960.16.

Twin Telephone Hook Up

Designed for local radio 'phone-ins', the system accepts a clean feed from the studio mixer and provides two incoming channels from either PO exchange lines or private circuits. Three-way discussions are possible, each channel incorporates a soft gate to cut line noise. No routine adjustments required.

Price: £661, \$794.32.

2005 AD (USA)

2005 AD, Naudain St, Philadelphia, Pa 19146, USA.

Phone: (215) 545-3488.

2022

20/2 mixer for live music and pa situations. Any number of channels up to 20 as required. Channels include: mic input 150 ohms balanced, with hi impedance mic and aux options; 20 dB mic pad, 30 dB preamp range; eq hi/lo shelves and mid bell; pan; cue mix; echo mix; mute; solo with indicator; led overload indicator; long throw plastic faders. Four digital led vu meters: left, right, solo/echo, cue. Headphone/monitor output gain. Two aux inputs with pan, solo and mute. Cue master, and echo return. Outputs 600 ohm balanced; external echo breakpoints. Modular construction on aluminium chassis. 74 x 38 x 14 cm, weight 18 Kg. Vinyl scribble strip.

TYCOBRAHE (USA)

Tycobrahe Engineering, 665 Valley Dr, Hermosa Beach, California 90254, USA.

Phone: (213) 376-8801.

Modular mixers for combinations of pa, sound reinforcement and live recording.

MXL24(-4)

24 input console for performer use. Sealed rotary level controls throughout; channel controls include: pan of monitor and main group bussing; input attenuate; three range eq, lo 50/100/150 Hz, mid 300/600/1.2k Hz, hi 2.5/4/7k Hz; monitor and main mix controls. Dual-band limiters fully synched for stereo operation, with hi/lo limiter frequency switch on main outputs. Eq circuitry uses active gyrators; power supply regulated over ranges 85-135 and 170-270 volts. Limiters attack 2 μ s, release 0.5s, limit 8.8:1 100 x 62 x 25 cm, weight approx 40 Kg. List price for eight channel version \$9400; for 24 channel version \$13 000, inclusive of shipping case.

VORTEXION (UK)

Vortexion Division, Clarke & Smith Manufacturing Co Ltd, Melbourne Works, Wallington, Surrey.

Phone: 01-669 441. Telex: 22574.

System 2000

Pa system that includes mixer, mixer/amplifier, and slave amplifiers. Maximum capacity of mixer is ten channels and the chassis is wired to accept the following input modules: 30/60 Ω balanced mic, 200 Ω balanced mic, 600 Ω balanced mic, hi imp ceramic gram, low imp mag gram, radio tuner, tape, priority, line and mic bass cut. System 2000 may be rack mounted or free standing.

Model 2001

May be used to extend 2000 by adding a further 16 channels.

WARD-BECK

Ward-Beck Systems Ltd, 841 Progress Avenue, Scarborough, Ontario M1H 2X4, Canada.

Phone: (416) 438 6550. Telex: 06-23469.

The company produces a range of mixers for sound reinforcement and broadcast applications costing up to \$35 000 per unit. The company states that many of its products are suitable for studio environments. Further details in the January issue.

YAMAHA (Japan)

Nippon Gakki Co Ltd, Hamamatsu, Japan.

UK: Kemble (Organ Sales) Ltd, Mount Avenue, Bletchley, Bucks.

Phone: Milton Keynes 71771.

USA: Yamaha International Corp, 6600 Orange-thorpe Avenue, Buena Park, California 90620.

Telex: 655423 YAMAHA BNPK.

Canada: Yamaha Canada Music Ltd, 1330 Portage Avenue, Winnipeg, 10, Manitoba.

Telex: 35398 YAMAHA CDA WPG.

Germany: Yamaha Europa GmbH, 2084 Rellingen b Hamburg, Siemensstrasse 22/34.

Phone: (04101) 3 30 31. Telex: 2-189170.

Australia: Rose Music Pty Ltd, 17-33 Market Street, S Melbourne 3205.

Telex: 32225 ROSEMUS.

EM70

Simple 6 into 2 (switchable) with reverb (spring line) and two Sanyo STK 025 output stages; auxiliary input groups and a choice of buffered outputs. Considerably improved eq and cosmetics with previous EM60.

EM150

More versatile 6/2 with panpots and reverb/echo sends on each channel. Subgroup inputs, spring line reverb, monitor send and overall 7-band graphic eq with 24 dB swing. Twin 75W rms output stages and vu meters.

PM-200B/300/400

Simple portable music and pa mixer. Various combination facilities including bass, treble, boost/cut es switchable two sends on each channel; switchable metering; hi pass filtering; five frequency eq switchable to -8/12 dB on PM-200B. Vu metering of one or two output groups. Phone jack or XLR connections. Prices: 200B £292, 300 £430, 400 £535.

PM430

Eight into two plus two subgroups—one prefade, one post fade, both post eq. XLR feeds and lo imp inputs. Lf and hf eq on all input channels and both main groups, vu and peak leds.

PM700

Twelve into two plus two 3-band eq on all channels and groups otherwise similar PM430.

PM-1000-16

16/4 portable or studio mixer for recording or quality pa applications. Comprehensive eq and subgrouping, sliders all channels and groups. Tb, pan, input select, etc. Metering vu on all groups, additional small vu on two exho subgroups.

PM-1000-24 and 32

Expanded versions of above.

ZOOM

Zoom Television Ltd, Pinewood Studios, Iver Heath, Bucks, UK.

Phone: 0753 654044. Telex: 84505.

MZM1

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work

RCM sax session

The session had the makings of a very unusual event, even by the diverse nature of mobile multitrack recording: after all, it was difficult enough to imagine what well over 100 saxophones would sound like, never mind the hassle of rehearsing and laying the material for a double A side in 40 minutes, start to finish. But that's just how it was planned and, in the event, how it happened.

The mind boggling organisational coupe was dreamt up by Michael Thorne of EMI; the saxophonists were delegates to the fifth World Saxophone Congress which took place at the Royal College of Music from July 28 to 31. They played a special arrangement (with 100 saxophones, it had to be) of the *White Cliffs of Dover* and *All the Things You Are* conducted by Paul Harvey, of the London Saxophone Quartet, who also wrote the outstanding orchestrations of the songs. It says much for the abilities of the international, mainly classical, sax-playing community that the operation went so smoothly; many didn't hear about the venture until they arrived at the RCM.

There, they were given their scores, if necessary a loaned instrument (courtesy of Buffet, Boosey and Hawkes, Henri Selmer et al), and as much lager as was necessary to cool a hot day (courtesy of EMI).

The organisation started a long while before the actual session, since there was absolutely no precedent for recording that many saxes. Further, it was an unpublished event as far as Convention programme was concerned which meant that, if any session hitches had occurred, no other time slot could have been found and all would have been lost. The question of performing royalties was resolved by donating them, indirectly, for the furtherance of the saxophone as an orchestral instrument; this is one of the objectives behind the Saxophone Convention. The orchestration was given a trial run using half a dozen saxophones in the demo studio underneath the EMI (Manchester Square) offices. The actual session was recorded with engineer Mike Sheady using the Abbey Road mobile, set up in the basement of the RCM the previous day, although the miking

had to be left until lift off.

1050. The opening concert, which started at 0930, ends. Soloists plus a military band leave the concert hall.

1051. Paul Harvey takes the rostrum announcing and explaining the project.

1058. Audience to the previous concert leaves as the session players file in. Only slight confusion as the seats are rearranged.

1107. The 16 microphones are set up at direction from producer Thorne. Several people bearing saxophones look rather bewildered.

1118. With the mics in place, the producer appears satisfied and goes downstairs to the control room.

1120. Paul Harvey's baton comes down for the first run-through of *White Cliffs of Dover* . . .

1159. Session ends.

It was a unique experience even if the material was directed at the nostalgic, silent majority. 'Impressive' is not enough to describe the sound which swelled up at the drop of the baton. From the gallery above the auditorium, it appeared to rise up from the floor in a solid wall, a unique, rich sound resembling a large symphonic string section playing in unison but without the percussive element. The effect was probably made more remarkable by the presence of so many different types of sax: there were strong, stomach-moving gruntings from the contra-bass section as well as the shrill counter balance of the sopranos. Both were blended perfectly in Paul Harvey's arrangement. The ensemble probably did better justice to *All the Things You Are* although this could represent a subjective preference for the basic piece of music. Nevertheless, the sax version of *The White Cliffs* represents a

tremendous improvement on the basic Dame Vera Lynn . . .

Technically, the session was straightforward eight-track recorded four stereo pairs corresponding to the four sax sections. The only problem derived, not from the recording process, but from the beer supplied to the musicians. If you listen carefully to the resulting record, you can hear distinctly at least three musicians cracking the beer before the last notes had decayed away, a vinyl testimony to the spontaneity of an extraordinary session.

Frank Ogden

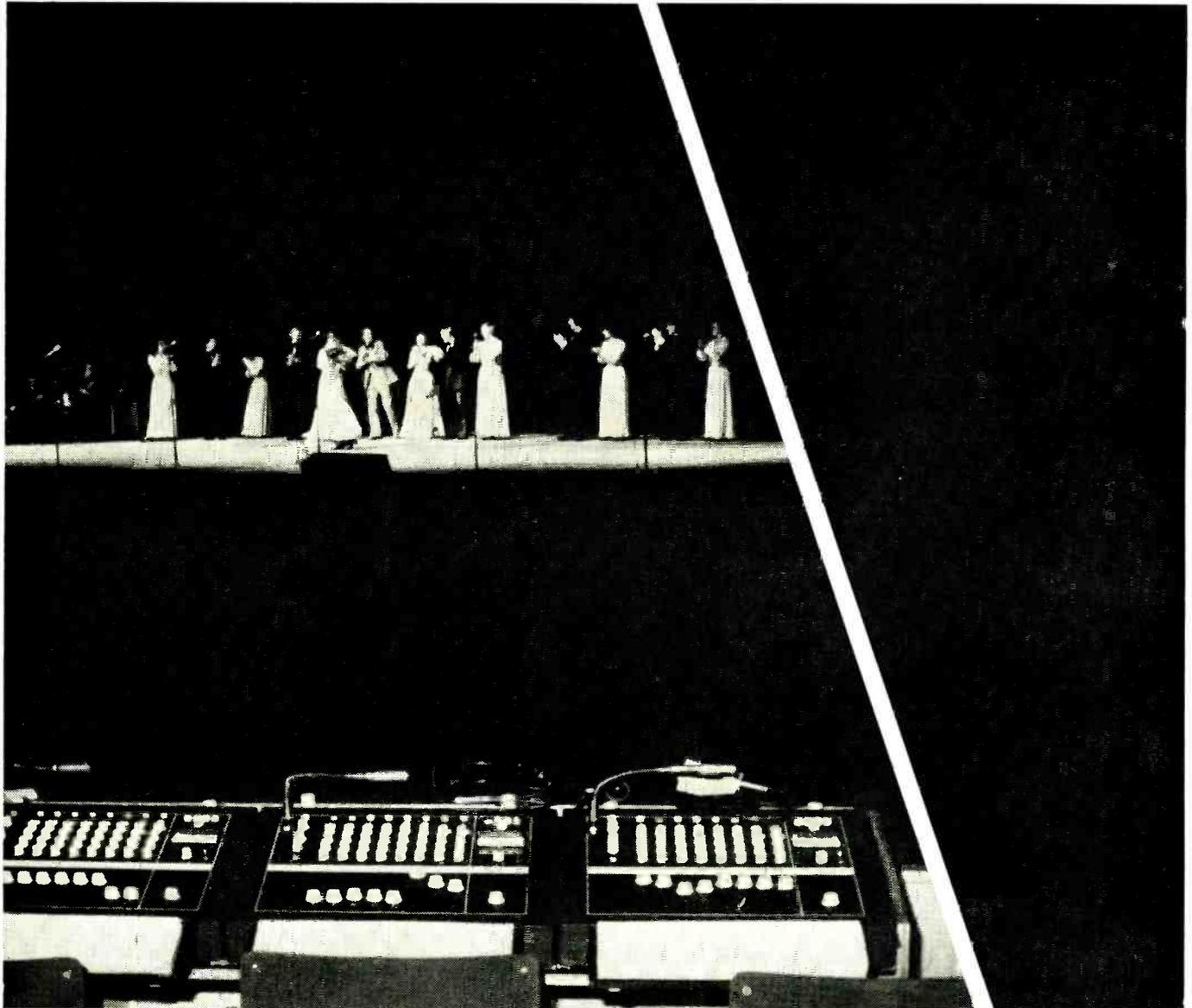
KKHI

KKHI is San Francisco's main classical music station and recently celebrated its 10th year on the 14th floor of the fashionable St Francis Hotel, on Union Square. Catering for a Bay area population of around four million, the station has a typical audience of around 25 000, yet its local standing is such that it can compete commercially with the numerous non-classical commercial stations in the city. Indeed it must, being run on a strictly sink-or-swim basis alongside three other (non-classical) stations in its West Coast group.

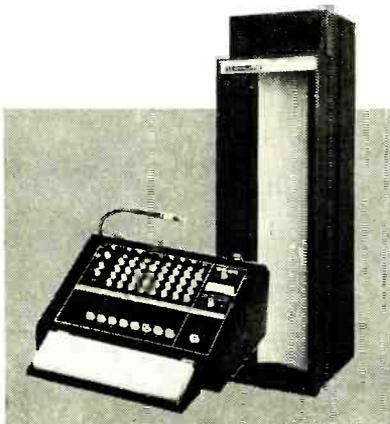
As a commercial station KKHI makes few concessions to audience gathering or to the advertisers. It broadcasts classical music—stereo fm and mono am—for 24 hours a day, seven days a week, apart from six hours off the air from midnight on Sundays, to allow for maintenance. A fair proportion of opera and choral music is broadcast, though during the day when housewives and people in cars may

60 ▶





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WORK

be using it for classical wallpaper music, KKHI broadcasts mainly instrumental works. Output includes minority tastes and the avant garde, and little or no beautiful music (Mantovani, etc) that is the staple fare of most other non-rock stations. A 3 am check produced Charles Ives and a late Beethoven quartet.

However there is no attempt to put classics into the commercials: they are put out as received from the agencies, normally identical to those appearing on pop stations, and may advertise anything from polish to politics, lettuce to legislation. Commercials are normally received on open-reel tape and transferred to cartridge; but a few are originated at the station and some are simply read out by the station announcer. In addition to music and commercials, the station carries news, rush-hour traffic reports, weather forecasts and stock market reports.

KKHI is somewhat unusual in adhering to separate announcers and studio engineers, rather than the 'combi' (self-operated) operation frequently found in British local and commercial radio and in America, or the fully automated pre-recorded operation that has overtaken many US stations to the dismay of quite a few presenters. But the separation of duties at KKHI is the result of existing agreements with unions, and may be reconsidered when these run out.

As set up at present the main control room faces the main announcer's booth, which contains little in the way of hardware except a boom-mounted ElectroVoice RE16 super-cardioid mic (which they say is almost immune to popping and bass rise, even when used very close-to), a microphone control, talkback and monitor facilities. From here the announcer reads the music links, introduces records and commercials, and reads agency news bulletins, etc. Symphonies and concertos, etc, are normally broadcast complete without breaks for commercials, but operas and a few other long works that are conventionally broken up in performance may have 'natural breaks' for news and ads. The aim is to prevent music being fragmented by commercials; and there is also a rule that commercials for competing products are not played within ten minutes of each other.

All music and commercials are played in from the main control room, which also houses the equipment feeding the transmitter lines. The two turntables are EMT 930ST

broadcast types with a 'no-wow' instant start device which mutes the output for a fraction of a second as the turntable comes up to speed. The cartridges are Stanton 681SE, which have proved robust enough to give up to three months life per stylus. Twin Ma-Car-ta cartridge recorder/reproducers plus a Spotmaster provide the facility for playing-in pre-recorded commercials, while twin Ampex 602 mono recorders dating from the fifties provide recorded stockmarket and traffic reports. The output of all these plus the announcer's mic is controlled by a Gates valve stereo desk, relatively simple by modern desk standards but completely adequate for the purpose. With Ampex remote control units it can also control a trolley-mounted stereo Ampex recorder or the outputs from two stereo Ampex recorders in the adjacent spare control room, or from any other patched source via the jackfield. Surprisingly all circuits are unbalanced, terminated outputs feeding any number of bridging inputs without loss. KKHI find this reduces, if not eliminates, problems due to accidental phase reversal of a channel. The monitor speakers in both control rooms are Altec; KKHI's chief engineer Fred Krock says they were chosen less for their accuracy of reproduction than their ability to emphasise any programme defects.

Adjacent to the main control room and booth are a similar spare control room and small talks studio, which can take over transmission in an emergency or can be used for recording interviews with guest speakers, visiting conductors, for making commercials, etc. In addition to the two Ampex recorders mentioned, the second control room also houses a Scully standby machine and a Metrotech logging recorder which provides an almost unbelievably bad recording of the station output plus a Post Office

time check signal: this is used to settle any disputes over what was broadcast or any rare complaints from advertisers over competing commercials being played within the specified minimum ten minutes.

Compression of the signal is carried out automatically by rack-mounted equipment in the main control room. Fred Krock's philosophy is to provide a 30 dB dynamic range for music on fm and a mere 5 dB on am. The limited range on am is considered necessary to cater for motorists in noisy city traffic. The 30 dB range on fm is a compromise between what they'd like to provide for hi-fi enthusiasts in quiet surroundings and the fact that the majority of the fm audience suffer from poor signals and noisy environments such as the kitchen. The dynamic range chosen seems to generate the least complaints all round. Speech and music are compressed separately and combined to give a compromise balance acceptable both to the hi-fi listener and to the housewife frying chips. Compression on fm is carried out with CBS *Audio-max III* and *ALC710* loudness control units, with up to 55 dB of gain reduction on am provided by a Gates *Sta-level* unit. The CBS units incorporate a threshold arrangement that preserves the dynamic range within a particular section of music rather than compressing everything to a mezzo forte, as well as a time delay of ten seconds which means that the gain does not start coming up straight-away at the end of a movement to cause a snatch at the start of the next.

In addition to broadcasting discs, which inevitably accounts for a major proportion of the music output, KKHI has earned itself a reputation for its enterprising broadcasts of the San Francisco and Oakland Symphony Orchestra concerts, the San Francisco opera and ballet performances, and

recordings of the Boston and Philadelphia symphony orchestras as well as local school orchestral concerts. For these, up to eight spaced Neumann *U87* capacitor microphones are used, via a modern transportable desk—in the case of the schools' concerts recorded in stereo on a Revox *A700*. The Symphony Orchestra concerts are frequently broadcast live in SQ quadrasonic matrix format and the station has produced a number of stereo and quadrasonic records. The master tapes I heard were quite superb, certainly a good advertisement for the skills of Fred Krock, who doubles as balance engineer and music producer. Incidentally the term engineer is one he feels is taken a little too seriously in some quarters of the profession—to him an engineer is and always will be the man who drives a steam engine . . .

The live concerts and operas are also multiplexed on to a video link for broadcast in Los Angeles, which spreads the cost—a single broadcast may cost \$5000 to put on (which makes UK local radio music budgets look a bit thin!). Enterprisingly, again, KKHI last year carried a live broadcast by the San Francisco Symphony Orchestra from Paris via satellite link, with the assistance of ORTF who provided the signal and links to the satellite station. Fred Krock flew over to supervise the balance and the results were remarkably good, even if it did cost some \$15 000 for the relay.

John Fisher

agony

In a provincial College of Art due to hold an evening of Mozart string quartets, it was realised that the sonic contribution of the local fire brigade might add an unintended modernity to the musical proceedings, since the exit road for its blaring pyrocical appliances ran directly beside the building's concert hall. A staff member was therefore directed to ask the station chief if, just for this evening, the engines' sirens could be turned on only as they came to the junction with the main road.

The fire chief put down his can of Coke and munched ruminatively on the last bite of cheese sandwich as he considered the request. Then, with a contented belch, he sat back and gazed kindly upon our pedagogic delegate and, with an air of one having arrived at a perfectly natural solution which has evaded those less intellectually endowed, queried: 'Couldn't they play more loud?'



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- Sweep equaliser 2, 30 Hz—15 KHz + 15dB.
- L.F. 3 turnover frequencies + 15dB.
- High and Low pass filters 12dB/Octave.

Input Module Spec.

Frequency Response:—within + 0.25dB
20 Hz—20 KHz.
T.H.D.:—Typically less .01% for 0dB out.
Headroom:—22dB for 0dB out.

Other Module Options Include:—

- Stereo Disc and Tape inputs with continuously variable high and low pass filters.
- Auxiliary send and return with 4 band E.Q.
- Output module with stereo monitor facility.
- Foldback master module with 3 band E.Q.
- P.F.L./Talkback/Stereo Monitor module.
- Compressor/Limiter.
- Sub-Mix module.

Other Features Include:—

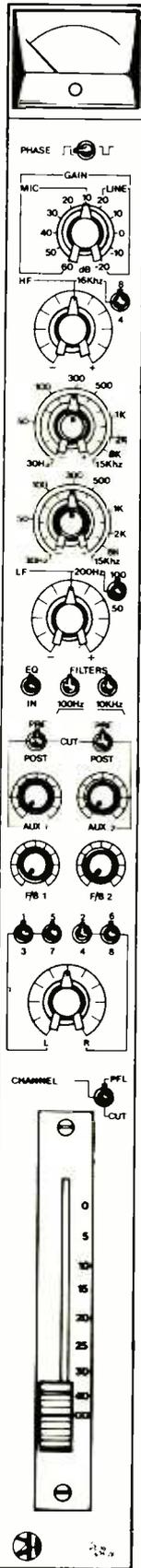
- 1, 2, 4 or 8 track routing.
- Illuminated v.u. (or P.P.M.) per channel.
- Modular construction.

Overall Specification of System.

Frequency Response:—within + ½dB.
20 Hz—20 KHz.
T.H.D. Typically .01% for + 4dBm output.
Output Clip Point + 28dBm balanced + 22dBm unbalanced.
Noise:—For —50dBm input, + 4dBm output —75dBm.



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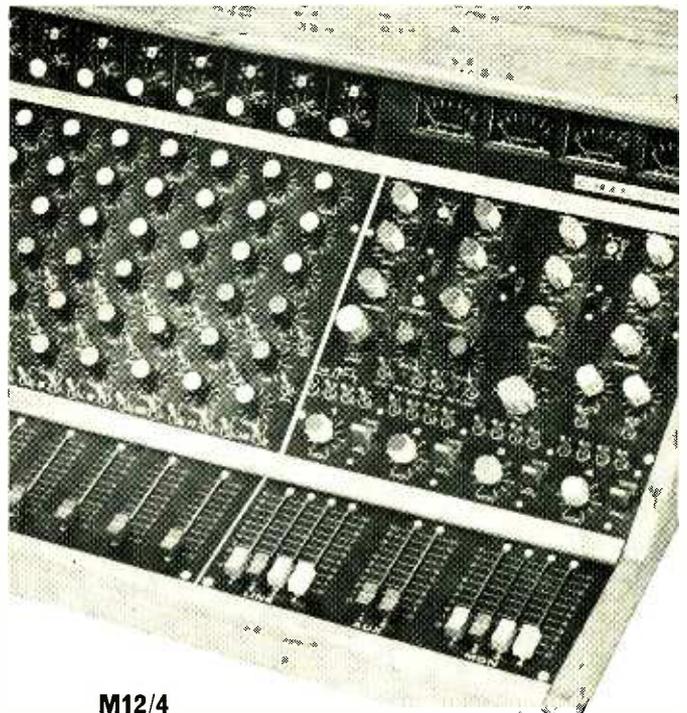
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Basic Unit contains: Per channel, Line input and Gain, HF and LF Eq, Two Aux Sends, one with pre/post, PFL, Pan, Channel routing, Ch fader.

OUTPUT GROUP: PPM with line/monitor Sw, Oscillator, Switchable 40 Hz, 100 Hz, 1 kHz, 10 kHz, 15 kHz, 2 Line/2 Monitor/2 Phones. Outputs +19 dBm, Mono/Stereo Sw, Aux Return (echo), Tape/Line/PFL Sw, select on Monitor or Phones output (Monitor mix 12/4 only). Optional Extras: Balanced Mic, Gram, Presence, Talkback, Limiter/Compressor, HF and LF Filters, 24v Power Supply.



M12/4

- M10/2 Mk4 Basic £410.00
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- M12/4 12 in 4 out £675.00

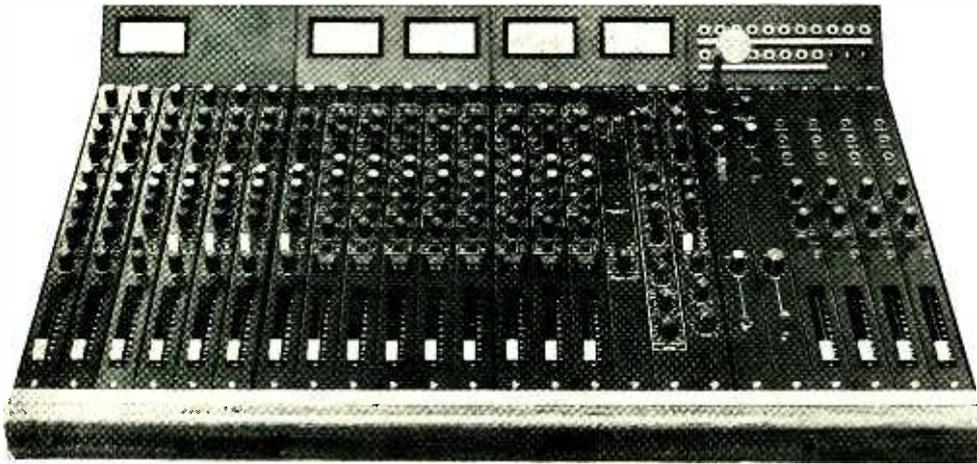
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reviews

Midas portable range modular mixing system Hugh Ford



MANUFACTURER'S SPECIFICATION

The following specifications are abbreviated details of the modules incorporated in the review console.

Input module PR 002

Sensitivity control and attenuator switch 0 or -20 dB, maximum input level 0 dBm (mic) or +20 dBm (line). Maximum gain 80 dB (mic) or 50 dB (line). Input impedance 600 ohm balanced mic or 10k ohm line. Treble and bass equalisers ± 16 dB at 15 kHz and 50 Hz. Presence ± 15 dB at 1.5, 3.5 and 7 kHz vari-Q. Outputs: 2 pre-fader foldback, 2 post-fader echo. Pan pot. Pre-fade listen. Sub-group routing switches. Noise figure -126 dBm, 20 Hz to 20 kHz unweighted.

Input module PR 003

As input module PR 002 except improved noise figure of -128 dBm, 20 Hz to 20 kHz unweighted. Additional channel mute and track selector switches.

Input module PR 004

Similar to input module PR 003 with additional equaliser facilities and 8-track routing. Equalisers: Treble variable shelving ± 16 dB at 6, 10 or 15 kHz. Bass variable shelving ± 16 dB at 40, 80 or 160 Hz. Middle variable bell response ± 16 dB at 500, 800 Hz, 1.5, 2.5, 3.5 and 5 kHz. High pass filter 16 dB/octave at 60 or 120 Hz. Twin foldback and echo as other modules but with pre/post/off selector switch on foldback 1 and echo 2. Output routing is twin 8-way thumbwheel switches on pan pot output.

Output module PR 011

+20 dBm output into 600 ohms with distortion of 0.05% reducing to 0.02% at +15 dBm output and below. Residual noise -76 dBm with fader fully open and one channel selected falling to -86 dBm when fader is down. Post fader insert, direct input to mixing buss and direct output by jack sockets.

Monitor amplifier with a/b switching. Pan pot. XLR connector for output and tape playback may be balanced if required.

Foldback and echo send/return master module PR 009

Foldback level control with bass, treble and presence equalisers on foldback send. Echo send and return level controls with equaliser on echo return. Digital thumbwheel switches for routing. Pan pot. Pre-fade listen on foldback and echo send.

Talkback and pre-fade listen module PR 020

Talk to foldback or to output via AKG gooseneck microphone with amplifier and gain control. Pre-fade headphone monitoring with level control and input summing amplifier.

Monitor and oscillator module PR 021

Oscillator switchable to 50, 150 Hz, 1 and 10 kHz. Oscillator output is variable and can be routed to either jack socket or to mixing busses. Monitor section comprises two amplifiers for summing lhs and rhs outputs from monitor pan pots on output modules. Master level, dim and mute facilities.

Crossover and limiter module PR 030

This is a special module for live sound applications comprising a pair of high/low pass filters with 18 dB/octave attenuation and less than ± 3 dB pass band ripple. The high pass output feeds a limiter via a level control. Distortion at normal operating levels is 0.05% thd. Limiter noise is less than -76 dBm. Crossover is normally at 800 Hz (-3 dB points of hp and lp filters) but can be changed to order.

Power supply unit

Fully stabilised +16 and -16V supply for mixer over $\pm 20\%$ input voltage range of either 115V or 240V nominal.

Price (as reviewed): £3600 (\$7350).

Manufacturer: Midas, 54-56 Stanhope Street, London NW1.

European agent: Louis D. Potesta, ARC, Rue Th. Decuyper, 134, 1200 Brussels.

THE review sample of the Midas mixer system was specially built to incorporate the more interesting modules in a single 16-input, 4-output mixer, and as such it is not typical of a normal product. In fact three types of input module out of the four available, one type of output module out of two available and one type of foldback and echo module out of two available were incorporated in the review mixer, in addition to a monitor and oscillator module, a talkback and headphone module, and finally a crossover module.

It follows that this review covers most of the range of available modules, but there are a number of optional variations within a module type and other options; unfortunately it is quite impossible to do full justice to even the mixer supplied within the space of this review.

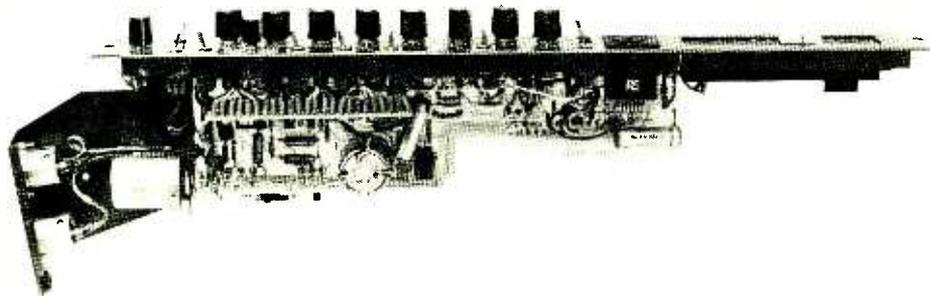
Mechanical construction of the Midas system is based on desk sections which each contain up to six modules and which are bolted together to form the required size of mixer. The desk sections are built from sheet metal and have a sloping rear panel which accommodates meters and jackfields as required for a particular configuration. All other connectors with the exception of the connection to a separate power supply unit are part of the individual modules in the form of 3-pin XLR connectors. When a module is inserted in the desk these connections appear at the rear of the desk which is generally an ideal position, but unfortunately the mechanical design of the desk is such that it is virtually impossible to remove some of the connectors without a pair of long-nosed pliers to release the XLR locking spigot.

The remaining connections to the modules are by means of printed circuit ISEP type connectors, the fixed parts of which are housed on a motherboard in the base of each desk section, the separate sections being wired together by soldered links and a substantial grounding braid.

Each module is based on a 'U' section front panel 41 mm wide by 511 mm long constructed from sheet steel and finished in a satin RAF blue/grey stove enamel with white legends. An additional part of metalwork supports the input connectors and transformers, with the printed electronics board being bolted to the 'U' section and all operator controls being secured to this section which also supports jack sockets where required.

All printed boards were of good quality fibreglass with high quality components of professional quality, but not only were the components not identified on the boards but no servicing information was made available even in the form of block diagrams of the modules (we are informed that circuit diagrams are available on request).

Although the component layouts were tidy, the standard of hand soldering left something to be desired, and in the case of the input modules some large capacitors had been rather untidily secured with messy rubber compound—clearly a modification, but it could have been a lot tidier!



From an operator's point of view the control layout was very clear with liberal use of coloured knobs, but the control density in the input modules was on the upper limit for the less nimble fingered and in all instances I would have liked to have seen an indicator lamp associated with the monitor (pre-fade etc.) switches. If one of these was left and forgotten it was necessary to hunt the complete desk for one of 27 switches scattered around. (We are informed that biased toggle switches can be fitted if requested.)

The signal routing in the review desk was based on eight group busses in addition to which there were two each of echo send and foldback busses and the monitor (cue) buss. The output modules could be fed from the input modules and the echo modules which, like the foldback circuits, could only receive their feed from the input modules and not from a group.

The output modules which had inject, insert and record breakpoints were also equipped with a panned feed to the monitor and oscillator module which has two amplifiers for summing the inputs and feeding them to two monitors. Output from the switched frequency and variable level oscillator is fed to either an external socket or to the inputs of the output modules.

The pre-fade listen and talkback module has the switched option of 'talk to foldback' or 'talk to tape' in which case the talkback is injected after the master faders in the output modules. So far as the pre-fade listen is concerned this is a very versatile system which can feed a large number of different points in the desk to a variable output headphone socket and also to an auxiliary vu meter which is wired at fixed level.

The echo and foldback master module sums the foldback signals from the input modules and passes the combined signal through a treble, bass and presence equaliser to the high level foldback send output. The echo inputs are similarly combined and routed via a level control to echo send output. The echo return has treble, bass and presence equalisers which are followed by an echo level control and thence to a pan pot which feeds the output modules via channel selector switches. In addition there is a 'spin' facility which feeds a variable amount of echo return into the echo send buss. Details of the individual modules including the availability of breakpoints and other facilities will be found later in this review, and it should be mentioned that rather than review individual modules I have treated the performance of the mixer as a whole. Thus the performance mentioned takes into account the weakest link in the chain in many instances.

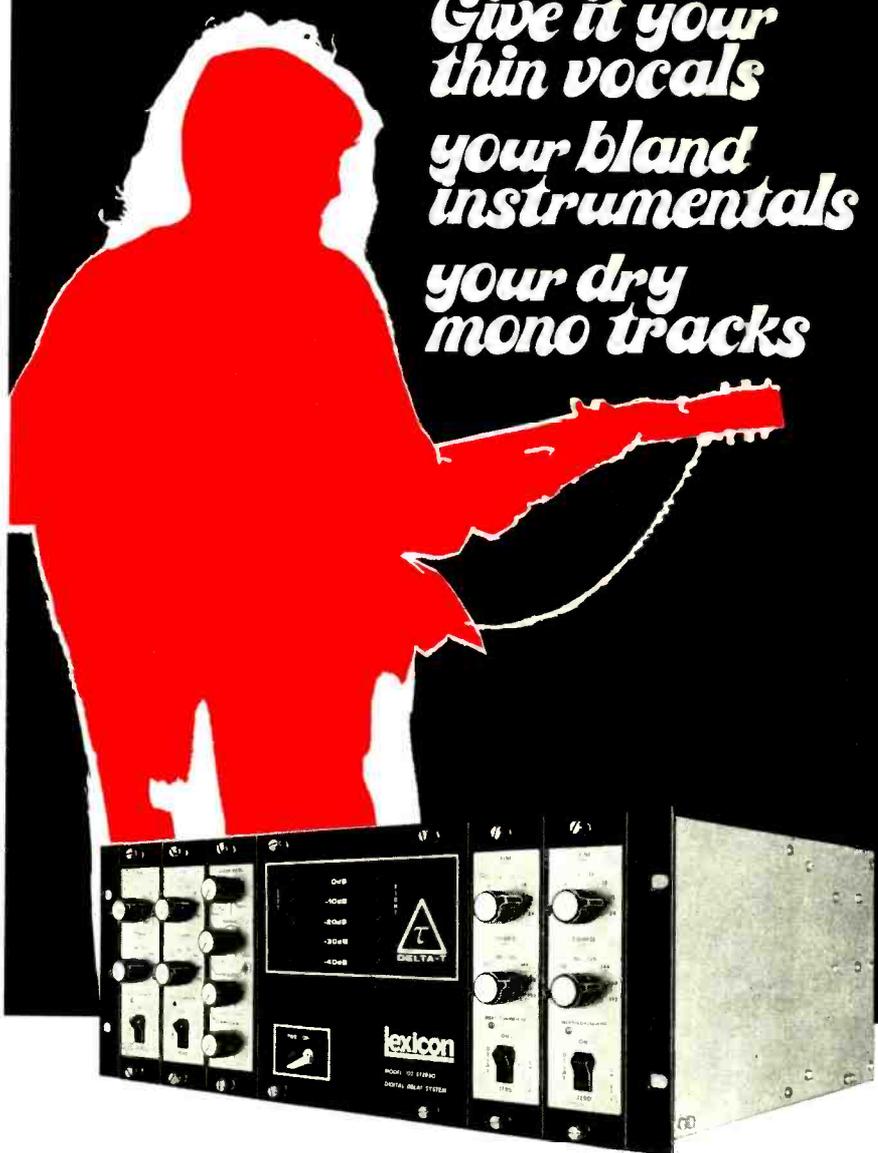
Input modules

The input modules types *PR 002* and *PR 003* are almost identical in function, the main difference being that the *PR 003* has the addition of a line level input and also has better noise performance on the microphone input. There is also a slight difference in the panning and pre-fade listen facility in that the *PR 003* module has a three position lever key switch which provides for mute and pre-fade listen with miniature toggle switches controlling the routing of the panned output to channels 1, 3 and L and 2, 4 and R. In the *PR 002* module

64 ►

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*The new VCO module also fits any 102-B or C mainframe to enhance its time-base signal processing capability.

Lexicon

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MIDAS MIXING SYSTEM

the pre-fade listen is a press-button, and miniature toggle switches control the routing of the panned output to channels 1, 3 or OFF and 2, 4 or OFF.

Both module types offered a microphone input to mixer output gain of 79 dB with an input overload point at -40 dBm input. Operation of the variable gain controls gave a 20 dB improvement in the gain and input clipping point, in addition to which the inbuilt 20 dB attenuator offered a facility for high inputs such as those from condenser microphones with an input clipping point around 0 dBm which is only just safe in some applications (however, other options are available).

The measured input impedance at 1592 Hz was in both cases 580 ohms which is, in my opinion, too low for 200 ohm dynamic microphones, but the line input on the PR 003 module had a satisfactory input impedance of 55k ohms with a maximum overall mixer gain of 59.4 dB and an input clipping point of -20 dBm at maximum gain. The 20 dB pad also operated on the line input, and the variable gain control effectively permitted infinite input levels.

When loaded with 200 ohms the effective input noise over a 20 kHz noise bandwidth was -125 dBm for the PR 002 module and -128 dBm for the PR 003 which is a most excellent performance, the respective 'A' weighted noise being -127 dBm and -130.4 dBm.

In the cases of the PR 002 and the PR 003 modules the equalisation facilities were found to be identical with high pass, bass, treble and presence controls. The performance of the bass controls and the 100 Hz switched high pass controls is shown in fig. 1 which shows a good characteristic conforming to the specification in addition to a very good law on the bass controls. Fig. 2 confirms the same points for the treble equaliser with fig. 3 showing the characteristics of the presence control at its three switched frequencies at maximum cut and boost; here again the potentiometer control was found to have an excellent characteristic.

Harmonic and intermodulation distortion were checked from the microphone input to the mixer output, and not for each module as such. This procedure masked major differences between the input modules as it appeared that the distortion farther down the chain was larger than the input module distortion; however, as is to be seen from fig. 4 for third harmonic distortion and fig. 5 for twin tone intermodulation distortion the overall performance is very good except at low frequencies at +15 dBm output. At lower output levels the low frequency third harmonic distortion was completely satisfactory, but the meteoric rate of increase at high levels below 30 Hz is alarming (look out for the bass drums!)

As a final point on the PR 002 and PR 003 modules and an introduction to the more complex type PR 004, all input modules had a desk mounted breakpoint jack for pre-fade insertion which fed the channel fader, the pre-fade output and the two foldback output level controls (except in the PR 004). Channel muting is post-fade and in the PR 002 and PR 003 modules affects the two echo send potentiometer outputs to the echo module.

MIDAS TYPE 002
INPUT MODULE
FIG.1
BASS EQ &
HIGH PASS

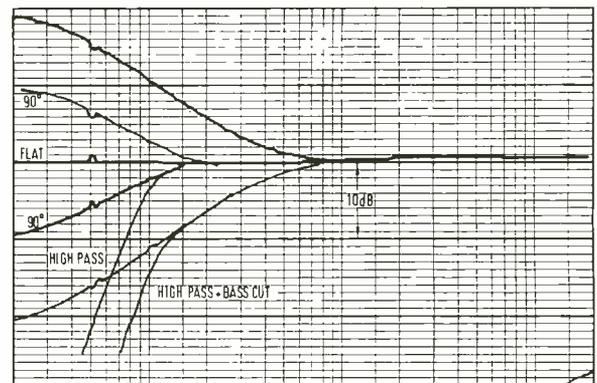


FIG.2
TREBLE EQ

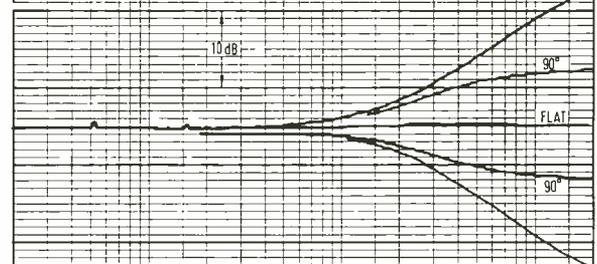
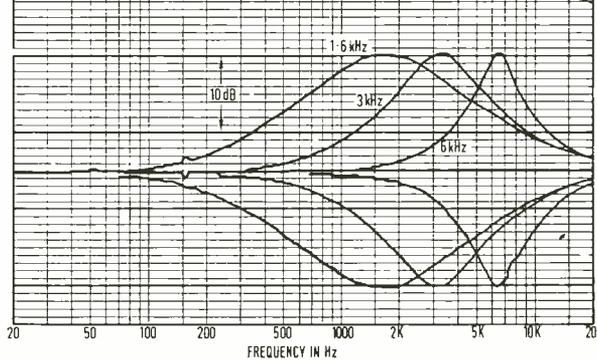


FIG.3
MID EQ
AT MAXIMUM



MIDAS TYPE 003
INPUT MODULE
FIG.4
THIRD HARMONIC
DISTORTION
(MIC INPUT TO
LINE OUTPUT)
AT +15dBm OUT

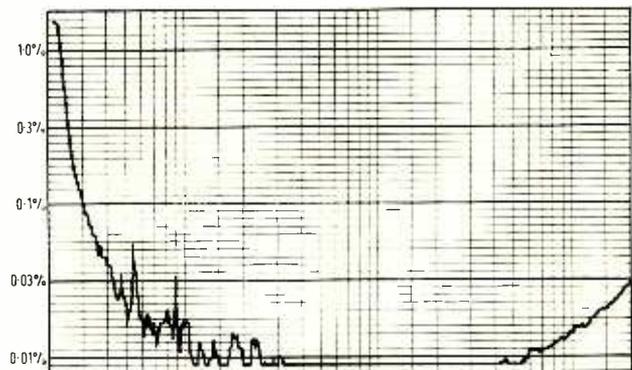
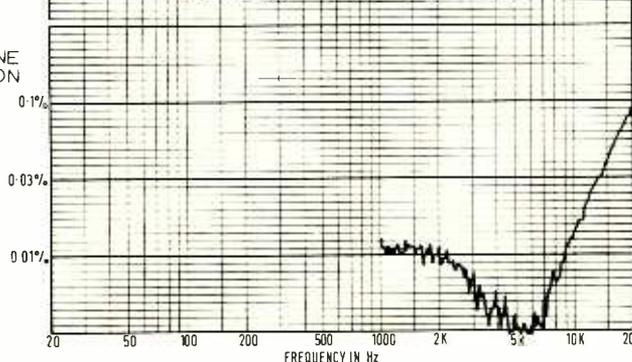


FIG.5
DIFFERENCE TONE
INTERMODULATION
DISTORTION
AT +15dBm OUT





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MIDAS MIXING SYSTEM

The type *PR 001* module had identical gain, clipping points, noise and microphone input impedance to the type *PR 003* input module, but in the *PR 004* the line input impedance was lower at 8400 ohms which is reasonable for most line sources.

In addition to far more complex equalisation features which I will come to, foldback from the two foldback level controls can be switched from off to pre-fade or to post-fade by a miniature toggle switch, as can the two echo sends with a second toggle switch. Channel mute is by a further toggle switch associated with an led indicator, but unfortunately the pre-fade listen switch has no led indicator. An additional feature is that the panpot outputs are fed to a dual digital thumbwheel switch which can route either panned output to any of the permitted eight output channels.

Coming now to the equalisers, the bass is controlled by a high pass filter which can be switched to have 3 dB points at 60 Hz or 120 Hz or can be set flat as is shown in fig. 6, which also shows the characteristics of the bass equaliser which comprises a three position switch for frequency and a potentiometer for slope. The switched frequencies of 40, 80 or

160 Hz represent the peaking frequencies while the slope control gives ± 16 dB control at the desired frequency with a very good law.

The treble equalisation has a similar arrangement with switched frequencies of 6, 10 and 15 kHz with a potentiometer having a ± 16 dB range and a good law, but the treble control introduces a fairly large shift at mid frequencies to the extent of ± 2 dB at 500 Hz (fig. 7).

The mid (or presence) control has a similar arrangement but with a six position rotary switch controlling the peaking frequency to nominal peaks of 500 Hz, 800 Hz, 1.5, 2.5, 3.5 or 5 kHz (I'm sure Herr Heinrich Hertz would not approve of the front panel legends Hz, kHz K or HZ which are scattered about with a potentiometer control providing ± 16 dB boost or cut, the overall characteristics of which are shown in fig. 8.

As a final remark on the very good input modules it is perhaps surprising that no provision was made for powering condenser microphones, particularly in the versatile *PR 004* module (again, this option is possible).

Output module type PR 011

The signals from the appropriate input modules and echo return modules, in addition

to the oscillator output, are fed to the input or the output modules, these being equipped with an 'inject' jack which is a high impedance (11 800 ohms) high level input, the available gain from this point to the module output being 16 dB. There follows the pre-fade listen facility and the main fader which is followed by a buffered 'insert' jack socket, the output end of which is wired directly to the group output on the rear panel and via a resistor to the 'record' jack socket.

With the exception of the group output, which was floating transformer coupled with a drive capability of +21 dBm (loaded into 600 ohms) from a low impedance (70 ohms), the inject, insert and record output were unbalanced and I regard the record output impedance far too high at 1500 ohms (I am informed that this is to protect signal levels in the output module and monitor circuits. A separate active buffer for the record output would be preferable).

The group output and record output are fed to a three position rocker switch which feeds a desk mounted vu meter for each channel and also the monitor level control and monitor panpot. The switch facility either switches these facilities off or connects them to the group output or to the tape return *XLR* connector which offers a 8100 ohm input impedance with the option of fitting a balancing transformer.

In the review sample the output from the panpot was fed to fixed monitor groups, but a switch may be fitted to feed the panned output to monitor groups 1 + 3 or 2 + 4.

The performance of the system as described in the section of this review dealing with the input modules has already taken into account the frequency response and distortion of the output modules, but a further word is appropriate on the subject of noise. Noise at the output with the fader fully open and one input channel selected was as the specification implies -78 dBm over the band 20 Hz to 20 kHz or -79 dBm 'A' weighted; however, with the fader closed the 'A' weighted noise fell to -87 dBm with little shift in the unweighted figure due to the introduction of mains hum from some unexplained source.

Monitor and oscillator module PR 021

The monitor section of this module consists of two amplifier chains for summing the left and the right output from the output module pan pots and feeding the summed output to a pair of rear panel *XLR* connectors which can be optionally balanced or unbalanced low impedance outputs. A single knob gain control is incorporated which has good tracking, and in addition there is a three position key switch which provides monitor muting in addition to a 'dim' position which reduced the monitor output level by 10 dB—a useful feature.

Line-up tone is provided by the oscillator section of this module which has four switched frequencies of 50 Hz, 150 Hz, 1 kHz and 10 kHz. The actual frequency was within 2% of nominal, except for the 10 kHz which was 5% low, and the harmonic distortion was adequately low with a worst case of 0.05% third harmonic or 0.04% second harmonic.

The output level is controlled by a potentiometer and its routing is controlled by a key switch which sends either to all the output modules or to an unbalanced jack socket on

MIDAS TYPE 004
INPUT MODULE
FIG.6
HIGH PASS FILTER
& BASS EQUALISER

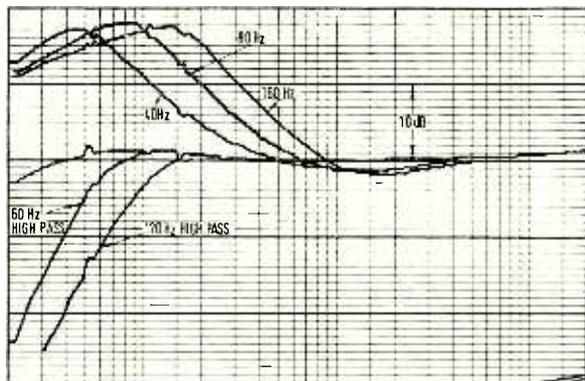


FIG.7
TREBLE EQUALISER

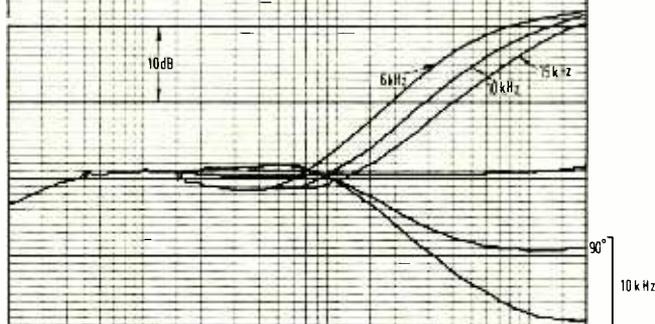
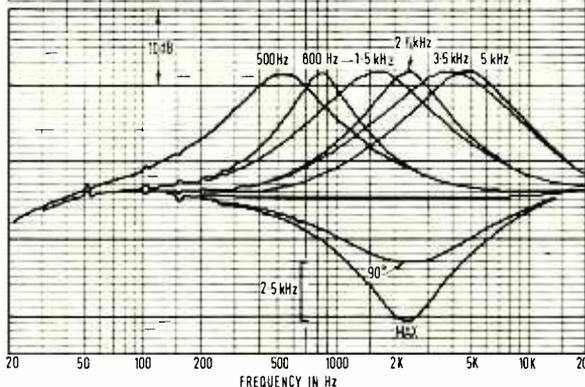


FIG.8
MID EQUALISER



the desk. The maximum available output level was found to be rather low at -1 dBm with a variable output impedance reaching 600 ohms maximum.

Pre-fade listen and talkback module PR 020

This module, as the name suggests, deals with the pre-fade outputs from all the input modules and output modules, but it also monitors after-fade outputs from the echo module. Any combination of the selected sources are added and fed via a level control to the headphone amplifier which was found to have more than adequate output for any normal headphones. In addition to the listening facility the inputs are fed before the headphone level control to an auxiliary vu meter on the desk.

This is a very important feature, as it is the only way of monitoring levels within the desk at any point before the group faders. It should at this juncture be mentioned that the group vu meters and the auxiliary vu meter are identical instruments which do meet the proper vu meter standards.

The talkback system starts with an AKG gooseneck microphone and its pre-amplifier, the microphone being directly mounted on to the module. Talkback is activated by a three position key switch which permits talking to the line output and tape, or talking to foldback with insertion before the foldback level control.

In the talk to tape position there is automatic operation of the studio monitor 10 dB dim system.

Echo and foldback master module PR 009

This module deals with a single echo channel and a single foldback channel, thus two such modules are required to make use of the facilities provided on the input modules.

The foldback signals from the input modules and the input from the talkback module are summed and pass to a foldback level potentiometer, this being associated with an after-fade listen facility which follows the treble, bass and presence equalisers in the foldback circuit. These equalisers were identical in performance to those in the PR 002 input modules thus giving a wide range of control over the foldback signal which has already been equalised in the input modules. The foldback output is a high level rear panel output with the option of a balancing transformer.

Echo send is derived from the incoming signals from the input modules, but can also have a controlled amount of echo return added by means of a 'spin' control in the echo and foldback module. Following this the echo send signal has a level potentiometer and is sent to the rear panel XLR connector in unbalanced or optionally balanced form at high level, with the facility of after-fade listening. Echo return is a high impedance input (54 000 ohms) which is followed by a screwdriver operated gain control followed by a bass, treble and presence equaliser again, identical to those in the PR 002 input modules.

Following the echo return equaliser there is a pre-fade listen facility followed by a desk mounted breakpoint which may be used for further equalisation or other outboard equipment. From this point the echo return has a potentiometer fader and is passed to the 'spin'

control and to the output panning control, an echo mute switch being included.

Two versions of output routing control were included in the review desk, one having the twin digital thumbwheel switches permitting either panned output to be routed to any output module, and the other having two three position toggle switches providing routing to busses 1/off/3 and 2/off/4 for the two outputs.

Crossover and limiter module PR 030

This is a highly specialised module which is intended for live sound applications and which the manufacturer says is normally supplied for use with Martin Audio pa loudspeaker systems. It is of course available to suit other pa systems in that both the crossover frequency and the attenuation at the crossover point can be factory adjusted.

In the case of the review sample the unit had been set for a crossover frequency of 800 Hz at -6 dB and it was confirmed that this setting had been done correctly, with the ultimate attenuation of both filters being 24 dB/octave.

After fade listening (and of course metering) is provided for both filters with the two separate switches also having a position for switching the output of the filter out of circuit. In the case of the high pass filter this facility is duplicated on a treble level control which has switched level steps from -8 dB to $+10$ dB in two decibel steps. These were found to be accurate, but the output of the treble filter was found to be about 2 dB up on the bass filter.

The limiter section of the treble filter had an attack time of 2 ms with a release time of 60 ms, both of which should be satisfactory. Green and red led indicators are provided for each filter, the green being marked -1 dB and the red (limiter input level) $+6$ dB for the bass and $+10$ dB for the treble. While the green leds indicated a safe operating condition, illumination of the red leds needed pretty severe over driving.

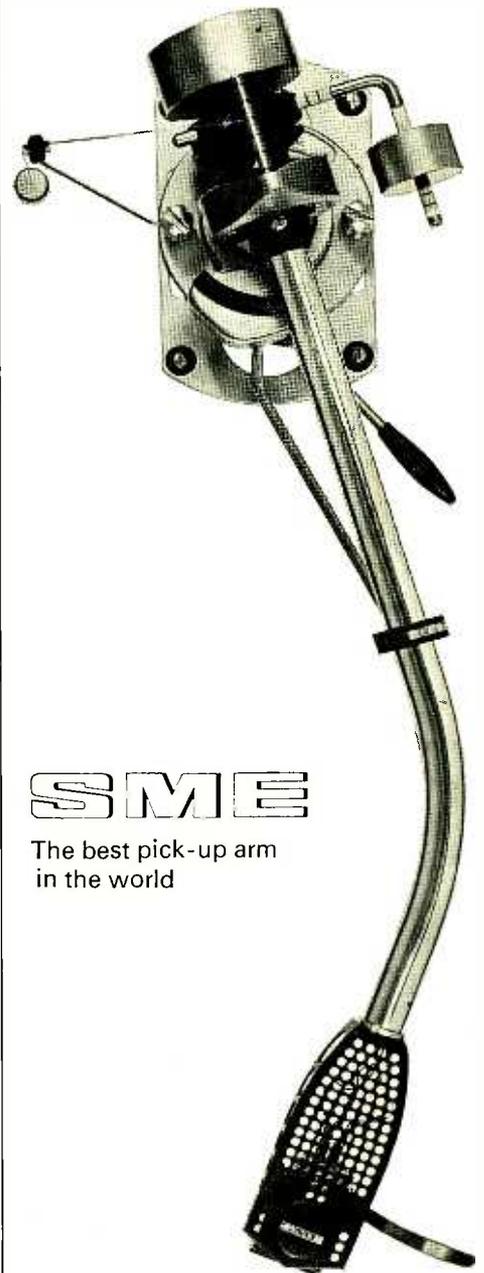
Six preset potentiometers are located behind a panel marked 'cover not to be removed'—this is of course a red rag to a bull! In view of the general lack of technical information the functions of these controls remain a secret.

Summary

In view of the large number of modules available for review it has not been possible to go into great detail, but the modules all did what they claimed and the overall system offered good crosstalk performance.

Although the Midas system is modular, it is not a 'do it yourself' system and therefore is not so easily altered or extended as some systems. Also I feel that the number of breakpoints are rather limited and I would have preferred to have seen a balanced system in this part of the world—or at least something better than a single jack handling the input and output (while identical facilities to those in the review sample are shown in the sales literature we are told that other options are available, but it is surprising that this option was offered for review!).

On the credit side the input modules have good flexibility and excellent noise performance and the cue system is unusually versatile. Also the echo and the foldback facilities are well conceived and offer facilities not always found in small mixers.



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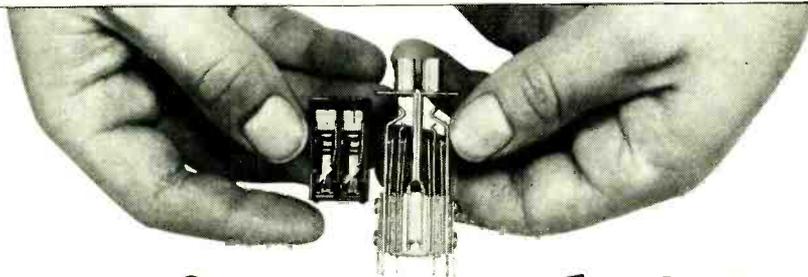
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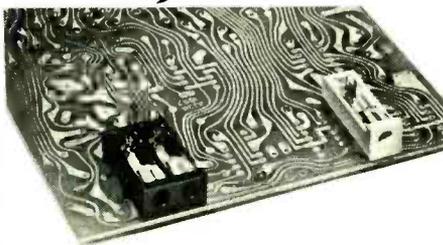
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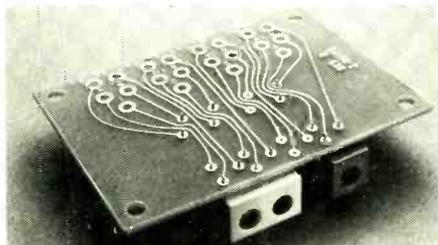


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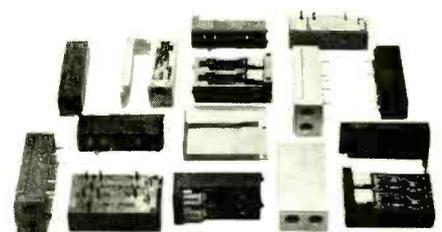


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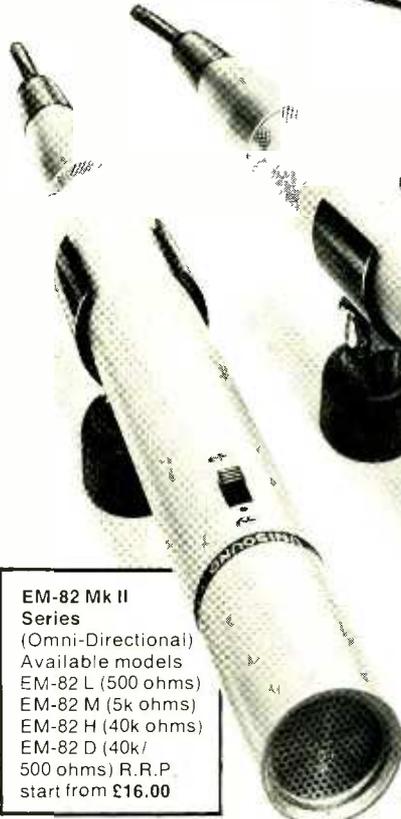
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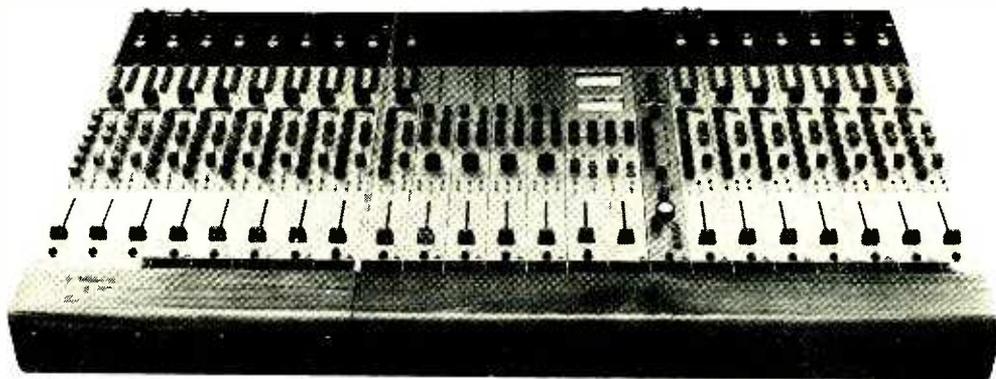
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Hugh Ford



MANUFACTURER'S SPECIFICATION

Overall system

Gain: maximum mic gain 70 dB.*

Maximum line gain 10 dB.*

Output: maximum output level into loads of 5k ohms and above +22 dBm.

Maximum output level into 600 ohms +16 dBm.

Nominal level +4 dBm.

Frequency response: line input to group output ± 1 dB, 20 Hz to 20 kHz.

Distortion: (line input to group output)

better than 0.05% thd at 1 kHz +20 dBm,

better than 0.15% thd at 10 kHz +20 dBm.

Noise: with ten input channels routed to one group and all faders set for unit gain: better than -70 dBm unweighted.

Crosstalk: with one channel routed to one group and faders set for unity. Not worse than -70 dBm 20 Hz to 20 kHz.

Power requirements: 110-240V, 50/60 Hz.

Dimensions: 15 module mainframe: 686 x 610 x 127 mm.

*System gain can be increased by up to 10 dB.

Input module

Mic input noise ref 200 ohms better than -120 dBm (unweighted). Line input noise ref 20k ohms better than -80 dBm (unweighted), maximum output +21 dBm. Distortion at +20 dBm 1 kHz better than 0.05% thd. Frequency response ± 1 dB, 20 Hz to 20 kHz. Module size: 500 mm by 45 mm.

Sub-master module

Maximum group output +21 dBm. Distortion at +20 dBm 1 kHz better than 0.05% thd. Noise better than -75 dBm ref 0 dBm (unweighted). Group gain pre-settable up to 10 dB. Module size: 500 mm by 45 mm.

Left/right master module

Maximum group output +21 dBm. Distortion at 20 dBm 1 kHz better than 0.05% thd. Noise better than -75 dBm ref 0 dBm (unweighted). Group gain pre-settable up to 10 dB. Frequency response ± 1 dB 10 Hz to 20 kHz. Module size: 500 mm by 90 mm.

Auxiliary module

Oscillator frequencies: 50 Hz, 100 Hz, 500 Hz, 1 kHz, 5 kHz, 10 kHz. Maximum output +10 dBm. Level accurate within 0.5 dB across all frequencies. Auxiliary outputs maximum level +21 dBm. Distortion at +20 dBm 1 kHz better than 0.05% thd. Noise better than -75 dBm (unweighted). Frequency response ± 1 dB, 20 Hz to 20 kHz. Monitor outputs as above. Talkback mic dynamic omni-directional. Maximum gain 60 dB. Module size: 500 mm by 45 mm.

Prices:	Input module	£150	\$283.80
	Left/right	£140	\$264.88
	Sub-master	£110	\$208.12
	Auxiliary	£180	\$340.56
	Typical 16 into 4 mixer	£3320	\$6292

Manufacturer: Trident Audio Developments Ltd, 4-10 North Road, London N7.

US agent: Audiotechniques Inc, 142 Hamilton Ave, Stamford, Conn 06902.

The only connectors and other user facilities associated with the mainframe are located on the top surface at the back of the console. The power input being a standard IEC type connector with its associated voltage selector for 110/240V operation and three 20 mm fuses which are properly identified. A further and rather unusual feature is that the +45V and +10V dc power supply rails are brought out at terminals at the back of the console, the idea being that should the power supply fail in one mainframe it may be powered from the adjacent mainframe by linking terminals. The type of terminal used for this facility is not properly insulated, such that the power supplies could be easily shorted by a loose audio connector or other piece of metal, so I regard this facility of doubtful value on the assumption that the power supplies do not have a habit of failing!

All components on the circuit boards are clearly identified by screen printing and a comprehensive owners' manual is provided. While this includes block diagrams and fault finding procedures, it is peculiar that, with the exception of the power supply unit, no full circuit diagrams are included.

Input module

The input arrangement starts with a transformer coupled microphone input which is provided with permanent +45V phantom powering. As I have found some microphones that take a dislike to unwanted powering, I would have preferred to have seen this feature switchable; furthermore, the permanent powering means that the inputs are not genuine floating inputs and can cause problems.

Following the input transformer, there is the microphone pre-amplifier which is associated with a calibrated front panel gain control with calibration points from 0 to 65 Db (sic)—why can't people get the abbreviations right? We also have many HZ and even KHZ! After the pre-amplifier, there is the mic/line switch which switches the input to the equaliser section between the unbalanced 6.35 mm line input jack socket and the microphone pre-amplifier.

The equalisation section, which can be switched in or out, comprises a low frequency shelving control, a high frequency shelving control and a mid frequency equaliser. The high and low shelving controls have a nominal range of ± 15 dB by means of potentiometer controls each of which is associated with a small toggle switch which alters the turnover frequency, 60 Hz or 150 Hz for the low frequency and 12 kHz or 8 kHz for the high frequency. The mid range equaliser is said to

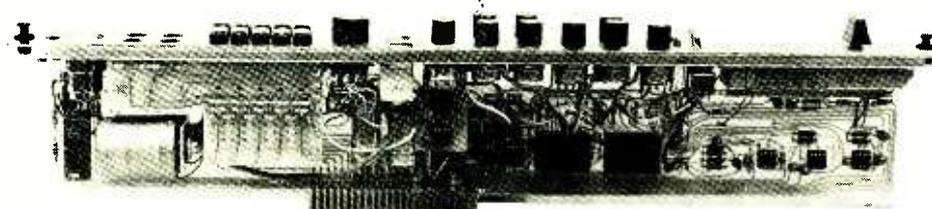
AS the name *Fleximix* implies, this mixdown system is a flexible modular system, the configuration of which can be readily altered in a short time. The basis of the system is four plug-in modules: an input module which contains equalisers and has line and microphone inputs; a sub-master module which has metering and monitoring facilities together with group panning; a left/right master module which is a twin channel module with metering and monitoring but no panning; finally the auxiliary module which includes talkback in addition to cue system control and an oscillator.

The collection of modules plug into a mainframe which is formed out of a combination of two mainframe units accepting either 8 or 15 standard module widths (the left/right master module being the only one which occupies two module widths). Any number of mainframe

units can be very simply joined together both mechanically and electrically.

As each mainframe section contains its own power supplies, avoiding a common buss; it follows that within certain limits any type and size of mixer can be quickly constructed by joining the required types of mainframe to hold the desired number of modules, these requiring simple insertion. Only in the case of the sub-master modules is it necessary to do any wiring, and this simply consists of inserting a single wire link for each module.

The maximum complexity of the *Fleximix* system is controlled by the bussing system which comprises eight sub-master busses, a left and a right master buss, four auxiliary busses and a cue buss. However, in addition to these, there are comprehensive patching facilities which could be used to provide further routings.



be of the peaking type and has two potentiometer controls, one for depth of ± 15 dB and the other for frequency from 300 Hz to 10 kHz.

From the equaliser the signal is fed to channel send and channel return breakpoints, both of which are unbalanced, and thence to a line amplifier which feeds the main fader on the input module and two auxiliary send potentiometers, in addition to the 'cue' toggle switch which also illuminates a led indicator when 'cue' is activated.

The fader output is buffered and fed to a channel on/off switch which has an associated red led indicator. From there the signal level is indicated on a small vu meter and also feeds two further auxiliary output potentiometers and a direct output breakpoint. From this breakpoint the signal is fed to a pan pot and then to ten 'self-illuminating' pushbuttons which determine the master grouping. The routing is nged for odd numbered sub-groups and the output to the left/right master module to copy one end of the pan pot, and the even bered sub-groups and the right output to left/right master module to occupy the aining switches.

he channel faders, like all other rs, may be optionally plastic or a quality carbon; the review sample was 1 with Duncan *slide-line* faders which are to be rather liable to the ingress of ette ash and beer. This comment also ied to the miniature toggle switches and ack sockets used as high level inputs and uts.

summary the input module has these ten uts in addition to two pre-fade auxiliary uts and two post-fade auxiliary outputs and re-fade 'cue' output. The channel send and n breakpoints may be used for feeding pressors or other devices, but I feel that use of an unbalanced input is likely to duce problems. Foldback and echo send well provided for by the channel send, t output or the auxiliary outputs which can cessed elsewhere in the mixer.

Sub-master module

he signals routed from the input modules fed via resistors to a virtual earth amplifier he sub-master module and thence to pre- input and output jacks which, like other faces, are unbalanced. There follows the p fader, the output of which is buffered and to the group on/off switch which is asso- ed with a red led indicator, the signal from switch being fed to a sub-group output and two further switches.

he pan source switch selects either the group uts or the external pan input socket and is the sub-group pan pot and from there, left/right master module. The other switch s the monitoring system from either the p inputs or a buffered external line input also feeds an inbuilt led type peak pro- me meter via a jack socket which may be l to drive an external meter. This also pro- s the 'cue' signal via a toggle switch which has an associated led indicator.

The monitoring system has potentiometer feeds to the auxiliary 1 and 2 busses and a monitor level control which is followed by potentiometer feeds to the auxiliary 3 and 4 busses, and also a monitor speaker switch for 'speaker' 1 and 2 feeding 'speaker' busses.

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FLEXIMIX SYSTEM

Left/right master module

This module is similar in function to the sub-master module, but it is a 2-channel module and has twin vu meters in lieu of ppms and the outputs are duplicated on jack and XLR plugs in unbalanced form.

Other than the external meter output and obviously the sub-group output being omitted, the external interface is identical with pre-fade breakpoints and an external line input which is associated with a 'group/line' switch. On the monitoring front there is the duplicated facility of the four auxiliary sends and a monitor level control, as well as the cue sends and speaker selection switches.

Auxiliary module

As far as the mixdown signals are concerned the auxiliary module accepts the signals from the four auxiliary busses and the two monitor speaker busses and passes these signals to buffer amplifiers and potentiometer faders. The auxiliary signals then pass to four jack outputs and the monitor signals to two monitor jack outputs. All these chains can be broken into by the cue system, such that any combination of auxiliary sends can be routed into the monitor system in addition to the cue buss, there also being a monitor mute switch.

This is further complicated by the talkback system which includes a microphone built into the module which can be routed to a 'talk to studio' output, to all auxiliary outputs or to all master and sub-master busses. The routing is accomplished by depressing one of three press-to-talk buttons.

The final facilities in the module include an oscillator with a choice of six switchable frequencies between 50 Hz and 10 kHz. The oscillator output is variable and fed to either a jack socket or to all main group busses by means of a 'slate' switch. A small inbuilt vu meter can be switched to monitor the oscillator output or the cue, monitor or auxiliary levels on any of these busses at their output points.

Performance

Initial attention was directed to the input and output connectors which, with the sole exception of the microphone input, are unbalanced. The gain of the microphone input was found to be variable over a wide range with maximum gain from the input to the output of the mixer of 69 dB associated with noise at the microphone input at -124.7 dBm 'A' weighted when loaded with 200 ohms. The effective input noise was however peculiar, in that the noise decreased with increasing source resistance to the extent of -131 dBm 'A' weighted with the input open circuit.

At maximum microphone gain the input clipping point was at -40 dBm with an input impedance of 2680 ohms at 1592 Hz—a generally satisfactory situation with the input impedance being relatively constant until the gain was increased to near maximum when the input impedance fell very rapidly to around the 600 ohm mark and became frequency dependent. However, the input clipping point was good at +19.4 dBm.

With the exception of the pre-fade returns, the remaining inputs to the modules had a sensible input impedance of a constant 18 000 ohms, but the pre-fade return inputs impedance

TRIDENT FLEXIMIX

FIG. 1
THIRD HARMONIC
DISTORTION AT
+20 dBm OUT

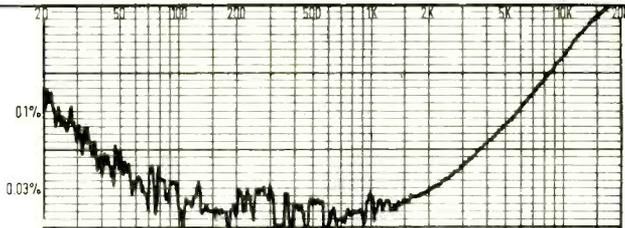


FIG. 2
DIFFERENCE
FREQUENCY DIST.
+10 dBm OUT (FROM
MIC. INPUT)

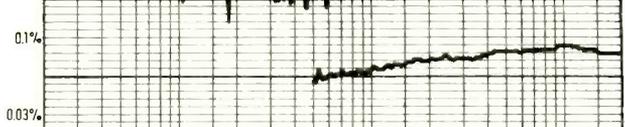


FIG. 3
LOW FREQUENCY
EQUALISER

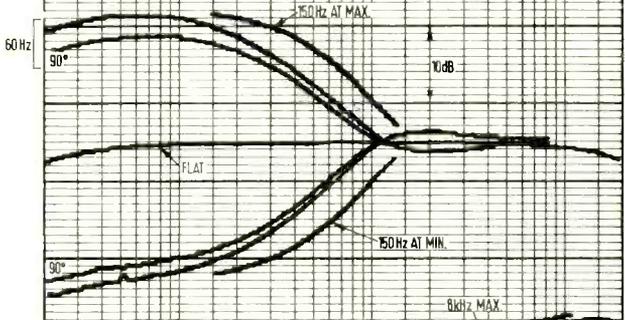


FIG. 4
HIGH FREQUENCY
EQUALISER

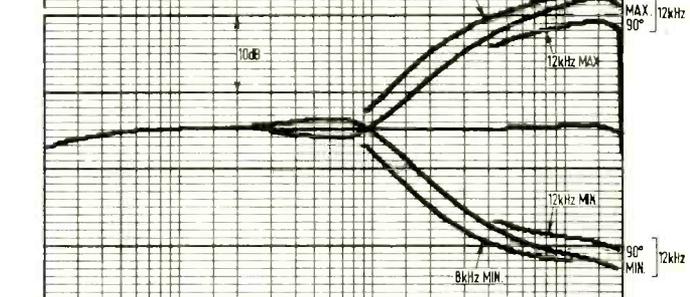


FIG. 5
MID EQUALISATION
AT MAXIMUM AND
MINIMUM

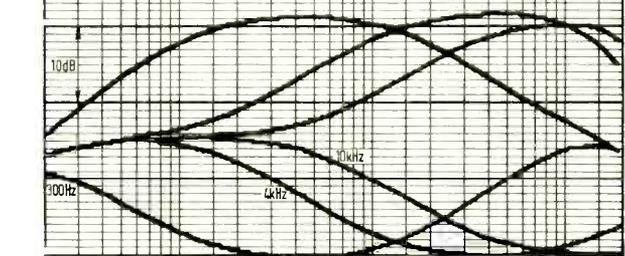


FIG. 6
MID EQUALISATION
AT 300 Hz SETTING

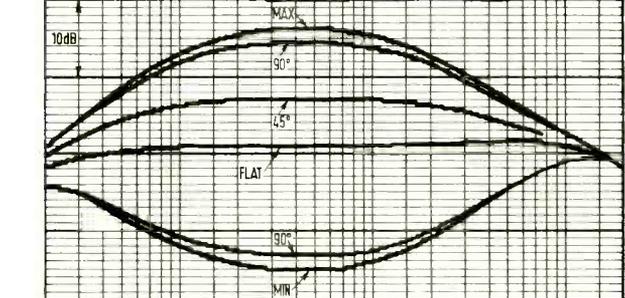
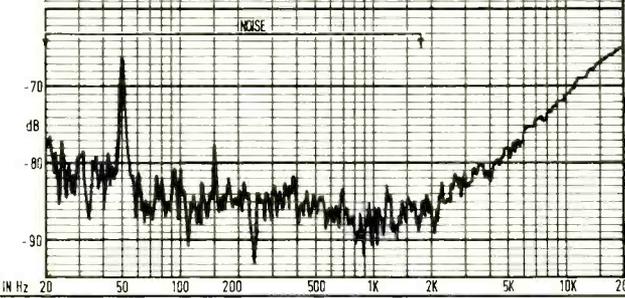


FIG. 7
CROSSTALK
ADJACENT
CHANNELS



varied with fader settings from something over 8000 ohms at minimum gain to just under 6000 ohms at maximum gain, both readings being on the low side for comfort.

All signal outputs except the talkback and the oscillator outputs had an impedance between 70 and 80 ohms which is adequately low, the talkback output having a lower impedance and the oscillator output impedance varying widely with output level setting, from a very low impedance up to about 580 ohms.

All signal outputs had a drive capability of +21 dBm over the audio frequency band, the overall mixer third harmonic distortion from microphone input to line output at maximum gain through being shown in fig. 1 which, in principle, confirms the manufacturer's specification. However, it should be noted that the level of high frequency distortion falls with the output level.

Intermodulation distortion measured at +10 dBm output under the same conditions was good, fig. 2 showing the twin tone difference frequency distortion of the even numbered difference frequency which was the predominant product. Measurements to the SMPTE method at +4 dBm output showed that no distortion product was above -75 dB.

The overall frequency response from the microphone input, and the performance of the high and the low frequency equalisers is shown in figs. 3 and 4 from which it is to be seen that the overall response is within ± 1 dB from the microphone input. Furthermore it was found that the mechanical zero setting of the equaliser controls was very accurate. However, as was the case in all *Fleximix* equaliser controls, it was found that the law is not particularly good. As can be seen from the frequency response plots, the first 90° rotation of the controls have substantial effect while the remainder of the rotation has little effect. It is however understood that the manufacturer has had difficulty with supplies of potentiometers, and this may account for the law observed.

Curves for the mid frequency equaliser are shown in figs. 5 and 6 from which it is to be seen that the equaliser is a very broad-band peaking type with a clean lift and cut characteristic unlike the treble and bass equalisers which have a certain amount of 'out of band' effect. Subjectively, the effect of all the equalisers was fairly dramatic, but I would have preferred to have seen an additional bass cut equaliser at low frequencies.

Crosstalk between adjacent channels was

absolutely minimal as is shown in fig. 7 which also shows the very low hum level achieved. No other interactive effects between input or between controls were observed.

Checking the mixer's metering showed that the very useful vu meter on each input module was not too far from being a genuine vu meter, the major error being that the rectifier did not cope with asymmetrical waveforms. However, this meter is quite adequate for its intended purpose of avoiding overload in post-equalisation stages in the mixer when large degrees of boost are applied by the equalisers. As was to be hoped, the vu meters in the left/right master module were the genuine animal, but the ppms in the sub-master modules were a distinct disappointment. All four ppms showed 6 dB asymmetry error and were all far too slow in risetime with an indication of -12 dB for a 5 ms tone burst when the indication should be -4 dB. Subsequent investigations showed that this was due to an artwork error on the board which will be corrected.

Turning to the auxiliary module, the talkback system was generally satisfactory with the reservation that the microphone picked up noise from the console control movements which might, in some circumstances, be annoying.

Summary

Fleximix offers a versatile system for constructing a wide variety of mixers with the minimum of complications. So far as performance is concerned, the system offers a good dynamic range with excellent distortion parameters and good headroom, the meters on the input modules being a great benefit. The signal routing facilities are excellent in the standard form, but even these can be altered with the minimum of trouble. The comprehensive operator's manual gives instructions for many modifications and good fault finding advice.

I feel that it is unfortunate that all, except the microphone inputs, are unbalanced, but I understand that a new transformer module may become available to overcome this criticism which relates particularly to portable operation. I have also been informed by Trident that they will soon be adding a stereo limiter/compressor module and a four quad joystick module to the range. Operation was in all respects simple and generally well co-ordinated with a good layout of controls which are well spaced and clearly identified. ■

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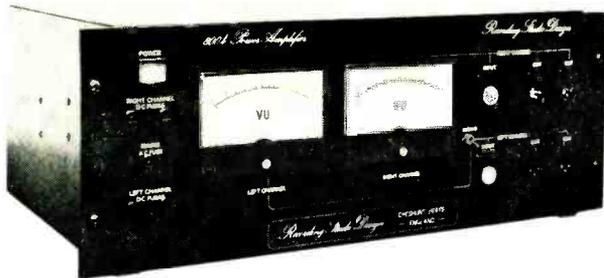
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COOLING

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INPUT

Switchcraft D3F on each channel with mono/stereo switch for paralleling inputs if required. (On front panel.) Wiring: Pin ① Earth ③ Live.

OUTPUTS

Switchcraft D3M x 2 paralleled per channel. (On front panel.) Wiring: Pin ① Earth ② Live.

FUSING

Two D.C. fuses per channel (6 amp fuses), one A.C. fuse (6 amp) all on front panel.

MAINS INPUT

Cannon XM series LNE 32, Push button illuminated on/off switch.

WEIGHT

45 lb.

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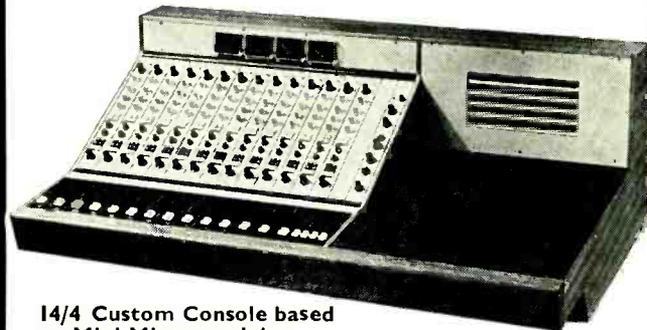
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An active filter to CCIR weighting characteristic for use with external voltmeter. (Ref. Dolby Laboratories Inc., Bulletin No. 43, Mar. 76.)

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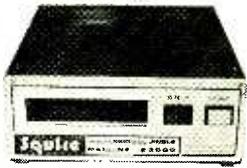
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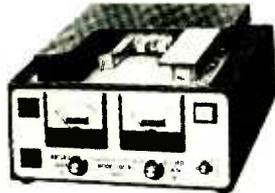
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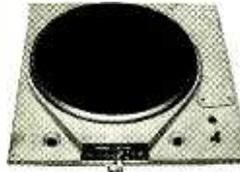


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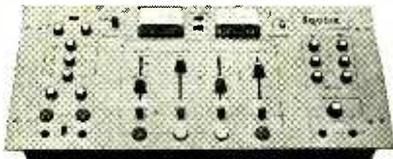
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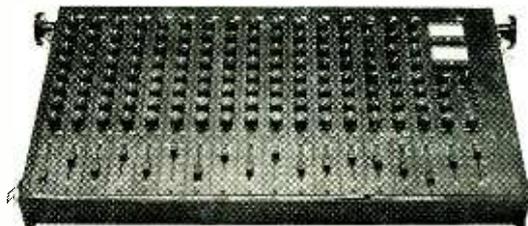


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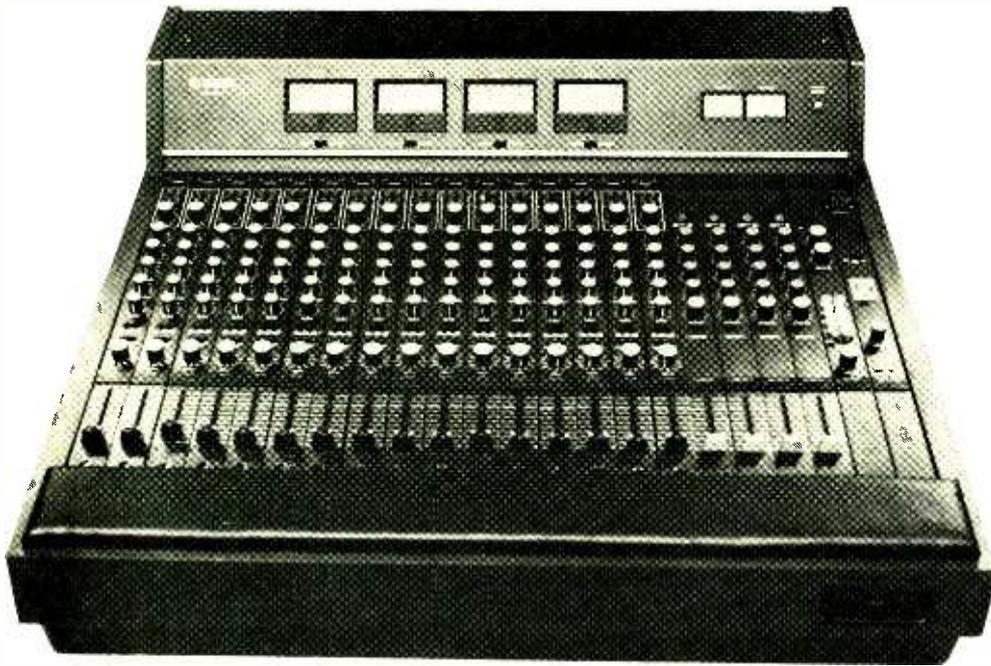
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Yamaha PM 1000 mixer

Hugh Ford

MANUFACTURER'S SPECIFICATION

Frequency response: +0, -4 dB, 20 Hz to 20 kHz; ± 0.5 dB, 50 Hz to 15 kHz.

Total harmonic distortion: less than 0.25% at +10 dB, 20 Hz to 20 kHz. Less than 0.5% at +20 dB, 70 Hz to 15 kHz.

Hum and noise*: -124 dBm equivalent input noise. -69 dB (73 dB s/n) line out A and B: master fader at nominal level and all input faders down.

-60 dB (64 dB s/n) line out A and B: master fader and one input fader at nominal level.

-63 dB (67 dB s/n) echo out: master send at nominal level and all echo mix controls down.

-54 dB (58 dB s/n) echo out: master send and one echo mix control at nominal level.

Maximum voltage gain (Input selectors at -60 dB, where applicable):

Program-74 ± 2 dB from channel in to line out A and B. 48 ± 2 dB from channel in to master out.

Monitor-74 ± 2 dB from channel in to monitor out.

Echo-74 ± 2 dB from channel in to echo out.

Sub in-30 ± 2 dB from sub in to line out A and B.

Pb in-30 ± 2 dB from pb in to line out A and B.

Master-32 ± 2 dB from master in to line out A and B.

Bass- ± 15 dB at 100 Hz, shelving.

Mid-range- ± 15 dB at 1 kHz, 2 kHz or 4 kHz; peaking.

Treble- ± 15 dB at 10 kHz, shelving.

High Pass Filter: 12 dB per octave roll-off below 40 Hz or 80 Hz.

Oscillator: 1 kHz or 7 kHz sine wave, +4 dBm at less than 1.0% thd.

Talkback: microphone input jack, preamp, level control, and push to talk switch; to programme busses and/or direct out.

Inputs to console: 16 channel inputs (microphone and line sources).

4 sub in (submixer input).

4 master in (hi-fi auxiliary program input).

4 pb in (playback input).

1 talkback mic in.

Mixing busses: 4 main program (line out).

4 monitor (speaker feed).

2 echo (foldback, stage monitor).

1 cue (preview).

Console outputs: 8 line (4 line A, 4 line B).

4 monitor (speaker feed).

4 master (hi-fi auxiliary program output).

2 echo (foldback, stage monitor).

1 talkback (talkback mic or oscillator out).

2 stereo headphone (console operator's monitor).

Crosstalk: -60 dB at 1000 Hz, adjacent inputs; -50 dB at 1000 Hz, input to output.

Vu meters (0 vu = +4 dBm): 4 x large, illuminated meters; switchable for master (line out) or monitor (monitor out). 2 x small, illuminated meters; echo (foldback) out.

Phantom power: 48V dc applied to balanced channel input transformers for powering condenser microphones. May be turned on or off with rear-panel switch.

Power supply: self-contained module inside console, fused and fully regulated. Requires 110-120V ac, 50-60 Hz, 45W. May be modified for 220-240V ac operation.

Finish: black anodised aluminium panels, padded armrest, rosewood veneer cabinet.

Dimensions: 87.2 cm w x 87.5 cm d x 27.7 cm h.

Weight: 50 kg.

*Measured with 6 dB/octave filter at 12.47 kHz: equivalent to a 20 kHz filter with infinite dB/octave attenuation.

Price: upwards of £2000.

Manufacturer: Yamaha-Nippon Gakki Co Ltd, 10-1 Nakazawa-Cho, PO Box 1, Hamamatsu, Japan.

UK agent: Kemble-Yamaha, Mount Avenue, Bletchley, Milton Keynes, MK1 1JE.

US agent: Yamaha International Corp, Buena Park, Calif.

THE Yamaha PM-1000 series of mixers comprise 16, 24 and 32 input by 4 output mixers, the review sample being a 16 input 4 output. However, the facilities described are generally common to the larger mixers, and the complete series is designed for sound reinforcement work in addition to use in small studios.

The complete mixer comprises the input modules, four master and monitor modules, a headphone and echo module and a talkback and oscillator module, all of which are plug-in modules. The main mixer body contains power supplies and metering. All input and output connectors are to the rear of the mixer and, with the exception of a patch point before the master faders, are in the form of standard XLR connectors offering floating transformer coupled connections.

Neglecting the monitoring arrangements for the time being, the mixer is based on four programme busses and two echo busses and a cue (solo) buss. Each input module may be switched to one or more of the programme busses and may be panned between busses 1 and 3 and 2 and 4 individually, or in pairs. In addition, each input module has a level control which feeds each of the echo send busses, but perhaps, surprisingly, this echo send is derived in the input module before the fader. The final output from the input modules is to the cue buss; this feed is activated by depressing a cue button on the input module which then feeds pre-fade input to the cue buss, thus providing a solo facility.

The talkback and oscillator module, which contains a 1 kHz and 7 kHz fixed frequency oscillator and a talkback microphone amplifier, may be switched to any or all the programme busses. In addition the module feeds a talkback output at the rear of the mixer. While the talkback level is variable by a potentiometer control on the console, the oscillator level is fixed at zero vu (+4 dBm) for equipment alignment.

The final inputs to the programme busses are from 'sub in' connectors at the rear of the mixer, these connections are floating and transformer coupled inputs which are intended as feeds from a sub-mixer or other high level programme source.

Headphone monitoring is provided by the echo and headphone module which has two parallel headphone outputs derived from any combination of the programme busses and the cue buss by a series of pushbutton switches on the module. The headphone level is variable and was found to have more than adequate range. This module also contains two 'echo master send' potentiometers which feed an echo line amplifier providing a floating and transformer coupled output for each echo buss,

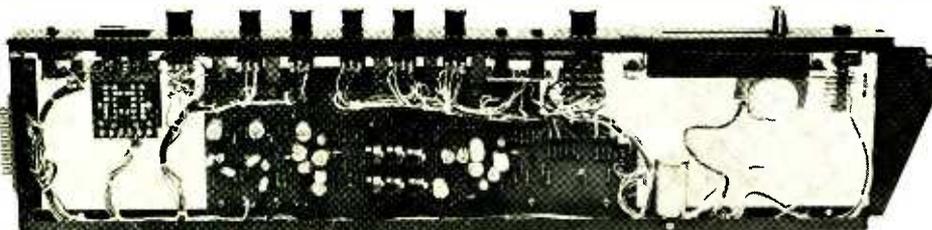
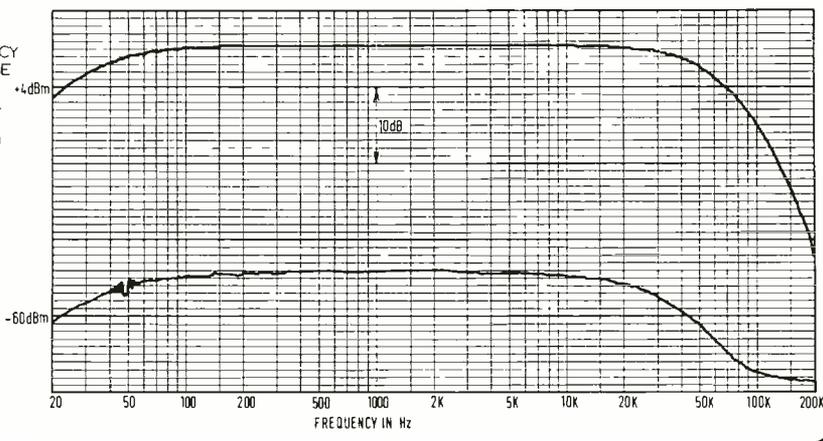


FIG. 1

PM-1000
FREQUENCY
RESPONSE
(FROM
CHANNEL
INPUT TO
LINE OUT)



the output levels for each being monitored by a pair of vu meters.

Programme feed from the four programme busses is buffered and fed to a patch panel which can be used as a breakpoint, from where the feed goes to a 'playback/direct' switch enabling either the programme buss feed or an external 'playback' feed to be switched to the line outputs. The audio feed from this switch is fed to the master faders which, in turn, feed line output amplifiers. There are two transformer coupled line outputs, one of which may be monitored with a vu meter which can also be switched to the monitor output.

Each monitor output is fed from a matrix of potentiometers which are followed by a 'monitor master' control for each monitor output channel. Thus each monitor output channel can be derived for any programme buss or from any combination of programme busses with the level from each buss controlled by a potentiometer in the 4 x 4 mixing matrix.

No echo return facility is provided as such, and it is suggested that a normal input module is used as echo return thus providing full mixing facilities for the echo return. As the input modules have a single input which has a very wide range of signal handling capacity this arrangement does not present any problems.

The standard of construction of the various modules was fairly 'domestic' and typical of much Japanese hi-fi equipment. In fairness, the external presentation was good and the identification of all controls was easy once a little experience had been gained with the mixer. A rather unusual feature was that the channel and master faders, operating as sliders, were in fact normal potentiometers driven by a rather clever friction wheel assembly. I think that the advantages of this mechanism are limited and, in view of the fact that two faders were faulty as received, I have some doubts about reliability. However, the arrangement is perhaps less prone to sweet coffee and beer than some slider faders, and it appeared that Yamaha had taken note of this problem in other parts of the mixer!

Wide separation between the controls and the liberal use of coloured knobs and self illuminating switches made operation quick and straightforward, but some care was required to avoid overload in parts of the mixer. Yamaha are to be congratulated on the comprehensive instruction book which provides full technical information and also gives a layman's guide to

operation including illustrations of how to wire-up the various connectors.

The input modules

Each input module is provided with a step attenuator giving 11 different nominal input sensitivities between -60 dBm and +4 dBm, this large range of sensitivities being controlled by a three stage attenuator part of which is before the input transformer. In all gain settings, the input is transformer coupled and floating with a common +48V phantom powering for condenser microphones which can be switched in or out of circuit.

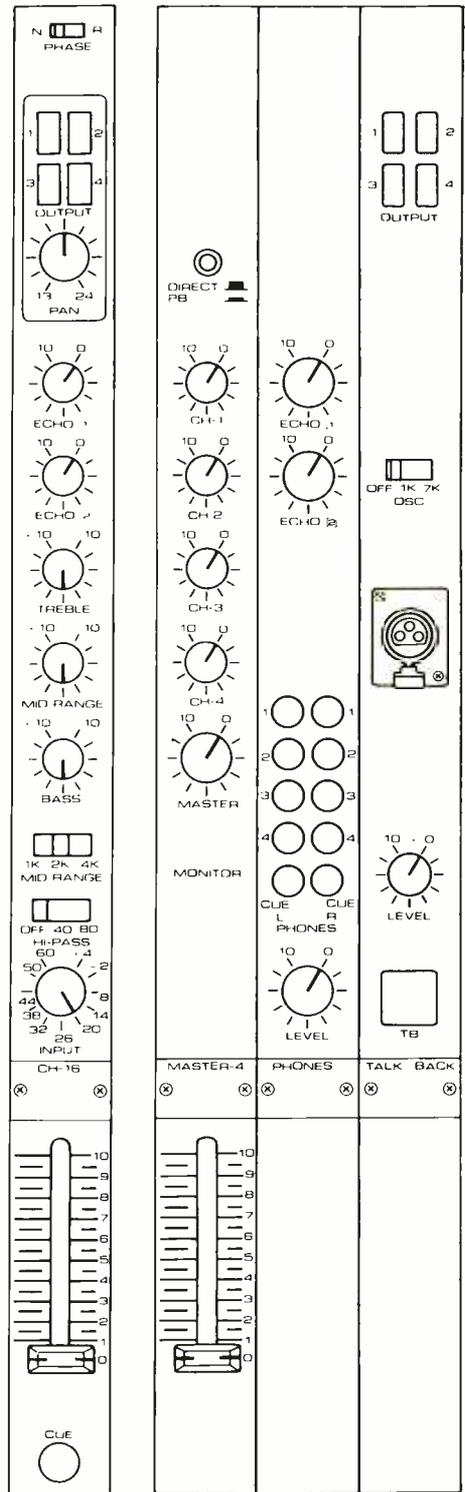
As is to be seen from fig. 1 the overall frequency response between the input and the line output of the mixer is virtually unaffected by the input gain so far as the audio band is concerned, and furthermore, the high frequency response has been rolled off at a sensible point.

The maximum available gain from the channel input to the line output was found to be 75 dB which is adequate for dynamic microphones. At the higher input sensitivities the overload margin was found to be 34 dB above the nominal input sensitivity, and in view of the larger selection of sensitivities this gives a more than adequate range. Noise referred to the input was when loaded with 200 ohms as follows:

20 Hz to 20 kHz rms unweighted	-120.5 dBm
'A' weighted rms	-123.5 dBm
20 kHz effective bandwidth rms	-123.5 dBm

This generally satisfactory performance held for all input sensitivity settings because of the split attenuator arrangement which only at very high input levels inserts series resistors at the input.

The section of the input attenuator which follows the phase reverse switch inserts series resistors at high input levels, with the result that the input impedance which is virtually constant at nominal input levels from -60 dBm to -20 dBm at 1000 ohms rises to approximately 2200 ohms at -14 and -18 dBm sensitivity and to 5550 ohms at the -2 and +4 dBm settings. Clearly the input impedance at high sensitivities is well chosen for both 200 ohm dynamic microphones and most capacitor microphones, but I would have preferred to see a higher



impedance (say 10 000 ohms minimum) at high input level settings.

The input section of the input module is followed by the equalisation section which comprises treble and bass equalisers and a mid range equaliser which can have its centre frequency switch selected to 1 kHz, 2 kHz or 4 kHz. The effect of this control potentiometer at the 2 kHz centre frequency is shown in fig. 2 for the extreme settings and the 90° off centre-

YAMAHA PM 1000

settings. Similar curves for the treble and bass equalisers are shown in **figs 3 and 4** from which it is to be seen that there is a rather serious mid-frequency shift introduced even with small degrees of equalisation. However all three equalisers have a good law with the initial 90° movement providing for most needs, and the remainder of the travel giving extremes of equalisation.

A further switch gives the facility of low frequency cut with either no cut, or cut at 40 Hz or 80 Hz 3 dB points with a roll off of 12 dB per octave. While this is a useful facility, it might have been an improvement if the 80 Hz setting had been ranged at a higher frequency.

From the equalisation section the signal is fed to the two echo send potentiometers and to the channel fader from here it is buffered and fed to the pan pot and the buss selectors. The pan pots on all channels were found to be an absolute abomination, for not only were they difficult to centre, but also minimal movement jumped the signal 3 or 4 dB with a consequential impossibility of meaningful panning.

Another feature which I do not like is that the buss selector switches cannot be used 'live' as they put clicks on the busses, thus the only way of muting a channel is to shut the channel fader. In practice the attenuation was high at 93 dB at 1 kHz or 88 dB at 10 kHz, but as the echo send is pre-fade this too must be shut on unwanted channels and cannot be preset. Another feature which was noted was that operation of the cue button (solo) dropped the channel output about 0.5 dB, but this is relatively insignificant.

The master and monitor modules

The program busses from the input modules feed directly to a buffer amplifier in the master module, the output of which is available at the jack breakpoint on the rear panel. After this breakpoint there is the line output amplifier which can be fed either from the breakpoint or from a transformer coupled playback input according to the setting of the direct/playback switch on the master module. Thus a tape recorder can be inserted at the breakpoint and A/B switching achieved with the master fader affecting the input to the line amplifier.

Output from the line amplifier feeds two transformer coupled outputs and also an input to the monitor mixing controls which are fed from, and can combine, all four line outputs. This is achieved by a simple matrix of potentiometers which feed a monitor master potentiometer for each monitor channel, in turn feeding line amplifiers. These are identical to the main line output amplifiers. The four vu meters on the mixer can be switched to read either the main line output or the monitor output, and I am pleased to report that genuine vu meters corresponding to the ASA standard are incorporated.

The line and the monitor output have a low source impedance between 80 and 90 ohms associated with a drive capability of +21 dBm (loaded with 600 ohms). **Fig. 5** shows the second and third harmonic distortion introduced between channel input and line output at maximum gain and with the input set for +20 dBm output into 600 ohms. At lower output levels the distortion falls such that at 0 dBm output

YAMAHA PM-1000

FIG. 2
PRESENCE CONTROL
AT 2 kHz SETTING

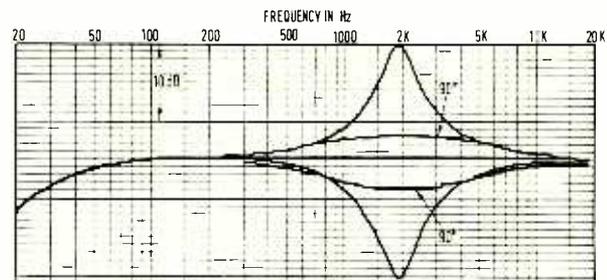


FIG. 3
TREBLE EQUALISER

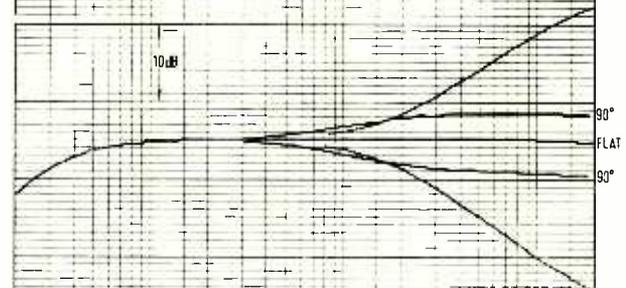


FIG. 4
BASS EQUALISER

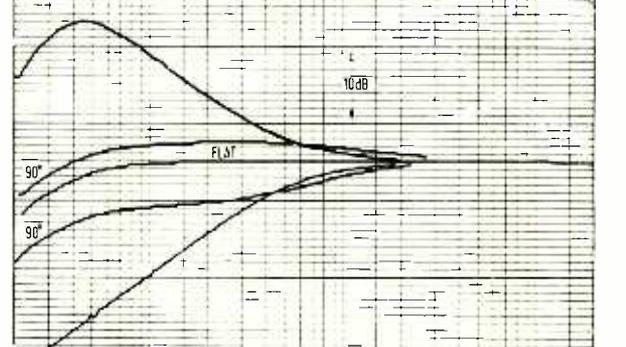


FIG. 5
HARMONIC DISTORTION
AT +20 dBm OUT
MAX GAIN

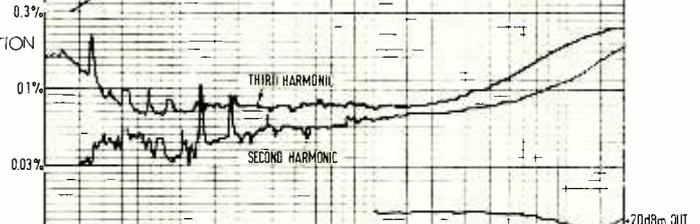


FIG. 6
DIFFERENCE
FREQUENCY
DISTORTION

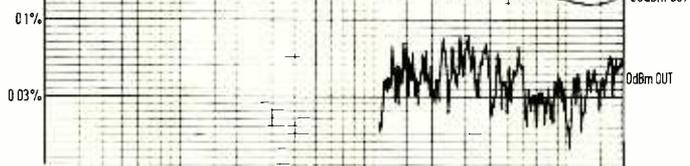
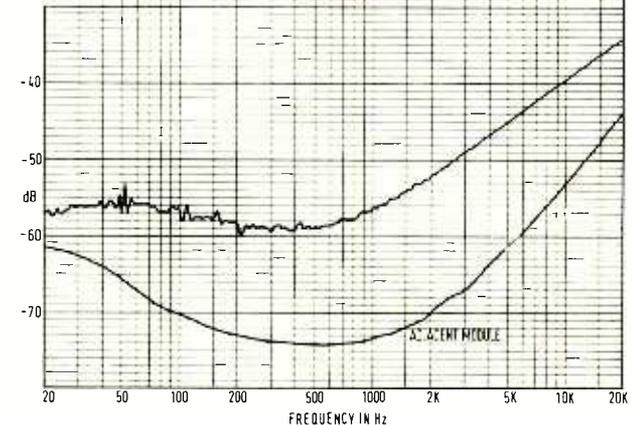


FIG. 7
CROSSTALK



the mid frequency distortion is about 6 dB less and that at high frequencies (say 10 kHz) the distortion is reduced by 10 dB. Thus the performance can be said to be good and reference to fig. 6 shows that the difference frequency intermodulation distortion is also at a low level.

No interaction between controls was noted, other than the effect of the cue button, and while the potentiometer controls (including the faders) were not the quietest I have known, their performance was quite satisfactory.

The headphone and echo module

The four programme busses and the cue buss are buffered and fed to ten pushbutton switches (five for each headphone stereo channel) such that any combination of busses can be fed to either side of the headphones which are driven via a level control and a small power amplifier. No problems were encountered with this section which has plenty of available output for two parallel pairs of headphones which are provided for by two stereo jack sockets.

Like the other busses the two echo send busses are buffered and fed to master echo send potentiometers, which in turn drive line amplifiers to provide line level outputs at the rear of the mixer. Naturally these two outputs are not confined to echo, but may be used for foldback or other purposes.

The talkback and oscillator module

Switch selection of 1 kHz, 7 kHz or 'off' control the oscillator which is intended for setting levels and which can be switched to deliver 0 vu (+4 dBm) to any combination of programme busses. The talkback amplifier in

the module uses the same output arrangement as the oscillator, operation of the 'press to talk' button disconnecting the oscillator as feeding talkback to the buss selector switches and also to the talkback line amplifier which feeds a transformer coupled connector at the rear of the mixer.

Oscillator frequency and level were found to be as accurate as is necessary for the intended use for level setting, and the distortion content was also reasonably low.

The instruction manual warns that crosstalk can be introduced if the oscillator is not switched off, this being true at a low level. However, the same applied to the talkback which could be an equally serious problem.

General

Crosstalk in other respects was not really a problem, the worst case conditions shown in fig. 7 would not normally occur in practical operation.

The upper curve in fig. 7 shows the crosstalk with one input channel driven at 0 dBm and routed to programme buss 1 with the adjacent channel at maximum gain, the input shunted with 200 ohms, and the output routed to programme buss 3—the result—56 dB crosstalk at 1 kHz.

The lower curve in fig. 7 was made under the same conditions but with the driven module disconnected from the programme buss, thus this curve is the crosstalk between adjacent modules under what are really unfair conditions!

While the Yamaha mixer is specifically intended for theatre work, and its monitoring

and 'echo' facilities are excellent for such purposes, it is clearly a well thought out mixer for the small studio.

The performance in terms of the measurement of distortion, noise and frequency response is generally good and the interfacing at the input and output ends is near the ideal. While there was no interaction between controls and all equalisers and other functions did what was claimed, the input modules were severely let down by the appalling performance of the pan pots.

While other minor shortcomings have been mentioned this is a really serious matter which must be put right by Yamaha—this will then be a very useful mixer.

agony

A certain cabaret singer was doing a one-night-stand at a night club in darkest Wales, and was being backed by her own md with the resident rhythm section. A little way into the set it became apparent that the bass guitarist was overplaying dreadfully, turning *My Way* into a facsimile of *The Flight of the Bumblebee*! At a suitable gap in the music, the md hissed 'lay back!' at the offending musician and was promptly rewarded with the sight of the said bassist laying back at an angle of 45° against his stack!

pop ~ mixer

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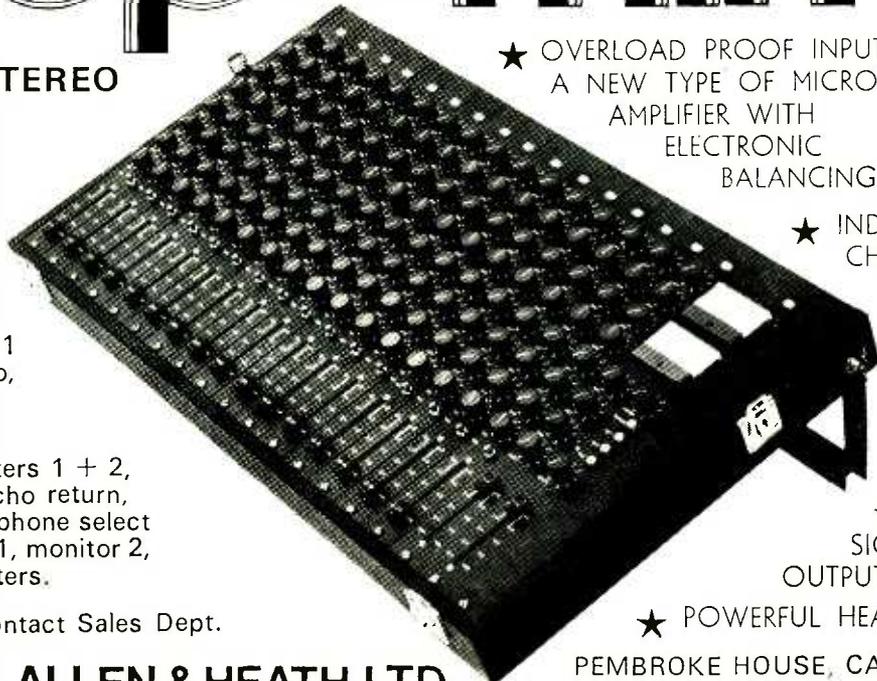
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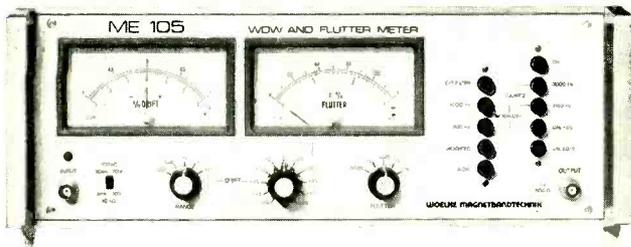
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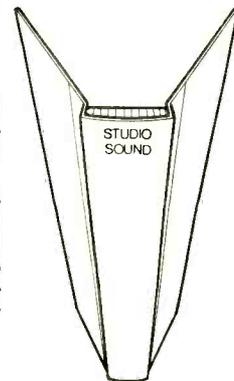


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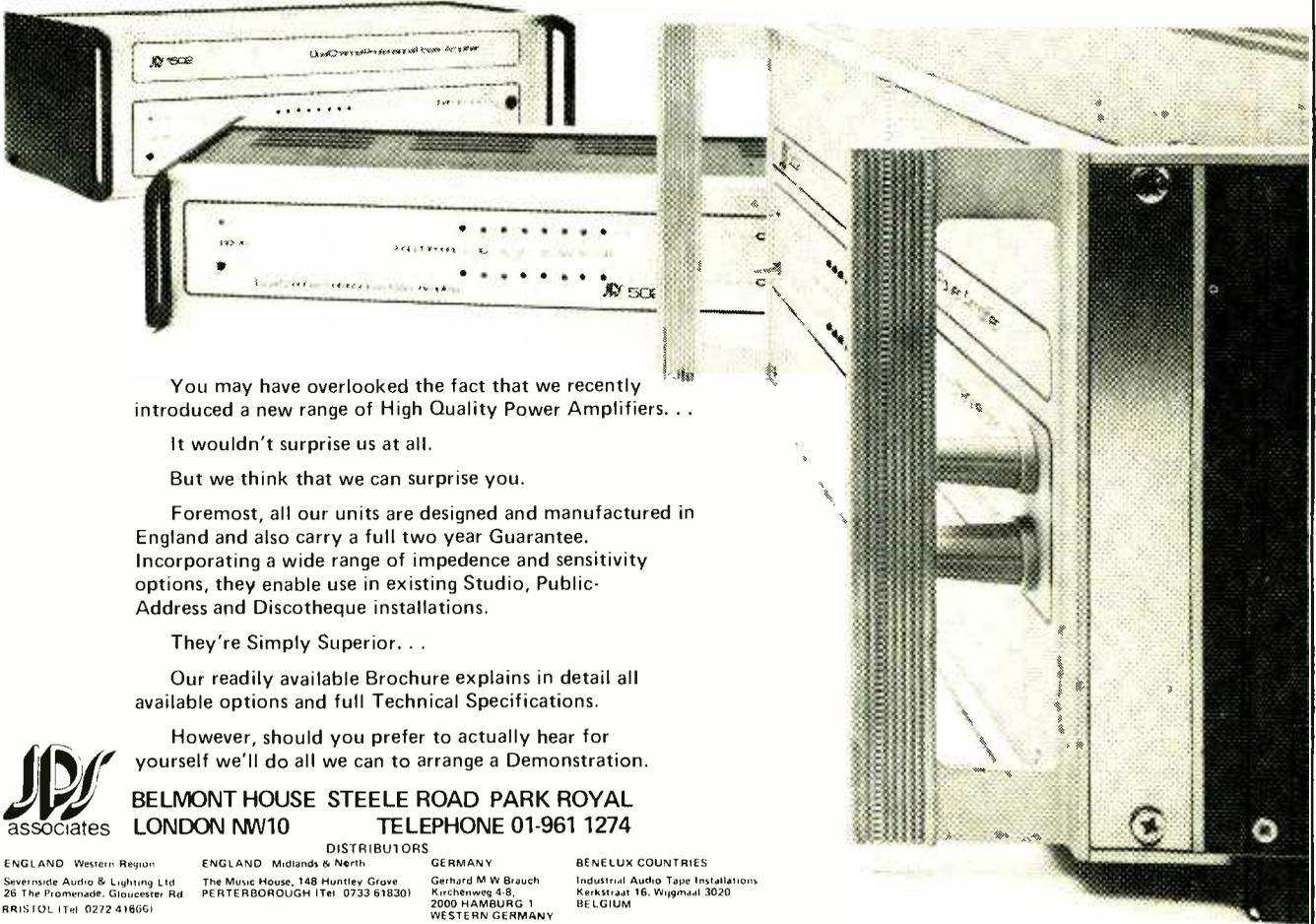
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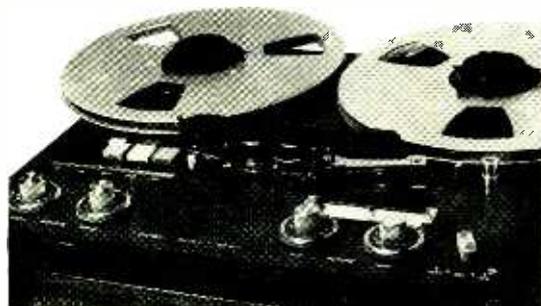
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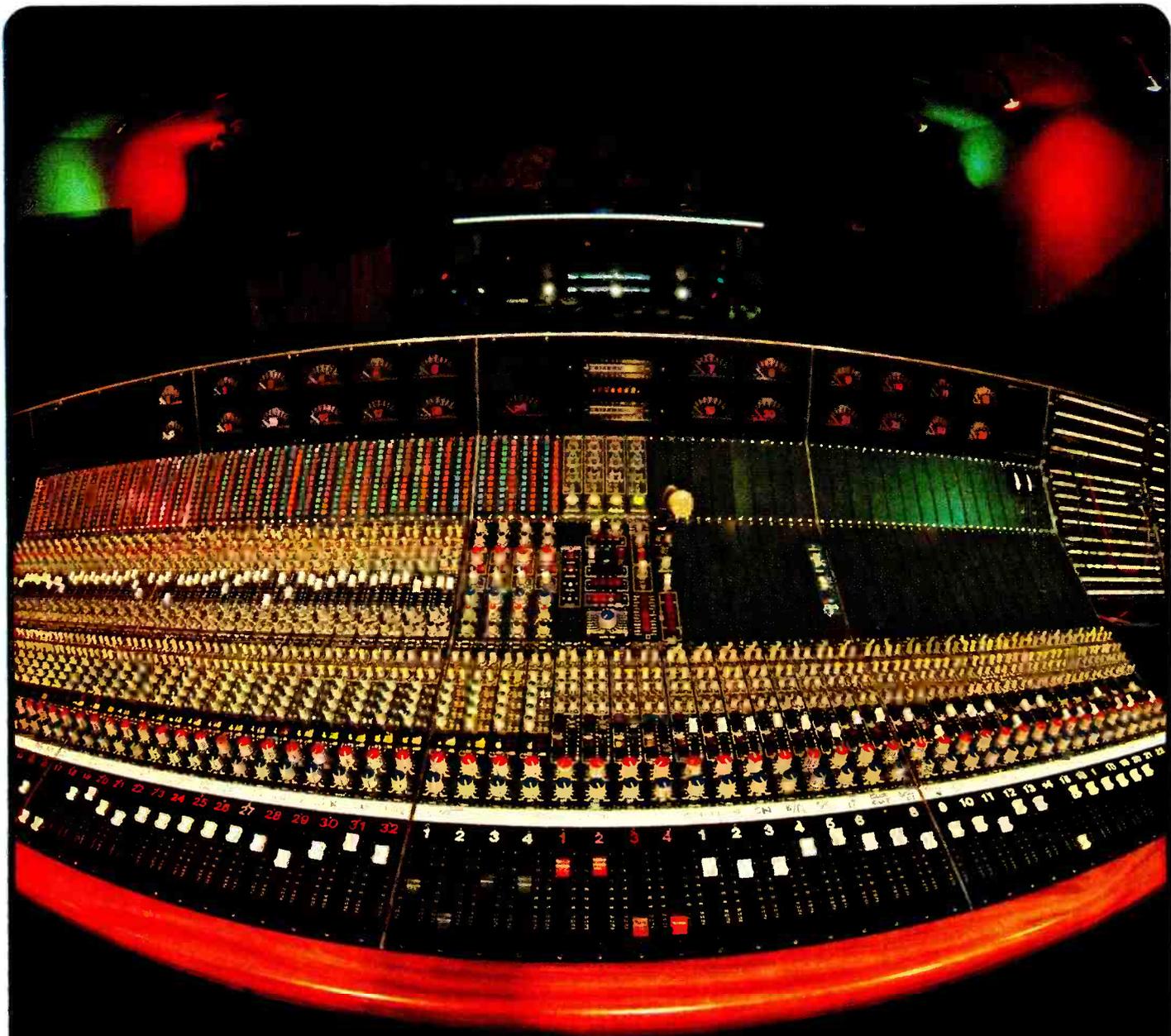
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