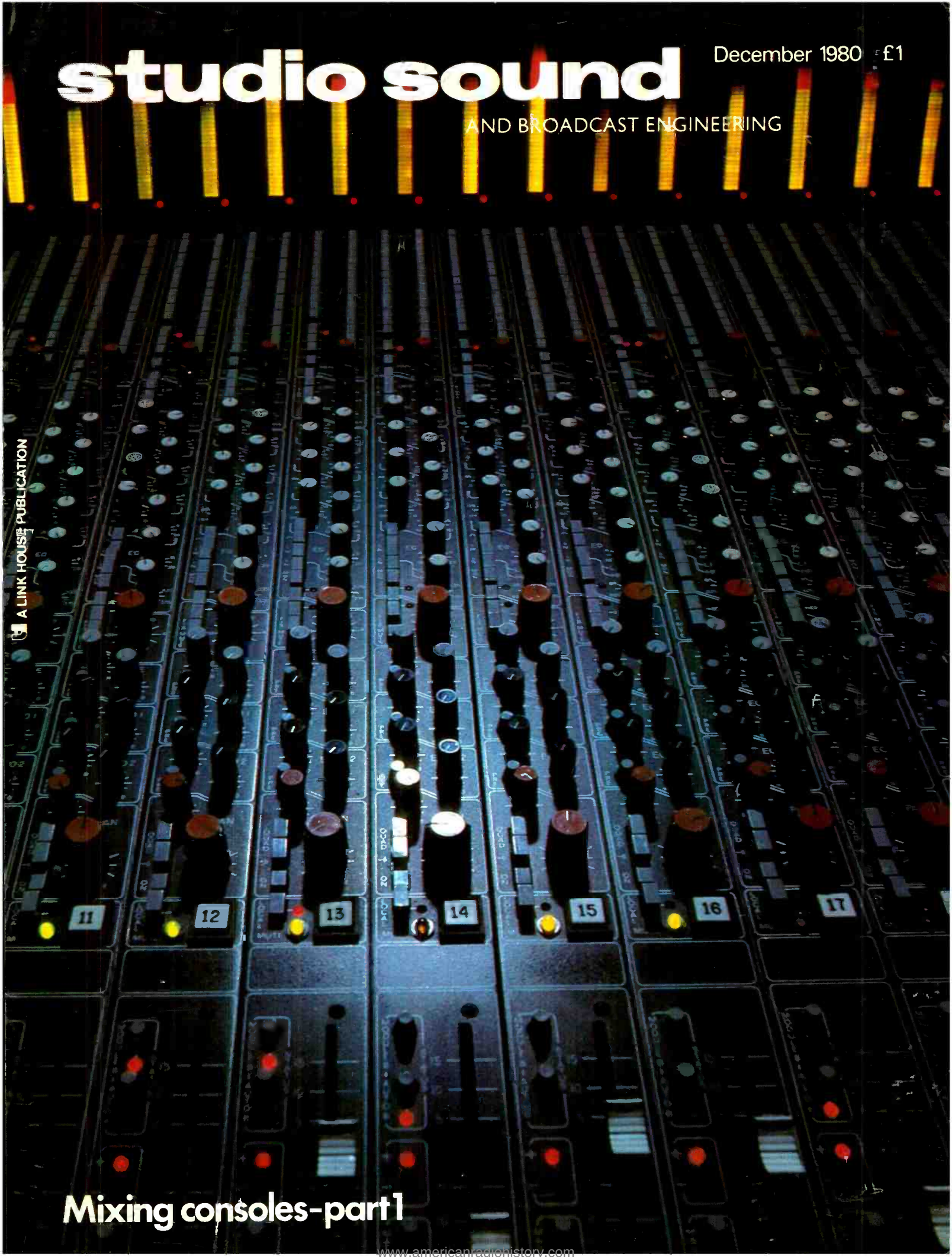
# studio sound

AND BROADCAST ENGINEERING

December 1980 £1

A LINK HOUSE PUBLICATION




## Mixing consoles-part 1

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# studio sound
## AND BROADCAST ENGINEERING



### Is audio lagging behind?

The recent IBC'80 Conference in Brighton was a most interesting — and in some ways, disturbing — experience. While at least 90% of the exhibition and the papers were concerned with TV, it was very interesting for me, as an audio engineer, to see how modern technology is being applied in the video field . . . and this was what disturbed me. Being acquainted with normal razor-blade-style tape editing of audio material, I was interested to play with Sony's new Digital Audio Editing system — it took me all of two minutes to use successfully.

On another stand I encountered a person in front of a video editing system, using exactly the same terminology and with the same ease of use, and I began to wonder why we weren't seeing nearly as much audio technology utilising such modern microprocessor systems as have been available in the video field for some years. We are definitely way behind.

Of course, I am well aware of the fact that video and audio signals are very different things to deal with, but I can still see the videodisc producer of a couple of years hence (before digital audio has really come into its own) moving from the video post-production room — where there's somebody sitting in front of a colour-coded typewriter keyboard coupled to a computer and display screen, whizzing half a dozen video machines back and forth on command from a pre-programmed list, with the box doing all the chores, leaving the editor to be creative — to the next room, wondering why sound mixers like us are still slaving away in front of 12ft of console with forty or more identical channels which differ only in the signals passing through them, pushing faders up and down and running from one end of the desk to the other to adjust channel 38, aided only by a fader-memory system and an *Intelocator,* and wondering why we still freak out at the merest hint of an alphanumeric keyboard within 15ft of the console! All this gala technology is being used by the video guys, and not by us. Why?

Well, one reason, of course, is that there isn't the feedback that there should be between manufacturers and users. If a desk manufacturer is thoughtful and asks his potential clients "What would you like the desk to do . . .", he is likely to get a row of blank expressions. Many of us simply don't know the possibilities. It is no surprise, therefore, that some manufacturers go away and design beautiful desks and computer systems that perform amazing electronic athletics, but leave us taking longer to do the session than before (luckily, there are exceptions to this!).

What I'm saying, then, is that it would be nice if manufacturers knew more of what engineers *needed* as well as wanted (and all may well be possible), and it would also be good if engineers knew the possibilities in case someone was to ask. This is where we as a magazine can help. What do you — engineers — *want* from automation and control? And what can you — manufacturers — offer? Write to us and let's get a dialogue going. We want to do a special issue on new audio technology next year, and this will all come in useful.

Of course, there are technical problems on the manufacturing end. It would be nice, and no doubt practical, to produce a device that takes a digital control word in one hole, and uses it to turn the audio passing through the device up and down, *for the price of a simple pot* (or not too much more). Using VLSI techniques, it could surely be done. But the R&D for this cheap little device would probably come in at the $2 million mark! It *isn't* practical — just yet. New developments in this kind of technology are still dependent on the 'Industry of Death' — armaments — and unless *they* can find a use for a 'digipot' without glitches, or the hi-fi market perhaps can, we'll have to wait, or find another way. Perhaps it's like space research — to do anything really effective, international co-operation must go beyond standards (not that there *are* any for digital audio, for example, despite valiant AES and APRS efforts), and reach for international systems, where many companies can spread the R&D out to reach a common solution.

**Richard Elen**

**Cover of Harrison 32 at The Workhouse, London by Adrian Mott**

**ISSN 0144-5944**
**DECEMBER 1980 VOLUME 22 NUMBER 12**

# Affordable Technology

## SYNCON series A

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*Series A has been designed to give maximum flexibility within a standard frame format. Sophisticated PCB design has virtually eliminated hardwiring making Series A an incredibly reliable and serviceable console; an important factor for studios without resident electronic 'Whiz Kids'. Add to this full parametric Eq and a superb status routing and grouping system, which enables 28 tracks or effects to be mixed through 14 stereo subgroups. The result is one of the most flexible and cost effective consoles to have ever been produced.*

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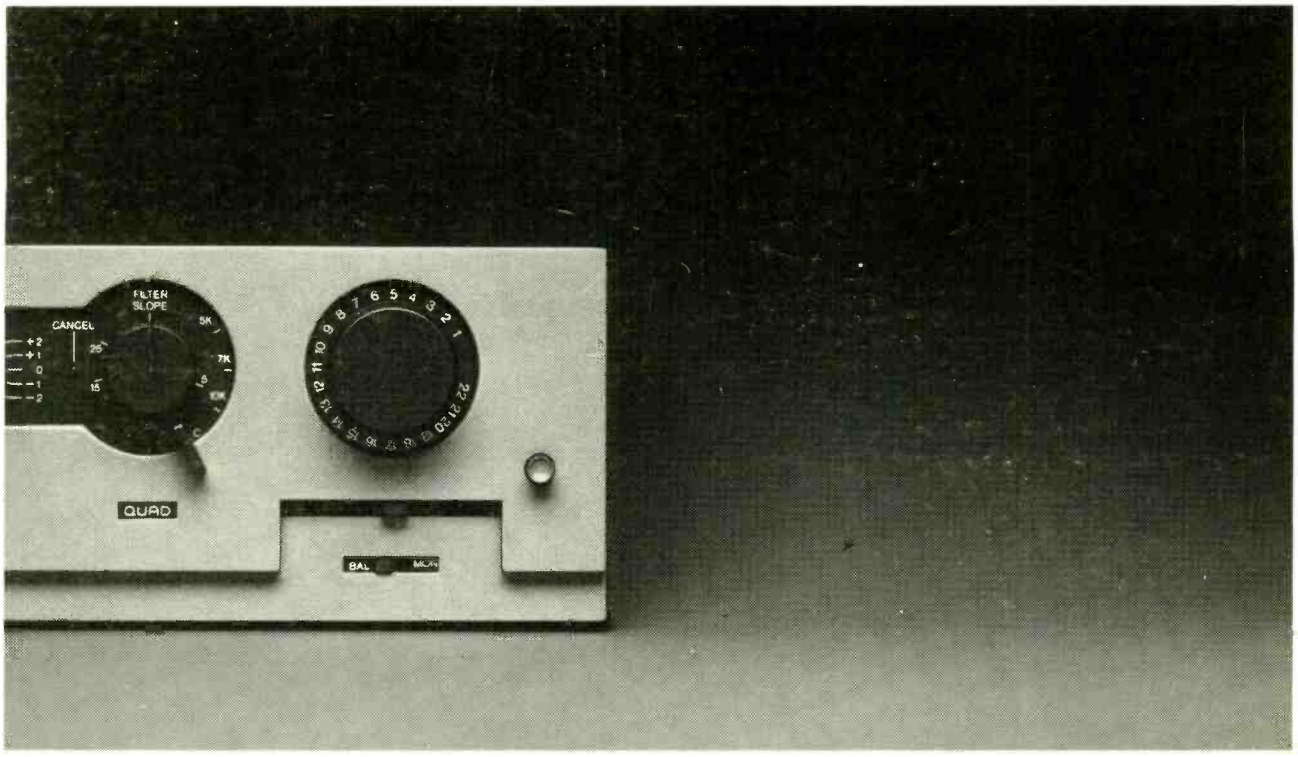


# If everything were perfect...

...a control unit would consist of an on/off switch, a volume control and a programme selector switch.

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- **Broadcasting**
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- **Disco**
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**The Professional Challenge:** Undistorted playback, even of the toughest-to-track, "hottest" recordings.

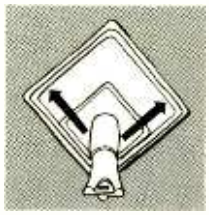
**The SC39 Solution:** The Shure-designed shank structure and bearing assembly gives trackability up to and beyond the theoretical cutting velocities of today's recordings. Frequency response is essentially flat across the audio spectrum, optimized for professional applications.

**The Professional Challenge:** Day-in, day-out rigours of slip-cuing, backcuing, and the inevitable stylus abuse that comes with the job.

**The SC39 Solution:** The internal support wire and special elastomer bearing ensure stable and accurate backcuing without groove jumping. This, plus the following exclusive features, protect the SC39 from accidental stylus damage.

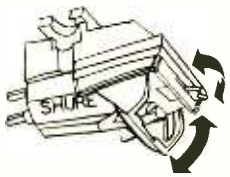
## SIDE-GUARD Stylus Deflector

A unique lateral deflection assembly prevents the most common stylus damage by withdrawing the entire stylus shank and tip safely into the stylus housing before it can be bent.



## FLIP-DOWN Locking Stylus Guard

The exclusive lever-operated, locking stylus guard gives the stylus tip positive protection when not in use. With the flip of a lever, it snaps out of the way and positions a highly visible cuing aid




**The Professional Challenge:** Prolonged record (and lacquer master) playability without objectionable noise buildup.

**The SC39 Solution:** A unique Shure MASAR™ stylus tip is designed to minimize noise and cue-burn on records. Tests on lacquer masters show that the noise level on a record played repeatedly with an unworn Shure MASAR tip is significantly below that of a similar disc played with an unworn conventional stylus. The SC39 also reduces noise buildup on 45 rpm records made from reprocessed or substandard vinyl.


**The Professional Challenge:** A multiplicity of different applications, which no one cartridge can satisfy.

**The SC39 Solution:** The SC39 Series consists of the following three cartridges, for every professional and high fidelity application:

| Cartridge | Stylus tip | Tracking force | Applications |
|---|---|---|---|
| **SC39ED** | Biradial (Elliptical) | 3/4—1-1/2 grams | High fidelity, or where light tracking forces are a consideration. Transcription, recording lab, playback of lacquer masters, high quality broadcast. |
| **SC39EJ** | Biradial (Elliptical) | 1-1/2—3 grams | Where heavier tracking forces are required. AM broadcast, disco. |
| **SC39B** | Spherical | | |

## The SC39 Series Professional Pickup Cartridges

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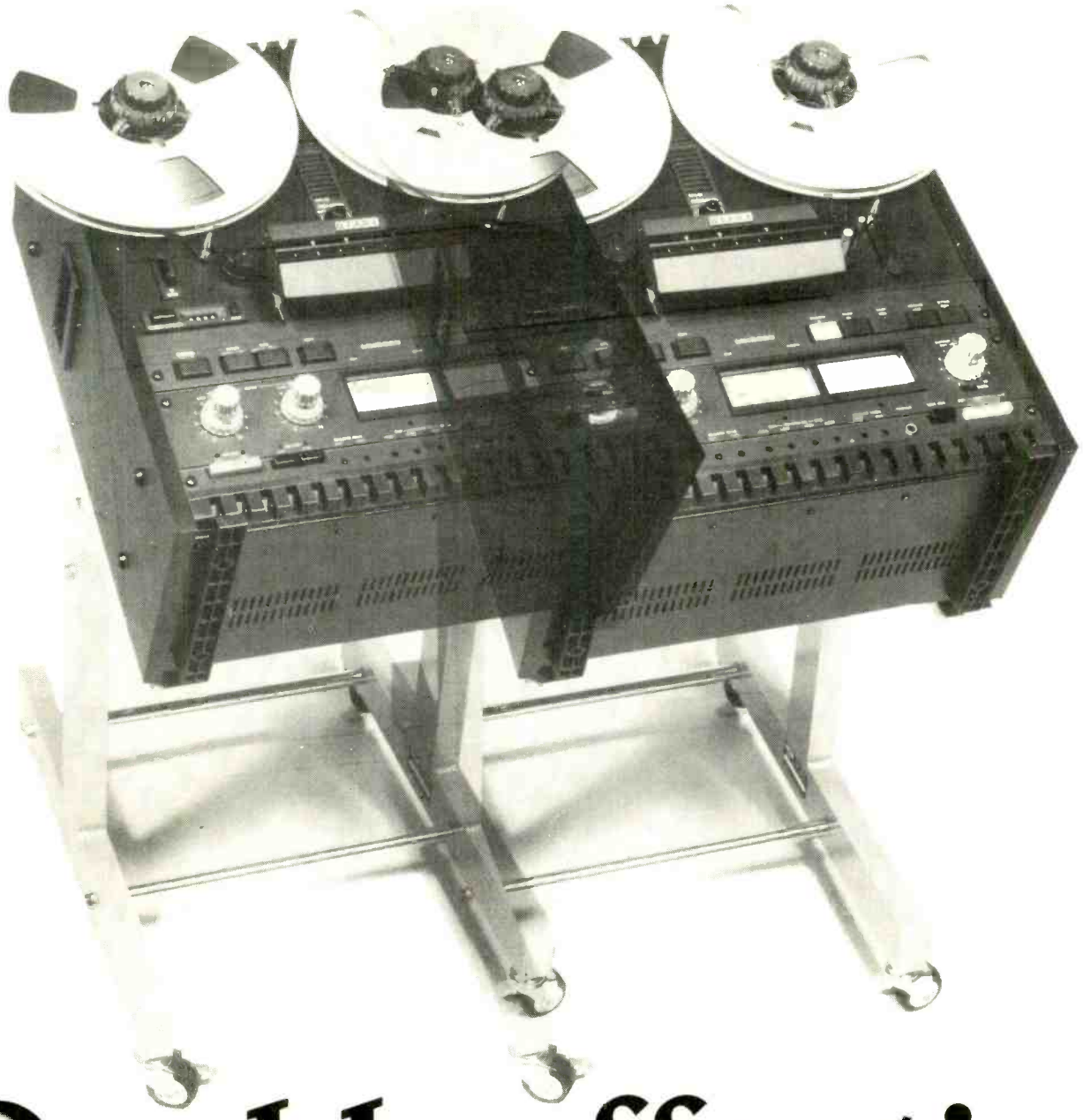
**OTARI MX5050B — the stereo recorder for the eighties.**



# Doubly effective

Embodying the facilities and ruggedness of tape machines costing double, or more, the new OTARI MX5050B is the recorder to meet the challenge of this decade, when economic restraints plus performance requirements will place greater demands on manufacturers than ever before. The MX5050B is the answer.

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OTARI

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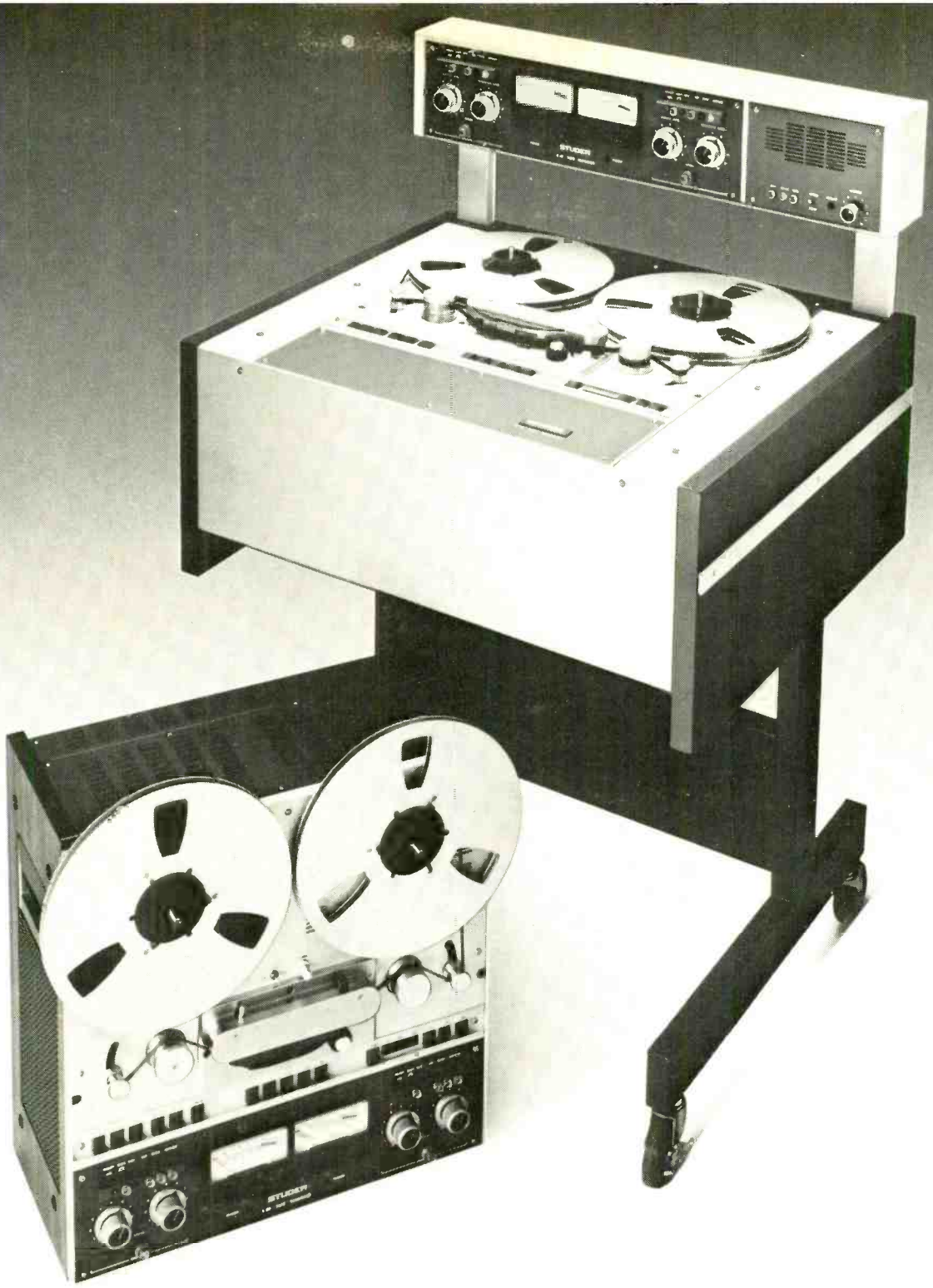

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When a Studer machine is needed as a rugged, reliable work-horse in the studio or mobile unit, the B67 is the natural choice.

The value-for-money B67 offers proven reliability and performance to justify its acceptance as the direct replacement to the renowned B62.

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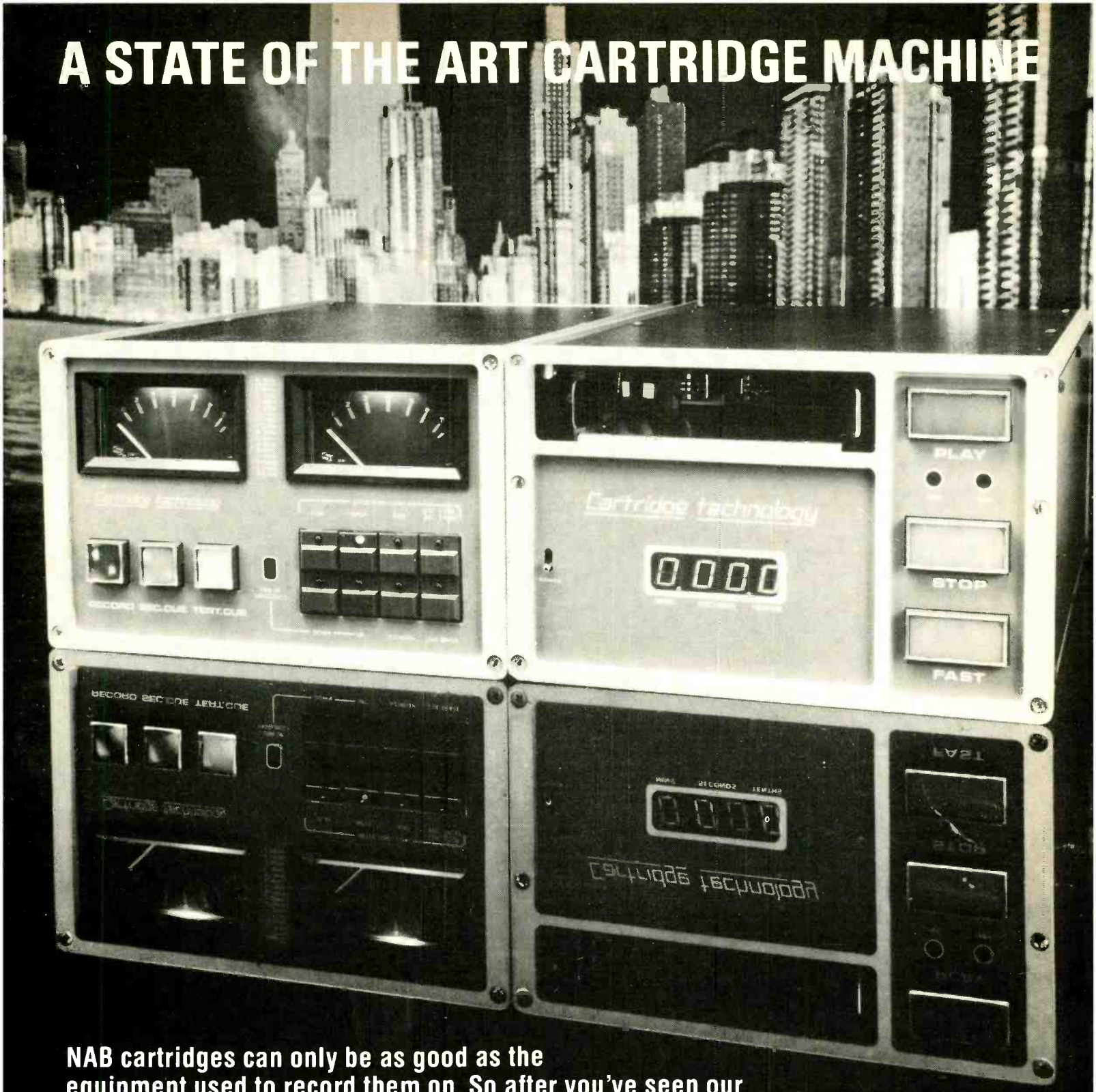
# A STATE OF THE ART CARTRIDGE MACHINE




**NAB cartridges can only be as good as the equipment used to record them on. So after you've seen our beautifully flat frequency response (between 250Hz and 10kHz we keep it within ·25dB) and superb distortion figures (less than 1·5% at 405nWb/m I.B.A. peak level).**

**The next thing is to listen as recordings sound cleaner too, probably because of the Phase Linear record electronics, and the sort of headroom you'd be impressed with on a 24tK recorder.**

**In fact Cartridge Technology is the closest you can get to reel to reel performance.**

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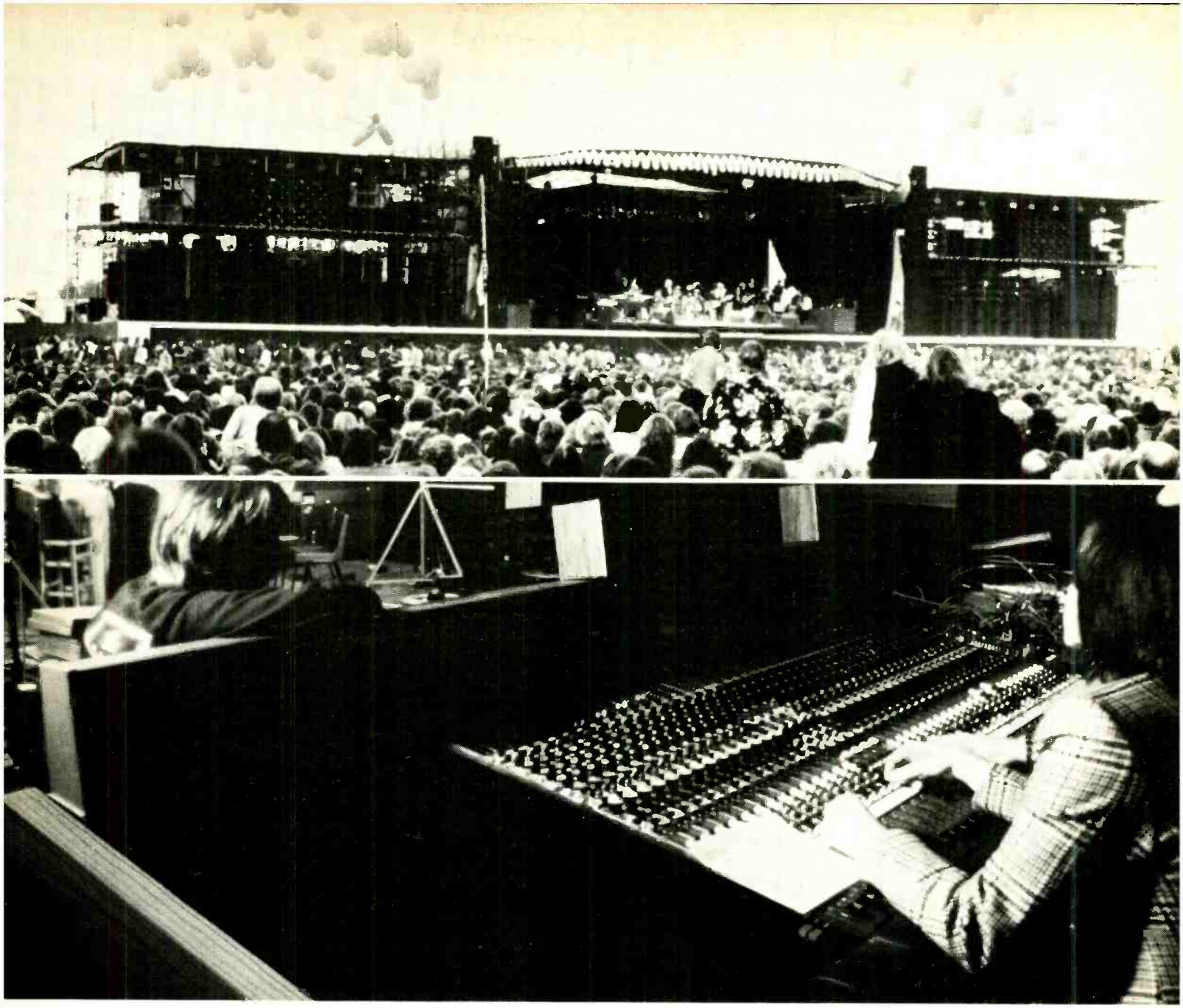

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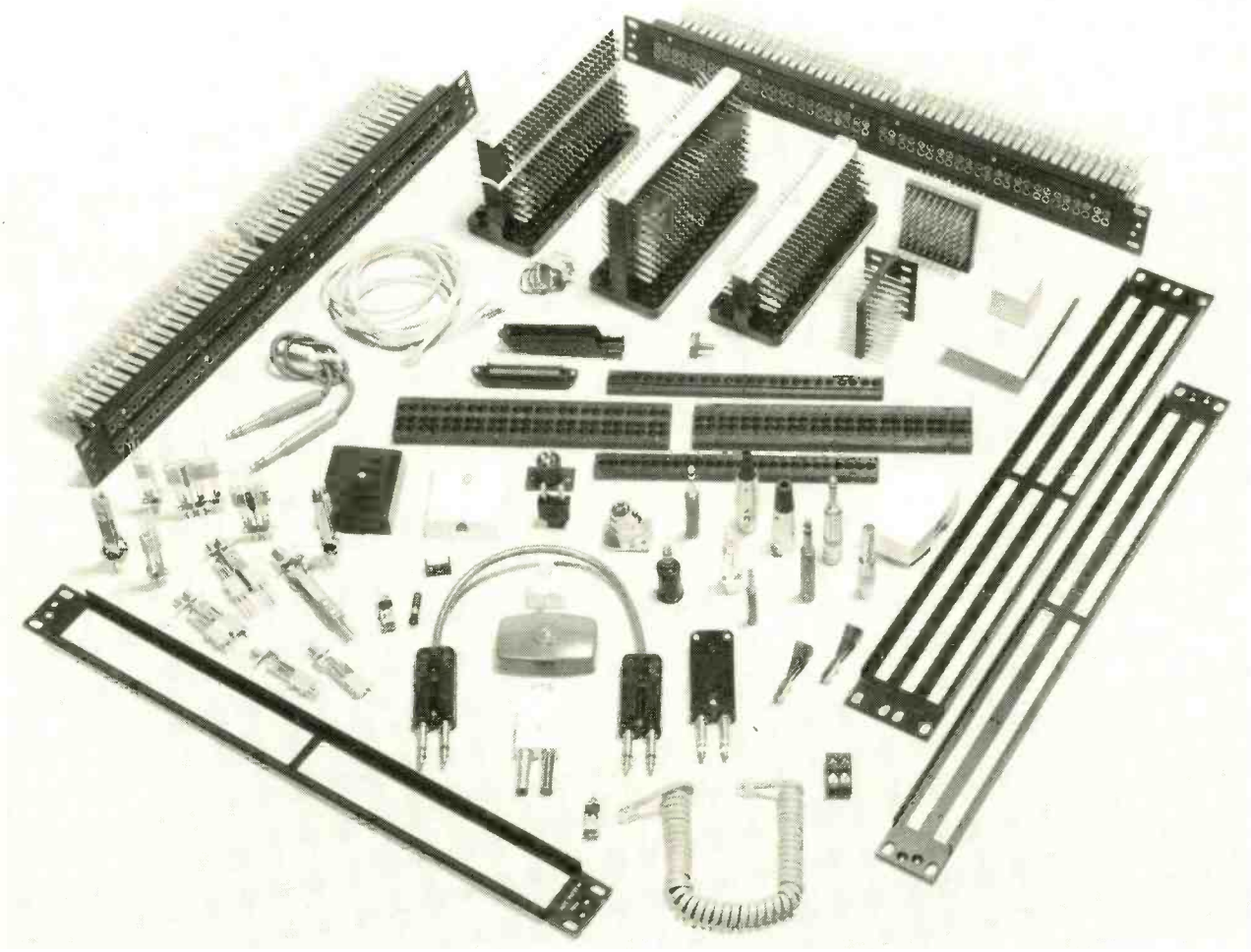

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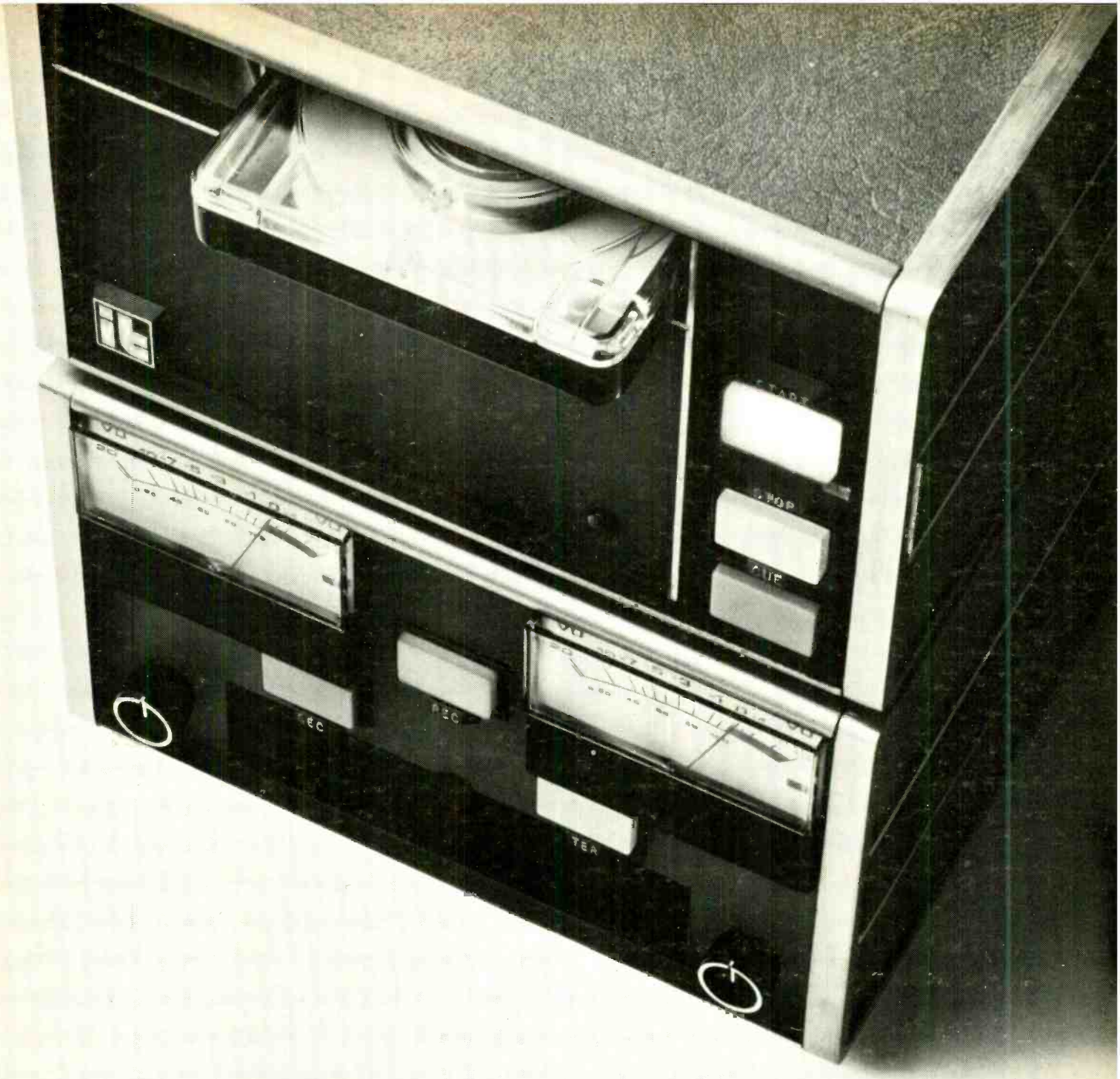

# THIS NEW GENERATION CARTRIDGE MACHINE FROM ITC ALMOST SPEAKS FOR ITSELF.

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With 19 patents pending for both electronic and mechanical innovations, it's no wonder that ITC's Series 99 sets new standards.

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"The original A77 had set a standard by which I have judged other domestic and semi-professional recorders for many years. It is now clear that the new B77 sets a new standard not easily surpassed at its price"

Angus McKenzie (March 1978)

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## Produced by: Alan Tarney
## Microphones by: Beyer Dynamic


When you're working with Beyer Dynamic microphones you're working with professionals. Specialist instruments backed by over fifty years of pioneering research and production experience to bring out the best in your performance. Microphones that are extremely well represented among bands and in recording studios right across the world, because we've been able to perfect them for all kinds of conditions and for every kind of job.

A recording engineer, a roadie, or a performer chooses Beyer Dynamic because he knows he can take two things for granted. First, it will give optimum performance for a given application. If the quality of sound you require can be attained by a microphone at all, then it can be attained by a Beyer Dynamic microphone. Second, it will be utterly dependable. Even studio microphones are not treated as carefully as they might be and on the road anything goes! Beyer Dynamic will stand up to the knocks and bumps of gigging like the professionals they are. That's why they're seen in the company of musicians of the calibre of Leo Sayer.

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Beyer Dynamic (GB) Ltd., 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Tel: (0444) 51003.

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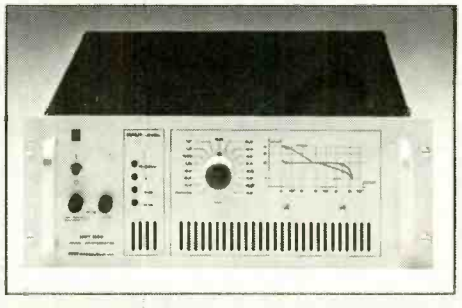
The EMT 250 offers numerous facilities, including the first reflection delay selectable decay characteristics.

The EMT 244 is a compact microprocessor reverb-only system.



They can even be made to sound like a plate!

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# news

## Ambisonic Decoder

A new unit from IMF Electronics brings the days of universal acceptance of the UHJ Ambisonic system even closer. Previously, the only decoder available has been one from Integrex, which has been around for a few years. Whilst this was designed primarily for the domestic market, the new IMF *D20B* decoder will equally be at home in the Ambisonic studios of the future.

Controls on the unit include master volume, layout (for setting up the system for your particular speaker positions), a UHJ button for Ambisonic decode, a 'test' position, a B-Format switch for replay of non-matrixed UHJ material (eg master tapes), forward preference and distance compensation switches (to bias the decoder towards the front of the Ambisonic soundfield, and to compensate for closeness to the speakers respectively), and a 'super-stereo' switch with associated 'width' control, to enable normal stereo material to be played back in 'simulated surround-sound'. This latter feature gives added image stability to normal stereo signals and enables the user to determine the desired width of the sound-stage.

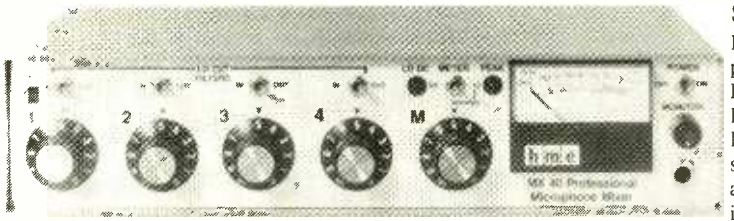
Initially, decoders are being made available on a limited basis, allowing audiophiles and professional users to experience the system. During initial setting up, the unit requires a fairly complex lining-up procedure, but when the basic parameters (like speaker layout) have been determined, the unit is very simple to operate. For those who have experienced Ambisonics, stereo will no longer be sufficient: this decoder makes professional and domestic surround-sound use easily practicable and is sure to have an impact on the development of future sound recording and reproduction techniques.

## Hire service

Mobitrack Sound Processes, which was formed three years ago to hire and service professional sound equipment for the film and TV industry, has now entered the recording industry market.

Current services offered by Mobitrack include sound film transfer to and from ¼in and SN Nagra tapes, 35mm and 16mm magnetic film; master duplicating on tape or cassette; hire of tape recorders, mixers, mics and cables, and video equipment; and servicing and parts supply for a variety of products

Mobitrack Sound Processes Ltd, 4 Latham Road, Twickenham TW1 1BN, Middlesex. Phone: 01-891 2815.



## UHF wireless mics

Four new UHF studio quality wireless microphone systems are now available from HM Electronics Inc.

Operating on 400-470MHz they offer more additional open channels than are available in VHF radio bands alone particularly in multiple systems.

Both the *System 24E Body Pac* and the *System 27E Handheld* UHF systems are available with standard and portable receivers and all are based on HME's existing dynamic expansion design which reproduces the input signal linearly to over 100dB.

HM Electronics, Inc, 6151 Fairmount Ave, San Diego, Cal 92120, USA. Phone: (714) 280-6050.

## Valley People Gain Brain II

Valley People, formed from the recently merged Allison Research and Valley Audio, has introduced its first new product the *Gain Brain II* limiter/compressor/Ducker. Based on psycho-acoustic research into the relationship between waveforms and perceived loudness, the device features waveform recognition circuitry which it is claimed gives significant improvement in dynamic integrity during limiting, and less pumping etc. than conventional peak or rms responsive devices. The unit offers the usual comp/limiter functions plus other facilities, such as an interactive gain control device (ducker) and controlled impact accentuation giving the effect of expansion even though the device is actually limiting. The device has provision for stereo intercoupling, side chain operation for frequency dependent gain control, and for remote VCA and/or remote GR metering. *Gain Brain II* costs $380, is designed to mount in the *TR 804* processing package, and can be used with the Valley People *EGC 101* VCA which is utilised as the unit's feed forward gain control element.

Valley People Inc, PO Box 40306, 2820 Erica Place, Nashville, Tenn 37204, USA. Phone: (615) 383-4737.


## Calrec automation system

A new automation system from Calrec Audio, is designed around its recently developed digitally controlled attenuator (DCA). This offers great noise and expense advantages over the VCAs currently used by most systems. The associated microprocessor based automation has dedicated key and ASCII input, floppy disk store and VDU output, with optional hard copy printer. The sytem will operate with SMPTE, Maglink or EBU timecode.

Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorks HX7 7DD. Phone: 0422 84 2159.

## Stolen equipment . . . 1

During the evening of September 29, prior to the 5th Sound Broadcast Equipment Show held at the Albany Hotel, Birmingham, several items of NEAL-Ferrograph equipment were stolen from the NCP car park adjacent to the hotel. Anyone with information on the items listed below are requested to contact NEAL-Ferrograph or the *Studio Sound* editorial office:

NEAL *302* Cassette recorders (black with teak end cheeks), serial nos. 31275 and 31464;

Ferrograph *SP7* type A2 stereo (balanced) recorder, serial no. 107471;

Ferrograph *SP74* 4-channel logging recorder, rack mount version, serial no. 108254;

Ferrograph *RTS2* audio test unit with tape and leads, in black leather carrying case, serial no. 4853; and

Ferrograph *ATU1* auxiliary test unit with test leads, in black leather carrying case, serial no. 1842.

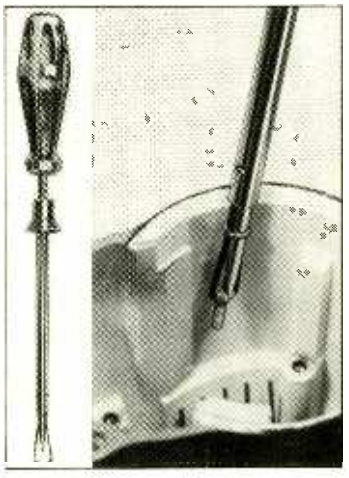
NEAL-Ferrograph, Simonside Works, South Shields, Tyne & Wear NE34 9NX, UK. Phone: 0632 566321.

## Stolen equipment . . . 2

We have also been notified that a Brenell *Mini 8* has been stolen, serial no. 000382/L8. If you are offered this machine, please contact either the police or Mr G Lawson at Listenfine Ltd, 22 Gibson Square, London N1 0PD. Phone: 01-359 0411 or 01-840 3444.

## Stolen equipment . . . 3

Recently stolen in London was one of the first Klark-Teknik *DN60* ⅓-octave realtime spectrum analysers, serial no. A004. Anyone with information on this analyser is asked to contact David Leake, sales/marketing manager, Klark-Teknik Research Ltd, Walter Nash Road West, Kidderminster, Worcs, UK. Phone: 0562 741515.



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A new range of screw-holding screwdrivers has been introduced by Drapers. Ideal for inserting and starting screws in narrow spaces or where a spare hand is needed to hold a torch, the screws can be held and released with a one-handed action.

Standard blades are available in 4, 5 and 6mm widths and for cross-head screws blades can be obtained for Nos 1 and 2 size screws.

Available from tool and hardware stores, the screwdrivers cost under £3. Further details on these and other hand tools from B Draper & Son Ltd, Hursley Road, Chandlers Ford, Hants.

24 ▶

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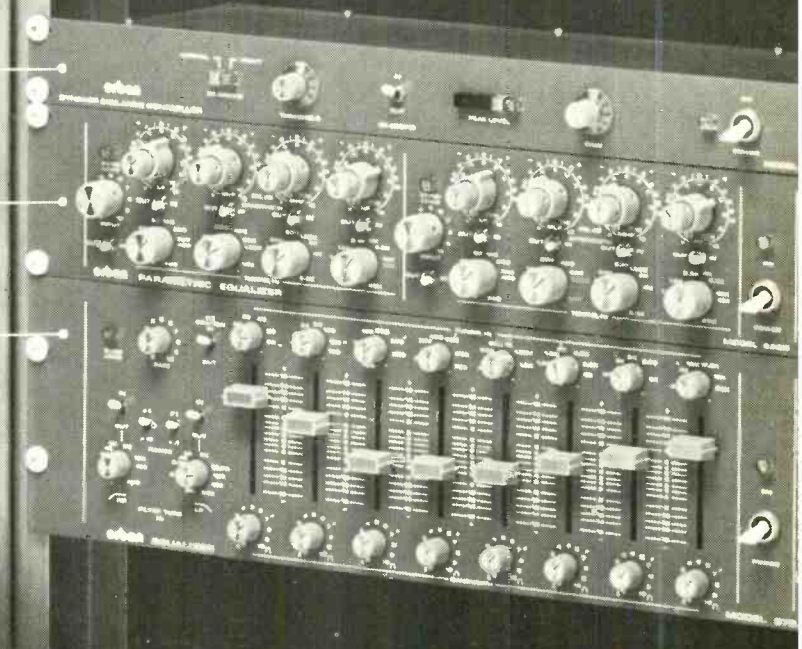

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## Training

● The dates for the sound system engineering seminars to be run by Synergetic Audio Concepts during 1980/81 have been announced:
December 9-11 (1980), January 27-29, February 17-19, March 17-19, April 7-9, May 7-9. May 19-21, June 23-25.

Courses are held at the Dana Point Marina Inn, California and further information can be obtained from Don Davis, Synergetic Audio Concepts, PO Box 115, San Juan Capistrano, Cal 92693, USA. Phone: (714) 496-9599.

● The Institute of Audio/Video Engineering are holding courses on studio maintenance, sound reinforcement, recording engineering, etc. Arranged in four 8-week sessions which consist of lectures and workshop periods, the courses take eight months to complete.
Institute of Audio/Video Engineering, 1831 Hyperion Avenue, Hollywood, Cal 90027, USA. Phone: (213) 666-3003.

## Agents

● Lockwood has appointed an agent for its studio monitors in the USA: Randell Kling, Randy's Roost, RCA Buildings, 30 Music Square West, Nashville, Tenn 37202, USA. Phone: (615) 254-8825.

## Contracts

● Neve is to supply Granada TV with four consoles worth nearly £200,000, one for OB use and three for studio re-equipment.

Latest orders from the BBC include a 50 input desk for the London TV Centre, two 20 channel desks for the London presentation studio and Bristol Studio B and a 40-channel mono TV console for the London TC-2 studio.

Three suitcase mixers have been ordered by RTE in Dublin bringing the total number of Neve consoles ordered by RTE to over 40.

● Feldon Audio have supplied a Sony *PCM1600* digital recording system to Unicorn Records who will also receive a Sony digital editing system at a later date.

● Sound reinforcement systems have recently been installed by Broadcast Training and Services Ltd at St John's College, Cambridge and Chelmsford Cathedral.

● Calrec Audio have been awarded a contract for a programme sound installation at the BBC studios in Glasgow. This is similar to a recent contract for the BBC television news and regional studio in Manchester. Further orders received by Calrec include: two digitally automated film dubbing consoles for Swedish Television; a 56-channel, 16 DCA group, automation ready broadcast/multitrack console for Tyne Tees TV; and a microprocessor controlled OB switching matrix for Piccadilly Radio.

## Addresses

● Professional Sounds Inc of Virginia, USA, has opened an office in Nashville. Phone: (615) 327-4747.

● ProTech Audio Corporation has moved to Flowerfield Bldg No 1, St James, NY 11780, USA. Phone: (516) 584-5855.

● Canford Audio has opened a new office at 652 Glenbrook Road, Stamford, Connecticut 06906, USA. Phone: (203) 348-4969.

● The International Association of Broadcasting Manufacturers has moved to Triumph House, 1096 Uxbridge Road, Hayes, Middlesex UB4 8QH. Phone: 01-573 8333.

## People

● Raymond Hills, the IBA's assistant director of engineering (operations) has become chairman of the Science, Education and Technology division of the Institute of Electrical Engineers.

● Hayden Laboratories has appointed David Jefferys as sales manager, domestic products responsible for Dual, Sennheiser and Empire products. David joins the company from AKG Acoustics.

● Michael Pappas has become field sales engineer, broadcast/industrial sales specialties, for the Otari Corporation, California, USA.

● Tangent Systems Inc has announced the following appointments: Gary Bailey to general manager; Thomas Scott, sales manager, concentrating on the development of international markets; Michael Schwartz to sales manager for the new Phoenix Group; and Craig Olsen to national sales manager for the Tangent Products Group.

● Denis Comper has joined Richard Swettenham Associates, consultants in audio electronics and acoustics. Denis is also chairman of CA Audio Systems.

## FCC 'Quadraphonic' decisions

The American Federal Communications Commission seems to have come to a decision on the implementation of so-called 'quadraphonic' broadcasting standards. In an amazingly convoluted discussion, it has decided that there will not be a prescribed encoding-system for FM 2-channel surround-sound broadcasting in the USA, and as a result, broadcasters will be free to use any 2-channel surround encoding system they like. This obviously makes good sense, as many radio stations are already transmitting records which have been encoded in a number of different ways, whether they realise it or not. Significantly, the FCC has decided not to adopt the CBS 'SQ' family as a standard, leaving the way open for American broadcasters to utilise modern systems like the British NRDC-backed Ambisonic (UHJ) techniques which have been used successfully by BBC and ILR stations in the UK, and by a number of European broadcasting oganisations, notably Holland's NOS.

Running through the FCC document, one detects a rather disturbing use of old-style 'quadraphonic' terminology—indeed the transcipt of the proceedings is an altogether remarkable document. It appears that at least one participant in the discussions was unaware of the fact that VHF FM was in use in Europe at all! The impression one gets is that while the commissioners were obviously well-intentioned, they were severely hampered by misinformation or a simple lack of information altogether. The documents certainly leave one with the impression that the FCC decisions will not mean much to other countries in technical terms, and that there will be little likelihood of international broadcasting standards being based on such ill-informed deliberations. The documents, laden with outdated terminology and jargon, and showing no signs that the fundamental psychoacoustic phenomena upon which true surround-sound is based have even been *heard* of by the commissioners, would be almost humourous if they did not represent top-level national decisions on techniques that will fundamentally affect the future of broadcasting.

It is stated in the documents that 'quadraphonic' technology has remained basically unaltered since 1971, for example; in some ways this is true, but what has really happened is that over the last ten years international research has left the misapprehensions and mistakes of 'quadraphony' behind, and has moved on to the more effective 'kernel encoding' systems based on correct mathematical, physical and psychoacoustic principles. These have apparently gone unnoticed by the FCC, and we are instead presented with a rather antiquated discussion of '4-4-4' versus '4-2-4' and so on, never a mention being made of the fact that the basic idea that surround-sound can be generated by taking four independent feeds to four loudspeakers is, quite simply, wrong, and that it matters not whether these four channels can be 'matrixed' successfully into two and back again (they can't) or not—the results will *still* be wrong. Anyone who has heard the superb Ambisonic demonstrations at recent exhibitions—notably the 'full-surround' Periphonic demo at the London AES Convention—will by now be quite convinced that *three* basic signals (which can be encoded quite respectably into two transmission channels if needed, and recovered successfully) will admirably reproduce a better horizontal-surround effect than the best 'discreet quadraphonic' system, and that *four* channels will give you excellent surround-sound with height.

Thus the FCC document is still concerned with the old arguments—invalidated by modern psychoacoustics—that 'separation' is the ultimate goal, rather than the modern view that the speakers should radiate sounds which relate to each other in a tightly-specified way, certainly not independent sounds.

The greatest area of confusion among the FCC Commissioners, however, seems to be their thinking in terms of 'systems' which are primarily the developments of specific manufacturers, rather than separating the basic arguments: a distinction *must* be made between the ways in which extra *transmission* channels may be made available by multiplexing (for 2½-, 3- or 4-channel surround broadcasting), and the way in which the surround information is *encoded on to the available channels*. Unless this distinction is made, we will simply be on the end of a competition between manufacturers, and the decisions on truly workable *system* specifications in the two areas will never be made. In addition, the FCC's area of interest should be primarily that of channel-multiplexing methods, where the results will directly affect bandwidths and band-planning, compatability and the like. Almost by default, it would seem, the FCC have in fact managed to make the distinction in their 2-channel specification, recognising that the prime fact is that only the multiplexing method need be FCC-determined. One hopes that a similar course will be taken on larger numbers of channels.

If the FCC takes the bull by the horns and decides only to determine multiplexing methods, this will have the added advantage that it will all come down to a purely technical discussion on multiplexing techniques and their properties—and here, recent BBC research may be very useful, confirming as it does the theoretical work of Halliday and Gerzon, that the reduction in service area as a result of multiplexing can be very small.

One cannot help but wonder what the final outcome of all these factors will be. It is interesting to note however, in the *Notice of Proposed Rule Making* released August 14, 1980 (FCC 80-434), that 'Broadcasters were . . . split in their preference for 4-2-4 and 4-4-4 systems.' The adoption of a hierarchical system such as UHJ would remove the need to resolve such a split in broadcasters' preferences for different numbers of transmission channels. It would also have the distinct advantage that the system works . . .

■

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# studio diary

## Trafalgar Recording Studios, Rome

To miss out on a studio called Trafalgar with the name I have, would just be ridiculous so upon my arrival in Rome they were naturally the first studio that I called upon!

Situated in a fairly residential part of Rome and near some parkland (just under the observatory, for the astronomically minded), the studios are just out of the way enough to make access easy and life not too hectic while at the same time being a tram or taxi ride away from the city centre.

In common with a lot of Italian studios, Trafalgar are owned by a music production and publishing company and are the brainchild of composer/owner/manager Franco Bixio. However, this does not mean that the studio specialises in its own productions and in fact a large percentage of the work is from outside, both from records and film work. Styles of music are varied but tend to be hit parade and pop/rock oriented.

The control room of Studio A is very much in the Eastlake style of things—tree bark, wood panelling, carpet, rear wall bass trapping plus ceiling traps, etc—and has been professionally done. The studio is the principal domain of engineer Gaetano Ria who was there to show me round. The room is fairly small but has a cosy atmosphere and the disposition is such that though two to three people behind the desk is the maximum, there is room for about six sitting in front of the console (which, after all, is where you want them!). Equipment is a Cadac *28/24* console with Lyrec 24-track and Telefunken *M15A* 2-track recorders, including 26 channels of Dolby. Monitoring is the Eastlake *TM7* system with Auratones on the desk. Ancillary units include UREI *1176* and *LA-4* compressors and limiters, ADR *Compex 760-RS* stereo comp/limiter, Orban parametric, Klark Teknik ⅓-octave graphics and Eventide *Harmonizer*. For echo, delay and reverberation effects a comprehensive selection is available which should be enough to satisfy most requirements, viz Ursa Major *Space Station, Master Room* reverb, AKG *BX20,* EMT *Gold Foil* and *440* DDL. Of interest also were the EFT stereo parametric and noise gates. EFT are an Italian firm and these were two of their latest products. The parametric is 4-band with very comprehensive facilities including low-and high pass filters in addition to the four parametric bands, making for complex processing. The noise gates—of which there are eight channels—are of the plug-in module variety (two rack unit case with power supply) and are easy to use as well as being effective, Gaetano telling me that they have had no hunting problems at all with them. There is also the usual collection of Revoxs and cassette recorders for the workhorse duties.

*Gaetano Ria at the Cadac console in Studio A*

Access to the studio is by a door at the right of the control room desk or from the hall at the main entrance. Studio A is mainly used for small group recording of 10 musicians with comfort. Recent improvements have been an Eastlake type drum cage and isolation booth for vocals, acoustic guitar, etc. There are also a large number of acoustic screens enabling booths to be built at short notice, giving the choice between 'open' studio or isolated conditions. Microphones are a selection of Neumann, Electro-Voice, Schoeps, Shure and AKG. The studio also has a very good selection of resident instruments including Steinway piano, Hammond *B3*/Leslie, Rhodes, vibes and marimbas, spinet, tubular bells and tympani. There is also a hire service on hand where any instrument can be delivered within the hour. Whilst discussing different recording techniques Gaetano emphasised that for him the most important thing was to start with a good sound in the studio before getting anything down on tape. If the sound is mediocre no amount of processing is going to put it right, ie you can't make a silk purse out of a sow's ear! For this reason the building up of rhythm tracks is avoided as much as possible and more time is spent on getting the ensemble sounding right in the studio—even rehearsing the musicians if need be. If the extra time spent results in a good cohesive rhythm sound then it is a good investment.

By this time we had been joined by Giorgio Agazzi, the other half of Trafalgar's recording team, and it was the moment to see Studio B. This is the larger studio and can accommodate 40 to 50 musicians at one sitting without any problems. The bulk of the work done here is film score recording though big band style sessions are not uncommon. The projection facilities are that of a modern cinema with a large screen in the studio. Owing to the disposition of the building, the projection room also looks out onto Studio A and a screen has been installed so that the studios can be used together. The acoustics of Studio B are that of a good small hall and there are quite a few high screens should separation be necessary. A drum cage is also in the process of being built.

The studio may be large but the control room is small. A metre or so below the studio floor level, access from the studio is down some steps and through two sliding glass doors between the monitors. The same Eastlake style of construction as control room A is retained and though space is limited (it was jokingly referred to as the smallest control room in Italy) the atmosphere is by no means claustrophobic. As far as equipment is concerned, Studios A and B are identical with the same model Cadac desk and Lyrec/Telefunken recorders. Outboard gear is duplicated as well though I did notice some UREI *545* parametrics as extras. Monitoring is again Eastlake *TM7s*. The two control rooms are similar enough acoustically to enable a session to be transferred from one room to the other without problems, the duplication of equipment meaning that no real re-adjustment is necessary. The *TM7* monitors use Gauss 12in bass drivers with a Gauss *4000* high frequency unit and have a very tightly defined sound with no 'boom' in the bass or 'tizz' in the trebles. Giorgio played me some selections from Keith Emerson's score for the film *Inferno* that he had recorded and the sound was very impressive indeed. There was also some big band work he had recently done with quite a dynamic range, once again the reproduction was startlingly clear and unmuddied.

As I was getting ready to leave, work was starting in Studio A with a group from Naples who were doing versions of the early Beatles hits with Neapolitan style lyrics while at the same time retaining as far as possible the original phonetic sounds. The song being worked on at the time was *Ticket to Ride* and the resemblance in sound of the vocals and instruments was uncanny. The original was on hand as a point of reference. Whether the completed album will be a success or not is too early to say but I wouldn't mind betting that it will be although even the Romans present couldn't understand the Neapolitan lingo!

In common with most successful studios, Trafalgar are not resting on their laurels and a small demo/budget studio is well under construction on the first floor. The studio will be large enough for the average small group and the little control room will be centering around yet another Lyrec 24-track and Soundcraft *1624* console. An update for Studio A next year is also planned with the existing console to be replaced possibly by a Harrison or Amek, the final decision having yet to be made.

In addition to their recording facilities, Trafalgar also have a large games room and relaxation areas for pauses during overdubs or while you are waiting for the guitarist to get in tune. For visiting groups and artists a residence is available just around the corner in the Studios' own grounds so that if you like having jam sessions at four in the morning you won't have the hotel manager banging on your door. (If you think the term residence too posh will private mansion do you? Either way, it's better than a hotel.)

Giorgio was waiting to take me on to another studio so I took my leave. Once again it had been a very friendly welcome and thanks to all concerned, especially for the splendid lunch! If you want to keel-haul your producer and sink the enemy you can set all sails for Trafalgar.

Trafalgar Recording Studios, Via Romeo Romei, 11, I-00136 Rome, Italy. Phone: (06) 358.1417 or 359.9919.

**Terry Nelson**

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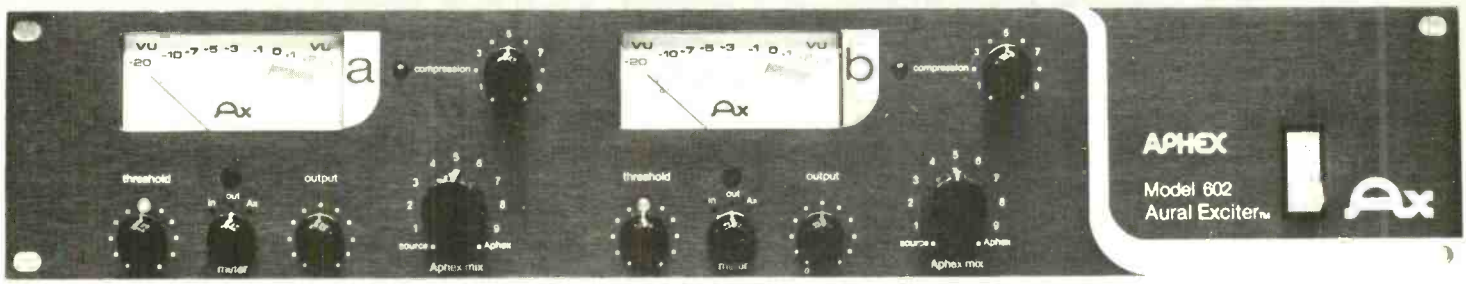


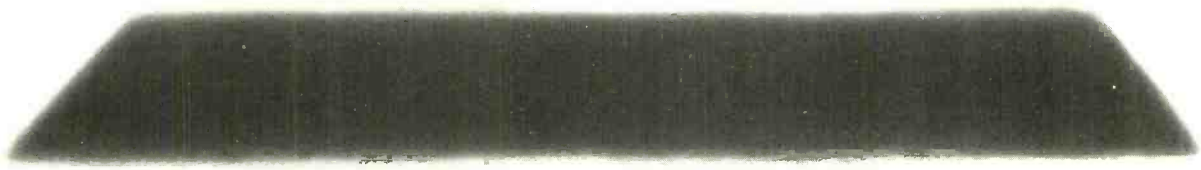

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## Satril Studio, London

What, yet another small 24-track studio, I thought as I travelled up London's Finchley Road to visit Satril Studio, the latest addition to London's seemingly never ending list of 24-track studios. You may forgive me my slighly querulous attitude, but in the present recessionist times it seems odd that hardly a month goes by without a new studio making a brave appearance and opening its doors to an apparently shrinking market. Yet as if to confound any expectations of hard times, these new studios all survive quite adequately although perhaps it is because they utilise less exotic equipment, structure their hire rates in the low to middle bracket, and often actively seek to develop new recorded talent, that these studios find their own niche in the recording industry. However, enough of the general UK recording scene, where does Satril fit into the overall London recording picture?

Part of the Henry Hadaway Organisation, Satril as a name has been known in the music business for over 10 years. Prior to it gracing the studio it was (and still is) one of the UK's smaller record labels. Growing out of MD Henry Hadaway's involvement in music publishing and production, the label has steadily increased in importance, and as the label expanded so did Henry Hadaway's desire to have his own in-house studio. The birth of the Satril Studio accordingly dates back to the early Seventies, when the idea of setting up a small demo studio was born. Although the project has only now come to fruition, and the specification has altered considerably in the meantime, the same basic precepts coloured the size, design and construction of the studio. These were that the studio be housed in the same building as the record company and the rest of the Organisation, that the studio be small and compact, and that it should be equipped to a high standard.

First priority, as always, was finding suitable premises and although in the intervening eight years between the idea and the resulting studio Henry considered constructing a purpose built complex to include offices and a state-of-the-art studio, he eventually decided to convert an existing building in London's Finchley Road. This being out of central London's rat race atmosphere, but still close enough to the West End to be only a 15 minute drive from the hub of the UK music and recording industry. With the multifarious activities of the music publishing, production, and record label parts of the company to be taken into account it wasn't until May of this year that studio construction commenced, by which time the remainder of the Organisation was settled into its new home.

While the Satril Studio is housed in the same building as the rest of the Organisation, and naturally many of its clients will be provided by in-house projects, the studio is a totally separate arm of the company and is open to all-comers. This is highlighted by the fact that on arrival at the studio there are two doors adjacent to each other—one for the studio and one for the offices. Entering that for the studio and you immediately reach a staircase leading down to the basement which is the studio's location. Being situated on a busy London thoroughfare the potential problems of noise isolation not surprisingly spring to mind, but once through the studio door you are struck by the complete de-coupling of traffic and other noise (including a pneumatic drill courtesy of the local council, during my visit). Congratulations must therefore be extended to Henry's father (an architect) and Project 2000, the studio's designers and constructors who have ensured that despite Juggernauts, etc, silence reigns.

Passing through the studio's entrance door you actually enter the studio itself, as the staircase is part of the studio. A somewhat unusual arrangement, but since the stairs and indeed the whole of the studio and control room are fully floating and isolated from each other this appears to cause no problems. This particular design configuration was was surprised to discover that the forced on the studio due to the relative lack of space. However, the studio which is approximately 270 sq ft and can house some 10 to 12 musicians, although compact is also surprisingly spacious. A feature of the room is in fact the careful utilisation of the available space, for example instrument amp traps are set back along one wall, while a drum booth is positioned under the staircase. (Incidentally, these features are all separately floated). For such a small room I was rather intrigued to discover from Chris Lewis of Project 2000 that the end of the studio which includes the control room window has been treated as a live end, while that opposite has been made a dead end. Originally rather sceptical of the value of such treatment in such a compact area I treatment does in fact have a quite noticeable acoustic effect, and in fact the room does benefit as a result. Possible food for thought there!

*Control room with MCI 428B console and Otari MTR-90*

Satril's control room is an almost identically sized room to the studio and again is a very compact room. Centrally placed opposite the window to the studio is an MCI *428B* 28/24 console, which is standard other than the provision of custom light bar VU/PPM meters with switchable hold and the inclusion of two console mounted Roger Mayer noise gates. As one would expect the ubiquitous pair of Auratones are mounted above the meter panel, these being driven by a Quad *303*. The main monitors are a pair of JBL *4333As* which are flush mounted either side of the control room window and angled in toward the console. These are bi-amped driven by BGW *600* and *250* power amps and fed via a Court room equaliser with one of the flattest room eq curves I have seen in a long time. This only going to prove the old adage that if the design and construction are up to scratch you don't have to tinker with the acoustics afterwards! Turning to the tape machines, the multitrack is an Otari *MTR-90* with autolocate and remote, while mastering machines comprise two Otari *5050*s and a Sony *TC766-2*. Incidentally the remotes for the 2-tracks are built into the console for ease of operation. Ancillary equipment which is primarily rack mounted in the rear wall of the control room comprises a wide selection of units including Eventide *Harmonizer*, BEL flanger, Orban *111B* stereo reverb, Klark-Teknik graphic eq, and MXR DDL. Other items include an EMT plate and various active/passive DI boxes from SES and Sescom. Satril are still experimenting with various types of mics but at present are using models from AKG, Neumann and Calrec. Instruments available include a Yamaha *CP80* electric piano, drum kit, and instrument amps as required. While the control room may be on the cramped side I certainly had no complaints about the monitoring. For such a compact room the control room exhibits a firm punchy bass, a very clean mid range, and a clear hf end. Thus, while Satril is a small studio it is clear that nothing has been skimped with regard to the acoustics.

The foregoing description takes in the business end of Satril, however, it is worth noting that above the control room and studio (in the record company offices) ancillary facilities are available. These being a bar and rest area and a maintenance room equipped with Ferrograph test equipment and the usual odds and ends. Similarly, studio manager Paul Hodsman, ex-Pye and the Marquee, is housed on this floor.

Since construction was completed in August Satril has hosted a number of sessions with users to date including Broken Home, Kenny Lynch, Patti Boulaye, Biddu, and the Slits.

Despite its relatively small size, Satril is an excellently designed, constructed, and well equipped studio. As detailed above it has some unusual features, but many of these give it a rather unique quality. As a venue for smaller bands the studio is likely to be highly popular, hence I would anticipate that it should have a very healthy future. **Noel Bell**

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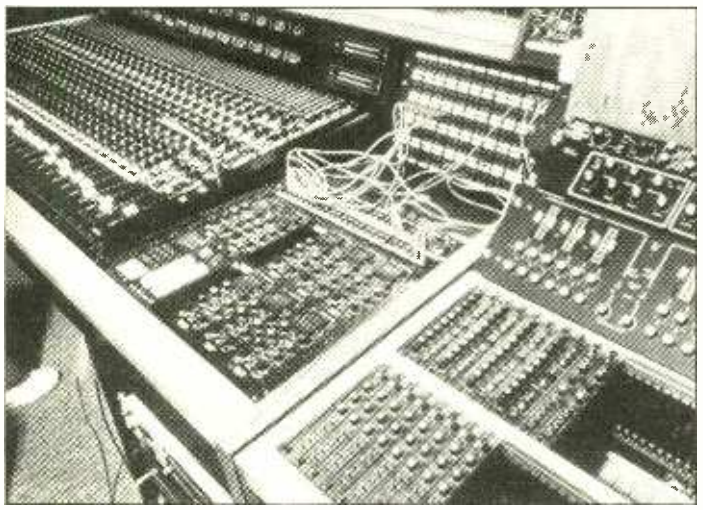

*Amek M2000 console plus a variegated selection of auxiliaries*

*Amek console with studio beyond*

## Soundhouse Joest Studio, Frankfurt

Nestling as it does, pretty much in the middle of West Germany, Frankfurt is a fairly major city in terms of the German and European music scene. Staged each year is the famous Frankfurt Fair primarily for musicians and, besides a magnificent old opera house (currently in the throes of renovation), the city boasts several multitrack recording studios.

Soundhouse Joest Studio was started in October 1978 by Hans Joest. An accomplished musician, Hans studied musicology at Frankfurt University and, having always been interested in groups and music he got the necessary together to build a studio on completion of his studies.

The original idea was to name the studio 'Opera Studio'. It is bang in the centre of Frankfurt's opera area with the Old Opera in sight across the street but, on second thoughts, Hans resisted the temptation since the name might evoke a somewhat misguided impression of where Soundhouse is at!

The building is a single storey, erstwhile clock factory which Hans laid claim to when it was standing empty and, drawing on his college studies and experience gained along the way, converted into a studio. Access to the studio is via large main doors at ground level opening on to a spacious yard for manoeuvring and off-street parking, a useful plus point as many a hard pressed roadie will testify.

Run by Hans and his wife Elvira, the studio has a very warm family atmosphere. Food can be brought in from a local Italian (or Chinese) takeaway restaurant. There are also some very 'in' jazz clubs in the area. The studio itself has no close neighbours so noise and local disturbance is not a problem. In summer they even have barbeque breaks outside—good for recharging the brain cells—at other times the 325sq ft control room includes its own en-suite relaxation area.

Workwise, Soundhouse do a lot of in-house items for Garlic-Productions, with Hans handling the commercial aspects. They are also doing work for CBS Frankfurt, Hansa Berlin and recently Ralph Siegel, Munich—just to mention a few. Resident engineer at Soundhouse, supplementing Hans, is Jochen Wenke (ex-Hotline, Frankfurt and Arco, Munich), a qualified Tonmeister.

Equipment at Soundhouse is pretty extensive. The desk is an Amek *M2000* 28/24 model with PPMs and RTW light-beam metering. Patchable auxiliaries are much in evidence and include eight Audio & Design Recording *Compex* modules, a complete *Scamp* system with compressors, eq, noise filters and gates and ADTs, and ADT *E950* paragraphic eq, Eventide *Harmonizer*, Orban *De-esser* and Marshall *Time Modulator*. Tape machines used are Telefunken *M15A* 24-track with Telefunken *M12*s for mastering. Creatively, control room-wise, a Korg *Mini-Pops* rhythm machine and ElectroHarmonix vocoder plus various ElectroHarmonix effects units are on permanent standby. Monitoring, via HH *SD500* amps, is through Electro-Voice *Sentry III* and a Klein and Hummel active system (as used in German Radio stations).

The actual studio is a fairly average size, about 485sq ft, with a booth for guitar amps or drums featuring connections through into the main studio. Having done some classical productions, using string quartet and oboe, the acoustics have deliberately not been kept too dry. Equipment in situ is extensive. A beautiful (real German) Steinway, Gretsch bass and Slingerland toms, Hohner *Clavinet D6*, Wurlitzer piano, Hohner string synthesiser, Korg *PS3100* polyphonic synthesiser, Oberheim *OB-1* synth and Hammond *A100* organ plus *Leslie* cabinet. As you no doubt guessed, Hans is primarily a keyboards player but will hire in anything necessary for a session given sufficient notice.

Microphones are mostly Sennheiser *421* and *441*, different types of AKG, Neumann *U47* and Electro-Voice *RE20*s. Tape used throughout is Ampex *456 Grand Master*—nothing but the best being the approach Hans tends to take.

Overall, Soundhouse Joest Studio is well placed, easily accessible and certainly has an enthusiastic owner—my guess is that there will be a few things of note out of Soundhouse before too long.

**Harry Mangle**

Soundhouse Joest Studio, Bockenheimer Anlage 35, D-6000 Frankfurt, West Germany. Phone: (0611) 722150.

## Hospital Radio return to Game Fair

Following last year's successful hospital broadcasts from the Game Fair in Wiltshire, the Devizes Hospitals Broadcasting Service was invited to the 1980 Game Fair at Welbeck Abbey in Nottinghamshire and brought the flavour of the countryside to over 23,000 listeners in the first networked live hospital radio outside broadcast.

The Game Fair is an annual country show run by the Country Landowners Association and demonstrates every aspect of country life and sport to its thousands of visitors. Between July 24 and 26 nearly 120,000 people visited the Game Fair where the Game Fair Hospital Radio broadcast some 65 interviews and demonstrations covering fishing, shooting, game conservancy, game cooking and many other aspects of the countryside. A handful of volunteers and amateur broadcasters manned the stand and produced 15 hours of live broadcasting which were relayed to listeners in all Birmingham's hospitals via BHBN, Gloucestershire's hospitals through Cotswold Hospital Radio and Devizes' via DHBS.

The studio for Game Fair Hospital Radio was built from scratch inside a mobile display trailer lent by a local double glazing window company, and equipment used was loaned by manufacturers and broadcasters for the event. A Neve mixer, Technics turntables, ITC cartridge machine, three Ferrograph *SP7* tape recorders, five Uher portables and 100ft mast from Radio Hallam is part of the impressive list of equipment used. The Post Office as usual provided an excellent quality landline and the Home Office issued a special licence to allow the broadcast across the country.

All the effort put into this OB was worthwhile, if the comments of the hospital listeners was the only measure, but the experience gained by the hospital broadcasters in all the interviews, preparation, presentation and engineering can only go to improve the standard of Hospital broadcasting, giving the listener a better service.

This was the second Game Fair covered by hospital radio, and the invitation to the 1981 Game Fair has already been made to the Devizes Hospitals Broadcasting Service. Next year the Game Fair goes to Buckinghamshire and possibly then the next goal will be reached—to link up hospital stations all over the country in a live outside broadcast so that several hundred thousand patients can hear what 23,000 did this year. That, of course depends on finding a sponsor for the landline costs, someone who will share in the enthusiasm and value of Game Fair Hospital Broadcasting. **Quentin Howard** ■


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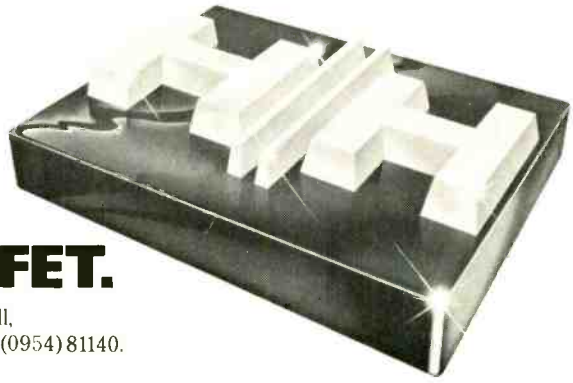

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# EMI digital console

Noel Bell

*Design trio Richard Fairhead, Ian Craven and John Richards with the control console*

**At this year's New York AES Convention the design team which produced the EMI digital multitrack recording console presented a paper detailing the specification and configuration of this unique console. Noel Bell visited EMI Abbey Road recently to see the console and here reports his findings.**

IN mid-July 1980 I visited EMI Abbey Road to meet the EMI team responsible for the design and construction of that company's totally digital multitrack recording console. Through the good offices of EMI Abbey Road's Ken Townsend and John Jarrett of EMI's Central Research Laboratories in Hayes, full facilities were made available to me to look over, and see in operation, this unique console. Prior to describing the console, though, the first question I asked of the trio of designers—John Richards, Ian Craven and Richard Fairhead—was, how long ago was the project formulated?

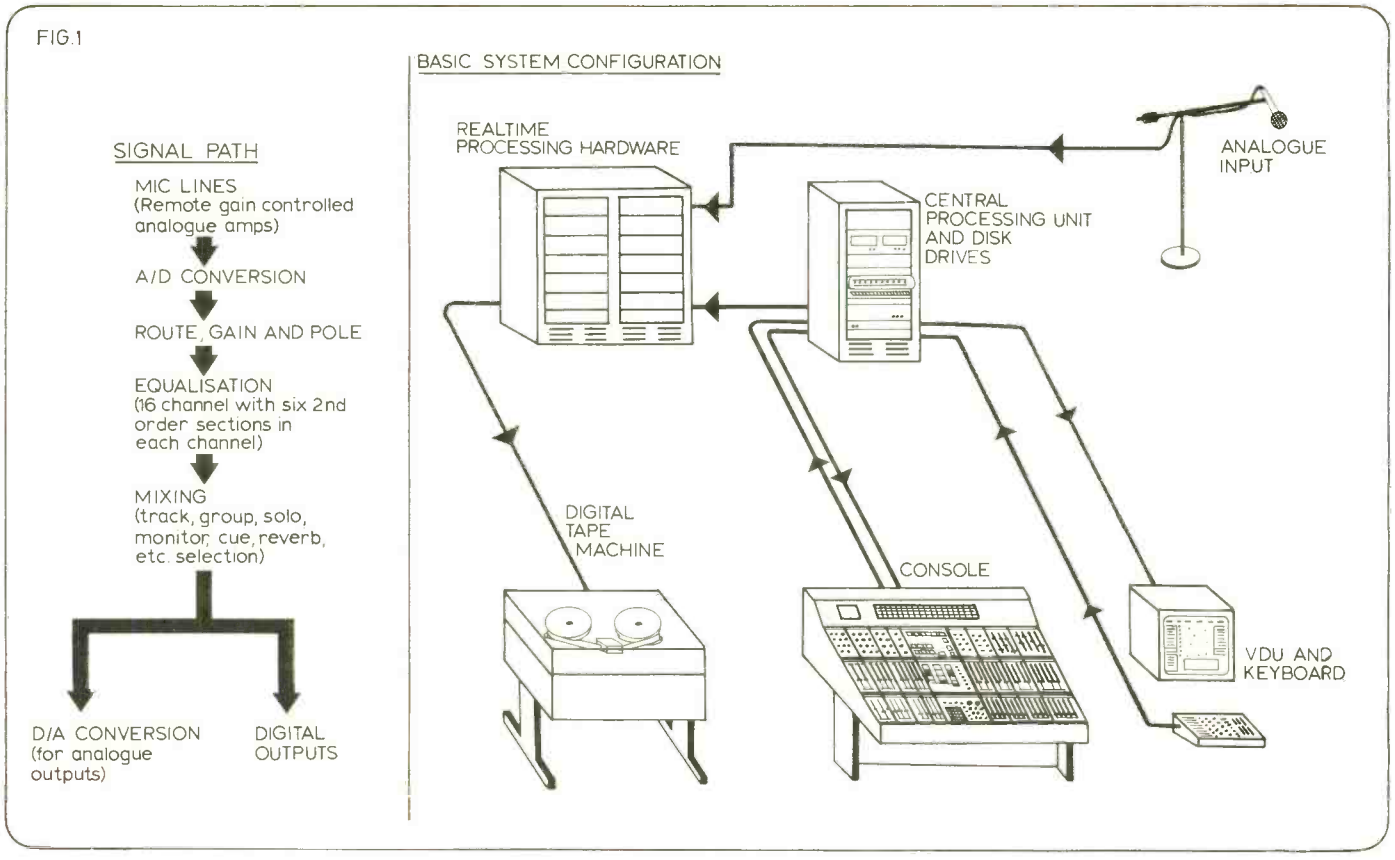
The answer of late 1975 as the period when the original idea of producing a totally digital mixing console was first mooted at the Central Research Laboratories in Hayes, rather surprised me. Although digital matters have been to the fore in the minds of designers over the last five or so years, 1975 seemed a remarkably early stage in the digital technology stakes to embark on such a radical and technically advanced project. Accordingly, I would have expected the project to have been a much more recent research task. However, it transpires that the project's feasibility study was carried out at this early stage, and satisfied as to the projects viability, work then commenced on formulating the original design concept of the console in early 1976. Rapid progress was made and by the middle of that year design work reached the stage where a start on the design of the console itself could proceed. Design and construction then proceeded over the following three years, during which time many problems were met and solved. The console finally became operational in November 1979 to the immense satisfaction of all concerned. With such a radical and technologically advanced design project there were naturally teething troubles, however, by April 1980 the design team were satisfied as to the operational functioning of the console and it was moved lock, stock and barrel from Hayes to EMI Abbey Road for field trials.

From the very beginning of the project, the central idea of the design team was to produce a multitrack digital mixing console. Whilst this was the prime aim other factors which affected the actual operational design as produced included the requirement that the console be of modular construction to aid maintenance; that it be capable of software control; that it be automation ready; and that it be suitable for easy utilisation by engineers used to analogue multitrack consoles.

Seen in the flesh, the digital console comprises a 16 input, 8 output, 6 group desk with dedicated signal processing hardware and software control. As installed at Abbey Road, the console with VDU display unit and software keyboard terminal is housed in one room—together with its associated EMI digital tape machines, Quad *303* power amplifiers, and Tannoy *Lancaster* monitors—while in an adjacent room is situated the console's realtime processing hardware, central processing unit, and floppy disk and hard disk memories. **Fig 1** illustrates the basic configuration of the EMI digital console system, and details the signal path. Referring to this it can be seen that there are four main parts to the system—namely the dedicated realtime signal processing hardware, the central processing unit with hard disk and floppy disk drives, a QWERTY keyboard terminal and video display unit, and the console itself.

The dedicated realtime digital signal processing hardware takes up two 19in rack units, is of totally modular construction, and operates on 16-bit data words at a sampling frequency of 50kHz. The available functions which can be handled include remote gain control of analogue mic line amplifier inputs; A/D conversion; routing, gain and pole control; digital equalisation; track, group, solo, monitor, cue, reverb, etc; selection; digital output

FIG.1

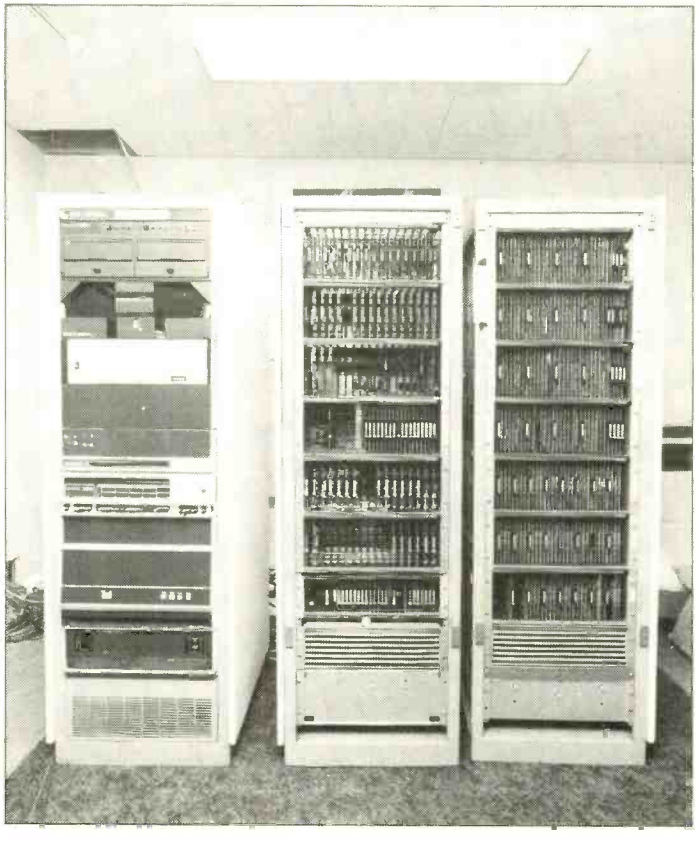



interfacing; and D/A conversion for analogue outputs. The decision to utilise this system of digital signal processing has the following advantages: it allows direct interfacing to EMI's digital tape machines; it allows for greater flexibility, eg in filtering; and it allows upgrading of the system to be carried out relatively simply. A further advantage is that maintenance is simplified as an additional feature of the hardware is the provision of a self diagnostic computer controlled maintenance facility which is under software control.

Moving on to the 19in rack housing the central processing unit and disc drives, this section of the system comprises a Data General *Eclipse S200* mini-computer, a character generator for the system's colour video display unit, two floppy disk drive units, and a hard disk drive unit. The hard disk has five Megabytes of fixed memory and a further five Megabyte of memory which is removable. These console control elements utilise the hard disk for program and data storage (additionally the hard disk may be used as a scratch area for automation data, although the console is at present non-automated) while the floppy disks are utilised for long term storage of remix data. Using the hard disk as a scratch area allows a number of trial mixes to be handled, 'optimum' results are then transferred and stored on floppy disk.

As the console is software controlled with the software defining the way in which console controls operate, redefinition of the software can change the operational facilities of the console. This facility of software changes implemented through the use of interchangeable floppy disks, therefore allows easy expansion and upgrading of the system (including in the future, totally automated remix facilities and a wider choice of VDU display formats). An advantage of this format is that engineer personalised floppy disks can be produced allowing individual engineer's preferences in the choice of control operation and equaliser parameters to be simply accommodated. For example the channel solo facility may cancel any previous selection, or may be used to build up separate submixes depending on the software choice. Similarly, the console's equalisation and filter characteristics are also under changeable software control.

*Central processing unit and disk drives (left), realtime processing hardware racks (right)*



Turning now to the console, or perhaps a more accurate description would be the 'control console', this consists of a control surface which sends digital commands to and receives display data back from the central processing unit. This console is not a console in the usual analogue sense of the word as with the exception of the recording engineer's talkback system, no audio signals, either analogue or digital, are present within the console itself. All audio processing being handled by the dedicated realtime processing hardware, which is fed the console commands and interpreted software controlled functions by the central processing unit. As such the console is accordingly more a control console

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# EMI console

than an actual audio mixer. **Fig 2** illustrates the basic layout of the control surface and from this it will be seen that its layout is modular, the modules plugging into a duplex buss system with the units having their own 'firmware identity', allowing the control surface to be readily reorganised simply by plugging the modules into different positions.

Prior to describing the individual modules, it is perhaps worthwhile to describe the console's specification and to give an indication of the facilities available in each channel. There are 16 input channels which can select either or four analogue or four digital programme sources with level control. Each channel has access to six second order equalisers (nominally high/lowpass filter, high/low prescence, and high/low tone). Channels 1, 2, 15 and 16 having pre and post equaliser patching facilities. Each channel also has a channel fader and the mixer has quadraphonic channel routing and pan to track/monitor/group busses, channels 11 to 16 acting as grouping channels, while channels 1 to 8 only can be routed to the monitor busses. Additionally there is a reverberation level and routing unit (post fader) and a cue level and routing unit (switchable pre/post fader). The 8-track monitor channels can select either an analogue source or two digital sources capable of A/B 8-track line input/8-track line output tape monitoring with level control. Additionally the mixer has quadraphonic routing and pan to the monitor busses.

The monitor amplifiers have a selection of 2- and 4-channel inputs, including monitor busses (via 4-track fader); track outputs 1 to 4; tape machine line out (1 to 4); reverberation busses 1 and 2; cue busses 1 and 2; two channel aux inputs; and two channel disc inputs. Other facilities include eight track output busses; six group busses; four monitor busses; two reverberation busses; and two cue/sync cue busses. Special functions which are available include track monitor 'stereo fader' link; display title assignment; and cue 2 pre/post fader. The mixer has four record/replay interfaces for use with two EMI stereo digital tape machines plus the facility to feed a multitrack digital machine. At present the console feeds EMI's 5-track/channel format stereo machines, but will soon be utilised with the EMI/MCI 2-track/channel format stereo digital machines (delivery of which are scheduled for the near future).

A prime design requirement for the control console, which has influenced the console layout and module configuration, was the requirement that control and console display be flexible, with the provision that automation of all control functions including equalisation be possible. Because of this design criterion 7-segment indicators are used rather than engraved legends, and the control and display functions are kept distinct, enabling the central control processor to update any displayed values without recourse to servo movement of controls or 'null indicating' arrangements. This latter function has entailed the replacement of locking push-buttons, fader knobs and rotary switches with stepped rotary encoders, incrementing or decrementing keys, and in the case of faders a continuous belt drive encoder.

However, to return to the console modules, or initially the meter panel, the topmost area of the console contains two items. To the left an LED display panel which indicates the number of the assigned channel (more on this later) and centrally placed an LED meter display for analogue channels 1 to 8 and 9 to 12. These being switchable VU or peak responding (true responding peak, not PPM!). Additionally, to the right of this area is the engineer's talkback mic.

Below the meter panel we come to the modules proper. Top left is the source selection module with switches for mic, rep 1, rep 2, sync, group, digital, overdub, eq, solo, pole, and mute plus LED indication of selections made. Next is the equalisation section comprising three modules termed tone, presence and filter. These modules are based upon the facilities provided in existing analogue EMINEVE and EMI consoles. The eq sections utilise incrementing or decrementing 'up' or 'down' keys to alter the display indicators, the displays for each second order eq section showing lift (or cut) in dB on a 2.5-digit display and frequency on a 3-digit display with a Hz/kHz indicator. The displays have a resolution of 0.1dB for level setting and a maximum resolution of 1Hz for frequency. Additionally the frequency display can also read 'off' in which case the equaliser is bypassed. The display content and number of steps are programmable (maximum 64 steps of gain, 32 steps of frequency) and this complements the flexibility of the processing hardware.

Referring to the frequency response shapes of the equalisation the design brief was to mimic those provided by simple passive networks using a reactive component for step (shelf) responses and two reactive components for resonant responses. As the console's equalisation is under software control this allows the range of operating frequencies and equaliser shapes to be determined by the central control processor and two modes of equalisation (pop and classical) have been provided.

The tone module provides hf and lf equalisation. High frequency centres are 2.7, 3.9, 5.6, 8.2, 11, and 16kHz with lift and cut being either ± 18dB in 2dB increments in the pop mode or ± 10dB in 1dB increments in the classical mode. Low frequency centres are 68, 100, 150, 220, and 330Hz (plus off) in both modes. The presence module is again split into hf and lf sections with switchable high or low Q. The hf section has frequency centres of 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, and 8.2kHz (plus off) in the pop mode and 0.56, 0.82, 1.2, 1.8, 2.7, 3.9, 5.6, 8.2, and 12kHz (plus off) in the classical mode. The lf presence section is identical for both modes with frequency centres of 220, 270, 330, 470, 560, 680, 820, 1,000 and 1,200Hz (plus off). Finally, the filter module has lowpass and highpass filters which mimic Butterworth filters. The lowpass filter being 12dB/octave with cut off frequencies of 3.9, 5.6, 8.2, 10, 12, and 15kHz (plus off), while the highpass filter is 12dB/octave with cut off frequencies of 47, 68, 100, 150, and 220Hz (plus off).

Continuing across the console, next is the channel routing module with track, group and monitor routing buttons plus a 1-8 keypad and LED indication. The same module also has a quadraphonic pan LED matrix with associated left/right and front/back pan buttons. Alongside this module is the track monitor routing module which has an identical quadraphonic pan section, plus 1-4 keypad buttons and monitor level fader with an adjacent LED level column. Far right of the

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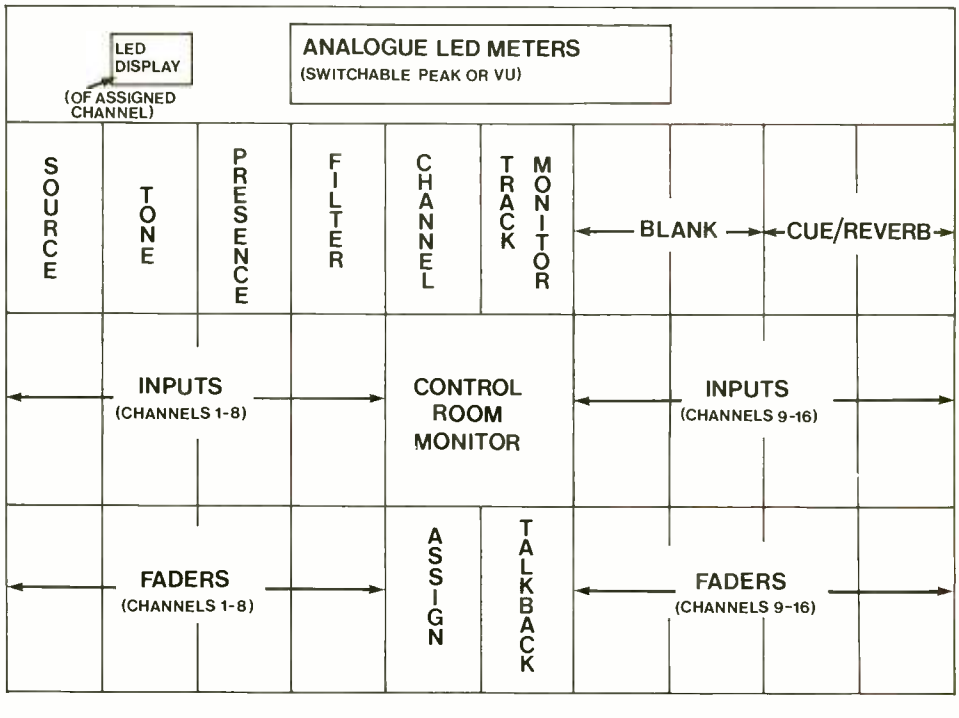
FIG.2 MODULE LAYOUT OF CONTROL CONSOLE



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# EMI console

top row of modules are two cue/reverb modules with cue level and routing plus reverb level and routing.

Moving down to the middle row of modules, these comprise the input channel modules with the control room monitor panel centrally placed between input channels 1-8 and 9-16. Each input module has two input channels with LED indication of channel status together with a stepped rotary encoder to adjust input sensitivity. Input sensitivity is displayed on a 7-segment display with the display range and step size being governed by the input selection made on the source module which is assigned to that particular channel. The step size is 2.5dB for analogue inputs with a range of −57.5dB to +20dB for microphones and −17.5dB to +20dB for line inputs, and for digital inputs the step size is 6dB with a range of −18dB to +18dB. Additional facilities on the input channel are eq and solo LED indication and input level metering in the form of a column of 15 LEDs. This LED column has one high intensity red LED, three red LEDs, and 11 green LEDs and is an all digital, peak reading meter with an instantaneous attack and smoothed decay. An unusual feature of the meter is its capability to display 'digital gain' overloads due to insufficient input gain headroom. When such a situation occurs the red high intensity LED only illuminates and warns that the most significant bit(s) of digital audio data are being truncated.

The control room monitor module features level controls for stereo and quadraphonic monitoring plus the usual selection of monitor and meter source selector switches. Additionally there is a 4-track fader on the monitor busses. The full facilities are detailed in the console specification above under the monitor amplifier section.

The front row of console modules comprises the fader modules laid out in duplicate fashion to the input channel modules, plus the assign and talkback modules which are centrally placed. The fader modules each have two channel faders with the faders being continuous belt faders which drive an encoder. Alongside the fader is an illuminated LED which displays the position of the fader. The illuminated LED tracking the fader as it is moved and locking-out at the end stops. A similar arrangement is utilised for the cue/reverb module level controls the only difference being that here rotary controls are used.

The talkback module is the only part of the control console which actually has audio signals present and features the usual cue, send and studio controls.

The assign module features a keypad labelled 1 to 16 plus a further button labelled SF. This SF key being used to select several special functions. When pressed a 'menu' is written in the message area (lower right hand part) of the VDU display and the 16 key pad may then be used to select the required function, whereby either the menu is cleared, or prompts for interactive dialogue via the 'QWERTY' keyboard are given. Functions currently available include 'save' and 'restore'. 'Save' storing the total status of the desk in a user designated disk file. 'Restore' then being used at any later date to restore the exact status from any nominated disk file. Incidentally the 'restore' command only takes approximately 2s to execute.

A feature of the control console is the extensive use of assignable controls. Assignment being available for the following modules, source, tone, presence, filter, channel routing, track monitor routing, and cue/reverb. Accordingly, all the facilities which are used either during session set-up, or which are individually adjustable during a session are provided with a set of controls which can be assigned to any one channel at a time. The controls and not the audio processing hardware being assignable.

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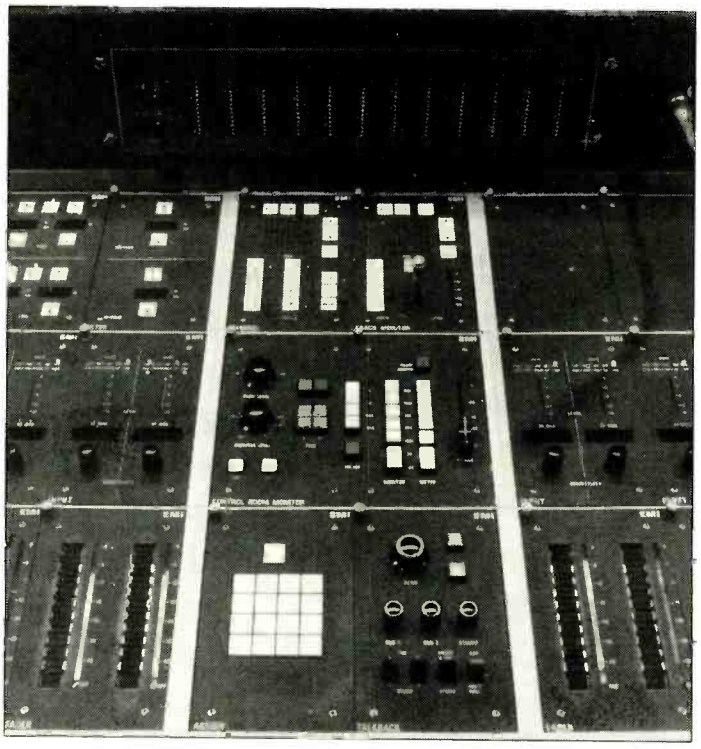
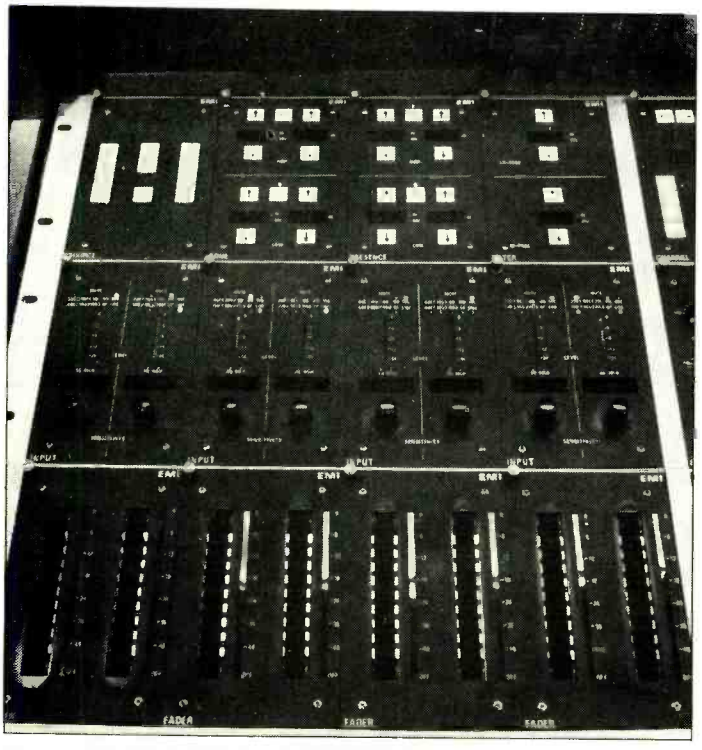
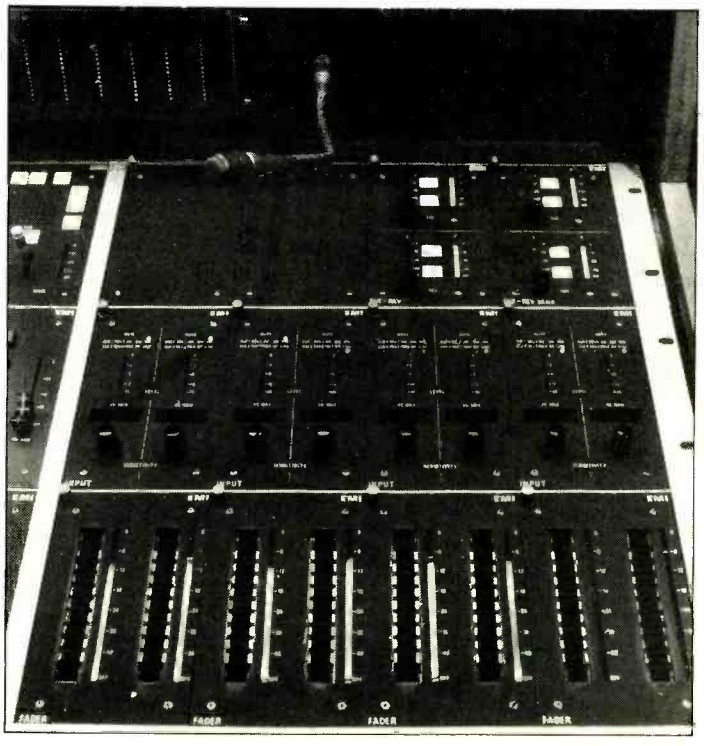
*(l to r) module layout of the control console (see Fig 2 and text for detailed description)*







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No. of Channels Required ☐

MIC INPUT:
- ☐ Transformer Balanced
- ☐ Electronically Balanced
- ☐ Unbalanced
- ☐ Floating
- ☐ (+ 48V Phantom)
- ☐ 20 dB Input Pad

LINE INPUT:
- ☐ Transformer Balanced
- ☐ Electronically Balanced
- ☐ Unbalanced

EQ TREBLE:
- ☐ Fixed Baxandall
- ☐ 3 Switched Freqs.
- ☐ Sweepable

No. of MID CONTROLS: ☐ 1 ☐ 2

MID FACILITIES:
- ☐ Fixed Frequency
- ☐ 3 Switched Freqs.
- ☐ Full Parametric
- ☐ (with Q control)

BASS FACILITIES:
- ☐ Fixed Baxandall
- ☐ 3 Switched Freqs.
- ☐ Sweepable

- ☐ High Filter
- ☐ Low Filter
- ☐ Faders 104mm CP
- ☐ 60mm Carbon

No. of Auxiliary sends required (0-6)
- ☐ ON/OFF
- ☐ PRE/POST
- ☐ Channel Prefade Insert

PFL FACILITIES:
- ☐ Standard PFL
- ☐ Auto PFL

OUTPUT GROUP FORMAT:
- ☐ Separate Groups
- ☐ In-Line Format

No. of Groups (1-32) ☐

No. of Auxiliary Sends on Groups (0-4) ☐

- ☐ Conductive Plastic Faders
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# EMI console

*Control desk with VDU and QWERTY keyboard beyond*

When a channel is selected on the assign module, the LED display panel on the control console's meter panel and the console's displays of all assignable controls in the relevant modules instantly change to indicate the control status of the selected channel. At this point any updating of that particular channel may then be carried out.

The use of assignable controls and the method of display and channel update outlined above, does however, cause a display problem of channel status for the remaining 15 channels which have not been selected. This problem has been solved in two ways. Firstly, each channel input module monitors the signals on the control buss and displays abridged information on the status of its particular channel via an LED display. There being 13 colour coded LEDs which continuously display status, indication being available for eq, solo, mute, cue 1, cue 2, reverb 1, reverb 2, overdub, pole, digital, group, mic and line. Secondly the channel status information is displayed on the colour VDU, a typical display being shown in **fig 3.** Information displayed includes input/output routing and track assignments.

An additional facility of the EMI system is the provision for some normally assignable controls to also be provided in dedicated form. For example to have equaliser controls always active on certain channels. This is achieved through the control console's modular format where duplicate or multiple modules may be inserted, so that it is possible to have any mixture of assignable, dedicated and duplicated modules. The only factor influencing module configuration being the availability of a physical space for any additional modules. As detailed earlier as long as there is physical space for a module, any module with the firmware identity of a particular channel may be inserted. When assigned to that channel, either assigned or dedicated modules will effect control and both will give cross indication of the correct display data.

A further feature of the EMI system is its ability to detect operator errors. Errors which can occur being 'illegal' routing combinations. For instance, as only channels 11 to 16 can act as grouping channels, but the same assignable controls are used on all channels it is possible to accidentally select inappropriate routing. Similarly, as some of the control console's keypads are multi-functional, eg the same keypad is used to select track outputs 1-8, group busses 1-6, or monitor busses 1-4; selection of groups 7 or 8, or monitor 5 to 8 would be errors. However, the central processing unit is 'aware' of the hardware layout and it can query any dubious operator commands via error messages which are displayed on the VDU.

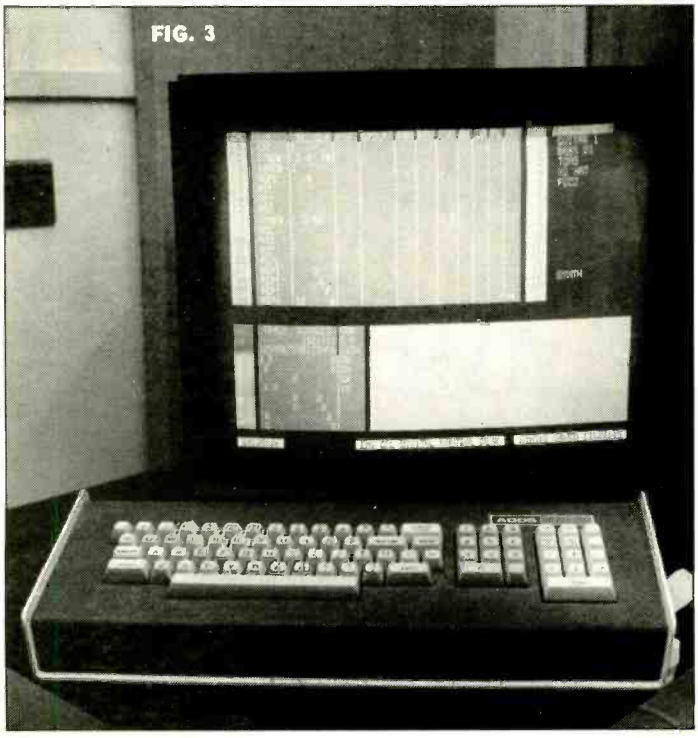
However, enough of the facilities, what of the system's performance. The EMI digital console uses 16-bit processing at a sampling frequency of 50kHz. Frequency response is 20Hz to 20kHz ±0.25dB and is governed by the performance of the anti-aliasing filters, reconstruction filters, and A/D and D/A conversion equipment. At present A/D conversion is by an on-board ranging system using a 12-bit mantissa and 2-bit exponent, ie 15-bit (12 + 2) and is the same system as used in the EMI and EMI/MCI digital tape machines. (Eventually it is intended that 16-bit linear A/D convertors will be used but a present these are not felt to be economically viable). In order to facilitate 16-bit processing the A/D conversion card converts the 12 + 2 digital input to a 16-bit fixed point word. All subsequent processing including D/A conversion being 16-bit.

Dynamic range of the system is 90dB with total harmonic distortion (peak level) being 0.03%. Peak signal to quantising noise ratio is 72dB with the amount of headroom above normal line level being 18dB. Channel idle noise for a terminated line input (all controls flat, −17.5dB input level sensitivity, fader at maximum) is −87.5dB. All the inputs to the console are balanced bridging transformer coupled with provision for phantom powering of mics, while all outputs are balanced transformer coupled. These performance specifications all referring to the analogue input to analogue output performance.

Looking to the future, the EMI design team propose that the present EMI digital console be improved by the provision of further facilities. Essentially improvement would be achieved by revising the console's operational software so that totally automated remix facilities could be made available, and additionally it would be possible that a wider choice of VDU display formats be made available. With regard to additional console modules, it is proposed to produce modules which would allow remotely programmed outboard equipment to be controlled from the control console, thus allowing outboard units to be integrated into an automated remix.

Finally, it is worth pointing out that this particular EMI digital mixing system is unlikely to be more than a one-off model. As a prototype digital mixing system it has proved conclusively that digital mixing and transfer facilities are operationally viable. The current evaluation of the console being carried out at EMI Abbey Road will help decide the targets for equipment performance, reliability, ergonomic design and system flexibility which future generations of EMI digital studio equipment will follow. As a fascinating pointer to the future the EMI digital mixer opens up entirely new vistas leading eventually, no doubt, to the all-digital studio. The prospect of a totally integrated all-digital studio complex, where digital signals are routed and transmitted through a centrally placed hardware processing unit with operational control wherever required, is not a too distant possibility. The current EMI investigations into digital audio technology could well indicate that EMI will be the first to produce such a complex. However, it remains to be seen what the future will bring. ■

*Typical VDU display*



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# Designing a professional mixing console

# Part Four

Steve Dove

Like a sausage machine, a console is expected to accept any scraggy fodder in the way of input level and impedance whilst producing a nice uniformly consistent output capable of being deposited in the tightly-defined container that is a tape track.

Fortunately, industry standards provide at least some clues as to what mixers are likely to have stuffed up them. Nevertheless these standards can obviously do nothing to alter the physics of the operation of the assorted transducers and sources used and the disparity in the treatment required for say, a dynamic mic and a tape machine output totally precludes a 'universal' input stage.

Mixer front-end design tends to be a little like working on a grown-up jigsaw puzzle where all the important pieces perversely refuse to fit. It's really delightful to find some that fit beautifully — as in line-level input stages. This euphoria is ground away by the problems inherent in other areas — notably mic inputs.

Optimising noise performance in a dynamic microphone preamp is a performance, juggling a seemingly endless number of variables. A dynamic mic may be represented (a little simplistically) as a voltage source in series with a fairly lossy inductance representing an impedance midband typically of between 150 and 300Ω (**fig 15**) Being a transducer and, of necessity, mechanical in nature, many complex varying motional impedance effects contribute to the overall scene, but for most design purposes the specified electrical analogue suffices. The low impedance is primarily to mitigate high-frequency attenuation effects due to inevitable cable capacitance, which in practical circumstances mounts up to horrifying values of capacitance that the transducer must drive along with its load. Unfortunately the impedance is not low enough that it may be treated as a pure voltage source; there exists a tiny signal at a finite impedance that must be daintily ferreted out for optimum performance.

The jigsaw commences. Textbooks on electrical theory quite correctly state that to extract maximum *power* from a given source the optimum load is equal in value to the source impedance matched. This however, in the instance of a dynamic microphone, is of doubtful (if any) value — OK, we've squeezed all the energy possible from the generator but to what end? Given that electronic amplifiers of the type useful in low-noise applications are of relatively high input impedance (ie voltage amplifiers) and that the terminating resistance that largely defines the microphone's load is in fact dissipating most of our hard-won power. It is the source's output *voltage* capability that is of greatest value, not the power. So as can be seen in **fig 16**, 'matching' does a very effective job of sacrificing 6dB of signal level which naturally has to be made up in the succeeding amplifier. This does not imply that the noise performance is 6dB worse than possible since the source impedance as seen by the (assumedly perfect) amplifier is now a parallel of the mic and it's matching load, hence half the value of either. The thermal noise generation of this combined source is consequentially 3dB less, hence the noise performance is only degraded 3dB by such a termination. Still, who wants to throw away a good 3dB before we even start hassling with the amp?

Another good reason for not terminating with an equal or any fairly low resistance is the effect on microphone response and subjective quality. Having an inductive characteristic, the dynamic microphone capsule has an impedance that rises with frequency, predominantly at high audio frequencies where the inductive reactance of the source becomes large with respect to the coil winding resistance. When terminated with a relatively low resistance, the complex impedance of the capsule and the termination resistor form a single-order 6dB per octave lowpass filter, gracefully rolling off the top.

Combine that with a fairly hefty cable capacitance and you may delete the 'gracefully', since the complete network now looks like a rather lossy second-order filter. Still, regardless of termination method, we're stuck with cable capacitance — it's always a consideration.

All right. No termination resistor. The way to go is obviously as high a termination impedance as possible — but oh-oh, jigsaw time.

## The Mixer Front-End

### Optimum Source Impedance

Amplifiers are not perfect. For noise criteria, the first device that the signal hits in the amp is the key one since the noise it generates usually masks, by a large margin, noise due to all succeeding stages.

All practical amplifying devices are subject to a variety of internal noise generating mechanisms including thermal noise generation, and this when measured gives rise to some important values, namely input noise voltage and input noise current.

For the most part, ordinary bipolar transistors are used as front-end devices both in discrete designs and op-amp IC packages so much of the following is specific to them.

These noise voltages and currents alter in both magnitude and ratio to each other with differing electrical parameters, especially collector current. Predictably, as this current decreases, so does the noise current (most of the noise is due to minor random discontinuities in device currents) and so the ratio between the noise voltage and current — or noise impedance — may be altered.

Thermal noise generation is common to all resistive elements, its amount being related to temperature and the bandwidth across which it is measured, an increase in either increasing proportionally the noise power generated. Under identical circumstances the noise *power* generated by any values of resistance is the same — differing resistor values merely serve to create differing ratios of noise voltage and noise current, the product of the two always equalling the same noise power. This particular noise phenomenon is totally unavoidable, it being the nature of atomic structure that when things get hot and bothered they grind and shuffle about randomly, creating electrical disturbances white in spectra (ie equal energy per bandwidth).

Even the real (resistive) part of the complex impedance of a dynamic mic generates thermal noise and this ensures that there is a rigidly defined noise value that cannot be bettered.

The difference between the noise floor defined by this thermal noise and the measured noise value of a practical system is known as the Noise Figure (NF) and is measured in dB. The noise output from a resistor is predictable, so a direct comparison of the noise voltage measured at an amplifier's output from a resistor applied to the amplifier input and the noise voltage expected of the resistor on its own is possible just by simply subtracting the measured gain of the amplifier. A measure of NF.

An interesting effect occurs when, with any given set of electrical parameters set up for the amplifier front-end device, the source resistance is steadily changed in value. A distinct dip in the NF occurs, see **fig 17**, and the value of resistor at which this dip occurs changes as the device parameters are changed (collector current primarily). For the usually predominant noise mechanism (thermal noise) a minimum NF occurs with a tiny amount of collector current (say 5 to 50μA) and a high source resistance (50kΩ up). Without diving into the mathematics, the nulling is balancing interaction between the external noise source and the internal voltage and current noise generators.

There is another major noise mechanism inherent to semiconductors, however, which is low frequency or If noise — a burbly, bumping type noise caused by the semiconductor surface generating and recombining sporadic currents — most prevalent in 'dirty' devices but present to a degree in all. It is subjectively apparent and has to be considered. Measured alone, If noise has its own set of collector current and source resistance nulls, usually far higher in current and lower in resistance than for thermal noise.

A compromise has to be struck. To make a generalisation, 100μA and 10kΩ for a typical low-noise PNP transistor seem about right. (PNP transistors are common in this area due to marginally better If figures over NPN types.)

The source resistance value is that at which the device is optimally quiet for audio purposes and is known (surprise) as the Optimum Source Impedance. Incidentally, this impedance has absolutely nothing to do with the kind of circuit configuration the device may be in — whether it be in a common-base amplifier with

FIG. 15 SIMPLISTIC MODEL OF A DYNAMIC MICROPHONE.

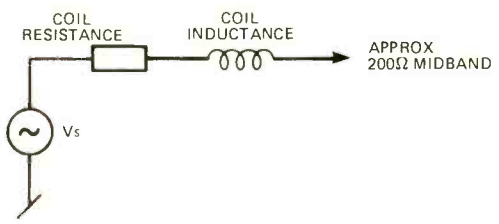
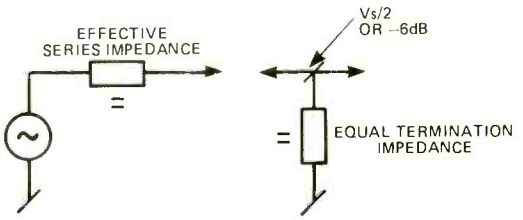



FIG. 16 'MATCHING' IMPEDANCES CAUSING LOSS.




an input impedance of 50Ω or in a totem-pole front-end with bootstrapping and a consequential input impedance of over 10MΩ — it doesn't matter. The source impedance for optimum noise performance stays at 10kΩ, or whatever, provided the collector current is the same in all cases. Optimum source impedance has nothing to do with input impedance.

This optimum impedance varies dependent on the type of input device used. For a field-effect transistor, the noise figure typically obtainable drops to an amazingly low value but unfortunately at an impedance of several dozen MΩ. Even supposing it was practicable to provide a source of that magnitude the whole arrangement would be so sensitive to any electromagnetic fields (such as RF) that even tiny amounts present would obliterate the noise advantage. The design and construction of capacitor microphones using FET front-ends highlights the hazards. The end results, more often than not, show such capacitor mics to be several dB noisier than a well-designed dynamic microphone/front-end combination.

Good bipolar transistors have OSIs in the region of 5 to 15kΩ, whether discrete or as part of an IC amplifier package. Ah! A piece of jigsaw that actually fits! By happy accident, these values closely coincide with the source resistance value that provides for optimum flatness of device transfer characteristics which helps a long way towards best frequency and phase linearity, hence stability in a typical high negative-feedback amp configuration.

**Fig 18** shows the effect of altering the source impedance into such an amplifier (using a conventional bipolar transistor input device) on output frequency response. The drop is due to the excessively high source impedance reacting against the device base-emitter and wiring capacitances to form a lowpass filter. The hf kink is a practical effect of the curious mechanism described last time, ie when a bipolar transistor is fed from an impedance approaching zero, its high frequency gain/bandwidth characteristic extends dramatically, radically altering the phase margin and consequentially the stability of an amp designed and compensated for more ordinary operating circumstances. The kink is a resonance within the amplifier loop caused by erosion of phase margin resulting from this mechanism, being only a very short step from oscillation.

As can be seen from the sketch graph, the response is maximally flat at a source resistance of around 10KΩ, about the same value as the OSI for noise performance.

A problem to reconcile. Our practical source impedance is nominally 200Ω for a dynamic microphone. The OSI for the best conventional input devices is around 10KΩ. How do we make the two fit?

## Microphone transformers

Please, don't go away. OK, you've heard some horrible stories about how nasty they are, but properly designed and used they do offer a good solution to the impedance matching and other problems.

Simplistically, a transformer is a magnetically soft core around which are two windings, the voltage ratio between the two being equal to the ratio of the number of turns on them. The impedance ratio is the turns ratio squared (eg a 10:1 turns ratio corresponds to a 100:1 impedance ratio) because power output cannot exceed power input and if the voltage is stepped up 10 times, the output current must be stepped down 10 times. Impedance, which is the ratio of voltage to current, is consequentially the square of the transformed voltage or current ratio.

Given this, it is a simple matter to calculate the ratio necessary to match the microphone impedance to the OSI that is actually being used and to a much lesser degree on the actual impedance of the microphone intended for use. Since few people are intense enough about the whole affair to bother measuring microphones, the assumption that 200Ω is a good mid-point serves well. The assumption that most bipolar input amplifiers have an OSI of between 5kΩ and 5Ω indicates that the transformer ratio should lie somewhere between 1:5 and 1:8.7.

Many consoles, notably some American ones, quite often use higher ratios (typically 1:10) probably in the naïve belief that the noise advantage of a step-up input transformer stems from the 'free gain' it affords, so the more the merrier. Although on a basic level it would seem to make sense that the less electronic gain you need to use the quieter the system must be, this fallacy completely belies the truth that the transformer merely allows you to *choose* and *alter* the impedance at which your amplifier is optimally quiet. Increasing the turns ratio makes the amplifier noisier.

Actually the 'free gain' can be more of a nuisance than a benefit. It is not unusual for mic inputs to receive transients exceeding +10dBu and mean levels of −10dBu especially in a nasty rock and roll environment. Even dynamic capsules can deliver frightening levels and this can pose headroom problems in the mixer front-end. A typical 1:5 transformer has a voltage gain of some 14dB (at 1:10 some 20dB) which would mean that even with no electronic gain after the transformer, normal mixer operating levels are being approached and exceeded. These circumstances make worrying about a dB or two of noise performance total nonsense and it just serves to point out that our poor mic front-end has to be capable if not perfectly optimised for, elephant herds as well as butterflies.

Transformers have numerous limitations, inadequacies and problems resulting from their

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FIG. 17 NOISE FIGURE CURVES FOR A GOOD PNP FRONT-END TRANSISTOR FOR COLLECTOR CURRENT VS. SOURCE RESISTANCE.

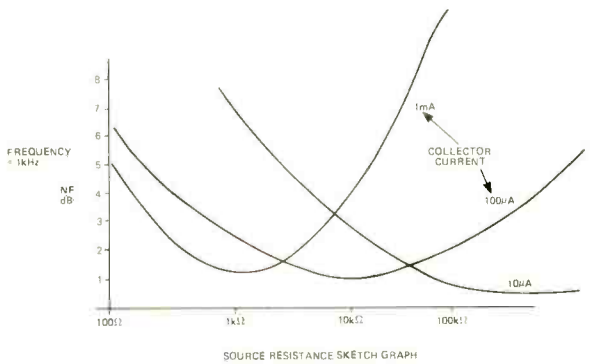
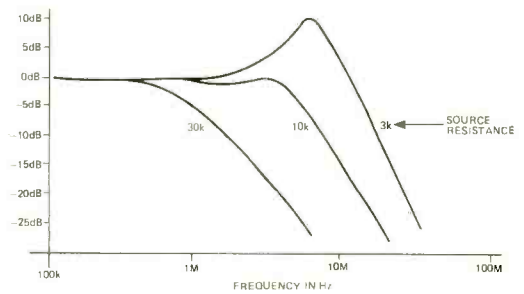



FIG. 18 GAIN VS. FREQUENCY FOR A TYPICAL FOLLOWER-CONNECTED OP-AMP HIGHLIGHTING EFFECTS ON RESPONSE OF SOURCE IMPEDANCE ON INPUT DEVICE.



physical construction that make their actual performance differ (in some respects radically) from that expected of the theoretical model.

## Core material

The heart of the transformer is the magnetically pliable material into and out of which the energy is induced. Virtually any material: nickel, steel, iron, ferrous derivatives and substitutes have the same basic limitations; saturation at a magnetic level beyond which they are incapable of supporting further excursion, and hysteresis — a crossover like non-linearity at low levels responsible for a significantly higher distortion than anything else likely to be found within a signal path.

These two effects at opposite ends of the dynamic spectrum mean that any transformer has a well-defined dynamic range within which it must be operated and which is quite less than the range of levels it would be expected to pass in use as a mic amp. This is especially true at low frequencies where the core is prone to saturation far earlier. Optimisation begins here. Is it to be designed for minimum hysteresis — hence low low-level distortion (butterflies) — or with lots of material tolerant of high signal levels (elephants?).

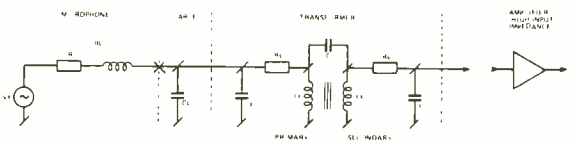
## Winding resistance

Windings are made of wire. Wire has resistance. Resistance means loss and lack of efficiency and noise performance. By the time there are enough turns on each of the windings to ensure the inductive reactances are high enough not to affect in-band use, the winding resistances can no longer be ignored.

## Winding capacitances

Capacitance exists between any things in close proximity, and that includes transformer windings — between each other, between adjacent turns and piles in the same winding and from the windings to ground. In this given instance it is nothing but bad news — capacitance between windings means unwanted leakage and imperfect isolation, whilst winding self-capacitance reacts with the winding inductances to form resonances. Resonances, even if way out of the audio band, invite response trouble, also disturbing in-band phase linearity. Combinations of these capacitances greatly affect one of the most touted advantages of transformers, Common Mode Rejection (CMR).

FIG. 19 TRANSFORMER COUPLING SHOWING MAJOR ELEMENTS



## Common mode rejection

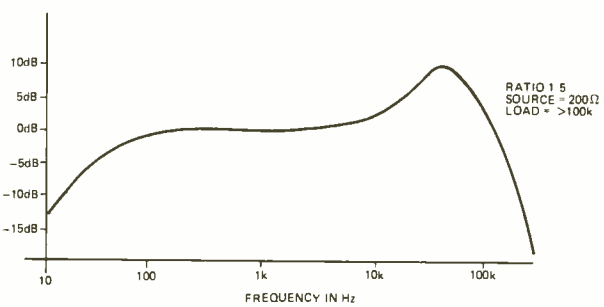
This is the ability of the transformer to ignore signals present in identical amplitude and phase on the two input legs, not transferring them across the secondary as differential information.

Principally, it is imbalanced distribution of capacitance along the length of the two windings, both with respect to each other and to ground that makes CMR less than perfect. Co-winding capacitance has the effect of directly coupling the two wiring masses together permitting common to differential signal passage worsening with increasing frequency at 6dB/octave. Electrostatic screening (a Faraday shield) between the windings helps alleviate, but certainly does not eradicate, co-winding capacitative coupling.

Further CMR worsening can be expected even if the two windings are perfectly balanced with respect to each other, if the primary winding is not end-to-end capacitatively matched with respect to ground. Any common mode signal from a finite impedance source (almost always the case) when confronted with such a capacitatively unbalanced winding sees it as being just that — unbalanced (becoming more so again with increasing frequency) hence again transferring input common mode signals across to become output differential information indistinguished from the wanted input differential source.

Broadcasters particularly are concerned with winding balance, not only on microphone transormers but on line-output transformers too, reasoning that common/differential transference is as likely to occur at a source as at an input.

FIG 20 TYPICAL TRANSFORMER TRANSMISSION RESPONSE




## The real thing

**Fig 19** gives a better idea of what our poor little microphone's signal has to suffer. The winding capacitances (Cp and Cs) form lovely resonances with the inductances, whilst the transformed-up primary winding resistance (rp) added to the secondary's resistance (rs) merely serves to increase the microphone's effective source impedance, hence inefficiency.

The frequency response of the transformer fed from a 200Ω source and measured at high impedance across the secondary looks something like **fig 20,** the lf droop attributable to one or both of the winding inductive reactances becoming relevant to signal impedances, whilst the hf peak is the aforementioned secondary winding self-resonance. Usually the primary self-resonance is fairly well damped by the source impedance but occasionally added cable capacitance can play cruel tricks here, too.

## 'Zorbal' network

The mic amp itself, as discussed, has a pretty high input impedance (MΩ and up) whilst its optimum source impedance is quite defined at around 5 to 15kΩ (if your head still doesn't hurt too badly from accepting that something can simultaneously have two impedances).

It's good engineering practice to consider how the circuit behaves when the operating impedances are no longer defined by the mic ie when it is unplugged. Ordinarily, the sketch circuit of **fig 19**, with the mic disconnected, would probably scream merrily away in oscillation, as would any circuit with a high gain, high input impedance amp terminated only by the collection of vile resonances and phase shifting elements that are an open-circuit transformer. An open-circut impedance-defining resistor (Ro in **fig 21**)

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FIG. 21 BASIC MICROPHONE PREAMPLIFIER SHOWING COMPENSATION COMPONENTS

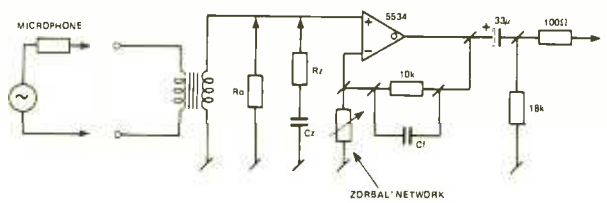
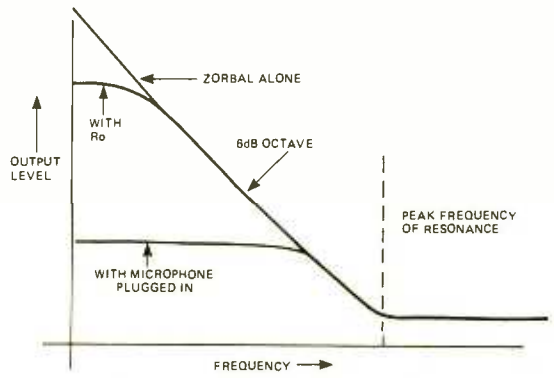



FIG. 22 FREQUENCY RESPONSE OF ZORBAL NETWORK



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of a value 10 or 20 times that of the amp OSL helps tame this, also marginally taming the secondary resonance.

There are a variety of techniques for dealing with this resonance, varying from pretending it doesn't exist through to actually *using* it as part of a front-end lowpass filter. The 'usual' way is to try to eliminate it as much as possible passively prior to the amp, the 'Zorbal' network in **fig 21** representing a typical approach. This is a series resistor/capacitor combination in conjunction with the open-circuit impedance defining resistor. They are calculated to produce a 'step' type response (**fig 22**) which when combined with the hump at the hf end of the transformer response produces a more acceptable roll off characteristic. Naturally, the inter-reaction between this network and the transformer's complex impedance is not quite that neat and tidy, the network capacitance reacting heavily with the transformer inductance, shifting the resonance frequency in the process. It is this which has led to the misconception that the capacitance somehow magically 'tunes out' the resonance.

Open circuit stability is dramatically improved since, as the sketch response drawing **fig 22**, here the network takes an even larger slice out of the overall hf response, keeping impedances at the nasty top end comfortably low.

From another tack, providing the compensating hf roll-off around a subsequent amp in the form of exaggerated feedback phase-leading, even around the mic amp itself (cf), has the advantage that the combination's noise performance at the higher frequencies remains unimpaired by an impedance mismatch resulting from a passive network.

Problems result in several areas. Compensation around the mic amp becomes limited when the electronic gain approaches unity whilst compensation around a late fixed-gain stage means that all stages prior to it, including the mic amp, have headroom stolen at the frequency of the resonance and to a degree of the magnitude of the resonance. This may or may not be a problem dependent on how far the lower side of the resonant curve invades the audio band.

The passive method reduces the magnitude of the resonance, the ultimate lowpass roll-off slope being that of the hf side of the resonance (which more accurately is a lightly damped LC lowpass filter anyway) which is some 12dB/octave. The active method uses an additional 6dB/octave curve in the compensation making a total 18dB/octave, but relies on the resonance being of a manageable quantity to begin with. Consequentially, a measure of both techniques is usually required, their balance and relationship being a long, long experimental process to optimise — for each different type of transformer at that, too.

This enforced filtering is of considerable advantage, helping to keep all sorts of unwanted ultrasonic garbage from finding its way into the mixer, and represents a major advantage of transformer inputs over solid-state varieties.

Further advantageous 'filtering' is the falling source impedance seen by the amplifier at extreme lf due to the winding inductive reactance reducing with frequency — this definitely helps combat the generation of excess lf noise.

There are regretttably two different amplitude response curves to be considered: one, the normal differential input, we have fairly thoroughly determined. The second, by virtue of its mechanism relying on imperfections within the main filter element itself — the transformer — rides completely roughshod over and oblivious to our carefully calculated filter responses. Common mode unrejected signals still appear at the amplifier input as if nothing had happened. Sick, isn't it?

## Input impedance

As we determined earlier, we would end up with better noise performance and cleaner sounds if the microphone looked into a high, preferably infinite, impedance. Preferences apart, we have already had to define the reflected load (input) impedance by the resistor needed to keep the front-end stable under unplugged conditions (Ro) but at least it is an order of magnitude and above working impedances so its effect is small. It does, though, act as part of an attenuator of input signals along with the source impedance and winding losses (**fig 23**). This is the major factor responsible for worsening front-end noise performance using transformers — any attenuation before the optimised amp directly degrades the noise figure, typically between 1dB and 6dB dependent on the transformer.

If the transformer was perfect, it could be assumed that the reflected impedance as seen by the microphone would be constant over the audio band — wrong! At the lf end (**fig 24**), the diminishing inductive reactance (it tends to zero with frequency) becomes a term of greater importance, affecting parallel impedances, attenuation, and hence efficiency. Winding self-capacitances and the passive compensation networks are largely to blame for the hf droop although the list of contributing mechanisms is nearly endless.

A good rule of thumb is that the midband input impedance should exceed 10 times the source impedance, say 2KΩ. Any wild variation in this impedance is obviously going to result in frequency and phase response aberrations — this is probably the greatest single drawback to transformer front-ends.

Attenutator pads, regrettably necessary in many instances to preserve headroom and prevent core saturation with 'elephant' sources should maintain expected operating impedances when introduced. The transformer primary should still be terminated with a nominal 200Ω whilst the microphone should still look at 2KΩ or above. Departure from these will cause the microphone/ amplifier combination to sound quite different when the pad is thrown in and out, as would be expected from altering source and load impedances and complex filter characteristics.

## Transformerless front-ends

Bringing the amplifier optimum source impedance down to that of conventional dynamic mics is possible by means other than transformers. Reducing the ratio of amplifier-inherent voltage and current noises has this effect, being managed by somewhat of a fiddle — namely paralleling up lots of identical input devices — maintaining about the same noise voltage but proportionally increasing noise current therefore reducing the ratio between them (ie noise impedance).

The usual technique is to place two of these multi-device input front-end amps ahead of an electronic differential amplifier, as in **fig 25**. All the amplifier gain is made within the first pair of stages, differentially cross-coupled. This gain arrangement, rather than referring to ground, greatly assists the ignoring of common-mode signals. Differential input signals are amplified since the reference for each of the two amps is the other amplifier, tied to an

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FIG. 23 FRONT-END ATTENUATION-WORSENING NOISE FIGURE

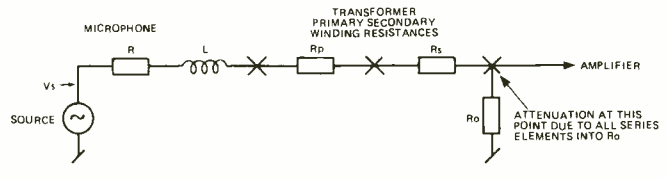



FIG. 24 TYPICAL INPUT IMPEDANCE CURVE

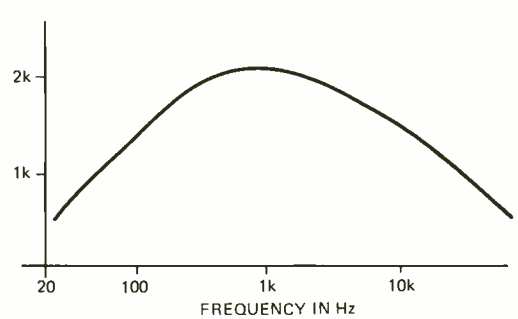
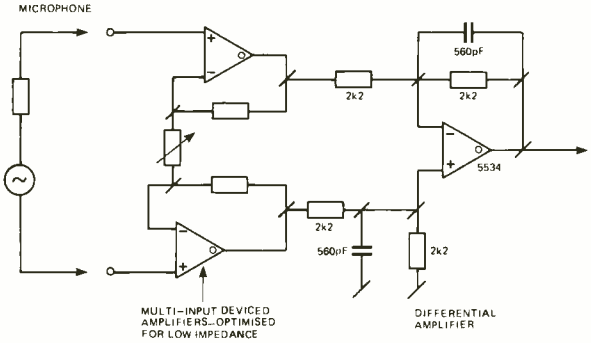



FIG. 25 BASIC TRANSFORMERLESS MIC-AMP ARRANGEMENT



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identical signal of opposite polarity.

If the input signals to the two amps are identical in phase and amplitude (common) the references for each of the amps are waving up and down identically to the signal — there is no voltage difference for the individual amps to amplify: presto, no gain. For ordinary differential input signals, the amplifiers operate conventionally, their 'ground' reference being a zero voltage point half way along the gain-determining variable resistor. This point is a cancellation 'null' between the opposite sense polarity swings of the two amps.

These amplifiers feed a conventional electronic diff amp running (usually) at unity gain, and in order to maintain stage noise as low as possible, the resistors are made as low in value as the devices can sensibly stand. Optimisation of impedances is not necessary since the outputs of the front-end pair can be assumed to be feedback zero impedance. This arrangement is unmistakably a bastardised 'instrumentation amplifier' which is a well-documented circuit configuration, the only thing of remark being the low impedance optimised front-end stages.

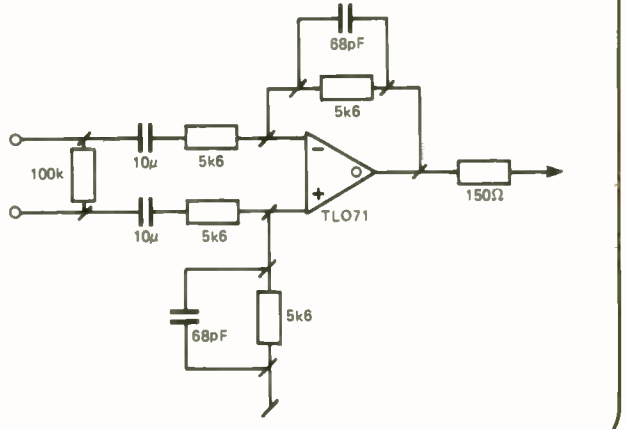
Although potentially offering far higher and flatter input impedances than transformer inputs there are, as always, hang-ups. Common-mode signals directly gobble up headroom in the first pair of stages even if those are operating as followers and they are subsequently cancelled in the diff amp. There is also the great danger that common mode signals (in addition to normal differential signals) can exceed the input swing capability of the input devices.

RF adores base-emitter junctions, this configuration giving it lots to play with. Filtering mic inputs sufficiently without sacrificing noise performance or input device hf gain (hence hf distortion, etc) is not a simple task.

Line inputs are commonly simple differential amplifiers, rather than unity-ratio transformers, similar to the one used in the transformerless mic amp, but with the resistor values elevated to bring the differential input impedance up to over the 10KΩ required of a bridging termination (**fig 26**). Noise of these stages is directly attributable to these resistor values, so the lower the better. An instrumentation amp configuration would seem to offer possibly better performance for noise (the diff amp resistor values may be small) but entails the use of undesirable voltage followers (see Part 3, November issue) with potential stability problems, voltage swing limitations and unprotected (for RF) input stages. At least with a simple diff amp the impedances are comfortably low and the inputs buffered by resistors from the nasty outside world.

The dc blocking series capacitors have, unfortunately, to be large in value to maintain an even input impedance at the lowest used frequencies and, being necessarily unpolarised, physically large and expensive. A small price to pay, though, for such a delightfully simple but important circuit element. ■

FIG 26 AN ELECTRONIC DIFFERENTIAL INPUT AMPLIFIER




# More on Op Amps

Please note that **fig 12** was wrongly included in Part Three of this article (November issue) and is referred back to in Part Four. The reference to **fig 12** on page 63 should read **fig 13e**. We apologise for this error.

## Front-end instability

Altogether the most obscure potential instability causing effect relates directly to the behaviour of the input stage in bipolar front-end op-amps. The gain/bandwidth characteristic of the input differential stage is greatly dependent upon the impedance presented to the input, the gain/bandwidth increasing with reducing source impedance. There is the possibility that given an already critical circumstance, the erosion in phase margin due to this effect can cause instability. This can be mitigated by limiting the gain/bandwidth excursion by means of a resistor, typically 1kΩ, in series with the input. Ordinarily, this would have little effect on circuit performance but may, especially in say mic-amps, detract from noise performance which is largely dependent on the amplifier being fed from a specific source impedance, of which 1kΩ would be a sizeable proportion. However, it's usually fairly easy to arrange that the IC doesn't have a zero impedance at either of its inputs in the design stage.

Fortunately, this is a problem that FET-input op-amps do not have, owing to the far greater isolation between the FET gates and their channels.

A similar approach to that proposed for output isolation ie an inductor rather than a resistor, in series with the affected input is, on the surface, an equally good idea. The inductor's impedance would be low at audio (so not affecting noise criteria significantly) and high at rf where the low source impedance phenomenon does its dirty work. Unless the value is critically defined, an inductor of sufficient value to provide a usefully high reactance at rf is also likely to be self-resonant with circuit stray and its own winding capacitances at a frequency probably still within the gain/bandwidth capability of the amplifier. Attempting to solve one potential instability by introducing a resonant tuned circuit doesn't really win many points.

## Band limiting

One of the first great superficially appealing results of using the enormous feedback inherent from using op-amps at the relatively low gain requirements of the audio world was a close approach to 'dc-to-light' frequency response. The author well remembers hysterical peals of laughter as a new mixer's response was measured as still ±0 right to the end of the testing oscillator's ranges and the badly disguised puzzled looks and worried glances when we listened to it.

Those who have experienced design with discrete circuitry will not be surprised that this source impedance instability effect is also the reason emitter-followers were the most instability prone of the three basic transistor amplifier configurations, also that the cure was the same. Not only does the series resistor limit the source impedance before zero, it also acts together with any pinout and base-emitter capacitance as a lowpass filter helping to negate further external phase-shift that may detract from stability.

This base source-impedance instability is quite insidious in that it can either contribute to instability of the amplifier loop if it is already critical or be a totally independent instability local to the affected devices—nothing whatsoever to do with the characteristics of the external loop.

Most audio signals, especially live ones from microphones and tape machine returns with a high bias content, have present a fair amount of ultrasonic energy which would remain ultrasonic if it weren't for the progressively worsening linearity and propagation delay of the amplifier effecting cross-modulation of these out-of-band signals down into the audible range. The linearity worsens because the amplifier's open-loop gain is falling rapidly with frequency enabling less and less feedback to be used (the feedback being that which is keeping it linear anyway) whilst the finite transit-time of the amplifier becomes a significantly greater part of the signal's period as frequency increases, meaning that servo-loop inaccuracies in the circuit assume greater proportions in the output signal.

Slew-rate limiting occurs when the fastest signal rise-time the amplifier is expected to pass exceeds the speed of the fastest stage in the amplifier giving rise to intermodulation effects that are dependent upon both frequency and signal level. A common subjective result of this limiting is for the high-end of a drum-kit to change in character of sound with differing levels of lower frequency instruments on which it is 'riding'. Another favourite is the 'disappearing snare drum' in which again the sound radically alters with changing level.

So much for the expected result of 'improved transient response' through having a wide-open frequency response. As is now obvious with hindsight, deliberately limiting the mixer's input frequency response to a little more than the audio band results in an amazing clean up of the sound. By removing a lot of the inaudible signals that cross-modulate within themselves, and with in-band signals, you eliminate the cause of much of the lack of transparency and mush that had become the trademark of first-generation IC op-amp consoles.

Despite improved devices, this remains valid today. By band limiting the programme signal as

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early on in the chain as possible to reduce inaudible signals, there is far less chance of them generating unwanted audible products. A front-end single order lowpass filter, operating in conjunction with all the other lowpass effects of feedback compensation arrangements throughout the console should provide adequate minimisation of these products, given modern devices.

'Purist' arguments about the undesirability of any deliberate filtering seem rather futile in a world of real devices and final signal destinations such as tape (with its generally anything other than linear phase and frequency characteristics), disc (oh, disc), radio (rapid filtering above 15kHz) or digital processing/recording (very, very rapid lowpass filtering to avoid frequency 'folding' or aliasing).

## Where to?

Modern console design's proliferate use of amplifier elements has mushroomed in recent years with the availability of compact and extremely low cost IC op-amps. Increasingly complex functional blocks are becoming increasingly commonplace—if in order to improve their electrical and sonic characteristics it would mean an increase in size and cost of well over an order of magnitude would they still be quite as popular? In the 'good old days' of valves it was not through any lack of expertise that equalisers even of today's complexity did not exist, it was just the size and cost of the concept that would have made even reckless men shudder. Also, it is to be noted, they were not really thought necessary.

Could it be that the next level of enlightenment in consoles is going to demand more simple and concise systems traded for a far higher and thorough level of elemental electronic design?

## Op-amp theory

Whilst there is no intention of turning this article into a beginner's guide to electronics, a brief description of the four main amplifier configurations used in op-amp circuitry could be useful. Almost all the circuitry in this series is based around these four formats, with very few exceptions, so a grounding in their characteristics will greatly facilitate finding your way around and understanding later circuits.

The op-amp is a 3-terminal device (**fig 13a**) labelled '+' '−' and '0'. They are normally operated between a split or differential rail of some ±15 to 18V, the junction between the supplies being called 0V and tied to the ground reference. All voltage and currents are measured and quoted with respect to this ground. For simplicity's sake power supply connections aren't shown.

The '0' terminal is obviously the output and is normally quite a substantial configuration capable of delivering some 20mA of either polarity, or put another way is capable of delivering its full output voltage (a little less than the rail voltage) into a load resistance of 1kΩ. The '+' and '−' input terminals are known as a differential input. If the − input is held steady at any voltage, and the '+' input moved from that same voltage in a positive direction, then the output voltage will rise positively at a rate of the input voltage change *multiplied* by the op-amp's quoted open-loop gain (for a 'TLO' some 100,000). Hence for a 100μV rise in voltage on the '+' input, the output voltage will rise 10V. If the '+' input moves negative of the − input voltage then the output voltage will go negative with respect to ground, again by the input voltage change times the amp's open-loop gain.

It doesn't really matter which of the inputs is held stable while the other one moves. If the '+' input is tied and the '−' input moved, then the output will still move to an extent determined by the gain but in the inverse polarity to which the input is moving. The '−' input is called the 'inverting input' because the output voltage changes in the opposite direction to the input, whilst the '+' is called the 'non-inverting input' because it moves in the same sense.

The real trick to the op-amp is this—if the two inputs are tied together and moved up and down in voltage, with an idealised unit the output will remain stationary at about 0V. This is called the common mode rejection characteristic. It is only the difference in voltage between the two inputs that causes the output to move, to a resultant voltage of the differential input voltage multiplied by the open loop gain.

OK, so now we have an amplifier with about 100dB gain. Very useful (ahem!). How do we go about making it give more usable amounts of gain, and defining that gain?

**Fig 12a** shows the basic 'voltage follower'. As the '+' input voltage rises, the output voltage rises also, pulling up the '−' input with it. The output cannot rise too far, though, or its effect on the '−' input would be to drag itself down again. A state of equilibrium is reached where the '−' input voltage balances against the '+' input, therefore maintaining the output voltage very close to that of the '+' input. Since op-amp inputs are of relatively high impedance, this configuration is used extensively to buffer critical circuitry away from a heavy or widely varying load.

A variation on the follower is the non-inverting amplifier shown in **fig 12b**. Here the output is removed from the '−' input by an attenuating voltage divider R1 and R2. As the '+' input moves, the amplifier again sets up an equilibrium between the '+' and '−' outputs as in the follower, only now in order for the '−' input to move as far as the '+' input to achieve the balance, the output has to swing far enough to overcome the attenuator. Hence the output voltage is the input voltage multiplied by the ratio of the total feedback network (R1 + R2) to R1.

The inverting amplifier (**fig 12c**) is really the same configuration but upside down with the input signal injected into one of the gain determining resistors.

If the input voltage rises, then the '−' input will try to rise above the '+' input, tied to ground. The output will drop to pull the other end of the resistor chain down so that the '−' input is back in balance with the '+' input. This way the amplifier always maintains the '−' input at virtually ground potential. The output voltage is thus determined directly by the ratio of the two resistors (since the bigger a resistor, the greater the voltage needed across it to drive the same amount of current through it—Ohms law) with the output voltage inverted with respect to the input.

Any number of source resistors can be tied into the '−' input. The output will generate an equal and opposite (given, as in **fig 12d** that all the resistors are equal) voltage to the sum of all the input voltages. The '−' input still remains very close in potential to ground, so any individual source resistor is looking at a virtual ground and its signal is therefore isolated from all the others. Tra-la! The virtual-earth mix-amp!

The last configuration (**fig 12e**) is really a combination of the inverting and the non-inverting amplifier configurations. This is the unity-gain differential amplifier. Here importantly, the output voltage is determined only by the voltage difference between the two inputs, irrespective of their relation to ground. If the non-inverting input is grounded, with the floating ground-free input source still connected between the inverted and non-inverted inputs the IC '+' input will be to all intents and purposes grounded, so the output voltage will just be an inverse of the input voltage. If the inverting input is grounded instead, the input voltage will be attenuated to half its value by R3 and R4. However, since the amp is now operating as a non-inverting follower with a gain of two (determined by R1 and R2) the output voltage is at unity gain and non-inverted with respect to the input signal. Ungrounding the inverting input and feeding the entire configuration with a floating source will give a unity output with respect to its differential input. One more neat feature. If the inv and non-inv inputs are tied together and the source voltage is applied to them with respect to ground, no output will result. Why? because the circuit is simultaneously behaving as a unity gain non-inv amp and as a unity gain inverting amp—result total cancellation. Well, nearly total. The degree of cancellation is a measure of the circuit's Common-Mode Rejection Ratio.

Nearly all the circuitry you are ever likely to come across in any op-amp orientated bit of gear is likely to be made of these or combinations of these circuitry elements. The main exception to this rule, at least in the circuits to come, are where the devices are being used as dc control signal conditioners such as voltage comparators in peak-overload indicators and limiter sidechains, and in the non-linear quasi-logarithmic curve generator for the PPM drive amp, together with the precision rectifiers.

As comparators, op-amps are really quite efficient. The purpose of a comparator is to wave a flag when voltage exceeds a specified level. Going back to the basic op-amp characteristics for a moment, we know that if our '−' input is tied to a reference voltage, when the '+' input is below that, the output will be negative and when above the output swings positive. The only ambiguity occurs when the two inputs are very close in voltage—in face within 300μV of each other, then it behaves as an amplifier with its enormous open-loop gain, the output dithering somewhere between the extremes of the output swing. Still, its unambiguous enough in the real world!

A minor snag to this is that some op-amp types (such as the *5534*) have diodes strapped internally between the '+' and '−' inputs, so trying to use them as comparators causes instant fry-up. Mind you, if you're lunatic enough to want to use a *5534* as a comparator, you deserve to blow it up!

Another basic circuit worth exploring here is a halfwave precision rectifier. The diode (**fig 12f**) is included in the loop from output to '−' input, the halfwave output being taken from the '−' input, not the op-amp's output. The output rises 0.7V to overcome the forward drop across the diode, whilst the input is positive, still enabling the '−' input to balance the '+' input, following for the positive half-cycle. In the negative half-cycle, the diode is reverse biased, the op-amp has no feedback and the output swings hard negative, but the '−' input stays tamely tied to ground by the resistor, having a value far less than the diodes' reverse leakage. ■

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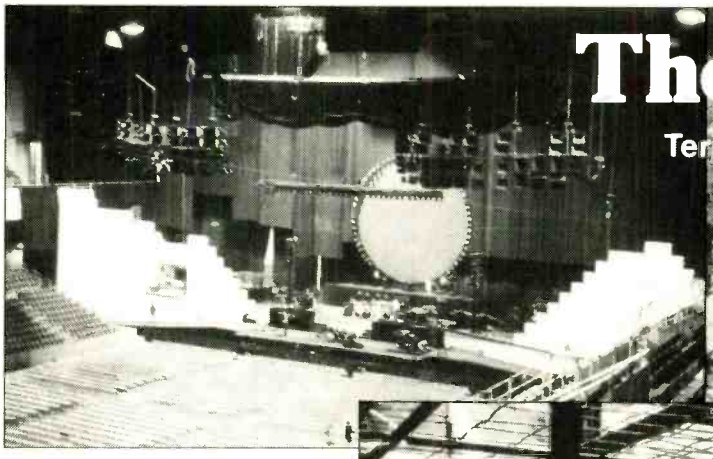
# The Wall

Terry N...



*(above left) General view of the stage including the main PA*
*(above right) Mix area*
*(below) Midas stage monitor desks*

DURING August 4-9, the Britannia Row 'transportable' studio was at Earls Court for the stage production of *The Wall*, performed by Pink Floyd. While hardly the ideal studio environment, Earls Court would appear to be a better proposition than the Wembley 'boom' box. Certainly the sound quality was excellent and certain people commented on the fact that the sound was more hi-fi than rock'n'roll. If by this they meant smoother then I would be the first to agree, though the system by no means lacked punch and Pink Floyd are hardly the average rock'n'roll group.

For *The Wall* a new system was used for the main stereo PA and completely flown with a resulting even distribution throughout the auditorium. The components were mainly Altec and consisted of the new *Manta Ray* constant directivity horns with the various models covering mids and trebles in medium and longthrow formats and coupled to Altec drivers. The bass end was via Altec twin 15in (38cm) front horn loaded cabinets but with Gauss drivers. In addition to the flown system, subwoofers consisting of twin 15in ported cabinets — all Altec — were placed around the arena under the side tiers. With the main PA cutting off fairly sharply at 50Hz, the subwoofers came in at around 80Hz and were mainly used for the special effects though they were sometimes brought in to reinforce bass guitar and keyboards. The left, right and rear stacks that form the three quad stations (the main PA is injected with the fourth quad signal) were the habitual Court Acoustics/JBL based systems. Power was provided by Altec *9440As* for the low end and Phase Linear *700Bs* for the rest. The stage monitoring system was a mixture of wedges for 'spot' monitors and high quality 3-way setups for general use. It must be mentioned that the actual volume onstage was surprisingly low and thus prevented a lot of clutter in the microphones and muddying things up.

Another factor that helped things along was the treatment of the auditorium acoustically. The arena itself was screened from the rest of the hall by heavy drapes and this with the audience — which always makes a good absorber! — helped to cut down reflections considerably. The large banners with the crossed hammers that gave the hall the atmosphere of a political rally also acted nicely as traps as well as cutting down appreciably reflections in the high end from the ceiling. The backstage area was also effectively screened by drapes and the stage itself carpeted in most places. Though visually unobtrusive, the two drumkits on the main stage were surrounded by extremely thick sheets of foam rubber which further contributed towards good separation. These dispositions may not have been ultra-sophisticated but it just showed that even simple attempts at treatment in difficult acoustic conditions are well justified.

With the complex staging that *The Wall* involved, such as the group playing on two different stages during the course of the performance, the number of mic lines needed to service two stages was quite considerable, or to be more precise, 104! For the stage monitoring alone two Midas 24/8 monitor desks were used, one for each stage, which could be crosslinked if necessary. House mixing was under the direction of James Guthrie — who also mixed the album — who had two assistant engineers to provide the extra pairs of hands. To cope with the number of mic and recorder channels no less than five Midas consoles were used, together with two Aphex VCA grouping consoles. The Midas custom built Pink Floyd console was naturally in attendance but minus one wing and it was this that had led to some technical problems. The missing wing having been lost in the Alexandra Palace fire three weeks previous to the concerts, there was no time for Midas to get a custom 20/8/2 desk out in time. However, they were able to get a routing panel as used on the Floyd desk to interface in with a standard Midas console and thus to the master section. Sod's law being what it is, this was not without its little problems, not the least being one of phasing where at one point during rehearsal half the PA disappeared into a beautiful null point when a master fader on the modified desk was brought up!

With the complexity of the system and especially all of the cross-patching involved, fault finding is a nightmare and all credit is due to the technical staff for getting things sorted out the way they did. In attendance to the consoles were two rows of rack cabinets — or as Robbie Williams of Britannia Row put it, the Earls Court AES show — full of all the ancillary equipment for the PA and the special effects such as comp/limiters, harmonisers, flangers, *Scamp* rack, ddls, etc. They even had a Lexicon *224* but with the Earls Court acoustics Robbie didn't think that they would be using it somehow! For the special effects tapes and backing tracks 1in tape 8-track recorders were used, these being a Soundcraft and an Otari, with a Brenell *Mini-8* there as backup. In the interests of synchronisation, the three 35mm cinema projectors and the Soundcraft were Maglinked together. All recorders used dbx noise reduction.

To give increased mobility and freedom of movement on stage, bass and guitar used transmitters — with two receivers being used on guitar for better resolution. Roger Waters also made extensive use of the new Vega radio microphone which gave a very good account of itself. The radio show did not end there as the same Mr Waters also used radio receiver headphones for foldback and cue which had been specially made by Vega. The combination of radio mic and 'phones made for exceptional mobility and it seemed to work very well.

For the concert the Pink Floyd were augmented by four musicians — guitar, bass, drums and keyboards — and a vocal quartet. Throughout, the clarity was exceptional and though things got loud at times it was never too loud! Rather than talk about power and watts, it is easier to talk in terms of spl, with an average of about 102-103dB going up to possibly 115dB in the loudest passages. At no time was the system under strain or into distortion so that dynamics were handled cleanly and with effect. Such a difference from situations where from the start the PA is at its limits before being taken into overdrive.

*The Wall* concerts demonstrated once and for all that live quality sound is a most exciting media. Did it sound like the record? I would say similar but with far more punch and presence and this time there was room for the musicians to stretch out. Record and live are not the same. Was it worth it? An unqualified 'yes' on my part, but then, perhaps I'm biased! ■

Thanks are in order to Robbie Williams of Britannia Row and his staff for having us along and taking time out to explain the system.

# business

BARRY FOX

## Blooming booms

To shoot sound direct, or to post dub, that is the question. In the early days of sound film, microphones were of such low sensitivity that they had to be hidden as close to the actors as possible, usually inside an in-shot telephone or bunch of flowers. And then came the boom mic, which cameramen have been anxious to get rid of ever since. Small wonder. Even after 50 years they still haven't learned to keep them out of their shots. Two films I've recently seen show the boom in so many shots that it's a wonder 'mic' isn't listed under the appearance credits. *Old Boyfriends* features full frontal boom mic throughout an entire indoor sequence, but *Dr Phibes Rises Again* goes one better. A boom mic dangles into the top of the frame so often that it soon seems a safe bet that any boomless sequence must have been shot without sound for post dubbing. Even *Saturday Night Fever* features several booms in shot.

There's one place where film and TV crews can't use a boom mic—at a boxing match. When you see a prize fight film like *Rocky* and *Rocky II* the match sequences carry all the audio impact of a ring-side seat. But when you see a boxing match live on TV there's something very audibly missing. For feature films the sound of each punch is post-dubbed as an effect to alarming effect. But in reality only open hand slaps make a noise which carries out into the arena. This presents very real problems for TV or newsreel filming. Some sound is picked up by mounting very directional gun mics alongside the fixed position TV cameras. These are usually around 60ft from the ring and with zoom lenses can give anything from long to fairly close shots. The really tight close-ups are handled by portable cameras handheld by operators right down at the ring canvas edge. These cameras usually have a small mic mounted on top so that as the camera follows the action it follows the sound as well. But even directional mics will pick up sound from the crowd behind the action and relatively little sound comes out of the ring. Hence the rather flat sound of fights on TV. So why on earth don't the OB units covering boxing matches adopt the technique which has now become almost standard practice for stage musicals? Rows of directional mics are strung along the footlights and over the stage with a sound engineer riding the faders to track the actors as they move to speak and sing. If an OB unit mounted downward-pointing mics in the lighting rig which hangs directly above the boxing ring and employed a sound engineer who was also a boxing enthusiast to ride the faders as the boxers move around the ring, the results could be a sensational improvement in audio atmosphere for boxing telecasts. Who'll be the first to try it?

## And the music goes round

From the USA comes news of a $5,000 cylinder phonograph machine. Although it's being offered by Art Shifrin (PO Box 128, Little Neck, NY 11363) as ideal for the "audiophile or record collector who has everything and fancies dusting off a collection of old cylinder records" there's much more to it than that. Doubtless a few audio nuts with money to burn will buy Shifrin's cylinder player for personal use but it is expected that most will be sold to sound archivists and libraries.

Art Shifrin was commissioned to look at the problem of transcribing old cylinder recordings for the motion picture and sound recording branch of the US National Archive. Of course, on the face of things there shouldn't be any problem in mounting an old cylinder on a modern motor drive and tracking it with a modified tangential tracking arm, as used in some modern hi-fi systems but it's not as easy as it sounds. The tracking arm (Shifrin used a Rabco) has to be heavily modified to accommodate the fast tracking rate required for cylinders of a wide groove pitch. The pickup cartridge (Shifrin used a Stanton) and preamp should provide a flat response so that equalisation "to taste" can be worked out on a trial and error basis using the resultant master tape. This saves wear and tear on the soft or brittle cylinder. Perhaps most important of all the cylinder drive should have a half-speed capability.

Many old cylinders, especially celluloid Edison Blue Amberols, are very badly warped and will cause the arm to bounce out of the groove if played at full speed and with a light tracking weight which is safe for the fragile old material.

In the press puff for his exotic product Shifrin makes the valid point that most cylinders were recorded on equipment of higher quality than that then available to play them back. So there is audio quality locked into old cylinders that their original owners never heard. In fact the same can be said of virtually every recording medium ever developed.

Cylinders, shellac discs, tapes, especially early cassette tapes and modern LP discs have all had locked into them more quality than the average contemporary domestic playback system has been able to extract. It is only over the last few years that this has changed with run-of-the-mill domestic reproduction equipment starting to outstrip disc pressing and cassette duplication standards and so laying their inadequacies bare to create dissatisfied customers.

The situation also offers a cautionary moral for the future. Any digital recording standard should look to the future, in respect of sampling rate and numbers of bits. Pity the poor record company which in years to come starts to reissue old digital master tapes and finds that through original adoption of an inadequate sampling rate and word length their reissues are of lower digital standard than whatever has by then become the everyday digital reproduction system.

## Language translator

A new gadget from Texas Instruments, a speaking language translator, could one day have a valuable spin-off for recording studios. There are already several pocket computer translators on the market which give a visual readout in one language, of words or phrases keyed in using a different language. The Texas translator uses the speech synthesis circuit also found in the Texas *Speak and Spell* which helps children learn to spell by speaking random words from a 240-word vocabulary, accompanied by a visual display of the spelling.

The synthesis circuit uses three chips: a ROM for storing instructions, a synthesis chip incorporating signal generators and digital filter, and a controller which is a slightly modified calculator chip. Speech is produced by feeding the filter with a raw sound input and doctoring the signal under control of data from the ROM. Raw pitched sounds are fed into the filter to provide a basis for voiced sounds and random noise is used for unvoiced sounds such as S, F and SH. The Texas trick, which enables a ROM of manageable size to store a useful number of words, is to draw only enough data from the memory to control whatever changes in the filtering are necessary. This takes advantage of the redundancies inherent in natural speech such as the sustained sound of a vowel.

Solid state memory capacity is currently increasing tenfold, every five years, so the current language speech modules which contain around 700 words should soon offer around 7,000. As these words can be combined and re-arranged more or less at will it shouldn't be long before studio engineers, producers and musicians will be able to use a synthesis translator to communicate irrespective of language barriers. Press a button sequence on the keyboard and every musician in the studio hears "Let's take that again" through the cans, in whatever language the producer wishes. By using remote readout, a message keyed into the translator in the control room can silently appear on LED displays dotted around the studio.

Translation and speech synthesis circuitry of this type offers practical jokers unlimited scope. By removing the ROM, or keying in combinations of unrelated phrases, it's possible to throw the poor beast into pathetic confusion that will engender sympathy in all but the hardest human heart. There's something very sad about a computer which keeps repeating "I have lost my where am I" or "How do you spell gurgle gurgle gurgle" in four languages after a cruel engineer has tampered with its brain ROM.

## Golden blunders

It's easy for a crooked record company to screw artists over royalties. If, for instance, the presses just happen to 'run on' for a while after the official production run has stopped or if a batch of faulty discs is re-packaged and sent out to the trade again instead of being destroyed, the result is a nice bonus of royalty-free income. Of course, just once in a while, biters are bit.

A few years ago a South African company (not exactly noted for its accuracy in royalty arithmetic) made the fatal mistake of proudly awarding one of its artists a gold disc for bumper sales. Subsequently they sent him a royalty cheque based on a fraction of the sales total needed to qualify for a gold disc.

The company was thus in a cleft stick; either say that the gold disc award was phoney or pay the artist royalties based on the gold disc figures. Reluctantly they chose the latter as the lesser of two evils. ■

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| Input | + 18 dBm. |
| Output | – 10 dBm – + 12 dBm |
| Ratios (Slopes) | Variable 1.5 – 20:1 or out. |
| Threshold | Automatic. |
| Attack | 500µS – 5 ms, auto dynamic. |
| Release | 15 ms – 4 secs + auto. |
| Size | 1¾" x 19" x 7½" (44.45 mm x 482.6 mm x 190.5 mm) |

*Export packed with illustrated instruction manual.*

**Audio & Design (Recording) Ltd.,**
North Street, Reading, Berks. RG1 4DA.
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PO Box 786, Bremerton, WA 98310 U.S.A.
Telephone: (206) 275 5009. Telex: 152426 a/b ADR USA.

DAL 9380

# Prosound 80 Exhibition~a report

The inaugural Prosound Exhibition held during early September at the West Centre Hotel in London, was a rather subdued affair which suffered indifferent attendance by visitors. Much of the lack of industry interest can no doubt be explained by the fact that Prosound was the third professional sound recording exhibition held in London this year (the others being AES and APRS). However, it seemed a shame that the organisers' and exhibitors' efforts met such a disinterested fate, especially as the venue and actual exhibition organisation were excellent.

With three exhibitions in the space of six months new products were not exactly in abundance. However, a number of items caught the eye. Foremost amongst the new products displayed was the *16:4:2* PA console from Allen & Heath. Although this will be the subject of fuller coverage in our New York AES report (when more details should be available) I was able to unearth brief specifications. As its name implies the console is a 16/4/2 mixer, extremely compact and tidily designed. Its features include transformerless balanced mic *XLR* inputs; ¼in jack line inputs; comprehensive push button routing; auto solo; four subgroups plus two main outputs; two routable echo returns plus solo; talkback facilities; stereo monitor tape return; six illuminated VU meters; and long travel 90mm input/output faders.

Audio Technica showed its new *Artist* series of dynamic and condenser mics. Notable for his enthusiasm was the company's Japanese demonstrator who took great delight in knocking hell out of the mics (via the floor, table edge and any other solid objects near at hand) in his determined efforts to illustrate how durable to 'shock' treatment the mics were. Not being a solid object I managed to avoid being the subject of a mic attack and can vouch for the fact that despite treatment even roadies or the most ill-feeling of studio engineers are unlikely to dish out— the mics worked perfectly. For those readers who feel in the mood for a bit of mic bashing the mics comprise the dynamic types (*ATM21* and *ATM21S* cardioid instrument mics; the *ATM41* cardioid vocal mic) and the following condenser types (*ATM10* omnidirectional instrument mic; *ATM11* and *ATM11SM* cardioid instrument mics; and the *ATM31* and *ATM91* cardioid vocal mics). Prices are £40 to £75.

Staying with mics, Shure introduced three new dynamic models, these being the *SM77* and *SM78* cardioid types and the *SM63* omni. Having lightweight aluminium alloy cases the mics are of compact design and include the usual Shure rugged construction and protection from handling and wind noise. The *SM63* and *SM78* are intended for vocal usage, while the *SM77* is intended for instruments.

Still with mics, Electro-Voice showed its established range of dynamic and condenser vocal and instrument mics, including its *Pro-Line* range. A new addition to the latter range was the *PL80*, a dynamic super cardioid vocal mic with in-built pop filter, proximity effect bass boost, and a frequency response of 60Hz to 17kHz. Electro-Voice also showed its recently introduced *XEQ-1* single channel, 19in rack mount electronic crossover/equaliser which combines an active 2-way frequency dividing network with a 5-position 'Thiele' lf equalising network and a continuously variable hf horn-driver equaliser. Electro-Voice additionally displayed a number of new items from sister company Tapco including the *C-12* 12/4/2/1 format mixer. This features routing of pannable inputs to any of four subgroups, plus simultaneous stereo and mono outputs. Other features include 48V dc phantom powering ±18dB lf and hf eq at 50Hz and 15kHz; and sweepable mf eq of ±12dB over the range 300Hz to 6kHz. The *C-12* may be expanded in 8-input stages by adding *C-8E* expander units. Other new items from Tapco were the *CP-X* 2-channel electronic crossover for biamplified loudspeaker usage; and the *C-201* and *2202* 2-channel, 10-band single octave graphic equalisers.

On the subject of graphic equalisers, Ban Electromusic the UK distributors for the Yamaha range of mixers, amplifiers, etc showed the new Yamaha *Q1027* ⅓-octave, single channel graphic equaliser. This is a 19in rack mount unit supplied with a tamper-proof acrylic cover, and provides 27 bands of ±12dB boost or cut. The unit features active filters, a bypass switch, and a switchable 18dB/octave highpass filter which may be switched to operate at 40 or 80Hz or out of circuit.

Audio Reinforcement Services showed its professional conversions of the respected Quad *405* power amplifier, available with either rear of front mounted Neutrik 3-pin *XLR* connectors and screwdriver operated input sensitivity controls. In addition the company displayed an example of the new *Taurus* power amplifier, but unfortunately were unable to give me a detailed specification as the units are only at the prototype stage and modifications are being considered. One other item which the company was displaying was the Brooke Siren Systems *AR117* phantom powering adaptor unit which allows the *AR116* DI box (see news pages April, 1980) to be powered from standard mic phantom powering through the unit's cable connection to the DI box output.

Rebis Audio featured its modular *RA200* series of signal processing equipment. Several new items were available for this range including a rear rack mounting power supply unit; the *RA200J* 4-way GPO jack connector module; the *RA212* mic/line amplifier module; and the *RA213* and *RA214* mixer/distribution amplifier modules. The *RA212* features balanced mic and line inputs, highpass filters at 75Hz and 150Hz, a switchable 15dB/30dB pad, LED overload indication, and a high impedance input which will accept unbalanced high impedance mics or direct feeds from instruments.

The *RA213* is a 4-channel mono mixer incorporating clean feed outputs from each channel, plus the facility to provide four aux outputs with level control when used as a distribution amp. The stereo *RA214* mixer/distribution amp allows mixing of two stereo inputs into one stereo channel, each input channel having level and balance controls plus a stereo clean feed output. As a distribution amp the stereo signal is fed to both pairs of inputs, the clean feed outputs then providing two pairs of aux outputs, again with level and balance controls.

Don Larking, the UK agent for BEL showed the *BA40* delay line/flanger which is available in balanced or unbalanced input versions. A versatile 19in rack mount unit, primarily aimed at the budget studio market, the *BA40* offers up to 160ms of delay with a minimum bandwidth of 4kHz; an ADT mode with up to 40ms delay (18kHz bandwidth); and a flange mode with up to 20ms of delay. Dynamic range is 90dB and the unit has controls for mix, regeneration, and manual or auto sweep. Outputs are pseudo stereo and the *BA40* may be externally controlled.

MM Electronics showed the new PACE *DM Series* mixing consoles, these being expandable from 8/2 up to 32/8, featuring a centralised microprocessor routing system to handle channel assignments and to store up to 16 complete mixes. The console's input channels feature VCA control, and the following facilities: channel fader; overload and channel 'on' LEDs: mute and PFL switches; pan, two echo sends; foldback control; switchable lf cut at 100Hz; 4-way equalisation (±15dB at 70Hz, ±10dB at 400/800Hz or 1.5/3kHz, and ±15dB at 10kHz); mic/line pad; and input gain control. The auxiliary section has a headphone outlet; foldback master send and PFL master send faders; echo master send controls; mixdown monitor sends; headphone source selection switches; and a LED matrix level indicator. The output module features echo return and output faders; mute and PFL switching with LED indications; autofade speed control; monitor pan; mixdown monitor volume control; and stereo LED level indication. The microprocessor routing system which is incorporated into the 4- and 8-output models, features 8-bit processing; digital display of channel and group routing; channel-to-group routing from a single keypad; and the facility to provide instant, noiseless drop-in's during recording. Channel and group selection is via a numeric keypad, while functions (enter input, enter output, preset patch, look patch, load routing, cancel routing) are via six function keys.

Studiomaster/Recording Studio Design were displaying their products for the first time at a UK exhibition. From RSD there was the *12/2* mixer which may be expanded in 4-input module sections up to a maximum of 24 inputs; the *800B* stereo power amplifier offering up to 220W per channel into 8Ω at 1kHz; plus the company's 3-way and 5-way stereo electronic crossovers. Meanwhile, from Studiomaster there were the *12/2B* and *16/4* mixers again with 4-channel expander modules; 16/8 and 20/8 consoles; and two stereo power amplifiers— the *800C* (225W/channel into 8Ω at 1kHz) and the *400C* (112W/channel into 8Ω at 1kHz)—both units featuring *XLR* inputs and outputs mounted on the front panel fascia. Collectively the units appeared to be well made and the facilities were well thought out. Accordingly, at the bottom end of the studio market I would foresee the units having a healthy future.

Overall, Prosound 80 was an interesting exhibition which made a valiant effort to fill the gap between the professional sound exhibitions and the more consumer and budget orientated music industry exhibitions. That it did not receive the attention it deserved from visitors was unfortunate, but not totally surprising considering the glut of sound exhibitions in the UK this year. Whether the organisers will persevere with the exhibition next year remains to be seen. However, I feel there is room for this exhibition and hope the organisers will try again. **Noel Bell**

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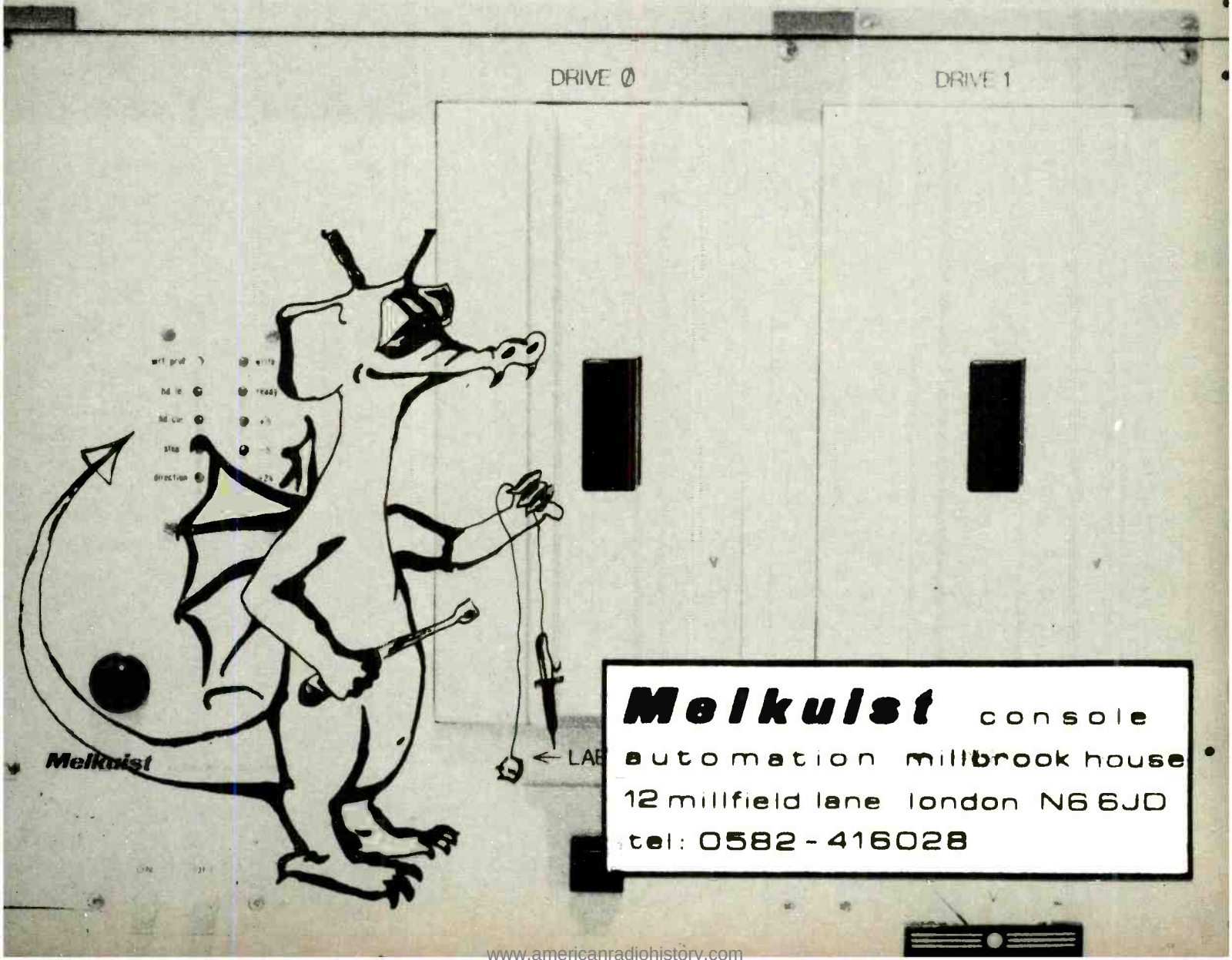


**Melkulst** console
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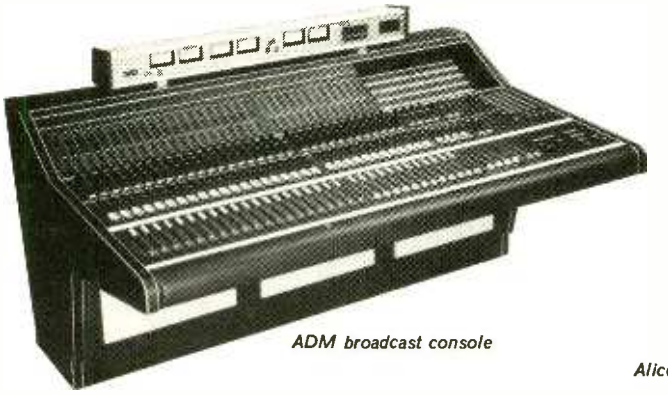
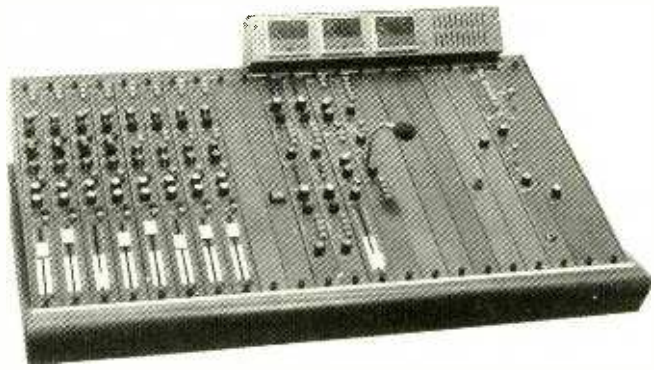
tel: 0582-416028

# Survey: mixing consoles A-M



*ADM broadcast console*



*Alice ACM*

**This is easily the largest survey subject that *Studio Sound* covers, and indeed our basic research list for this year included over 130 companies making mixing consoles. Not all are however, included since some declined to update their entries from the last surveys. While previously we have split this survey into two parts, PA and Broadcast, and Multitrack, after much thought it became apparent that there is so much overlap between the areas, that the division became very difficult. This year they have been split more sensibly: A to M this month, and N to Z in January 1981, since it is unfortunately not possible to include the entire survey in a single issue.**

## ADM (USA)

**ADM Technology Inc, 16005 Sturgeon, Roseville, Michigan 48066, USA**
**Phone: (313) 778-8400. Telex 231114.**

**BC-5 Series**
Broadcast production consoles. Format up to 16 low level inputs or 28 high; four outputs with individual VU and monitor, echo send 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.

**NRC series**
8/16/24 track recording consoles, in identical design but format as appropriate. Pcb mother board inter-connection reduces cost of hand wiring; simultaneous quad, stereo and mono mix-down, 'total' op-amp circuitry; Vue Scan metering; full talkback and slate; four cue, two solo systems; four quad joysticks; sync interface.

**1641**
Remix console for simultaneous four, two and one channel mix from 8/16 source. Sixteen dual concentric quad pots, four joysticks, with full group routing; four remote tape controls; solo on all inputs; quad matrix break points; four echo sends.

**2400/3200**
24/4/2 broadcast production console (*3200* has 32 inputs), Slidex sealed linear attenuators, two foldback and two PA busses, 4-band 14 frequency reciprocal eq, four monitor busses, VU meters, timer, full size jackfield, mic and line inputs, preselect input matrix noise suppressor module, limiting amplifiers, oscillator talkback module.

**ST Series**
Modular AM/FM stereo broadcast consoles, variety of inputs, outputs and signal processing, three separate stereo and one mono outputs, slider faders, VU meters.

## ALICE (UK)

**Stancoil Ltd, Alexandra Road, Windsor, UK.**
**Phone: 07535 51056. Telex: 849323.**

**12-48/16-48**
Full function semi modular multitrack consoles for small recording and production studios. 12 or 16 inputs with balanced mic, 48V phantom power, dual line/re-mix inputs, insert jacks, eq in/out, foldback, two echo sends, PFL, channel on/off, choice of faders. Four groups, 8-track monitoring with individual A/B, sync foldback and monitor echo. Oscillator, talkback, eight buffered VUs.
**Price:** from £1,620.

**12-4/16-4**
Semi modular mixers for production and CCTV studios, PA etc. Up to 16 inputs, balanced mic, dual line/remix, insert jacks, direct outputs. Four groups with limiters, choice of faders, custom versions to order.
**Price:** from £1,190.

**ACM Series**
Modular mixing system for mono, stereo, 4 or 8-group configurations with matrix output routing for up to 24-track working. Wide range of modules includes stereo line input and comprehensive monitoring for radio commercial production studios, CCTV etc. All mixers custom-built.
**Price** (guide): 10/2 £3,090; 12/4 £3,990; 16/8 £6,200; 16/8/16 £8,230.

**ABCM Series**
Modular mixing systems for mono and stereo broadcasting. Custom built consoles include central script area, integral jackfields, etc. Wide range of modules includes dual input mono mic and stereo line, multiple clean feeds, voice-over ducker system, comprehensive monitoring.
**Prices:** from £4,500.

**828 Series**
8 and 12-channel stereo output portable mixers, transformer balanced mic inputs, line input via c/o switch, direct channel outputs, full eq, echo, foldback, PFL, limiters, headphone and LS monitoring outputs, VU meters or PPMs to order, mains or external 24V powered, all steel case.
**Price:** from £539.

**STM 8**
Compact full facility on-air mixer for outside broadcasts, DJ self-op or small production studio use. Three mic channels with limiter, eq, electronic on/off, voice-over ducker selection, pan, pfl. Five stereo line channels with optional RIAA phono inputs, remote start facilities, PFL etc. Clean feed, auxiliary and PA outputs, comprehensive monitoring via headphones and PPMs, simultaneous mono and stereo main outputs, multiple talkback facilities, all inputs and outputs balanced, choice of faders.
**Price:** with conductive plastic faders £1,580.

## ALLEN & HEATH (UK)

**Allen & Heath Brenell Ltd, Pembroke House, Campsbourne Road, London N8, UK.**
**Phone: 01-340 3291. Telex: 267727.**
**USA:** Audio Marketing, 652 Glenbrook Road, Conn 06906.
Phone: (203) 359-2312. Telex: 9965/9.

**Mini Mixer**
The smallest professional mixer in the world, the *Mini mixer* is designed for use in areas such as portable sound systems and 'on stage' submixing. As the unit has enough physical space for balanced input transformers these items are supplied separately, prewired for insertion into the mixer inputs.
*Auxbox* option provides talkback, oscillator, monitor and line link capability.
**Price:** £195; *Auxbox* £53.

**Production Mixer**
The *S6-2* production mixer features two stereo RIAA equalised units, two stereo line inputs and two microphone inputs all fully equalised with PFL and PFM. An autofade circuit is incorporated giving variable programme 'ducking'. Remote state microswitches are provided giving solid state control of 5A relays inside the external power supply.
**Price:** £510.

**SD 12-2 Stereo Console**
Designed for portable sound reinforcement applications where fully professional facilities are required on location. The *SD 12-2* features: 12 input channels with mic-line selection, channel insert points, channel direct post fade outputs, 4-band eq, pre eq foldback (with separate foldback eq), echo send and PFL. A comprehensive 4-way monitoring system includes tape return monitoring with the stereo metering system switching with the monitor selection. *XLR* connectors are standard with the option of phantom powering, multicore and flightcase.
**Price:** £456.

**16:4:2**
16 input sound reinforcement mixer featuring transformerless balanced mic *XLR* inputs; ¼-in jack line inputs; comprehensive pushbutton routing; auto solo; four subgroups plus two main outputs; two routable echo returns plus solo; talkback facilities; stereo monitor tape return; six illuminated VU meters; and long travel 90mm input/output faders.
**Price:** £850.

**SR20 and SR28**
At the top of the Allen & Heath sound reinforcement range these mixers can provide virtually every feature required for 'live' sound mixing. With up to 28 inputs and a choice of 4, 6 and 8 subgroups

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feeding a stereo master output stage, the unit can be supplied to customer's specification. Being fully modular the *SR Series* is particularly suited to applications where service delays cannot be tolerated.
**Price:** from £1,800.

**Modular series III**
Compact range of consoles for smaller studios with maximum of 24 input modules and eight output groups with 16-track monitoring standard. Parametric eq standard, three pre/post aux sends, line level input and output insertion point.
**Prices:** 24/6/16 £3,435, 16/8/16 £2,695, 12/4/8 £2,075.

**Syncon**
Modular mixing system capable of accepting up to 28 input/output modules per frame with 16 buses (24 with split buss configuration), four master busses, six auxiliary busses. Modules combine input, output and monitoring sections with a master multitrack/remix selector and comprehensive solo system with monitor priority. Typical of the simplified and cost effective design philosophy are the channel insertion points mounted directly on each module but normally hidden by the armrest. Other modules include stereo ouput channel and monitor/communications types.
**Prices:** 28/28/4 £12,500, 24/24/4 £11,152, 20/20/4 £9,804, 16/16/4 £8,456.

**Syncon Series B**
Modular in-line console, designed for the smaller studio, but providing up to 44 channels with 24-track capability, with optional *Fadex* automation. Based in *SB11* input/output module which allows record, overdub, subgroup and remix, with inputs for mic, line and effects return, 24-track assignable routing, P&G sliders for both main and monitor faders, four aux outputs, two sweep eqs, shelving hf eq, channel muting, solo in-place, monitoring. SB21 aux master and SB31 monitor master modules, also 2-colour light column LED metering.
**Price:** on application.

## ALLINGTON (UK)
**Allington Audio Developments, 14 Lenton Blvd, Nottingham, UK.**
**Phone: 0602 44943.**

**EMM range**
Modular multitrack consoles using input/monitoring/output module, master status, monitoring, echo send/return modules. Only three modules are required in addition to the input/output modules, and the master status module enables channels to be switched to record, remix and overdub. The input/output modules have mic, line and remix inputs, four-band eq, two foldback and two echo sends.
**Prices:** *EMM 16/16* £3,950, *EMM 24/24* £4,950.

**SRM16/2**
PA console with 16 inputs and two outputs, balanced mic inputs, peak overload indicators, hi, mid and lo eq, panning, two aux outputs, PFL, VU metering, – 125dBm equiv input noise, + 18dB max out into 600Ω.
**Price:** £680.

**SRM16/4**
Similar to above with four outputs.
**Price:** £840.

## ALLISON (USA)
**Valley People Inc, 2820, Erica Place Nashville, Tenn 37204, USA.**
**Phone: (615) 385-4737. Telex: 558610.**
**UK:** Scenic Sounds Equipment, 97-99 Dean Street, London, W1V 5RA.
Phone: 01-734 2812. Telex: 27939.

**65K Analog Programmer**
Designed to be the fastest, most reliable, and most easily expanded form of automation for pro-audio, film, video, and media equipment. Employment of exclusive priority encoding techniques allow the *65K* to program as many as 8,192 variable console functions (65,536 digital bits), while responding to a change in any of these console functions within 4ms. This means that the *65K* system can be expanded to any degree desired, without speed compromises.

The *65K* code is a series of individual words, each containing address information for the associated console function. Four parity checks are made on each word, and each word has a time duration of 4ms. In the event of a storage medium dropout of sufficient magnitude to make decoding impossible, the word or words affected are held at the last valid value, rather than being decoded in error. No 'memory' of dropouts is propagated into the code on subsequent encoded passes — each encoded pass is a clean data stream. Dropouts only affect the word or words existing in the code at the time the tape error actually occurs.
**Capacity of mainframe:** 64 analogue functions (0 to + 5.6V) in increments of 16 functions.
**Capacity of expander package:** 192 analogue functions in increments of 16 functions. Power derived from mainframe.
**Price:** $4,246 for *65K-A1-32* (32 function analogue programmer).

## ALTEC (USA)
**Altec Corp, 1515 South Manchester Avenue, Anaheim, Cal 92803, USA.**
**Phone: (714) 774-2900.**
**Europe:** Altec Lansing International Ltd, 17 Park Place, Stevenage, Herts SG1 1DU, UK.
Phone: 0438 3241. Telex: 825495.
**UK:** Theatre Projects Sound Ltd, 10 Long Acre, London WC2E 9LN.
Phone: 01-240 5411.

**1628A**
Automatic microphone mixer with eight inputs, one master output and one priority output. Provides envelope detector dynamic range of + 3 to – 67dBm and attenuator response time of 6dBm/ms rise and 10dB/s decay.
**Price:** £610.

**1690**
Recording console with eight balanced mic and eight unbalanced line inputs, two aux inputs, two programme outputs, eight line outputs, four sub outputs, – 126dBm input noise, channel LED peak indicators operating at + 14dB, nine segment vertical bar LED meter display.

## AMEK (UK)
**Amek Systems and Controls Ltd, Islington Mill, James Street, Salford M3 5HW.**
**Phone: 061-834 6747. Telex: 668127.**
**UK:** Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: 01-734 2812. Telex: 27939.


*Altec 1690*

**USA:** Everything Audio, 16055 Ventura Blvd, Suite 1001, Encino, Cal 91436.
Phone: (213) 995-4175. Telex: 651485.

**M3000**
36/24 + 32 master recording console with automation facilities, VCA faders, parametric eq, quad mixdown, dc subgrouping of both channels and echo returns, eight aux busses, mute/solo grouping system, status control of signal flow path, in-line design.

**M2000A/2500**
36/24 + 24 master recording console with automation facilities, VCA faders, parametric eq, stereo mixdown, DC subgrouping of channels and echo returns, six aux busses, mute/solo system, in-line design.

**M2000**
28/16 + 24 master recording console, manual control with mixdown subgrouping system, mic and line inputs per channel, 4-band switched eq, four sends, 16 mix busses, 24-track monitoring, stereo mixdown, control room and studio monitoring systems, in-line design.

**M1000**
32/8/2 + 8 concert sound reinforcement console with 8-track monitor mix, 4-band parametric eq with pass filters, four aux busses.

## AMPRO (USA)
**Ampro/Scully, 826 Newton Yardley Road, Newton, Penn 18940, USA.**
**Phone: (215) 968-9000. Telex: 510-667 2299.**

Range of broadcasting consoles with modular plug-in amplifiers and remote starts for external source equipment for all nine inputs. Various versions from 6 channel 24 inputs mono, dual mono or stereo up to 12 channel 48 inputs units.
**Prices:** between $2,500 and $5,600.

## APSI (USA)
**Audio Processing Systems Inc, 40 Landsdowne Street, Cambridge, Mass 02139, USA.**
**Phone: (617) 354-1144.**

**Model 2000**
Modular reinforcement console available with large or small mainframes, 32, 24 or 16 inputs, four submix, four master and four quad channels. Modules include input with 4-band eq and filter, submix, master and quad.
**Prices:** $8,646 to $11,670.

**Model 3000**
Modular multitrack recording console with 32, 24, 16, 8 inputs, 24, 16 or 8 outputs, in-line modules, four mono effects sends and returns, stereo submaster and master/monitor sends, submaster sends assignable to master, master status control, 4-band parametric eq, in-channel LED indicators, slider main and monitor faders, two stereo cue systems, oscillator, patchbay, optional automation, transformers.
**Prices:** $13,600 to $31,200.

## AUDIOARTS (USA)
**Audioarts Engineering, 286 Downs Road, Bethany, Conn 06525, USA.**
**Phone: (203) 393-0887.**

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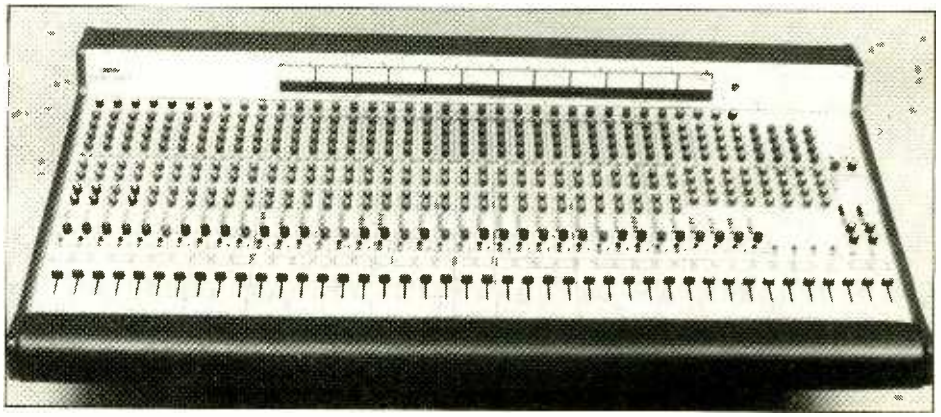
*APSI 2000*



# The Strong, Silent Types.

**Atlantex products are built for a tough, professional life. They are well-designed and made with the finest components for clean, noise-free circuitry.**

Ashly audio processing units represent the technology of the future. The well-designed, easy-to-use layout allows precision control over the audible spectrum. Shown is the SC-50 peak limiter compressor. Other 19" Ashly units are parametric equalisers, electronic crossovers, pre-amp/processors.

Sescom, the world's finest audio interfacing units, are renowned for high quality products, combined with ruggedness and reliability. The wide range of models includes D.I. boxes, audio transformers, cable testers, and many more useful studio accessories.


The Furman range includes mono and stereo parametric equalisers with pre-amps, tunable crossover/bandpass filter, and (shown here) the neat reverb system with limiter and equaliser. The simple layout and wide range of control gives full scope for creative engineering at a price which gives great value for money.

Built to the highest standard, Whirlwind leads are made with top quality Belden cable, with Switchcraft and ADC connectors.
Available from 1' patch cords to 24-input multicores, they are sturdily constructed to give years of trouble-free service.

**Atlantex**

*Write or phone for illustrated catalogues.*

**Atlantex Music Ltd.,** 34 Bancroft, Hitchin, Herts SG5 1LA.
Telephone 0462 31511 Telex 826967

# Survey

**Monitor 10**
Stage monitoring and mixing system, five subgroup busses, 10 mix busses, 26 inputs and outputs (16-channel configuration), direct output control on each input, VU meters on all output channels, separate solo meter, 4-band parametric eq, highpass filter, talkback, communications module.

**4000 Mixing System**
Recording and reinforcement mixer, modular with from 12 to 32 input channels, four subgroups, 4- and 2-track outputs, separate reinforcement outputs, 4-band parametric eq, six sends, six aux/effects inputs with panpots, six tape inputs, solo, 15 segment metered outputs and groups.

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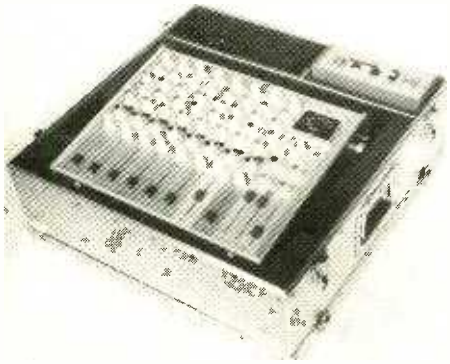
## AUDIO DEVELOPMENTS (UK)

**Audio Developments, Hall Lane, Walsall Wood, Brownhills, Staffs, UK.**
**Phone: 05433 5351. Telex: 338212.**
**USA:** Coherent Communications, 13733 Glenoaks Blvd, Sylmar, Cal 91342.
Phone: (213) 362-2566.

**AD007 Mini Mixer**
Eight to 24 inputs into four outputs and aux, plus direct outputs from all inputs for multitracking, balanced throughout, range of fader, monitor and meter options. Incorporates two linkable compressor/limiters.



**AD031 Micro Mixer**
8. 10, 12, 14 or more inputs into two outputs with mono mix down, one aux output. Wide range of metering and monitoring options, mono or stereo compressors, tone generators, talkback facilities, special film version available. 12 to 48V or mains.

**AD045 Pico Mixer**
6/2 balanced in/out portable mixer with Nicad batteries, fitted with Tonader/Phantom powering as standard, PFL monitor functions and battery status on meter.

**AD045 Pico Plus Mixer**
Similar to above but with 1kHz tone, eq bypass and phase change.

**AD049 Mixette**
Portable 4 input, mono output mixer with either a VU or PPM meter; LED overload indicators; and headphone monitoring. Battery or mains powering, and suitable for use with Nagra recorders.

**AD060**
Compact 4 input, single output mixer designed for ENG usage, with external 24V dc powering; *XLR* inputs/outputs; three input filters; headphone monitoring; and LED column output level indication.

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## AUDIO HELP (France)

**Audio Help, 5 Rue de Solferina, F-92100 Boulogne, France.**
**Phone: (1)609 03.11.**

**CS2405**
Modular console mixer available with 16, 24 or 32 inputs, separate monitoring for eight to 24-track, 16 submasters (in stereo pairs), stereo and four masters, patch bay with cable trough, VU metering, usual eq or parametrics, four echo sends, numerous other facilities.

**CSM6**
Modular console/portable mixer with input modules in multiples of 6, 12, 18, 24 etc, and eight subgroups, two echo sends, two foldback sends. Two different input modules, one with parametric eq and peak LEDs.

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## AUDITRONICS (USA)

**Auditronics Inc, 3750 Old Getwell Road, Memphis, Tenn 38118, USA.**
**Phone: (901) 362-1350.**

**700 series**
Available as *710* with capacity for 24 input channels and 16 multitrack outputs, as *720* with 36 input positions, and *730* which is similar but with separated patch bay and reduced metering area. In addition, each model has two mono and one stereo outputs, four effects outputs, two foldback outputs, stereo control and studio monitor outputs, 24 VU meters, VCA input grouping faders with six submasters, transformerless inputs using Trans-Amp modules.
**Prices:** $41,934 to $63,294.

**Grandson 110A series**
Recording/remixing/production/on-air mixer available with up to 18 or 26 input positions, 16 outputs, two echo send/receive channels, talkback, optional eq on each channel, two foldback outputs, oscillator, optional stereo inputs, various other options.
**Price:** $11,430 to $23,540.

**Model 532**
Automated console designed around the Allison Research *65K* programmer. Uses automated faders designated *Model AFG* which have read, write and update modes. A grouping function is incorporated working with nine busses selected by thumbwheel which includes automated group mute, group master channel automatically becomes member of group. Installed on desks of varying complexity, the *532* automation system includes two separate modules: automation master fader and automation track select which allows interfacing with three tracks on the tape recorder for recording the automation information.

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## AUDIX (UK)

**Audix Ltd, Stansted, Essex CM24 8HS, UK.**
**Phone: 0279 813132.**

**MXT-1000**
Full broadcasting performance, comprehensive facilities and a flexible design make the *MXT-1000* audio mixer particularly suitable for the small radio and recording studio, mobile and theatre applications. Details of a special radio 'on-air' version of the *MXT-1000* are available on request. The *MXT-1000* readily enables the individual customer's specific requirements to be met without recourse to 'custom building'. Both number and choice of input channels, as well as two or four group working — two stereo groups can be selected and supplied as a working system at short notice.

**B100 Series**
The *B100* range of modules and mixers has been designed specifically for the broadcasting industry. Two basic systems are available, designated *B101* and *B102*. The *B101* consoles are 2-group systems and the *B102* has facilities for four groups plus two main outputs or six groups.

**3500 Series**
The *3500* range of modules has been designed for the larger studios where 8-group working is essential. Based on a 35mm modular width, the range offers a compact console with maximum flexibility and facilities. Consoles can be built with any number of input channels, mixing to eight main groups for multitrack working, plus a further mixdown from the eight groups to two main outputs for direct transmission.

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## AUTOMATED PROCESSES (USA)

**Automated Processes Inc, 789 Park Avenue, Huntingdon, New York 11743, USA.**
**Phone: (516) 427-6024. Telex: 950-247.**

Modular systems for any requirement, based on sections including the following *312* preamp, balanced in for 150/600Ω, 15-65dB gain, reverse polarity and overload protected; *544* input assign module; *840* slate/tone; *544* echo send/return; *846* foldback; *325* line booster; *330* eq preamp; *440* fader, plastic track, illuminated scale, multigang within 0.5dB; *475* fader with precision metal wiper; *480* joystick quadpot; *525* complimiter with threshold, output two range frequency dependent release and stereo link; *550* equaliser, hf 5, 7, 10, 12.5, 15kHz, mid 0.4, 0.8, 1.5, 3, 5kHz, lf 50, 100, 200, 300, 400Hz; audio band pass filter switchable, eq in/out; *553* equaliser, hf, mid, lf fixed frequency; *559* nine band graphic equaliser, approx octaves 35 to 16kHz; *575* sine wave osc, 20 to 20kHz in 13 steps, low distortion and output meter; *701* 10W power amp for small speaker or can systems; *705* 50W power amp; *730* 2 x 200W power amp; *940* automated fader, with plastic track and LED ± cursor indication, write/safe/update switching; *954* programmable parametric equaliser hf 800, 1.8k, 3.5k, 7k, 16kHz, mid 200, 500, 1k, 2k, 5kHz, lf 30, 60, 130, 260, 600Hz, bell and notch options with write and in switching, compatible Allision/Automated programmer.

**Automix**
For typical channel arrangement on Automix fully automated console mixdown system. Console available in 24 or 32 channel options as standard, in conjunction with Allison/Automated programmer. All functions automated, including eq, subgroups and pan. Multiple LED indications of status and related functions.

**1604**
Supplied standard as up to 16/4 console using various standard modules. Includes standard echo foldback, monitor and metering options.

**2483**
Supplied standard as up to 24/16/24 console with extra capacity for particular requirements as necessary.

**2824**
Up to 28 inputs each with direct output and quad or stereo panning, 16 mixing busses, up to 24 VU meters, four echo busses comprehensive monitoring, two *model 525* compressor limiters, wired for four.

**3224**
Up to 32 inputs with 16 groups, eight echo busses.

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## AVAB (Sweden/USA)

**Avab Elecktronik AB, V. Hamngatan 1, S-41117 Goteborg, Sweden.**
**Phone: 031 11.20.32. Telex: 27531.**
**UK:** MCI (Professional Studio Equipment) Ltd, MCI House, 54-56 Stanhope Street, London NW1 3EX.
Phone: 01-388 7867.
**USA:** Avab America, 1714 Stockton Street, San Francisco, Cal 94133.
Phone: (415) 421-3562.

**FM800**
Production mixer built into lightweight aluminium case, eight input channels each with pan, hf and lf eq, monitor level, PFL, switched gain, line and mic inputs, slider fader claimed to be 'sealed'. Also ref oscillator, highpass filters, phase reverse, mixer to boom talkback, tape stop/start, director/script monitor outputs, VU meters, slate microphone, 12V and 48V phantom powering on each input, two stereo outputs, mono output, Nagra connector.
**Price:** on application.

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## B&B (USA)

**Aphex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046, USA.**
**Phone: (213) 655-1411. Telex: 910-321 5762.**
**UK:** Aphex Audio Systems UK Ltd, 35 Britannia Row, London N1 8QH.
Phone: 01-359 5275.

**OAS-24 Grouper**
Stand alone grouping system designed to be used in conjunction with most consoles, improves mixing flexibility by providing subgrouping control of multiple channels with one fader, plus a master fader for all the subgroups, standard configuration handles 24 channels and up to nine subgroups plus group master, also mute on each group, 0dB gain.
**Price:** $8,000.

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## BIAMP (USA)

**Biamp Systems Inc, 9600 SW Barnes Road, Portland, Oregon 97225, USA.**
**Phone: (503) 297-1555.**

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At Trident, we believe in giving you exactly what you want, not simply supplying whichever console comes nearest to your present requirements.

That is why we have developed our latest console — the Series 80.

Being fully modular, it can be tailored from 16-track to its full mainframe capacity of 24-track at any time. And when you want to go automated, that's simple as well.

So you really can tailor your facilities as and when you need to.

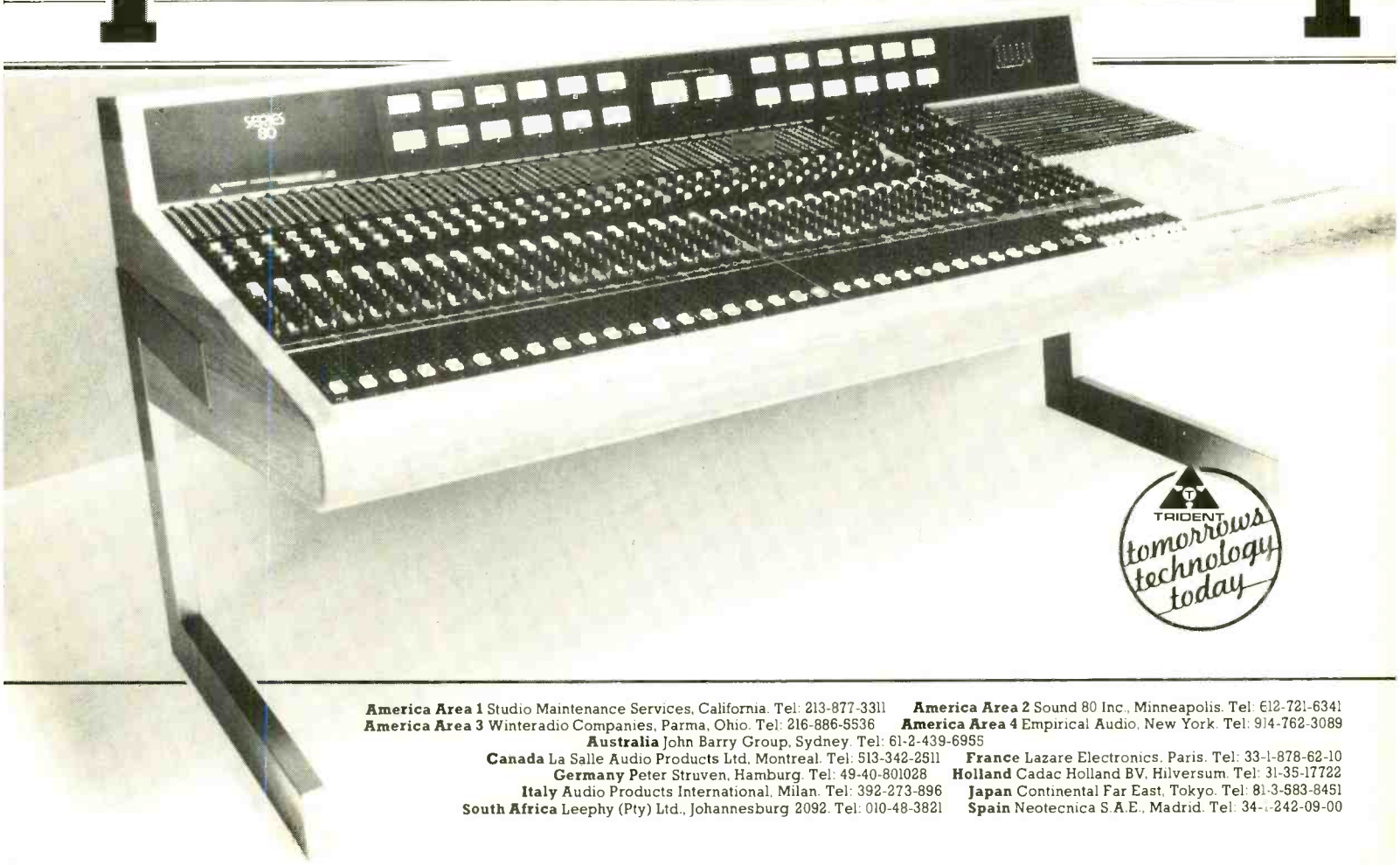
The quality, of course, is up to Trident's usual high standard, with fully modular patchbay (512 patchpoints), +24dBm output capability and solid state switching, all based on designs proven reliable with the superb TSM range.

But the best feature of all is its highly competitive price: **up to — £22,000** depending upon format, with a financial package deal available.


Contact Ken Bray or Steve Gunn who'll be pleased to arrange a free demonstration for you.

**Trident Audio Developments Ltd.**
Shepperton Studio Centre,
Squires Bridge Road,
Shepperton, Middlesex,
England.
Tel: Chertsey (09328) 60241
Telex: 8813982 Trimix G

# TAILORED TO YOUR POCKET




**America Area 1** Studio Maintenance Services, California. Tel: 213-877-3311 **America Area 2** Sound 80 Inc., Minneapolis. Tel: 612-721-6341
**America Area 3** Winteradio Companies, Parma, Ohio. Tel: 216-886-5536 **America Area 4** Empirical Audio, New York. Tel: 914-762-3089
**Australia** John Barry Group, Sydney. Tel: 61-2-439-6955
**Canada** La Salle Audio Products Ltd, Montreal. Tel: 513-342-2511 **France** Lazare Electronics, Paris. Tel: 33-1-878-62-10
**Germany** Peter Struven, Hamburg. Tel: 49-40-801028 **Holland** Cadac Holland BV, Hilversum. Tel: 31-35-17722
**Italy** Audio Products International, Milan. Tel: 392-273-896 **Japan** Continental Far East, Tokyo. Tel: 81-3-583-8451
**South Africa** Leephy (Pty) Ltd., Johannesburg 2092. Tel: 010-48-3821 **Spain** Neotecnica S.A.E., Madrid. Tel: 34-1-242-09-00

# Survey

**2442**
24/2 console with 4 submaster outputs, four bands of eq, monitor, echo, and switchable pre-post aux busses, 48V phantom power, mic/line switching, four separate echo/line channel inputs, sub send controls, priority solo, headphone monitoring, four VU meters.
**Price:** on application.

**1642**
Similar to above, but ony 16 input channels.
**Price:** on application.

**1682/1282/8802**
16, 12 and 8 input channel stereo mixers, all with 3-band eq, aux send, monitor output.
**Prices:** on application.

## 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 ⅔-octave equaliser.

**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. Also ⅔- and ⅓-octave equalisers.

## BROADCAST AUDIO (USA)

**Broadcast Audio Associates, 11355 Pyrites Way, Rancho Cordova, Cal 95670, USA.**
**Phone: (916) 635-1048.**

**System 12/16**
12- and 16-channel modular broadcast mixers, log taper slider faders, cue detent, separate cueing button (stereo), dc audio switching using LCDs, 10 plug-in relays for remote control, switched gain, numerous outputs.

## BROADCAST ELECTRONICS (USA)

**Broadcast Electronics Inc, 4100 North 24th Street, PO Box 3606, Quincy, Illinois 62301, USA.**
**Phone: (217) 224-9600.**
**UK:** Broadcast Audio Equipment Ltd, PO Box 31, Douglas, Isle of Man.
Phone: 0624 4701. Telex: 627900.

**Series 150 and 250**
Rotary control type broadcast mixers using ladder type maintainable step attenuator with cue buss switching, FET buss selection, mono/stereo available in five or eight channels, in mono or stereo, in deluxe or standard (with sealed pots).
**Prices:** on application.

## BULGIN/SOUNDEX (UK)

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

**Series 1300**
Four inputs, two outputs (one stereo input, two mono pannable), PPM or VU metering, *XLR* or jack connectors.
**Prices:** £220 to £277 depending upon options.

## CADAC AUDIO (UK)

**CA Audio Systems Ltd, 141 Lower Luton Road, Harpenden, Herts AL5 5EQ, UK.**
**Phone: 05827 64351. Telex: 826323.**
**USA:** Irv Joel & Associates, 528 River Road, Teaneck, New Jersey 07666.
Phone: (201) 692-0010.

**In-line series**
Range of consoles for music recording and remix, models for 16-, 24-, 32-, 40- and 48-track working, with individually and master controlled functions, six section equalisers switchable in channel or monitor, programmable overdub, main faders interchangeable for monitor or channel, in remix track outputs to busses and additional input per track to 4-track mix. Various options including digicat digitally controlled subgrouping, and CARE automation.

**320 series**
Standard and custom console for broadcasting, configurations from 8/2 through to 24/2 with range of equalisers and input modules.

## CAE (USA)

**Custom Audio Electronics, 2828 Stommel Road, Ypsilanti, Michigan 48197, USA.**
**Phone: (313) 482-6568.**

**XPC-16P Series**
Modular sound reinforcement mixer that uses no mainframe, chassis or motherboards, with modules simply fastening side-by-side with internal Molex connectors. The basic input module features switched gain, eight output assigns, two aux sends, pan, lf and hf eq with selectable bend points, and solo, while the *XPC-16P* input module is similar but additionally with built-in limiter, three aux sends, 3-band fully parametric eq with hf and lf switching peak or shelving, high and lowpass, and eq in/out. The submaster module includes master outputs in stereo, pan, stereo lo and hi pass eq, assign switches for other submasters or masters. An alternative output module is the 8-Mix Master module for monitor mixing and studio applications, while the 8-Line In module provide eight line inputs for effects returns and submixes; also a Communications module with intercom and lamp.

## CALREC (UK)

**Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorks HX7 7DD, UK.**
**Phone: 0422 842159. Telex: 517479.**
**USA:** Edcor, 16782 Hale Avenue, Irvine, Cal 92714.
Phone: (714) 556-2740 Telex: 685557.

**L series**
High density mixers with 35mm wide modules, designed for broadcasting studios (particularly television). Input channels provide phantom powering, wide sensitivity, eq and filters, channel and group routing module allow up to 16 main, 4 echo, 4 foldback and 2 PA groups, provision for AFL, PFL, pan. Provision for main or main clean feed mix down, mono and stereo monitor, subgroups, recording matrices, multiway working, talkback and communication systems, PPMs or VU metering.

**M Series**
Based on the *L series* but has micro-computer automation and floppy disk storage enabling automation of all normally possible functions. Use of a new design DCA allows direct control by 8-bit digital system presenting virtually passive audio circuit which minimises distortion. For multitrack and broadcasting applications and capable of meeting changes in track requirements.

## CAMBRIDGE ELECTRONIC WORKSHOP (UK)

**Cambridge Electronic Workshop, 4 Water Lane, Oakington, Cambridge CB4 5AL.**
**Phone: 022023 3737. Telex: 87183.**

**Theatre Consoles**
High quality portable and installed desks for theatre use. Fully modular desks purpose built to provide a range of custom assemblies from standard production items. Complete worldwide installation and commissioning service. Standard 2 and 4 group models available. Cue lights, show relay, communication facilities, tape remotes VU/PPM metering. Any group or input may be metered via PFL, also stereo and off-tape monitoring, switching for eight output/LS line. Standard module includes separate mic and line sensitivities, hf, variable mid, high/low pass filters, eq in/out, two aux pre or post pan, PFL, group routing.

**10/2**
10 input channels, two main groups, two aux groups, PFL, oscillator, full talkback, four direct inputs.
**Price:** around £3,500.

**12/4**
12 input channels, six direct inputs all accessing two mono and four main groups. Mono groups routed to main groups via quad pan pots. PFL, oscillator, full talkback, foldback groups with eq available to a maximum of eight.
**Price:** around £6,000.

## CANARY (UK)

**Canary Mixing Desks Ltd, 17 West Hill, Wandsworth, London SW18 1RP, UK.**
**Phone: 01-870 7722. Telex: 889294.**

**10/2, 16/2**
10 and 16 input, stereo mixers, flight case packaging, each channel with three section eq, input gain, foldback and echo sends, pan, PFL, slider faders, jack connector, *XLR* to order, VU metering.
**Prices:** 10/2 £294; 16/2 £441.

**24/2, 16/2 Plus**
24 and 16 input, stereo mixers, each channel with a separate VU meter, also meters on output, 4-band eq, pre and post fade sends channel on/off, AFL, stereo headphone monitor.
**Prices:** 24/2 £1,050; 16/2 £742.

**12/2**
12 input, stereo mixer for PA and recording, *XLR* balanced inputs, four channels with line inputs, 4-band eq, two aux outputs, VU meters on outputs.
**Price:** £440.

## CHILTON (UK)

**Magnetic Tapes Ltd, Chilton Works, Garden Road, Richmond, Surrey TW9 4NS.**
**Phone: 01-876 7957.**
**Canada:** Radio Service Inc, 2500 Bates Road, Montreal, Canada H3S 1A6.

**QM3 Series**
Available in 12/4 (8-track monitoring) and 16/8 (16-track monitoring) formats for recording applications, and 24/8/2 and 20/4/2 PA formats. Features include P & G faders, four aux sends, PPMs, and an auto channel mute system (optional on the 12/4 format). Options include parametric eq, filters, LED bargraphs on inputs, and comp/limiters on outputs.

**M Series**
Available in 10/2 and 16/2 formats, suitable for recording or PA applications. Choice of input modules including balanced mic and RIAA magnetic input; standard features include 3-band eq, two aux sends, and PPMs on outputs.

## COHERENT COMMUNICATIONS (USA)

**Coherent Communications, 13733 Glenoaks Blvd, Sylmar, Cal 91342, USA.**
**Phone: (213) 362-2566.**

**MX-80**
Motion picture location sound mixer, four input, mono output, *XLR* connectors, mic and line inputs, mf eq, hf pass, VU meter, slate, phase reverse, headphone output with level control.
**Price:** $1,500.

## D&R (Netherlands)

**D&R Electronica BV, Keizersgracht 284, NL-1016 EW Amsterdam, Netherlands.**
**Phone: 020 25.01.30.**

**MR600 series**
Recording/PA mixer, 6, 12 and 18 input channels, mic/line/insertion, gain, hf, mid and lf eq, foldback, echo send, panpot, PFL, overload VU meters, four outputs.
**Price:** Dutch guilders 954 to 1,804.

**1000 series**
Console mixer for recording, and/or PA, in-line concept with eight subgroups, direct out facilities, 10, 20 or 30 I/O versions, parametric eq, phase reverse, remix/sync/group/aux sends (four), solo, LED bar metering on each channel, master/monitor with all normal facilities.
**Prices:** Dutch guilders, 2,790 to 6,740.

**ST1600 series**
Master recording consoles using input/output channel featuring two overlapping parametric equalisers, overload indicators, six cue sends, simplified construction by using modules of eight channels, Master module includes record, replay/

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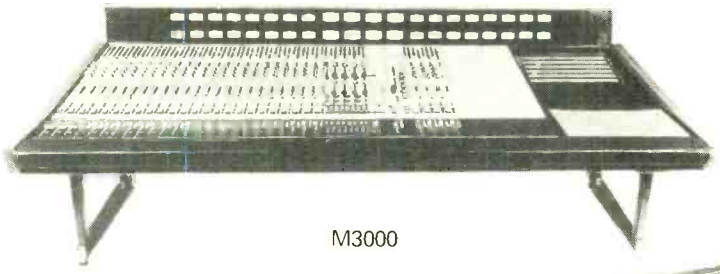
# AMEK

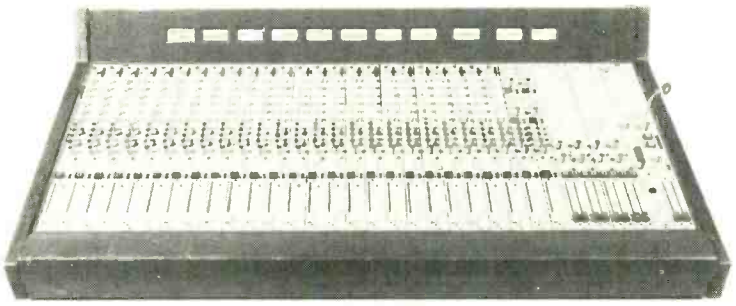
PROFESSIONAL MIXING CONSOLES



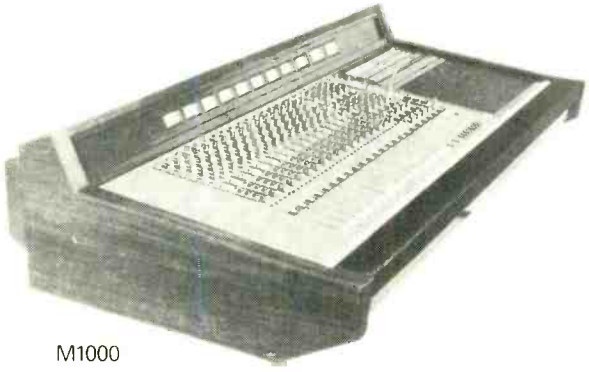
M3000

The AMEK/TAC current product range: TAC 1682, TAC 500, AMEK 1000 systems offering consoles of varying sophistication for recording, sound reinforcement, A/V production, onstage monitor mixing; AMEK M2000 non-automated, M2000A/2500 and M3000 automation-capable master recording consoles for 16/24/48 track recording. Coming: AMEK's Tapepak and Autopak computer mixdown systems....

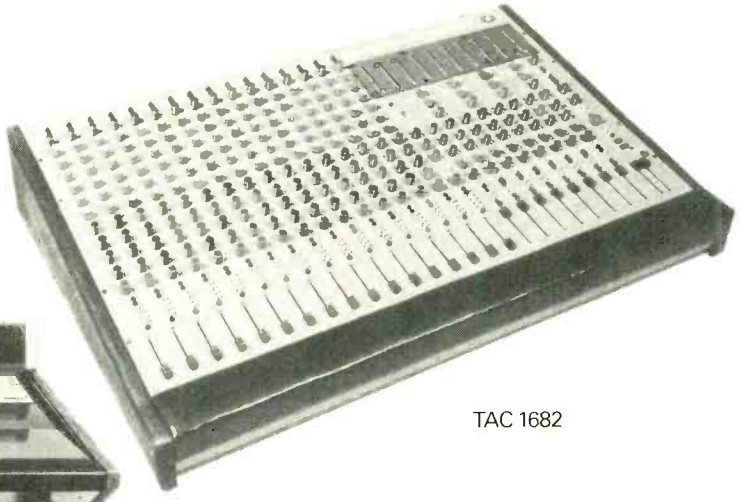
M2000



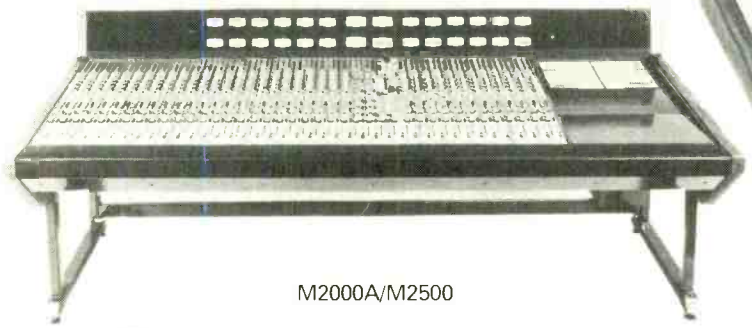
TAC 500



M1000



TAC 1682



M2000A/M2500

UK SALES: SCENIC SOUNDS, 97-99 DEAN ST, LONDON W1V 5RA (01) 734 2812

AUSTRALIA: AUDIO CONTROLS, SYDNEY (2) 922 1777 FRANCE: CYBORG, PARIS (1) 845 9448
GERMANY: JEFF NIECKAU, B F E, MAINZ (06131) 46811 ITALY: AUDIO PRODUCTS INTERNATIONAL, MILAN (2) 236 6628
SOUTH AFRICA: ELTRON, JOHANNESBURG (11) 23 0018
USA: BRIAN CORNFIELD, EVERYTHING AUDIO, LA (213) 995 4175 MARTIN AUDIO, NEW YORK (212) 541 5900
WESTBROOK AUDIO, DALLAS, TEXAS (214) 699 1203

AMEK SYSTEMS AND CONTROLS LIMITED/TOTAL AUDIO CONCEPTS LTD, ISLINGTON MILL, JAMES ST, SALFORD M3 5HW, ENGLAND (061) 834 6747 TELEX 668127 NICK FRANKS/GRAHAM LANGLEY

sync and remix, and subgrouping is also available.
**Price:** Dutch guilders 24/24 15,850, 32/32 18,500.

## DYNACORD (West Germany)

**Dynacord Electronic GmbH, Sienmensstrasse 41-43, D-8440 Straubing, West Germany.**
**Phone: 09421 3101.**
**UK:** Beyer Dynamics (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP.
Phone: 0444 51003.

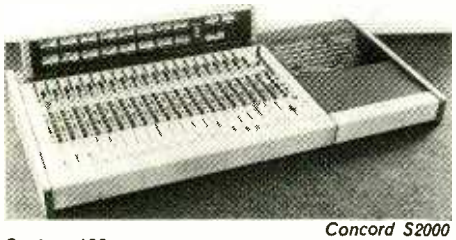
**MC1233C**
12/2 mixing board for vocal and orchestral PA systems, in aluminium flight case, foldback, hf, mid and lf eq, *XLR* connectors, VU meters, monitoring.
**Price:** on application.

**MC1200/1600**
12/2 and 16/2 on-stage mixer, padded arm rest, echo and effects units connections, *XLR* connectors, VU meters.
**Price:** on application.

**MC20/8/2**
20 input, eight subgroups, two masters, for PA or studio applications, *XLR* mic inputs, jack line inputs, low cut, 3-way eq with parametric eq, two effect and foldback channels.
**Price:** on application.

## EELA AUDIO (Netherlands)

**Pieter Bollen Geluidstechniek BV, Hondsruglaan 83a, NL-5628 DB Eindhoven, Netherlands.**
**Phone: 040 42.44.55. Telex: 59281.**
**UK:** Eela Audio, 13 Molesworth, Hoddesdon, Herts.
Phone: 09924 68674.
**USA:** Audicon Marketing Group, 1200 Beechwood Avenue, Nashville, Tenn 37212.
Phone: (615) 256-6900. Telex: 554494.



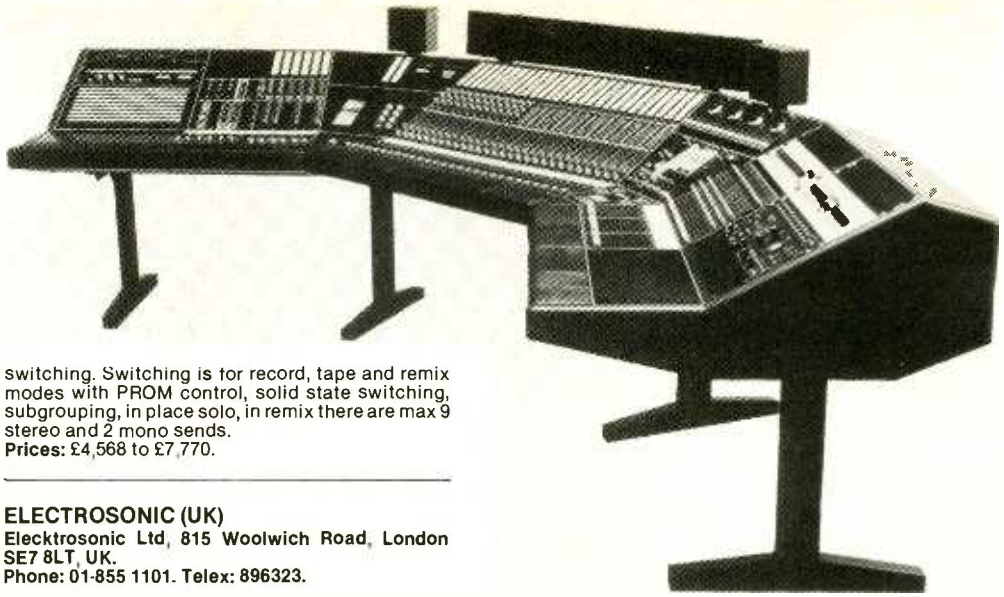
*Concord S2000*

**System 100**
Modular block mixer, allowing different configurations to be assembled, *S101* is input block with four mic/line inputs with two separate *XLR* inputs for each channel, phantom powering, high pass filter, 3-band eq, optional direct output, mute, aux send, pan control, PFL. *S102* is stereo output block with two echo returns, limiter, insertion point, monitor bank with tape return, headphone output, aux circuits. *S103* is input block with four stereo line level inputs, reverse, eq and aux sends, mute. *S104* is 8-track interface unit providing eight separate channels each with a 12-position selector switch to take 10 channel inputs and left and right outputs for routing to an 8-track recorder, monitor matrixing, LED record indication, stereo cue, transport remote controls. Available in standard formats of 4/2, 8/2, 12/2, 16/2.
**Prices:** £548 to £1,210, many options.

**System 200**
Modular block mixer, allowing different configurations to be assembled from a 4/2 film dubbing mixer to a 16/8 recording console, or even larger. *S201* is single channel input module with four group routing and two aux sends, two separate inputs, hf, mf and lf eq, direct output, PFL, *S202* similar with 8-group routing, *S203* has 4-group routing with 4 aux sends, *S204* is 8 with 4, *S205* is output module with monitor section and one aux send, *S206* similar with 2 aux sends, *S207* aux master/osc/talkback module, *S208* similar with 4 aux masters, *S209* is monitor master module, *S210* patchpanel, up to 28 modules per chassis, VU or PPM metering.
**Prices:** 12/4 £2,888; 16/8 £3,908.

**Concord S2000**
In-line mixing console, available with 12, 20 or 28 I/O modules, console is built from only three different modules, the I/O modules, a master/monitor module, and patchbay module with status switching. Switching is for record, tape and remix modes with PROM control, solid state switching, subgrouping, in place solo, in remix there are max 9 stereo and 2 mono sends.
**Prices:** £4,568 to £7,770.

*Formula Sound custom desk*



## ELECTROSONIC (UK)

**Elecktrosonic Ltd, 815 Woolwich Road, London SE7 8LT, UK.**
**Phone: 01-855 1101. Telex: 896323.**

**Control desks**
Custom built sound control desks for theatres, conference centres, PA systems, etc. In addition to providing comprehensive sound mixing facilities, many other control and communications functions may be fitted, particularly for complete systems. Also stage managers desk.

## ELEKTROIMPEX/BEAG (Hungary)

**Elektroimpex, PO Box 296, H-1392 Budapest, Hungary.**
**Telex: 225771.**

**FIT-IC**
European style multitrack recording console available with up to 30 input channels with high, mid and low eq with low and highpass filters, two aux sends, four main groups, eight full and eight extensive multitrack output groups, 16-channel monitoring, internal patchbay, PPMS, numerous other modules and facilities. Console is based upon 25mm channel width.
**Prices:** on application.

## ENERTEC (France)

**296 Ave Napoleon Bonaparte, F-92505 Rueil-Malmaison, France.**
**Phone: (1) 977.92.23. Telex: 203404.**

**UPS4000**
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, high pass filter; eq with boost/cut, eq Baxandall characteristic ±12dB at 60 and 10kHz or presence at 0.7/1.2/2/2.8/4/5.6kHz ±12dB in 2dB steps; band pass 24dB/octave at 100/250/500Hz and 4/6/8kHz; routing module; auxiliary outputs, four aux sends, both pre/post; echo return with gain to main group bussing; output amp balanced; limiter/compressor, 'limiting function – 10dBm' with 25dB headroom, threshold variable over 20dB range, variable attack and release; fader with mute and PFL; mic TB 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.

**UPS1602**
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, high and low eq, talkback PFL, internal power supplies and optional remote control facilities on each channel. Headphone and VU monitoring is standard.

**UPS5000**
Range of consoles with 10, 12, 16 and 24 input channels, with four main groups, four aux groups, four principal outputs, four aux outputs, control room monitor, studio monitor, talkback, PFL, 3-band eq, test channel.

## 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.

**FPC**
Portable, flat console available in formats between 8/2 and 16/8. Balanced mic input with gain, lf, hf boost/cut peak selectable. VU metering on groups, balanced out; 25 hours operation on one set 'C' batteries; solid aluminium construction. 72 × 62 × 5cm, weight 12 to 19kg depending on format.

**FIC**
Flexible modular system for recording. Input module includes level, select and pad switches, input fader, echo send and gain pre/post, compressor, high and low eq, foldback, VU. Output module includes slider, echo return, compressor, eq, VU meter. Monitor modules include 10 × 10 select matrix, slate, talkback.

## FORMULA SOUND (UK)

**Formula Sound Ltd, 3 Waterloo Road, Stockport, Cheshire, UK.**
**Phone: 061-480 3781.**

Custom built recording and PA consoles to customer's specifications.

## GELF (UK)

**Gelf Electronics Ltd, Unit 5, Mount Avenue, Bletchley, Milton Keynes MK1 1LS.**
**Phone: 0908 77503.**

**Monitor Mixer 16/6**
Developed particularly for stage monitoring, this provides 16 inputs and six independent outputs. Input sensitivity is –40dB and each channel provides lf, mid and hf eq and separate level controls for each output group. Each output has a 9-band eq.
**Price:** £2,700.
Gelf also manufactures larger mixers using similar modules.

## CLIVE GREEN (UK)

**Clive Green & Co Ltd, Britannia House, Leagrave Road, Luton LU3 1RJ, UK.**
**Phone: 0582 411513. Telex: 826138.**
**France:** Enertec, 296 Avenue Napoleon Bonaparte, F-92505 Reuil Malmaison, France.
Phone: (1) 977.92.23. Telex: 203404.

**Broadcast Console**
Multitrack mixing console for broadcast studios, 32

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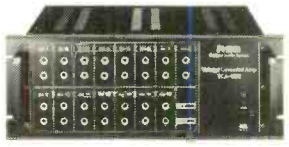
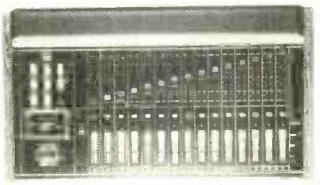
# turnkey mix





## AUTOMATION NOW

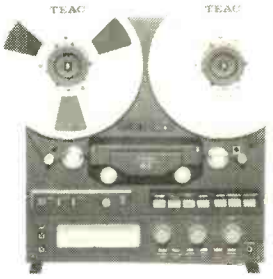
The Roland Compu-Editor, is the first console automation system we have seen that does not use up valuable tracks and is also sensibly priced.
This self contained unit will control up to 15 channels of audio (inputs, outputs or auxiliaries), and stores all the working level information internally or dumps to tape. You can update, override manually and lock up to any tape machine using the internal SMPTE generator/decoder. Many advanced features make sophisticated automation possible for any studio. On demo now or send for details.

## ANNIS MAGNET-OMETER

It works somewhat like a compass, but tells you when. Put it next to a tape head, guide or capstan, and you get an accurate reading of the residual magnetic field. The scale is accurately calibrated, 5-0-5 Gauss, and an extension probe for awkwardly positioned heads is available. Exclusively from Turnkey.

## ONE FOR THE ROAD

We've put TEAC's Portastudio into a roadcase with all the facilities you need for a working portable studio setup. A pair of Auratone monitors are driven by a custom 30W stereo amp, and we include, headphones, mikes, a patch bay and a selection of Accessit signal processors. All parts available separately or customised to requirements.



## TEAC 32-2

As predicted in the last Mix, Teac's new stereo mastering machine proves to be a winner. Switchable NAB/IEC equalisation, varispeed, big VU's, motion sensing and a closed loop type tape path all contribute to its success. What's more, it's priced well below the competition.

## 12 by 2 SPECIAL

We have acquired a batch of quality branded stereo recording or PA mixers. Each channel has wide range mike or line inputs, insertion points, four band eq, and two auxilliaries. The output section features echo returns, VU metering and powerful headphone monitoring. A snip at £360.00 plus VAT.

## SHORT TAKES

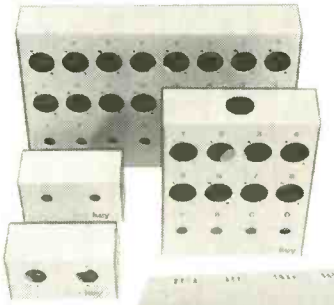
**Flight** cased eight track system available for hire . . . . **ASC** machine now sold but we can do a great deal on Wollensak copiers . . . . **bulk** tape scheme operating . . . . **we** wire a double decker bus for eight language guided tours of London . . . . **variable** delay GBS available soon . . . . **name** band buys 5 portastudios to take on tour and be creative in hotel rooms . . . . **Turnkey** monitor system completed, call in for a demonstration . . . . **New** TEAC sixteen track here at last . . . . **Plans** afoot to double the size of our present premises . . . . **number** one album made using Prokit/Seck mixer . . . .

## MIKE BOX

We now have a range of exclusive wall or cable mounting connector boxes. The standard type takes 8 female XLR's and 4 jacks, the large version is exactly twice that, and the two smaller boxes accept 2 jacks or XLR's respectively. All types have back and side cable entries and fixing holes, and are available with or without connectors.

## EXR EXCITEMENT

Introducing the alternative aural exciter that you can purchase outright. Employing patented circuitry, this stereo processor provides psychoacoustic enhancement for any signal. Connect simply to auxiliary send and return, or process stereo direct, and stereo spreads, clarity increases, putting it basically, everything sounds crisper. It is not a fancy tone control or compressor, call for a demonstration, and be convinced. An exclusive US import from TURNKEY.



## ADVANCED AUDIO DESIGNS DDL

New from America, this processor makes full band delays up to 250mS available in 1mS steps. A front panel digital display shows the programmed delay and full footswitch remote functions are available. As well as normal delay effects, (enhanced by a feedback control) the circuitry allows effects such as flanging, pitch alterations, frequency modulation and infinite repeat hold. Exclusively from Turnkey.

## GREEN BOOK

Much more than a catalogue, the new "Turnkey by Mail", 28 page book includes hints on setting up a studio, choosing equipment, and other practical advice. Call or write for a copy or use the reply coupon in the September issue of Studio Sound.


## 5 STUDER 24 TRACK'S DELIVERED

The Soundcraft 1624 is the most sophisticated mixer in its price range. The Studer A80 twenty four track is the most reputed, and now at revised prices offers the best value in the market. Put them together and you have a package set for the eighties. Our experience of both private and commercial installations enable us to tailor this package to your exact requirements. Prices start from around £30,000. Call Andrew Stirling on 01-440 9221 for full details.

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All the products that we sell can be bought using Access or Barclaycard/Visa. Order by phone for fast delivery. Call or write for a copy of our new "Turnkey by Mail" catalogue or visit our demonstration room in North London during normal office hours.
Our business is helping you with yours.

VISA Access

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

# Survey

inputs, 24 track monitoring, stereo masters, six cue sends, six echo sends, muting, three headphone circuits, automation available. Console in in-line design with I/O/M modules, with separate jackfield and meter bridge. Input module is transformerless, multitrack routing switches, panpot, channel couple for stereo inputs, 0 to 60dB stepped gain, monitor pre-set, six section eq with four main bands with 15dB presence or absence with adjustable bell curves, high and lowpass filters, phase reverse, PFL pre eq, mute, four monitor/mixdown groups.

## 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: 093 22 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**
Monaural 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 flexiblity that will satisfy any stereo requirement.

**Mono/Stereo 5**
Broadcast audio control console, five channels, with 13 switched inputs, available in mono or stereo, VU metering, cue and monitor gains, rotary faders.

**Executive**
10 channel, with 22 inputs, switched to specific channels, includes network channel, cue intercom system.

**M90**
Broadcast desk, with up to 26 mixing positions and 52 inputs, with two, four or eight output configurations, combined mono output standard, optional eq, high and lowpass filter on each channel, LED function indicators, input and output monitoring.

▼

## HARRISON (USA)

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

**MR-1**
Utilises DCI (Distributed Control Intelligence) digital-analogue, hybrid-console architecture whereby an individual micro-computer is placed in most console modules. Operational characteristics of the 56 input, 48 output console are under software control; and the *MR-1* features automated panning, echo sends, group assignment, echo return, and automated insertion of patch points, filter, and equalisation. The *MR-1* is specifically designed for compatibility with synchronised 24-track tape machines.

**3624 and 2824**
In-line multitrack consoles using input/output modules where all internal stages have their inputs and outputs brought out onto an electronic switching card using FETs which allows the 'organisation' to be freely changed to accommodate different operating modes. Each channel features 24 independent assignment busses, assignment pad, mic gain and pad, full parametric eq and hp filter, multitrack monitor, stereo cue, echo sends, quad pan, mute/solo, automated fader with nine grouping busses. An internal channel patchpoint can be selected to different areas of the module. Operational status includes source monitor for recording, return monitor for overdubbing, return mix for mixdown, and source mix allowing a monitor mix on the main VCA faders. Metering is via 12 segment electronic VUs, and automation is available. 36 and 28 input versions with 24 outputs.
**Prices:** *3624* $78,852, *2824* $65,463.

**4832, 4432, 4032 and 3232**
Basically similar to above but with 48, 44, 40 and 32 inputs with 32 outputs. Input/output modules have further facilities such as two patchpoints, four echo sends etc. 36 segment electronic VU/PPM meters are fitted as standard. Transformerless microphone amplifiers are standard.
**Prices:** *4832* $149,270, *3232* $103,807.

**Auto-Set**
Microcomputer based programme primarily for automation of Harrison consoles but which can be used for many other applications. Uses full ASCII keyboard with visual display unit (32 x 16 characters) and provides numerous facilities. Full details on application.
**Price:** $21,572.

**Live Performance Console**
Available in either 24 or 32 input mainframes with satellite extender frames of either 24 or 32 input configurations constructed from aircraft aluminium with a weight of about 84kg for a 24-channel console. Features include four pairs of main stereo groups, 3-band parametric eq with high pass filter on each input/output module, eight auxiliary send groups, automation ready, Penny and Giles VCA fader section with switching to select any or all of eight subgroup masters which allows for grouping of subgroups.

**Note**
Harrison are to introduce a new in-line multitrack console at AES New York (November 1980). This will be available in two versions, automated and non-automated. Full details will be included in our AES Report.

## HH (UK)

**HH Electronic, Viking Way, Bar Hill, Cambridge CB3 8EL, UK.**
**Phone: 0954 81140. Telex: 817515.**
**USA:** Audiotechniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902.
Phone: (203) 359-2312.

**Stereo 16**
16-input stereo mixer with four band eq, balanced low impedance input switchable to high imp unbalanced, peak programme indicator, foldback, echo and pan. Graphic equaliser built in as standard, VU meters also fed from channel PFL, stereo phone socket, optional digital effects units which plug into front panel, *XLR* or jacks with multi-pin connector for stage box.

**Stereo 12**
Similar to above but only 12 channels and less peak indicators, graphic equaliser and separate monitor VU.

## HILL (UK)

**Malcolm Hill Associates, Hollingbourne House, Hollingbourne, Kent, UK.**
**Phone: 062780 556.**

**A Series**
Uses basic channel module featuring variable gain (from −90dB), ±18dB high, mid and low eq, foldback aux and echo sends, pan, function and fader. Connectors jacks (option *XLR*), 4-band eq in output groups, VU metering previous to output faders. 4-track capability.

**B Series**
Similar to *A series* but standard with *XLR* connectors and VU meter on each channel.

**C Series**
Similar to *A series* but with mic/line channel switch, Penny and Giles faders, 8-track routing, various monitoring options.

**D Series**
Designed specifically for complex PA applications, this series is based on A, B and C series but with additional high and low pass filters, three frequency band selection on mid control, two post fade sends, four output channels, 100 mm wire-wound professional faders, quad possibilities.

**K Series**
Modular mixer, 24 or more channels, 8-, 16- or 24-group selection, 4-, 8-, 16- or 24-track monitor, LED level indication, PA subgroup, monitor mute or dim, pre or post selection of monitor sends, bal in and out, *XLR*, jack or multi connectors, line-up oscillator, 4-band eq, three way LED indicator or VU on each channel, VU or PPMs on outputs.

**J Series**
Modular sound reinforcement console available in 24/8/2 and 32/8/2 configurations with optional 10-channel extensions. Layout and facilities similar to the *K Series*.

## ITAM (UK)

**Industrial Tape Applications, 1-7 Harwood Avenue, Marylebone Road, London NW1 0AE, UK.**
**Phone: 01-724 2497. Telex: 21879.**

**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; low, mid, high eq; echo send; foldback; 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 11kg.
**Price:** £647.

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# PROLINE PROFESSIONAL recorders

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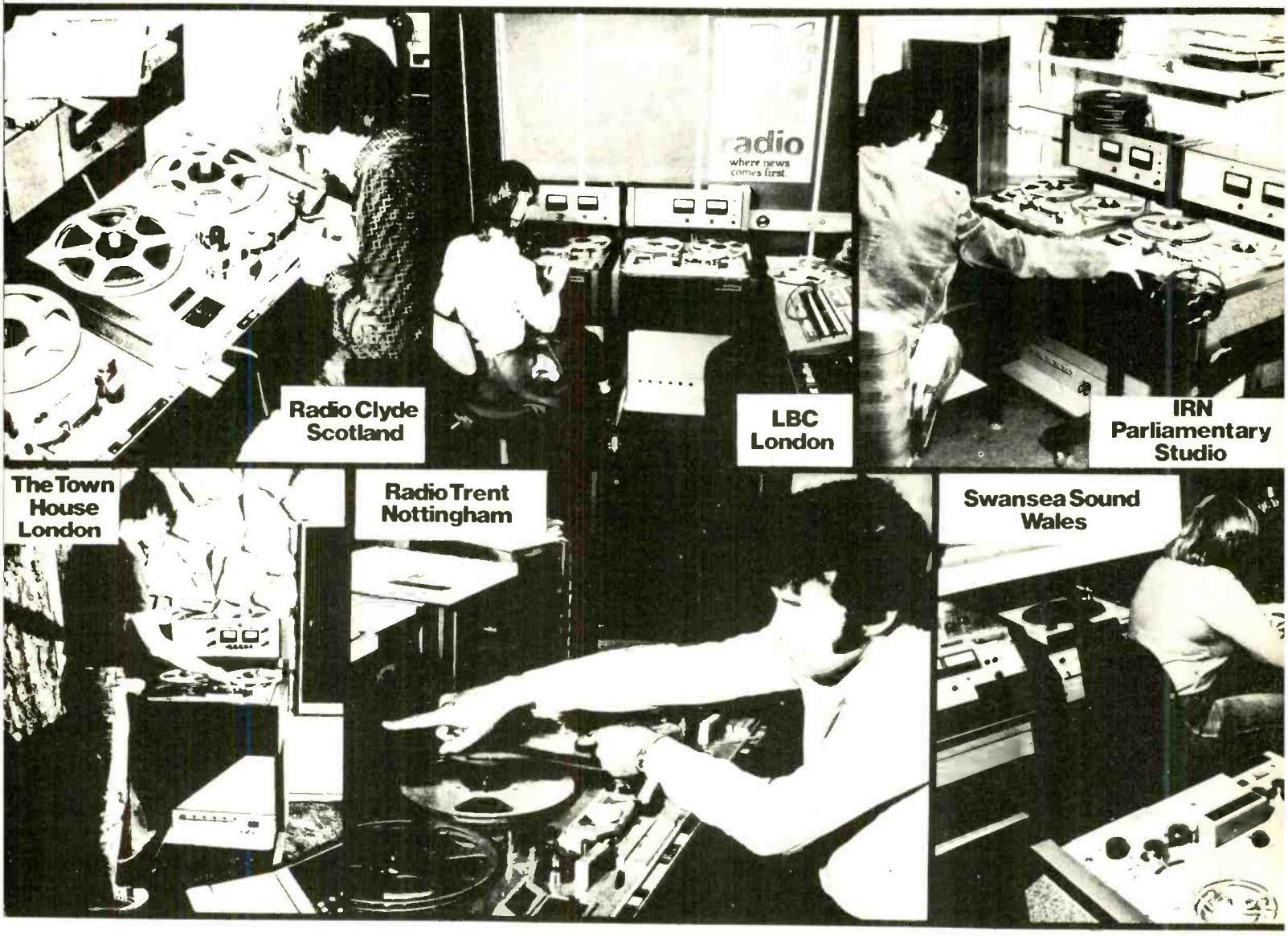



Speak to Tony Costello or John Robinson about them at:

319 Trinity Road Wandsworth
London SW18 3SL

Telephone 01-874 9054
Cables Leemag London SW18
Telex 923455 Wembley

*Also at:* **PICCADILLY RADIO, METRO RADIO, RADIO TEES RADIO FORTH, THAMES T.V.**

**LEEVERS-RICH EQUIPMENT LIMITED**

# Survey

## INTERFACE (USA)
**Interface Electronics, 3810 Westheimer, Houston, Texas 77027, USA.**
**Phone: (713) 626-1190.**

**Model 16T8**
Theatre mixer with 16 inputs with eight push button selected submaster busses (input modules can feed any number of busses) with pot submasters and eight outputs selected by matrix pots from the eight submix busses and each equipped with a slider fader. (*Model 24T8* is similar with 24 inputs). Modules include conductive plastic sliders, balanced XLR inputs, switched gain, three eq circuit, solo, phantom powering, four cue sends.

**Series 104**
Basic mixers, 8, 12, 16, 24, 32 inputs for 4-, 8- or 16-track recording, VU meters, normal or parametric eq, pot masters standard, sliders extra, group activate, stage monitor version with direct matrix (32 x 8), three equalisers.

**Series 308/316**
Similar to above, but provides eight stereo submixes and two outputs, VU meters.

## INTERNATIONAL CONSOLES (USA)
**International Consoles Corp, PO Box 862, Provo, Utah 84601, USA.**
**Phone: (801) 224-4263.**

**Modular Console**
'Plug-in Perfection', 'Modular System' console, with modules available for each separate function, and separately updatable, to avoid total console replacement. Console provides inherent illumination of all controls, but only appropriate sections illuminated at particular times. Memory system stores position of each knob, which illuminates when matched, 24-track monitor, VU monitoring of all active circuitry, up to eight stereo cues, limiting, noise gate circuits. Modules include preamp (mic), input selector, track access, signal processor (eq), buss assignment, Fader (*Fadex*), arm rest, control room monitor, oscillator, summing amp, master logic, push button, master fader, buss (master module), track (master module).

## JBL (USA)
**James B Lansing Sound Inc, 8500 Balboa Blvd, Northridge, Cal 91329, USA.**
**Phone: (213) 893-8411. Telex: 674993.**
**UK:** Harman (Audio) UK Ltd, St John's Road, Tylers Green, High Wycombe, Bucks HP10 8HR.
Phone: 049481 5331.

**7510**
Automatic microphone mixer for PA applications, four to 24 inputs expandable in groups of four, rotary level controls, auto mic on/off and output level correction without feedback, fast attack time on gating, manual, auto or priority modes for each channel.
**Price:** on application.

## IRV JOEL (USA)
**Irv Joel & Associates, 528 River Road, Teaneck, New Jersey 07666, USA.**
**Phone: (201) 692-0010.**

**JL-412**
Automatic broadcast console designed to provide automated programming of sequences up to 28 events and 11 input sources, modular system with manual override or operation, 28 thumb wheel switches select any input for complete control of an hour or more of programming, sensing 25Hz tones at the end of reel to reel sources, and secondary tones on carts, LEDs indicate status of each input module, only one source on air at a time, apart from voice over, trim pots, headphone amp, three VU meters.

## KAJAANI (Finland)
**Kajaani Oy, Electronics Div., Nuaskatu 11, SF-87400 Kajaani 40, Finland**
**Phone: (8) 86-37311. Telex: 45148.**

*Irv Joel JL-412*

**10 EA Series**
Series includes standard consoles ranging from 6 to 24 inputs, 2 to 4 outputs, 2 to 4 aux groups, 4 subgroups. Due to modular construction changes according to customer needs are possible. The consoles are compact units including power supplies. All inputs and outputs are transformer balanced.

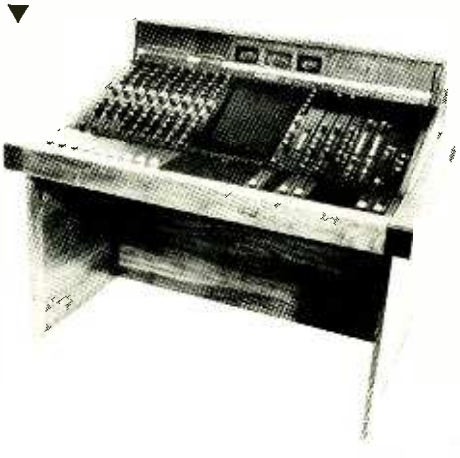
**KAJAC Series**
In-line type multitrack console designed for broadcast studios. Consoles allow multitrack recording up to 36 tracks with simultaneous stereo broadcast. Each channel has mic + line input and multitrack playback input, six section eq, 4 mono and 1 stereo aux sends, on/track routing to 4 of 36 busses with fast thumbwheel switches, monitor routing to 4 busses that can be used as two stereo pair. Console operation modes are selectable centrally. Dc controlled faders may be ganged to 8 masters.

## LIBRA (UK)
**Libra Electronics Ltd, 105/9 Oyster Lane, Byfleet, Surrey, UK.**
**Phone: 09323 51051.**

**Live Sound Mixers**
Designed for theatres and conference/art centres with input and output selection designed specifically for such applications. Each input module can be selected to any input and combination of output. Thus an input can be assigned through one or more faders to any configuration of outputs. This follows normal theatre lighting practice where cues can be pre-prepared while existing cues are in use. Group control can be arranged by plugging outputs back to an input assigned to a separate output.
**Price:** from £2,500.

## MALDWYN BOWDEN (UK)
**Maldwyn Bowden International Ltd, 168 Edward Street, Brighton BN2 2JB, UK.**
**Phone: 0273 607384.**

**Series 24A**
Radio broadcasting mixer, fully expandable, modular system, adaptable from simple presenter desk to network master control desk, optional eq on both mono and stereo channels, double anodised legends, stereo and mono metering and monitoring, versatile talkback and intercommunications with headphone rings, auto voiceover, phone-in channels, optional script spaces, outside broadcast stereo selection with talkback, remote equipment starts off-fader (on switched), stereo correction of onesided contributions.
**Price:** on application.



## MAP (USA)
**Modular Audio Products, 1385 Lakeland Avenue, Bohemia, NY 11716, USA.**
**Phone: (516) 567-9620.**

**IMPAC series**
Range of modular broadcast consoles, three standard mainframes, VU meters, versions with up to 12, or 16 input modules, either mic or line, with mono or stereo outputs, output equalisers, air feed selector, stereo monitor outputs, up to 48 switched inputs to the channels.

## McCURDY (Canada)
**McCurdy Radio Industries Ltd, 108 Carnforth Road, Toronto, Ontario M4A 2L4, Canada.**
**Phone: (416) 751-6262. Telex: 06 963533.**
**USA:** McCurdy Radio Industries Inc, 1711 Carmen Drive, Elk Grove Village, Illinois 60007.
Phone: (312) 640-7077. Telex: 910-222 0436.
**UK:** Seltech Equipment Ltd, Rose Ind Est, Cores End Road, Bourne End, Bucks SL8 5AT.
Phone: 06285 29131. Telex: 848960.

**SS7800**
Free standing modular console with 30 mono mixer channels with slide attenuators, full assignment facilities for up to eight sub master and two or four master outputs. One mic and one line input per channel, echo send, foldback, solo, cue talkback system, monitor selects, optional jackfields, equalisers, compressors, pan modules, etc.

**SS7900**
Free standing modular mixer available in standard configurations of 24 or 32 mixers with 4, 8 or 16 submasters or masters, full assignment switching, two mic and two line inputs per channel, echo send, foldback, solo, cue, talkback, monitor. Options include multifrequency testing and slate oscillators, equalisers, compressors, jackfields etc.

**SS8400**
Free standing modular, 12-channel mixer, with two inputs per channel and a choice of input modules to accommodate any input. Each input assignable to either or both output channels, complete cue, talkback, monitor, foldback and echo send facilities. Options include test oscillators, equalisers, compressors, input selectors, remote controls, larger versions up to 20 channels available.

**SS8500/8600/8700**
Similar to above, but 10, 20 and 20 channels respectively.

**SS8550/8650**
Economical, compact free standing mixers, 10 and 16 channels respectively, otherwise similar to *SS8400.*

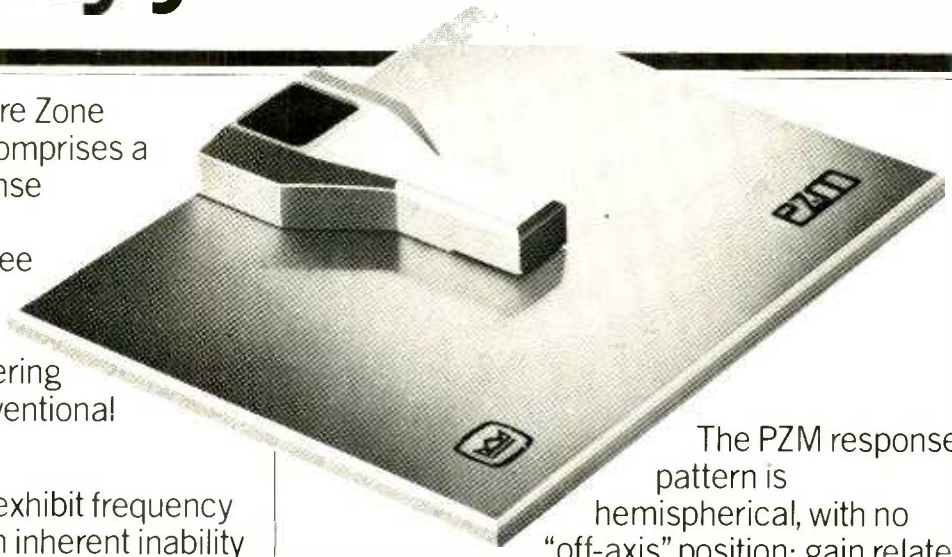
**SS8800**
Modular, compact desk mounting 8-channel console with two inputs per channel with a choice of mono and stereo line and microphone input modules. Max three stereo output channels, two programme, and one aux with mono sum output. Each input channel assignable to any or all stereo ouputs. Complete cue, talkback and monitor facilities with comprehensive built-in remote dc functions.

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

**JH-500C Series**
Available in six frame sizes (28 to 56 inputs). MCI plasma display light meter system standard, including selectable VU or peak metering. Optional *JH-50* automation system provides level and mute automation for up to 64 functions plus meter display of fader levels. All consoles include VCA grouping for eight groups, four echo returns, built in alignment oscillator and communications system, and control room and studio monitoring. All I/O modules include 32-track assignment, 4-band equaliser and variable highpass filter,

70 ▶

# Can you afford to ignore the most significant development in microphone technology of the last fifty years?




The revolutionary Pressure Zone Microphone (PZM[tm]) family comprises a range of hemispherical response microphones which give a transparently natural sound, free from non-linear characteristics – such as proximity effect and comb filtering – that are exhibited by all conventional microphones.

Traditional microphones exhibit frequency response anomalies, due to an inherent inability to satisfactorily combine direct and reflected signals, thus leading to phase-induced amplitude cancellations and reinforcements, or comb filtering.

Amcron PZMicrophones[tm] eliminate this effect because they detect sound by means of a new process. This takes advantage of the fact that, as a sound wave approaches a boundary (such as a wall, table or floor), there is formed at this boundary a pressure field four or five mm. deep, within which the direct signal and its reflection from the boundary remain in phase and add coherently.

The Amcron PZM places a small pressure transducer inside the primary boundary pressure zone, facing the boundary. This prevents any direct signal reaching the microphone, thus eliminating the possibility of phase-induced interference and providing a significant improvement in signal quality.

The PZM response pattern is hemispherical, with no "off-axis" position: gain related to distance will change, but not tonal quality. The PZM responds accurately to up to 150 db spl, yet hears a whispered conversation in an ordinary room at ten metres.

Engineers are finding that the PZM continually suggests new miking techniques. And that in many applications fewer PZM's are required than traditional microphones. In fact, the PZM is changing ideas about how a microphone should look, sound, and be used. Don't you think that it's time you got in on the act, and gave the PZM a listen?

Details of available models, prices, and suggestions for applications are obtainable from the sole UK importers and distributors.

HHB

HHB Hire and Sales. Unit F. New Crescent Works. Nicoll Road. London NW10 9AX. Tel: 01-961 3295 Telex: 923393.

Amcron

PZM and PZMicrophone are registered trade marks of Crown International

quad/stereo/mono mix capability, six sends for effects or foldback, three solo sends, and both channel and monitor systems with independent VCA reversible faders. The *JH-556* is the ultimate console designed for use with dual multitracks. Broadcast version and numerous options are available.
**Price:** 36 I/O $101,679; 48 I/O $144,260; 56 I/O $161,428.

**JH-600 Series**
Available in two frame sizes (18 to 36 inputs), the *JH-600* series features standard *JH-50* automation, factory installed, for level and mute automation, grouping and solo-in-place functions. VU metering is standard, MCI plasma display light meter system for peak metering is optionally available. All consoles have completely transformerless differential inputs and outputs and include 5 echo returns, built-in alignment oscillator including pink and white noise generator and communications system, and control room and studio monitoring. All I/O modules include 24-track assignment, 3-band equaliser with highpass and lowpass filters, stereo/mono mix capability, six sends for effects or foldback, three solo sends, and both channel and monitor systems with independent and reversible faders. Broadcast configuration and numerous options are available.
**Price:** 18 I/O $32,200; 36 I/O $51,106.

**JH-50 Automation**
Automation system that may be incorporated or retrofitted to most audio consoles, on most consoles automates inputs and echo returns, and provides automation control of level, mute, grouping (eight), solo in place. The standard processor handles 64 VCA functions, while each console input and echo return to be automated requires one VCA fader module with level, group master select, update, LED direction indicators, mute and solo in place.
**Prices:** processor $7,137; digitiser board for any 16 functions $1,983; VCA modules $370 each; typical 32 function system $22,943.

## McMARTIN (USA)

**McMartin Industries Inc, 4500 Sth 76th Street, Omaha, Nebraska 68127, USA.**
**Phone: (402) 331-2000.**
**UK:** Lee Engineering Ltd, Napier House, Bridge St, Walton-on-Thames, Surrey KT12 1AP.
Phone: 09322 43124. Telex: 928475.

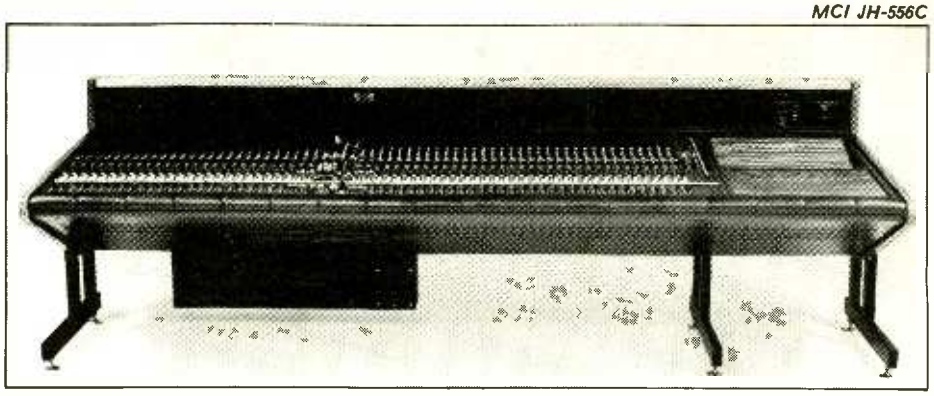
**500 Series**
Small broadcast console for mic and four line inputs, built-in cue speaker, studio muting, stereo capability. Various options for card amps.
**Price:** mono $1,250, stereo $1,775.

**1000 Series**
Broadcast consoles with five or eight stereo channels with either slider or rotary faders, built-in monitor amp, headphone amp, all inputs on screw connectors.
**Price:** $2,500 to $4,100.

## MTE ELECTRONICS (Australia)

**MTE Electronics, PO Box 48, Ashgrove, Queensland, Australia 4060.**
**Phone: 07 302173.**

**Series 85**
A presentation to air console, available in 12- or 18-input mainframe sizes, with as many input channels fitted as are initially required. Choice of three input channels, microphone, mono line and stereo line. Silent solid state switching, insertion links, cue facility and an independent auxiliary output are standard features of all input channels. Additionally the channel on/off switching controls all logic and provides machine control from the one set of buttons; an optional timer module is also controlled from the on/off logic. Three stereo and three mono programme outputs are provided. Stereo monitoring and cue outputs are provided also a talkback and internal cue amplifier and speaker are fitted. The 18-input mainframe is fitted with four VU meters (PPMs are optional); the smaller 12-input mainframe is normally fitted with two meters. Two 10-input headphone modules are



*MCI JH-556C*

supplied each with its own volume control. A switch module allows the meters to read various functions within, and external to, the console. The power supply is rack mounted and requires 5¼ in of rack space. Options include: line selector modules, count up timer, limiting module, equaliser module, customising as necessary such as transmitter controls, etc.
**Prices:** from $12,000 (Australian) depending on facilities.

**Series 250**
A production console designed for broadcasters with 16-, 24- or 32-input, 4- or 8-group (sub-group oriented), stereo monitor/master/remix console. Features of the input channel. Separate mic and line inputs with rotary level presets, assignment to 4 or 8 tracks and remix, phantom power, 4-knob equaliser, two auxiliary sends, two effects sends, solo/PFL monitoring, peak indicator, long throw conductive plastic faders, insertion point.

Other features include, off tape or group monitoring, master monitor module, auxiliary and effects master module, communication/test module, VU or peak meters (light column meters in development), *XL-3* connectors on prime inputs and outputs, prime inputs and outputs are balanced. Choice of Trans-amp, Jensen or Sowter transformers. Power supply is rack mounted requiring 5¼ in of rack space.
**Prices:** from $20,000 (Australian) depending on facilities.

## MICRO-TRAK (USA)

**Micro-Trak Corp, 620 Race Street, Holyoke, Mass 01040, USA.**
**Phone: (413) 536-3551. Telex: 955497.**
**UK:** Lee Enginering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP.
Phone: 09322 43124. Telex: 928475.

**6618**
Broadcast 6-channel, stereo/mono console with rotary conductive plastic faders, three inputs per channel, 10W monitor amp, on air lights VU meters, logic switching, various preamp types.

**D-format**
Range of broadcast consoles, 4- and 5-channel units available in mono or stereo, with various inputs, various outputs, monitor amp, cueing.

## MIDAS (UK)

**Midas Audio Systems Ltd, 54-56 Stanhope Street, London NW1 3EX, UK.**
**Phone: 01-388 7060/387 7679.**
**Canada:** Gerr Electro-Acoustics. 363 Adelaide Street, Toronto, Ontario M5A 1N3.
Phone: (416) 868-0528.

**PR System**
Range of consoles for live sound reinforcement, on-stage monitoring, recording and production applications, in a variety of input/output configurations. Range has included 32/24 for location recording, 44/8/2 for PA, 18/8/8 for film dubbing, system of three consoles for Supertramp including 32/8/2 concert sound console, 24/4 effects console and 36/8 on stage monitor console. There are 20 standard *PR System* modules with a wide range of input modules providing varying degrees of simplicity and complex eq, various subgroup and output modules, master control, aux out modules, on-stage input module with eight rotary levels control for eight groups. All faders are P&G, meters Ernest Turner, frame built up from six module sections, multilink cables and boxes available.
**Prices:** range from £5,300 to £20,000.

**TR System**
New range of mixing consoles specifically developed for theatre sound mixing applications, available in 24, 30, and 36 8-8 formats, the system is fully modular and built to the same specification as the *PR System*. Comprehensive routing to eight subgroups and direct to group outputs one and two, eight subgroup by eight group output matrix with routing from the subgroups to six aux busses, all aux busses switchable pre or post fade, two inputs for each channel, comprehensive eq, stereo monitoring, tape replay inputs for 8-track recording, P&G faders, *XLR* connectors.
**Prices:** £18,700 to £24,500.

## MILLBANK (UK)

**Millbank Electronics, Uckfield, Sussex TN22 1PS, UK.**
**Phone: 0825 4166. Telex: 95505.**

**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.
**Price:** £375 *XLR*, £346 DIN.

**Musicmaster Three**
Stereo entertainment mixer with six channels, channel monitoring, bal mic or bal line inputs, coarse sensitivity, echo/reverb outputs, channel on/off, priority override, remote outputs.
**Price:** on applicaton.

## M-JAY (UK)

**M-Jay Electronics Ltd, 90 Kingsdale Gardens, Drighlington, Bradford BD11 1EZ, UK.**
**Phone: 0532 852075.**

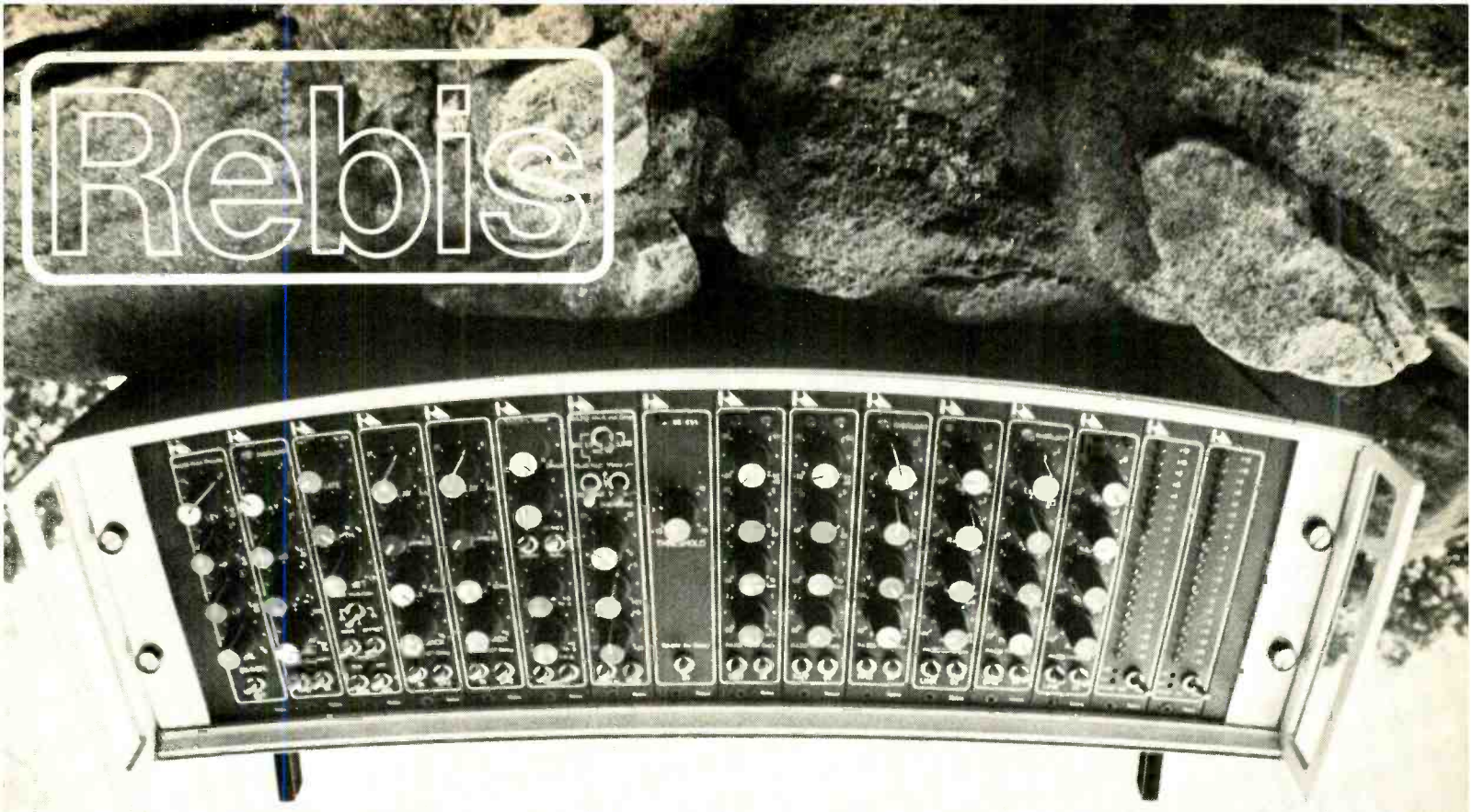
**Airedale Studio Mixers**
Range of consoles from 16/8/8 to 32/24/24, with stereo outputs.
**Price:** on application.

## MM (UK)

**MM Electronics, PA:CE Musical Equipment Ltd, 63 Kneesworth Street, Royston, Herts.**
**Phone: 0763 45214.**

**DM Series**
Range of mixers expandable from 8/2 up to 32/8. Four and 8-output versions feature centralised microprocessor channel and group routing system. Input channels feature VCA control, channel fader, overload and channel LEDs, mute and PFL switches, pan, two echo sends, foldback, lf cut, 4-band eq, mic/line pad, and channel gain control. Aux and output modules offer full monitoring facilities.

**MP Series**
8, 12, 16 or 20 channel stereo or 4-track mixers for small studios or PA. Semimodular construction with unbalanced inputs, two masters, VU meters, high, mid 1 and 2, low eq, foldback, echo, pan and slider fader. The *MP385/485* provides eight outputs with modified channel selection. The *MP185 Super 16* is similar to the basic series with PFL, peak indicators on all channels, 7-band graphic equaliser on each stereo output, and also 2-way electronic crossovers. Other options on MP series for mute switches, talkback, *XLR* instead of normal jack connectors, balancing transformers and multipins.
**Prices:** £228 to £1,076. ■




# New Perspectives

The RA200 Series has established itself as the most versatile approach to sound processing. Hardly surprising since its the fastest growing and most comprehensive modular system in the world. Modules to date include:

RA201 Noise Gate
RA202 De-esser
RA203 Compressor-Limiter
RA204 Parametric Equaliser
RA205 ADT/Delay
RA206 Oscillator
RA207 LED Meter
RA208 Modulator
RA209 Mixer
RA210 RIAA Preamp.
RA211 Timer
RA212 Mic/Line Amp.
RA213 Mono MDA.
RA214 Stereo MDA.
RA200J Connector

Rebis

For further information contact: Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 5AB. Tel: 0384 71865.

SSE

Export Enquiries to: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27939 Scenic G.

France; Lazare Electronic, Paris 8786210. Netherlands; SAP Amsterdam 797055. Sweden; Tal & Ton Gothenberg 130216. Belgium; S.E.D. Brussels 522 7064. Spain; Mike Llewellyn Jones Madrid 637 0752. Japan; Continental Far East Tokyo Tlx. 72 22498. U.S.A.; Great West Indies Music Co., Gulf Div., Miami 2712120.

# Harrison 32

**MANUFACTURER'S SPECIFICATION**
**NOTE:** no performance specification is published but the following is taken as typical and was obtained from the manufacturer's technical service manual and relates to a complete desk.
**Impedances:** mic preamp input 8kΩ. Line inputs 10kΩ. Line output impedance 53Ω.
**Levels:** nominal input level at line inputs +4dB, +24dB max. Nominal level at patch points +6dB, maximum return level. +24dB. Normal nominal level at outputs +4dB. Max output level for <1% THD +17dBm at patch points, +25dBm at outputs.
**TIM:** using the DIM 100 method the worst case figures for both microphone and line inputs are 0.03% at +24dBm output.
**RF Immunity:** a 10mV common mode RF signal with 30% AM at 400Hz injected into the mic or line inputs and swept from 100kHz to 54MHz produces no detectable output except between 5MHz and 8MHz when the signal in the output is 3dB above noise.

**Frequency response and distortion:**

| | | Frequency | | | | |
|---|---|---|---|---|---|---|
| | | 20Hz | 40Hz | 1kHz | 10kHz | 20kHz |
| Mic input @ max gain +6dBm out | Level (dB) | −0.2 | −0.1 | 0 | −0.5 | −1.5 |
| | THD (%) | 0.1 | 0.05 | <0.01 | <0.01 | – |
| Mic input @ max gain +18dBm out | Level (dB) | −0.3 | −0.1 | 0 | −0.5 | −1.6 |
| | THD (%) | 0.15 | 0.05 | <0.01 | 0.02 | — |
| Mic input @ min gain +24dB out | Level (dB) | −0.1 | 0 | 0 | −0.4 | −0.5 |
| | THD (%) | 0.5 | 0.07 | 0.01 | 0.02 | 0.003 |
| Line input +16dB in/+18dB out | Level (dB) | −0.2 | 0 | 0 | −0.3 | −1.0 |
| | THD (%) | 0.15 | 0.05 | <0.01 | 0.02 | — |

**Crosstalk:** the following figures relate to the mic input driven at −40dB with an output level of +20dB.

| Switch | Crosstalk (dB) | | | | |
|---|---|---|---|---|---|
| | 40Hz | 100Hz | 1kHz | 10kHz | 15kHz |
| Track assign | −80.5 | −80.5 | −80.0 | −76.0 | −74.0 |
| Ping | −98.5 | −98.0 | −97.5 | −85.0 | −81.5 |
| Mute | −89.5 | −89.0 | −86.5 | −71.5 | −67.5 |
| Fader down | −68.5 | −88.5 | −86.5 | −71.0 | −67.5 |

**Manufacturer: Harrison Systems Inc, PO Box 22964, Nashville, Tenn 37202, USA.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ.

This module forms part of the Harrison *32* series of consoles which would normally be equipped with a group master module, a monitor module and possibly a quad master module and a communication module. All modules are equipped for automation of the level controls and all signal routing is accomplished by logic levels driving FET switches in lieu of relays which are not used in this console because of their limited reliability.

Very complex signal routing is possible and grouping of level controls is purely a matter of interconnecting dc control lines under logic control. Given this versatility, the complete console is designed for use with two separate multitrack recorders designated A and B. Each input module is designed to accept inputs either from a microphone or from either of the multitrack machines A or B. Proceeding from the far end of each input module (which is 780 × 44mm (lw)) the 32 output routing switches are arranged in two rows of 16, each having an adjacent red LED indicator which is illuminated when an output has been assigned. The left-hand row of switches relates to the odd-numbered tracks (1 to 31) with the right-hand bank dealing with the even-numbered tracks. Below the assignment buttons a further button initiates the panpot which can pan fully between the even-numbered and the odd numbered tracks.

Below the assignment sections come the controls for the input, consisting of four pushbuttons and two potentiometers. The balanced microphone input has +48V phantom powering which may be switched on or off by a switch on the communication module. However, it is perhaps unfortunate that this affects all input modules making it impossible to mix microphone types. From the input, the microphone feeds a phase-reverse switch followed by a switchable 20dB pad before the microphone input followed by the mic amp which has a full range potentiometer gain control. The remaining two pushbutton switches in this section have adjacent red LED indicators to show their operation. One switch selects the line input A or B by operating FET routing switches whilst the other, the 'ping' switch, selects either the line input or the microphone input, the line input having a ±6dB gain trim potentiometer.

Proceeding down the panel there are four separate equaliser sections comprising an hf equaliser, an lf equaliser and two mf equalisers. Each of these has a frequency control and a cut/boost control in the form of calibrated potentiometers. In addition there are highpass and lowpass filters again with frequency controls and a fixed slope, the frequency controls being calibrated. One pushbutton switch is used to switch the equalisers in or out and another for the high- and lowpass filters.

An additional feature of the lf equaliser is that by means of a pushbutton switch, its shape can be altered from the normal shelf-type eq to a peaking-type eq with cut or boost. Additional switches allow the equaliser to be inserted in the monitor chain and also eq solo, in which case a red LED indicator is illuminated.

Within the monitor section there is the full range monitor level potentiometer which may be defeated by a 'fix' button which fixes the monitor level—a useful feature when setting up a session.

74 ▶

# Feldon Audio are proud to announce their appointment as exclusive U.K. distributors for the Synton range of products


## Syntovox 221-The Intelligible Machine that set the standards in vocoder techniques. £2780·00*

The Syntovox 221 is a 20-channel vocoder system already in wide use in sound recording studios, radio stations, scientific institutions, and by leading composers, for its outstanding quality and unexcelled intelligibility. Included are 54 dB/octave filters – a feature not to be found in any other vocoder on the market. It offers the versatility of a built-in pulse generator for direct speech synthesis, with several control units for pitch modulation.

### Also available: the Syntovox 222 (Triple Two)

– a simplified vocoder system specifically created for performing musicians who need a flexible, easy-to-use machine for on-stage and session work. Triple Two is the trend setter for budget recorders – with a price to prove it: £468.00.*

synton HOLLAND

* Prices subject to variation, dependent on the rate of exchange.

UK Distributors

## Feldon Audio Ltd.,

126 Great Portland Street, London W.1. Tel: 01-580 4314. Telex: London 28668.

In addition the monitor may be fed to solo or muted. Pressing a 'mon' button in the equaliser section inserts the equalisers into the monitor. Within the cue section, the cue signal may be derived from pre- or post-fade, being fed to the full-range cue level control the output of which may be panned left or right. Similarly, the two echo send sections may be fed from pre- or post-fade, each section having two outputs with independent level controls.

The following section is the quad panning section which feeds the four quad mixing busses. Two potentiometers affect the left/right and rear/front panning. Three pushbutton switches in this section alter the effect of panning. A button labelled 'quad' has to be depressed to activate the rear/front panning, otherwise the information is only fed to the left/right busses. Normally the left/right panning is 3dB down at the mid point with a sine/cosine characteristic, but pressing a −6dB button, the panning is lowered to −6dB at the centre position with the same sine/cosine characteristic—claimed to improve mono compatibility. The final switch is an on/off switch for the quad panning section.

Before coming to the fader section there is the 'Mute/Solo-in-place system' which consists of a momentary pressbutton, a yellow LED indicator and a local switch with a nearby red warning LED. This works in association with the group master module and the local switch. Normally, the pressbutton mutes the individual input module and extinguishes the yellow LED; however, if the master mute/solo button is set to solo the button mutes all other modules—if more than one module is set to solo it remains in circuit. Pressing the local button inhibits this action.

The remainder of the input module is largely occupied by the excellent Penny and Giles fader adjacent to which there is a decimal thumbwheel switch for group selection (zero to nine, with zero being ungrouped) and a 'master' button with a red warning LED indicator. Pressing the 'master' switch makes the adjacent fader the group master for the locally selected group.

The remaining features which consist of plus and minus LED indicators and two pushbutton switches with adjacent warning LED indicators are associated with automation. The plus and minus LEDs show if the local fader setting is above or below the setting from automation. The remaining pushbuttons decide if the particular module is being controlled by group A or group B of the automation system with the final control being associated with updating automated control.

**Inputs and outputs**

Probably the most important input is the microphone input and all too often manufacturers arrange this with far too low an input impedance: not so Harrison. Measurement of the mic input impedance showed it to be a constant 8.06kΩ without the attenuator pad in use, dropping to 1.34kΩ with the 20dB pad in circuit, irrespective of the mic gain setting. It was noted that the 20dB pad provided 19.5dB attenuation, close enough to the nominal 20dB.

Without the pad in use, the common-mode rejection was excellent as shown in **fig 1a**, but inserting the 20dB pad deteriorated the common-mode rejection to that shown in **fig 1b**. However, at the higher input levels requiring the pad the common-mode rejection is not so critical.

The maximum level acceptable at the mic input without the 20dB pad was found to be −39dBm at maximum gain, rising to +15dBm at minimum gain—these increasing appropriately with the 20dB pad inserted—an excellent signal handling capability.

With the channel fader set to zero the maximum gain from the mic input was 70dB and that of the line input 0dB ±6dB depending upon the gain trim setting which had a ±6dB range. Irrespective of this setting the balanced line input impedance remained at 9.90lkΩ with the common-mode rejection staying virtually constant at 45dB over the frequency range 20Hz to 20kHz.

On the output end, the line-drive output had a source impedance of 50Ω with a maximum drive capability of +26dBm or +26.5dB above 0.775V into a high impedance.

The application of a 1kHz squarewave to the mic input without the 20dB pad produced the squarewave shown in **fig 2** at the output loaded into 600Ω with only the slightest indication of ringing. However, if the output was unloaded, ringing was a serious problem.

Turning to the other output connections, the echo sends, cue send, quad summing busses and

76 ▶

FIG.1
HARRISON 32 COMMON MODE REJECTION AT MIC INPUT

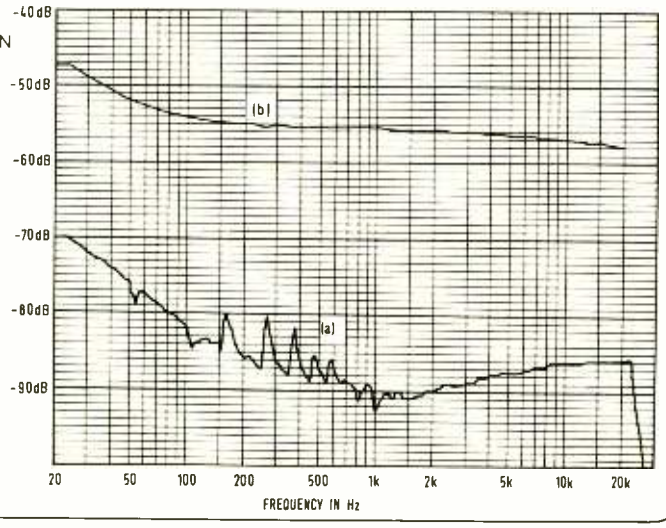



FIG. 2

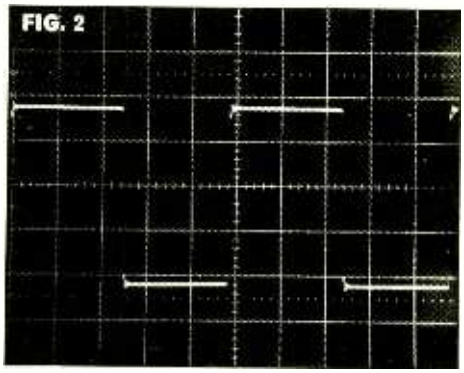


FIG.3
HARRISON 32 HARMONIC DISTORTION WITH MIC INPUT AT MAX GAIN

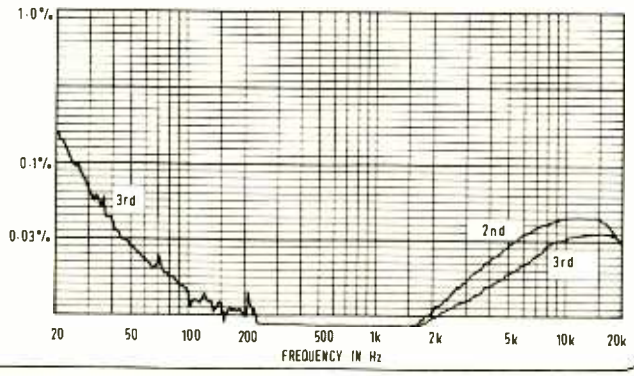
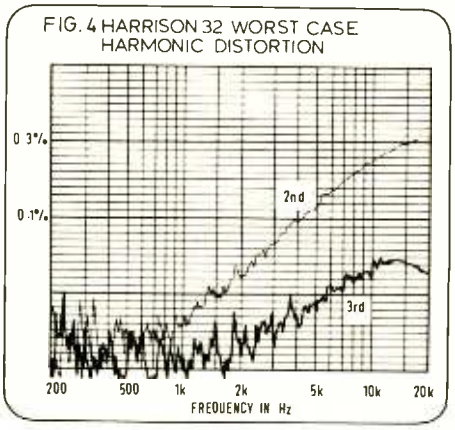



FIG. 4 HARRISON 32 WORST CASE HARMONIC DISTORTION



the assignment buss all had output impedances of 10kΩ so that they could be summed at a virtual earth amp. The patch outputs and returns were ground-compensated connections and the VU meter feed a 100Ω unbalanced feed—all sensible arrangements.

**Noise**

Of prime concern in input modules is the noise in the mic preamp, and measuring this over an effective 20kHz noise bandwidth (using a 15.7kHz lowpass filter with an attenuation rate of 6dB/octave) with the mic input shunted with 200Ω, gave an excellent noise factor of only 1.7dB (ie noise referred to the input was −128dBm).

With the channel fader set to normal 0dB gain the noise in the multitrack feed output was found to be −69.5dBm (CCIR weighted quasi-peak) or −80.5dBm (A-weighted) irrespective of the setting of the line input gain trim. The insertion of the filters or the equalisers in the 'flat' position had no effect upon the noise and the use of the equalisers had the anticipated effect upon the output noise levels.

Checking the crosstalk across the track assign switches showed this to be better than −80dB at 1kHz as was the isolation across the 'ping' switch

78 ▶

FIG. 5
HARRISON 32 CCIF
INTERMODULATION DISTORTION

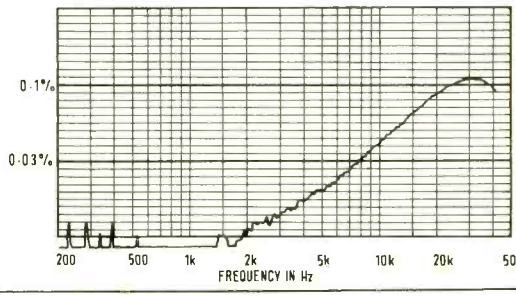



FIG. 6
HARRISON 32 FREQUENCY RESPONSE

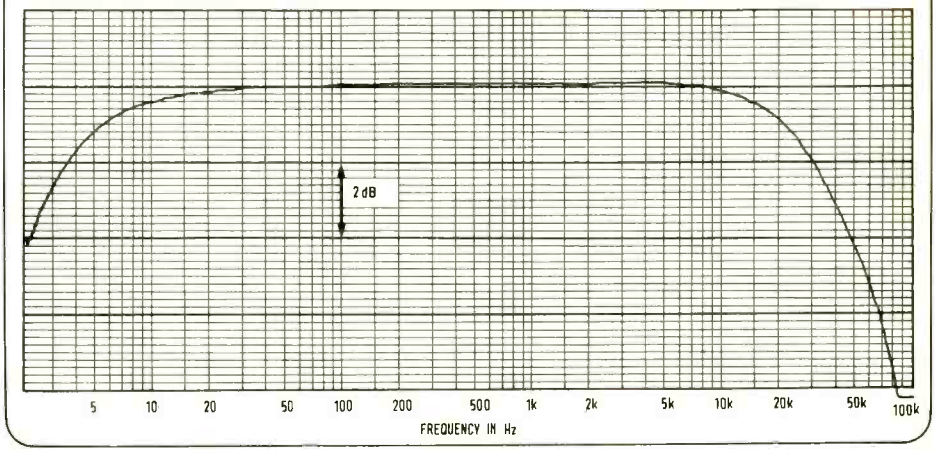
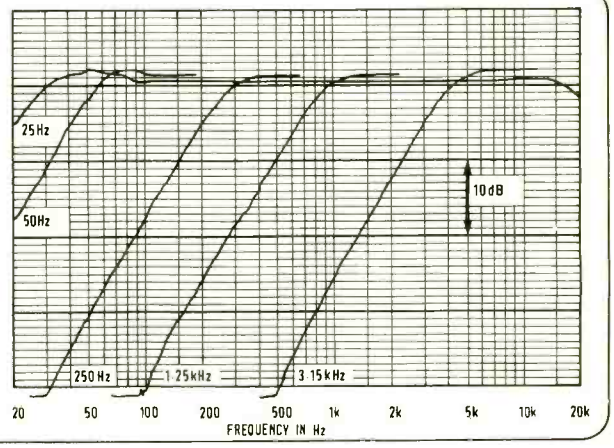



FIG. 7
HARRISON 32
HIGHPASS FILTER



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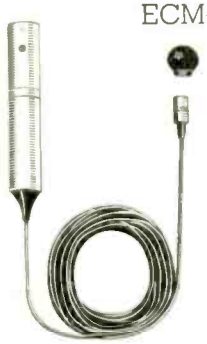

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and the mute function.

**Distortion**

Both harmonic distortion and intermodulation distortion to the CCIF twin tone method were investigated for the line level input and also the mic input. Generally the distortion via the line input was less than 0.03% at any level over the frequency range 20Hz to 20kHz with the mic input giving higher results.

**Fig 3** shows the second and third harmonic distortion for the mic input at maximum gain with +20dBm output and with the group fader set to the normal 0dB point. The worst case harmonic distortion was found with the mic input at maximum gain and +10dBm output as shown in **fig 4.**

Again using the mic input at maximum gain the CCIF intermodulation distortion at +20dBm output was at a low level within the passband of the module as shown in **fig 5**, and investigating other levels and control settings failed to produce any worse results.

**Frequency response, equalisers and filters**

The overall frequency response from the mic input or from the line level input to the line level output were found to be almost identical, both having −1dB points at 20kHz and being effectively flat down to 20Hz as shown in **fig 6** for the line level input.

Insertion of the high- and lowpass filters showed that both had a fixed 12dB/octave slope with the range of cutoff frequencies shown in **figs 7** and **8.** It can be seen from these figures that the

80 ▶

FIG. 8
HARRISON 32
LOWPASS
FILTER

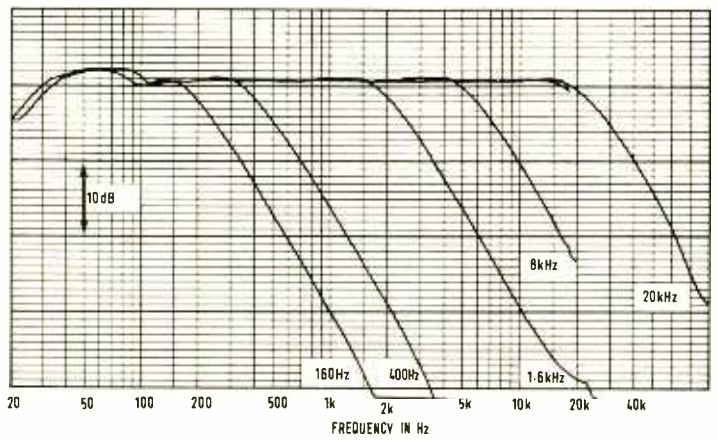



FIG. 9
HARRISON 32 LF EQ
SHELVING MODE

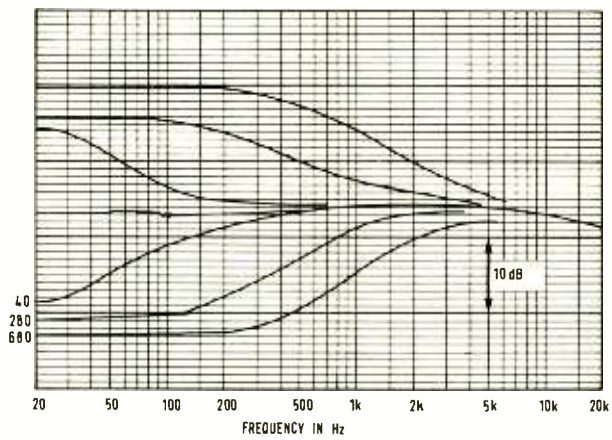
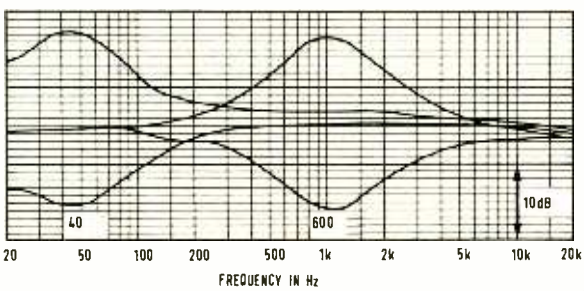



FIG. 10
HARRISON 32 LF EQ
PEAKING MODE



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calibration points on the module's panel are not particularly accurate. The filters are, however, very versatile and have a wide frequency range.

Turning to the equalisers, their insertion with all cut/boost controls at their mid-point (zero cut or boost) led to significant deviations from a flat frequency response. The low frequency equaliser has two modes of operation: either a shelving mode, or a peaking mode if a peaking button is depressed. For maximum cut and boost conditions the characteristics of these two modes of operation are shown in **figs 9** and **10**, which offer completely different features, but again, the control calibration tends to be somewhat arbitrary.

Similar remarks apply to the hf equaliser and to the two mf equalisers, the characteristics of which are shown in **fig 11.**

Overall the equalisation section is excellent with the equalisers having a sensible range with the feature that their frequencies overlap allowing for more dramatic effects when used in conjunction with the high- and lowpass filters.

**Other matters**

The stereo pan control was found to be of the full-range type allowing either channel to be fully cut off with its centre position being a −3dB point relative to the full output at either extreme. So far as the channel fader is concerned this provided a maximum cut off in excess of 90dB with accurate calibration points at 5dB intervals from +15dB to −25dB.

Just checking a single I/O channel did not permit investigations into the versatility of the FET switching of the signal routing, but this is clearly an extremely versatile system when interfaced in a full console.

The general standard of construction was good with the large mother board plugging into three printed circuit connectors which would normally be mounted within the console. Supported by the mother board, which houses a large number of components, are four additional printed circuit boards which function to support one bank of assignment switches, the VCA, the FET switches and the transformerless mic preamp, all of which can be readily changed.

Whilst a generally good service manual is provided I find it surprising that it does not include many layout diagrams and that no component identifications existed on the printed circuit boards.

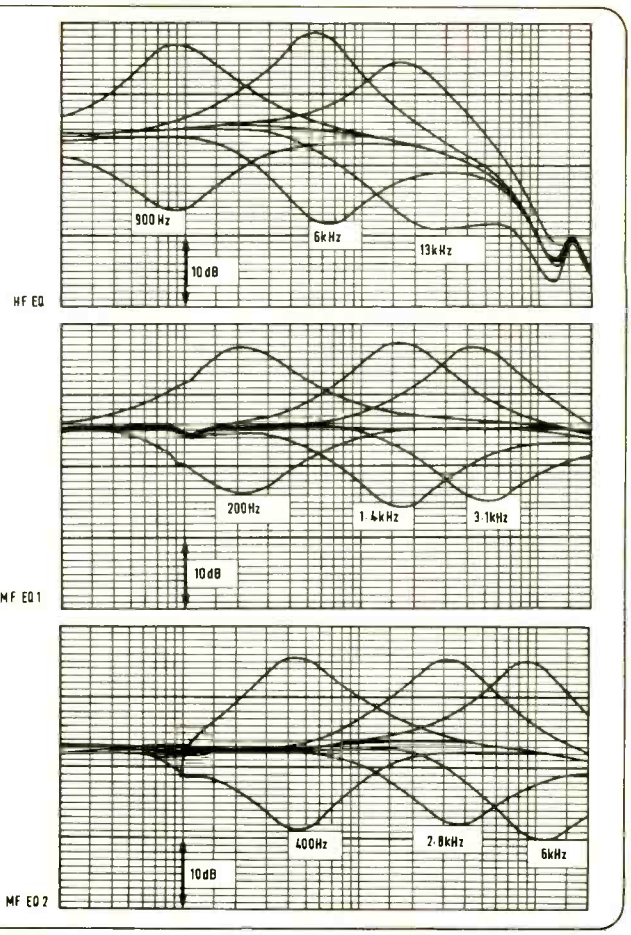
By modern standards the control density on the front panel was low with the result that all knobs were easily operated even by those of us with large and clumsy fingers! Control identification was excellent with LED warning lamps being illuminated adjacent to controls of major importance when operated. The minimum of brightly coloured knobs are used, making the complete desk restful to the eye and clear to operate.

**Summary**

This is a most versatile input/output module offering many facilities and a good overall performance. Of particular interest was the very quiet and transformerless mic input section which eliminates the ringing associated with transformers and also the versatile equalisers and filters.

Overall, a well-made and uncluttered module with an excellent performance. **Hugh Ford**

FIG. 11
HARRISON 32
CHARACTERISTICS OF
HF AND MF EQ



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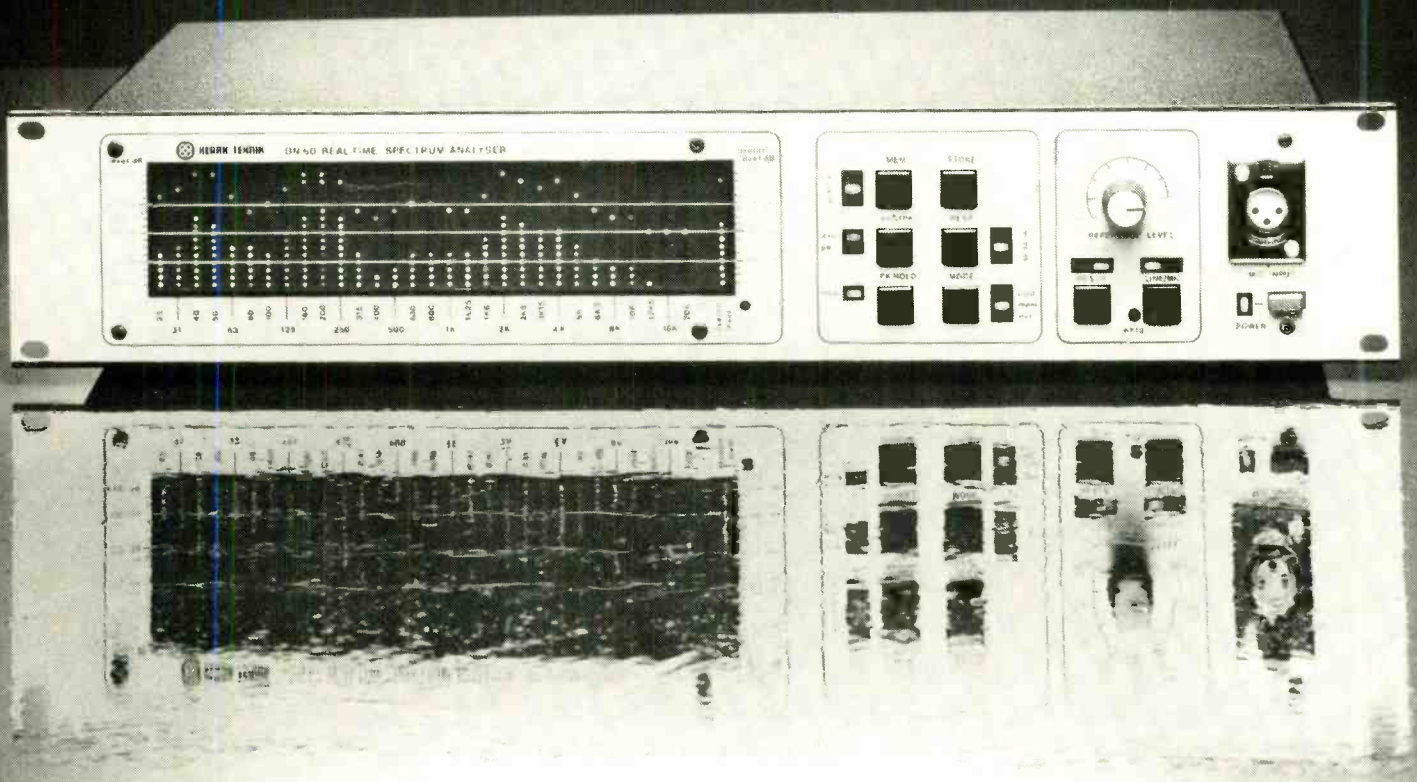


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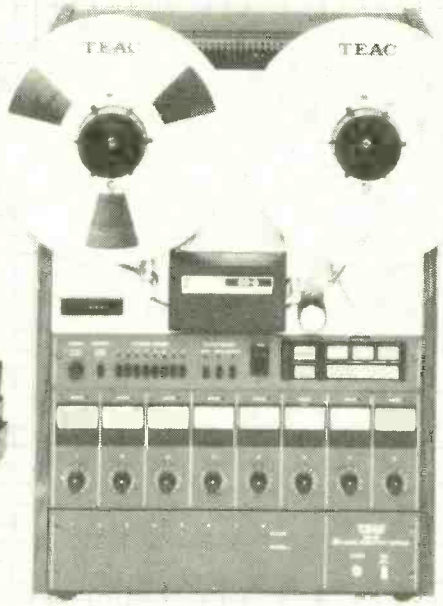


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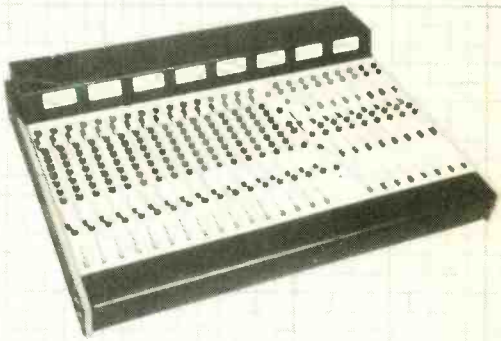

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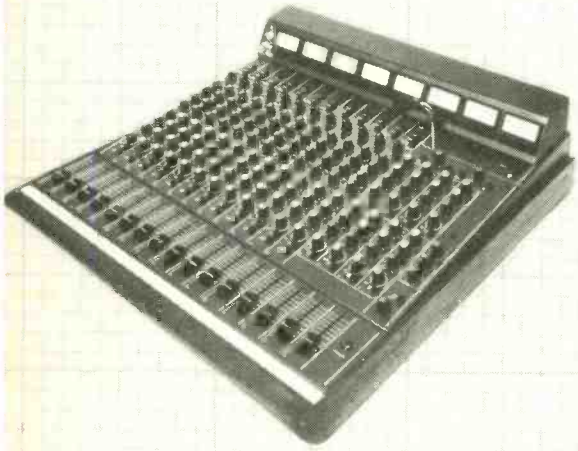

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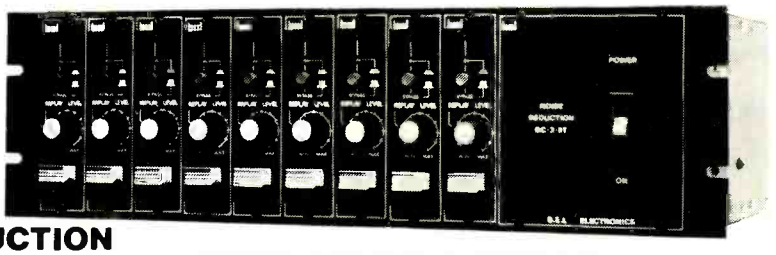

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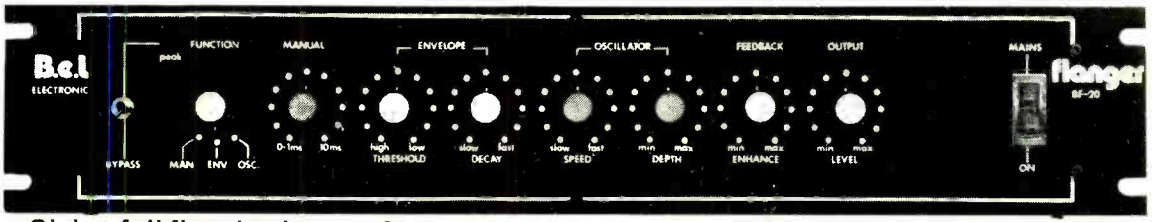


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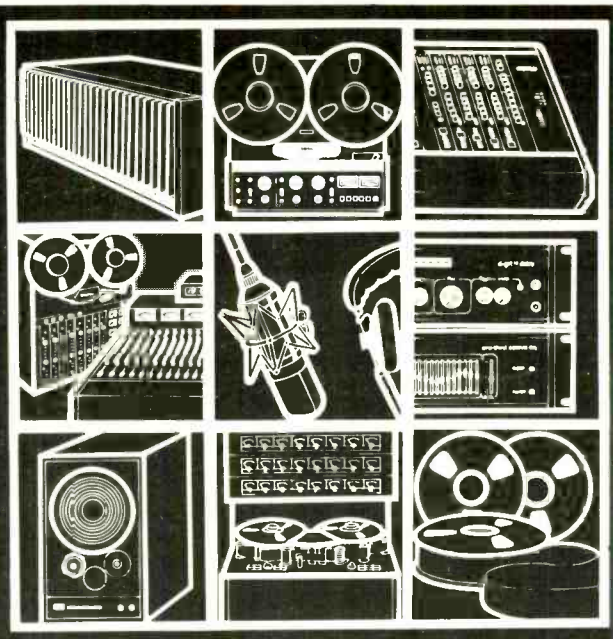

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JBL and Tannoy supply most of the world's monitor speakers but no studio is complete without a pair of Auratones. Monitor amplifiers include Quad 405, 303, HH TPA and MOS FET, Turner and Amcron

### Accessories

We have large stocks of many accessories, including Ampex 406/407 tape and Grand Master, all lengths of Ampex cassettes, EMI splicing blocks, leader tape, D.I. boxes, track sheets etc

### Mail Order

Our fast efficient delivery service is available to anywhere in the UK. Just phone or write for a quotation on the equipment you require.

## Lake Audio

Lake Audio Consultants
33 Church Street
Rickmansworth
Hertfordshire WD3 1DH

If you would like to know how Lake Audio can help you, telephone us on Rickmansworth (092 37) 70488

Send now for your copy of THE 'TOTAL PACKAGE'

# TRAD

## Sound Workshop
PROFESSIONAL AUDIO PRODUCTS

## 1600 SERIES CONSOLES
8/36 in - 4/32 out

**Options:** Trans Amps, Parametric Eq, Sweep Eq, High Resolution Metering, VCA Grouping, Arms Automation & Super Group, Spectrum Analyser.

## A selection of used equipment available from our showrooms

| TAPE MACHINES | £ |
|---|---|
| **Lyrec** 24 Track 15 ips with Remote and Autolocate | 9000.00 |
| **Lyrec** 24 Track 15 ips with Remote and Autolocate | 10000.00 |
| 3M M79 24 Track | 12500.00 |
| **Studer** A80 24 Track Kk 1A with Autolocate | 14500.00 |
| **Ampex** MM1200 24 Track | 14500.00 |
| **MCI** 16 Track JH100 with Mk II Autolocate | 8500.00 |
| **Studer** 16 Track A80 Mk I | 11000.00 |
| **Studer** 8 Track A80 Mk II | 6000.00 |
| **Scully** 280 8 Track, mint condition | 3000.00 |
| **3M** 400 Series 8 Track | 3750.00 |
| **Klark Teknik/Richardson** 4 Track ½" | 2200.00 |
| **Ampex** AG440 8 Track 1" | 3400.00 |
| **Ampex** 300 Series 4 Track on ¼" | 700.00 |
| **Ampex** AG440B Stereo | 1100.00 |
| 2 x **Ampex** 351 Stereo, each | 400.00 |
| **Studer** A80 R Stereo | 3500.00 |
| **MCI** JH110B Stereo, 6 months old | 2250.00 |
| **Studer** C37 Stereo Transistor, Electronics by Decca | 900.00 |
| **Revox** B77 HS Stereo, as new, demo. only | 500.00 |
| **Revox** B77 HS Stereo ¼ Track, as new, demo. only | 500.00 |

| NOISE REDUCTION | |
|---|---|
| Dolby M16H | 4500.00 |
| Dolby A361 | 295.00 |
| Dolby A360 | 275.00 |

| MIXING CONSOLES | £ |
|---|---|
| **Neve** 32-24-24 Rebuilt and as new | 29000.00 |
| **Neve** 30-16-24, 4 years old | 27000.00 |
| **Neve** 20-4-4 old Rupert Desk | 4500.00 |
| **Cadac** 32-24-24 L Desk | 24000.00 |
| **MCI** JH4040 with 36 Modules, Plasma Display, etc. | 21000.00 |
| **Sound Workshop** 28-24 Automated, ex-demonstration | 17000.00 |
| **Allen and Heath** Mod. II 16-8-16 | 1700.00 |
| **MCI** JH4040 with 18 modules V US | 9000.00 |

| ECHO PLATES, SPRINGS, DIGITAL DELAYS ETC. | |
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| The fabulous **Audicon Plate** | 2400.00 |
| **Audicon** Remote | 350.00 |
| **E.M.T.** Stereo Valve 140 Plate | 2200.00 |
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| **Tradeq** 180D Stereo Spring | 210.00 |
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| **Lexicon** 224 6 programme reverb | 4250.00 |

All MXR Equipment in stock at low low prices.
Full range of **WEBBER TEST TAPES** in stock.

**Prices are exclusive of VAT.**

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| **A.K.G.** C414, new | 224.00 |
| **A.K.G.** C451, CK1 new* | 91.00 |
| *(With Stand Mount and Wind Gag) | |
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| **Neumann** U87 | 250.00 |
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| H.H. 'S' 500D | | 290.00 |
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TRAD

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**149b. St. Albans Road, Watford, Herts, WD2 5BB, England**
**Tel: Watford 47988/9** **Telex: 262741**

# we're moving
## in all the right directions

### to even faster service

S.E.S. has a reputation for fast and personal service in supplying the right equipment for studio installations. Now with improved premises and facilities our supply and installation functions will be even more efficient – and that goes for our 'same day' service too. We hold stock from over 25 leading manufacturers plus a full range of accessories.

Our stocks include AKG, Alice, Allen & Heath, Ashly, Auratones, Beyer, Brenell, Formula Sound, Furman, JBL, Keith Monks, MXR, Neal, Quad, Revox, Sescom, Sonifex, Spendor, Tannoy, Tascam, Teac, Technics and Uher.

We can therefore select the right 'package' for your needs, without bias.

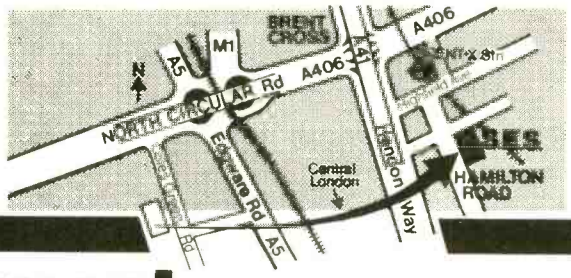
Please telephone for our brochure and price list.

### to larger premises

From July 1st 1980 our new premises become operational. We're not moving far but for the better.

We'll have more room, better facilities, larger and more comprehensive stocks. You are welcome to call at any time and test equipment in our demonstration studio.

**Our new address: 100 Hamilton Road, London NW11**
**Telephone: 01-458 9133 Telex: 87515 WISCO G**




# Studio Equipment Services Limited

100 Hamilton Road, London NW11
Telephone: 01-458 9133
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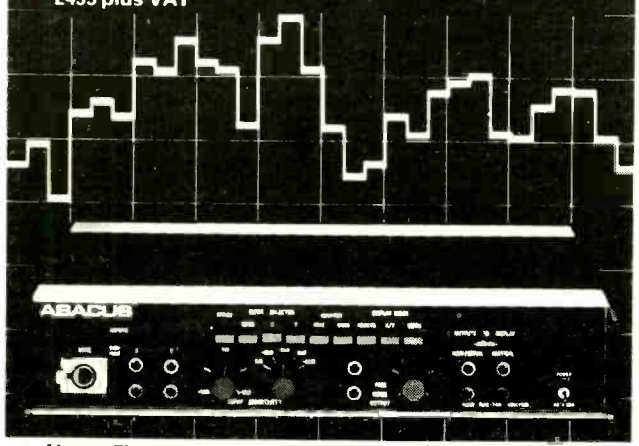
# ABACUS ARTA 600

Use the **ARTA 600** third-octave audio analyser adaptor and an oscilloscope to display the real-time intensity and spectral distribution of sounds.

The internal pink noise generator enables the electrical or electro-acoustic frequency response of systems to be accurately and rapidly determined.

**£495 plus VAT**




**Abacus Electrics** 10 Barley Mow Passage, London W4 4PH England
Telephone: London 01-994 6477 Telex 8811418

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**Note:** Advertisement copy must be clearly printed in block capitals or typewritten.
Replies to Box Nos. should be addressed to the Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after Box No. indicates its locality. **SEX DISCRIMINATION ACT 1975:** No job advertisement which indicates or can reasonably be understood as indicating an intention to discriminate on grounds of sex (e.g. by inviting applications only from males or only from females) may be accepted, unless (1) the job is for the purpose of a private householder or (2) it is in a business employing less than six persons or (3) it is otherwise excepted from the requirements of the Sex Discrimination Act. A statement must be made at the time the advertisement is placed saying which of the exceptions in the Act is considered to apply.

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## SERVICES

★**Pressings** of classical quality (colour also), promptly manufactured from your master tapes. Sleeve printing, mailing service. Studio or mobile units for master recording. Specify requirements to Mike Bull, Sound News Studios, 18 Blenheim Road, London W.4 1ES. Tel. 01-995 1661. C

★**A quality pressing** and duplication service provided to studios, etc. Complete with cutting, processing, labels, sleeves, art work, inlays, etc. Minimum order for LPS—250, singles—500, cassettes—250. Example price for complete 46 minutes cassette to include mastering, printed label and library case, on Agfa tape—80p each plus VAT. For further details: SRT Record and Tapes Ltd., 01-446 3218. X

STUDIO ACOUSTIC DESIGN

**Acoustic Technology Limited**

58 The Avenue
Southampton
SO1 2TA
Tel 0703 37811

320 Dresser Tower
601 Jefferson
Houston Texas 77002
Tel 713/759-9768

**IF YOU NEED . . .**

Cassette Duplication
Blank Cassettes
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Splicing Tape
Empty Tape Spools
White Tape Boxes
8T Cartridge Bodies
Lubricated Tape
Head Cleaner Tape

Why not ring us on 01-399 2476/7 and let us quote you for your next requirements.

**MEDIATAPE LIMITED, 29a Tolworth Park Road, Surbiton, Surrey.**
**01-399 2476/7**

ZIPPER MOBILE RECORDING STUDIO
Get Taped Where You Play
16 TRACK Acoustically Designed Control Room £9.50 per hr.
JBL Monitors/Phasing/Flanging
Comp/Lim's/Noise Gates/A.D.T.
Dolby A's For Mastering.
Contact Jeffrey on
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01-637 9977

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SUPERSCOPE CASSETTE PLAYERS BY MARANTZ
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**01-363 2337**

**COUNTY RECORDING SERVICE**
For super quality Master Discs, Demo Discs and Pressings. Scully lathe with our latest MKW 80 Stereo Cutting System.
Also half speed cutting for that very special disc.
Dolby 'A', Dolby 'B' and DBX noise reduction.
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**Cassette and open reel copying in large and small runs. Blank cassettes supplied between C-3 and C120. Dolby A and B facilities available. Studio facilities available for voice-overs. Design, artwork and print service. Established suppliers to most of the major publishing houses and Examining Bodies.**

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**Sound Communication**

Field House, Wellington Road, Dewsbury, West Yorkshire WF13 1HF. Telephone 0924 451717

**Main 3M WOLLENSAK Dealers**
Meticulous alignment of all machines before sale. Excellent servicing facilities. Suppliers of quality virgin cassettes in bulk. Fast-copying service. Prompt personal attention.
**SOUND CASSETTE SERVICES Ltd.**
P.O. Box 2, Chard, Somerset TA20 1LR
Tel. 04606 5393

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SPEECH RECORDING
CASSETTE DUPLICATING
OPEN-REEL DUPLICATING
LANGUAGES/AUDIO-VISUAL
**SPEECH-PLUS RECORDINGS LTD**
32 PAGES WALK, SOUTHWARK, LONDON SE1 4SB. 01-231 0961/2

If you need a PROPHET synthesizer in a hurry, then summon
**PROPHETMAN**
on
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24-hour studio hire service programmers available

100C-60 cassettes beautifully copied in stereo
**Just £59.50** (plus VAT)
We can copy from 100 to 5,000 high quality cassettes on our high speed loop-bin system. load them precisely into top class shells. Price includes library case and all production work from your ¼in. edited master. Any length C-5 to C-90. Ring for price check.

**STUDIO REPUBLIC**
**High Street, Pinner**
01-868 5555

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**TANNOY SUPER REDS — M1000 FOR HIRE**

Only **£50** per week

Also rapid turnround Tannoy speaker repair, London collection/delivery.

**Berkhamsted 74653**

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HIGH SPEED CASSETTE COPYING IN MONO OR STEREO AT COMPETITIVE PRICES

Long or short runs.
Blank cassettes supplied in bulk.
A growing reputation for reliability.

**MORARD SOUND PRODUCTIONS**
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**Telephone 01-689 7424**

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## TANNOY SERVICE

We have an extensive stock of Tannoy spares and exchange units and offer a prompt, efficient service including delivery and collection. We perform B & K analysis on all units to factory set specifications.

For all repairs, contact the factory accredited service agents, Elliott Bros. Ltd.

**ELLIOTT BROS. (Audio Systems) LTD.**
**114/115 Tottenham Court Road, London W.1.** 01-388-1833

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## FOR HIRE

to fit in your Noise Reduction Rack, dbx K9 Cards, **£55** per day.
Urei Time Aligned Monitors, Model 813, **£50** per day.

**Phone 01-229 9595**

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## FOR SALE—TRADE

★**Bose 802 speakers** with equalisation, £499 per pair or £473 without equalisation. Amcron DC 300 £530 and D150A at £335. All prices plus VAT. Contact Geoff Yates, C.A.V.S. Ltd. 01-363 6125. X

★**Yorkshire Erricks** of Bradford. Tascam, JBL, Bose, AKG, Beyer, Calrec, Revox, Ferrograph, Spendor. Sales, servicing, exchanges, leasing. Bradford (0274) 22972 (Paul). X

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## FOR SALE—TRADE

TAPE DUPLICATING
ENDLESS CASSETTES
INDUSTRY SUPPLIES
EXACT LENGTH
CASSETTES

John Smailes

**SELECTA SOUND**
**FREEPOST**
**ROMFORD RM2 1BR**
**Tel. 040-24 53424**

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★**3M** Wollensak Cassette Copies. Also endless loop cassettes, single edged razor blades. Sound Marketing & Services. Tel. Norwich (0603) 45338. X

★**For sale,** Electrosound semi-automatic cassette loader, 18 months old, very light usage, excellent condition. With spares, transformer and manual, £1,800 including delivery. Phone Dublin 760928/785974. M

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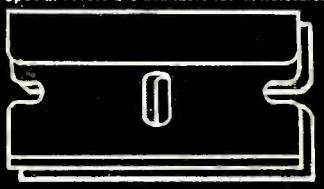
## SINGLE-EDGE BLADES

**£4·50 (inc VAT) per box of 100. Cheque with order please. Agents wanted in most areas. Very Special Prices are available for Wholesalers.**



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**Phone: 01-958 5476**

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## SOUNDCRAFT

**1in 8-TRACK** model SCM 381
PLUS
**8-CHANNEL DBX**
**£5200** inc. VAT

Surplus to requirements.
Virtually unused. Save £1300.

**AM ACOUSTICS**
contact: Vaughan Maybury
telephone: 01-351 0216
01-402 9118

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**SALE OF NEW UHER ACCESSORIES**

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| Z214 | Nicad Battery | £25 |
| Z514 | Carrying case | £25 |
| M517 | Remote control mike | £23 |
| M634 | Pair of stereo mikes for cassette machines | £35 |
| AKG | D109 Neck mike | £25 |
| AKG | D190CS Mike | £45 |
| AKG | D140C Mike | £49 |
| AKG | D170E Mike | £55 |
| BASF | LP35LH 900ft tape on 5in reels | £2·95 |

All mikes are fully wired. All prices are subject to VAT.

**WYCOMBE CAMERAS**
**45 King Edward Court, Windsor, Berks.**
**Tel. Windsor 67774**

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## TANDBERG
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## NEAL-FERROGRAPH

***For the best prices and Service***

***PHOTO ACOUSTICS LTD., 255a St. Albans Road, WATFORD. Tel: 32006***

or at

The Studio, Perry Lane, Sherington, Newport Pagnell. Tel: 610625

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## For Sale

Contents of studio including:
Solid State Logic A4000 console
18 inputs: 16 monitors
8 VCF groups
Fully prepared 32 channel
Main frame
Scully 16 track recorder
Plus Dolby rack 16 + 4

**Phone:** 0242 33555

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**AUDIO EQUIPMENT FOR SALE**

★ 40 Reels of virgin Scotch ¼" tape on NAB spools **£6.50** each.
★ 4 AKG D1200E Dynamic microphones **£45.00** each.
★ 2 AKG-Tapco 6 into 2 quality road mixers **£295.00** each.
★ 4 AKG St200 anti-vibration mic. stands with telescopic booms **£40.00** each.
★ 4 CALREC CM1050 cardioid condenser microphones **£70.00** each.
★ 2 Beyer +48v dual phantom power packs **£95.00** each.
★ 6 High Performance 15m Neumann mic. leads **£10.00** each.
★ 1 Pair of K160 headphones **£25.00.**
★ AKG CMSE Electret-condenser microphone kit with 3 basic combinations—Omni, cardioid and shotgun—includes clamps and leads. **£295.00.** Ring us for more information on this one.

Apart from saving you money these articles are genuinely in excellent condition.
PHONE **PURIST SOUND TECHNIQUES** AFTER SEVEN ON **948 1331**

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As a result of re-organisation and re-equipping, the Manor Studios Group offer the following equipment:

## FOR SALE

One Ampex MM1100 24/16 track with auto locate and remote control **£13,500**

One Ampex MM1100 16 track **£7,000**

One Neve console, 24+4/24/24 plus 2 x 2254A compressors **£15,000**

One Ampex AG-440B 2 track/servo **£1,000**

One Ampex AG440B 4 track/servo **£1,500**

**Telephone Kidlington (08675) 2128**

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## PROPERTY FOR SALE

★**Welsh farmhouse** in beautiful quiet location. 14ft x 16ft Studio Shell, 5 bedrooms, 1.7 acres. Barn with conversion potential. Modernised but needs plaster and finishing. Offers over £26,000. 093-888 300. M

## HOUSE FOR SALE

Complete seclusion only 25 miles from London: 4 bedrooms, dressing room, bathroom, 3 receptions, utility/laundry, kitchen, cloakroom, 2¼ acres, stable block or studio. Great potential. Beautiful adjoining orchard if required. **£78,000.** Tel. (0342) 833613.

## FOR SALE—PRIVATE

★**Yamaha** CR 1000 Tuner/Amplifier £350, DBX 122 Noise Reduction Unit £100 o.n.o. and Nakamichi Tri-Tracer 1,000 cassette deck, £750 o.v.n.o. Telephone Hornchurch 59909. M

★**Allen & Heath** 16/8 mod 3, as new. Offers over £1,500. Ring 0761 412497 after 5.00. M

★**Sony TC377** three-speed ¼-track stereo, superb condition, £145. Ashford (Kent) 26424. M

★**Brennell Type 19** 8-track one-inch tape machine, good condition, £1,700 o.n.o. Also TEAC 3340S, offers. Tel. 0266/821208 (Office), 87506 (Home). M

★**MCI 110A** 8-track 1in tape machine £4,750 o.n.o. Allen & Heath Mod 111 mixer, 16 in and out, 8/16 £2,350 o.n.o. Immaculate condition. Ring 01049 251 51374 (Ansafone). M

★**One pair JBL 4315** studio monitor speakers, 18 months old, extremely good condition, £850. Tel. Exeter 33138. M

★**Scully 280** 8-track 1in machine with spares including P.S.U., new capstan and reel motors, Ampex 1in test tape and service manuals. £2,750. Tel. 025 125 4253. M

## STUDIO FACILITIES

★**Fanfare Records.** Tape-disc pressings, demo's masters, any quantity. Studio/mobile Neumann disc cutter. S.A.E. brochure. 1 Broomfield Close, Rydes Hill, Guildford, Tel. 0483 61684. X

★**Disc Cutting** master and demos, pressings, cassettes, mobile recording studio. Free brochure. TAM Studio, 13a Hamilton Way, London N.3. Tel. 01-346 0033. X

★**New Wollensak cassette copiers** directly imported by C.A.V.S. Ltd., cost less and have full service/spares back up. E.g. Wollensak 2770 still costs £999 plus V.A.T. Also available Telex Copuette at £299 plus V.A.T. and all other Wollensak, Telex, Pentagon similar units. Contact Yates, C.A.V.S. Ltd., 01-363 6125. X

★**Accurate level** control starts with a Cathedral LA3 comp/limiter module, from £30 per channel. Telephone Halsall (0704) 840328. B

★**Radio Studio,** ideal for making commercials. Neve desk, also mobile with 16 track Neve. Send for rate card. CCL Associates, Rookery House, Newmarket. Tel. 0638 67278. Tlx 81647. M

## WANTED

★**Moog synthesiser** (studio type) wanted. Either system 35 or 55. Will collect. Please phone Mr. Webb, 01-675 4978. B

## SITUATIONS VACANT

★**Manager/Operator** required to run and maintain Electronic Music Studio. Apply: Senior Administrator, Dartington College of Arts, Totnes, Devon. M

★**Electronics Engineer** to run and maintain general pool of audio/video equipment. Apply: Senior Administrator, Dartington College of Arts, Totnes, Devon. M

## SITUATIONS WANTED

★**Balance Engineer** with good reputation and vast experience, including groups, orchestras and film work, seeks interesting position with happy company, preferably in or around London. Box No. 845 c/o *Studio Sound.* M

For Further INFORMATION on

**STUDIO SOUND**

ring

**PHIL GUY**

on 01-686 2599

**LEADING POP STUDIO IN MUNICH**

have a vacancy for a first class recording engineer. Must be able to record small groups as well as modern popular orchestras up to 40 musicians. Knowledge of German not essential. Top salary for the right person. Box number **844, c/o Studio Sound.**

**1 MCI 536 LM automated desk,** 1 JH 114 24-track machine with autolocate 3, 2 x JH 110 BC stereo machines, all prewired for 32-track operation and interconnected with pluggable multicables so that the equipment can be relocated within hours. Inspection by appointment in Switzerland.

**Box Number 841**

# Technical Service Engineer

## Professional recording equipment

The company markets a wide range of top-quality professional products including multi-track audio tape machines.
If you have graduate-level ability in electronics engineering together with a knowledge of both digital and analogue circuit design, you'll be able to make a major contribution to the work of a small team specialising in these sophisticated products. You'll spend a considerable proportion of your time on field service visits to customers' premises, as well as working at the service centre in West London. Full product training will be provided.

The impressive remuneration package consists of competitive starting salary, plus estate car and other large-company benefits.

*Ref: S3884/SS*

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**PA Advertising**

Hyde Park House, 60a Knightsbridge, London SW1X 7LE. Tel: 01-235 6060 Telex: 27874

PA

*A member of PA International*

INNER LONDON EDUCATION AUTHORITY

## LEARNING MATERIALS SERVICE

**Television Centre, Thackery Road, London SW8**

# HEAD OF SOUND (ST4)

The television Centre produces a range of educational programmes distributed in the form of 16mm film, videocassettes and sound cassettes. The sound section of five members works with professional equipment (Neve, Studer, Sandor, ITC, etc.) to provide an audio component of high standard. The head of sound will lead the section and also to mix and process many of the programmes. He/she will be responsible for training new staff, and with the Chief Engineer and others will also undertake responsibility for the equipment and for its purchase and maintenance.
Applicants should have suitable theoretical qualifications with **significant** relevant experience at senior level. A good working knowlege of all sound operations associated with television and film is essential.

Salary is within the scale **£8756.64** to **£9593.64**

Further information and application forms available from the

**Education Officer** (EO/Estab. 1C), **Room 365, I.L.E.A., The County Hall, London SE1 7PB**

TELEPHONE 01-633 7456

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Inner London Education Authority

## LEARNING MATERIALS SERVICE

Television Centre, Thackeray Road, London SW8 3TB

The Television Centre produces a range of educational programmes in the form of videocassettes, sound cassettes and 16mm film for distribution within London and nationally. It has a colour television studio, colour mobile unit and film unit all equipped to professional broadcasting standards.

*Vacancies have arisen for the following:—*

### STUDIO SOUND SUPERVISOR ST3 (£8,115 – £8,709)

Required to mix and process programmes, supervise the assistant in the studio, and on a relief basis, operate mike booms and other sound equipment. Previous experience essential, and technical qualifications highly desirable.

### STUDIO SOUND ASSISTANT ST2 (£7,029 – £7,842)

General studio work, rigging, boom operation, tape and grams etc, but with periods of location recording work using the Nagra or other equipment. The latter work could involve overtime and occasional overnight stays. A good knowledge of sound techniques in television and film is required, though consideration will be given to those with experience elsewhere in sound recording if they have suitable technical qualifications. A current driving licence is highly desirable.

*Further information and application forms available from:* **The Education Officer (EO/Estab. 1C), Room 365, The County Hall, London SE1 7PB. Telephone 01-633 7456/7546.**

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*Alice* have the following vacancies:

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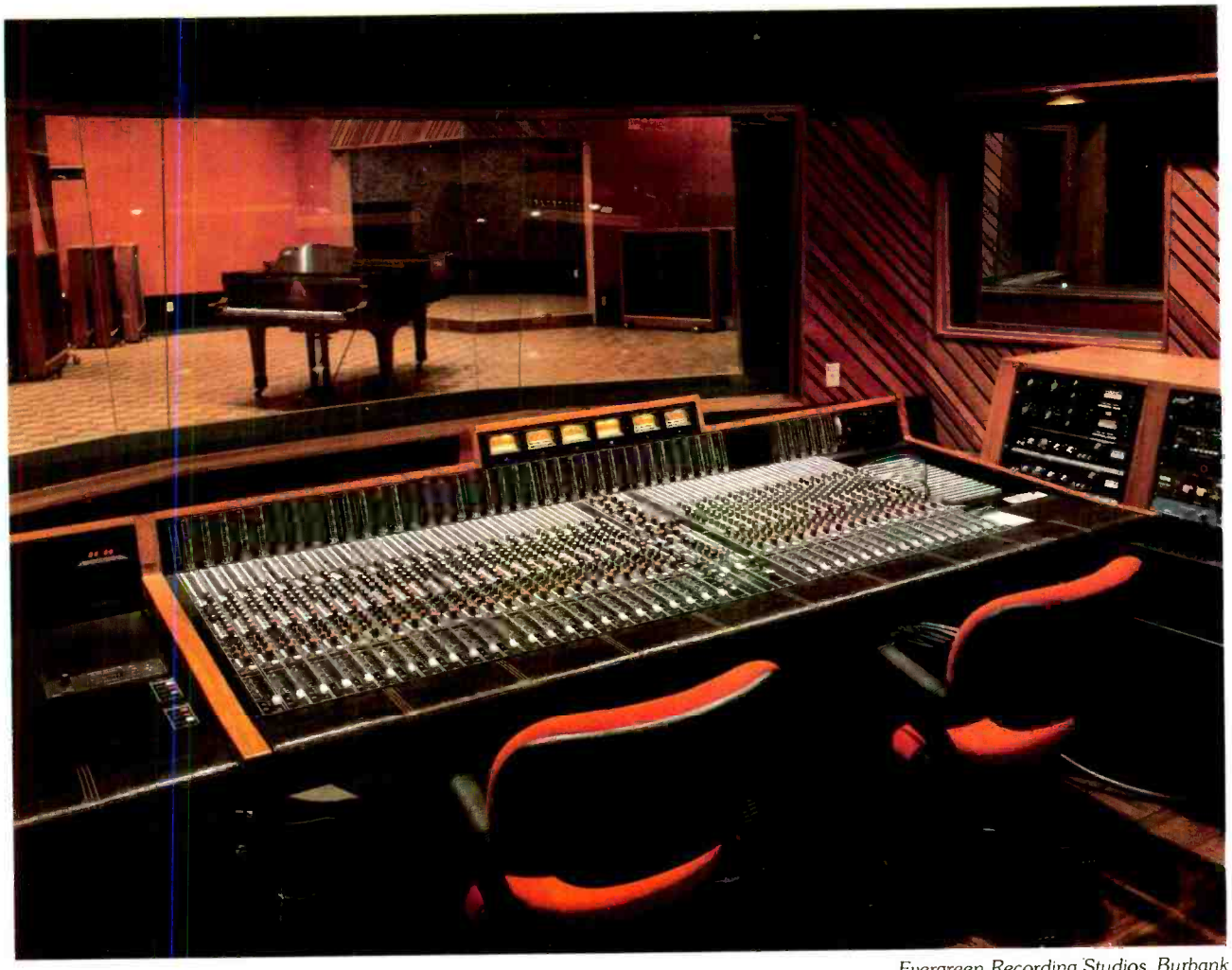

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