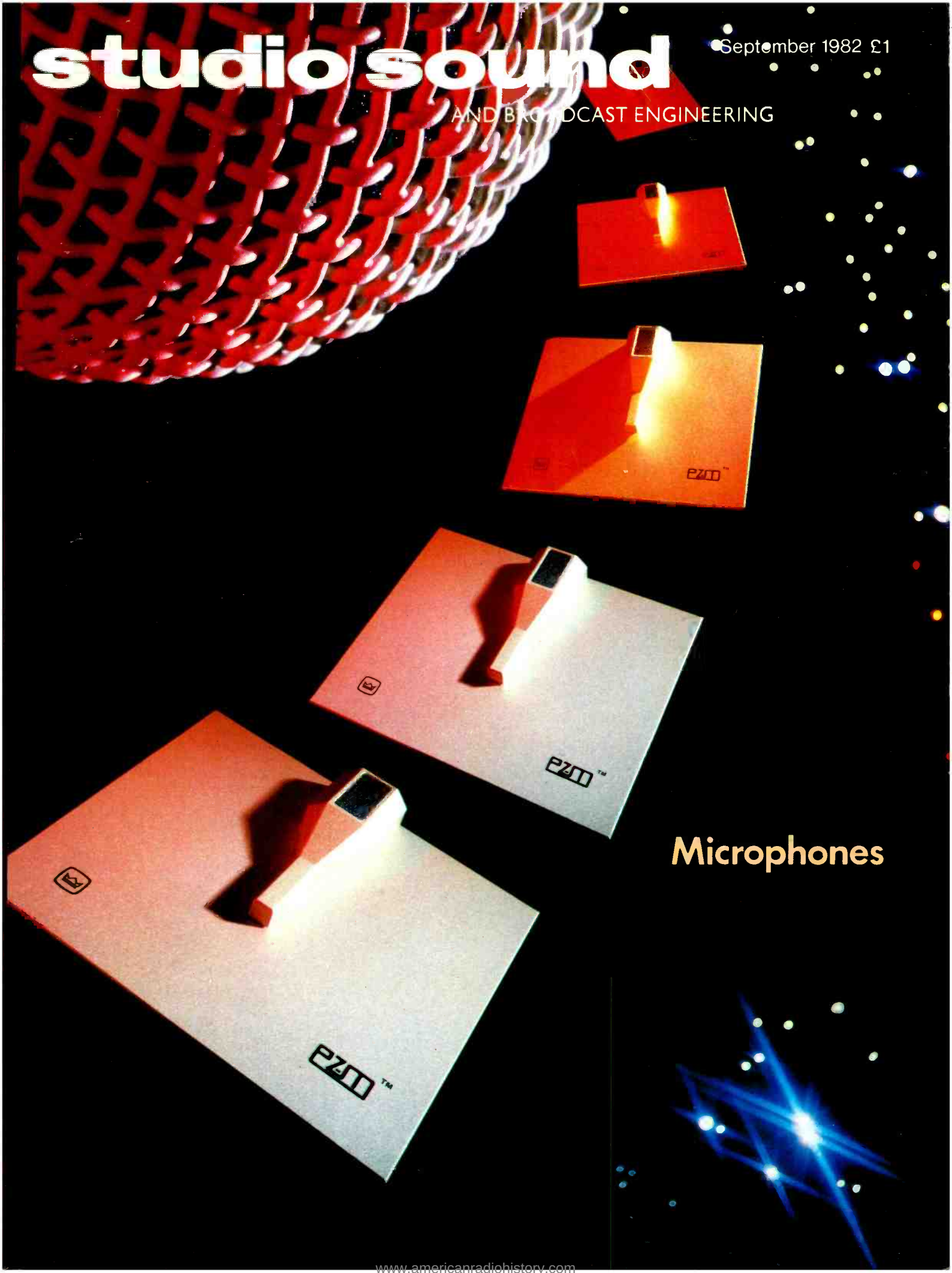
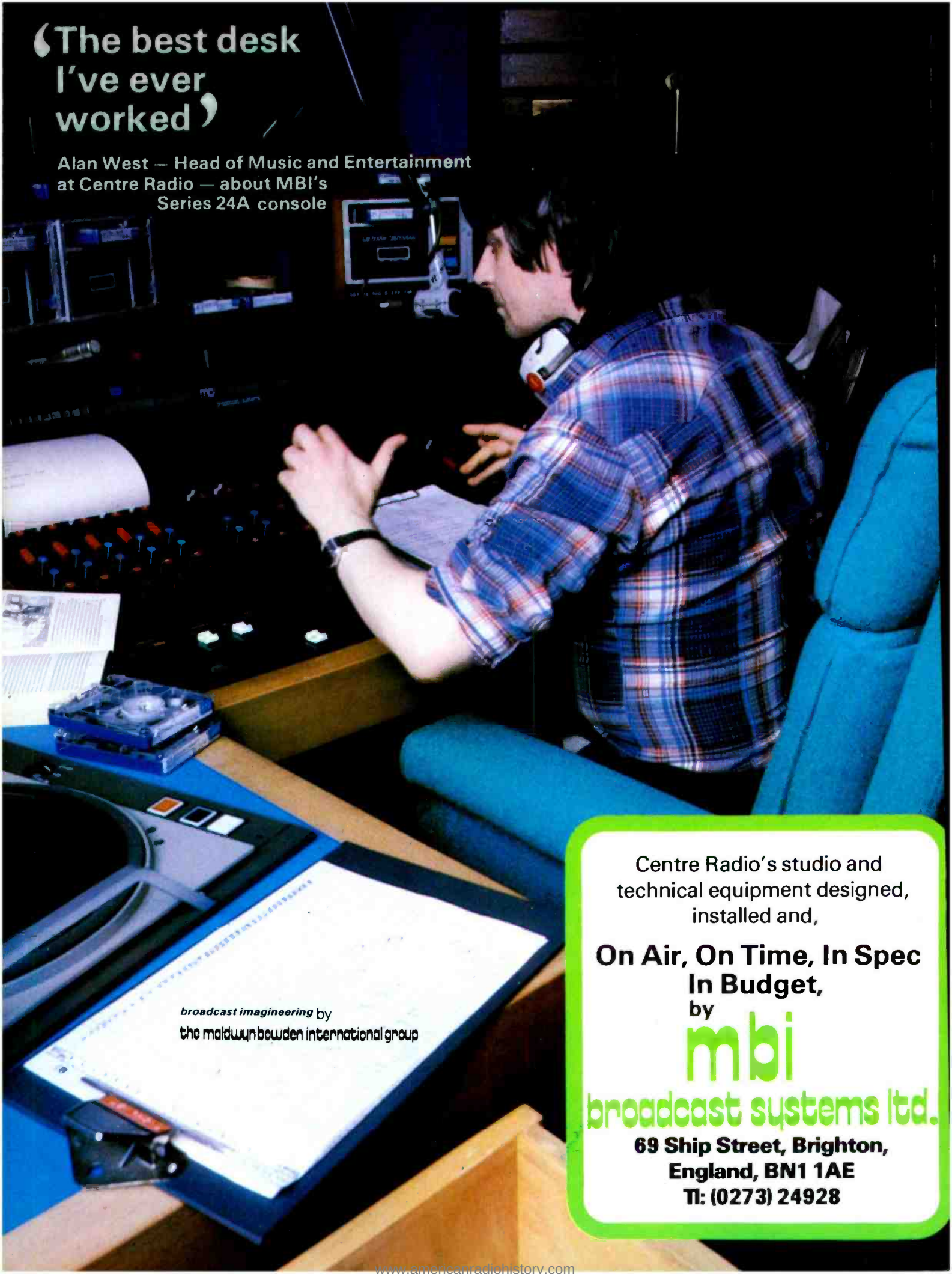
September 1982 £1

# studio sound

AND BROADCAST ENGINEERING




## Microphones

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# studio sound

## AND BROADCAST ENGINEERING

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VOLUME 24 NUMBER 9
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ABC MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

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### Cutting off your nose

By the time you read this, it is highly likely that the British Musicians' Union—and, soon no doubt, similar organisations in other countries—will have 'outlawed' certain instruments in the class that we might describe as 'those devices which reproduce the sound of another instrument by electronic means'. Their argument is, no doubt, that the use of such devices (specifically the E-mu Systems *Emulator* and the Linn drum machines) reduces the work oppportunities for those musicians whose instruments are simulated or reproduced by these devices.

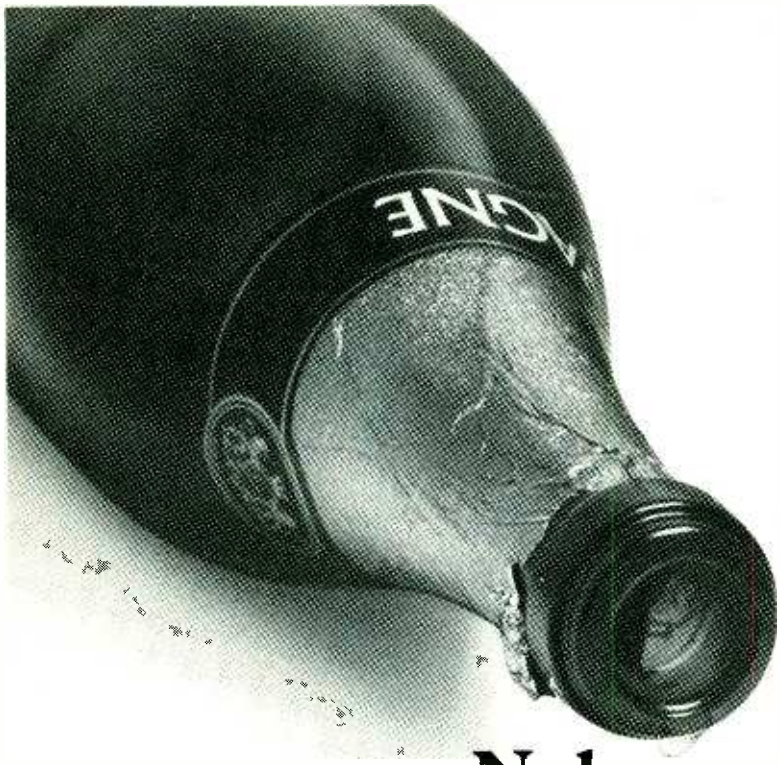
In one or two cases this might be true. By and large, however, it isn't. Let's remember the *Mellotron* for a moment. Yes, bands used it because they wanted a string sound: in that sense it might replace string musicians. But generally bands used the *Mellotron* for one of a number of reasons. First, they often couldn't afford to hire session musicians for an album, let alone a tour. Second, the *Mellotron* was simply a rather lo-fi tape machine and did not offer either high quality reproduction or real dynamics. In other words, it produced a *Mellotron* sound. Third, and perhaps most important, it enabled a band to retain musical control over the performance. Finally, the *Mellotron* enabled the keyboard musician to expand the range of sounds he or she produced, thus creating more work for such musicians.

All four of these arguments hold true for the present situation. The *Emulator* enables the addition of sounds previously economically unavailable to bands in the studio or on the road. It must be played by a musician, who happens to be a keyboardist. It produces its own sound, because a sampled input has to be looped at a point determined by the musician. In addition, it has a sequencer facility which enables musical lines to be realised that would be impossible on almost any other instrument. The *Emulator* enables the artist to retain full control over the realisation. It adds possibilities to the keyboardist's art. The Linn, too, fits these arguments. Indeed, most Linn owners appear to be drummers adding to their repertoires. Banning the instruments makes it impossible for musicians to offer a sound which is currently fashionable and in demand. The Linn, like other drum machines is not used as drums are. The pattern is likely to be boringly repetitive to play and impossible for a drummer to perform without adding odd little improvisations. This is just what a lot of modern music does *not* want.

Indeed, this is the fundamental point. It is still true that if you want a string sound, or a saxophone sound, or whatever, the best way to get it is to hire session musicians. Synthesisers have their own sounds which are unique to them, even if they use recording techniques to get it. Those synthesised sounds, and that mechanical lack of 'human' feel are vitally important in a wide area of modern music. They are central to many modern musicians' mode of musical expresson. The Musicians' Union is an important and valuable part of the modern music scene. If it wishes to maintain its vital role in protecting the rights of musicians against exploitation it must represent *all* musicians and accept the instruments they play. By considering rulings like this, it proves it does not represent all, but will discriminate against those younger members of the musical fraternity who are introducing new ideas. Too many rock musicians already feel that the MU is out of touch with their needs. It isn't true, but rulings like this will perpetuate the myth.

The exact areas of expertise may have changed: the musicians may spend as much time programming a computer as plucking a string or blowing down a tube, but he or she is still a musician.

New technology is vitally important in the music business. Not only that: it offers exciting new directions and possibilities. The industry needs that newness. It must not pretend it doesn't exist. **Richard Elen**



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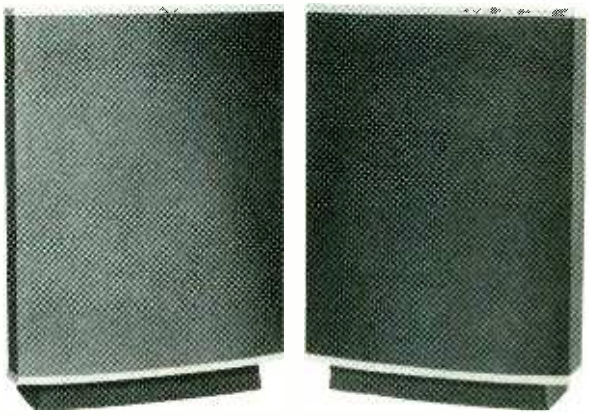
For further details and the name and address of your nearest Quad ESL-63 retailer write or telephone The Acoustical Manufacturing Co. Ltd., Huntingdon, Cambs., PE18 7DB. Telephone: (0480) 52561.



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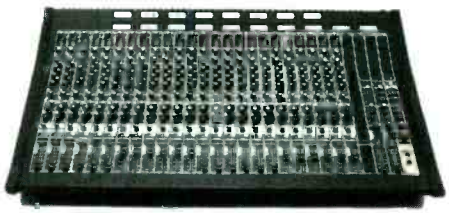

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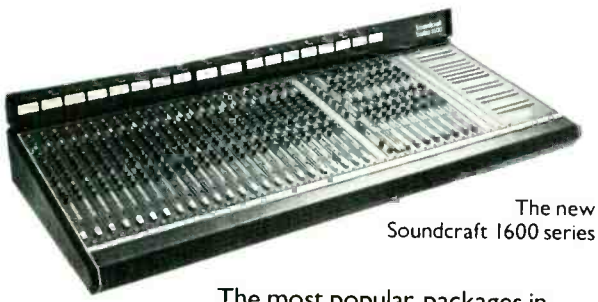

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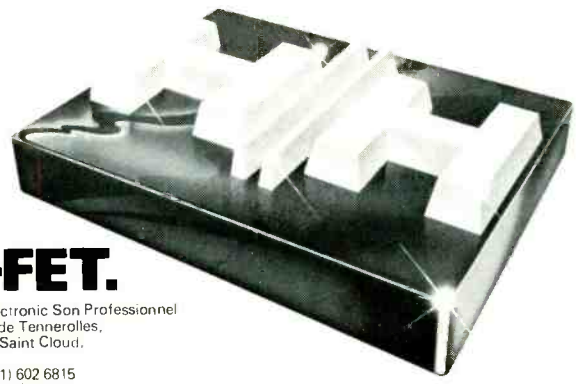

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* Varispeed.
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As chosen by CARDIFF BROADCASTING, RADIO WEST, etc.

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**£1666** (+ VAT)
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This excellent range of outboard effects modules is now available from ITA. This is the only rack system on the market that does not need an expensive separate power supply — all modules are self-powered! The range of modules includes:

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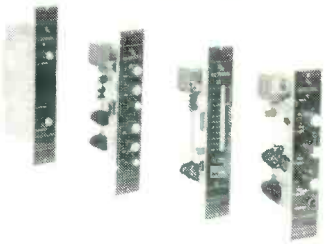
All modules priced under **£80**. A rack is available at **£35**.



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A very quiet low-cost 8/2 mixer. Performance figures meet IBA spec. Extremely flat frequency response, distortion<0.08% at +20dBm output at ALL frequencies.
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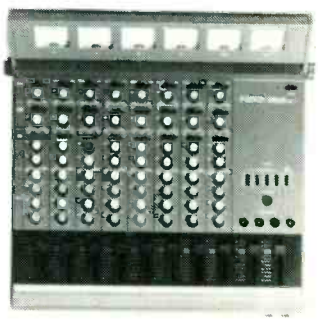

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**Price:**
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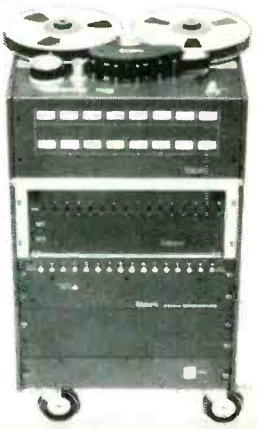
**With Audiofad faders: £4,360.**

**Stand: £155.**

(exc. VAT)



**16 TRACK PACKAGE.**
The new Sigma is available in a complete 16 track system, with the Itam 1610 recorder. Prices from under **£9,000** for a complete package.

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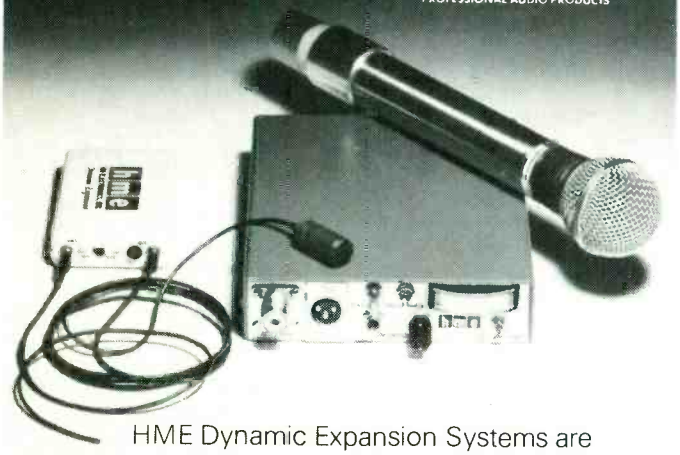

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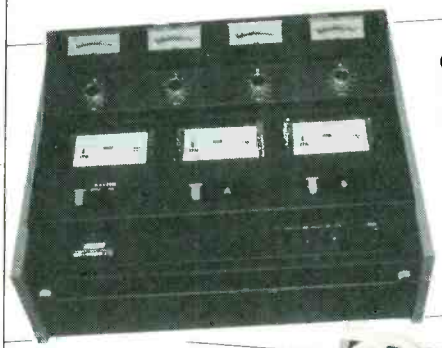

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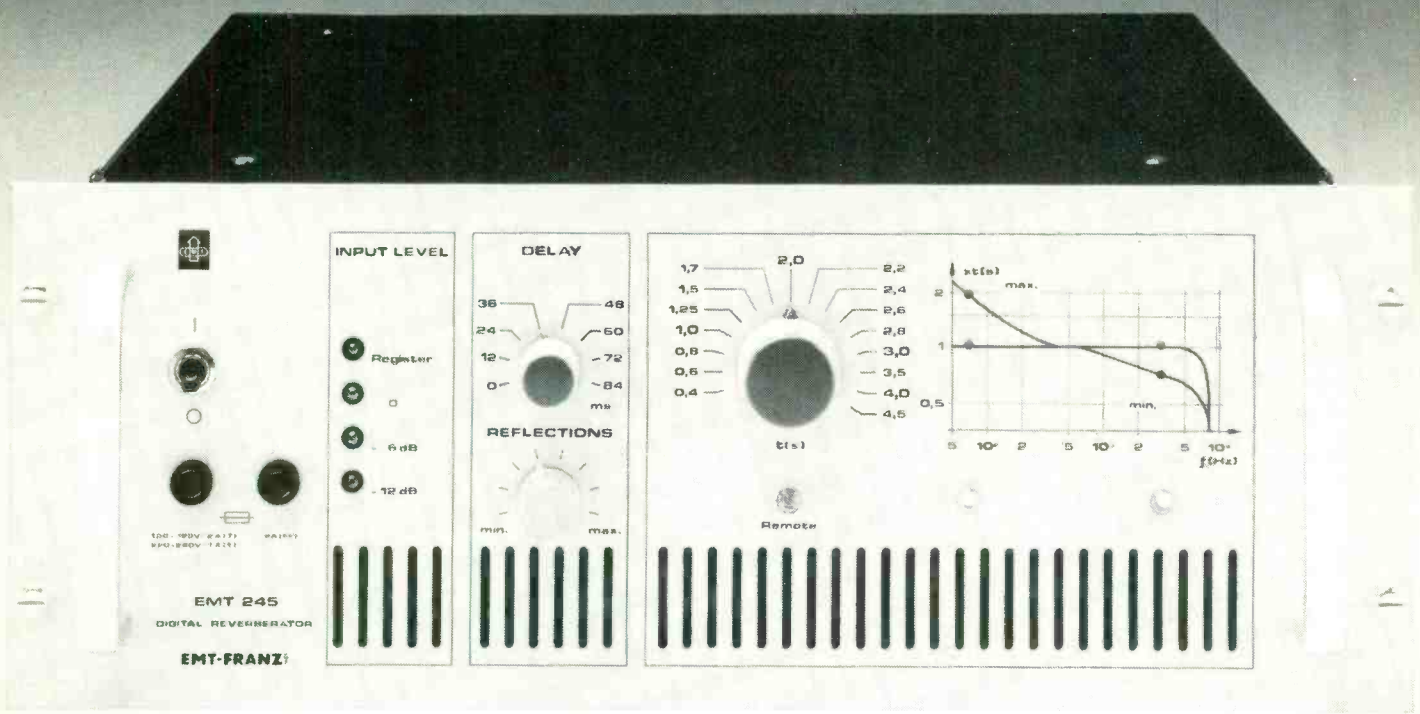


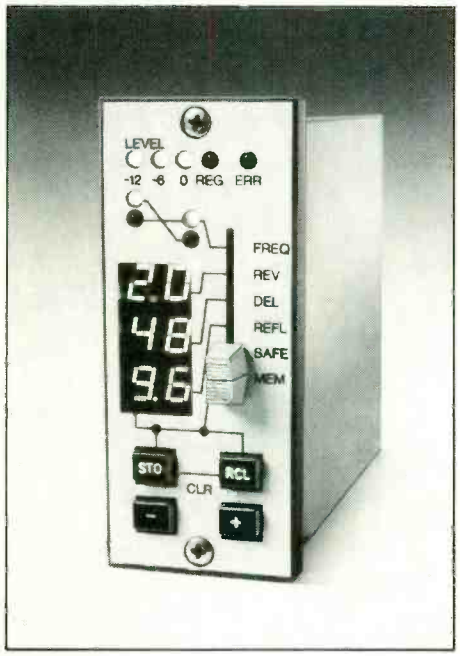


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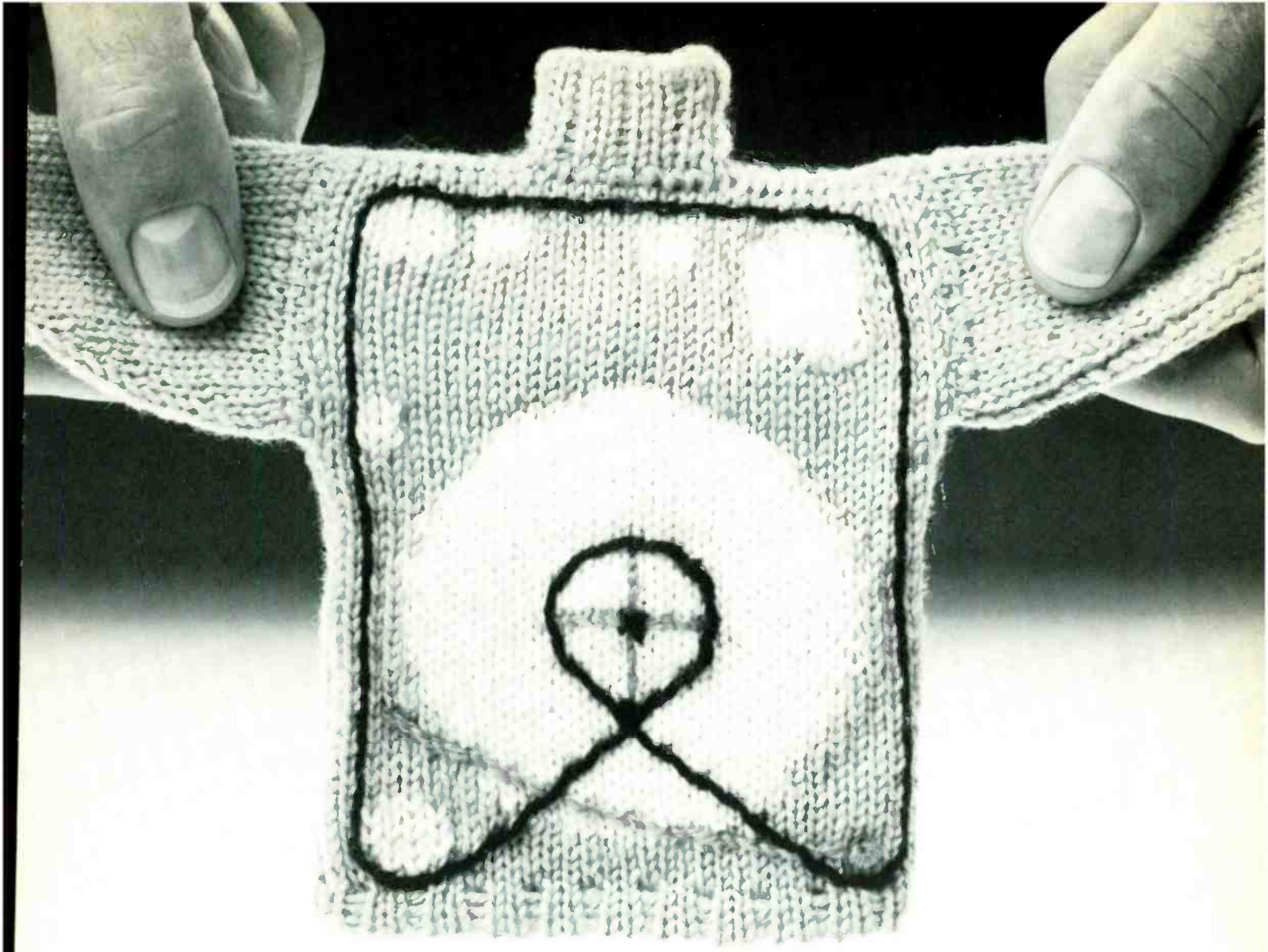

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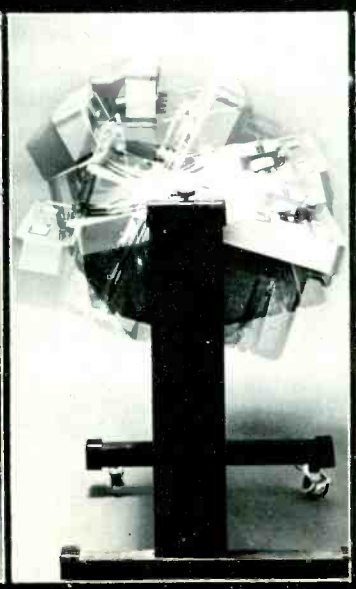

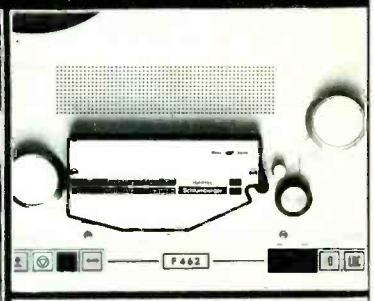



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The Lexicon PCM41, developed from the Prime Time, offers a complete repertoire of effects; such as automatic double tracking, flanging, slap echo, infinite repeat, doppler pitch shift and many others. Its ease of control makes it ideal for on-stage use where dramatic sounds can be created with studio precision.

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Lexicon digital delay systems are used throughout the world in concert halls, auditoriums and stadiums. Lexicon creates clean musical effects to enhance performance and open up new dimensions in sound.

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**F.W.O. Bauch Limited**

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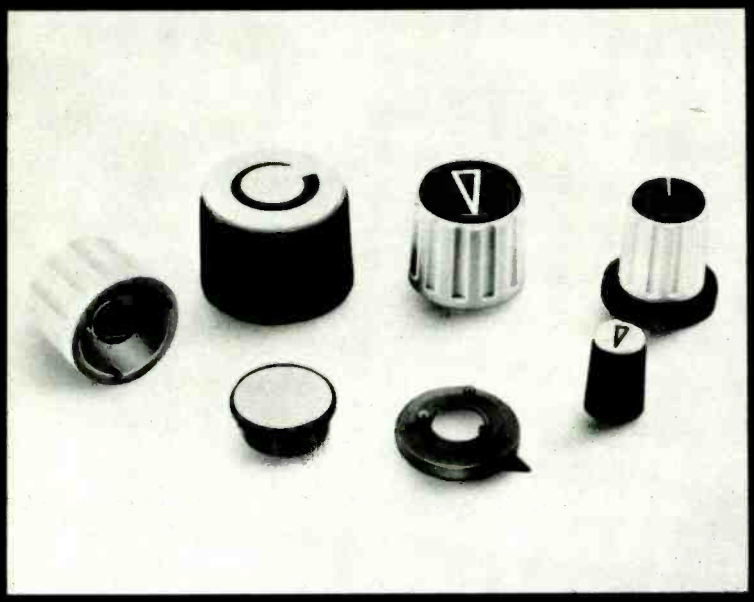

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The AEG-Telefunken MX80 and MX80a are a completely new breed of PCM tape recorders. Now, for the first time, you can use cut-and-splice editing procedures on a PCM machine. Smooth, silent splices are ensured by a sophisticated automatic cross-fade technique which joins the signals before and after the splice.

But AEG-Telefunken didn't stop with just one innovation. They designed these machines to be so simple that anyone familiar with analogue master-tape machines can operate them. For example, they use standard analogue controls; they aren't unduly sensitive to dust and dirt; they're rugged, reliable and simple to maintain and service.

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And you'll be pleased to hear that all these innovations have resulted in a system which is about half the price of our competitors.

The AEG-Telefunken MX80 and MX80a — the new breed of PCM recorders.

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## MX 80a

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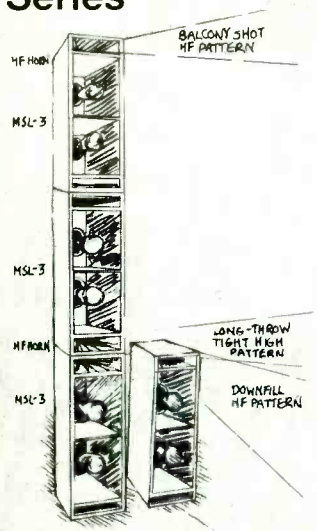
# Technical Information Series



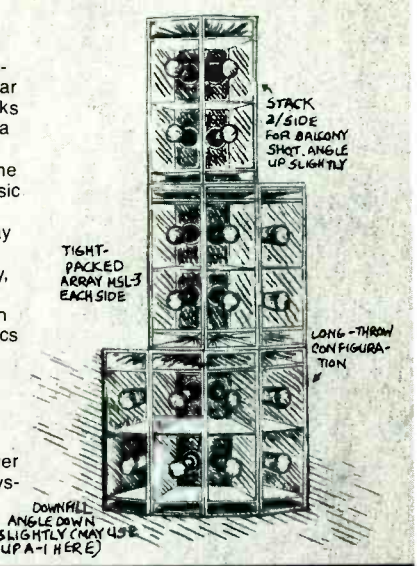

Topic 1
Loudspeaker Arraying

At Meyer Sound, we've applied over a decade of research and field experience to the production of a growing line of reinforcement loudspeaker systems optimized for arraying, and we've developed sets of simple, clear guidelines for applying these systems. For the professional user, calculation and experimentation are replaced by a body of dependable techniques offering the means to make arrays which afford consistent, exceptional performance.

**Polar Control**
An important key to this performance is careful control of polar response. Meyer Sound reinforcement systems are designed to be coherent not only in terms of phase, but also in terms of propagation. For this reason, the crossover transition in Meyer systems is smooth and seamless, and frequency response remains consistent over long throws. In arrays, propagation coherence means smooth addition between adjacent units, minimizing lobing and producing a coherent image of the source behind the array. In practical terms, this means even, controlled coverage, greatly enhanced clarity, and little or no need for room EQ.

**Modular Design**
Meyer Sound reinforcement loudspeakers are designed as modular systems: full-range building blocks which offer the flexibility to meet a wide variety of demands. This means, for example, that the same product which serves for live music reinforcement in a 500-seat club can be used to make a large array for voice reinforcement in a 15,000-seat sports arena. Finally, since the array retains the performance of the modular unit with which it is made, its characteristics are predictable.

**User Orientation**
For the professional in the field, dependable real-world performance is the ultimate goal. At Meyer Sound, we direct our efforts in system design and documentation toward making that goal more achievable. If you would like more information on the theory behind our arrayable systems, and how these systems can be made to work for you, call or write us today.




Meyer Sound

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# This delay was worth the wait


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**The DF-4015 is available with up to four outputs, each of which will deliver 192 milliseconds of delay in 3 millisecond steps. For further information on the DF-4015 and Knowles' Automatic Mixers please contact the Audio Team on (044 46) 5432.**

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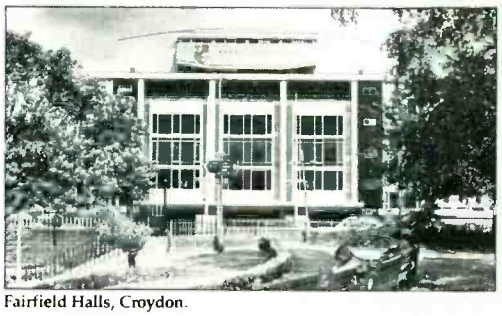

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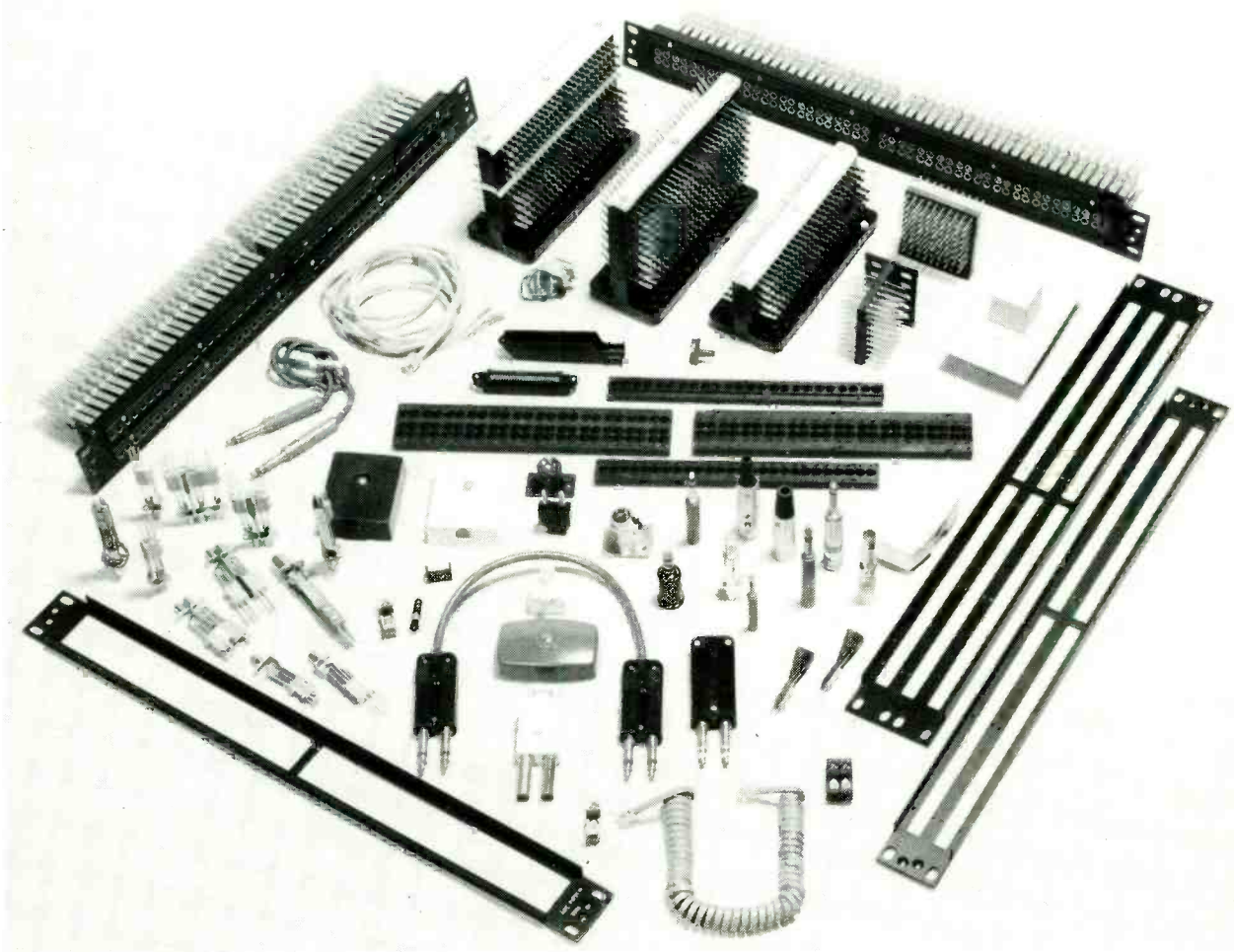

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# diary

## ILR/Polytechnic linkup

A unique experiment in British local radio has recently begun in South Wales. CBC, the Cardiff ILR station, has been connected by private wire to the studios of the Media Resources Unit at the Polytechnic of Wales, Pontypridd, about 15 miles away. Students studying radio production at the Poly now have the opportunity to broadcast some of their programmes, produced as part of the course, to a potential audience of over 500,000 people.

## Technical Projects

In order to reflect more closely the broad base of its work in the field of entertainments industry electronics, Theatre Projects Ltd is changing the name of its Special Projects operation to Technical Projects. Technical Projects will encompass electronic design, manufacturing and installation projects, with retail sales of sound and lighting equipment remaining under the banner of Theatre Projects Services. In addition the skills and experience of MJS Electronics in broadcast and test equipment design will be combined with the Theatre Projects design team's experience in the design of sound reinforcement, television, film and broadcast studio equipment.

## Transrack

French manufacturer, Transrack, has introduced a new, modular desk and 19in racking system which although primarily designed to house word processors, mini computers and other business equipment using microprocessors, is also suitable for general electronics housing. The new racking system, termed *Synthese*, is formed from a 30/10mm steel frame clad in large, lightweight 6mm thick panels of Noryl structural foam. The complete system comprises various configurations of operator and engineering desks, plus racks of 12U, 24U or 36U height.

**Transrack, 14 rue Moulin Bateau, BP 74, F-94380 Bonneuil, France. Phone: (03) 39.43.44. Telex: 220499.**

## Audio & Design Marketing

Audio & Design (Recording) Ltd, the Reading-based manufacturer of outboard equipment, has established a professional marketing division incorporating the UK distribution of Dutch manufacturer Eela Audio's equipment. Bill Dyer, the UK representative of Eela Audio, will continue to work within the marketing setup.

Other products available through the new division, to be known as Audio & Design Marketing, will include AEG *Telcom* noise reduction, preamp boards from US manufacturer Straight Wire Audio, plus Calrec mics along with a range of Ambisonic products.

The marketing of Audio & Design's own products will not be changed in any way.

**Audio & Design (Recording) Ltd, 16 North Street, Reading RG1 7DA, Berkshire.**

**US:** Audio & Design (Recording) Inc, PO Box 786, Bremerton, Washington 98310. Tel. (206) 275-5009. Telex: 152426.

## AM stereo USA

Following the recent decision by the Federal Communications Commission to allow the transmission of AM stereo, the Harris Corp has announced that it has already commenced selling its AM stereo broadcasting system and that it intends licensing manufacturers of home radios to use its stereo receiving technology. Harris claim to hold some 150 contingent orders from AM stations for stereo systems and hopes to convert these to firm orders over the coming months. Whether American AM stations will decide to take the plunge into stereo transmission still remains to be seen, especially considering the FCC's decision to allow the marketplace to decide between the five incompatible AM stereo systems currently on offer.

## Contracts

● Trident has supplied Nimbus 9 Recording Studio, New York with a custom 32/24 *Series 80* console; Record Plant Studios, New York with a 48 input in-line *Series 80* with a remote fully modular patchbay for the studio's 'white' mobile; and Kingdom Sound, Syosset with a 40 input/32 monitor *TSM* console which is to be fitted with Melkuist *GT800* automation.

● Feldon Audio has supplied a Sony 2-track digital recording and editing system to Tape One Studios, London. The system comprises *BVU U-matic* machines, *PCM-1610* processor and an *AE-1100* digital editor.

● Swedish Radio and TV has received nine *MTR90* 24-track tape machines from Otari. Three of the machines are 16-track pre-wired for 24-track.

● Hardware House (Sound) Ltd has recently completed the design and supply of a touring sound reinforcement system for the National Theatre of Qatar in the Arabian Gulf. The system includes an Amek *M1000* 26/8/2 console; ancillary equipment from Brooke Siren Systems, Eventide, Micmix and Roland; Court Acoustics *Proflex* and Gauss/JBL monitors powered by Amcron amps; a comprehensive multicore line system; plus mics from AKG, Crown, Beyer, Neumann and Shure.

● Tamevie Service Ltd has supplied a 24 input, 8 output, 16 monitor return Soundcraft *1600 Series* console to RMS Studios, London.

● The BBC has ordered a further 100 Rogers *LS3/5A* monitors, plus 100 Rogers *LS5/8* monitors from Swisstone Electronics.

● MCI has supplied a transformerless 32 input *JH-500D* console, *JH-24* 24-track tape machine and *JH-110B* mastering machines including a ½in mastering machine to CECCA Sound Studio, Dallas—the new 24-track studio opened by Charley Pride, the country music artist. An unusual feature of the console is that the studio's limiters and effects units are hard wired, normalled into I/O's 25 to 32 for effects sampling without patching.

## Sound recording courses

The short course *Sound Studios and Recording* which has been offered by the Department of Electronic and Communications Engineering at The Polytechnic of North London over recent years is again on offer this year. The course, which commences in late October, is a part-time course with examinations in June 1983. As previously, the course provides a thorough grounding in the workings of recording studios with particular emphasis being given to practical studio equipment and operational aspects of the course. A new feature of the course for future years is the intention to include visits to studios to give a broader view of the recording industry. Details of this course are available from: Department of Electronic and Communications Engineering, The Polytechnic of North London, Holloway Road, London N7 8DB, UK.

Further to the above, as a result of discussions with the APRS, Salford College of Technology is proposing to offer full-time courses in *Recording Technology and Techniques* commencing in September of this year. The courses are available in two forms: a three-year course with a minimum entry age of 16 and entry requirements of at least five 'O' levels including mathematics, physics and English; or a two-year course with a minimum entry age of 18 and entry requirements of at least two 'A' levels including mathematics and physics or engineering science. These new courses will cover the whole gamut of recording technology and techniques and will be particularly configured for the technician who wishes to be involved in the design and maintenance of sound recording systems and related signal processing systems. To support the courses the College will include in its facilities a multitrack studio plus an extensive range of test and repair equipment. Further details of the courses are available from: The Admissions Tutor (Recording Courses), Department of Humanities, Salford College of Technology, Adelphi Building, Peru Street, Salford M3 6EQ, UK.

28 ▶

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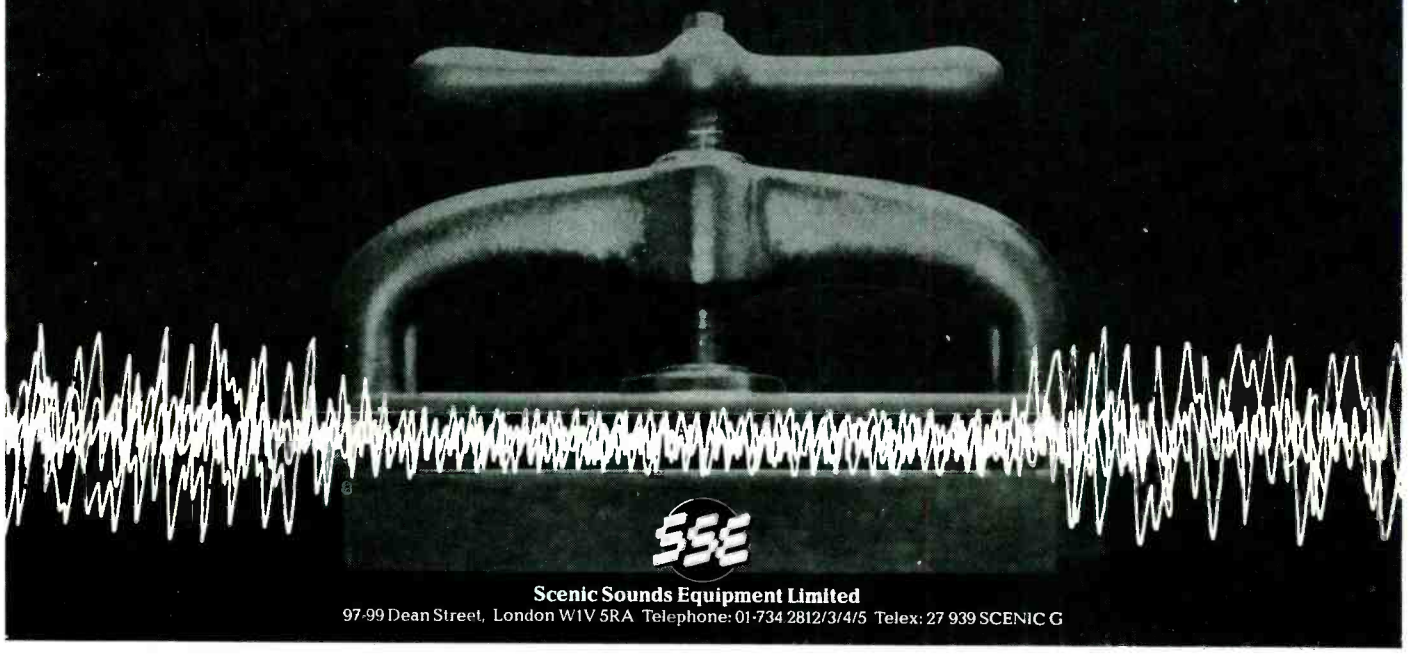
Dynafex, from MICMIX, removes noise from existing programme. So if you have any noisy master material on carts, VTR, disc, cassette, land line or tape Dynafex can offer up to 30dB of noise reduction without the compatability problems of encode/decode systems.

**dynafex**



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# diary

## MU threat to 'copy cat' synths

At the Central London Branch Meeting of the British Musicians' Union on 20th May, 1982, the following motion was proposed and passed by a vote of two to one:

*"This Central London Branch requests the Executive Committee to institute an official ruling to proscribe and prohibit, for the purposes of recording or live performances, the use of all electronic devices that make audible imitation or simulation of any musical/percussion instrument as defined by the Musicians' Union directory.*

*"We further request the E.C. to make provision and formulate new agreements with the parties concerned, with effect to proscribe and prohibit the use of any recording or live transmission that bears in effect any such electronic device as defined above."*

This motion has created considerable speculation throughout the industry, and not surprisingly, the UK national press have picked it up and 'deduced' that this could be the end for such bands as Human League, Landscape, Duran Duran, etc. This is, of course, nonsense. However the very fact that this motion has attracted so much interest to the use of synthesisers and electronic musical instruments illustrates the concern being expressed in certain corners that new technology is depriving more traditionally skilled musicians of their livelihoods.

The motion was proposed by Neil Lancaster—a session singer/writer/arranger. He is extremely worried by the advance of new technology into the music 'profession', though he is not aiming his attack on the use of synthesisers towards synthesiser bands such as those mentioned above. He feels that these groups are peripheral to the main body of the music industry, employing only a small percentage of the union's membership, and by using synthesisers they are not really putting other members out of work. His worries, as identified in the motion, are with the use of these electronic devices (synthesisers, rhythm units, etc) to *simulate* existing musical instruments. 'If you agree that music is a living art form, then it figures logically that you cannot have music without musicians; and in the sense where they are replaced by cheapskate facsimiles of musicians, then the question arises—is it unethical?—is it dishonest?—because it is certainly a recorded lie, and I think that it is time that this should be brought out into the open and discussed.'

The passing of this motion has certainly done the latter, with much press coverage, and Neil Lancaster himself has found that his life isn't as quiet as it used to be. 'I've been contacted by all kinds of people who have obviously got hold of the wrong end of the stick—I don't want to ban synthesisers, just to prevent their dominance of an already troubled industry. Technology is moving at a fantastic rate, and in ten years time, if nothing is done to stop it, the synthesiser will have put all the conventional musicians out of work.

'I've been discussing the misuse of synthesisers with various musicians for years now. In the right context they are magic; this motion is not an attack on synthesisers but on the total misuse of the instruments when they are used to imitate and substitute for musical instruments and musicians which would normally be used—this is generally done for economic reasons.'

One of the reasons that the effects of this branch meeting has sparked off so much interest must lie in the present state of the recording industry. The economic situation, with the possible exception of the advertising world, is well in the doldrums; recording and production companies are also on the decline, and the session musician faced with the fall in demand for his services must see the synthesiser as an obvious target—it is one thing that can be identified as a possible reason for his plight.

As things stand, the passing of this motion is just the first step in the process of becoming Union policy: in July it will be considered by the London District Council and, if approved, passed on to the Executive Committee in August, who will decide whether or not this motion should become Union policy. If so, there could be quite a stir come September. However, it would seem that the Union itself is in a bit of a dilemma over this one, and that it is unlikely that Neil Lancaster's motion will gain the approval of the Executive Committee.

The Union has had an agreement with the BPI and various other major organisations, including the BBC and ITV, that runs as follows: 'Instruments and devices incorporating pre-recorded sounds or producing sounds by electronic means must not be used to replace or reduce the employment of conventional instrumentalists in circumstances where they may reasonably be expected to be used; they may, however, be used to produce sounds that cannot be produced by conventional instruments'.

The Union feels that these agreements are fair, and that to seek to clamp down further on the use of the synthesiser would be extremely difficult. A working party confirmed this in 1979: 'It would be impractical to ban specific instruments on the grounds that they would be potentially capable of reducing employment; such a ban would also be unacceptable to those members who perform on the instruments in question, and incapable of enforcement'. So the Union is at present relatively happy with the situation, and unless they can be persuaded to change their thinking with new 'evidence' then this motion has little chance of acceptance.

Well, there is no real new evidence as such; however, although these agreements may be working in some areas, there is definitely a case against the synthesiser *if* you consider it wrong for it to simulate existing instruments. Such simulations are taking place, and conventional musicians' work is being eroded. Secondly, though, technology has advanced considerably over the past couple of years and simulations of existing instruments are far more easily attainable, and will become more and more realistic over the next few years—what will be happening in ten years time? In 1979 we did have the 'string carpet'; now it is possible to create a lifelike string section, but to say that such a creation is non-musical is rubbish. To be able to 'feel' a string section (or whatever) using a keyboard and performance controls, takes considerable musical skill.

Ron Geesin, one of this country's top composer/synthesists, has some interesting views on the attempt to get the use of the synthesiser restricted. Unlike Neil Lancaster's view that being a musician is a professional occupation, he considers musicians to be just middlemen who are there to transpose the notions of the composer into sound. 'There is coming a time very soon when the digital synthesisers will be flexible, that they will be able to provide all the nuances of inflection as from a musical instrument such as a clarinet, oboe, etc, and musicians who do not realise this will be out of the game. There are, for example, thousands of jazz band saxophonists of the '30s and '40s who have already become casualties of change. There are far too many people in the world who get a pursuit, playing a musical instrument, and they put their blinkers on in order to concentrate on playing the musical instrument and then when society has changed they don't realise it and become afraid. You can relate musicians, those in the medium range of sessions and orchestral—i.e. not soloists or top feature session players—to unemployed steel workers: they both have their blinkered approach and they are both skilled craftsmen.'

As with every dispute there are two sides to be considered, and the Union, as such, is at present somewhat on the fence. In order that the majority of members can be best represented in this important issue, it is necessary for the Union to be able to gauge the feeling of its members. At the London Branch Meeting just three synthesiser players turned up, and the Agenda had been circulated some weeks before. If, therefore, you are a member of the MU, and have an interest in this dispute, please let your views be known to your local branch office. **Dave Cromble**

## Manor Mobile at LWT

The Manor Mobile was in use recently at London Weekend Television's Stonebridge Park studios during recording for *Understanding Opera*, a new series to be shown in Britain later this year which will introduce viewers to the wide appeal of opera. The series is being recorded on multitrack for the preparation of a stereo audio version to be transmitted in those countries which have stereo TV sound capability.

# New realms of expression from MXR.

The Pitch Transposer is MXR's newest addition to our professional line. It is one of our most innovative products, and possibly the most revolutionary signal processor in the music industry today. It is a unique, high-quality unit which provides a cost effective and flexible package for today's creative artists.

The Pitch Transposer extends your musical boundaries by creating live instrumental and vocal harmonies. It has 4 presets which allow the artist to predetermine the intervals to be processed. Transposed intervals can be preset anywhere from an octave below to an octave above the original pitch. The chosen interval is activated by means of touch controls or a rugged footswitch. LED indicators display which of the four presets has been selected.

A mix control is provided, enabling the unit to be used in one input of a mixing console, or with musical instrument amplifiers. A regeneration control provides for the recirculation of processed signals, creating more and more notes, depending upon the selected interval. This results in multitudes of voices or instrumental chords. An entire new range of sound effects and musical textures, unattainable with any other type of signal processor, is suddenly at your fingertips.

With many other pitch transposition devices a splicing noise, or glitch, is present. The MXR Pitch Transposer renders these often offensive noises into a subtle vibrato which blends with the music, and is, in some cases, virtually inaudible. The result is a processed signal which is musical and usable.

We have been able to maintain a high level of sonic integrity in this most versatile signal processor. The frequency response of the processed signal is beyond 10 kHz, with a dynamic range exceeding 80 dB.

A micro computer based display option allows the user to read the created harmonic interval in terms of a pitch ratio, or as a musical interval (in half steps). This unique feature allows the pitch to be expressed in a language meaningful to both musicians and engineers.

We designed our Pitch Transposer as a practical musical tool for those actively involved in creative audio. It reflects our commitment to provide the highest quality signal processors with the features and performance that will satisfy the creative demands of today's musical artist. See your MXR dealer.

**Atlantex Music, Ltd.,** 34 Bancroft Hitchin, Herts. SG51LA, Eng., Phone 0462 31513, Tlx 826967

MXR Professional Products Group

# new products

## Firmware and software from Eventide

Eventide have produced a firmware upgrade for Hewlett-Packard *9845* computers, plus new spectral analysis software for the *Apple II*. In addition, the company has announced a hardware simulator and demo program to show the benefits of the Eventide realtime analyser systems.

Eventide already offer memory expansion hardware to upgrade the HP *9845* desk-top computer to 1.6MB storage. The new firmware package enables up to the full memory capacity to be used to emulate floppy disks, tape cartridges or even hard disks, offering operational speed improvements of up to several hundred to one.

The Eventide plug-in spectrum analyser has been available for several small micros for about two years. The new *Specsystem* software package for the *Apple II* and *Apple II Plus* greatly improves the analytical powers of the system.

Also available from Eventide is the *Hardware Simulator* and demo program which allows a potential purchaser of the RTSA to see exactly how it will behave after installation (and purchase!). The program is available free, recorded on a blank disk sent in by the user.

**Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA. Phone: (710) 581 2593.**

**UK:** Feldon Audio, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 28668.

## New Loft products

Phoenix Audio Laboratory, manufacturer of the Loft range of ancillary processing equipment, has introduced two new units, the *Model 401* parametric equaliser and the *Model 403-M* electronic crossover.

The *Model 401* is a 4-band 19in rack mount unit with overlapping frequency ranges covering the range 30Hz to 20kHz with ±18dB of boost or cut. The band ranges are 30Hz to 600Hz (LF), 100Hz to 2kHz (LMF), 400Hz to 8kHz (HMF) and 1kHz tp 20kHz (HF). Each band has adjustable Q with a range variable between ½ and three octaves, and the bandwidth may be adjusted without affecting the amount of boost or cut. As the *Model 401* incorporates a preamp with up to 20dB of gain and an additonal low level output (padded –20dB), it may be interfaced to equipment at musical instrument levels, or can be used as an instrument preamp. In addition, the unit can also provide simultaneous line level and instrument level feeds.

The *Model 403-M* is a mono 2-way, 18dB/octave (state variable filter) electronic crossover. Again a 19in rack mount unit, this electronic crossover has continuously variable crossover frequencies from 40Hz to 12kHz (LF 40Hz to 8kHz, HF 600Hz to 12kHz). Features of this unit include detented and recessed controls calibrated in dB; LED peak output indicators; power on/off suppression; and ¼in phone jack inputs and outputs.

**Phoenix Audio Laboratory Inc, 91 Elm Street, Manchester, Connecticut 06040, USA. Phone: (203) 649-1199.**

## Emulator updated

E-mu Systems has announced a series of updates to the *Emulator* digital polyphonic keyboard instrument. All *Emulators* now include as standard a realtime multitrack sequencer allowing complex musical compositions and sound effects to be created, the sequencer also being available for retrofitting to earlier models. Using the *Emulator's* built-in disk drive, completed sequences can be stored on floppy diskettes along with the instrument's sounds.

Further additions to the instrument's facilities include two foot switches and a foot pedal. The foot pedal duplicating the function of the MOD wheel, making it possible to control vibrato depth while playing with both hands. One of the foot switches acts as a sustain pedal, while the other controls a new keyboard doubling mode. In this mode, notes played on the lower half of the keyboard are automatically doubled by the sound in the upper half of the keyboard.

Turning to hardware, E-mu has announced the availability of an analogue voltage interface allowing any source of control voltages and gates to control *Emulator* channels. Possibilities include remote polyphonic keyboards and polyphonic sequencers.

On the software front, two new optional programs have been introduced. User's Multi-Sample allows the recording of up to eight individual samples at ½-octave intervals across the keyboard allowing more accurate reproduction of resonant sounds. This program also makes it possible to have eight independent sounds available on the keyboard simultaneously. The other new program, a Personal Computer Interface, allows any computer equipped with an *RS-232* serial port to control *Emulator* sounds.

**E-mu Systems Inc, 417 Broadway, Santa Cruz, Cal 95060, USA. Phone: (408) 429-9147.**

**UK:** Syco Systems Ltd, 20 Conduit Place, London W2. Phone: 01-723 3844. 32 ▶

*"I wouldn't feel comfortable going to a recording session without a Shure SM7 ... that's a fact!"*

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**SHURE**

**You simply can't make it any clearer.**

For the address of your nearest dealer together with full details of the Shure Microphone range, write to: Shure Electronics Ltd., Eccleston Road, Maidstone ME15 6AU or telephone: 0622 59881.

# new products

## Cassette gauge

Audio consultant and engineer, Mike Jones, has provided us with information on a simple go/no-go gauge manufactured by him for the cassette industry. The gauge which is manufactured to the maximum tolerances of the IEC 94A specification, is machined from steel to an accuracy of 0.001in and is nickel plated to extend its life and protect the steel from corrosion. Designed for the rapid assessment of C-Zero's and cassettes by unskilled personnel, the gauge immediately indicates those that are either oversized or bowed. Cassettes can be inserted in two ways allowing the back and front edges to be checked as well as the complete cassette body.

**Mike Jones, Audio Consultant Engineer, 31 Parkfield Avenue, Eastbourne, East Sussex BN22 9SE, UK. Phone: 0323 52300.**

## Buzzbox protects valuable gear

The *Buzzbox* is a novel personal alarm system designed for use with musical instruments, equipment, luggage and the like. No larger than a pack of cigarettes, the unit features an 'acceleration detector' which causes the unit to 'bleep' loudly when moved. The *Buzzbox* may be attached in a number of different ways, and a complete multi-purpose fixing kit is supplied with the unit. Typical mounting is via adhesive pad, through a rigid front-panel, or on a hanging loop.

The unit is activated by a key, which is removable in both the 'on' and 'off' positions. After activation, a 5s reset period allows the user to leave the unit without triggering the alarm. Thereafter, movement triggers the alarm, the system being retriggered by continued movement. The buzzer sounds for about 3min after movement ceases, the unit then returning to the 'armed' state. The 'fired' state can only be terminated by turning the device off with the key. The unit retails for £12.95.

**Visioncrest Ltd, 1211 Greenford Road, Greenford, Middx UB6 0HY, UK. Phone 01-864 0244/5.**

## BGW Proline series

BGW now have two amplifiers available in their new *Proline* range, unveiled recently. The *Model 7000* was introduced late last year, while the new *Model 6000* was introduced at the recent NAMM show in Atlanta. The *7000* offers 200W RMS per channel and is a 5¼in high rack-mount unit, while the *6000* is a compact 3½in package offering a solid 100W RMS per side. 150W output devices are used in both amps, the smaller featuring four such devices and the larger amp containing eight. Both amps feature modular design, low noise discrete circuitry, thermal circuit breakers, thermostatic switches on the heat-sink and power transformer, and current limiting protection circuits against shorting on the output stage. The *7000* also features forced-air cooling with the novel venting of heated air through the front panel to avoid overheating of other gear in the rack.

**BGW Systems Inc, 13130 South Yukon Avenue, Hawthorne, Cal 90250, USA. Phone: (213) 973 8090.**

**UK:** Theatre Projects Ltd, 10 Long Acre, London WC2E 9LN. Phone: 01-240 5411.

## New Linndrum

Linn Electronics, manufacturer of the *LM-1* digital drum machine, has introduced an improved model at a substantially reduced price. The new *Linndrum* has digital recordings of a wide range of drum and percussion sounds stored in computer memory and is capable of storing as many as 49 different rhythm patterns which are user programmable in real time with adjustable error correction and complete editing functions. The sounds available on the new machine include bass, snare, open and closed hi-hat, three toms, two congas, sidestick snare, tambourine, cabasa, cowbell, handclaps, plus crash and ride cymbals. Snare, toms and congas are all tunable by front panel controls, or control-voltage inputs. The improved *Linndrum* allows pre-programmed patterns to be sequenced for playback; dynamics, odd time signatures and 'human rhythm feel' are all programmable; and all the patterns remain in memory even when the unit is unpowered. The machine also has tape storage functions enabling programmed data to be kept on cassette for later reloading. The *Linndrum* will sync to a wide variety of synthesisers and sequencers and can overdub to tape.

A useful feature is the provision of a front panel stereo mixer section with volume and pan controls which augments the unit's separate outputs for all sounds.

**Linn Electronics Inc, 18720 Oxnard Street, Tarzana, Cal 91356, USA. Phone: (213) 708-8131.**

**UK:** Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

**UK:** Syco Systems Ltd, 20 Conduit Place, London W2. Phone: 01-723 3844.


*Model 9100A*

## Orban Optimod-AM improved

Orban has announced the availability of the second generation of its *Optimod-AM* broadcast unit. Two versions will be available: the *9100A/1* mono unit which may be converted to stereo operation by simply plugging in additional circuit cards (available as a field retrofit kit), and the *9100A/2* sum-and-difference stereo unit. The *9100A* offers a number of improvements over its predecessor, the *Model 9000A*, including a new 6-band limiter with a distortion-cancelled multi-band clipper which, together, offer at least a 3dB increase in RMS modulation levels.

Other improvements include an improved transmitter equaliser with four sets of adjustments which may be remotely selected; 25dB of headroom; outputs for two transmitters; and a smooth gated gain-riding AGC at the system's front end.

**Orban Associates Inc, 645 Bryant Street, San Francisco, Cal 94107, USA. Phone: (415) 957-1067. Telex: 171480.**

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


# The Acclaimed Multitrack Engineering Logic. Otari MTR-90.

Otari science integrated the cold logics with sophisticated electronics into a compact yet responsive whole. The unique pinchrollerless transport with 60mm diameter direct drive capstan is eloquent case in point. The industry's first CPU-controlled 3 motors, utilizing advanced PLL DC servo method, deliver fully symmetrical constant tension tape path. It induces the gentlest handling of your 2″ master tape with far more precision than ever. While eliminating tape wear and stretching generic to the conventional pinchroller design.

The MTR-90 comes fitted with the functional efficiency like digitally timed silent punches, electronic cueing, digital timer and ±20% varispeeed with 0.1% readout. SMPTE interface access for audio-video, audio-audio synchronization. Spot erasing is perfected thanks to the new narrow head block design. Full-remote as a standard, along with optional 10-position autolocator.

Or high slew-rate components, active mixing of bias and audio for better aural results. Advanced modular concept is exemplified in single card circuitry.

The MTR-90 is available in 24, 16 and 16 prewired for 24 configurations.

OTARI

Otari Electric Co., Ltd.
4-29-18 Minami-Ogikubo, Suginami-ku, Tokyo 167
Phone: (03) 333-9631, Telex: J26604

# product guide Radio mics

## ARTECH (UK)

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

**Transmitter:** pocket pack or handheld with either Shure *SM58* or electret omni elements; Audio input – 33dB to 60dB (45mV to 0.78mV), 150 to 600Ω; variable compression over 35dB range; HF power output 50mW into 50Ω, high power units 500mW. Dimensions – single battery pocket model 102 x 60 x 21mm, 270g; dual battery model 102 x 85 x 21mm, 298g; handheld model 241mm long, 30mm diameter, 440g (only one battery).
**Receiver:** battery operated portable with optional mains power supply, or rack-mounting cards for mainframes with built-in mains power supplies; Audio outputs mic level 150Ω bal, line unbal 50Ω + 10dB, phones will drive 50Ω; RF sensitivity 1.5μV for 20dB S/N, 5μV for 40dB; adjacent channel rejection 85dB. Dimensions – portable 125 x 180 x 25mm, 880g, rack 480 x 134mm
**Overall system specification:** frequency response (20dB below limiting): 80Hz to 20kHz ± 2dB, includes 6dB/octave roll-off at 60hz to remove wind and rumble.
S/N: 64dB unweighted 66dB A weighted.
Harmonic distortion: 1kHz typically 0.5% 100Hz to 20kHz 1%.
Pre-and de-emphasis: 50μs.
Carrier frequency range: VHF 120MHz to 240MHz, UHF 400MHz to 470MHz.
**Mini-Mic:** Professional subminiature electret condenser mic measuring 11.7 x 8.38 x 8.28mm: noise 26dB SPL; output impedance 3kΩ unbal (bal available); audio sensitivity 60dB below 1V RMS per μbar; battery 1.1V to 20V DC; available with a multitude of connectors.

## AUDIO LTD (UK)

**Audio Ltd, 26 Wendell Road, London, W12 9RT. Phone: 01-743 1518.**
**USA:** Murry Rosenblum Sound Associates Inc. 21 – 36 33rd Road, Long Island City, NY 11106. Phone: (212) 728-2654.

**AU18/RMS5H transmitters:** *AU18* pocket transmitter. *RMS5H* handheld with cardioid or omni electret elements. Suitable audio input for moving coil or electret mics, 30 and 600Ω; pre- and de-emphasis 50μ; carrier frequency 70MHz to 250MHz; stability ±5kHz at 175MHz; RF power output from 1mW to 40mW. Dimensions – pocket 118 x 59 x 22mm, 270g; handheld 260mm length 30mm diameter, 450g.
**RMS5 receiver:** battery-operated receiver; mic level 30Ω; 5μV for 40dB S/N. Dimensions 225 x 155 x 64mm, 1.6kg.
**RMS8 Series:** pre- and de-emphasis 50μs; carrier frequency range 140 to 250 MHz, UHF system available between 400 and 500MHz; frequency stability ±5kHz.
**AU18/RM8H transmitters:** *AU18* pocket transmitter, *RMS8H* handheld transmitter with omni or Shure *SM58* cardioid element; specification otherwise similar to *AU18/RMS5H*. Optional high power transmitter in 140 x 66 x 22mm case, with two *PP3*s allows up to 100mW; with separate 12V power supply and without space for internal batteries up to 500mW is possible.
**RMS8 receiver Series:** battery-powered receiver; mic level 30 to 150Ω, headphone 1mW/600Ω; RF sensitivity 5μV for 40dB S/N. Dimensions – 180 x 125 x 25mm, 880g. *RMS8/2:* 2-channel version of the above.
**RMS8A:** updated version of the *RMS8* with headphone level control; Lemo socket for external powering and aux out and *XLR* audio out.
**RMS8M:** mains powered receiver with *XLR* audio, headphone output and RF level meter.
**RMS8T:** Twin-channel receiver.
**TR58:** subminiature electret mic 13.3 x 7.6 x 4.5mm operating voltage 1 to 1.5V, available with optional powering adaptor enabling it to be used with ordinary tape recorders.

## BEYER (West Germany)

**Beyer Dynamic, PO Box 1320, D-7100 Heilbronn. Phone: 071 31.82.348. Telex: 728771.**
**UK:** Beyer Dynamics (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Phone: 0444 51003.
**USA:** Beyer Dynamic Inc, 5 – 05 Burns Ave, Hicksville, NY 11801. Phone: (516) 935-8000.

**TS73/TS83/SM84:** *TS73* pocket transmitters *TS83* with built-in limiter, *SM84* handheld radio mic with exchangeable heads; operating frequencies one or two channels between 26MHz and 46MHZ; RF output power available in 1mW or 10mW. Dimensions – pocket 105 x 67 x 25mm, 200g, handheld 170 x 50 x 41mm, 300g.
**TE20:** portable receiver, battery operated; frequencies up to three channels between 26 and 46MHz; 140 x 85 x 30mm, 280g.
**NE75/NE84:** mains/battery receivers for up to three channels; built-in modulator speaker; 9V battery; diversity connections on *NE84*.
**NE77:** receiver with simultaneous three-channel reception; frequencies 26 to 46MHz; 361 x 216 x 48mm.

## CETEC VEGA (USA)

**Cetec Vega, 9900 Baldwin Place, El Monte, Cal 91731. Phone: (213) 442-0782. Telex: 910-587 3539.**
**UK:** Cetec International Ltd, Unit 15 Northfield Ind Estate, Beresford Avenue, Wembley, HA0 1YB. Phone: 01-900 0355. Telex: 935847.

**77/80/81/88 transmitters:** *77* is pocket transmitter with circuitry sealed in compartment separate from battery, *80/81* is handheld transmitter with built-in mic element. Transmitter power 50mW; frequency range 150 to 216MHz. *88* is pocket pack with built-in mic.
**58/63 receivers:** *58* standard receiver, *63* diversity receiver. Response 40Hz to 15kHz; multifunction metering; mains or 12V power.
**66/990 receivers:** similar to *58/63* but portable. Powered from four 9V batteries.
**89 receiver:** mains powered receiver for *88* transmitter; 70Hz to 12kHz.

Cetec Vega have a wide range of accessories and aerials.

## COMREX (USA)

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

**450RA/TA system:** pocket UHF transmitter with matching pocket receiver designed to be mounted on a camera. 450 to 451MHz, 455 to 456MHz; transmitter input any low imp mic; RF output power 150mW. Dimensions each 76 x 127 x 25mm.
**450DS diversity system:** diversity receiver mounted in luggage type case. Includes two *450RA* receivers, a diversity combiner, a monitor amplifier and speaker, and an internal power supply enabling the system to be operated from AC power or internal NiCads. Case also holds *450TA* pocket transmitter and *HHT-1KA* handheld transmitter.
**HHT-1KA transmitter:** handheld transmitter with built-in electret mic, with dual automatic modulation control; 1W output; 220 x 44 x 38mm.
**CTA/CTB Cue Transmitter:** rack-mounting 1W transmitter, 26.1 to 26.48MHz *CTA*, and 161.625 to 161.775MHz *CTB*, includes ducking limiter operating on line level, 6kHz bandwidth.
**CRA Cue Receiver:** pocket-sized cue receiver with high level headphone output of 600mW into 8Ω; antenna operates from earphone cable; battery 9V Mallory *MN1604*; 75 x 125 x 25mm; 50 to 550MHz or 26.1 tp 26.48MHz.

## EDC (UK)

**Elkom Design Ltd T/AEDC, 29A West Street, Wareham, Dorset BH20 4JS. Phone: 09295 6050/6061.**
**USA:** Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Conn 06906. Phone: (203) 348-4969/1045. Telex: 643678.

**Cygnus transmitters CTXP/CTXH:** available as pocket *CTXP* or handheld with cardioid electret (omni to order) *CTXH:* audio input matches any 200Ω, low imp or 2kΩ electret; RF output power 10mW, higher output power available for export. Dimensions – pocket transmitter 111 x 45 x 19.5mm; handheld 215mm x 20mm diameter.
**Cygnus receivers CRX and CRX/A;** mains or external battery operated; numerical channel and status indicator. *CRX/A* simplified panel version with only on/off on front. Audio outputs mic level 30 to 300Ω balanced, line bal or unbal.
**Overall system specification:** pre- and de-emphasis 50μs; carrier frequency range UK 174MHz to 175MHz band; Europe 37.1MHz standard, or 27MHz to 60MHz band; to order 150MHz to 200MHz band.
**Minkom System:** transmitter and receiver are each pocket sized in plastic cases. Specification very similar to *Cygnus* but receiver same as transmitter with 0dB into 8Ω output; 6 hours operation from NiCad.
**Sirius System:** handheld mic/transmitter with integral Shure *R97* dynamic mic capsule. Specification similar to *Cygnus* system, transmitter has silver zinc rechargeable battery for 8 hour continuous use, receiver has optional switched channels (5 crystals), built-in charger.

Wide range of rechargeable batteries, vertical and right angle helical aerials, di-pole aerials, lapel mics, windshields, and coloured slip on sleeves for handheld mics also available.
**Pikamic:** self-contained transmitter module that fits into the *XLR* output socket of any conventional cable mic. Includes silver-zinc rechargeable battery which can also produce phantom power for a condenser mic. Five channels in 173.80 to 175MHz band. European 27 to 60MHz and 150 to 250MHz; RF output 10mW into 50Ω load (higher for export models); 35mm max diameter, 103mm long.

## EDCOR (USA)

**Edcor, 16782 Hal Avenue, Irvine, Cal 92714. Phone: (714) 556-2740. Telex: 685557.**

**PM1/PM5 transmitter:** pocket transmitter with belt clip, available as *PM1 Interviewer* with built-in mic or *PM1 Demonstrator* with attached dynamic external mic, *PM5* handheld with dynamic cardioid element.
Operating frequency 30 to 50MHz; RF output 200mW; FM modulation 40kHz deviation; *PM1* 31 x 70 x 98mm.
**ST-3B/ST-3B2:** mains or DC powered receiver in cabinet case, *ST-3M2* has two channels. Audio output up to 5V for driving high imp, 100mV for low imp; RF sensitivity 2μV for 20dB quieting; 75 x 185 x 254mm.
**PR1:** personal mini pocket receiver with belt clip; basic specification as above, but 500mW into 8Ω output for headphones; battery operation from 9V alkaline, 4 hours life.
**ST-3B diversity Receiving System:** specification similar to *ST-3B* but with two receivers, two antennas and a diversity switch.
**E-COM1 The Elite:** pocket transmitter, crystal controlled, with mini jack, optional phantom powering; 40dB compressor, external antennas; 9V alkaline battery; operating frequency 150MHz to 210MHz.
**E-COM3 Receiver:** single-channel crystal controlled receiver signal energised electronic switch; operating frequency 150MHz to 210MHz.
**E-COM5 Diversity:** similar to *E-COM3* but diversity with two receivers and electronic switch.
**E-COM7 Body Receiver:** battery powered pocket receiver, headphone output; operating frequency 150MHz to 210MHz.

## HM ELECTRONICS (USA)

**HM Electronics Inc, 6151 Fairmount Avenue, San Diego, Cal 92120. Phone: (714) 280-6050. Telex: 697122.**
**UK:** Theatre Projects Services Ltd, 10 Long Acre, London, WC2E 9LN. Phone: 01-240 5411. Telex 27522.
**USA:** Advance Access Group, 10526 West Cermak, Westchester, Illinois 60153. Phone: (312) 562-5210.

**WM222/WM225A transmitters:** body pac pocket transmitters, *WM222* has dynamic expansion providing wide dynamic range but requiring expansion receiver; *WM225A* has soft compression plus adjustable non-clipping limiter; low imp dynamic or electret mic input; switchable bias, positive ground, *WM222* – 52dBm, *WM225A* – 65dBm; 50mW nominal RF power output, *WM225A* switchable 50/100mW; dimensions – 102 x 64 x 20mm.
**WM250/WM252 transmitters:** handheld transmitters *WM250* similar to *WM222* specs, *WM252* similar to *WM255A* specs, but both with either Shure *SM57* or *SM58* elements; 267 x 30mm diameter.
**WM122/WM125:** mains or externally powered receivers, *WM122* with dynamic expansion capability. *WM125* straight; audio outputs line level bal 600Ω (0dBm), mic/ebel bal 200Ω (– 52dBm), monitor 1V into 50Ω; RF sensitivity 1μV for 30dB quieting; 146 x 76 x 178mm.
**WM152/WM155:** specifications basically similar to *WM122/WM125*, but *Flat Pac* receivers with two or four batteries, or external 10 to 30V; 146 x 39 x 178mm.
**WM300:** executive receiver, specification similar to *WM125* but simplified controls and outputs; mains only.

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Sony Digital Audio is anything but a new idea. As far back as 1974 Sony introduced their original working digital audio recorder.

Even at that stage its wider dynamic range, flat frequency response, lower distortion and lack of deterioration in repeated copying put analogue equipment in the shade.

But now, having put much time and effort into research and development, Sony have produced a range of digital audio equipment which produces results even better than their original machine. Giving sound recordings which are virtually indistinguishable from the original performance.

An achievement made possible not only by improving on the original design but also by Sony extending the digital audio range to include a 24 track recorder, reverberator, 2-channel audio processor, preview unit and electronic editor. The widest range of digital audio equipment on the market.

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And we'll give you some impressive copies.

COMMUNICATION SYSTEMS DIVISION

SONY

# Sony Digital. Sound recording even better than the original.

# product guide Radio mics

**AD5/AD10 Diversity Systems:** passive diversity systems that combine the outputs of three antennas into one receiver, while *AD10* also provides four outputs.
**Overall system specification:** carrier frequency range 150MHz to 174MHz, or TV versions 174MHz to 216MHz; S/N 60dB on standard system. 95dB on dynamic expansion system; 1% distortion.

HME produce a wide number of systems composed of the above transmitters and receivers, with roadcases and other accessories.

## MARTI (USA)

**Marti Electronics Inc, PO Box 661, 1501 N Main, Cheburne, Texas 76031. Phone: (817) 645-9163.**
**UK:** Clyde Electronics Ltd. Ranken House, Anderston Cross Cent, Glasgow. G2 7LB. Phone: 041-221 5906/248 3001.

Marti Electronics manufactures a range of rack and freestanding wideband transmitters and receivers providing broadcast quality for links and reverse talkback purposes. Range includes 8W 950MHz model, and 1W and 40W versions in 150MHz to 172MHz band, and 0.7W and 25W versions in 450MHz to 470MHz band.

## MICRON (UK)

**Audio Engineering Ltd, 33 Endell Street, London WC2A 9BA. Phone: 01-836 9373.**
**USA:** Micron Audio Products Ltd, 210 Westlake Drive, Valhalla, NY 10595. Phone: (914) 761-6520.

**Micron 100 series transmitter:** available as *101* with one 9V battery, or *102* with larger case and two 9V batteries, pocket packs; audio input and connector uses 8-pin Lemo connector which can directly accept 200Ω dynamic (−74dB), dynamic via 20dB pad 2kΩ (−54dB); wide range of mics can be used. FM deviation ±75kHz max, normally 22kHz at limiter threshold; RF power output 10mW or 30mW; dimensions *101* 93 × 62 × 22mm; *102* 120 × 62 × 22mm.
**Micron 200 series transmitter:** *TX203* handheld transmitter with interchangeable cardioid or omni capsules, switchable bass cut and alignment; features as pocket transmitters; battery one PP3 (3 hrs). *MN1604* (12 to 15 hrs); length 25cm. antenna 10cm flexible helical.
**MR1/MR2 receivers:** *MR1* mobile receiver with external power and leather case, and *MR2* mains powered receiver in diecast case with monitor loudspeaker; audio output −51dB into 50Ω; RF sensitivity 2μV, 20μV gives 50dB S/N; adjacent channel ejection 80dB; dimensions *MR1* 120 × 95 × 32mm; *MR2* 185 × 115 × 55mm.
**Overall system specification:** S/N 500μV signal strength 55dB with receiver at max AF, 70dB with AF gain −20dB; pre- and de-emphasis 50μs; carrier frequencies 30MHz to 500MHz.
**Diversity systems:** *MD81* comprises *MDU101* diversity combining unit and two *MR1*s; *MDS2* is a modular frame system available in 4-, 6- and 8-channel configurations, which contain mains/battery powering, antenna distribution amplifiers and line level output; 8-channel frame capable of 19in rack mounting.

## NADY (USA)

**Nady Systems Inc, 1145 65th Street, Oakland, Cal 94608. Phone: (415) 652-2411.**
**UK:** Hardware House (Sound) Ltd, 1/7 Britannia Row, Islington, London, N1 8QH. Phone: 01-226 7940.

**Black Systems:** pocket transmitter using FM Band II, *Nasty Cordless Black* has high impedance input for musical instruments; *Nady Cordless Black* has low impedance input; used with good quality FM receiver.
Operating frequency turntable from 88MHz to 108MHz; modulation wideband FM; harmonic distortion less than 1% THD; operating range 250ft; features on/off toggle, vernier action tuning control externally, level adjustment, 30in wire antenna 9V alkaline battery provides 12 hour operation.
**Blue Systems:** basically similar to the *Black* systems, but use low-noise circuitry that provides 99dB S/N with less than 1% distortion; must be used with *Pro 400* or *Pro 500* receivers operating over 88MHz to 108MHz.
**Nady VHF Systems:** pocket or handheld transmitters, fixed frequency with wide dynamic range; operating frequency 150MHz to 216MHz; transmitter output 50mW or 125mW switchable; S/N 102dB; harmonic distortion 0.6%; modulation FM ±15kHz; operating range 1 500ft line of sight. 200ft adverse conditions; receivers basic or diversity available; image rejection 100dB image and spurious rejection.

## PANASONIC (Japan)

**Matsushita Electric Ind Co Ltd, PO Box 51, Osaka Central 530-91, 1006 Oaza Kadoma, Osaka, 571. Phone: 06 908-1121. Telex: 63426.**
**UK:** National Panasonic Ltd, 308-318 Bath Road, Slough SL1 6JB. Phone: 0753 34522. Telex: 847652.
**USA:** Panasonic Co. 1 Panasonic Way, Secaucus. New Jersey 07094. Phone: (201) 348-7000. Telex: 710-992 8996.

**WX-9000:** body pac transmitter designed for ENG applications in television, non-directional electret microphone, audio limiter; audio input mulitpin connector, sensitivity 84dB SPL, 90dB SPL and 96dB SPL at 3kHz; S/N 50dB; carrier frequency 450.4 or 450.2MHz, switchable; transmitter output 30mW; 2.6 × 3.5 × 0.7in..
**WX-9200/9250:** matching receivers; *WX-9200* is externally powered (typically from TV camera), while *WX-9250* has internal batteries; audio output −60dBm on *XLR*, 1mW at 8Ω on min jack for monitoring; RF sensitivity 10μV for 20dB S/N; carrier frequency 450.4 or 450.2MHz switchable.

## RELLO (UK)

**Martello Sound Ltd, Haywood Way, Ivyhouse Lane, Hastings, E. Sussex TN35 4PL. Phone: 0424 713220. Telex: 957066.**

**TXR:** pocket transmitter; mic level 200Ω on pre-5-pin socket; FM deviation ±75kHz; RF output power 10mW; operating frequency 174 to 175MHz; 57 × 38 ⅛83mm.
**RXR:** mains powered case receiver; output mic level 300Ω bal, and 400mV impedance; RF sensitivity mute at 5μV; 203 × 127 × 51mm.
**Performer:** complete radio mic system using handheld transmitter with dynamic ball-top element, and receiver built into custom case; telescopic aerial built into lid; mains powered.

## RF TECHNOLOGY (USA)

**RF Technology Inc, 54 Wilton Road, Westport, Connecticut 06880. Phone: (203) 226-9511.**

**Transmitter:** pocket pack transmitter; Audio input −40dBm to −60dBm, 3kΩ unbal, will power electrets; carrier frequency range 947MHz to 952MHz other to order; RF power output 50mW optional 500mW amp/battery pack; dimensions − 76 × 20 × 137mm.
**RM100 series diversity receivers:** *RM100* 5-channel in rack, *RM101* 1-channel pocket pack or strapped to recorder, *RM102* 1-channel in metal case, *RM104* 2-channel in metal case; all with main and diversity receivers; audio output *RM100* line + 8dBm 150 Ω bal. −50dB 150Ω bal. *RM101* −50dBm 150Ω; dimensions − *RM101* 100 × 33 × 140mm; *RM102/4* 230 × 310 × 50mm.

## SCHAFFER (USA)

**Ken Schaffer Group Inc, 10 East 49th Street, New York, NY 10017. Phone: (212) 371-2335.**

**B and T:** pocket transmitter and battery or mains powered receiver, transmitters available with high or low impedance inputs; operating frequency 50MHz to 216MHz, single-channel only; range with 'proper antenna placement' 600ft; receiver sensitivity 1μV for 20 dB quieting; image rejection −70dB.

## SENNHEISER (West Germany)

**Sennheiser Electronic, D-3002 Wedemark 2. Phone: 05130 8011. Telex: 0924623.**
**UK:** Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St. Peter, Bucks SL9 9UG. Phone: 02813 89221. Telex: 849469.
**USA:** Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018. Phone: (212) 239-0190. Telex: 421608.

**SK1010-9 transmitter:** pocket pack transmitter that includes removable mic elements and has optional neck noose; omni or cardioid elements; audio input 8-pin connector with 1mV input for 40kHz swing; carrier frequency bands 30MHz to 45MHz. 140MHz to 174MHz; UK 174MNz; RF output power 50mW; 150 × 46 × 24mm.
**EM1010-4 receiver:** cabinet mounted receiver, built-in monitor speaker; audio outputs 1.55V, 200Ω; RF sensitivity 2μV gives 50dB S/N. 50μV gives 65dB; dimensions − 294 × 172 × 97mm.
**SKM4031 Mikroport-solo:** handheld vocal radio mic/transmitter available in wide and narrow band FM versions.

Sennheiser also have systems operating in the 72MHz to 76MHz. 25MHz to 110MHz and 40MHz to 44MHz bands.

## SONY (Japan)

**Sony Corporation, PO Box 10, Tokyo Airport, 149. Phone: 03 448-2111. Telex: 22262/24666.**
**UK:** Sony UK Ltd, Pyrene House, Sunbury-on-Thames, Middlesex. Phone: 09327 81211. Telex: 266371.

**WRT42/WRT57/WRT27 transmitters:** *WR142* VHF handheld, *WRT57* UHF handheld, *WRT27* UHF pocket pack; handheld have cardioid electret elements; audio input *WRT27* 4kΩ suitable for *ECM50* mic; also dynamic mics; frequency bands VHF 40MHz to 47MHz. UHF 470MHz to 488MHz, 900MHz to 950MHz; FM deviation VHF 2kHz, UHF 2.4kHz; RF power output 30mW, available for any national standard; dimensions handheld 171mm long × 20mm diameter, pocket 59 × 20 × 82mm.
**WRR52/WRR57/WRR27:** *WRR52* VHF module mount, *WRR57* UHF module mount. *WRR27* portable, shoulder slung; RF sensitivity muting level − 30dB, S/N 55dB with 60dB RF input; audio output −20dBm 600Ω, portable −64dBm 600Ω; dimensions − 68 × 89 × 205mm, portable 148 × 35 × 106mm.

Sony also produce diversity units for separate receivers and tuner base and portable base units.

## SWINTEK (USA)

**Swintek Enterprises Inc, 1180 Aster Avenue, Unit J, Sunnyvale, Cal 94086. Phone: (408) 249-5594.**
**UK:** Optical & Textile Ltd. 22/26 Victoria Road, New Barnet, Herts EN4 9PH. Phone: 01-441 2199/0098. Telex: 8955869.

**WMS111 series transmitters:** handheld with Shure *SM57* or *SM58* elements. *TS* pocket pack, *T* pocket pack; audio inputs −54dB 50 to 250Ω or high impedance for electret, positive or negative phantom bias matches *ECM50, CE10, MiniMic, EV085* etc. FM deviation 10kHz deviation; frequency hand 150mHz to 220MHz; S/N 70dB; spurious radiation −40dB; RF power output 50mW *TS/T*, 20mW *TH*; dimensions − *TS/T* 95 × 57 × 22mm; *TS* 216 long × 32mm diameter.
**WMS111 series receiver:** portable receivers with a variety of powering and monitoring arrangements; audio output mic level − 30dBV on balanced *XLR* 50 to 250Ω, high level unbal on jack 600Ω line level and headset unbal 6dBV 100Ω jack; RF sensitivity 0.25μs for 12dB SINAD, 70dB S/NB.

All models available with optional *dB·S* companding system to give 80dB S/N.
**Mark 1L-SM57:** system comprising *WMS111TH* handheld transmitter with *SM57* element. *WMS111RAC-THR* receiver. NiCads and case.
**Mark 2L-50A:** system comprising *WMS111TS* pocket transmitter and *WMS111RAC* receiver, and case.

## TELEX COMMUNICATIONS (USA)

**Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420. Phone: (612) 884-4051. Telex: 297053.**
**UK:** Avcom Systems Ltd, Newton Works, Stanlake Mews, London, W12 7HS. Phone: 01-7400051. Telex: 892513.

**WT-100:** belt pack transmitter, designed for use with Telex electret lavalier mic *WLM-100*; audio input low impedance, bias voltage for mic provided; response 50Hz to 15kHz ±2dB; S/N 80dB with 100ft range; carrier frequency 150 to 174MHz; transmitter output 50mW; range 400m; dimensions − 2¾ × 4 × 1in.

**WHM-300/400:** similar to above, but handheld transmitter/mic; 15mW max output; 300m range. *WHM-300* is electret with switches for RF and audio. *WHM-400* is dynamic mic with no switching; dimensions 11¾in long using ball screen 2¼ diameter, flat side screen 1¾in diameter.
**FMR-1:** marching receiver, operated as a diversity receiver when two antenna are used, phase shifting the combined signal for best performance. Minimum distance between antennas should be 20ft for diversity reception; audio output 0dB or −50dBm selectable, headphone monitor output; RF sensitivity 1μV for 12dB S/N; carrier frequency 150 to 174MHz. ■

# NEUTRIK CONNECTORS

SWISS

Neutrik is an Electro-Acoustical, Electro-Mechanical Research, Development and Manufacturing Company.

20 International Patents have been granted on Neutrik Connectors and several more are pending.

## Connector Programme 1982

**LINE CONNECTORS,** 3,4,5,6 pin configuration, male and female, matt black or silver finish.
**CHASSIS SOCKETS,** 3,4,5,6 pin configuration, male and female, matt black or silver finish.
**NON-LATCHING UNIFIED HOUSING CHASSIS SOCKETS,** in 3 pin configuration, male and female, silver finish.
**LINE CONNECTORS, RIGHT ANGLE,** in 3,4,5,6 pin configuration, male and female, silver finish.
**CHASSIS SOCKETS FOR P.C. BOARD,** 3 pin configuration, male and female, horizontal and vertical mounting, silver finish.
**LNE,* MALE AND FEMALE LINE CONNECTORS AND CHASSIS SOCKETS,** silver finish.
* These connectors are not suitable for making external connections to equipment for domestic use as defined in the Electrical Equipment (Safety) Regulations 1975.
**LOCKING JACK SOCKET AND 2-POLE JACK PLUG,** silver finish.
**MODULAR ACCESSORIES,** e.g. from XLR to DIN, male to female, XLR and 2-pole jack plug, etc.

Distribution nationwide

Sole Agent U.K.
**The House of Exclusive Components**
**Eardley Electronics Ltd**

**Eardley House**
**182/184 Campden Hill Road**
**Kensington, London W8 7AS**
**Telephone: 01-221 0606 Telex: 299574**

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# The 8X32 Digital Reverberation Unit from Ursa Major.

Already recognised by many leading studio and broadcast organisations as one of the most comprehensive and most natural sounding digital reverberation devices on the market today.


*Specifications and Features:*
* Four programmes: Plate I Plate II Hall and Space.
* Separate control of up to 96ms for both early reflections and initial delay times.
* Early reflections and initial delay levels variable: 8 steps.
* Reverb time ranging from 0.2-19.9 seconds depending on programme selected.
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* 64 non-volatile storage registers.
* Microprocessor – based control and display of all programmable reverberation parameters.
* Optional versions available with remote control.
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**U.K. Distributors**
Feldon Audio Ltd.,
126 Great Portland Street, London W1N 5PH Tel: 01-580 4314. Telex: London 28668.

# product guide
## Mic stands

### ACCURATE SOUND (USA)
**Accurate Sound Corp, 3515 Edison Way, Menlo Park, Cal 95008. Phone: (415) 365-2843. Telex: 348327.**

**Starbird:** rubber castor-mounted stand with 360° rotation boom arm.

### AEA (USA)
**Audio Engineering Associates, 1029 North Allen Avenue, Pasadena, Cal 91104. Phone: (213) 798-9127.**

**Collapsible stands:** *AEA/4707* 18in to 7ft; *AEA/428* 28in to 12ft; *AEA/532* 32in to 15ft.

### AKG (Austria)
**AKG GmbH; Brunhildengasse 1, A-1150 Wien. Phone: 43222 95.65.17 0. Telex: 131839.**
**UK:** AKG Acoustics Ltd, 191 The Vale, London, W3 7QS. Phone: 01-749 2042. Telex: 28938.
**USA:** AKG Acoustics Inc, 77 Selleck Street, Stamford, Conn 06902. Phone: (203) 348-2121. Telex: 84451121.

**ST30:** lightweight telescopic boom with collapsible legs.
**ST102A:** studio boom with telescopic upright and screw mounted legs.
**ST200:** telescopic upright stand with collapsible legs.
**ST12:** stand with circular cast iron base and telescopic tube.
**ST4A/41/43:** rectangular solid base with rubber feet for gooseneck mics, stand adaptors and flexible shafts.

AKG also manufacture a range of goosenecks, stand adaptors, numerous mounting facilities, windshields and extensive accessories for the *CMS* range of capacitor mics.

### ALAN GORDON (USA)
**Alan Gordon Enterprises Inc, 1430 Cahuenga Blvd, Hollywood, Cal 90028. Phone: (213) 466-3561. Telex: 910-321-4526.**
**UK:** Optical & Textile Ltd, 22/26 Victoria Road, New Barnet, Herts EN4 9PH. Phone: 01-441 2199/0098. Telex: 8955869.

Lightweight fishpole boom extending from 5 to 12ft in three telescopic sections. Built-in mic cable.

### ALTEC LANSING (USA)
**Altec Corp, 1515 South Manchester, Anaheim, Cal 92803. Phone: (714) 774-2900. Telex: 655415.**
**UK:** Rank Strand Sound and Cinema, PO Box 51, Great West Road, Brentford, Middx TW8 9HR. Phone: 01-568 9222. Telex: 27976.

**UMS100/101/102/103:** stands with heavy circular bases and telescopic uprights adjustable between 88 and 160cm.
**UMS110/111:** stands with heavy circular base and telescopic upright, adjustable between 87 and 162cm.
**UDS100/101:** desk stands with circular bases.
**UBB100:** boom attachment with brass swivel mount.
**UBB200:** baby boom attachment with all chrome steel counterweight and ratchet-type lock.
**UBS200:** adjustable holder for two guitar mics; includes 15cm tube.

Altec also manufacture goosenecks and various adaptors.

### ATLAS (USA)
**Atlas Sound, 10 Pomeroy Road, Parsippany, NJ 07054. Phone: (201) 887-7800.**
**UK:** Kelsey Acoustics Ltd, 28 Powis Terrace, London W11 1JH. Phone: 01-727 1046.
**SB-100W:** stand with 110in boom; height adjustable 61½in to 91½in; 350° mic follower; base has heavy duty lockable wheels.
**SB-36/SB-36W:** boom with solid base; grip action clutch with air suspension system for counterbalance; boom length 62in and adjustable height 48 to 72in. *SB-36* (general purpose); *SB-36W* (stage version).
**Omni series:** stands with rectangular counterweighted base allowing positioning of the stand at the traditional 90° as well as 75° and 105°; floor standing (32 to 61in) or lectern height.

Atlas also produce a wide selection of general purpose upright, desk and special purpose stands with accessories.

### BEYER (West Germany)
**Beyer Dynamic, PO Box 1320, D-7100 Heilbronn. Phone: 071 31.82.348. Telex: 728771.**
**UK:** Beyer Dynamics (GB) Ltd. 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Phone: 0444 51003.
**USA:** Beyer Dynamic Inc, 5-05 Burns Ave, Hicksville, NY 11801. Phone: (516) 935-8000.

**ST220:** anti-vibration stand; adjustable column 83 to 157cm height; folding legs.
**ST199:** lightweight stand; adjustable 30 to 150cm height.
**ST201/1:** noiselessly adjustable stand; screw-in legs; height 83 to 150cm.
**ST251/2:** 3-section adjustable stand with folding legs; height 60 to 152cm. *ST252* has 66cm adjustable boom.
**ST205A1:** lightweight stand with flat section folding legs; height 91 to 152cm.
**ST212:** heavy duty stand with 2-section column; height 1.5 to 2.25m, boom reach 0.9 to 1.8m.
**ST195:** heavy duty stand for mounting PA cabinets; removable folding base; height 1.1 to 1.7m.
**ST208A:** heavy duty stand with 4-section column extending to 4.5m.
**ST255:** short column stand; telescopic boom with reach 83 to 152cm.
**ST259:** drum stand with boom.

Beyer also manufacture a range of table stands, goosenecks, clamps and accessories.

### CANFORD AUDIO (UK)
**Canford Audio, Stargate Works, Ryton, Tyne & Wear NE40 3EX. Phone: 089422 7171. Telex: 537792.**

**Anglepoise mic stands:** heavy duty with standard ⅜in mounting spigot; Cable can be internally threaded; table or wall-mount brackets; can be modified for use with heavier mics.

### COLORTRAN (USA)
**Colortran Inc, 1015 Chestnut Street, Burbank, Cal 91506. Phone: (213) 843-1200. Telex: 677252.**
**UK:** Colortran UK, PO Box 5, Burrell Way, Thetford, Norfolk IP24 3RB. Phone: 0842 2484. Telex: 81294.

**Compact mic boom 540-009:** automatic balancing and stainless steel wire pulley system for extension control; noise-free operation with panning and tilt handle control; short rear boom overhang; boom length from pivot point is 96 to 202in; can be mounted on *Compact* pram *540-011* enabling the height of the boom pivot to be adjusted 78¼ to 120in; 360° rotation; telescopic wheel axles; collapsible side flaps.

### EAGLE
**UK:** Eagle International, Precision Centre, Heather Heather Park Drive, Wembley, HA0 1SU. Phone: 01-902 8832. Telex: 922131

**FS2/FSB2:** adjustable stands with two sections; max height 1.4m; snap fit legs.
**PRO range:** interchangeable parts enabling a variety of stands to be constructed.

### FLEXO (USA)
**Harris Corporation, PO Box 4290, Quincy, Illinois 62305. Phone: (217) 222-8200. Telex: 404347.**

**Mikester arms:** range of mic arms that remain where positioned with loads up to 4lb; max extension 36in in any direction. General model clamps or screws to any surface; bracket version for wall or vertical mounting; floor model as general but on 40in stand with heavy 13in diameter base.

### KEITH MONKS (UK)
**Keith Monks (Audio) Ltd, South Fleet, 26-28**

# "Untwisting all the chains that tie the hidden soul of harmony." Milton, 1608-1674.

Knowledge is the key to unequalled audio equalisation — and Klark-Teknik's DN60 Audio Spectrum Analyser is a rack-mounted, laboratory standard instrument that provides instantly usable information for an enormous range of applications. With continuous measurement and display of signal levels at 30 points across a broad audio spectrum from 25Hz to 20KHz, this cost-effective microprocessor-based analyser adds new standards of accuracy to the audio professional's vocabulary.

For easy equalisation, the 30 measurement frequencies of the DN60 exactly match the control frequencies of our latest two-channel DN30/30 equaliser. Add the inexpensive RT60 Reverberation Analyser to untangle structural reflections. Result: exact knowledge permits exact adjustment of response levels for total control of sound consistency. DN60 has got the features you need, because it is:

The most powerful audio-analyser on the market today — and because it is microprocessor-based, not only accurately monitoring the full audio band from 25Hz to 20KHz but also offering three memories plus a peak hold memory.

Options include X/Y plotter, dot matrix printer, the matched RT60 Reverberation Decay Analyser and a calibrated measuring microphone.

It is a tough but compact rack-mounted instrument with easy operation and superb 'lights-out' readability, and it is tested rigorously to Klark-Teknik's usual high standards, with a long burn-in period to ensure maximum reliability on the road and in the studio.

**ALL THESE USES!**

- Tape recorder alignment
- Room acoustical analysis
- Microphone/loudspeaker design and testing
- Reverberation checks
- Continuous system quality control
- Audio components research and development
- Fast semi-automatic production testing
- Selective noise level checks and environmental analysis
- Quality assurance for VTR audio channels
- Broadcast programme quality monitoring
- Music content analysis and level monitoring
- Level optimisation in disc cutting

For technical details ask for:
Our DN60/RT60 Data Sheet.
Our DN30/30 Data Sheet.

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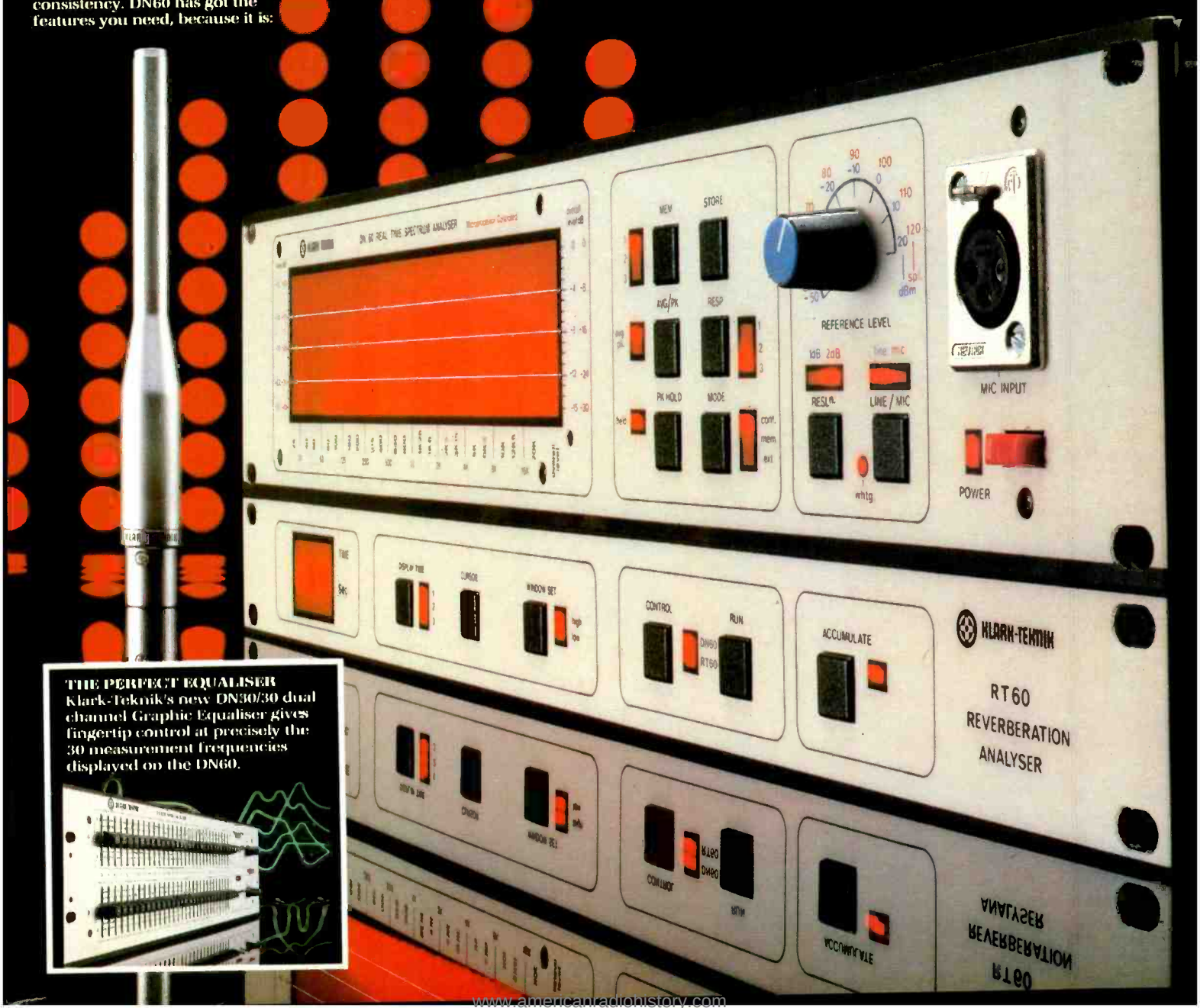
**Klark-Teknik Research Limited**
Coppice Trading Estate, Kidderminster, DY11 7HJ, England.
Telephone: (0562) 741515 Telex: 339821

**Klark-Teknik Electronics Inc.**
262a Eastern Parkway, Farmingdale, NY 11735, USA.
Telephone: (516) 249-3660


**THE PERFECT EQUALISER**
Klark-Teknik's new DN30/30 dual channel Graphic Equaliser gives fingertip control at precisely the 30 measurement frequencies displayed on the DN60.

# product Mic stands guide

**Reading Road, Fleet, Hants. Phone: 02514 20568. Telex: 858606.**
**USA:** Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Conn 06906. Phone: (203) 348-4969/1045. Telex: 643678.

**MS/M and BA/M:** heavy duty mic stands of medium weight; height 98 to 180cm; three screw legs.
**MS/S and BA/S:** lightweight mic stands; height 96 to 117cm; three screw legs.
**MS/L and BA/L:** Heavy duty floor stand forming base for *Studio* series; four screw legs; height 114 to 213cm. Boom arms 98 to 121cm and 170 to 210cm. *EXT/1* extends booms by 91cm and can be stowed inside boom when not in use.
**MS/W:** wheeled studio stand with reinforced base assembly; rubber suction cups enable stand to be locked in position; height 118 to 208cm.
**MS/CT/2:** floor stand with cast base; height 96 to 117cm.
**MS/LM and MS/LCT/2:** low floor stand 50 to 91cm height range.
**MS/F/2:** folding floor stand; height 71 to 183cm; three folding legs.
**DB/1, DB/2 and CF/1:** drum boom arms which attach to *MS/CT* or *MS/M* stands giving 360° coverage in a 71cm length from the clamp. *CF1* is 180cm ceiling or wall fitting for *DB* clamps.
**BS/1/B and BS/2/B:** banqueting stands for table or floor use, with telescopic tube.
**MS/PA/C:** toggle stand with telescopic upright that provides 180° vertical coverage; four screw legs; 132 to 215cm.
**MT/1:** collapsible large tripod stand; height 54½ to 103in; range of accessories.
**MSF3:** portable mic stand with folding legs.

Keith Monks also manufacture a wide range of clamps, stereo bars, spring grip clamps, table stands, fishpoles, goosenecks and thread adaptors.

## LUXO (USA)

**Harris Corporation, PO Box 4290, Quincy, Illinois 62305. Phone: (217) 222-8200. Telex: 404347.**

**Multipurpose arms:** range of mic arms, all are spring balanced and stay where positioned with loads up to 6lb and reaches of 21 to 56in.

## MATTHEWS (USA)

**Matthews Studio Equipment Inc, 2405 Empire Avenue, Burbank, Cal 91504. Phone: (213) 849-6811/ 843-6715. Telex: 691599.**

**Studio:** tripod adjustable in two sections from 41 to 112in.
**Concert:** similar to *Studio* but with articulated leg.
**Location:** tripod with articulated leg; height 53 to 196in in four sections.
**Pro Roller:** tripod on locking wheels; height 66 to 210in in four sections.
**High Roller:** larger version of *Pro Roller*; height 84 to 266in.

All these stands can be fitted with a 6ft boom and wheels where not supplied.

## MOLE-RICHARDSON (USA)

**Mole-Richardson Co, 937 North Sycamore Avenue, Hollywood, Cal 90038. Phone: (213) 851-0111. Telex: 910-321 4615.**
**Type 103B boom:** system of control cords enables easy length adjustment 158¾ to 274¼in in two sections. Range of hangers for different mics.

## MUSIC TECHNOLOGY (USA)

**Music Technology Inc, 105 Fifth Avenue, Gardena City Park, NY 11040.**

**Mic stand:** tripod-based boom stand with rubber shock absorbers.

## NEUMANN (West Germany)

**Georg Neumann GmbH, Charlottenstrasse 3, D-1000 Berlin 61. Phone: 030 251-4091. Telex: 184595.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.
**USA:** Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

**M31:** stand with solid base; height 110 to 180cm.
**M32:** collapsible tripod; height 90 to 180cm.
**M35/G35:** substantial stand with tripod base; Height 1.4 to 5m.
**M184:** substantial stand with solid wheeled base; 4.5m height.
**M272 series:** stands with solid circular base; height 1.2 to 2m; built-in wired connector available in five types to fit most Neumann mics.
**MFS31 series:** mic stands with built-in connector on gooseneck.
**MA:** fishpole length 1.23 to 3.75m; swivel mic holder.

Neumann also produce goosenecks, stand adaptors and elastic suspension units.

## SENNHEISER (West Germany)

**Sennheiser Electronic, D-3002 Wedemark 2. Phone: 05130 8011. Telex: 0924623.**
**UK:** Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Phone: 02813 89221. Telex: 849469.
**USA:** Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018. Phone: (212) 239-0190. Telex: 421608.

**MZS142:** lightweight floor stand.
**MZS144:** floor stand with rubber tipped detachable legs.
**MZS210:** floor stand with antivibration mounts in legs.
**MZS211:** boom arm for mic stand.

## SHURE (USA)

**Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204. Phone: (312) 866-2200. Telex: 724381.**
**UK:** Shure Electronics Ltd, Eccleston Road, Maidstone, ME15 6AU. Phone: 0622 59881. Telex: 96121.

**MS10C:** regular floor stand, positive ring lock.
**BB44:** baby boom 78cm reach.
**MS20:** heavy duty floor stand, rubber feet and decoupling.
**S15:** very lightweight tripod stand, fully adjustable.

Shure also produce a wide range of mic holders, windshields, table stands and mounts.

## SIMMON (UK)

**Simmon Sound & Vision, 28a Manor Row, Bradford, Yorks. Phone: 0274 307763/307788.**
**Simmi fishpole:** light alloy mic boom extending from 4½ to 9ft.

## SONY (Japan)

**Sony Corporation, PO Box 10, Tokyo Airport, 149. Phone: 03 448-2111. Telex: 22262/24666.**
**UK:** Sony UK Ltd, Pyrene House, Sunbury-on-Thames, Middlesex. Phone: 09327 81211. Telex: 266371.

**B-302/B-402:** various mic boom stands. *B-302* height 40 to 71in, boom length 41in. *B-402* height 34 to 58in, boom length 35in.

## SWAN (UK)

**UK:** Kelsey Acoustics Ltd, 28 Powis Terrace, London W11 1JH. Phone: 01-727 1046.

**Major MS2:** hydraulic telescope stand with cast base.

**MS1DH:** two section heavy base desk stand.

Extensive range of clamps, adaptors and mic holders, etc.

## VALAN (UK)

**Valan Electrics, 1034 Yardley Wood, Warstock, Birmingham, B14 4BW. Phone: 021-474 2229.**

Range of goosenecks and mic mounting bars.

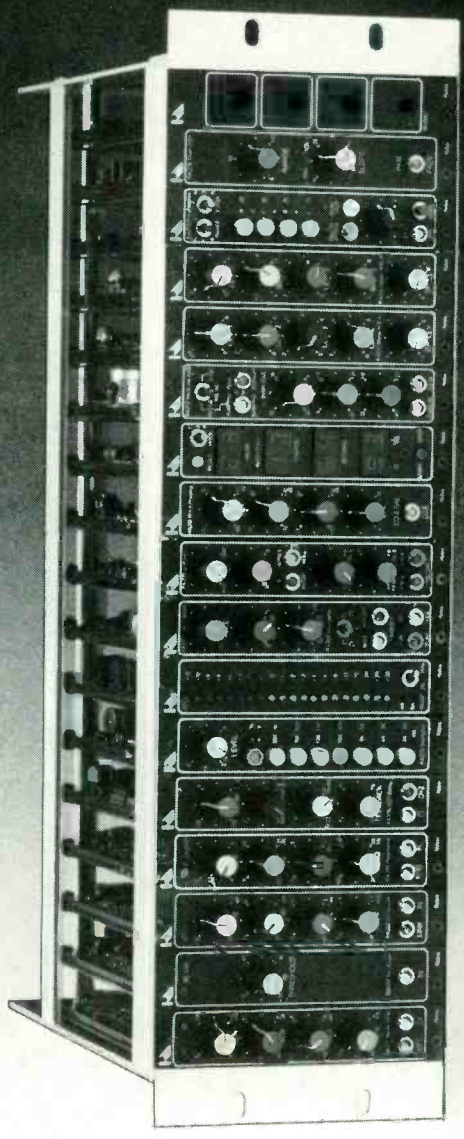
## WYNDCLIFF (UK)

**Walter Luther Ltd, 102 Chaldon Road, Caterham, Surrey CR3 5PH. Phone: 0883 48666.**

**HD1:** double extension stand complete with roller castors.
**HD2:** single extension similar to *HD1*.
**Coombi-Major:** lightweight boom stand.
**FH/85:** fishpole with min length of 128cm.
**SHD3:** multipurpose stand with load bearing centre member and tripod legs. Uses include lighting, column speakers and mics.
**Accessories:** range of head accessories for their stands. ■

# Rebis RA200 Series

## The Nº1 Gate

## The Nº1 System

Get the full facts on the most creative modular system in the world.

Rebis Audio Ltd., Kinver Street, Stourbridge, West Midlands, DY8 5AB, England.
Tel: 0384 71865. Telex: 335494.

**Australia;** Audio Mix Systems, Sydney 371-9009. **Belgium;** S.E.D., Bruxelles 522-7064. **Canada;** Heinl Electronics Inc., Ontario 495-0688. **Denmark;** Kinovox APS, Lynge 18 76 17. **Finland;** Studiotec, Helsinki 90 556 252. **France;** Lazare Electronics, Paris 8786210. **Germany;** Thum & Mahr Audio, Leverkusen 2173-41003. Hausmann Concert Electronic, Berlin 4336097. Studiotechnik Jurgen Klever, Hamburg 6901044. **Greece;** P.D.R. (Recording Services)O.E., Athens 80-29-807. **India;** Kapco Sound, New Delhi 43718. **Jamaica;** Audiofon Systems Ltd., Kingston 926-2569. **Japan;** Hibino Electro Sound Inc., Tokyo 864-4961. **Netherlands;** Special Audio Products B.V., Amsterdam 797055. **South Africa;** Tru-Fi Electronics, Johannesburg 838 4938. **Spain;** Mike Llewellyn Jones, Madrid 445-1301. **Sweden;** Tal & Ton, Gothenberg 803620. **U.S.A.;** Klark-Teknik Electronics Inc., Farmingdale, N.Y. 249-3660.

# product Microphones guide

**This survey covers microphones used in studios and for music PA, but excludes many small mics designed for public address purposes. Where possible, mic variations are given, but where there are numerous versions with different sockets, clamps, carrying cases, etc, these are not detailed.**

KEY

**Transducer type:** D—dynamic moving coil; R—ribbon; DR—double ribbon; C—capacitor,E—electret; PG—pressure gradient.
**Polar response:** O—omnidirectional; C—cardioid; HC—hypercardioid; SC—supercardioid; 8—figure-of-eight; V—various; VS—various switchable; S—special.

## AKG (Austria)

**AKG GmbH, Brunhildengasse 1, A-1150 Wien. Phone: 43222 95.65.17 0. Telex: 131839.**
**UK:** AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Phone: 01-749 2042. Telex: 28938.
**USA:** AKG Acoustics Inc, 77 Selleck Street, Stamford, Connecticut 06902. Phone: (203) 348-2121. Telex: 84451121.

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| D12E | D | C | 200 | 0.22 | Large diaphragm |
| D40 | D | C | 400 | 0.23 | |
| D58E | D | HC | 200 | 0.07 | Talkback microphone |
| D80 | D | C | 200 | 0.13 | On/off switch |
| D109 | D | O | 200 | 0.11 | Lavalier microphone |
| D125 | D | C | 200 | 0.19 | |
| D130 | D | O | 200 | 0.17 | |
| D190E | D | C | 200 | 0.23 | |
| D190ES | D | C | 200 | 0.23 | On/off switch |
| D202E1 | D | C | 200 | 0.16 | 2-way cardioid system, bass cut switch |
| D222EB | D | C | 250 | 0.15 | 2-way cardioid system, bass cut switch |
| D224E | D | C | 200 | 0.13 | |
| D310 | D | C | 200 | 0.13 | |
| D310S | D | C | 200 | 0.13 | On/off switch |
| D320B | D | HC | 200 | 0.14 | 3-position bass cut switch |
| D330BT | D | HC | 200 | 0.12 | 3-position bass cut switch and presence boost switches |
| D900 | D | SC | 200 | 0.30 | Shotgun microphone |
| D1200 | D | C | 200 | 0.23 | Bass cut switch |
| C535EB | E | C | 200 | 0.9/0.18 | 4-position bass cut and attenuator switch |
| C567E | E | O | 200 | 0.6 | Tie clip microphone |
| C34 comb | C | VS | 200 | 0.45 | Stereo microphone |
| C414EB | C | VS | 150 | 0.6 | Bass cut switch, 2-position pre-attenuator switch |
| C414EB-P48 | C | VS | 200 | 0.9 | For 48V phantom power only |
| C414E1 | C | VS | — | — | Remote control of polar pattern |
| C422 comb | C | VS | 200 | 0.6 | Stereo microphone |
| CMS range of pre-amplifiers, capacitor capsules and accessories | | | | | |
| C451 | amp only | | 200 | — | Preamp for 9 to 52V power supply |
| C451EB | amp only | | 200 | — | Same as *C451* but with 2-position bass cut switch |
| C452EB | amp only | | 200 | — | Preamp for 48V power supply with 2-position bass cut |
| C460B | amp only | | — | — | Uses standard CMS capsules |
| CK1 | C | C | 200 | 0.95 | Standard capsule |
| CK1S | C | C | 200 | 0.95 | Presence boost |
| CK4 | C | 8 | 200 | 0.6 | |
| CK5 | C | C | 200 | 0.95 | Built-in windshield |
| CK8 | C | S | 200 | 1.5 | Short shotgun |
| CK9 | C | S | 200 | 1.1 | Long shotgun |
| CK22 | C | O | 200 | 0.8 | Built-in wind and pop screen |

All output values are in units of mV/μ B at 1kHz.

## ALTEC LANSING (USA)

**Altec Corp, 1515 South Manchester, Anaheim, Cal 92803. Phone: (714) 774-2900. Telex: 655415.**
**UK:** Rank Strand Sound and Cinema, PO Box 51, Great West Road, Brentford, Middx TW8 9HR. Phone: 01-568 9222. Telex: 27976.

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| D60L | D | O | 200 | —60dBm | Lavalier |
| D80C | D | C | 200 | —59dBm | Grey metallic finish |
| D81 | D | O | 200 | —54dBm | Satin chrome |
| D90P | D | O | 200 | —58dBm | Satin chrome |
| C61L | E | O | 200 | —54dBm | Miniature lavalier |
| C70C | C | C | 200 | —40 to —70dBm | Satin chrome |
| C71 | C | O | 200 | —40 to —70dBm | Satin chrome |

## ASTATIC (USA)

**Astatic Corp, PO Box 120, Conneaut, Ohio 44030. Phone: (216) 593-1111. Telex: 980712.**
**UK:** The Sound Powered Telephone Co, Woodrolfe Road, Tollesbury, Maldon, Essex CM9 8XD.

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| 950S | D | C | 150 | —54dB | Contoured, switch |
| 925S | D | C | 150 | —54dB | Flat, switch |
| 855S | D | C | 150 | —54dB | Contoured, switch |
| 852S | D | C | 150 | —54dB | Flat, switch |
| 850A | D | C | 150 | —54dB | Flat |
| 850SA | D | C | 150/40k | | Flat, switch |
| 857H | D | C | 40k | —57dB | Peak free |
| 857HS | D | C | 40k | —57dB | Peak free, switch |
| 857L | D | C | 150 | —57dB | Peak free |
| 857LS | D | C | 150 | —57dB | Peak free, switch |
| 815S | D | C | 150 | —54dB | Contoured, switch |
| 812S | D | C | 150 | —54dB | Flat, switch |
| 810A | D | C | 150 | —54dB | Flat |
| 810SA | D | C | 150/40k | | Flat, switch |
| 1070 | D | O | 150 | —54dB | |

## AUDIO-TECHNICA (Japan)

**Audio-Technica Corp, 2206 Naruse, Machida, Tokyo 194. Phone: 0427-22-7641. Telex: 2872-357.**
**UK:** (*AT series*) Audio-Technica Ltd, Hunslet Trading Est, Low Road, Leeds LS10 1BL. Phone: 0532 771441. Telex: 557991.
**UK:** (*ATM series*) John Hornby Skewes & Co Ltd, Salem House, Garforth, Leeds LS25 1PX. Phone: 0532 865381. Telex: 556167.
**USA:** Audio-Technica US Inc, 1221 Commerce Drive, Stow, Ohio 44224. Phone: (216) 686-2600.

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| AT801 | E | O | 600 | —48dB | Lightweight |
| AT802 | D | O | 600 | —56dB | For outdoor recording |
| AT803S | E | O | 600 | —57dB | Submin lavalier |
| AT803R | E | O | 600 | —57dB | For remote power supply |
| AT805S | E | O | 600 | | Miniature tieclip type |
| AT811 | E | C | 600 | —56dB | — |
| AT812 | D | C | 600 | —60dB | Switch |
| AT813 | E | C | 600 | —55dB | Large windscreen |
| AT813R | E | C | 600 | —55dB | For remote power supply |
| AT814 | D | C | 250 | — | Designed for hand use |
| AT815 | E | C | 600 | — | Gun mic |
| AT831 | E | C | 600 | — | Submin mic with clothing and guitar clips |
| ATM10 | E | O | 600 | — | Instrument mic, accessories available |
| ATM10R | E | O | 200 | — | For remote power supply |
| ATM11 | E | C | 600 | — | Instrument mic accessories available |
| ATM11R | E | C | 200 | — | For remote power supply |
| ATM13 | — | — | — | — | Guitar mic |
| ATM21 | D | C | 600 | —60dB | Instrument mic |
| ATM31 | E | C | 600 | —55dB | — |
| ATM31R | E | C | 200 | — | For remote power supply |

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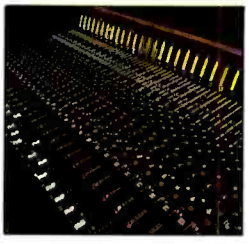
*AKG C535EB*

**Facilities:**

The MR-3 is supplied complete with integral patchbay and varying frame sizes to accommodate up to 56 input channels.

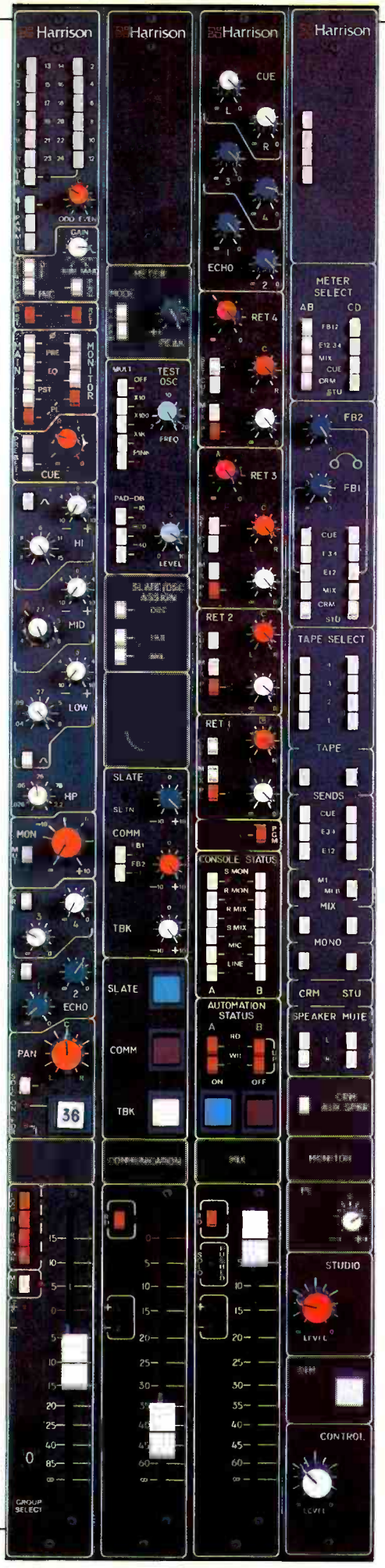
Each input module has a full 24-track output-assign matrix and three bands of parametric E/q, with a high pass filter and optional variable 'Q' on each band.

In addition, each module offers six auxiliary sends and a direct assign button for multitrack recording.



Major console status changes are effected with one-button ease. Six modes of operation are available including two new statuses for broadcast and video post production.

The standard VCA faders enable the operator to establish VCA groups when recording and mixing. The console is prepared for rapid installation of three proven automation systems: Melkuist, Allison and Harrison's own Auto-set.




# The Harrison MR-3. High on Features, Low on Price.

You can never afford to buy cheaply. What you must do these days is buy economically.

Recognising this, Harrison has developed the MR-3 music desk. High on impressive features, but not on cost, the MR-3 represents excellent value and a unique opportunity to invest in Harrison performance.

In other words the MR-3 guarantees maximum efficiency in 24-track recording.

The Harrison MR-3. Underpriced it may be, undermade it's not.

To find out more about the Harrison MR-3 contact F.W.O. BAUCH at the address below.

Harrison

**F.W.O. Bauch Limited**

49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ
Telephone 01-953 0091, Telex 27502

# product Microphones guide

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| ATM41 | D | C | 250 | —56dB | Vocal mic, handheld |
| ATM91 | E | C | 600 | —56dB | Bass boost |
| ATM91R | E | C | 200 | —49dB | For remote power supply |
| PRO4L | D | C | — | — | Stage vocal mic |

### B & K (Denmark)

**Bruel & Kjaer A/S, DK-2850 Naerum. Phone: 02 80.05.00. Telex: 37316.**
**UK:** Bruel & Kjaer (UK) Laboratories Ltd, Cross Lances Road, Hounslow, Middlesex TW3 2AE. Phone: 01-570 7774. Telex: 934150.
**USA:** Bruel & Kjaer Instruments Inc, 185 Forest Street, Marlborough, Mass 01752. Phone: (617) 481-7000.

The company is better known for its instrumentation microphones, but points out that several are suitable for music recording.

| | | | | | |
|---|---|---|---|---|---|
| 4133 | C | O | 25 | 12.5 | 3.9kHz to 40kHz |
| 4165 | C | O | 25 | 50 | 3kHz to 20kHz |

A suitable preamplifier for these capsules is model *2619*. Output figures are in units of mV/Pa.

### BEYER (West Germany)

**Beyer Dynamic, PO Box 1320, D-7100 Heilbronn. Phone: 071 31.82.348. Telex: 728771.**
**UK:** Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Phone: 0444 51003.
**USA:** Beyer Dynamic Inc, 5-05 Burns Ave, Hicksville, NY 11801. Phone (516) 935-8000.

| | | | | | |
|---|---|---|---|---|---|
| M130C | DR | 8 | 200 | —60dB | *XLR* |
| M160N | DR | HC | 200 | —60dB | DIN |
| M160C | DR | HC | 200 | —60dB | *XLR* |
| M260NS | R | HC | 200 | —61dB | DIN, switch |
| M260NCS | R | HC | 200 | —61dB | *XLR*, switch |
| M400C | D | HC | 200 | —54dB | *XLR*, switch |
| M500N | R | HC | 200 | —61dB | DIN |
| M500C | R | HC | 200 | —61dB | *XLR* |
| M600C | D | HC | 200 | —57dB | *XLR*, switch |
| M69N | D | C | 200 | —52dB | DIN |
| M69C | D | C | 200 | —52dB | *XLR* |
| M88N | D | HC | 200 | —52dB | DIN |
| M88C | D | HC | 200 | —52dB | *XLR* |
| M101N | D | O | 200 | —58dB | DIN |
| M101C | D | O | 200 | —58dB | *XLR* |
| M111N | D | O | 200 | —62dB | Lavalier, lead |
| M201N | D | HC | 200 | —59dB | DIN |
| M201C | D | HC | 200 | —59dB | *XLR* |

MC series comprises CV710 preamp for 48V phantom powering, CV720 for 12V phantom powering and the CK701/2/3/4/6/7/8 range of capsules. With DIN or *XLR* connectors.

| | | | | | |
|---|---|---|---|---|---|
| MC711/721 | C | O | 200 | —41dB | Modular |
| MC712/722 | C | O | 200 | —41dB | Modular, pop shield |
| MC713/723 | C | O | 200 | —39dB | Modular |
| MC714/724 | C | C | 200 | —39dB | Modular, pop shield |
| MC716/726 | C | SC | 200 | —39dB | Modular, short shotgun |
| MC717/727 | C | HC | 200 | —39dB | Modular, long shotgun |
| MC718/728 | C | 8 | 200 | —40dB | Modular |
| MCE5 | E | O | 200 | —43dB | Submin |

### CALREC (UK)

**Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorkshire HX7 7DD. Phone: 0422 842159. Telex: 51311.**
**USA:** Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310. Phone: (206) 275-5009. Telex: 152426.

*CM1000* series of 48V phantom-powered mics with non-detachable capsules:

| | | | | | |
|---|---|---|---|---|---|
| CM1001C | C | O | 1k | 0.8 | Handheld |
| CM1050C | C | C | 1k | 0.8 | — |
| CM1051C | As *CM1050C* with bass roll-off | | | | |

*CM2000* series of 48V phantom-powered mics with detachable *CB20C* preamplifier and a choice of capsule:

| | | | | | |
|---|---|---|---|---|---|
| CM2001C | C | O | 1k | 0.8 | *CC01* capsule |
| CM2003C | C | O | 1k | 0.8 | *CC03* capsule |
| CM2050C | C | C | 1k | 0.8 | *CC50* capsule |
| CM2051C | C | C | 1k | 0.8 | *CC51* capsule |
| CM2056C | C | C | 1k | 0.8 | *CC56* capsule |

*CM2100* series of 7.5 to 50V phantom-powered mics with detachable *CB21C* preamplifier and choice of capsule:

| | | | | | |
|---|---|---|---|---|---|
| CM2101C | C | O | 1k | 0.8 | *CC01* capsule |
| CM2103C | C | O | 1k | 0.8 | *CC03* capsule |
| CM2150C | C | C | 1k | 0.8 | *CC50* capsule |
| CM2151C | C | C | 1k | 0.8 | *CC51* capsule |
| CM2156C | C | C | 1k | 0.8 | *CC56* capsule |

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| CM10 | 7.5 to 50V phantom-powered talkback mic on 320mm non drop stem | | | | |

Output figures are in units of mV/μ B.
*CM600* series of professional entertainment microphones, DIN connectors with unbalanced outputs requiring 45 to 50V, *not* phantom:

| | | | | | |
|---|---|---|---|---|---|
| CM602D | C | O | 500 | —127dB | Vocal/instrumental |
| CM652D | C | C | 500 | —127dB | Instrumental |
| CM654D | C | C | 500 | —127dB | Vocal compensated |
| CM656D | C | C | 500 | —127dB | Vocal comp, windshield |

CM4050 *Soundfield* microphone. This comes complete with the *Soundfield* control unit *CS5014/3* and is designed primarily for surround sound and ambisonic recording, and allows post session control of stereo microphone operational mode and position. Greater rigging flexibility reduces setting up time. (Also see reviews in this issue.)

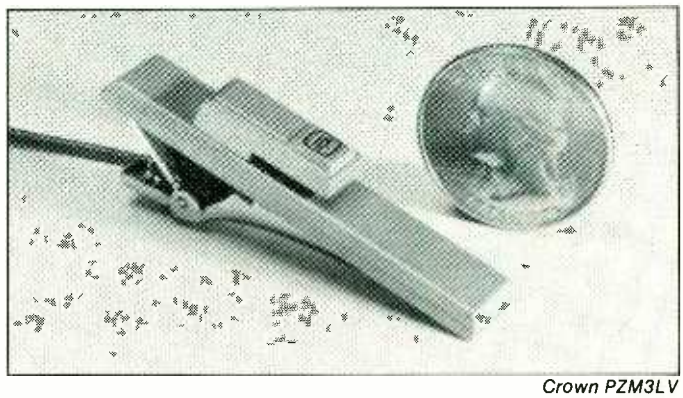
### COUNTRYMAN (USA)

**Countryman Associates, 417 Standord Avenue, Redwood City, Cal 94063. Phone: (415) 364-9988.**
**UK:** Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

**EM-101:** condenser mic which can be fitted to virtually any musical instrument using adhesive tape; supplied with individual calibration curves; phantom or battery powered with a max SPL 150dB. Also available *EM-102* battery powered only, *EM-202* uncalibrated version of the EM-102, *EMW* for wireless use.

### CROWN/AMCRON (USA)

**Crown International, 1718 West Mishawaka Road, Elkhart, Indiana 46514. Phone: (219) 294-5571. Telex: 810-295 2160.**
**UK:** HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10. Phone: 01-961 3295. Telex: 923393.



*Crown PZM3LV*

**PZM Series:** pressure zone microphones using the Pressure Recording Process, offering improved sound quality resulting from the lack of phase interference within the pressure zone. *PZM-6LP* is 2½ × 3in with cable output, while the *PZM-30GP* is 5 × 6in with an *XLR* socket output. Both require either a *PX-18* transformer or *PA-18* active power supply, being battery or phantom powered. Also *PZM2LZ* lavalier model and *PZM-31S*, similar to *30GP* but with deeper LF response.
**PZM 3LVR/3LV:** pressure zone mics mounted on a clip-bar 5cm by 1cm with active power supplies. *3LVR* has two mics on the same bar for broadcast applications.

### C-TAPE (UK)

**C-Tape Developments Ltd, Unit 19, Holder Road, Aldershot, Hants GU12 4RH. Phone: 0252 319171. Telex: 858623.**
**USA:** Griffith Jones & Associates, 3074 Greenwood Trail SE, Maryetta, Georgia 30067. Phone: (404) 953 0697.
**USA:** Hammond Industries Inc, 8000 Madison Pike, Madison, Alabama 35758.

**C-ducer System:** contact transducer system in the form of tapes, that are fixed to musical instruments; available in three sizes, 3in, 8in and 30in; power supply/preamp available in several formats—mono, stereo, 2-channel, 6-channel with mixer (for drums), mains, battery or phantom powered versions.

### D.I. TAPES (UK)

**D.I. Tapes Ltd, 107 Park Street, London W1Y 3TA. Phone: 01-629 6223. Telex: 298404.**

**Magnasound contact condenser mic:** sensitive condenser contact mic designed to be attached to the soundboard of a musical instrument and picks up only the vibration of the instrument and no spill. Mic contains own preamp circuitry and requires the use of the *Powerpack* which supplies balanced or unbalanced outputs. Battery or phantom powered.

### EAGLE (Japan)

**UK:** Eagle International, Precision Centre, Heather Park Gate, Wembley HA0 1SV. Phone: 01-902 8832. Telex: 922131.

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# And Now The Proline Professional Package For ALL Your Recording Needs.

Proline 1000 and 2000 Tape Recorders
Tomcat Cartridge Recorders
BMX Mixing Consoles
Slow Speed Logging Recorders
Garner and Leevers Erasers

PROLINE PROFESSIONAL

Leevers-Rich Equipment Limited
319 Trinity Road Wandsworth London SW18 3SL
Telephone 01 874 9054
Cables Leemag London SW18 Telex 923455

# product Microphones guide

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| PROM50 | E | SC | 600 | —60dBV | 'Rifle' mic |
| PROM70 | E | C | 600 | —62dBV | 10dB f to b |
| PROM80 | D | C | 200 | —64dBV | Body as *M70* |
| PROM90 | D | C | 600 | —64dBV | — |
| CO-96 | E | C | 600 | —62dBV | 'Pencil' mic |
| PROM3 | E | — | 600 | —62dBV | Miniature tie clip mic |
| PROM5 | E | — | 600 | —57dBV | Submin tie clip mic |

All output values are in units of dBV/Pa (+3dBV).

## ELECTRO-VOICE (USA)

**Electro-Voice Inc, 600 Cecil Street, Buchanan, Michigan 49107. Phone: (616) 695-6831.**
**UK:** Electro-Voice (Gulton Europe) Ltd, Maple Works, Old Shoreham Road, Hove, Sussex BN3 7EY. Phone: 0273 23329/778401. Telex: 87680.

| | | | | | |
|---|---|---|---|---|---|
| RE10 | D | SC | 150 | —56dB | Bass tilt switch |
| RE15 | | | | | |
| RE11 | D | SC | 150 | —56dB | Bass tilt switch |
| RE15 | D | SC | 150 | —56dB | Bass tilt switch |
| RE16 | D | SC | 150 | —56dB | Bass tilt switch |
| RE18 | D | SC | 150 | —57dB | Bass tilt switch, shock mount |
| RE20 | D | C | Several | —57dB | Shock mounting |
| 627C | D | C | Lo/Hi | —58dB | Bass emphasis |
| 631B | D | O | Lo/Hi | —56dB | — |
| 635A | D | O | 150 | —55dB | For high sound pressure use |
| 660 | D | SC | Lo/Hi | —56dB | Close use |
| 671A | D | C | Lo/Hi | —57dB | General purpose |
| DO54 | D | O | 150 | —58dB | Boom or stand |
| DO56 | D | O | 150 | —61dB | Shock isolated |
| DS36 | D | C | 150 | —60dB | Blast filter |
| RE50 | D | O | 150 | —55dB | Noise-free |
| RE55 | D | O | 150 | —57dB | 40Hz to 20kHz |
| 1776 | E | C | 150 | —50dB | Blast filter |
| 1777 | E | C | 150 | —54dB | Close use |
| CS15P | E | C | 150 | —45dB | 40Hz to 18kHz |
| CO90 | E | O | 150 | —57dB | Lavalier mic |
| CO85 | E | O | 150 | —56dB | Mini mic |
| RE85 | D | O | 50/250 | —61dB | Lavalier mic |
| RE51 | D | O | 50/250 | —54dB | Headset |
| 644 | D | C | Lo/Hi | —53dB | Gun mic |
| DL42 | D | C | 150 | —50dB | Gun mic |
| CL42S | E | C | 250 | —33dB | System C |
| CH15S | E | HC | 150 | —40dB | System C |
| PL77AA | E | C | — | — | Vocal mic |
| PL88 | D | C | 150/25k | —58dB | Vocal mic |
| CO94 | E | O | 150 | —45dB | Miniature tie clip type |
| PL80 | D | SC | 150 | —56dB | Vocal mic |
| PL91A | D | C | — | —60dB | Vocal mic |

## EPM (Canada)

**RD Systems of Canada Ltd, 2 Thorncliffe Park Drive, Unit 28, Toronto, Ontario M4H 1H2. Phone: (416) 421-5631.**
**UK:** John Page Ltd, Wesley House, 75 Wesley Avenue, London NW10. Phone: 01-961 4181. Telex: 24224.

**P650:** parabolic mic with clear plastic reflector, built-in EQ, preamp and speech/music. Also provided is a headphone output for on site monitoring. Power from two 9V batteries.
**S1000:** similar to *P650* but with twin mic capsules side-by-side for stereo pickup.
**P200:** non-electronic version of *P650.*
**S300:** non-electronic version of *S1000.*
These EPM parabolic mics were developed in conjunction with Dan Gibson.

## FRAP (USA)

**FRAP, PO Box 40097, San Francisco, Cal 94140. Phone: (415) 431-9350.**
**UK:** Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX. Phone: 0825 5566. Telex: 957098.

**Flat Response Audio Pickup Type F Professional Series:** system containing 3 piezoelectric pickups in one transducer to respond to vibration in three dimensions. Range of preamps with balanced and unbalanced outputs, 2- and single-channel systems, various output levels and impedances with battery or mains models.

## IMAGE DEVICES (USA)

**Image Devices Inc, 1825 NE 149 Street, PO Box 61-0606, Miami, Florida 33181. Phone: (305) 945-1111. Telex: 519358.**

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|

**IDI Micro Mike:** miniature electret mic measuring $\frac{5}{16} \times \frac{11}{16} \times \frac{3}{16}$ in. Capsule is isolated from the casing which is constructed from smooth plastic material so that contact with clothing will generate a mimimum of noise. *Model 14* supplied with 4½ ft of cable. Comes with accessories. Recommended for wireless mic applications. *Model 30* supplied with 12ft cable with locking micro plug, model BT balancing transformer and *XLR* connector. Also comes with same accessories as *Model 14.*
**Model B-60M Twin Model:** similar to the *Model 30* but two units mounted side by side to give greater reliability in live broadcasting situations. Range of accessories and fittings.

## KEITH MONKS (UK)

**Keith Monks (Audio) Ltd, South Fleet, 26-28 Reading Road, Fleet, Hampshire. Phone: 02514 20568. Telex: 858606.**
**USA:** Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 348-4969/1045. Telex: 643678.

| | | | | | |
|---|---|---|---|---|---|
| C133D | D | O | 200 | —71dB | Hand or stand |
| C133K | As *C133D* with on/off switch | | | | |
| C133SU | As *C133K* with *XLR* connector | | | | |

The *C133SU* is also available in a 30Ω version (—83dB output).

| | | | | | |
|---|---|---|---|---|---|
| MO97D | D | O | 200 | —55dB | DIN and switch |

Output values are referenced to 0dBm = 1mW10μB.

## MELODIUM (France)

**UK:** Amdio Ltd, 26-28 Reading Road South, Fleet, Hants. Phone: 02514 20568. Telex: 858606.

| | | | | | |
|---|---|---|---|---|---|
| C133 | D | C | 10/200 | — | General purpose, DIN/*XLR* |
| M110D | D | C | — | — | PA on/off switch |
| M121E | E | C | 600 | — | On/off switch |
| M097D | D | C | 200 | — | On/off switch, DIN/*XLR* |
| 79A | D | O | 200/50k | — | Lavalier |

## MILAB (Sweden)

**CTAB, Knutsgatan 6, S-26500, Astorp. Phone: 042 515 21. Telex: 12442.**
**UK:** Audio Video Marketing, Unit 21, Royal Industrial Estate, Jarrow, Tyne and Wear NE32 9XX. Phone: 0632 893092.
**USA:** Cara International Ltd, 4145 Via Marina, No. 120, Marina del Rey, Cal 90291. Phone: (213) 821-7898.

| | | | | | |
|---|---|---|---|---|---|
| P-14 | D | SC | 200 | 2 | Handheld |
| F-67 | D | C | 200 | 2 | Handheld robust |
| F-69 | D | C | 200 | 2 | Prof handheld robust |
| HM49 | D | O | 200 | 2 | Robust |
| LD-18 | D | O | 200 | 2 | Robust |
| RD-34 | D | C | 200 | 2 | Robust |
| CL-4AD | E | O | 200 | 10 | Lavalier mic 48V powered |
| CL-4BD | E | O | 200 | 10 | Lavalier mic bat. powered |
| DC-20 | C | O | 200 | 10 | Mini mic |
| DC-21 | C | C | 200 | 10 | Mini mic |
| DC-63 | C | VS | 200 | 2-8 | 44 combinations |
| DC-73 | C | C | 200 | 8 | Handheld bass cut |
| DC-96 | C | C | 200 | 8 | Low noise |
| LC-25 | C | C | 300 | 250 | Transformerless line level |
| MP-30 | E | H | 200 | 6.3 | Hemispherical |
| MP-31 | E | H | 300 | 250 | Transformerless line level hemispherical |
| TC-4 | C | VS | 200 | 10 | Remote controlled |
| VM-40 | C | O | 200 | 2.5-8 | Pad—roll-off |
| VM-41 | C | C | 200 | 2.5-8 | Pad—roll-off |
| MS-8 | C | VS | 200 | 5 | Stereo mic MS or XY system remote controlled |
| XY-82 | C | VS | 200 | 20 | XY system 48V powered mono system remote controlled |

Condenser mics are powered by MIPOW (equivalent to Phantom system) except for the TC-4 and MS-8 which works on older 120V system.

## NEUMANN (West Germany)

**Georg Neumann GmbH, Charlottenstrasse 3, D-1000, Berlin 61. Phone: 030 251-4091. Telex: 184595.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
**USA:** Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

| | | | | | |
|---|---|---|---|---|---|
| KRM82iMT | C | HC | 150 | 21mV/Pa | Shotgun |
| KM83i | C | O | 200 | —131dBm | 10dB cut |
| KM84i | C | C | 200 | —131dBm | 10dB cut |
| KMS84i | C | C | 200 | —131dBm | Pale finish |
| KMS84iMT | C | C | 200 | —131dBm | Dark finish |
| KM85i | C | C | 200 | —133dBm | Bass roll-off |
| KM86i | C | VS | 200 | —133dBm | Switchable responses |
| U87i | C | VS | 200 | —133dBm | Switchable responses |
| KM88i | C | VS | 200 | —133dBm | Switchable responses |
| U89i | C | VS | 200 | 8mV/Pa | Switchable responses |
| U47FETi | C | C | 150 | —133dBm | Bass roll-off |
| SM69FET | C | VS | 150 | —125dBm | Stereo |

48 ▶

# Reel Dynamite

There's only one way to produce a tape that will deliver a consistently super-clean sound.

And that's simply by blowing all compromise in a tape's over-all dynamic design.

Easier said than done, of course.

But thanks to 3M tape technology, Scotch 226 Audio Mastering Tape has managed to blast a way through the compromise barrier.

Take the hairy problem of print-through, for instance.

**Unlike most other state-of-the-art mastering tapes, Scotch 226 Tape, from 3M provides 2 to 3dB less print-through than the best of its rivals.**

**Which, in itself, is pretty devastating enough.**

But what about factors such as headroom and biased tape noise?

Or signal-to-noise ratios? Or distortion and frequency response levels? All those factors that directly influence ultimate sound quality?

In two words: no compromise.

Reel after reel, batch after batch, Scotch 226 Tape delivers headroom and distortion properties that are simply second to none.

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For further information please contact:

Martin Luddington,
Recording Materials Division,
3M United Kingdom PLC.,
3M House, PO Box 1,
Bracknell, Berkshire RG12 1JU
Telephone: Bracknell (0344) 58398


3M and Scotch are trade marks.

3M

# product Microphones guide

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| USM69 | C | VS | 150 | 10mV/Pa | Stereo, local switchability |
| QM69 | C | VS | 150 | —125dBm | Quad |
| KMA | C | O | 800 | 5mV/Pa | Lavalier |

*KU801* Dummy head system comprising two *KM83* mics for binaural recording

### PANASONIC (Japan)

**Matsushita Electric Ind Co Ltd, PO Box 51, Osaka Central 530-91, 1006 Oaza Kadoma, Osaka, 571. Phone: 06 908-1121. Telex: 63426.**
**UK:** National Panasonic Ltd, 308-318 Bath Road, Slough, SL16JB. Phone: 0753 34522. Telex: 847652.
**USA:** Panasonic Co, 1 Panasonic Way, Secaucus, New Jersey 07094. Phone: (201) 348-7000. Telex: 710-992 8996.

| | | | | | |
|---|---|---|---|---|---|
| WM-8000 | D | C | 250 | — | For vocal use |
| WM-8050 | D | C | 250 | — | For vocal use |
| WM-8100 | E | C | 250 | —50dB | For phantom or internal battery power. Subsonic filter, HF + LF cuts |
| WM-8150 | E | C | 250 | — | Instrument use. Battery or phantom power |

### PASO (Italy)

**UK:** Amdio Ltd, 26-28 Reading Road South, Fleet, Hants. Phone: 02514 20568. Telex: 858606.

| | | | | | |
|---|---|---|---|---|---|
| M8 | D | C | 200 | — | PA, speech/music, low cut |
| M103 | D | C | 200 | — | Elastic suspension |
| M300 | D | C | 200 | — | Pop shield |

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|

### PEARL (Japan)

**UK:** Pearl Music Ltd, 29 North Acton Road, London NW10. Phone: 01-961 5055.
**USA:** Pearl International, 408 Harding Industrial Drive, Nashville, Tennessee 37211.

| | | | | | |
|---|---|---|---|---|---|
| CR57 | E | — | 200 | —62dB | Switchable 12dB attenuator |
| CR55 | E | C | 200 | —62dB | LF and attenuator switching |
| CR45 | E | C | 200 | —66dB | Vocal mic |
| CR25 | E | C | 200 | —66dB | 8dB attenuator switch |
| DX75 | D | C | 200 | —75dB | Built in pop filter |
| DX98 | D | C | 300 | —76dB | Designed for flat response close miking |
| D700 | D | C | 200 | —76dB | Vocal mic |
| DX65 | D | C | 300 | —76dB | Vocal mic with LF roll-off and presence boost |
| C500 | E | C | 600 | —66dB | On/off switch |
| CX50 | E | C | 600 | —66dB | 9V operation |

### PEAVEY (USA)

**Peavey Electronics Corp, 711 A Street, Meridan, Missippi 39301. Phone: (601) 483-3565.**
**UK:** Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex, TN22 5SX. Phone: 0825 5566. Telex: 957098.

| | | | | | |
|---|---|---|---|---|---|
| PBL | D | O | 250 | —52dB | PA mic |
| PBH | D | O | 50k | —52dB | PA mic |

### PHILIPS CCTV (Netherlands)

**Philips Industries Elcoma Div, Eindhoven. Phone: 040 72.33.31. Telex: 51121.**
**UK:** Philips Business Systems Ltd, Cromwell Road, Cambridge, CB1 3HE. Phone: 0223 45191. Telex: 81547.
**USA:** Philips USA, 7530 Frontage Road, Skokie, Illinois 60077.

| | | | | | |
|---|---|---|---|---|---|
| LBB9003/05 | D | O | 200 | — | Lavalier |
| LBB9020/35 | D | C | 200 | — | General purpose |
| LBB9020/45 | D | C | 200 | — | Switch, speech/music filter |
| LBB9031/05 | D | C | 200 | — | With cable |

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| LBB9101 | D | O | 200 | — | Speech/music filter |
| LBB9032/05 | D | C | 200 | — | Switch, gooseneck |
| LBB9033/05 | D | C | 200 | — | Gooseneck |
| LBB9018/07 | D | SC | 200 | — | Restricted sensitivity |

### RWO/FOSTEX

**Canada:** Interlake Audio Inc, 680F Dobble Street, Winnipeg, Manitoba R2K 1G4. Phone: (204) 668-0248.

| | | | | | |
|---|---|---|---|---|---|
| M85RP | D | S | 600 | —76dB | Noise cancelling |
| M88RP | D | 8 | 600 | —72dB | Switchable LF filter |
| M80RP | D | 8 | 600 | —72dB | Identical to *m88RP* but no filter |
| M77RP | D | C | 250 | —76dB | Adjustable frequency response |
| M55RP | D | C | 250 | —76dB | For hand held use |

### SCHOEPS (West Germany)

**Schalltecknik Dr-Ing Schoeps, Spitalstrasse 20, Karlsruhe 41, D-7500 Karlsruhe 41. Phone: 0721 42016/42011. Telex: 7826902.**
**UK:** Scenic Sounds Equipment, 97-99 Dean Street, London, W1V 5RA. Phone: 01-734 2812. Telex: 27939.
**USA:** Posthorn Recordings, 142 W 26th Street, 10th floor, New York, NY 10001. Phone: (212) 242-3737.

The *CMC* series of complete capacitor mic comprise a preamplifier module connected directly, or via an 'active' cable, to an interchangeable capsule. The mics listed below utilise the *CMC5* preamps (48V phantom powering); the *CMC3* operates from 12V phantom and the *CMC4* from 12V 'parallel' powering. The type number of the compete mic is composed of the preamp model plus capsule (eg *CMC56 = CMC5 + MK6* capsule).

| | | | | | |
|---|---|---|---|---|---|
| CMC52U | C | O | 40 | 1.2 | Flat response |
| CMC53U | C | O | 40 | 1.0 | HF boost |
| CMC54U | C | C | 40 | 1.2 | |
| CMC540U | C | C | 40 | 1.6 | Close use |
| CMC541 | C | HC | 40 | 1.3 | |
| CMC55U | C | VS | 40 | various | Two patterns |
| CMC56U | C | VS | 40 | various | Three patterns |
| CMC58U | C | 8 | 40 | 1.0 | |
| CMTS501U | stereo | VS | 200 | various | |

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|

A stereophonic capacitor mic with cardioid, bi- and omnidirectional patterns on each capsule. The capsules are mounted one above the other, and can be rotated through 360°. 48V centre-point powering. (*CMTS301* identical with 12V powering.)

| | | | | | |
|---|---|---|---|---|---|
| MTSC54 | stereo | C | 40 | 1.3 | |

A stereo (110° ORTF-principle) twin-capacitor mic with two *MK4* capsules mounted at either end of a T-bar. Axial separation is 170mm. Preamplifier module is 48V phantom powered; other modules for 12V powering are also available.

| | | | | | |
|---|---|---|---|---|---|
| CMH52C | C | O | 40 | 1.0 | 'Pop' filter |
| CMH54C | C | C | 40 | 1.2 | 'Pop' filter |
| CMO3 | C | O | — | — | Miniature lavalier type |

All output figures are in units of mV/μ B.

### SENNHEISER (West Germany)

**Sennheiser Electronic, D-3002 Wedemark 2. Phone: 05130 8011. Telex: 0924623.**
**UK:** Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Phone: 02813 89221. Telex: 849469.
**USA:** Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018. Phone: (212) 239-0190. Telex: 421608.

| | | | | | |
|---|---|---|---|---|---|
| 540 | D | O | 200 | — | Phantom power 48 to 24V |
| MD211 | D | O | 200 | 0.13 | Flat response |
| MD214 | D | O | 200 | 0.10 | Lavalier |
| MD408 | D | SC | 200 | 0.13 | Integral gooseneck |
| MD431 | D | SC | 200 | —55dB | Musicians mic |
| MD416 | D | C | 200 | 0.13 | Hand held |
| MD418 | D | SC | 50 | 0.13 | Integral gooseneck |
| MD421 | D | C | 200 | 0.20 | Switched bass EQ |
| MD430-2 | D | SC | 200 | 0.18 | Close use |
| MD441 | D | C | 200 | 0.20 | Shockmount |
| MKE10 | E | O | 47k | 1.00 | Mini lavalier |
| MKE883 | E | HC | 200 | | |
| MKE803 | E | SC | 200 | 0.50 | |
| MKE403 | E | C | 200 | 0.30 | |
| MKE203 | E | O | 200 | 0.30 | |

The *MKE883/803/403/203* mics use a common powering module with interchangeable capsules which are also available separately.

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# product Microphones guide

| Model | Transducer type | Polar response | Impedance (Ω) | Output | Remarks |
|---|---|---|---|---|---|
| MKE2002 | E | O | 1k5 | 1.00 | Dummy head pair |
| MKH106 | C | O | 200 | 2.00 | 12V A-B |
| MKH125 | C | O | 200 | 0.32 | Lavalier |
| MKH126P48 | C | O | 200 | 2.00 | As MKH125 |
| MKH406P48 | C | C | 200 | 2.00 | 48V phantom power |
| MKH406 | C | C | 200 | 2.00 | 12V A-B |
| MKH416P48 | C | SC | 200 | 2.50 | 48V phantom power |
| MKH416 | C | SC | 200 | 2.00 | 12V A-B |
| MKH816P48 | C | HC | 200 | 4.00 | 48V phantom power |
| MKH816 | C | HC | 200 | 4.00 | 12V A-B |

Output figures are in units of mV/μB; *MKH125* and *MKH126P48* share a common capsule (*MK12*) with different power unit. The former is 12V A-B powered while the latter is 48V phantom powered.

**Telemike:** electret mic module system for live sound recording for film, tape or PA. System includes accessories for fastening to camera, choice of powering modules, capsules, etc.

## SHURE (USA)

**Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204. Phone: (312) 866-2200. Telex: 724381.**
**UK:** Shure Electronics Ltd, Eccleston Road, Maidstone, ME15 6AU. Phone: 0622 59881. Telex: 96121.

| | | | | | |
|---|---|---|---|---|---|
| SM7 | D | C | 150 | —79dB | Bass presence |
| SM10 | D | C | 200 | —87dB | Headset mounted |
| SM12 | As *SM10* with built-in earpiece | | | | |
| SM11 | D | O | 200 | —85dB | Lavalier mic |
| SM17 | D | O | 200 | —85dB | Mounting for guitar etc |
| SM33 | R | HC | 38/150 | —76.5dB | Bass switch |
| SM53 | D | C | 150 | —81dB | Wide range |
| SM54 | As *SM53* with 'pop' filter | | | | |
| SM57 | D | SC | 38/150 | —82dB | Presence boost |
| SM58 | As *SM57* with 'pop' filter | | | | |
| SM59 | D | C | 150 | —83dB | |
| SM61 | D | O | 150 | —82dB | 'Pop' filter |
| SM62 | D | C | 150 | —82dB | 'Pop' filter |
| SM63 | D | O | 150 | —76dB | Vocal use |
| SM78 | D | C | 150 | —57.5dB | Vocal mic, stage |
| SM77 | D | C | 150 | —57.5dB | Instrumental mic, stage |
| SM76 | D | O | 38/150 | —86.5dB | Slim line |
| SM81 | E | C | 150 | —64dB | 10dB attenuator, switchable LC |
| SM82 | C | C | 260 | —19dB | Line amps and limiter |
| SM85 | C | C | 150 | —74dB | Handheld vocal mic |

All output figures are referenced to 0dB = 1V/μB, open circuit. There is now an omnidirectional capsule for the *SM81* with its own attenuator, known as the *R104A*.

## SOLIDYNE (Argentina)

**Solidyne SRL, Tres de Febrero 3254, 1429 Buenos Aires. Phone: 701-8622.**
**USA:** Intectra, 2349 Charleston Road, Mountain View, Cal 94043. Phone: (415) 967-8818. Telex: 345545.

**Integrated Microphone AMI-100:** intended for use on sports transmissions and has an electret type capsule, internal windscreen and its own line amplifier. Four pen-sized batteries give a running time of 25 hours while delivering up to +20dBm over a 600Ω line. Two or more units can work in parallel. Due to the fact that each *AMI-100 mMIC* has one output for headsets, each speaker can hear the other.

## SONY (Japan)

**Sony Corp, PO Box 10, Tokyo Airport, 149, Japan. Phone: 03 448-2111. Telex: 22262/24666.**
**US:** Sony Corporation of America, 9 W 57th Street, New York, NY 10019. Phone: (212) 371-5800. Telex: 424595.
**UK:** Sony (UK) Ltd, Pyrene House, Sunbury-on-Thames, Middlesex. Phone: 09327 89581/876441. Telex: 266371.
**UK:** Feldon Audio, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 28668.

| | | | | | |
|---|---|---|---|---|---|
| C-47 | C | C/O | 50 | 57dB | High quality instrument use |
| C-48 | C | C/O /8 | — | 37.8dB | Dual diaphragm, bass cut |
| C-38B | C | C/O | 250 | 48dB | Instrumental use |
| C-37P | C | C/O | 250 | 50dB | Broadcast use |
| C-55P | C | C | 250 | 50dB | Vocal use |
| C-76 | C | SC | 250 | 38dB | Long shotgun |
| C-74 | C | SC | 250 | 38dB | Short shotgun |
| ECM-30 | E | O | 250 | 53dB | Very small |
| ECM-50PS/PB | E | O | 50/250/600 | 55.8dB | Compact lavalier |
| ECM-51 | E | O | 250 | 53dB | Mic on telescopic arm |
| ECM-41 | E | C | 250 | 53.8dB | Mic on telescopic arm |
| ECM-53F/ 53FP | E | C | 250 | 51/52dB | Gooseneck |
| ECM-56F | E | C | 250 | 54.8dB | Multipurpose stand mounted |
| ECM-23F | E | C | 250 | 56dB | |
| ECM-33F | E | C | 250 | 53.8dB | Multipurpose |
| ECM-65F | E | C | 250 | 54.8dB | Handheld use |
| ECM-64P | E | O | 250 | 54dB | Vocal use |
| F-115/115A | D | O | 600 | 57.8dB | All-weather protected |
| F-660 | D | C | 250 | 58dB | |
| F-560 | D | C | 200 | 57dB | Vocal use |
| ECM-150 | E | O | 250 | —56dB | Submin mic with accessories |
| ECM-260F | E | C | 200 | —54dB | Boosted HF response |
| ECM-969 | E | VS | 200 | —52dB | Similar to the *ECM-989* but the head is not detachable and a *MRU-90* remote unit is required to control the directivity |
| ECM-989MS | E | VS | 200 | —52dB | Stereo MS, separate power supply |
| F-520 | D | C | 250 | —57dB | Vocal mic |
| F-420 | D | C | 250 | —58dB | Switched |
| ECM-65F | E | C | 250 | —54dB | Phantom or battery powered |
| ECM-64P | E | O | 250 | —54dB | Phantom or battery powered |
| C-35P | C | HC | 100 | — | Slim styling |
| C-36P | C | C | 100 | — | Slim styling |

Output level at 1kHz 0dBm = 1mW/ B

## SUNN (USA)

**Sunn Musical Equip Co, Amburn Industrial Park, Tualitin, Oregon 97062. Phone: (503) 638-6551.**

| | | | | | |
|---|---|---|---|---|---|
| M100 | D | C | 600 | — | Handheld vocal mic, large windshield |
| M200 | D | C | 600 | | Wider frequency response |
| M300 | D | C | 600/10K | | Improved HF response |
| M400 | D | C | 250 | | On/off switch with lock |

## SUPERSCOPE (USA)

**Superscope Tape Duplicating Products Inc, 455 Fox Street, San Fernando, Cal 91340. Phone: (213) 365-1191. Telex: 910-496 1481.**

| | | | | | |
|---|---|---|---|---|---|
| EC1 | E | O | 'low' | —52dB | |
| EC3 | E | C | 'low' | —52dB | |
| EC5 | E | C | 'low' | —52dB | |
| EC9P | E | C | 250 | —56dB | Low-cut filter |
| EC12B | E | O | 250 | —52dB | Tie-clasp or boom |
| EC15P | E | O | 250 | —52dB | Mini tie-clasp |
| EC33S | E | C | 'low' | —46dB | Coincident stereo |

Output figures are referenced to 0dB = 1V/10μB at 1kHz.

## TURNER (USA)

**Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420. Phone: (621) 884-4051. Telex: 297053.**
**UK:** Canadian Instruments and Electronics Ltd, Harris-Bass House, Station Road, Ilkeston, Derbyshire DE7 5TX. Phone: 0602 302331. Telex: 377755.

| | | | | | |
|---|---|---|---|---|---|
| SE11 | D | C | 150 to 200 | 77dB | Isolated from handling noise |
| SE13 | D | C | 150 to 200 | 77dB | Differs from *SE11* in casing |
| SE16 | D | C | 150 to 200 | 77dB | Gooseneck mounted version *SE13* |
| TC20 | D | C | 200 | 77dB | Principally for vocal use |
| SE14 | D | O | 150 to 200 | 80dB | Switch |
| 2760 | D | O | 150 to 200 | 81dB | Robust |
| 35 | D | O | 150/40k | 84/62dB | Lavalier with accessories |
| 35A | D | O | 150 to 200 | 84dB | Lavalier with HF boost |
| S35A | Identical to *35A* but with on/off switch | | | | |

Output levels measured at 1kHz, open circuit with reference to 1V/microbar.

## WRIGHT (USA)

**Wright Microphones, 2093 Faulkner Road NE, Atlanta, Georgia 30324. Phone: (404) 321-3886.**
**UK:** Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9221. Telex: 25769.

| | | | | | |
|---|---|---|---|---|---|
| SR-1 | E | C | 150 | — | Phantom powered 12 to 48V, small |
| TSR-1 | E | C | 150 | — | Solid state output stage |

■

# Sony have just made the world's most advanced 24-track analogue recorder...

# business

BARRY FOX

## Double Standards

What really puzzles me about the industry we are all involved in is its apparent double standards. Imagine, if you will, what would happen if a record company issued bootleg copies of early performances by The Beatles, Rolling Stones and BeeGees made specially to boost the morale of the armed forces, for instance in Vietnam, but specifically barred from commercial release? Imagine also that the recording contracts had called for the destruction of all the masters to prevent commercial release, but an enterprising record company got hold of some of the original pressings and re-mastered. Imagine even that the HMV shop in Oxford Street sold them at above list price. The Musicians Union, the MCPS, the BPI, the IFPI and probably the CBI, FBI and CIA as well, would all be down on the record company and shop like a ton of bricks. The music trade press, which has (rightly) fought the good fight against commercial piracy, would be in there rooting too.

Now stop imagining and, if you keep back numbers, turn to page 10 of *Music and Video Week*, December 12, 1981. Under the headline Victory for Jazz Lovers an *M and VW* correspondent writes about the release of 10 LPs of V-disc recordings. Although the recordings were made in the 40s many of the listed artists, like Woody Herman, Peggy Lee, Ella Fitzgerald, Frank Sinatra, Lena Horne, Red Norvo, Count Basie, Teddy Wilson, Les Paul and Roy Eldridge are still alive. *M and VW* described the issue of their 40s work as "a major coup" and a cause for "rejoicing". Well, yes, if (like me) you like jazz. But perhaps no, if (also like me) you reckon a law for one is a law for all.

The story of V-discs is well known by anyone who has been in the music business for a while, or has an interest in music industry history. It's told partly in Italian on the sleeve note for the new issues. To cut a long story short the US recording industry ground to a halt with a musicians' union strike between August 1942 and November 1944. The president of the American Federation of Musicians, James Caesar Petrillo, was worried about the loss of employment for musicians through the boom in radio listening, and the craze for juke boxes in bars which had previously employed bands. Instead of attacking the broadcasters and juke box owners, Petrillo just pulled the carpet from under the recording industry. Hence the AFM strike. Only vocal groups, or harmonica players, could record. (Have you ever wondered why there were so many harmonica bands in the 40s?) The only other exceptions to the rule were records made for the armed forces, christened V-for-Victory discs. To help the war effort the best musicians of the day recorded free for the troops. The scheme continued after the end of the strike. At the end of the war the masters were smashed with sledge-hammers. It was an act of artistic vandalism, but if the promise of destruction hadn't been made, V-discs would never have been recorded. Once the promise was made, the law dictated that it had to be honoured. The new V-disc LPs are dubbed from collectors' copies of the original pressings that went to the troops. Musically they are superb. But legally? Isn't it commercial piracy?

I put this question to *M and VW* in a published letter (January 23, 1982). In a published footnote the editor defended his paper's praise of the re-issue of historic jazz tracks re-recorded from albums which are no longer commercially available. "The record company," he said, "is to be congratulated". No, I said in a private letter, the whole point of V-discs was that they were never commercially available nor ever intended to be. I waited for a reasoned reply to put me right if I was wrong. "Please do not bother me with any more of your nit-picking pedantry," I was told. Meanwhile none of those guardians of the music industry soul and purse like the BPI, MU or IFPI said a word.

The V-disc LPs have a recommended retail price of only £4.50 each, even though they are being imported from abroad. Clearly both the record company and the importer are playing fair over price. But at the HMV shop in Oxford Street V-discs were being sold for £5.99, making an extra £1.49 of clear, unadulterated profit for HMV.

Jazz musicians are used to being ripped off, so whatever their legal rights, it's unlikely that any of the artists on the V-discs will waste time, money and effort in picking a fight. Most of them are too old, tired and rich, or too old, tired and poor, to care. But what will happen if some middle-aged pop star with a hot shot manager under contract to a greedy record company finds himself in a similar position? The V-disc issue and trade press stance may have created an interesting precedent.

## Weather or not

In the build up to the Falklands confrontation, the London news radio station LBC was broadcasting reports on the weather in the South Atlantic. The idea was to give the families of the forces out there some idea of what they were going through. LBC was getting its weather reports from the Meteorological Office. But the 'Met' is part of the Ministry of Defence.

Within a few days the Met. Office staff received an edict from the MOD: don't talk to LBC or any other radio station about the weather in the South Atlantic. To ram the message home the MOD classified the Falklands' weather as an Official Secret. So, on pain of jail, the reports had to stop. Presumably this meant that the Argentine naval captains sailing in the South Atlantic could no longer rely on messages from their London-based spies, to tell them what the weather was like on deck.

## Paying for publicity?

Anyone in the business of making or selling audio equipment, either professional or domestic, will sometimes need to demonstrate it publicly. British hi-fi shows, like that held every year at Harrogate, are a Babel of sound. So are some of the smaller pro audio shows. For convenience most demonstrators re-record discs onto tape. But this is of course illegal. There are two approaches which the manufacturer can adopt; either play honest and pay for a copyright licence, or pay nothing and hope no one finds out. A recent incident explains why more and more firms are likely to opt for the dishonest approach.

One of Britain's major loudspeaker manufacturers was exhibiting at last year's Harrogate show, and tried to play it straight. They approached the Mechanical Copyright Protection Society for a licence to dub a few minutes of music on to tape for use at the four-day show. The price quoted was around £400. Nonsense, they said, we'll negotiate direct with the record companies who usually waive any copyright fees because of the publicity they get. Obviously it helps to sell a record if a major manufacturer uses it to demonstrate a hi-fi system. The MCPS then had second thoughts. They came back with a quotation of £10 + VAT for a music copyright licence. But the manufacturer still had to negotiate a separate copyright payment or waiver direct with the individual record companies. All very confusing. The incident raises both a question and a moral. The question is how many firms, wanting to do the honest thing, have been deterred by the time-consuming confusion and an absurdly high quote from the MCPS and simply paid nothing to anyone? The moral is, if the MCPS quotes you a daft price for playing honest with them, don't be afraid to haggle.

## Spoiled

On June 26, 1980 Gerry Bron, managing director of the Bron Organisation told the Annual General Meeting of the BPI what everyone present wanted to hear. Bron's associated company, Design Electronics, thought it had finally come up with a spoiler system to stop people copying records on to tape.

"I can't guarantee anything at this stage," said Bron. "What we have come up with so far looks promising but will need at least six months for rigorous testing." The spoiler, according to Bron, would give the tape recorder the 'heebiejeebies'. According to music press reports, Bron reckoned that practical demonstrations of the spoiler could be staged in about three weeks time, ie July 1980.

If it had been almost anyone other than Gerry Bron talking, it would have been easy to dismiss it all as technical ignorance typical of the record industry. But Bron, and the people like Peter Osborn working at Design Electronics, are nobody's fools. Inevitably, news of Bron's spoiler spread. The *Sunday Times* reported on how the impossible was close to achievement; for £500 extra on disc production the threat of home taping would be banished for ever. The magazine *Engineering Today* carried a similarly optimistic report. But three weeks passed without any demonstration. Six months passed without any demonstration. Every few months I'd phone the Bron Organisaton and ask for an update on spoiler progress. It was, I was told, 'in limbo' Design Electronics had been wound down and folded up, after the failure of its *Cuemix* foldback system. Finally, early in 1982, Bron quietly—and with none of the publicity which surrounded the original announcement at the BPI's 1980 AGM—threw in the towel.

They abandoned the patent application which had been filed by Design Electronics. So once again spoilers are dead; at least until the next time someone announces that they've invented one and the music press and music industry is daft enough to believe them.

By the way, I have invented a spoiler. With each new record you buy, you also get a free representative of the BPI. He sits quietly by your gramophone until you try and tape the record. Then he pulls out a gun and shoots you dead. ■

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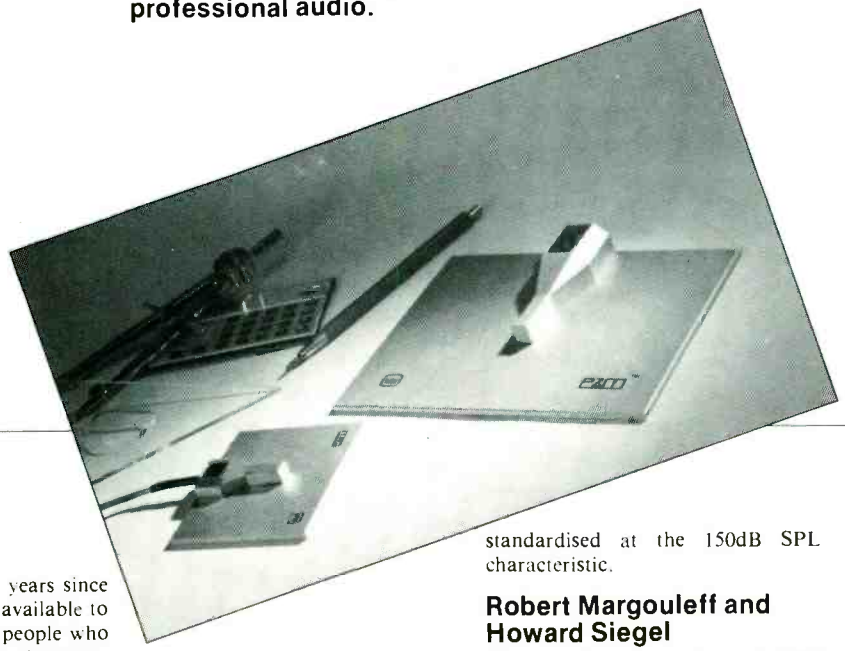
# Pressure Zone Microphones

**There have been several articles published extolling the virtues of the pressure zone microphone developed by Ken Wahrenbrock, and now manufactured and marketed by Crown International Inc, in the USA and handled by HHB in the UK. They mention the basic principles behind the particular design parameters, and suggested mic positions which could possibly pick up the best sound of the instrument focused on, but none really went into any depth when it came to the practical applications. This piece is primarily concerned with how the mics have been accepted and incorporated into the mainstream of professional audio.**



**Bob Anthony**

IT'S been almost four years since the first *PZMs* were available to a significant number of people who could utilise their unique characteristics. I've questioned engineers who have spent a significant length of time working with the mics in a variety of applications. Their thoughts, feelings and recommendations are herein recorded for your reference and evaluation. I hope they shed some more light on this exciting new breakthrough in microphone technology.

## Background

Ed Long and Ron Wickershim pioneered the pressure zone recording process. Instead of flush-mounting pressure calibrated microphones, as had been the practice, they turned the mic elements over and made them face the boundary surface. (The original microphone employed a modified ½in diameter B&K measurement capsule.) This innovation eliminated some of the comb filtering and anomalies inherent in the previous methods of microphone mounting.

In February of 1978, after completing several reference recordings, they demonstrated their Pressure Recording Process, or PRP (both are trademarked names) to a Syn-Aud-Con seminar in San Francisco. Two months later, a demonstration was performed at Filmways/Heider Recording Studios in Hollywood using the basic design on a session with a contralto soloist, a pianist, a bass player and a guitar player. Ken Wahrenbrock was so impressed with the outcome that he set about trying to perfect the concept. He was able to reduce the cost by utilising a small electret condenser capsule that was pressure calibrated. Together, he and the Davis's tested the design, and soon distributed it to Syn-Aud-Con graduates for further experimentation.

Wahrenbrock became the licensed manufacturer and within a year hundreds of microphones had been sold. In 1980, Crown bought the world licensing rights from Syn-Aud-Con and the product was standardised at the 150dB SPL characteristic.

## Robert Margouleff and Howard Siegel

Of the five mics that engineer Howard Siegel owns and carries with him from studio to studio, three of them are *PZMs*. He has those mics because *PZMs* are not yet available at all studios. He has two of the original Ken Wahrenbrock-made *PZMs*, and one small Crown that he likes to use on kick drum. The location changes depending on the sound he's going for, the kind of kick drum, the kind of music, how much low frequency he needs, and how hard the drummer plays.

"I've used the Crown slightly up the side on the inside of the bass drum. I think once you get the *PZM* that close to the sound source, or inside it as with a bass drum, the mic couples with the surface of the entire cylinder. Using a larger backing-plate wouldn't really make that much difference because only the two edges of the plate would be touching the drum shell. I usually put something like foam rubber underneath the plate so it doesn't actually come in contact with the surface. That way I don't get any clicks when the drum is hit."

After a great deal of trial and error, the most successful set-up entails laying the mic on top of a breezeblock that's turned up on end. The block is directly in front of the bass drum, and raises the *PZM* to the level of the drum's centre, where it picks up fundamental and very few harmonics. Siegel occasionally extends the kick to about three times its length by hanging moving blankets from the front of the drum, to a mic stand placed beyond the breezeblock in much the same way you would put up a one man pup tent.

"The best thing we've done," remarks the engineer, "is tape two *PZMs* together back to back. We recently did some things with saxophonist David Sanborn in a rehearsal room, where Bob wanted me to record the rehearsals. I really only had my mics to work with, and a couple of extras. I did a whole drum kit with a *PZM* on the kick, a pair of *PZMs* overhead, and a snare mic—nothing else. I really loved it. If I was going to do it for an album, I would add tom tom mics for the fact that the tom toms were a little distant-sounding. The hi-hat was incredible. The mics were taped together for a stereo field, or rather

a dual-hemispherical field. (The backing-plate of a *PZM* determines what the condenser capsule will 'hear'. Any sound that occurs on the same side as the capsule will be picked up. A sound even the slightest bit beyond the plane of the backing plate is almost completely isolated from the mic. Hence, the hemispherical field or pattern.) It's amazing how it cuts off right at the plate plane. We've been doing percussion, too, in basically the same way. The player can move his instruments underneath the two *PZM*s that are taped together, and they cross the field beautifully.

"We've experimented with mounting them on the chest of a conga player, or rhythm player who is constantly moving around. Whenever and wherever he plays, he's always about the same distance away from the instrument. If he has three or four drums, it saves a lot of hassles. Doing that in stereo didn't work; doing it in mono did."

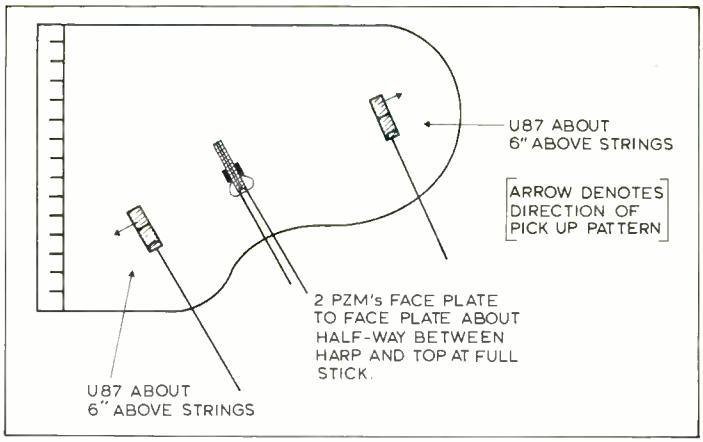
"I never use screens around the drums," stresses producer and Grammy winner Robert Margouleff. "The drum kit is a collection of instruments. It's the foundation of the music and usually takes the most mics. We try to leave the kit open as much as possible, to let the vibrations couple to the space for a bigger sound."

"We've had the *PZM*s for about a year," says Howard Siegel. "The mic is not for everything, but once you develop a technique for it it's very useful. There's a lot of leakage involved with these mics. You either have to have them in an isolated situation, or you have to like the leakage. It's a subjective type of thing.

"David Sanborn's rehearsal was held in a small rehearsal room with all the amps aimed at the drum kit, and the sax amplified through a PA. All of that went into the *PZM*s over the drums, and it sounded wonderful. As long as it sounds good, it doesn't matter how much leakage you have. In some spots, there was more sax through the *PZM* than there was on the sax mic. It sounded good though."

"People try so hard to eliminate leakage," continues Siegel, "because they think it sounds awful. When you record an acoustic piano that's covered completely with blankets, the leakage you get is all below 400Hz. But if you leave all the blankets off the piano the leakage sounds incredible. What makes the sound so good is the addition of the high-end leakage which is what you hear when you listen to a live performance. Most engineers don't listen to the piano until they have all the blankets on it. At that point, the leakage sounds bad, and they try even harder to eliminate it. If they listened to it naturally, they might like it."

Siegel suggests trying a simple experiment. "Place a guitar player and drummer in the studio together. The guitar will leak across the room into the kick-drum mic, but it will sound fine until you put something in between those two instruments that eliminates all the high frequencies and leaves all the lows. What you have is rumble going into the kick mic; that sounds terrible. Boosting the kick-drum at 60Hz makes it even worse, because you're equalising the leakage, not just the primary instrument on the track. If you choose the right mic, and the right location, the track naturally has the right LF content you need."




*Howard Siegel's mic set-up for acoustic grand piano.*

Bob Margouleff agrees, but is quick to point out that there's a time to use leakage and a time not to. "That's a very subjective decision that the producer and engineer have to make. The artful use of leakage is the kind of awareness you have to have if you're doing a lot of live recording, where your primary concern is to serve the audience. If you know how to use leakage properly, it's another technique in your bag of tricks that you can use in your favour."

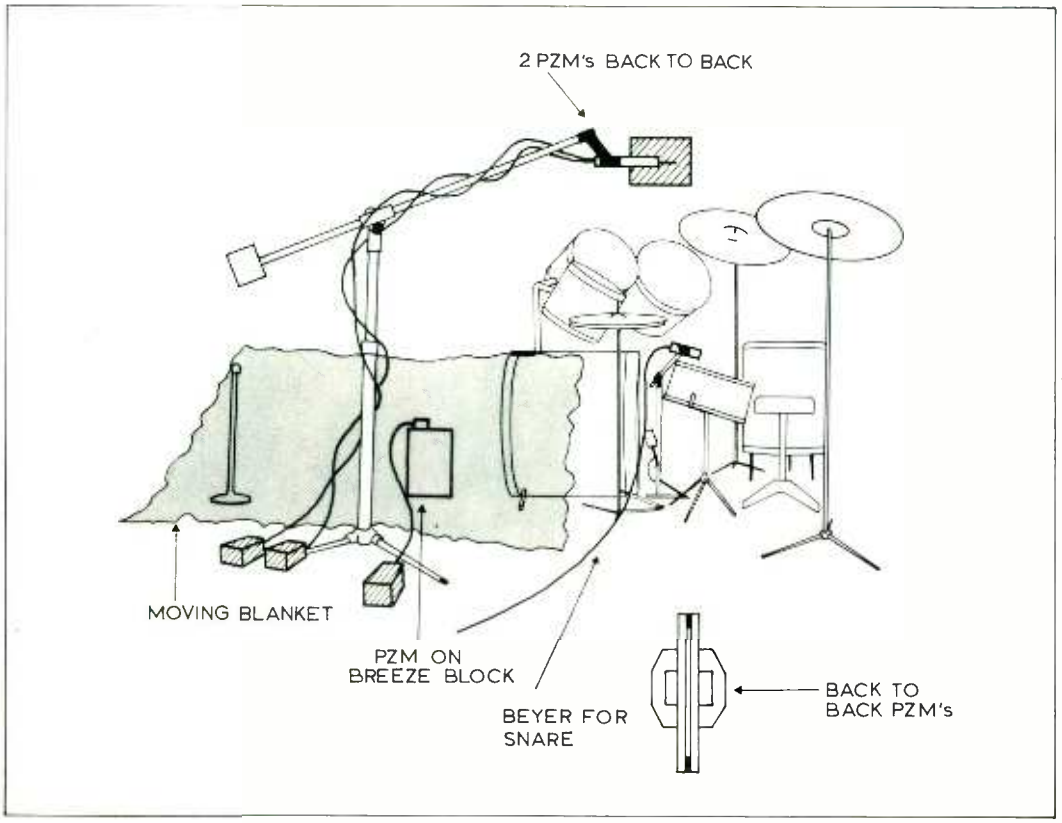
Siegel finds that "the reason most engineers go for microphones other than *PZM*s is because even with the backing plate that the manufacturer recommends, you don't get anywhere near as much bottom as you do with a conventional, large-diaphragm condenser. Where you use it depends on the sound you're going for. It can work well on just about anything as long as you like the sound you get out of it, because it's a completely different sound than you would get out of any other kind of mic."

The *PZM* is often referred to as a mic that gives an accurate representation of the sound source with a minimum of coloration. Siegel states: "I view 'coloration' as a term used to describe a mic that gives you peaks at certain frequencies. The *PZM* has a very heavy slope of frequency response; it has a great deal of HF content, and very little LF. It seems to be a straight line that goes from way-down at low frequencies to way-up at high frequencies. You might call that coloration. I would say that the *PZM* colours the sound, because it gives a certain frequency characteristic of its own, although it heavily weights it towards the high frequency.

"I don't think the response is musical; you have to work to make it musical. The secret is to look at the mic as another tool to work with. In order to get the same sound with another mic, you'd have to resort to all sorts of EQ and other tricks that would create distortions and noise problems. The *PZM* gives you a lot of top end and a lack of near reflections without the disadvantages you'd get with another mic."

Margouleff's experience with

*Drum mic placement. The moving blanket provides sufficient isolation to eliminate most leakage. There are three PZMs and a Beyer 260 on the snare drum.*

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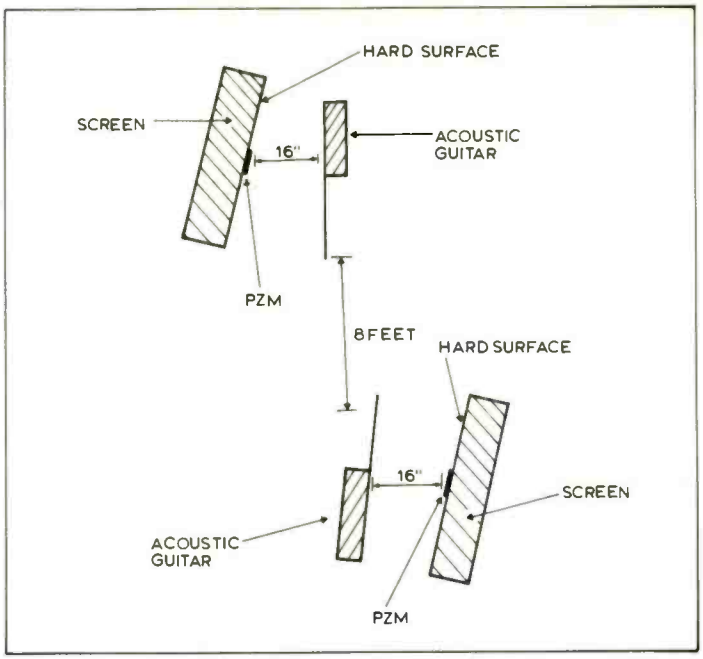
recording two acoustic guitars simultaneously was positive. He attached one *PZM* to the hard-surfaced side of each of two screens. One player faced one screen, and the other player was 180° opposite with the screen on the other side facing him. "I used very little equalisation, but did a good bit of limiting, and the sound was incredible. I don't like EQ that much. The law is: use the right mic, or DI, at the right place, at the right time, and get your sound at the instrument. That's secret rule number one."

During his numerous years of studio work, Robert Margouleff has observed: "Many engineers have learned mic placement by rote, and for the rest of their life, that's where they put the microphone. Before even listening to the sound of the instrument in the studio, the inexperienced engineer will run right back into the control room, and immediately start to EQ. Wrong! *Always listen to the instrument in the room first!* Each mic will give the snare, for example, a slightly different sound. The mic is, in a sense, an equaliser, and the choice of whether or not to use a *PZM* should be based on that criterion."

The production team of Margouleff and Siegel concentrates primarily on self-contained groups, so for that reason, the opportunity to record a horn section with a *PZM* hasn't come up. They are recording a lot of sax with David Sanborn, but haven't found the *PZM* to be the right mic. In addition, the duo have discounted the idea of mounting a *PZM* on a guitar amp. "The mic seems to accentuate the things I don't like about the guitar amp such as the unpleasant distortion in the super high-end," says Howard Siegel. "There's a lack of warmth, because the bottom end is lacking."

Margouleff sums up their experiences with the view that, "The *PZM* is like any other mic in that it transforms sound into an electrical signal. It's not the ultimate answer—it's a useful tool for particular applications."




*The two acoustic guitar players are placed about 8ft apart, in accordance with the traditional 3-to-1 rule which states that the mics should never be too close to each other. The general rule of thumb is to keep the second mic away from the first by at least three times the distance that the original mic is from the subject.*

## Biff Dawes

Biff Dawes is an independent engineer who does most of his work at Wally Heider's recording studio in Hollywood. He gets calls regularly to do remotes with the Heider truck, and 90% of his sessions include amplified instruments. "I use *PZM*s basically for ambience or audience mics. They're great in places where I can't easily mount a mic stand or holder. I can mount them on the walls, and they pick up an incredible amount of sound. I have to add, though, that it doesn't always work. I can't say the sound is always right, but they do give you more freedom in live applications."

Aside from the ambient use, Dawes doesn't recommend them on stage, because they'd pick up everything: "Sometimes you can get away with them for acoustic grand piano. The loudness of the monitors will determine if it will work or not. Sometimes it turns the whole soundboard into a microphone and you literally pick up everything. Inside a console or upright piano isn't too bad, because you can eliminate a whole lot of leakage—they work really well there. As far as putting them in front of a drum set or a string section, I haven't done that live."

In the controlled environment of a recording studio, the *PZM*s fare much better, but again, that's mostly for ambience. "You can put them in front of a drum set for stereo by mounting them on surfaces such as plywood or music stands. I'll usually fasten them on the glass for string dates, or to get a big, rock drum sound. The distance from the drum kit varies depending on how big a sound I want. I've found that approximately 20 or 30ft is good. I use them instead of delay or echo in a drum mix. Of course, if there are other instruments in the room, you'll end up with leakage."

Heider's facility includes a large scoring room—Studio A. Permanently hung across the ceiling about 15ft in the air, are four *PZM*s. each mounted on a 4 × 4ft plate, and facing down at about a 45° angle. Two mics are in the middle of the room with one at each side. "The room is used for big string dates," says Dawes, "and if your track assignments allow it, you can throw the *PZM*s on separate tracks. A lot of times you can start with those, and add in whatever close-section miking you need for the mix. It's cleaner and quieter.

"In terms of frequency, I don't find them too warm sounding. They are nice for cymbal mics; they're real smooth. The ones we use here are all the original ones that Ken made by hand. Even in an ambient situation where I've had them on a very large surface, I still find that they're rather thin. Supposedly, the new ones have an improved low-end."

Another of Heider's studios possesses an overhang. Placing a set of drums under the lowered ceiling allows for a closer and more directional effect from the mic once it is mounted on the underside of that lower surface.

Guitar overdubs are often done with four or five mics at one time. Dawes uses a *PZM* on the glass or on the floor in front of the amp. "It's like any other microphone," says Dawes. "There are no absolutes. You can't say it's going to work every time on drums or on strings. All you can do is put it up and try it."

## Bill House

Bill House was one of the first engineers to use *PZM*s in England, and so far, is enthusiastic about the new concept. "If you like the sound of a room, it will give you more of that sound than any other mic I've seen! Well, a good condenser will do that, too, if it's open all round, but there's something about the sound hitting a flat plate like that that really gives me a sound I like. For ambience, it's probably the best mic there is, and it's really durable. It can take high volumes—150dB SPL.

"I like its frequency response. If it's close enough to the source, I get all the bottom-end I need. On the original demos we did for Rocky Burnett, we were having trouble with his proximity to the mic. We taped a *PZM* to the studio window, and set up an *87* in front of that. He appeared to be singing into the *87*, but we were actually taking the vocals from the *PZM*. It sounded really good. I was surprised. It sounds good on just about anything, depending on the surface you have it on. It might sound better for vocal on glass than it does on wood or metal. It definitely sounds different. It picks up the sound of the surface that it's on as opposed to just the sound of the element inside the mic like a Neumann. On anything that's percussive we've ended up rolling off the bottom end—everything below 100Hz or so. The mic spits a little."

One of the recommendations from the *PZM notes* is to stick the mic in a bass drum. "That's where it seems a little bottom shy," says House. "To get a good drum sound during a Beach Boys' session, we were trying all sorts of things. We used a wooden drum riser, and laid the *PZM*s on that. All we used was a kick-drum mic and the two *PZM*s. The mics were picking up the reflection of the sound off the wood of the riser. The balance of the snares and tom was perfect, and sounded better than any of the overheads or close mics. We used the *PZM*s and six other mics, but with just the two *PZM*s and the kick-drum mic, it was incredible. From the drummer's perspective, one was about 2ft to the left of him and another 2ft to the right. The entire riser was a microphone. Somehow, the sound hitting the riser seemed to even out the response; it evened out the levels. The mix was much easier than trying to balance out the level of each mic.

"I've found that the only equalisation the *PZM*s take well are cuts. You can't really boost them that much, because they get really noisy, although I've never got any feedback from them. But the reason you're using them in the first place is for a natural sound. If you want to get some creative tones, you can use two mics, severely EQ your conventional mic, and leave the *PZM* in for some natural sound.

"I haven't used them on bass yet," continues Bill House, "but I bet they'd be pretty good, if you set them on the floor in front of the amp. But that's the good thing about using a new mic; you just keep trying things. I tried taping a *PZM* to an acoustic guitar, and except for

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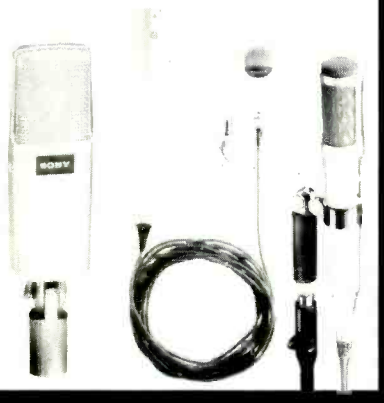

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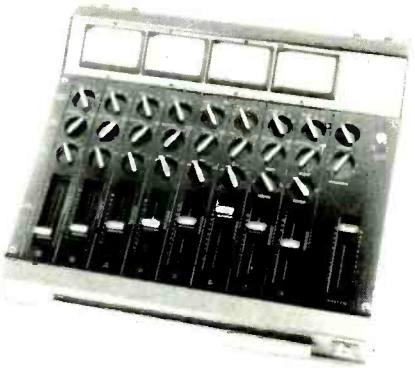

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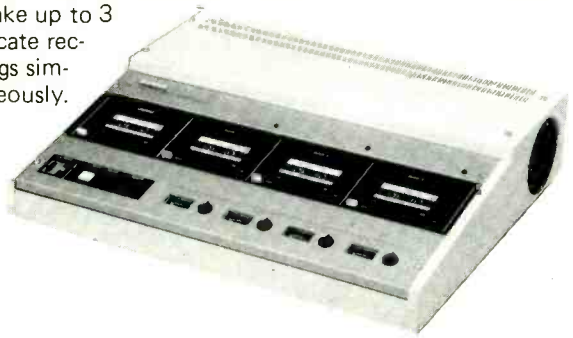

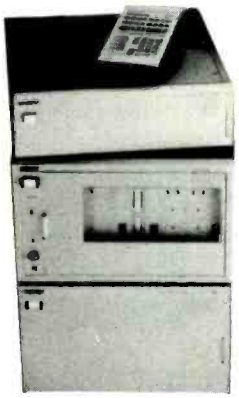

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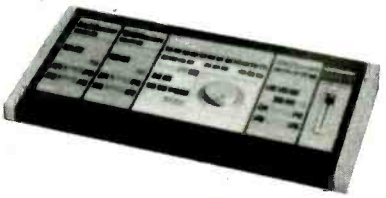

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the fact that it had a tendency to pick up too much finger noise or cufflink noise of the player, the actual sound of the instrument was very good. Now that was the mic with the large backing-plate. With the smaller plate, it may not be such a problem. The only place I could put it was behind the bridge."

*PZMs mounted in dishes over the San Diego Symphony orchestra.*

## The next step: evolution

"I work with Crown now in a consultant capacity by continuing to develop new models, and helping people learn how to use the existing products," says Ken Wahrenbrock, sitting behind his office desk in Downey, California. "I also edit a monthly *PZM* newsletter that Crown distributes to owners in order to keep them informed, and up-to-date with what other users around the world have gathered from their experiments. For example: we've discovered that as a result of the backing plate, the *PZM* comes across about 6dB hotter than a regular mic with no backing plate. Even though they're actually the same distance from the sound source, the *PZM* seems like it's half as close."

The pressure zone microphone has been developed by committee. Wahrenbrock emphasises the fact that there are three or four people across the USA who have worked extensively with the original prototypes, and were instrumental in suggesting and shaping the present improvements that are coming out of the Downey laboratory.

The two main criticisms that Ken Wahrenbrock kept encountering referred to the comb-filtering effects, and the absence of a strong bass response. To directly confront the first weakness, the capsule was standardised at 0.001in above the backing-plate. That tactic raised the comb filtering above the audible range to about 46kHz. The second issue involved radical design changes, yet adherence to the basic principles characteristic to the pressure zone concept.

Any sound on the same side of the plate as the capsule gets picked up; anything to the far side of the boundary plate is ignored. Wahrenbrock decided to build various combinations and shapes of backing plates to customise the mics to particular needs.

Instead of metal, he chose the versatility of plastic. The converging plates actually form corners and their intersecting angles define the area to which the microphone is live, thus making the pick-up pattern more directional. "The ¼in plastic is pretty rugged. We've made some with ⅛in plastic, but they're light, and you have to be careful with them. The direction of the capsule into the corner (whether along one plane or bisecting the angle between two sides) doesn't alter the response of the microphone. We just happened to mount them along one plane. The important consideration is to get the element as close to the corner as possible in order to keep the reflections that hit the capsule to a minimum.

"Some of these versions (the smallest, 3-sided *PZM*s) are becoming popular on pulpits or altars of churches, or on lecterns. They work better than the flat models, because the three sides provide better isolation, and eliminate any residual comb filtering that results when two of the flat models are placed too close together."

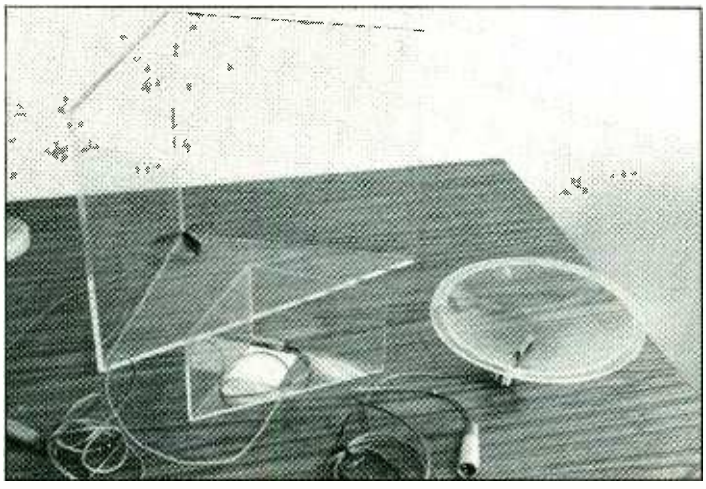
In addition, the larger the backing plate, the better the bass response. The previously mentioned shapes in the 12in size have a larger boundary on the vertical surface, and afford the enhanced low-end. A quarter wavelength of the lower frequency limit is represented by the distance from the centre of the capsule to the edge of the boundary. Using just the backing plate that comes on the Crown versions, that frequency is about 200Hz. Below that, the response drops 6dB, and continues down to whatever the frequency response of the capsule is in a free field. At that point, it loses its pressure zone mode, and becomes a free field microphone. The small diaphragm, however, still reproduces the articulation obtained with other mics.

A variation on the 3-sided boundary designs is a pyramid that's meant to be hung upside down over the stage. Again, the pick-up pattern is an extension of the planes, and anything outside of that pyramid shape is not 'heard'. There is also a right-angled corner that recreates the corner of a room in an open space. This may be placed on the floor, on a stand, or hung upside down above a sound source.

Another remarkable innovation is the 8in or 12in plexiglass dish. Once attached to a boom stand or gooseneck, the dish can be faced in any direction with the resultant pattern being an almost perfect parabola. Like the other boundaries, only the sound within the parabola is of any significance. As far as the microphone is concerned, nothing else exists.

The fact that the plexiglass is clear makes it invaluable on low-visibility situations. No matter where they are located, the dishes, or the other new designs for that matter, don't obstruct lines of sight, and for most applications are practically invisible. "The dishes are made for us by an outside contractor," says Ken Wahrenbrock. "We distribute them, but it's quite a problem. We're considering—in conjunction with Crown—marketing just the bar, cable and power supply, and suggesting that the purchasers put together their own backing plates for their specific purposes."

*PZM prototypes with corners and dish reflectors.*



## Symphonic applications

When Ken Wahrenbrock isn't on the road for Crown, or working in his California laboratory, he spends much of his time in San Diego testing his prototypes with David Johnson, a production engineer for Communications Company, owner of Studio West Recording Studio and, most importantly, consultant to the San Diego Symphony Orchestra.

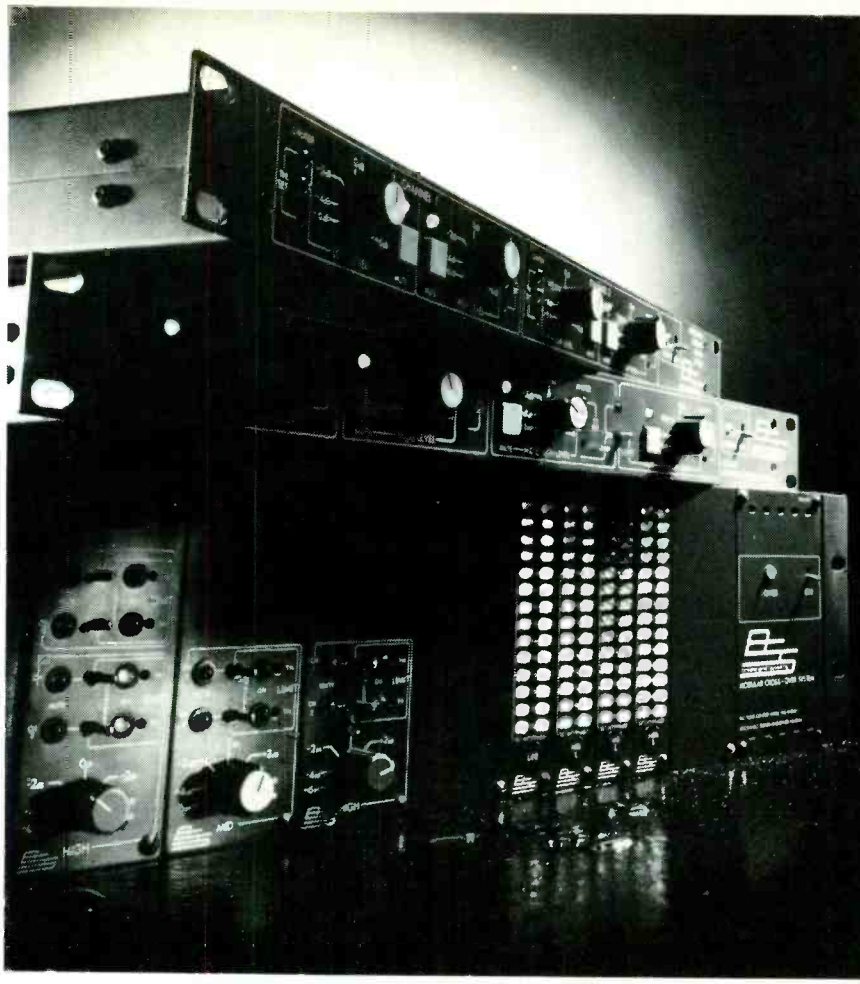
In recent years, the Symphony had been plagued with, and criticised for, poor sound reinforcement. It owns a portable stage and half-shell, and usually does a series of four or five one-night concerts per week during the summer tourist season. The demands of this kind of performance philosophy created a need for equipment that's durable and dependable as well as versatile. Fortunately, the timing was right. The experimental *PZM*s found a live workshop, and the Symphony returned to the good graces of its sponsors.

The sound reinforcement system consists of a set of *Stanley Screamer* subwoofers, Stan's *817* bass bin, and an Altec *Manta Ray* for the top end on either side of the stage, powered by Altec *9440*s for the subs, BGW *750*s for the mid-lows, and the BGW *250*s for the highs.

All the mics are *PZM*s. David Johnson points out, "I used to use Neumanns on the high strings and celli, and Sennheiser *421*s on the basses—usually one mic for every two players. Now I'm using either the dishes or the 2½ design in varying sizes. The 2½s are set on the floor in front of what I want to pick up. The distance isn't really too critical. The players are in the habit of moving them around. They're really easy to work with, and the bass is surprising. I generally allocate one dish for every two chairs of strings, and locate it approximately 3ft above and directly between the players."

The pick-up pattern of the *PZM* dish is a 3-dimensional parabola.

60 ▶



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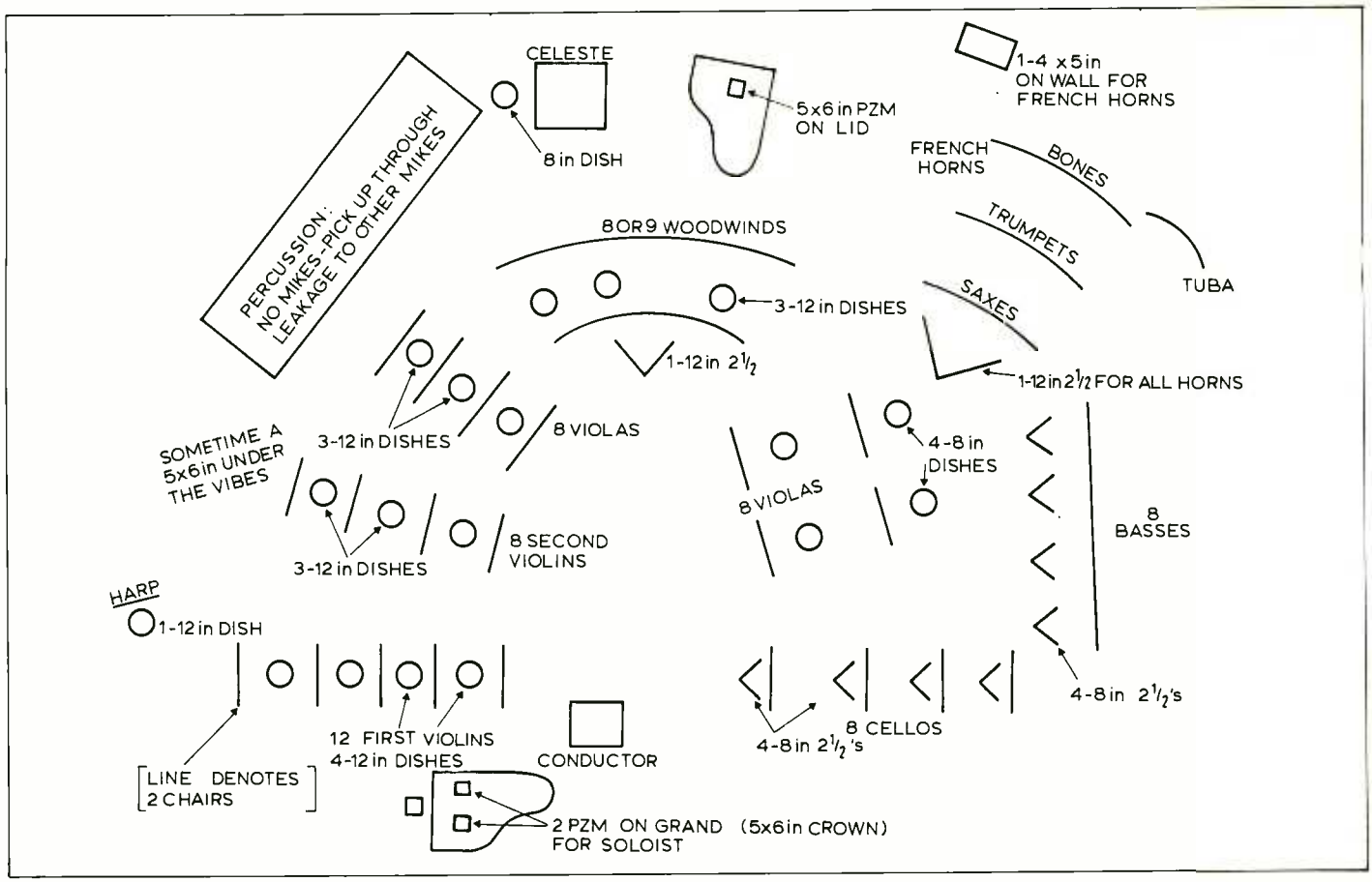



*San Diego Symphony miking set-up used during the summer 1981.*

The field extends off the edges, and when faced downwards, forms a bell or cone shape with excellent isolation. "That's one problem I had with the Neumanns," notes Johnson. "You wouldn't believe the coloration we got with all those live mics on stage. That's why I put three Crowns on the ceiling, which is actually a 6 × 42ft decoratively-covered wood boundary that hangs above the stage floor. I did that for a whole year, but we weren't getting the richness of the high strings. With the addition of the new designs, I removed the *PZM* over the basses, because the 12in × 2½s pick those up easily. I have one in the centre towards the back to fill in the brass, and another towards the front at stage right just for experimentation."

The newest prototype is the handheld model. According to Dave Johnson, the mics are not prone to popping, and are great for the troublesome vocalist or announcer who insists on eating the mic or punctuating Ps.

"I'm using almost no EQ," says Johnson. "The board is flat for the *PZM*s. With the other mics, we were using some bizarre settings to try to get the sound we wanted. For the first concert we did here on the 4th of July, we set the mics up at random. It was like we took a blanket off our heads. There was a very open sound; the high end was excellent. What's even more amazing is the low end we got from the string section."

One major drawback still to be ironed out is the matter of monitors and feedback. With such a large pick-up pattern, loud monitors are prone to causing hot spots and feedback loops. If the volume is kept low, some of that can be eliminated.

## Bits and pieces

Here are a few suggestions for microphone placement that really take no explanation, but have been tried, and recommended to me.

● Place a *PZM* in an echo chamber for an ambient richness and naturalness.

● Fasten a Crown model to the inside top of a *Leslie* cabinet.

● Attach one to a wall or other large surface to record sound effects.

● Lay one on the floor to pick up tap dancing or sound for a play. (Don't forget to tell the dancers that it's there!)

## Biographies

**Ken Wahrenbrock** *is credited as being the first to come up with a workable and practical application of the pressure zone recording process. He is presently a PZM research consultant to Crown International, and an independent acoustical consultant.*

**Biff Dawes** *joined the staff at Wally Heider Recording about 10 years ago and has been engineering for the last six. Although he is independent now, he still does most of his work at that facility, specialising in remote recording. His recent projects include live albums for Fleetwood Mac, the Eagles and Devo, and a couple of location broadcasts.*

**Bill House** *is a musician, producer and engineer who divides his time equally between LA and London. In the last 18 months he's done projects for Rocky Burnett, the Pirates, the Hitmen, Shonna Lang and Carla deVito. He prefers to work at either Wally Heider's Recording Complex in Hollywood, California, or Rockfield in Wales.*

**Robert Margouleff** *is best known for his work as Stevie Wonder's engineer/producer. During that time, he garnered three Grammy nominations, and a Grammy Award for Wonder's* Innervisions *LP.*

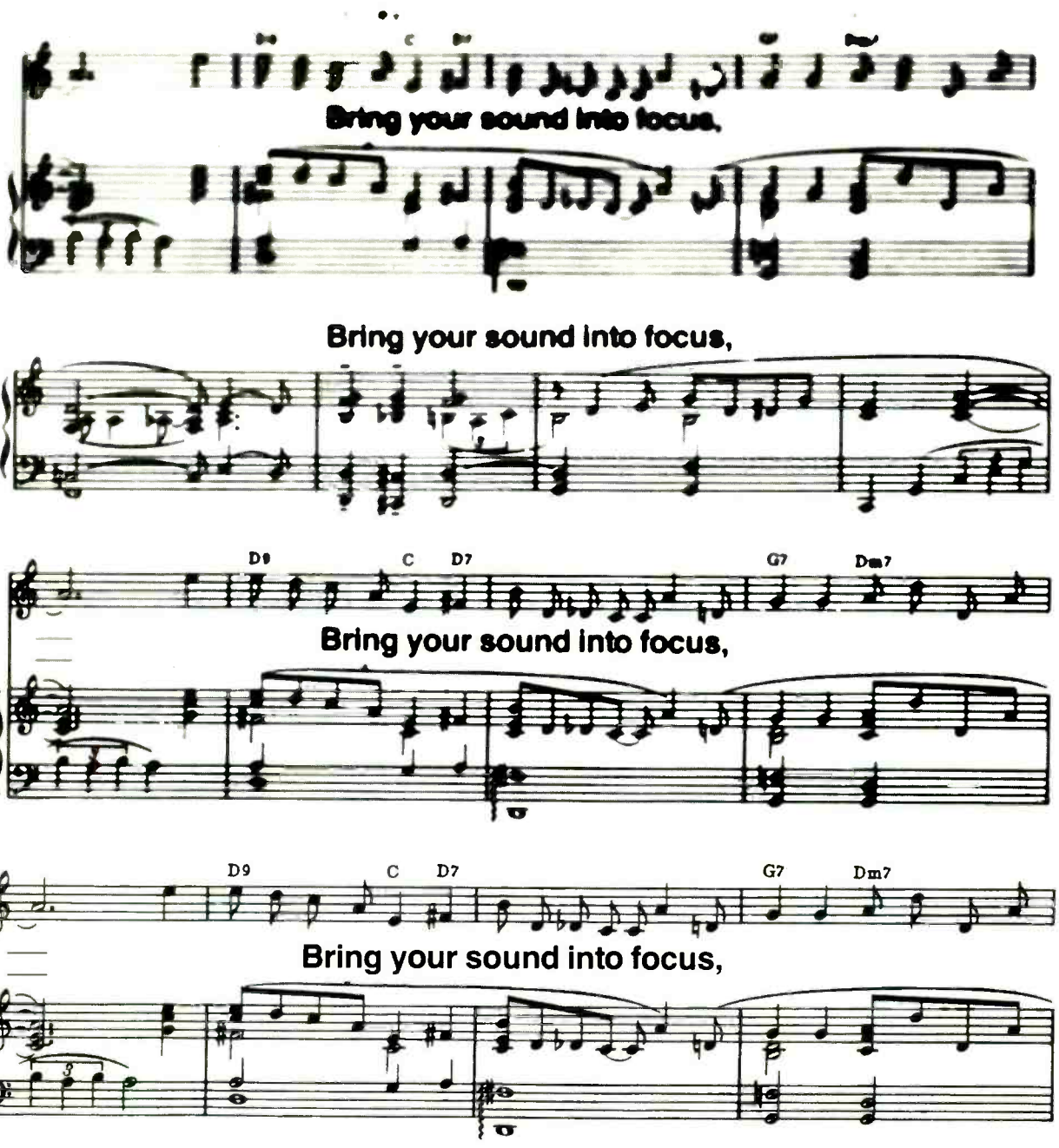
*When Margouleff decided to produce full-time in 1975, he recruited* **Howard Siegel** *as his engineer, and together they were instrumental in the reorganisation and substantial redesign of Los Angeles' Record Plant Recording Studios in 1977. Their two latest projects were albums for studio sax master David Sanborn and blues-rocker Elvin Bishop.*

**David Johnson** *met Ken Wahrenbrock through Syn-Aud-Con and has since been testing Wahrenbrock's new prototypes in real-life situations like the San Diego (California) Symphony concerts. Together they plan on writing several in-depth pieces on PZM theory and technique.*

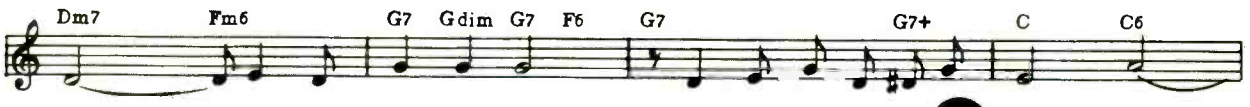
## Conclusions

I hope the previous suggestions have given you a little insight into the practical uses of the *Pressure Zone Microphone,* and stimulated your creative juices so you'll try a few experiments on your own. No new concept or technology can progress without the feedback of the people in the field. If you discover any unique, innovative, or just plain interesting applications, please let us know, or contact Ken Wahrenbrock, so the information can be added to the storehouse of *PZM* theory.

For more information on presently available product line, a copy of the Crown *PZM Application Notes,* information on new designs and the *PZ Memo* (a newsletter to keep users of *PZM*s abreast of current developments), please use the following addresses: Crown International Inc, 1718 W Mishawaka Road, Elkhart, Indiana 46517, USA, and HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX, UK. ■




# Aphex II

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# Control room acoustics

## Part two

**Andy Munro (Turnkey Two)**

*"The hall itself is a monument to the imprecision of acoustical science, with its battery of glass resonators suspended from the roof like so many Cona coffee machines and already gathering dust, which will presumably in due course affect their resonance." (1)*

*"There should be an effectively anechoic path between the monitor loudspeakers and the mixer's ears that extends for at least 2 to 5ms beyond the initial time delay gap." (2)*

*"The shorter the time intervals between the individual reflections and the direct sound, the less is the ear able to detect acoustic comb filter effects. Also such reinforced music is often evaluated as more pleasing simply because of this variety of phase effects." (3)*

These three statements each by an acknowledged writer in his own field show the difficulty in determining a logical approach to acoustic design given that the final judgement will be totally subjective.

The acoustic parameters for the recording or performing environment itself should be clear cut – such auditoria have been built and used for the purpose for at least 3,000 years. The Greek amphitheatre at Epidauros was constructed around 400 BC, seated 14,000 people and gave birth to the legend of 'perfect acoustics'. Let us analyse the sound field propagation of such a theatre (**Fig 2**). The open air theatre cannot sustain a reverberant sound field and will be considered anechoic. (In fact discrete reflection may occur depending on the architectural features within the area.)

A sound source such as a single voice in raised conversation would have an approximate level of 73dB SPL at 1m.

Using inverse square law decay the level at a distance of 30m would be 43.5dB or 29.5dB less! This could account for the fact that most Greek amphitheatres were situated on a hillside facing towards a nearby forest in order to avoid environmental noise levels such as passing chariots. Certainly it shows why sound reinforcement is used in the same auditoria today.

The sound level achieved by the same voice in an enclosed space is given thus:

for a room volume $V = 43{,}000m^3$,

$RT60 = 3s$

$S\bar{a} = 2{,}300$ (using classical Sabine analysis).

Taking the mid frequency Q of the talker as 5 we find:

$\Delta Dx\,(1m) - \Delta Dx\,(30m) = 26.5 - 4$

$= 22.5dB$

∴ level at 30m from stage would be $73 - 22.5 = 50.5dB$.

∴ room gain as it is often called $= 50.5 - 43.5 = 7.0dB$. (4)

Considering equivalent power requirement, if the same level were to be achieved outdoors then 50 times more electro acoustic power would be needed. However, this 'free power' has been gained at the expense of articulation in that the intellegibility of the sound heard within the reverberant sound field will be diminished. The open air auditorium will have articulation losses %AL CONS of nil whereas the large hall we have defined will give % AL CONS = 8%, not bad in fact, as 15% is regarded as the accepted limit for loss of articulation in speech. (Dc = 8.2m).

$$\%\text{AL CONS} \propto \frac{D2^2\,RT60^2}{VQ}$$

$$\frac{VQ}{1000} = \frac{215{,}000}{1000} = 215$$

Suppose the hall is much smaller, say $15{,}000m^3$, at 30m max distance area

% AL CONS = 20%

$$\frac{VQ}{1000} = 75$$

(VQ/1000 is a multiplier used in the articulation formula.)

Therefore for a given RT60 a large hall or studio will give articulate sound coverage far more readily and small halls must be less reverberant for the same value of %AL CONS.

It can be seen that a long reverberation decay in a smaller auditorium or recording studio will give rise to considerable masking effects which will totally change the subjective quality of any sound source heard or recorded within that space.

This fact was recognised in the early '30s by BBC engineers who published preferred reverb time curves for rooms of any given size. The curves differ for speech and music indicating a subjective recognition that articulation losses can be a positive feature in environments intended for music reproduction. For example a typical medium sized studio of $100m^2$ would be specified by BBC designers as requiring an RT60 of 1.4s for music and 0.85s for general purpose speech and drama. They also determined that an RT60 of less than 0.3 was extremely undesirable for either speech or music unless under special circumstances. The articulation loss in a music studio of the above specification would be 10% at worst for a maximum performer-to-microphone distance of 10m. Other work carried out in the same period compared reverberation with frequency and determined that an increase of RT60 with decreasing frequency was desirable although difficult to define as the type of music recorded was an overriding consideration.

How does the monitoring environment relate to the foregoing descriptions of acoustic performance? The most important factors for a monitoring environment can be defined as follows:

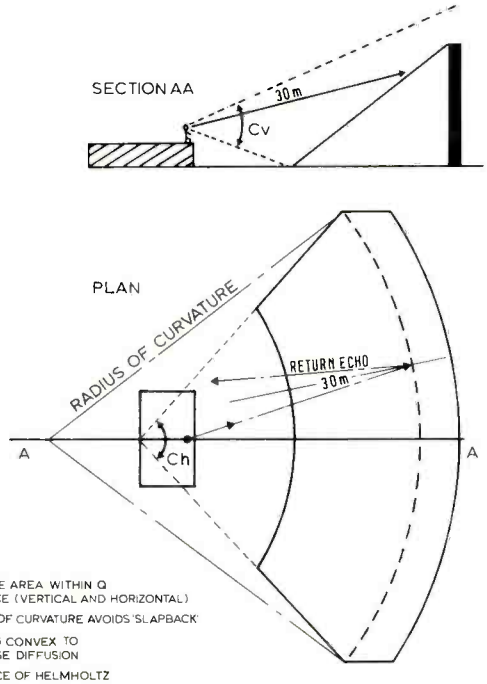
1. To give an accurate representation of the recorded or transmitted programme material in terms of:
   (a) amplitude – frequency linearity;
   (b) phase linearity;
   (c) dynamic linearity;
   (d) psycho-acoustic integrity;
   (e) acoustic compatibility with end user.
2. To be sufficiently isolated from the recording environment with minimal ambient noise.
3. To be environmentally conducive to intense concentration for long periods in terms of:
   (a) Temperature and air quality;
   (b) Lighting quality;
   (c) 'Creative comfort';
   (d) Absence of distraction.
4. To be technically and ergonomically interactive with involved personnel.

For the purposes of this article factor 1 only shall be considered, the remainder forming the basis for future discussion.

The monitor system comprises a pair of louspeaker units radiating into an enclosed space. The purpose of the system is to:

(i) Determine the optimum recording parameters (track

FIG.2 CLASSICAL AMPHITHEATRE – POINTS OF DESIGN




NOTES
1) THEATRE AREA WITHIN Q OF VOICE (VERTICAL AND HORIZONTAL)
2) RADIUS OF CURVATURE AVOIDS 'SLAPBACK'
3) SEATING CONVEX TO INCREASE DIFFUSION
4) EVIDENCE OF HELMHOLTZ RESONATORS UNDER SEATS

laying) ie microphone position, use of screens etc;

(ii) Quality control the recording process ie to check what goes in comes out as it went in. (A/B monitoring);

(iii) Provide the means to produce a product compatible with and pleasing in a domestic playback situation (Mixdown).

Although seemingly compatible, purposes (i) and (ii) are distinctly separate from (iii).

Relating (i) (ii) and (iii) to factor 1 in our list of monitoring parameters we find some interesting conflicts.

During the initial recording process it is vital that the engineer hears an uncoloured impression of the recording environment. Any important reflections and early reverberation characteristics should not be masked by a stronger early sound field in the monitoring environment. However, in the final analysis the finished products will almost certainly be heard in an extremely coloured early reverberant sound field (Walkman users excused!)

Another important factor in rock studios at least, is distortion created by the monitor speakers themselves, not to mention certain amplifiers driven to and beyond their linear capabilities. The constantly increasing demand for sound levels peaking at 120dB SPL has resulted in a breed of horn loaded compression drivers delivering anything up to 20% harmonic distortion. It should be duly noted that the amplifier power required to produce such levels with linearity must be in excess of 4kW for a system of sensitivity 93dB/1W/1m in an effectively anechoic room using horn loaded speakers. The cynical may at this point question the validity of such levels but there is a case for high level monitoring in that psychoacoustically the level of performance in the studio should be accurately reproduced in the control room in order to interpret its musical value. Rock music has brought about the means by which the recording industry has grown as a whole and in the process has produced both the best and the worst in every facet of that industry.

Phase linearity within the monitoring environment falls into two categories: linearity within the monitor chain – replay heads, console, crossover, amplifiers, speakers; and interference patterns caused by discrete reflections interfering to produce comb filter effects within specific time zones.

Those in the first category are relatively straightforward aspects of electronic design but it is remarkable how little attention seems to be paid by both manufacturers and users to publication of phase response data of the equipment they use. (5)

The second aspect of phase response only became apparent when time delay spectrometry was developed in the late '60s. This form of measurement is well documented although still financially beyond the reach of almost all but the larger acoustic consultancies and industrial users. The results of TDS, however, have changed several well entrenched attitudes to the design of listening environments and there is a slow, almost embarrassed movement towards many of the concepts originally dismissed by traditional purists as "just another trendy American marketing exercise".

Specifically, TDS enables acoustic performance to be measured in exactly the same way the ears/brain do, as a Fast Fournier Transform function operating in both time and energy domains.

The early reflected energy in a room can be shown to distort the amplitude-frequency curve severely at the specific points in time before an overall masking effect can be applied by the remaining energy in the room.

Conventional acoustical measurement such as impulse and pink noise give no indication of such early effects although they are useful in many steady state assessments of a room performance.

Much can be determined by the use of geometric and wave analysis and control rooms lend themselves to such treatment by virtue of their smaller size. Part one of this article discussed reasons why a small room is incapable of sustaining a true reverberant sound field without considerable modification of its acoustic parameters and even then will not completely satisfy statistical analysis beyond a few basic criteria.

It is important to realise that all rooms determine the development of the sound field by virtue of their shape, size and acoustic absorption. At low frequencies sound radiates as a spherical wave from a point source and any point on that wave may be considered a point source of secondary radiation (Huygens Law). This phenomenon accounts for the ability of sound to travel around corners and to fill every corner and crack of a room with alarming ease.

At higher frequencies sound propagates more and more in a predictable geometric fashion and obeys 'ray' theory to a useful degree. The crossover between geometric and wave propagation is determined by the smallest dimension of the room, which in the case of control rooms, is almost invariably the ceiling height. Below this frequency acoustic energy is distributed as a series of harmonically structured peaks and nulls relating to resonant standing wave conditions.

As each standing wave corresponds to a half wavelength room path (or multiple thereof) it is obvious that a large number of different path lengths are required to give even energy distribution. This is most easily achieved in an asymmetrical shell, with overlap of each of the fundamental dimensions. The shell should be rigid enough to act as a reflector to the lowest frequency given by the particular room. The actual crossover from geometric to wave frequencies is given by;

$$fc = \frac{3v}{d}$$

where d is smallest room dimension and v is sound velocity. (6)

This gives our original room (see part one) a crossover at 343.25Hz, but it should be realized that the changeover is gradual and not fully accomplished until two octaves lower in the case of 'wave theory' acoustics at 86Hz.

As control rooms are invariably used for the monitoring of stereo material the higher frequencies must be radiated into the room in such a way that any anomalies in the geometry of one side of the room are matched by the other, in order to preserve phase integrity. Failure to achieve this will result in poor centre image and at worst a noticeable difference in left-right monitor response. This effect is most critical for early reflections and becomes insignificant for reflections arriving within the "Haas Zone".

This requirement obviously conflicts with the low frequency geometry of the room and therefore an inner symmetrical shell must be constructed with a crossover frequency to the outer structural shell as defined. For the faint-hearted (and cramped) it is possible to create a combination of these two shells providing the original room dimensions are within certain preferred ratios. It is possible to make the outer shell symmetrical but of such structural geometry as to create the correct overlapping standing wave pattern.

The alternative approach to the low frequency shell is to absorb virtually all bass frequencies after they have passed the monitoring position. Although sometimes a necessity due to design constraints (extremely small rooms, mobiles etc), this approach has inherent disadvantages:

1. Higher monitor power needed;
2. Loss of space using large traps;
3. 'Unreal' or non existent reverberant field.

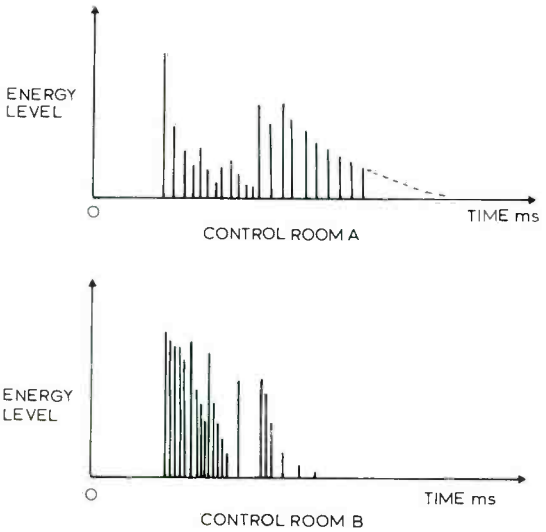
To compensate for bass traps several designers make the front and side walls hard and reflective causing many early order reflections. **Fig 3** shows a TDS comparison of the two types of room.

Each vertical line represents a complete frequency sweep of a heterodyne analyser tracking its own oscillator with respect to time. The FFT analyser displays time and level as 400 discrete bands of information with, in the case of B & K at least, the facility to 'window' by a further magnitude of 10. In other words each individual line may be viewed by integration as a complete 20 to 20kHz frequency v level spectrum.

The great advantage of TDS and a time related approach to design in general is that any control room may be significantly improved almost overnight by use of specialist materials requiring a minimum of down time and building work. This is particularly true of frequencies above fc and by skilful use of Helmholtz resonators even low frequency problems can be eliminated or improved.

Considering the high capital cost of the recording studio and the competitive nature of the business, improved acoustic performance should be considered a vital investment particularly as most other forms of potential signal distortion are slowly being removed from the chain. ■

FIG. 3 TYPICAL TDS SPECTRUM





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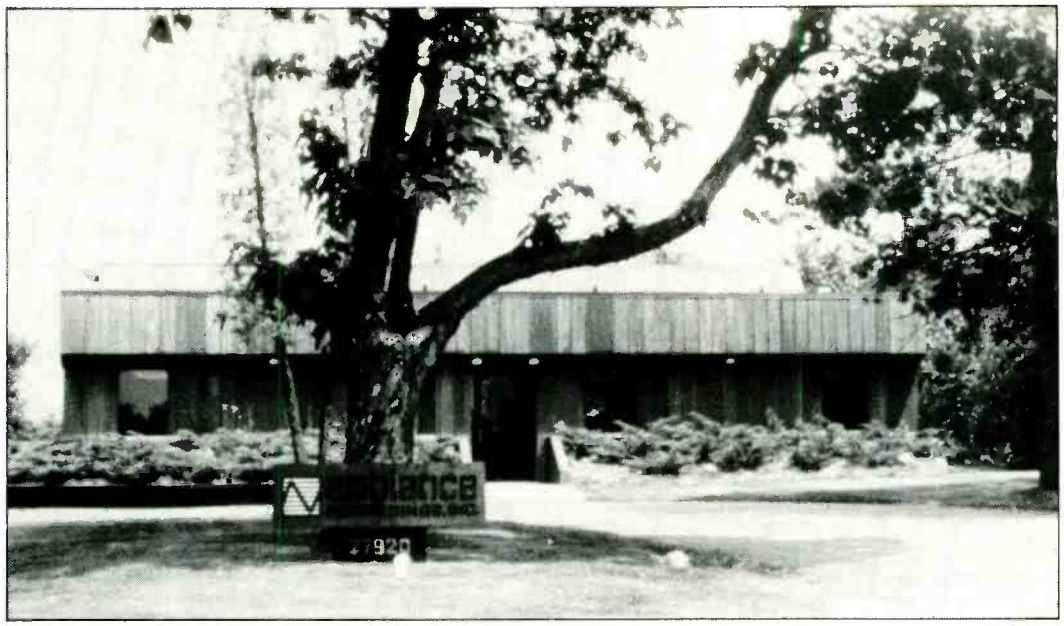
(1) Sunday Times review of Barbican concert.
(2) Don Davis *AES Journal* 1980.
(3) M. Rettinger *dB* magazine June 1980.
(4) Sound System Engineering: Don and Carolyn Davis

$$\Delta Dx = 10 \log \left[ \frac{Q}{4\pi Dx^2} + \frac{4}{S\bar{a}} \right]$$

(5) Richard Heyser, *AES Journal* 1969.
(6) *Syn Aud Con* Vol 9 Number 3.

# Studiofile:1

## Ambience Recordings, Michigan



"For an Italian kid from Brooklyn, it's a dream come true." That's how Jerry Silecchia, president, describes Ambience Recordings, Inc, a three-studio complex 20min from downtown Detroit. Silecchia, who "didn't want to live and die within a five-block area of Flatbush, like so many people I knew," came to the area in 1974, after many years in New York radio. His experience has included holding the post of production director at WCBS-FM, and more recently, at CKLW in nearby Windsor, Ontario.

"I left New York after CBS instituted a promotion freeze," Silecchia says, "and I told myself at the time that I would have my own recording and production studio within five years". Twelve days before that deadline, Silecchia was handed the keys to Ambience.

The first thing that strikes the visitor to the studio is the pastoral setting. Farmington Hills is on the fringes of suburbia, with lakes, parks, homes, shopping malls, and some low-rise industry. There are two large old trees in the front yard, one of which Silecchia says is a candidate for a tyre swing. "Saving the trees was a priority," he explains. "The parcel of land next door was actually cheaper to buy, but it had no trees." The building looks small from the outside, but is actually quite spacious, and houses, besides the three studios, an extensive sound-effects library and Silecchia's office, the walls of which are lined with Emmys, Clios, and other industry awards.

The two 4-track production rooms, mirror images of each other, feature customised Quad-Eight boards with nine inputs and Penny & Giles faders. Tape machines—4-track, 2-track and mono—are Scully *280Bs*. Each studio has a Nakamichi *581* cassette deck. Reverb and effects are handled by Ursa Major *Space Stations,* and monitors are the French-made *Cabasse,* which resemble medium-sized hi-fi speakers but cost, Silecchia says, $1,000 each. The rooms are long and narrow, and the overdub booths are positioned so that the engineer and producer have close eye contact with the talent, while the client can sit at the other end, out of the way.

The main control room was designed by George Augspurger, late of Westlake Audio, and wired by Mark Lantz, an engineer at CKLW. Silecchia says it is the only 24-track studio in the Detroit area that was built from the ground up as a studio. The centrepiece is a Quad-Eight *Pacifica* console with 24 inputs and four equalisable echo returns. Modified Scully *280Bs* are used here as well for mixdown, and an MCI *JH-24* with *Autolocator III* handles the 2in tapes. A pair of JBL *4343Bs* hang from the ceiling on chains, while *4311s* and *Auratones* are closer to the console. There are 24 channels of dbx noise reduction wired in, but Silecchia says that since the studio has switched from Ampex *456* to Agfa *PEM468,* which he finds has a 6dB better noise floor, he uses the noise reduction less.

Outboard gear includes a pair of UREI *1176s*, a dbx *900* rack with comp/limiters, a de-esser, and four gates, and an Eventide *949 Harmonizer.* A newly-reprogrammed Lexicon *224* digital reverb was a recent purchase, after the studio had been renting the unit for some time. The monitors are powered by Crown, SpectroAcoustics, and Sanyo amplifiers, and the large JBLs are biamped through AB Systems crossovers and equalised with UREI ⅓-octave graphics.

The studio room has a wood tile floor, much of which is usually covered by a foam pad to control the liveness. The piano is a 1923 Steinway grand, once the property of a local physician, that has been completely rebuilt. A pair of Crown *PZMs* are semi-permanently mounted in the lid, and Silecchia occasionally uses an AKG *414* to soften the sound. The studio also owns a set of Ludwig drums. A pair of JBL *L300s* on the floor provide playback monitoring.

Although Detroit's recording scene was set back when Motown moved its operations out to the West Coast, there is still enough business around that Ambience, one year after its January 1980 opening, was operating in the black. Commercials occupy about half of the studio's time, mostly during the day. Among the many accounts the studio has hosted have been Coca-Cola, the Big Boy hamburger chain, and the Detroit Red Wings hockey team.

Musicians doing tracks here have included former Ray Charles associate Marcus Belgrave, R J Rice, and a 15-year-old singer named Dmitri. "He just got signed with Buddah on the basis of a tape he did here," says Silecchia. "They're calling him the next Michael Jackson. He's really the quietest kid you've ever seen. He just walks in, wearing his baseball cap, and sits over in a corner until we're ready for him. But when he sings, he's all energy."

Chet Atkins heard a live remote that Silecchia and his crew did from the Joe Louis Arena in Detroit and was impressed. Atkins is now doing tracks at Ambience for a Roger Whittaker album. "Chet likes the strings in Detroit better than what he can get in Nashville," Silecchia explains, "so we're going to record a section in Orchestra Hall on an 8-track, and then bump it up to 24 back here".

Probably the biggest project to come through Ambience's doors so far is the recent *Nine Tonight* double-live album by Michigan's favourite son, Bob Seger. The album was based on tapes from Seger's 1980 concert tour, recorded by the Record Plant Mobile Unit. The work at Ambience has consisted mostly of ". . . a lot of hairy edits. Seger is very picky about his lead vocals, and we ended up combining parts of songs from different nights," says Silecchia.

Punch Andrews, Seger's manager, made the original connection with Ambience through Jerry Adams, the head of Harmony House, a local record retail chain, and a commercial client at the studio. "We started getting these strange phone calls asking if we had certain pieces of equipment. I finally told whoever was calling that we could get anything they wanted on a day's notice," recalls Silecchia. "Punch eventually came in, and he liked what he saw. One thing they needed was 24 tracks of Dolby, so I got on the phone, and within two hours, it was on its way. Mark Lantz took the day off from CKLW and wired it in."

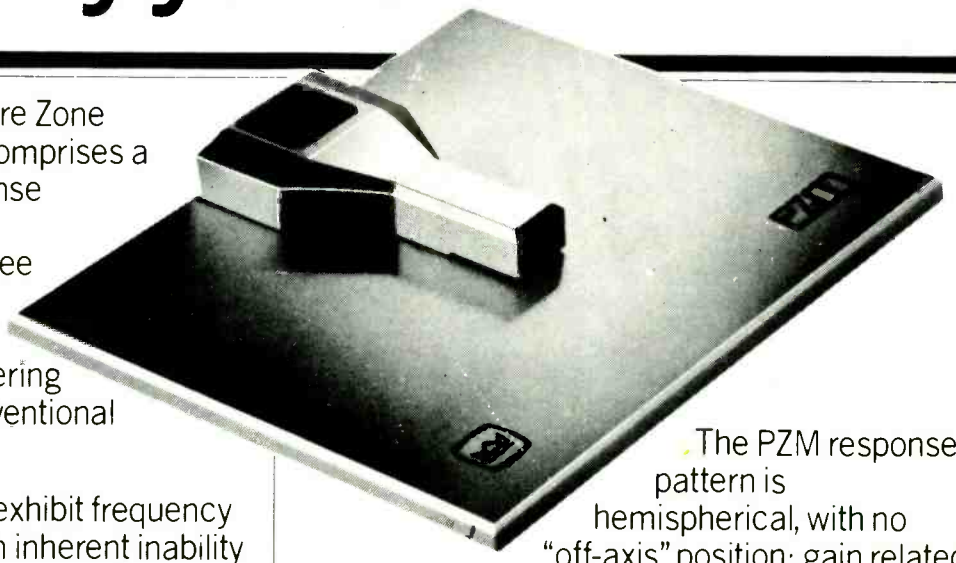
Seger travels with his own engineer, but at one point, that gentleman began to have a lot of trouble with some 2in edits, and, at a particularly tense moment, Andrews asked Ambience's chief engineer, Gerard Smerek, if he could handle the session. "Within a week," says Silecchia, "they had got so much confidence in Gerard that Seger would go out in the parking lot and play catch while Gerard was doing edits. Seger now calls him 'the man with golden hands.'

"At a mixing session, you'll usually see three heads bowed over the board, with Seger at the vocal fader, Punch on the crowd level, and Gerard in the middle, doing the rest."

One of the happier outgrowths of the sessions with Seger started when a young lady named Donna Watton came into the studio dressed like Wonder Woman to deliver a singing birthday telegram for Seger. Donna, who Silecchia thinks sounds like Liza Minelli, is now working on her own project at Ambience.

Ambience Recordings, Inc, 27920 Orchard Lake Road, Farmington Hills, Michigan 48018, USA. Phone: (313) 851-9766. **Paul D. Lehrman**

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



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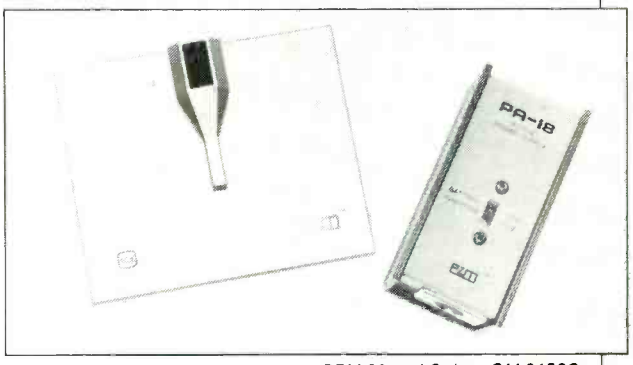
# Microphones




PZM 30 and Calrec CM 2150C

THE measurements on each mic were made under identical conditions with the sensitivity derived from tests with white noise taking the A-weighted mic output in comparison with the A-weighted output from a Bruel and Kjaer standard 1in microphone. Self noise is related to a sound pressure level of 74dB, being equivalent to 1$\mu$bar or 20dB below 1Pa. Microphone impedance is of course important in relation to loading, which includes both the amplifier load and the cable capacitance. Impedance was therefore measured using ⅓-octave bands of random noise with the mic effectively unloaded and then loaded into 600Ω (or in some cases 100Ω).

As is essential, the frequency response (see page 72) was measured under anechoic conditions using a standard ½in Bruel and Kjaer type *4165* mic to drive a compressor loop in the drive to the sound source. Polar responses were also measured under anechoic conditions at 125Hz, 1kHz and 12.5kHz, but for this measurement no compression loop was required (see pages 74 to 78).

Whilst pop sensitivity, sibilance, handling noise and sensitivity to wind noise were subjective assessments, the sensitivity to magnetic fields was evaluated by placing the mic in a coil energised by the 50Hz power line.

### CM 2150C

This is a sample of the Calrec *2100* series studio transistor capacitor mics which consist of the type *CB 21* amp, and a selection of five different capsules: omnidirectional with an inbuilt windshield; extended response omnidirectional; extended response cardioid; cardioid with reduced bass; and cardioid with a fixed mesh windshield.

The amp consists of a phantom-powered FET amp with the matt black body equipped with a satin chrome *XLR* plug at one end. At the other end the mic capsule secures to the body with a coarse thread which should be quite difficult to damage.

On test, current consumption was unusually low at 0.44mA at 48V. Two samples of the mic exhibited a self noise of 21dBA SPL or 31dB CCIR-weighted quasi-peak with the sensitivity being 0.4mV/$\mu$bar with the output impedance being constant with frequency at 150Ω.

The microphones were very sensitive to wind noise, even with the optional windshield, with medium 'pop sensitivity' and a good performance with sibilants. Sensitivity to handling noise was rated as medium. The microphones were also rather sensitive to external magnetic fields with 10 Oe giving an equivalent 84dB SPL output.

Reference to the plotted frequency response shows a well controlled front response with a front-to-back ratio of about 22dB from 200Hz to 2kHz, both samples being identical in these respects.

Examination of the polar response showed one sample to have an asymmetrical rear response, the performance of the good sample being shown and illustrating a well-balanced cardioid microphone.

### Crown PZM

The Crown *Pressure Zone Microphones (PZM)* are of a novel type which has been available for about two years. The manufacturer claims that these microphones operate only on the direct sound wave by mounting an electret capsule at a non-absorbent boundary. The two types supplied for review, the *PZM-6* and *PZM-30*, have virtually identical specifications except for size, both microphones consisting of an alloy plate with a small 'penthouse', the *PZM-6* measuring 2½ × 3in and the *PZM-30*, 5 × 6in, the latter containing an *XLR* plug and the former a flying lead with an *XLR* plug at its end.

A special power supply/amplifier is essential for these mics and two types are available, one using purely active circuits and the other using a transformer. Both types are small boxes 5 × 1⅞ × 1¾in with an *XLR* plug in one end and an *XLR* socket in the other. Powering of these boxes can be either by a 48V phantom feed or two internal 9V *PP9* batteries with a specified life >500hr. A slide switch in the top selects internal or phantom powering with the output being balanced for termination into 1kΩ or greater.

The actual current drain from batteries was found to be 0.42mA for the transformer version and 3.1mA for the active version or 0.42mA and 2.9mA respectively when 48V phantom powered.

Both versions exhibited a similar performance with a sensitivity of 0.3mV/$\mu$bar from a source impedance of 70Ω. Self noise was good at 20dBA SPL or 33dB CCIR-weighted quasi-peak. Normally handling noise does not apply since the mics should be mounted on a floor or wall, but should they be handled the noise is very bad although sensitivity to wind noise was good with sensitivity to sibilants and pop being excellent.

Both types were very insensitive to external magnetic fields with 10 Oe giving less than an equivalent of −50dB SPL.

As these mics are intended to be mounted at a boundary it is not clear how to interpret the frequency response under anechoic conditions. The response was measured with the mics suspended in the anechoic chamber and as expected the one with the larger plate had the apparent HF shelving shifted down in frequency.

With the smaller *PZM-6* one would expect mounting at a boundary to increase the output at long wavelengths (low frequencies) and thus provide a flat response with a non-absorbent boundary which would not appreciably effect the plotted HF performance. In the case of the larger *PZM-30* the dip in response at 4kHz gives grounds for suspicion and I cannot see that this mic will have a flat HF response when mounted at a boundary.

The polar response of both types was quite remarkable with the front response of both types being almost perfect over ±60° about the axis with the rear response of course being irrelevant. One would therefore expect an excellent polar response under the recommended operating conditions.

### Milab DC63

This is a variable pattern condenser mic incorporating a dual membrane system with dual FET amps supplied by a 48V phantom powering system. The microphone, which is finished in satin

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**MANUFACTURER'S SPECIFICATIONS**

| | CALREC CM 2150C | CROWN PZM-6LPB | CROWN PZM-30GPG | MILAB DC63 | NEUMANN U89i | SHURE SM 63 | SONY C48 | SONY ECM989 | SONY C-36P |
|---|---|---|---|---|---|---|---|---|---|
| Type: | Condenser | Condenser | Condenser | Condenser | Condenser | Moving Coil | Condenser | Condenser | Condenser |
| Directivity: | Cardioid | Hemispherical | Hemispherical | Variable | Variable | Omni | Variable | MS Stereo | Cardioid |
| Sensitivity (mV/$\mu$Bar): | 0.6 | 0.15 | 0.15 | 0.5 | 0.8 | 0.16 | 0.89 | 0.4 | 0.89 |
| Sensitivity (nV/Pa): | 6.0 | 1.5 | 1.5 | 5.0 | 8.0 | 1.6 | 8.9 | 4.0 | 8.9 |
| Frequency response: | 30Hz-20kHz | 50Hz-15kHz | 50Hz-15kHz | 20Hz-20kHz | 40Hz-18kHz | 50Hz-20kHz | 30Hz-16kHz | 20Hz-20kHz | 30Hz-16kHz |
| Self noise: | 18 phons | 29dB SPL | 29dB SPL | 20dBA | 17dBA | — | <22dBA | <28dBA | 22dB SPL |
| Nominal impedance: | 100Ω | — | — | 200Ω | 150Ω | 150Ω | 150Ω | 600Ω | 100Ω |
| Recommended load: | >1kΩ | >1kΩ | >1kΩ | — | >750Ω | — | — | — | >3kΩ |
| Powering: | 7.5-50V | 48V | 48V | 48V | 48V | None | Battery/external | Battery | 48V |
| Connector: | XLR | XLR | XLR | XLR | XLR/Tuchel | XLR | XLR | XLR-5-12C | XLR |
| Weight: | 120g | — | — | 325g | 400g | 80g | 550g | 320g | 120g |


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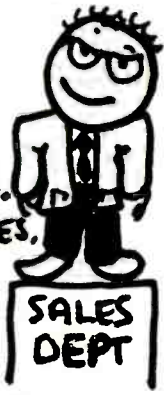


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# reviews

Milab DC63

Neumann U89i

Shure SM63

chrome, is fitted with an *XLR* plug in its base above which there are two rings operating internal microswitches. The bottom ring selects flat or a highpass response with or without a 12dB pad, with the top ring selecting the polar diagram in association with a potentiometer which is thumb operated through a slot higher up the mic's body. In one position of the ring switch the pot varies the polar response between cardioid and figure-of-eight whilst in the other position the polar diagram varies from a cardioid to omnidirectional.

These variables gave a mild shift in sensitivity when tested which was measured at 0.48mV/$\mu$bar in the omnidirectional setting when the measured noise was 24dBA SPL or 35.5 dB CCIR-weighted quasi-peak.

The output impedance was adequately low at around 150Ω with the microphone drawing 0.94mA at 48V phantom powering. It was quite insensitive to wind noise and popping with reasonable handling noise and performance on sibilants.

External magnetic fields of 10 Oe gave an equivalent of 63dB SPL which is reasonably good.

The frequency response shown was plotted in the cardoid setting with the upper front response trace showing the effect of the 6dB/octave switchable highpass filter with its −3dB point about 50Hz. Clearly the front to back ratio of this microphone is very well controlled being almost 18dB from 50Hz to 6kHz without much change.

An irritating feature of this mic was that the front was not identified and it is thought that the control settings are confusing.

Three polar responses were plotted, for the cardioid, figure-of-eight and omnidirectional settings. As can be seen the cardioid setting gave good results with the figure-of-eight patterns being rather unbalanced at the sides. The omnidirectional setting was perhaps incorrect.

**Neumann U89i**

The Neumann *U89i* is a twin membrane capacitor mic designed for 48V phantom powering. The unit, which has a satin chrome finish, incorporates an *XLR* plug in its base and three recessed rotary switches beneath the grille. Each switch shows a legend through a small hole, one switch being a 6dB attenuator, the second offering a choice of linear of highpass filters at 80Hz or 160Hz and the third selecting the polar response. The latter has a selection of four patterns, omnidirectional, cardioid, hypercardioid or figure-of-eight.

The measured sensitivity was 0.75mV/$\mu$bar in the cardioid and figure-of-eight polar patterns from a constant source impedance of 180Ω.

Noise was remarkably low at an equivalent of 18dBA SPL or 29dB CCIR-weighted quasi-peak. Response to both handling noise and sibilant sounds was very good with a medium sensitivity to wind noise and a reasonable anti-pop performance.

Current consumption at 48V was quite low at 0.7mA from the phantom powering. The application of a 10 Oe external magnetic field gave an output equivalent to less than 50dB SPL, an excellent performance.

Frequency response was plotted in the cardioid setting for the front and back responses, the upper trace showing the effect of the 160Hz highpass filter setting, the filter having 6dB/octave attenuation. Whilst the frequency response for the front and rear was generally good, there was a peculiar effect at about 40Hz. The response was plotted several times to try to find the cause of this effect, but without success in the time available.

Polar plots were made for the cardioid, figure-of-eight and omnidirectional settings. In the cardioid setting the HF performance at the sides is rather disappointing with the figure-of-eight performance being excellent. As with the cardioid setting the HF performance at the sides was not good in the omnidirectional setting.

**Shure SM63**

The Shure *SM63* is the only moving coil microphone included in this review and is intended for either handheld or stand-mounted use.

Finished in satin chrome, this microphone is small and exceptionally lightweight with an *XLR* plug built into the handle. The unit comes complete with a windshield and a stand adaptor.

The sensitivity to wind noise and popping was good even without the windshield. Handling noise was minimal but the mic did not take too kindly to excessive sibilants.

The sensitivity was quite high for a moving coil unit at 0.16mV/$\mu$bar from an impedance which varied from 200Ω at 100Hz to 320Ω at 10kHz. Being a moving coil unit it was more influenced by magnetic fields than the capacitor mics, giving an equivalent 94dB SPL output for a field of 10 Oe.

A particularly nice feature was that the non-metallic grille was exceptionally robust and very easy to replace should it be damaged.

The frequency response at the front shows the intentional low frequency roll-off which was very close to the manufacturer's data with a dip in the response at 6kHz, the performance at the back being good.

The polar response shows a good performance to the front with the anticipated loss of high frequencies to the rear for a microphone design of this type.

**Sony C48**

The Sony *C48* is a twin-capsule mic with electrically switchable cardioid, figure-of-eight and omnidirectional patterns with two further switches giving 'music' or 'voice' filtering and inserting a 10dB attenuator.

These switches are located behind a hinged panel in the lower mic body with a window higher up showing red LED indicators for the three polar diagrams and mechanical indicators for the other two switches. Also behind the hinged panel is a holder for the 9V type *PP3* battery which can power the mic in the absence of a phantom supply, an on/off switch in the base being used for battery powering.

The stand adaptor equipped with a ½in female pipe thread hinges on to the body with the *XLR* connector hinging on to the stand adaptor.

Current consumption from the 48V phantom powering was 0.7mA, or 4.6mA when battery powered. In the cardioid setting the sensitivity was 0.8mV/$\mu$bar with the self noise being reasonable, equivalent to 24dBA SPL or 32dB CCIR-weighted quasi-peak.

The output impedance remained below 150Ω with the sensitivity to external magnetic fields being equivalent to 84dB SPL to 10 Oe – rather sensitive. The performance against sibilants and

70 ▶

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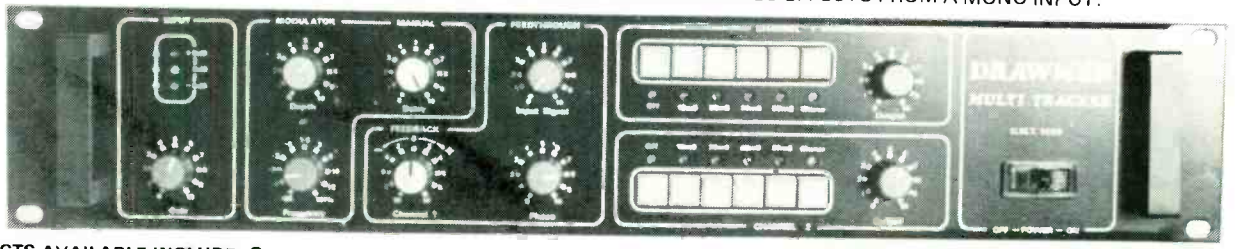

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popping was very good with the sensitivity to wind noise being very good in the omni pattern, medium in other settings. This mic was relatively insensitive to handling noise.

Reference to the frequency response plot for the cardioid pattern shows that the 'voice' filter had a peculiar effect in that it tilted the frequency response rather than acting as a highpass filter. As confirmed by the polar response, the front-to-back ratio was not very good but remained constant with frequency over a wide range.

Reference to the polar plots shows a rather irregular rear response at high frequency in the cardioid mode but an excellent figure-of-eight performance. In the omnidirectional mode the performance is excellent at low and mid frequencies but is lacking at ±90° at 12.5kHz.

**Sony ECM 989**

The Sony *ECM 989* is a battery-powered capacitor mic of the mid-side configuration incorporating three capsules, one facing the front and the others at ±90°. The outputs of the three capsules are mixed in a matrix to theoretically synthesise two cardioid mics, the angle between the axes of which can be electrically altered.

Other than the supplied windshield and stand adaptors the microphone comes with a special cable which plugs into the 5-pin *XLR* in the base and provides the two outputs at 3-pin *XLR* male connectors, the right channel being identified with a red dot. The microphone body can be separated from the capsules and connected by a 5-way *XLR* lead – thus allowing remote control of the angle between the two cardioid patterns at distances said to be up to 100m.

Other than the capsule lock there are two controls on the microphone body, the angle pot calibrated at 0°, 90°, 120° and 150° and the 3-position on/off switch. When the latter is switched on a red LED flashes if the battery is

*Sony C48*


*Sony ECM 989*

usable with the two on positions giving 'music' and 'speech' filtering.

Unscrewing the bottom half of the microphone gives access to the single AA size 1.5V battery from which the microphone draws 28mA for its internal 1.5V-to-9V DC-DC converter.

In the straight ahead mode the sensitivity was 0.3mV/μbar with the noise performance not being good at 27dBA SPL or 38dB CCIR-weighted quasi-peak for the two outputs.

The source impedance remained constant at 200Ω with the sensitivity to external magnetic fields being rather poor at an equivalent of 92dB SPL for 10 Oe. The sensitivity to wind noise, handling noise and popping was good with a medium sensitivity to sibilants.

Reference to the frequency response plot made in the 0° setting will show that the 'music' response was very flat with the 'speech' setting introducing a 6dB/octave roll-off below 150Hz. The front-to-back ratio in this setting remained fairly constant with frequency up to 4kHz.

Checking the polar response for the two channels in the straight ahead setting showed them to be effectively identical with the right hand polar response being shown.

Changing the angle between the effective cardioids played havoc with the polar diagram with the plots for the two outputs becoming dissimilar and a resemblance to a cardioid pattern being difficult to see as shown in the two polar diagrams for the 120° setting.

**Sony C-36P**

This is a cardioid capacitor microphone with the cardioid pattern horizontal (90° to the mic axis) when held vertically. The mic, finished in satin chrome, includes an *XLR* plug in its base with the capsule screwing on to the other end by means of a rather fine thread. The top of the capsule is identified with a cardioid symbol.

Intended for handheld or stand use, a stand adaptor is supplied with a ½in pipe thread and adaptors. Powering via a 48V phantom circuit the microphone drew 1.7mA with a sensitivity of

72 ▶

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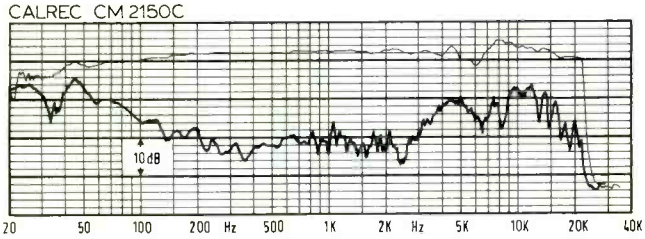
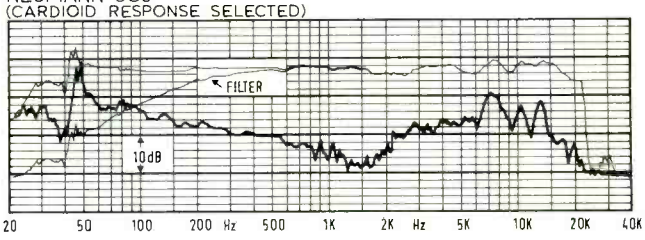
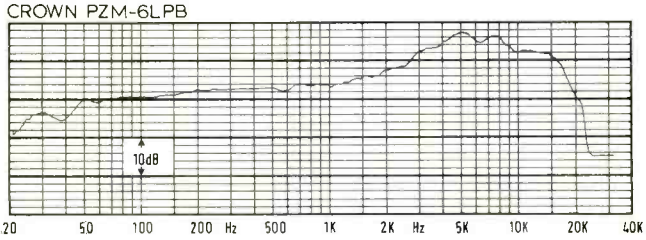


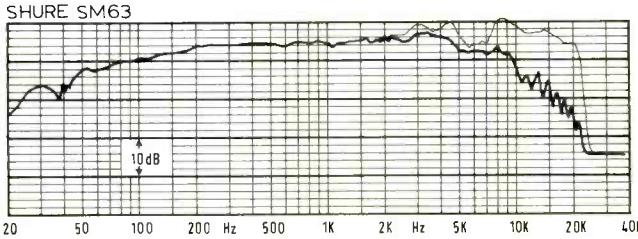

NEUMANN U89
(CARDIOID RESPONSE SELECTED)



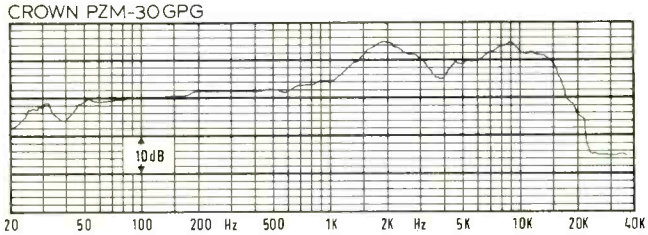

CROWN PZM-6LPB



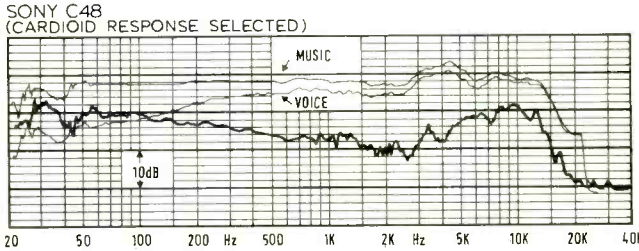

SHURE SM63



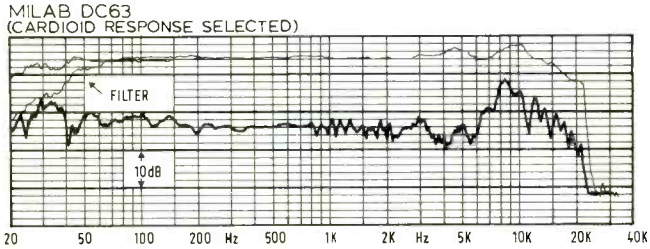

CROWN PZM-30GPG



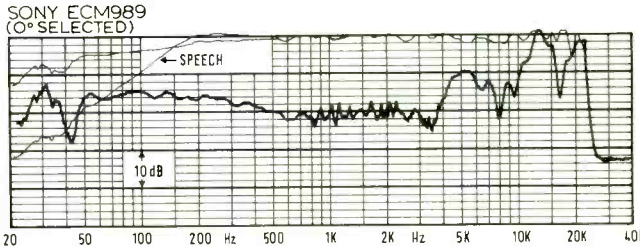

SONY C48
(CARDIOID RESPONSE SELECTED)




MILAB DC63
(CARDIOID RESPONSE SELECTED)




SONY ECM989
(0° SELECTED)



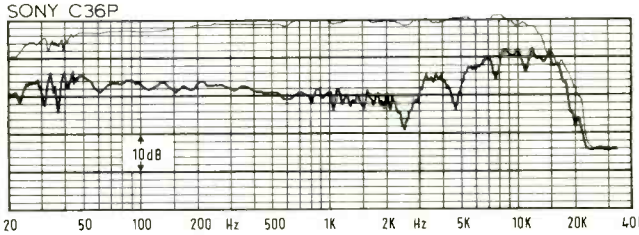

KEY

0° ——————

180° ——————

**NOTES**
(1) Pen speed 40mm/s with 50mm wide paper.
(2) Paper speed 100mm/s.

SONY C36P

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0.95mV/μbar from a source impedance remaining below 120Ω.

Self noise was on the high side at an equivalent of 24dBA SPL or 33dB CCIR-weighted quasi-peak with the sensitivity to external magnetic fields being good at an equivalent of less than 64dB SPL for a 10 Oe field. Sensitivity to wind noise was poor without the supplied windshield with the mic being rather sensitive to handling noise. Sibilants were handled well with the mic being fairly insensitive to popping.

The frequency response plot shows a well maintained response at front and back with a satisfactory front-to-back ratio. These matters are confirmed by the polar diagram plot which shows a very good performance over ±90°.

**Conclusions**

The mics reviewed show large differences in all performance parameters, particularly in respect of polar diagrams. Simply to say that a microphone has, for instance, a cardioid response hardly defines its performance.

Whilst multipattern mics are an attractive idea as they provide several polar responses at less cost than a set of dedicated mics, in my opinion the performance tends to be good only for a single pattern and a compromise for the others.

Whilst these reviews give a guide to the mics, as with other transducers, measurements tell only part of the story. The choice between mics which measure well will depend upon individual taste and the particular application. **Hugh Ford**

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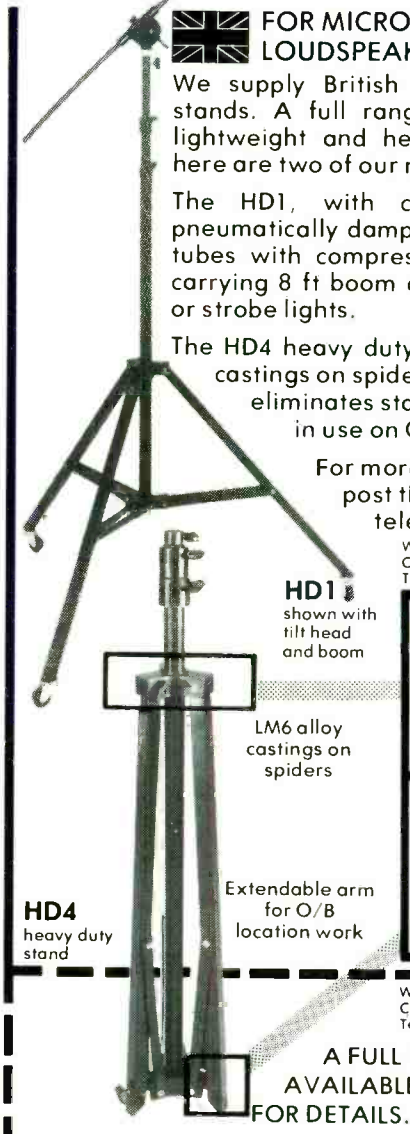

**HD1** shown with tilt head and boom

LM6 alloy castings on spiders

**HD4** heavy duty stand

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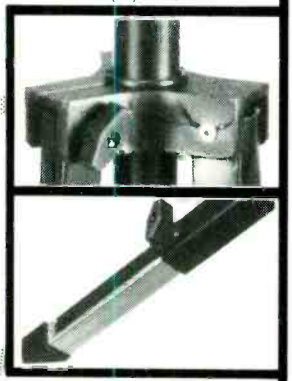

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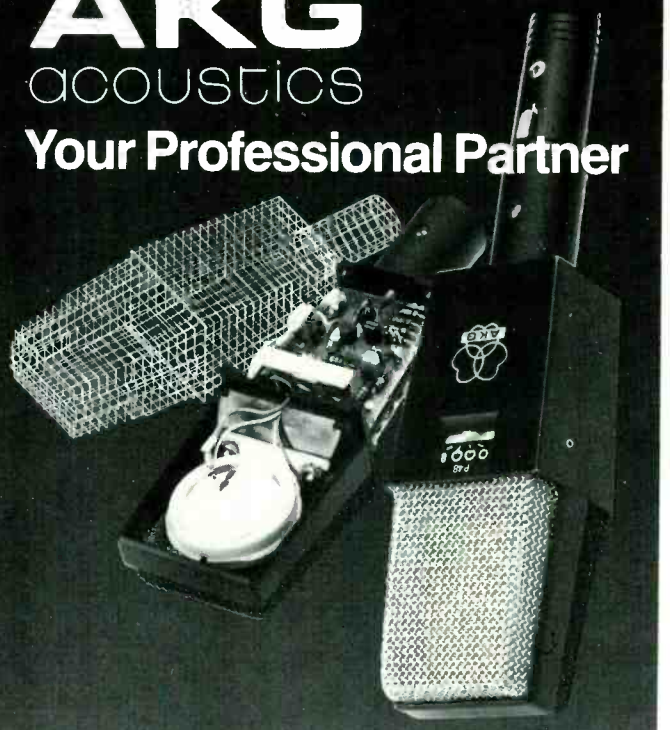

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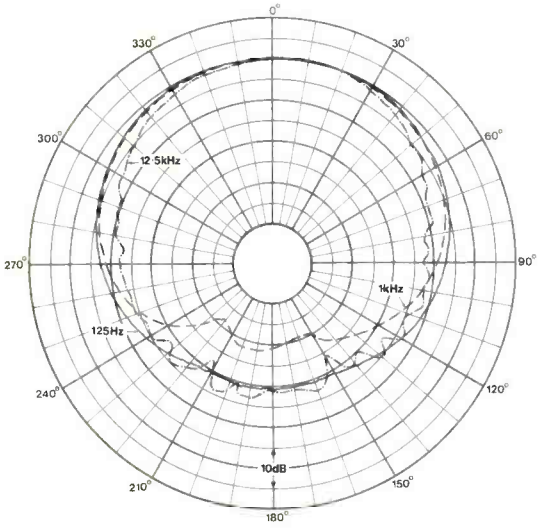
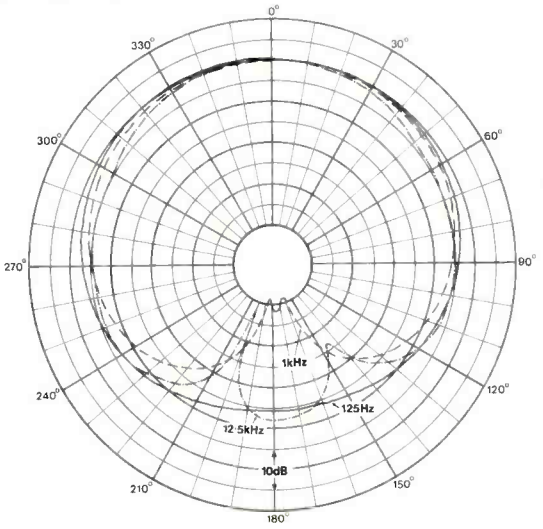
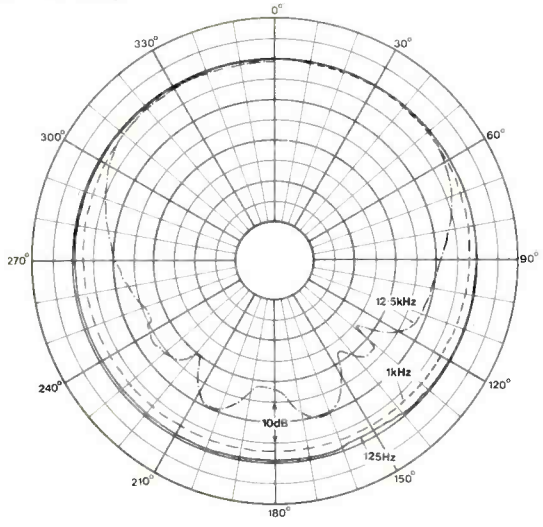


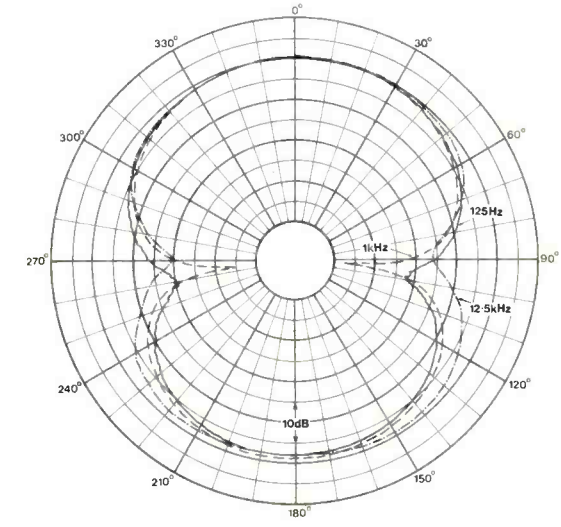

MILAB DC63—OMNI



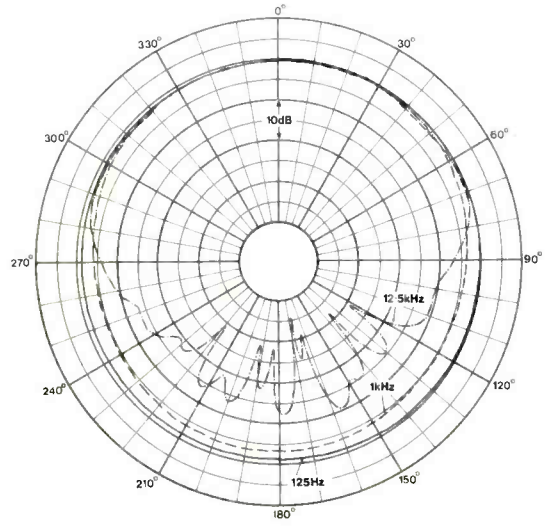

CROWN PZM 6LPB



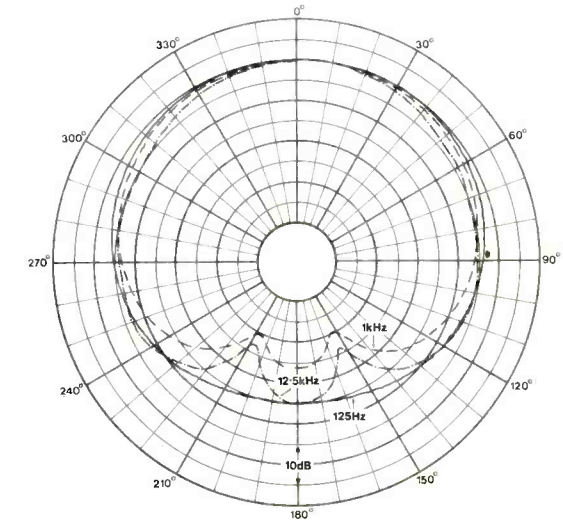

MILAB DC63—FIG·OF·EIGHT




CROWN PZM 30GPG




MILAB DC63—CARDIOID

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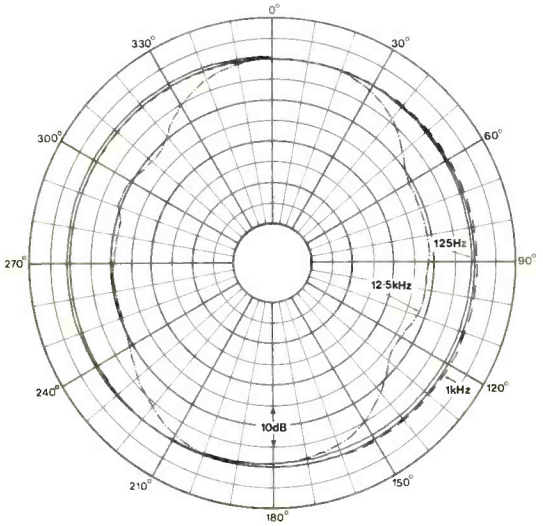
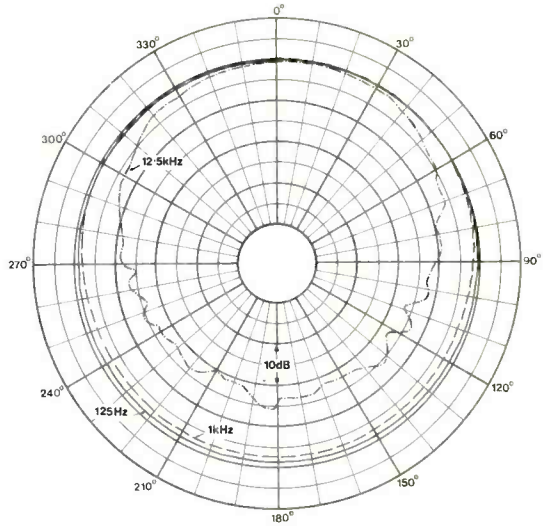
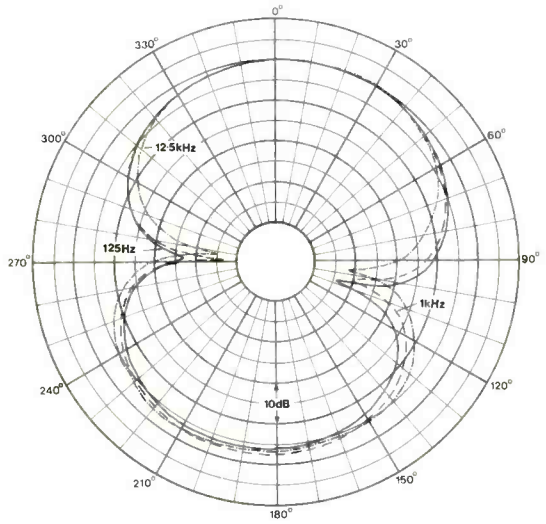
NEUMANN U89i—OMNI



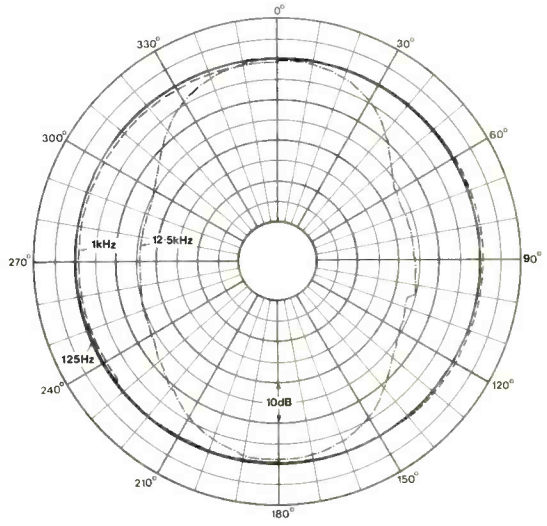

SHURE SM63



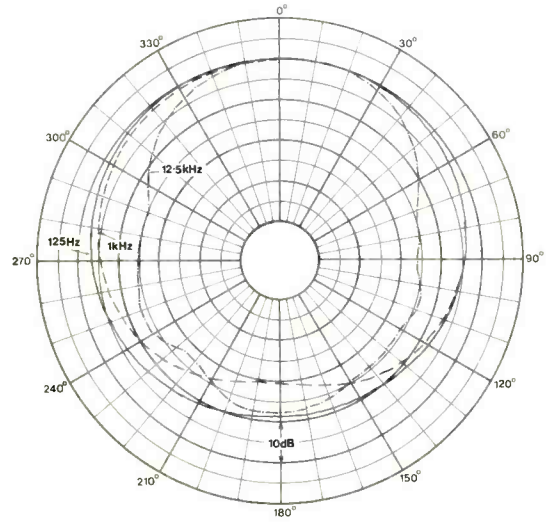

NEUMANN U89i—FIG-OF-EIGHT



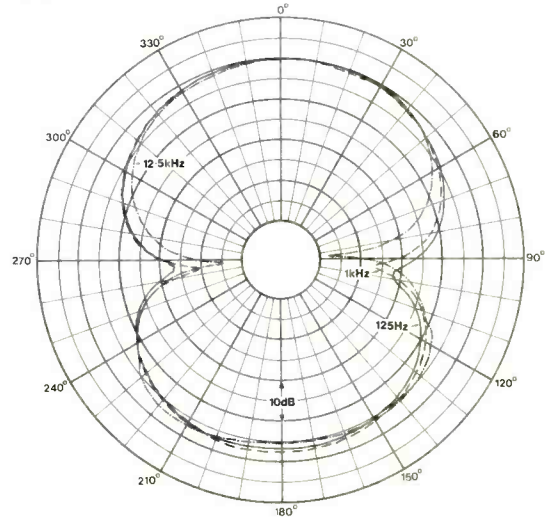

SONY C48—OMNI




NEUMANN U89i—CARDIOID




SONY C48—FIG-OF-EIGHT

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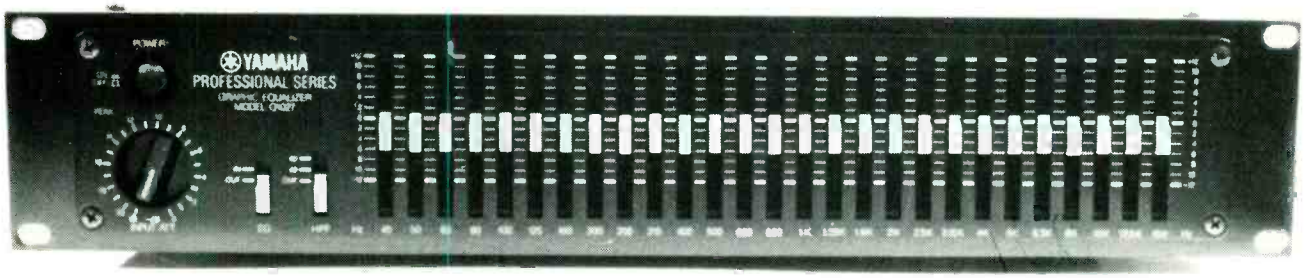


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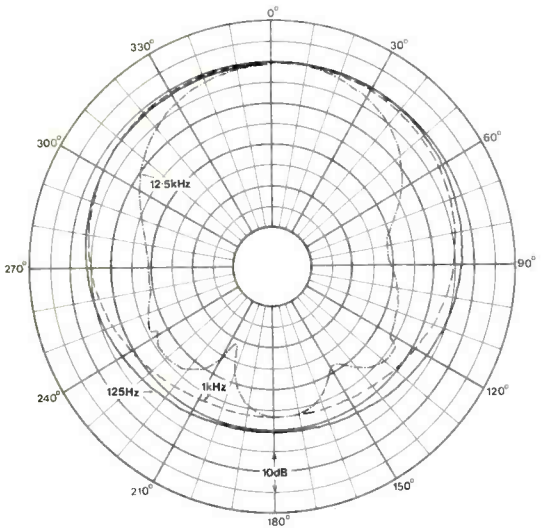
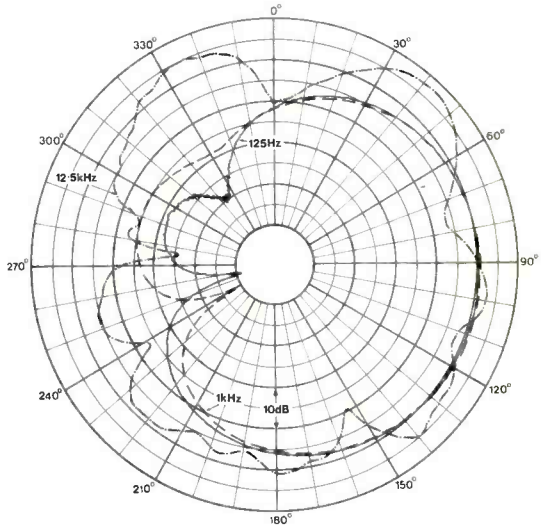
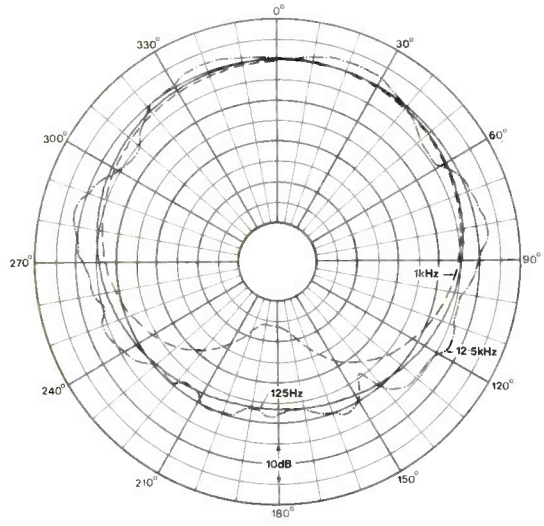
SONY C48—CARDIOID



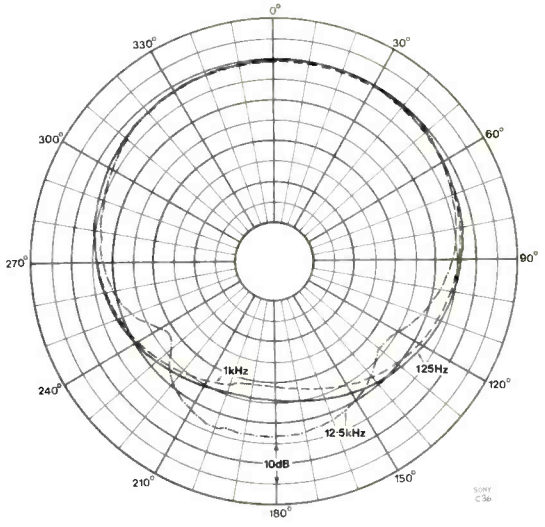

SONY ECM 989—120° RIGHT OUTPUT



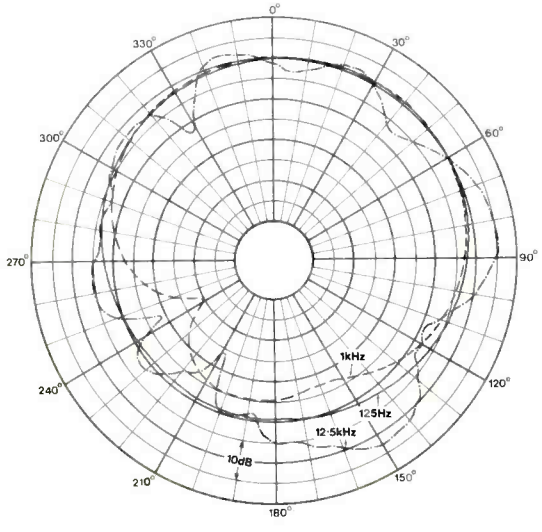

SONY ECM 989—0° RIGHT OUTPUT




SONY C-36P




SONY ECM 989—120° LEFT OUTPUT

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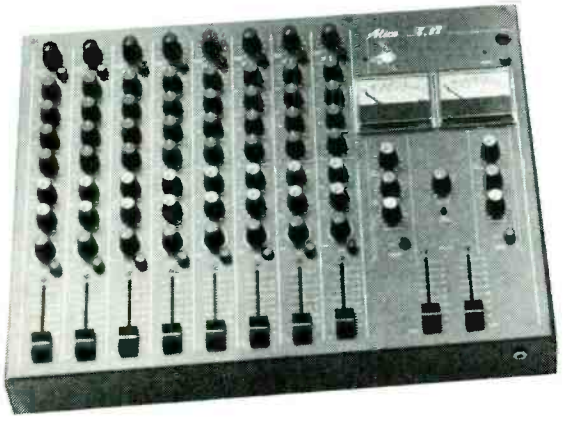
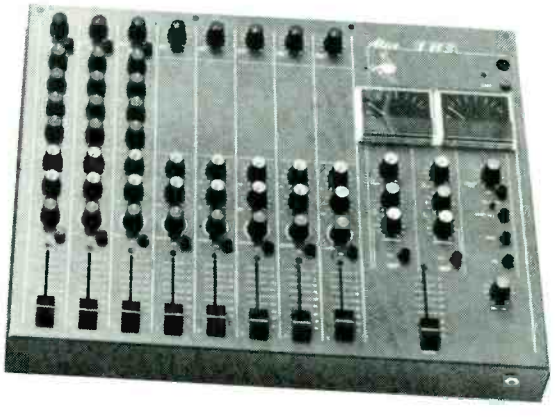
# COMPLEMENTARY PAIR





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# Calrec Model 3B Soundfield microphone system

THE *Soundfield* microphone system is a unique combination of mics permitting ambisonic recording in such a manner that enables retention not only of front and back signals but also information in the vertical plane. This all comes from NRDC 'ambisonic' technology developed by a team including Professor Peter Fellgett at the University of Reading and Michael Gerzon of the Mathematical Institute in Oxford.

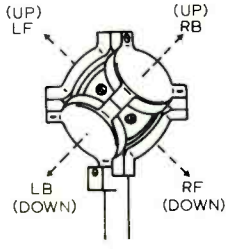
The real beauty of the *Soundfield* system is that it records the soundfield which can later be manipulated by panning and steering the signals in the horizontal and vertical planes.

The microphone consists of four subcardioid mic capsules mounted very close together in a symmetrical format shown in **Fig 1**, which gives left front up, left back down, right front down and right back up signals. These outputs from the microphone are known as the A-format signals which are processed in the control unit into what is called the B-format which is recorded on to tape—more about this shortly.

The four capsules are identical capacitor units with a cardioid type response pattern of (2 + cos ß) which feed FET preamps in the mic head. These preamps are phantom powered down their balanced output lines which can deliver +20dBm corresponding to 138dB SPL which is an extremely loud sound.

Psychoacoustic studies show that below 700Hz (where the half-wavelength corresponds to the distance between the ears) the sound perceived corresponds to the sum and difference signals between the ears which is equivalent to the output from an omnidirectional mic and a figure-of-eight mic with its axis crossing the head. Because the head may be rotated, a further figure-of-eight response is needed with its axis in line with the head. In addition to this, vertical information can be derived from a figure-of-eight response in the vertical plane.

FIG.1
SOUNDFIELD MIC CAPSULE CONFIGURATION




What this boils down to is that we require the equivalent of an omnidirectional pressure mic (W) and three pressure gradient mics with figure-of-eight responses in the front/back plane (X), the left/right plane (Y) and the vertical plane (Z). These W, X, Y and Z signals are known as the B-format signals and it is these which are recorded on to four tape tracks for subsequent manipulation.

The derivation of the omnidirectional W signal is simple as it is the result of adding the outputs of the four mic capsules in phase. Consideration of **Fig 2** shows that the front/back (X) figure-of-eight can be derived from adding the two diagonal patterns (left front — right back) + (right front—left back). Equally, the Y signal can be derived from subtracting the diagonal patterns such that Y = (LF — RB) — (RF — LB) = LF — RB — RF + LB. Similarly the vertical Z signals come from Z = LF — LB + RB — RF.

From the microphone the A-format signals feed the input module which is equipped with a 20dB attenuator pushbutton and mute pushbuttons for the individual capsules which flash red when activated.

From here the amplified A-format signals are fed to the A-B matrix which converts the A-format to the B-format. This module contains 16 preset controls which are aligned to match a

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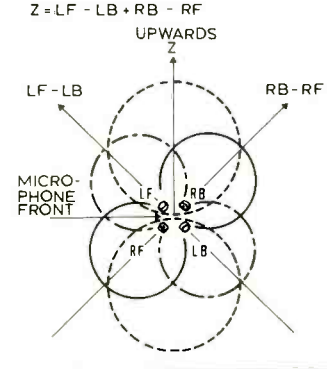
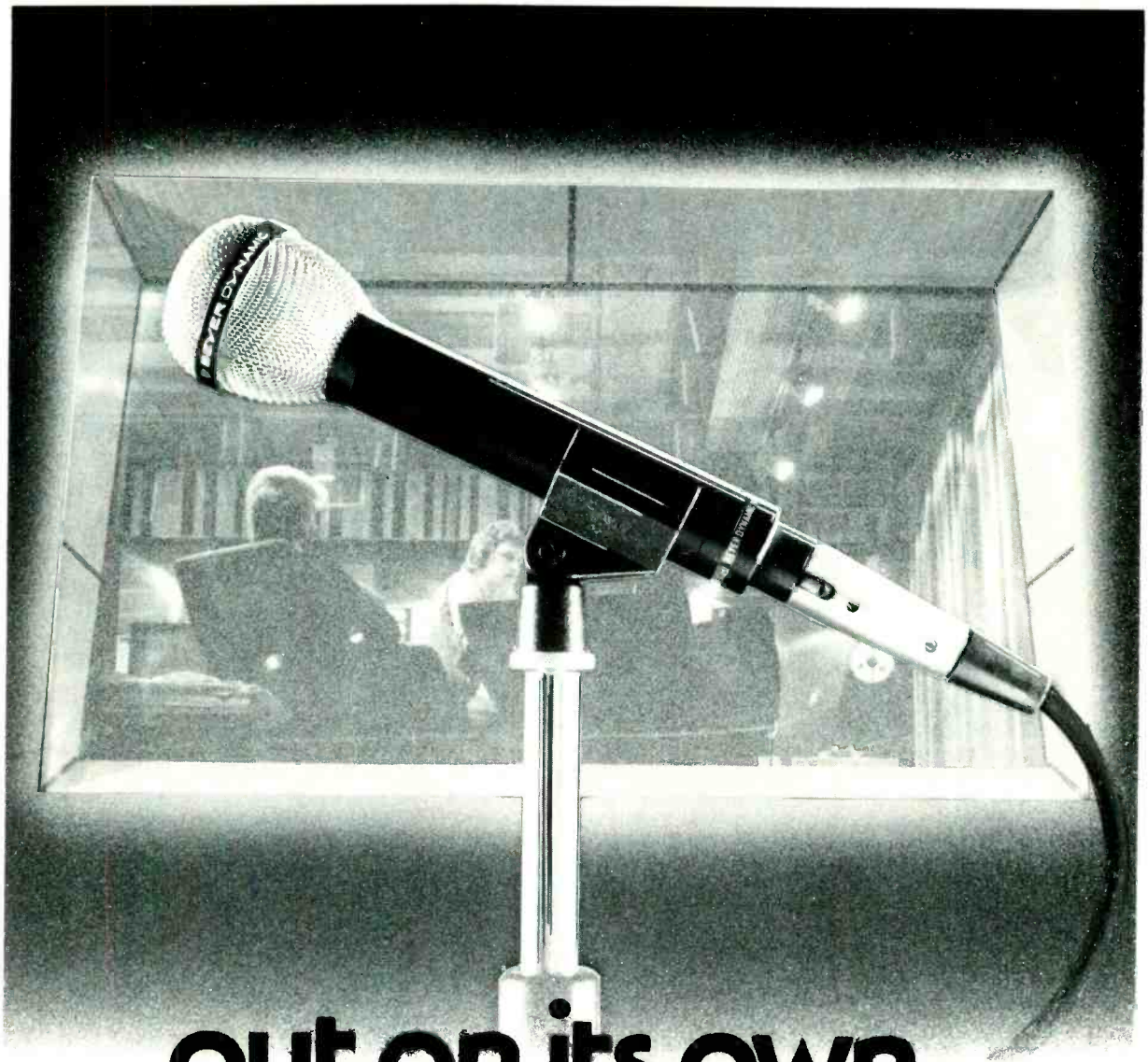
FIG.2
SOUNDFIELD MIC DERIVATION OF PATTERNS






# out on its own

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particular mic using tests in an anechoic chamber. This module also includes switches for electrically inverting the mic which is necessary if, for instance, it is suspended from a ceiling.

The B-format signals then pass to the B-gain module which includes fixed high and lowpass filters in addition to drive amps, the gain of which is controlled by two front panel switches giving +6dB or +14dB gain (+20dB when both are operated). In addition there is a 4-gang gain pot for controlling the recording level.

Finally, before the tape recorder outputs, there is the monitor module which includes a PPM which may be switched to monitor any of the four B-format signals with the facility to switch in 20dB of gain in the PPM amplifier.

This module can also be switched to monitor the inputs from tapes. There is also a test tone facility which feeds a test tone to X, Y, Z or all outputs at PPM 4 according to the position of the PPM monitor switch. Tape outputs and inputs take the form of unbalanced XLR connections at the rear panel, having a nominal level of +4dBm corresponding to the PPM 4 calibration.

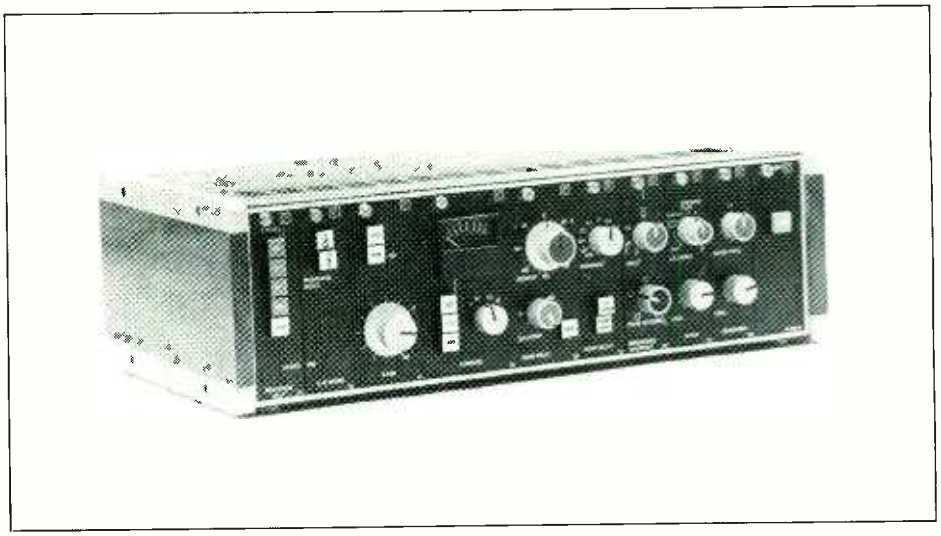
With the exception of the power supply module with its illuminated on/off switch the rest of the soundfield control unit is concerned with manipulation of the B-format signal from tape or from the B-format signals derived from the inputs.

The first of these modules is concerned with effectively rotating and tilting the microphone, that is controlling azimuth and elevation. When changing azimuth it is necessary to maintain a constant mic sensitivity for the X and Y components and this requires the law $X^1 = X \cos ß + Y \sin ß$ and $Y^1 = Y \cos ß - X \sin ß$. This requirement is achieved simply by using a 2-gang sin/cos pot which gives a full 360° control of azimuth.

Tilting of the microphone is by means of the elevation control which operates on the X and Z signals to give ±45° tilt. This more simple requirement is achieved by producing the separate ±45° components and mixing them in the required proportion to give the desired $X^1$ and $Z^1$ signals. Careful choice of the values of the resistive components around the elevation pot allows the desirable sin/cos law to be followed.

The next *Soundfield* module is concerned with 'dominance'. This allows the direction of the dominant sound to be shifted to the front/back or up/down in eight switched steps and can for instance be used to give an orchestra dominance over the noise from the audience. This control manipulates not only the effective polar diagram but also the amplitude of the X/W or Z/W signals for back/front or up/down dominance respectively.

Following the two soundfield control modules a number of options are available in the output module. Firstly, if 'B output' is selected, the B-format signals may be recorded on to tape via the gain control—this facility may be used for dubbing using the soundfield controls—or for direct recording also using the soundfield controls. The second option is to use the 'ambisonic decode' setting. This allows the use of four loudspeakers connected to the output sockets for monitoring whilst employing the soundfield controls with the direct B-format signals being recorded on to tape. In this condition the loudspeaker outputs are compensated in amplitude and phase to give the optimum psychoacoustic effects with the four loudspeakers in a square 2 to 3 yards from the listeners. Where a square layout is not possible a loudspeaker layout control optimises the outputs for rectangular layouts between 1:2 and 2:1 in aspect ratio.



Further alternative outputs are the quadruple and the mono/stereo formats. In these formats the compensation of phase and amplitude is removed and the mics act as four cardioids with the rear mics being switched off in the mono/stereo setting. In both these formats a polar pattern and angle module is switched into action. This allows the angle between the effective stereo pair to be changed continuously between 0° (corresponding to mono) and 180°. In addition, the effective polar pattern of the stereo pair may be continuously varied between omnidirectional through cardioid and hypercardioid to figure-of-eight.

Headphone monitoring of the front effective microphone pair is provided with its separate gain control and a stereo width control which may be reduced to mono.

The complete control unit is housed in a 19in wide unit, 3U in height. All modules are easily removable for servicing, having gold plated connectors which plug into sockets within the rack unit.

The layout of the controls is uncluttered with all the controls being clearly identified and readily mastered once the complexities of the system are understood.

So far as information on the system is concerned the manufacturer provided me with an excellent manual including description of the system, alignment, full circuit diagrams, PCB layouts, circuits and parts lists.

**Inputs and outputs**

The basic maximum sensitivity of the sound-field system was found to be 64dB sound pressure level for 0dBm output at the X, Y and Z outputs, with the actual microphone system sensitivity being 5.4mV/μbar for each capsule.

The mic input attenuator which switches the gain of the input amps, was found to offer 9.4dB attenuation for the four inputs against a nominal 10dB with a flat frequency response. The two gain switches in the B-format gain module offered 5.8dB and 13.6dB additional gain or with both switched in an extra 19.8dB gain, the frequency response remaining flat up to above 20kHz.

By applying a signal to the common polarisation voltage feed to the four capsules, the sensitivity and overload performance of the system was explored. Frequency response of the four channels was found to be matched to within ±0.2dB from 20Hz to 20kHz.

The overload limit on the microphone head was reached when the output hit the ±15V rails corresponding to 140dB SPL. This level is well above anything likely to be met in practice; however, the input module was not capable of accepting anything like this. With the 10dB attenuator out of circuit the input module could manage 114dB SPL at the onset of clipping, or 124dB SPL with the attenuator in circuit. Certainly this performance would be a limitation in some applications and an input overload indicator would be highly desirable.

Turning to the eight unbalanced outputs, four to tape and four to loudspeakers, these could all deliver in excess of +20dBm loaded into 600Ω from a very low source impedance of less than 2Ω. The two stereo headphone outputs could deliver a similar level, but each from separate source impedances of 160Ω.

Tape return inputs, also unbalanced, were found to be able to handle in excess of +20dBm with a rather low input impedance which varied with control settings between 1650Ω and 4500Ω.

**A/B matrix**

The performance of the A- to B-format matrix was explored by again applying a signal to the mic's common polarisation feed and measuring the X, Y and Z outputs with a selective voltmeter at 1kHz whilst switching various combinations of mutes.

Checking the rejection of unwanted combinations gave the results shown in **Table 1** which vary widely. These figures relate to the unit as set up for a particular mic head which has been compensated using tests in an anechoic chamber.

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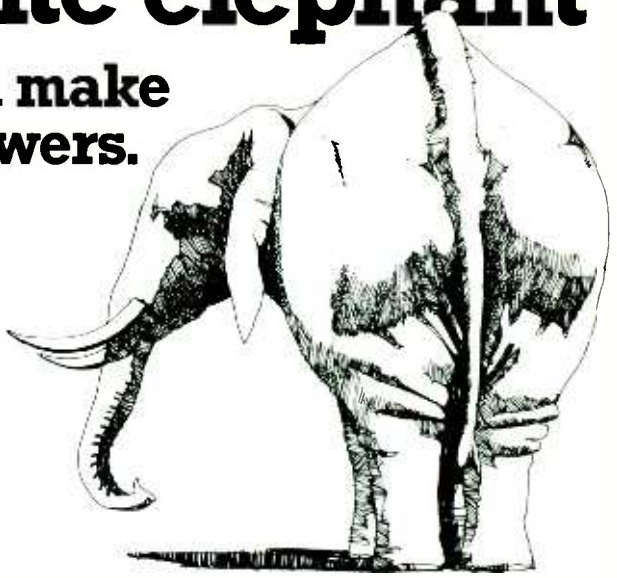

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It follows that small differences between mic capsules will make large differences to the figures given in **Table 1.**

With certain combinations of control settings or soundfields it was possible for waveform clipping to occur in the A/B matrix at quite low levels, for instance, if the left back and right front channels alone were present, clipping occurred at an equivalent of only 103dB SPL with the 10dB pad out of circuit.

**TABLE 1**

| Output | Combinations/rejection | | | |
|---|---|---|---|---|
| X | RFRB —31dB | LFLB —57dB | LFRB —25dB | LBRF —30dB |
| Y | RFLB —32db | LFRF —30dB | LFRB —32dB | LBRB —32dB |
| Z | RFRB —34dB | LFRF —24dB | LFLB —20dB | LBRB —33dB |

**TABLE 2**

| Measurement method | Quad (worst case) | Ambisonic decode | B-format |
|---|---|---|---|
| 22Hz to 22kHz RMS | —72.0dBm | —80.0dBm | —86.0dBm |
| A-weighted RMS | —77.5dBm | —84.0dBm | —92.0dBm |
| CCIR-weighted RMS ref 1kHz | —68.0dBm | —75.5dBm | —85.5dBm |
| CCIR-weighted quasi-peak | —62.5dBm | —71.5dBm | —81.0dBm |
| CCIR/ARM ref 2kHz | —75.0dBm | —82.0dBm | —92.0dBm |

**General**

As the metering is after the B gain control it does not give any indication of clipping in the input or B matrix modules, the B gain control having excellent tracking between the four channels down to —20dB.

An indication of PPM 4 on the meter corresponded to —0.5dBm output with the division between PPM indications being 4dB within the readability of the meter.

Selection of the test tone gave a level of 0dBm on the four outputs at 1043.9Hz with the third harmonic distortion being 0.05% and the second harmonic 0.01%.

Operation of the azimuth control gave most desirable effects. With omnidirectional mic settings the azimuth control shifted levels only 0.5dB, but with crossed 90° cardioid settings the azimuth control gave 22dB rejection at 45° and 135°. In a figure-of-eight configuration in line the off-axis rejection was as much as 43dB. Similarly the elevation control gave only 0.5dB level shift over its full range.

**Distortion**

Subject to avoiding clipping, which could occur in several parts of the system without any warning—the manufacturer should certainly look into the clipping problems in various sections and fit appropriate indicators—distortion was always at a very low level.

Within the mic input section and the A/B matrix the harmonic and twin tone intermodulation distortion remained below 0.01% irrespective of level. Measurement of the same distortion products from the tape inputs to the loudspeaker outputs with the azimuth/elevation and the dominance modules in circuit, again showed distortion at any level below clipping to be less than 0.01%. In fact intermodulation distortion did not exceed 0.01% until 32kHz was reached.

**Frequency response and noise**

The frequency response for the four channels from the mic head to the B-format outputs is shown in **Fig 3,** which demonstrates very close matching in sensitivity and level from 20Hz to 20kHz.

The continuation of the chain from the tape inputs to the loudspeaker outputs gave the frequency response as shown in **Fig 4,** with no deviations from 20Hz to 20kHz.

Noise in this section to the loudspeaker outputs depended to a large extent on the decoder settings and where appropriate the synthesised microphone polar diagram. Noise referred to the tape inputs was as given in **Table 2.**

Measurement of the mic noise in terms of a pair of synthesised cardioid mics as a coincident stereo pair produced good results. In terms of A-weighted sound pressure level the noise was 24dBA or CCIR-weighted quasi-peak 32dB SPL.

**Summary**

In measurement terms the overall performance of this microphone system is certainly very good with low noise and low distortion. However accidental clipping in several sections could be a problem with no user indication of clipping conditions although clipping can, of course, usually be overcome by altering control settings.

In view of the infinite variety of polar diagrams available the mic was not tested under anechoic conditions. Whilst a separate user report will appear with this technical review I cannot resist some subjective comments.

My impression is that this is the smoothest microphone that I have come across with the minimum of coloration. In particular the reproduction of the human voice and environmental sounds is uncannily natural.

Used purely as a stereo microphone the *Soundfield* has a great deal to offer, let alone its more sophisticated applications. **Hugh Ford**

FIG.3 SOUNDFIELD MIC FREQUENCY RESPONSE - CAPSULES TO B-FORMAT OUTPUTS

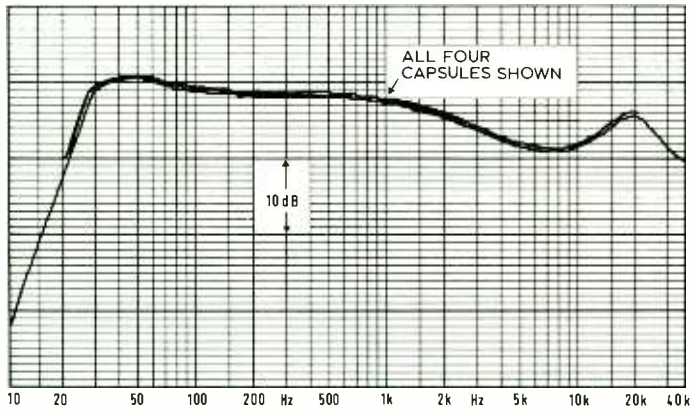
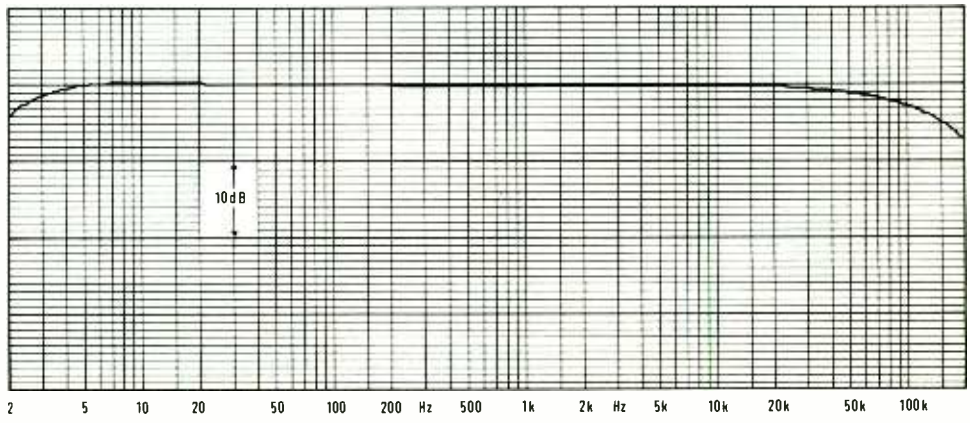



FIG. 4 SOUNDFIELD MIC FREQUENCY RESPONSE - TAPE INPUT TO OUTPUT



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# Calrec Model 3A an operational assessment

THE *Mark 3A* microphone differs slightly from the newer *Mark 3B* described by Hugh Ford; in general terms, the *Mark 3B* has improved performance and includes a useful LED feature in the microphone itself. The electrical differences between the two would probably not be noticed on a subjective basis.

Many examples are available of the Ambisonic recording capabilities of the *Soundfield* microphone, issued as consumer-format 2-channel UHJ discs and tape cassettes. I was more interested in seeing how the microphone performed in perhaps more subtle ways when used ambisonically, in exploring the post-production facilities of the soundfield controls, and in a general assessment as a conventional mono/stereo microphone.

**Tests and monitoring**

The control unit was set up to drive four identical power amps and four phase-matched 2-way loudspeakers of around 6 litre capacity. This system was used to monitor the output of the microphone ambisonically, and to replay B-format test recordings taken from the mic or synthesised by other means. B-format recordings were taken from the microphone and made to include Z-channel (height) information; although no use is made of this in horizontal-surround decoding, it was felt prudent to make some recordings including height information against the day a professional 'with height' decoder arrives.

In exploring mono and stereo use of the microphone, various arrangements were synthesised using the soundfield controls and recordings made on a conventional stereo machine. The majority of stereo monitoring was carried out using a pair of Mission *730 Mk 1* loudspeakers rather than the much smaller enclosures used for ambisonics, to take advantage of the greater power handling and low frequency extension. The same arrangement was used in post-production stereo synthesis of material already recorded in B-format.

The microphone was set up in rooms of various sizes to record ambience, speech and other sounds at various distances. It was also set up outdoors, on a rooftop 65ft above ground to record the dawn chorus of birds very early on a June morning, and in a garden at ground level to capture the rustic sounds of a summer evening: bees buzzing, birds fluttering, leaves whispering, jet aircraft roaring overhead and railway trains clattering past. Several thunderstorms were also recorded outdoors, the microphone being mounted vertically beneath a large golfing umbrella, or more securely inside the house to take a 'window' perspective on the thunder and rain. Murphy's Law arranged that at no time did any storm (some of which were severe) pass directly overhead; nevertheless, the 'brooding' quality of outdoor ambience, with mutterings of storms and thunder rolling around the skies as the edges of storms passed by, made excellent test material.

For direct stereo recording, cardioids or figure-of-eights were synthesised, and set at various angles, mostly between 90° and 120°. Quad pairs were also synthesised, and various angles and patterns tried, such as back-to-back cardioids crossed at 90°. The same patterns were synthesised from B-format recordings, and the various possibilities listened to in conventional stereo. Use was also made of the stereo headphone facility of the control unit, the 'out of head' images made possible by some of the synthesised patterns being compared to those obtained by traditional binaural arrangements using miniature omnidirectional electrets mounted on dummy heads or separated by a vertical plate.

The B-format decoder of the control unit was also compared subjectively to the Abacoid *Professional Ambisonic Decoder, PAD 9211,* using B-format material derived from the *Soundfield* microphone.

**Ambisonic performance**

I have never before heard indoor or outdoor ambience captured and reproduced with such stunning reality. In the case of outdoor recordings, one of the promises of this technology—that of 'transparent walls'—was met. Distant sounds were reproduced far beyond the walls of the listening room, correct in all perspective. Birdsong and all the various minute sounds near and far were effortlessly recreated, and at times it was hard to believe that the loudspeakers in the room had anything to do with the soundfield. Sounds were so natural and convincing that it was often impossible to differentiate those recorded and those audible in the room from outside, particularly if windows were open. This led to amusing incidents like stopping the tape to listen to a bird apparently singing outside, only to discover that the particular bird was not 'live' but BASF!

Use of some of the *Soundfield* controls destroyed the sense of reality with the outdoor recordings. Azimuth rotated the field, elevation up or down changed the angle of 'view', but the soundfield remained stable and even. Changes in dominance crumpled perspective; they made the soundfield 'lumpy' and immediately made the listener aware of the artificial nature of the soundfield. This is perhaps to be expected; such a control and effect is a new experience in audio terms and no doubt in time listeners will adapt to such effects on outdoor recordings. I would liken the effect to the flattened and distorted perspectives obtained photographically by the use of a lens of extended focal length; we have all seen the effects so often that they are accepted by the eye and the brain does not protest. The dominance controls did not appear to have this effect on recordings made indoors however and I shall deal with this below.

The thunderstorms recorded outdoors were impressively captured, as was the distinct 'pressure wedge' of being outdoors under a large umbrella in the rain. But here the soundfield tended to form an annular ring about the listener at full centre, raindrops hitting the umbrella above or adjacent to the microphone being reproduced about 5ft away; that is to say, on the circle passing through the four monitoring loudspeakers. Sounds farther from the microphone were reproduced in correct perspective, rain hitting bushes and trees and thunder rolling at a distance were all 'out-of-room' and very realistic.

Indoor recordings recreated the ambience and acoustics of different sized rooms very accurately. Using the microphone in a rather confined space (much smaller than the physical dimensions of the listening area) produced a rather unnerving and claustrophobic effect, reflected sounds appearing to originate uncomfortably close to the listener, with an amount of mental confusion caused by the eye telling the brain that the walls of the (real) room were so far away and the ear perceiving reflections in the soundfield indicating 'phantom walls' much closer. There are intriguing possibilities to be explored here: use of the *Soundfield* mic in drama, for instance, as well as special effects in conjunction with a synthesised soundfield when working from multitrack as source material.

The dominance controls were found to be most useful on indoor recordings: artificially changing the mic's position in the room, the acoustic view of the room changes but the phantom physical confines of the (recorded) room remaining largely constant. This effect seems to hold good regardless of the size of the original room, which implies that the crumpled perspectives noted on outdoor ambience do not occur when the *Soundfield* mic is used to capture a soundfield physically limited and confined by reflecting surfaces. Thus, dominance controls are useful in overcoming any compromises in microphone positioning which may have to be

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made in certain venues, yet do not distort the soundfield or introduce an obvious element of artificiality in the reproduced effect. The effectiveness of dominance and elevation controls was demonstrated when recording a thunderstorm from within a room with the mic positioned close to an open window leaning outwards at around 75°. Use of these controls on the resulting B-format recording allowed useful changes in perspective, increasing or decreasing the acoustic influences of the room and rain on surfaces outside and below the mic. The stability of the window image was remarkable, as was the ability to 'zoom' to and from the window. Probably because of the brain's acceptance of windows admitting outside sounds, distortions in perspective were not found disturbing or unduly artificial.

Tests using voice or other sounds very close to the mic indoors indicate that localisation in the reproduced soundfield became vague and blurred. Since the microphone represents the head of the listener in the soundfield, sounds originating 4in away would have to be reproduced 'in the head' of a listener positioned at full centre. However, my tests seem to indicate that there extends a zone of about 2ft around the mic where the reproduced image refuses to localise. This cannot be wholly attributed to deficiencies in decoder or speaker arrangements, nor to interference fringes from the physical presence of the listener in the soundfield, as experiments—with soundfields synthesised from discrete sources using elementary localisation controls—show it is possible to vector phantom images very close indeed to the listener, to at least halve the 'no admittance' zone around the listener.

At distances of about 2ft localisation is fairly good, although I have doubts about the perspective. Beyond 5 to 6ft, the soundfield falls happily and naturally into place.

**Stereo performance**

Whilst I remain doubtful about some aspects of the *Soundfield* mic's ambisonic performance, it is a very different story when various arrays are synthesised and the mic used for conventional stereo, or mono, recording. There are no doubts at all about localisation in a stereo image of sounds originating just a few inches from the mic —images are stable and as convincing as stereo can ever be.

The mic is without doubt the most 'transparent' type I have ever heard, and I am unable to pinpoint any tell-tale colorations, only those produced by synthesising various polar patterns; for example, the typical bass-humping of cardioids on closely-miked speech.

Because certain of the *Soundfield* controls remain operative when a conventional stereo signal is taken from the control unit, these can be used to clean up or sharpen the pickup of the mic and discriminate against unwanted sound splash. Unless the mic is being used in a live broadcast situation, where the stereo output could be mixed with other conventional or synthesised microphones, it may be wise to record the mic output as a B-format signal and take advantage of the post-production possibilities and re-takes so that the best compromise can be found.

In short, the *Soundfield* is a superb stereo microphone, with many exciting possibilities as a result of the ambisonic technology, and must be assured of a future even if the full production techniques of ambisonics are never employed.

**Ergonomics**

The relative complexity of the microphone makes a dedicated multiway connecting lead necessary, and the MIL *C-26482* 19-pin multipole connectors used are not readily available as line-mounting mating pairs. Normally, 160 yards of lead restricts SPL handling at high frequencies, but the manufacturer quotes 138dB SPL at 1kHz, 134dB SPL at 10kHz under such circumstances, so long leads are not a problem. In a studio situation, it may not be convenient to operate with a 1-piece lead and cable drum, so that dedicated sectional leads may have to be made up, perhaps using some other type of multipole connectors, such as the circular *QM*-type.

The connector at the mic-end of the lead supplied was threaded to accept the $\frac{3}{8}$ in Whitworth thread of standard mic stands and booms, allowing it to be mounted readily in a vertical position on a stand. The microphone is light enough to be suspended by its lead without much fear of excessive strain, although the angle of cable entry into the connector/mounting boss causes a slight sideways tilt (nothing the *Soundfield*'s controls can't correct if required). The *Mark 3A* was found to be sensitive to mild physical shock and care should be taken not to tap the mic stand or allow the cable to flap against it, otherwise disturbing low-frequency thumps and rumbles result.

The *Mark 3B*, I understand, is fitted with an LED indicator, visible from below when the mic is suspended. Not only does this LED indicate power-on, it also serves to indicate the relative ambisonic 'north' or 0° azimuth. Very useful, and a feature missing from the earlier *3A*.

The controls of the various modules comprising the control unit are straightforward for the most part, provided that time is taken to sit down with the manual to work through them and become familiar with the various functions and options. Discard or ignore the operating manual at your peril! A useful adjunct to the Calrec manual is a shortform guide entitled *The XWYZ of the Soundfield Microphone* prepared by Mike Skeet of Whitetower Records.

I found the output level control to mistrack noticeably over the lower part of its range, and as this was used to set the monitor level, it was rather a nuisance. I eventually solved this by arranging L-pad attenuators in the output of the tape recorder, fixing its own output level controls with small blobs of *Plasticine* after checking for identical levels in each of the B-format channels using a millivoltmeter. This allowed the output level control on the Calrec control unit to be used over the central portions of its range, where

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## UHJ Encoder

A 19in rack-mount unit, 1U high, the Calrec UHJ encoder may be used to produce consumer-format 2-channel UHJ software from professional B-format ambisonic masters. Compared to the complexity of the *Soundfield* Mic control unit module rack, the encoder is rather boring to look at, but is a vital link in providing end-user ambisonic software.

The front panel carries the only control—the mains power switch. The encoder operates on 110/240V AC mains, voltage selection effected by a screw on the rear panel which engages an internal switch. The rear panel is furnished with a 3-pole IEC mains input socket, mains fuseholder, voltage selector screw and input and output signal sockets.

B-format input signals X, W and Y only—Z (height) information is not used in the encoding process—are input via 3-pin *XLR* sockets, female contact, wired to BS/IEC standard. UHJ 2-channel signals are output via 3-pin *XLR* sockets, male contact, wired to the same standard.

Tests were carried out using the encoder in conjunction with the Abacoid *Professional Ambisonic Decoder* and the same array of phase-matched speakers and monitor amps used in the subjective evaluation of other ambisonic hardware. By feeding B-format signals in parallel to the inputs of both pieces of equipment, and connecting the UHJ-encoded output to the UHJ input of the decoder, it was possible to make an A/B comparison of the directly decoded B-format signal and the UHJ encoded signal by moving the input selector switch on the decoder.

Such a direct comparison showed up some of the deficiencies of 2-channel UHJ. Generally speaking, the soundfield is not as well defined, images are 'fuzzier' and localisations at 90° and 270° azimuth (east and west positions) are much more unstable and uncertain. Overall, the UHJ soundfield is 'grainier' and details subtly veiled. I would stress that this is a direct A/B comparison, and that 2-channel UHJ is capable of impressive results when heard in isolation.

In terms of audio fidelity, the encoder appeared transparent and noise-free. It will no doubt become a basic but very necessary piece of equipment for any studio using ambisonic recording techniques and where consumer-format stereo-compatible copies are required from the more robust B-format professional masters. It will, of course, allow a client copy of completed or partially-completed work (rough mixes in the case of synthesised soundfields derived from multitrack) playable on domestic stereo equipment and producing an ambisonic soundfield if a domestic UHJ decoder and the necessary additional amps and speakers are used.

**Peter Carbines**

tracking of the separate elements is much more acceptable.

This could well be a problem in a studio situation, where accurate channel gains are vital to the proper reproduction of an ambisonic soundfield and monitor levels are much more confortable at lower SPLs than is usual for stereo monitoring. Perhaps the manufacturer could offer the option of a module incorporating matched VCAs to ensure accuracy of gain setting.

The rear-mounted headphone sockets I found awkward, and if the control unit was rack-mounted, it would be difficult to reach them. I think that the two 6.3mm stereo jack sockets would be better mounted on the front of the headphone module.

Probably the biggest design defect lies in the function selector switch, which is co-axially mounted with the loudspeaker layout control. Misadjustment of the layout control is all too easy when the function selector is moved, and there seems no logic in combining the two controls in this manner. To make matters worse, the layout control is uncalibrated, so the whole process of setting up an accurate soundfield for monitor or replay purposes is rather hit and miss. I strongly advise that the layout control be separated from the function selector and provided with a better indication of the aspect ratios between the monitor speakers—some of the hazards of setting up and working with ambisonic soundfields have been described in *Circles of Confusion* (*Studio Sound*, August 1982). Ideally, the layout control should be accessible with a screwdriver.

**Which decoder?**

In assessing the soundfields captured by the *Soundfield* mic and the effects of the soundfield controls, it was felt that the performance of the Calrec decoder could be improved. Although not particularly obtrusive, there was a tendency for a 'noise node' to localise at 180° azimuth at a vector point approximately midway between full centre and the arc between the 'rear' speakers. Positioning oneself at this noise node, a degree of phasiness in the soundfield was perceptible. The noise node appeared to have no effect in terms of stability of images localised there, and did not seem to colour the sound of such images.

This effect has been noted before in earlier designs of B-format decoder, and appears common to domestic 2-channel UHJ decoders. Since the Abacoid *Professional Ambisonic Decoder* (reviewed *Studio Sound*, August 1982) was still on hand, subjective comparison was possible. The latter decoder tends to spread noise evenly over the soundfield with no obvious node and very little phasiness in the soundfield. In terms of image stability and localisation, there was nothing to choose between the decoders. However, I felt that the Calrec decoder had a slight 'veiling' effect which made it more fatiguing to listen to. I do not feel, though, that the performance of the decoder and the ergonomic problem of the layout control are in any way a real impediment in using the facilities of the *Soundfield* mic for ambisonic or conventional recording. Its advantages and performance far outweigh the niggles in the control unit.

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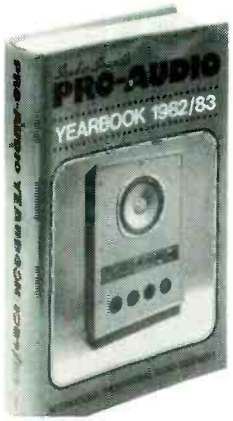


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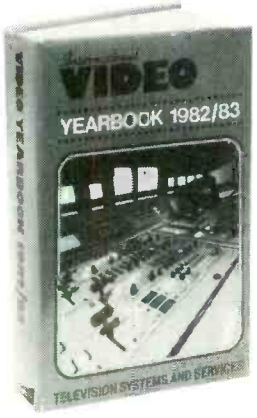


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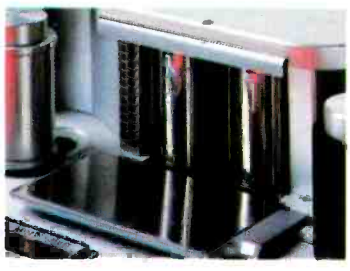

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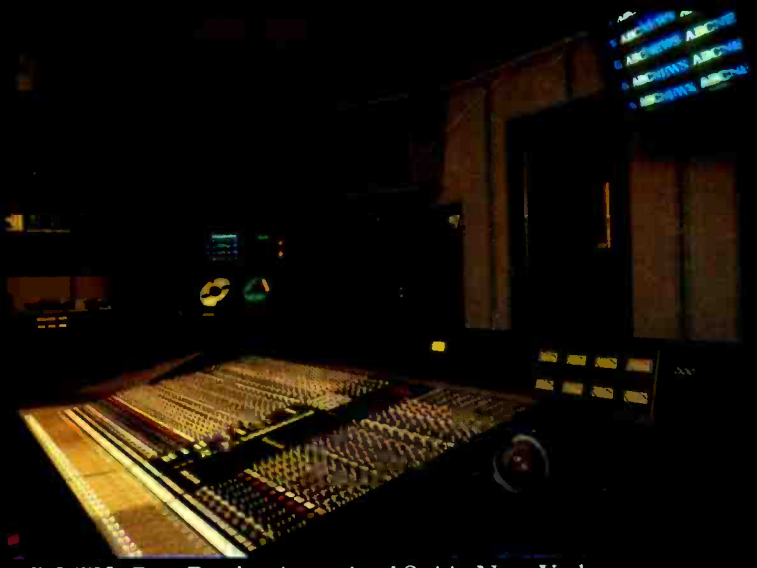

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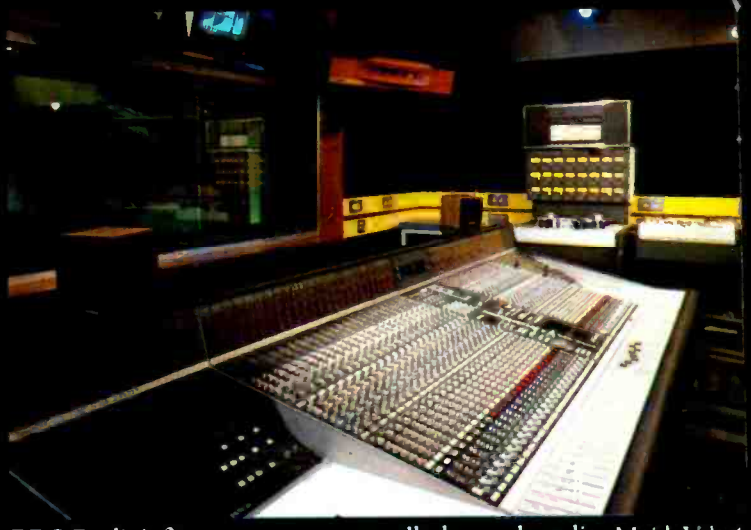

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