

# studio sound

July 1982 £1

AND BROADCAST ENGINEERING



**APRS preview**  
**Studio design & monitoring**

# The Producer Package

## The New Series 1600 + the SCM 762 Multi-Track.

The Series 1600 offers 4 mainframe configurations with 16 track monitoring: 16, 24, 32 channel and, as featured, 24 channel with patchbay.

This format is wired for 24 track interface and the patchbay also accesses 32 external signal processors.

The SCM 762 is a fully professional 2 inch recorder which may be ordered as a 16 track, 16 track prewired 24, or as a 24 track machine, each of which has the option of a nine memory autolocator.

**The Producer Package from Soundcraft –  
The Innovators.**



# Soundcraft



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# studio sound

## AND BROADCAST ENGINEERING

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PUBLICATION



MEMBER OF THE AUDIO  
BUREAU OF CIRCULATIONS

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### The magic of acoustics

Despite all the obvious technical developments, improved tools of the trade, and present wide selection of acousticians and consultants who can be brought to bear on the construction or reconstruction of a recording studio, studio design still gives most people the impression of being somewhat akin to occultism. It would seem that over the years the techniques and theories of acoustic design—at least as far as studios are concerned—have developed from the kind of primeval 'shamanistic' approach analogous to throwing bones up in the air and reading their positions when they land, which was prevalent in the early days of the independent studios, to a more complex approach analogous to the Qabalah, embodying not only rigorous techniques of high technical proficiency but also highly-developed prejudices, conditioning and sometimes political expediency. There is also a lot more money in it.

And while one can often appreciate the scientific elegance and sophistication of modern studio design and acoustic techniques, much as one can admire a Qabalist approach to magic, sometimes it seems that such systems lack the 'feel'—and sometimes the emotion—that can be invoked by throwing bones in the air or casting runes.

The fact is that the rune-casting approach actually worked quite well, although it is less fashionable today. The recording studios of the '60s, especially when they were independent studios rather than those owned by record companies, were largely designed without the aid of acousticians and studio designers. These studios were often designed by their owners or managers, and the techniques which created these studios included, certainly, a grasp of some elements of the developing

science of acoustics, but there were somewhat larger contributions from common sense, and, undoubtedly, more than a little luck. The result was sometimes a recording engineer's nightmare. Rather more of the time, however, it was a studio and a control room with 'character', each studio having a virtually unique environment and 'feel'.

With the rise of the first groups of professional studio designers, unique character fell out of fashion, resting as it did to a large extent on rather more 'live' environments than were later fashionable with the advent of more tracks, multi-multimiking, and the need to reduce leakage. Studios became rather similar and characterless.

Today, however, the situation is changing. There are many more designers, and they are using many more scientific (and sometimes quasi-scientific) methods and techniques of design. Many of the different techniques and theories clash horribly and produce wildly differing results. Character is returning to the studios, as competition between designers, and competing theories, increases. As a result, what we are seeing, hearing and using are studios which are more interesting and, once again, suited to greater variety in the sound of the final product. But the differences today are more the result of differing theories and different aspects of the science of acoustics, than they are the result of luck. Although there may be less of a 'feel' to the techniques in use today than in earlier times, the results are probably more effective for the modern world. While there is still a place for the casting of runes, there is also a wider selection of possibilities in studio design today than there was a few years ago. And they stand a better chance of success. The technology has not lost its magic.

Richard Elen

# Turnkey's Guide to the APRS

A preview of eight exhibits you should visit, and why.

## **MXR**

**42/43**

Meeting the challenge of cheaper digital technology, MXR have dropped prices but not quality with a new full bandwidth delay and a simplified pitch shifter. Both products feature a control range that's attuned to music recording applications, and both are priced below the four hundred pound barrier.

## **Fostex**

**57**

Personal Multitrack is how Fostex describes itself. Their revolutionary eight track on quarter inch makes its debut at the APRS. Dolby C and a unique head design contribute to the remarkable sonic quality of this machine, that's making multitrack possible for a growing number of musicians. A powered micro monitor and professional 'printed circuit ribbon' microphones will be shown for the first time.

## **AKG**

**72/73**

It's interesting to note that new products at both ends of the scale are catering to a widening market for pro audio. The broadcast standard C460B extends the capacitor range, and a budget matt black dynamic, the D80 offers rugged quality for musicians.

## **Tascam**

**88/89**

More facilities for less, with an update of their multitrack recorders. The latest Portastudio, with dBx, punch in and sweep equalisers now expands the possibilities of the original studio in a suitcase. And a new, low cost eight tracks on half inch, based on an economy transport with optional dBx will undoubtedly cause a stir in the market.

## **Soundcraft**

**68/71**

There's a brand new console with a familiar number. The Series 1600 offers full sixteen track facilities with no compromise of quality or engineering at surprisingly low cost. The console has an integral meter pod, jackbay and floor stand options. Packaged with their latest multitrack recorders, it's an entirely British built and backed recording system that's hard to beat.



Musical Products  
Group

## Roland

The day of the Universal Musician is approaching rapidly. 'Drumatix' and the 'Bass Line' are two small, computer controlled, programmable synthesisers that can be synchronised and play exactly what you instruct them to. Eventually they may replace multitrack altogether...

115

## Turnkey

65/66

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There are updates in our ranges of exclusive products from Annis, Auratone, EXR and Goldline.

Infinity Panels are a new product from Turnkey Two, designed to solve acoustic problems rapidly.

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## Rebis

121

Having swelled their modular racking range to include almost every form of signal processing, Rebis have moved on to noise reduction. They've chosen the Telefunken Hi-Com system, a highly praised technique, but only now available in economy packaging. Evaluate it for yourself before you make any noise reduction decision.

And in case you didn't get a copy of our new 44 page 'Turnkey by Mail' catalogue with last month's Studio Sound, please call for one at our stand.

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 9 0 Ed Stewart.  
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 12 45 John Dunn.  
 13 0 Dance Band Days.  
 14 30 New Swingle Singers.  
 15 0 Folk Entertainers.  
 16 30 Sounds of the Sun.  
 17 0 You've Got to Be Joking.  
 18 30 Be My Guest.  
 19 0 Brian Matthew.  
 20 0 Truckers' Hour.  
 21 0 and the Night Music.

Radio 3 - 247m (1,215kHz), VHF;  
 275m (1,089kHz), VHF;  
 285m (1,053kHz), VHF.

Radio 3  
 6 55 Weather.  
 7 0 News.  
 7 5 Your Choice. Part 1: Bach, Copland.  
 8 0 News.  
 8 5 Your Choice. Part 2: Rossini, Greig, Kodaly.  
 9 0 News.  
 9 5 This Week's Composer: Liszt - Symphonic Poems.  
 10 0 BBC Northern Symphony Orchestra: Schubert, Mozart (Prague Symphony), Lutoslawski (Concerto for Orchestra).  
 11 5 Elizabeth Maconchy Concert.  
 11 35 Bournemouth Symphony Orchestra: Mahler Symphony No 6.  
 News.  
 Concert Hall. Oboe and recital: Böhm, Böhm, Böhm, Böhm.

Radio 4  
 6 0 News Briefing.  
 6 10 Farming Today.  
 6 30 Today.  
 8 33 Yesterday in Parliament.  
 9 0 News.  
 9 5 Midweek: Kelly. Henry  
 10 0 News.  
 10 2 Electrostatic loudspeakers by Peter Walker.  
 11 0 News.  
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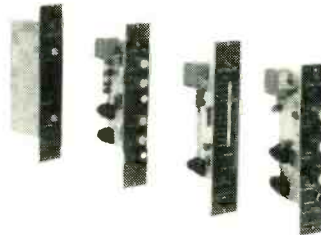
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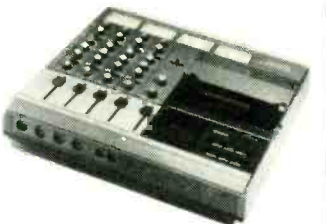
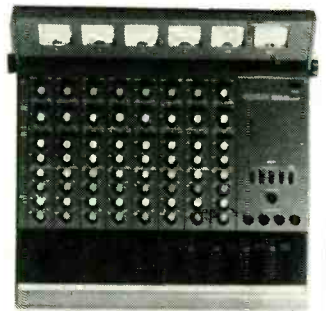


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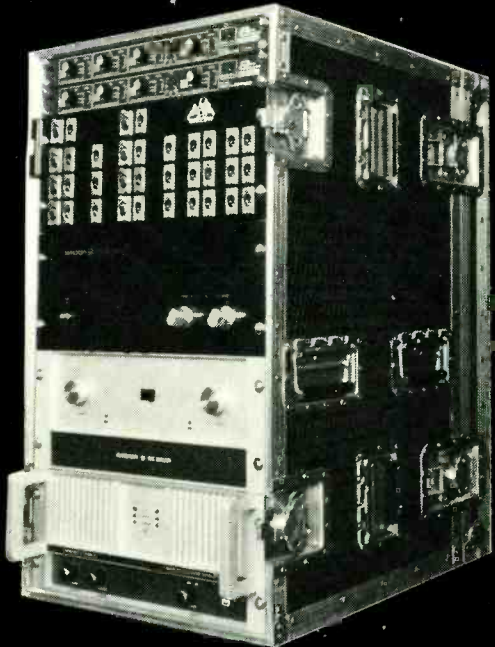
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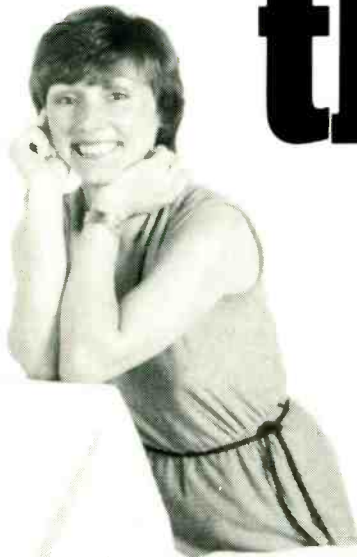
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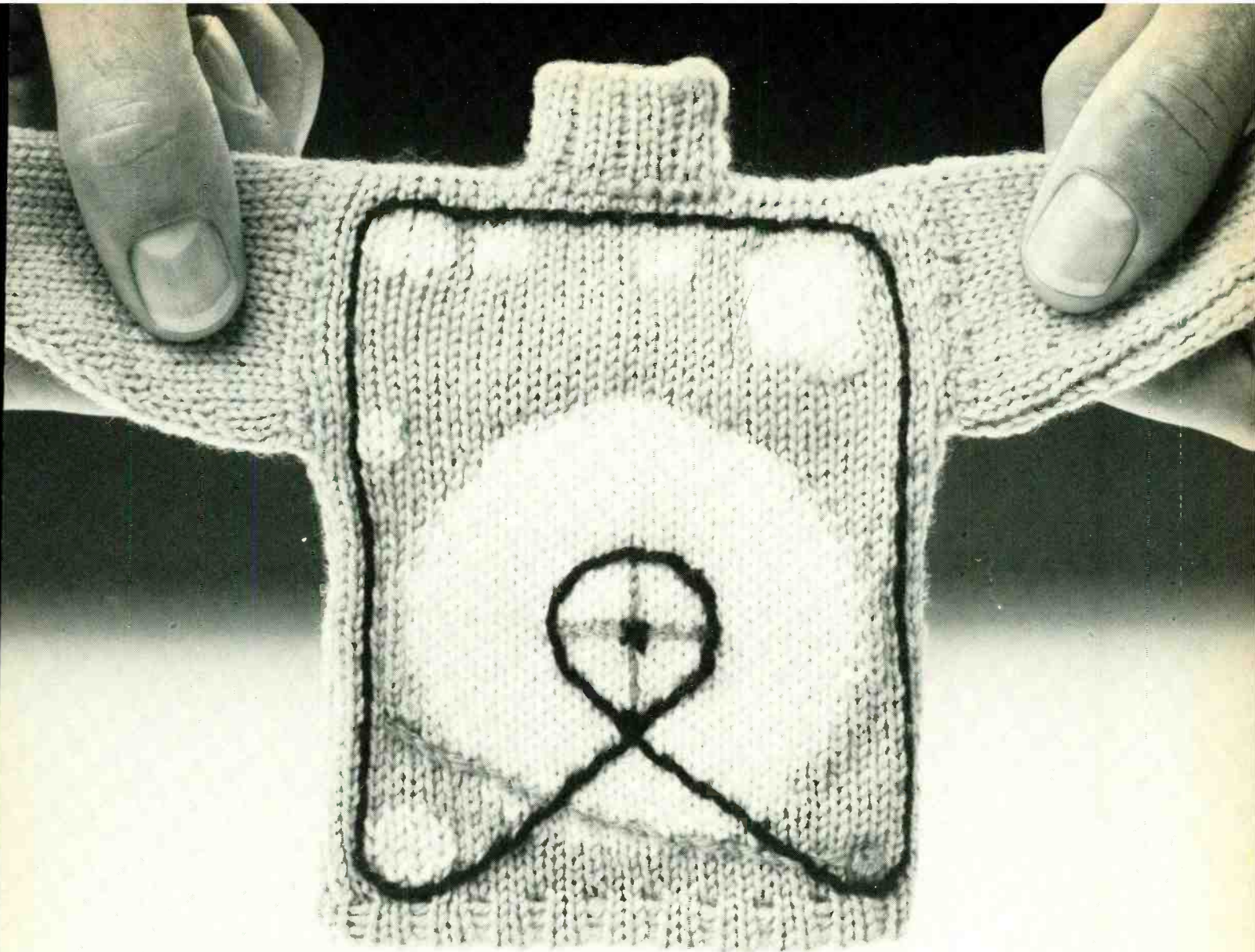
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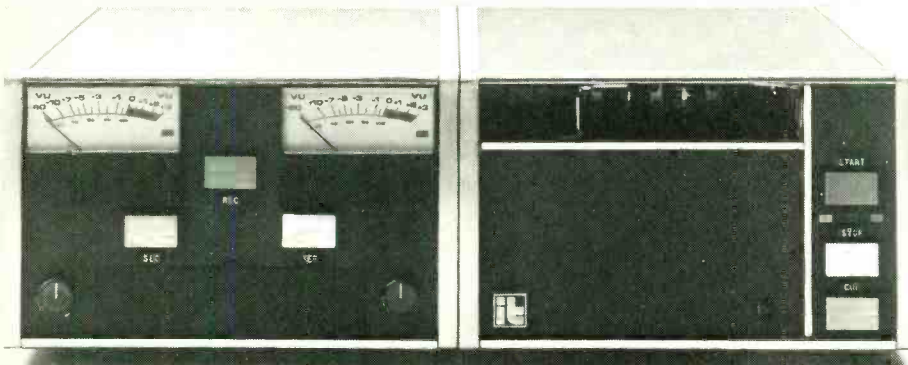
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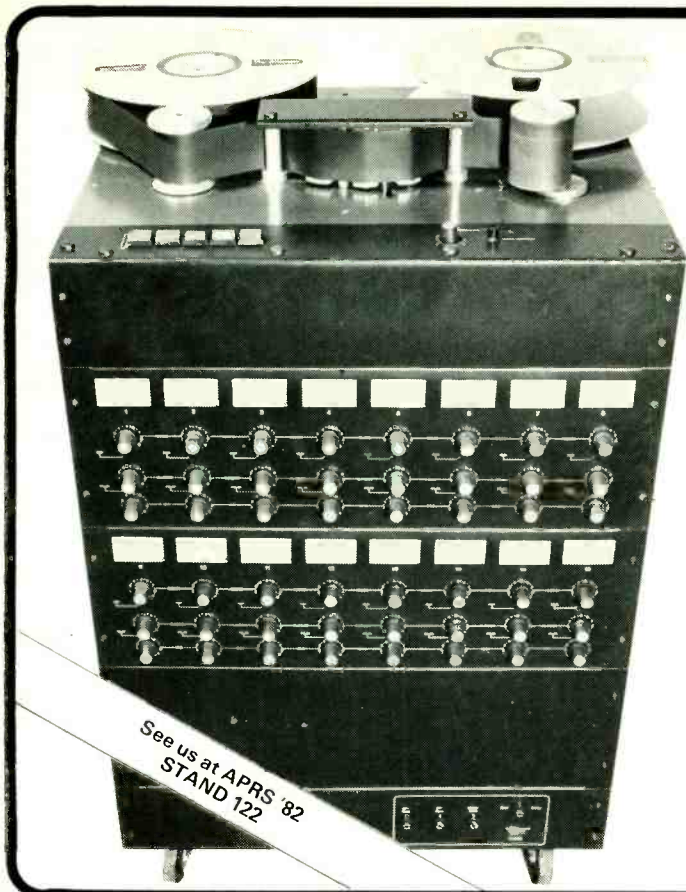


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**EDC**

## PLUTO 3-1 ENG MINI MIXER



2 mono dyn/cond mic channels  
1 dyn mic/line input channel  
Return cue line input  
Commentator cue line output  
48V phantom powering  
0dB test tone, cueing microphone  
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Runs from dry cells or eliminator  
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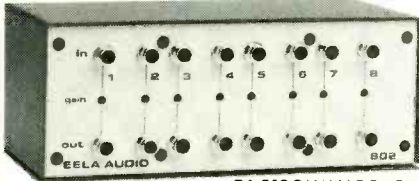
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# EELA AUDIO STUDIO EQUIPMENT

EA 800 SERIES



EA 850 STAGE BOX



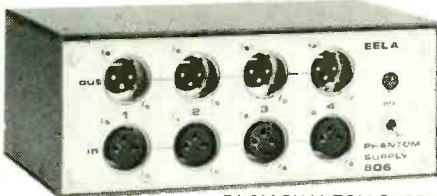
EA 802 8 WAY BOOSTER



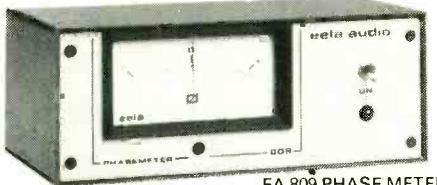
EA 803 TELEPHONE HYBRID



EA 804 STEREO DISC PREAMP



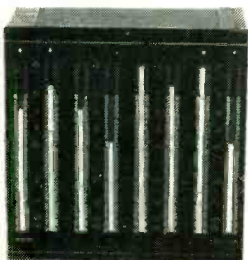
EA 806 PHANTOM SUPPLY



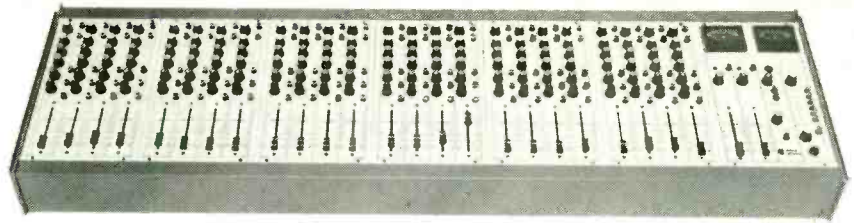
EA 809 PHASE METER



EA 823 TEST METER



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S100 *Consists of a module system, the versatility of which lends itself to the assembly of mixers of multiple configurations, using a method of construction that makes for a simple, sturdy and attractive unit. These mixers have been designed specifically to satisfy the need for compact but high quality professional mixer for use in: mono, stereo and four track studios, broadcast stations, audio-visual units, film and video dubbing studios, hospital broadcast, theatres and other public address systems.*



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S191 *Particularly suited to audiovisual facilities.*



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The Lexicon Prime Time is a real sound builder. It makes studio enhancement 'live' and, offering an integral input and output mixer on two outputs, it is central to the stage performance of many top musicians.

Lexicon digital delay systems are used throughout the world in

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# DID YOU SAY PORTABLE ?

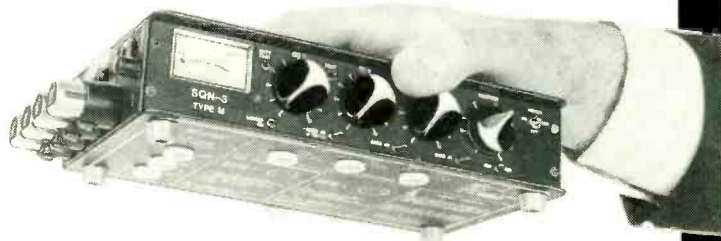
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for ENG/EFP and location filming

The SQN-3M is the smallest truly professional 4 : 1 mixer available today, offering comprehensive microphone powering, peak metering and a peak limiter. Now specified by most European broadcasting networks.

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- ★ 2 balanced line outputs (one with attenuator switch)
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- ★ Also operates from external supply of 5-18 Vdc.
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- ★ Impressive overload margins



**WEIGHT with batteries LESS THAN 1,5 kg**  
**CASE DIMENSIONS 210 x 120 x 44 mm**  
**LOW ENERGY**

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The SQN-3 TYPE C is a special version with remote control and quartz pilot for Kudelski's Nagra SNN tape recorder, which clips to the top lid of the mixer creating the most versatile portable sync recorder ever available. Total weight with tape and batteries less than 2Kg. Send for brochure and independent user report.

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Look at the list of features we've incorporated for your benefit.

- **Series Filter Configuration** to eliminate filter interaction when two or more sections are tuned to the same frequency, and to reduce noise and distortion usually developed in the summing stage.
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Want to hear more? Get yourself a Maxi Q and 'tune' in to the new standard for parametric equalization!



### More Good News!

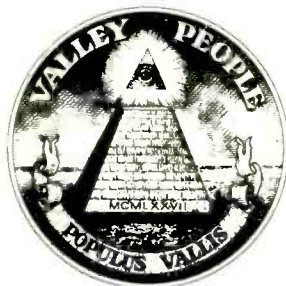
The MAXI Q is easily interfaced with the other Valley People signal processing greats, the KEPEX II and GAIN BRAIN II. In combination, this powerful trio offers excellent creative effects including frequency-selective limiting and de-essing, frequency-selective expanding and noise-gating, frequency-selective keying, as well as complex functions, such as keyed pan/keyed EQ.

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# ANNOUNCING

## THE OVER THE ROAD SHOW

arr by  
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Audio Sales

at the Kensington Town Hall 23rd, 24th and 25th June.  
DON'T MISS THE A.P.R.S. EXHIBITION, we did. We were too late applying for a stand. *BUT IN ORDER THAT WE DO NOT MISS YOU WE WILL BE ACROSS THE ROAD AT THE KENSINGTON TOWN HALL AND OPEN UNTIL LATE.* We look forward to seeing you there.

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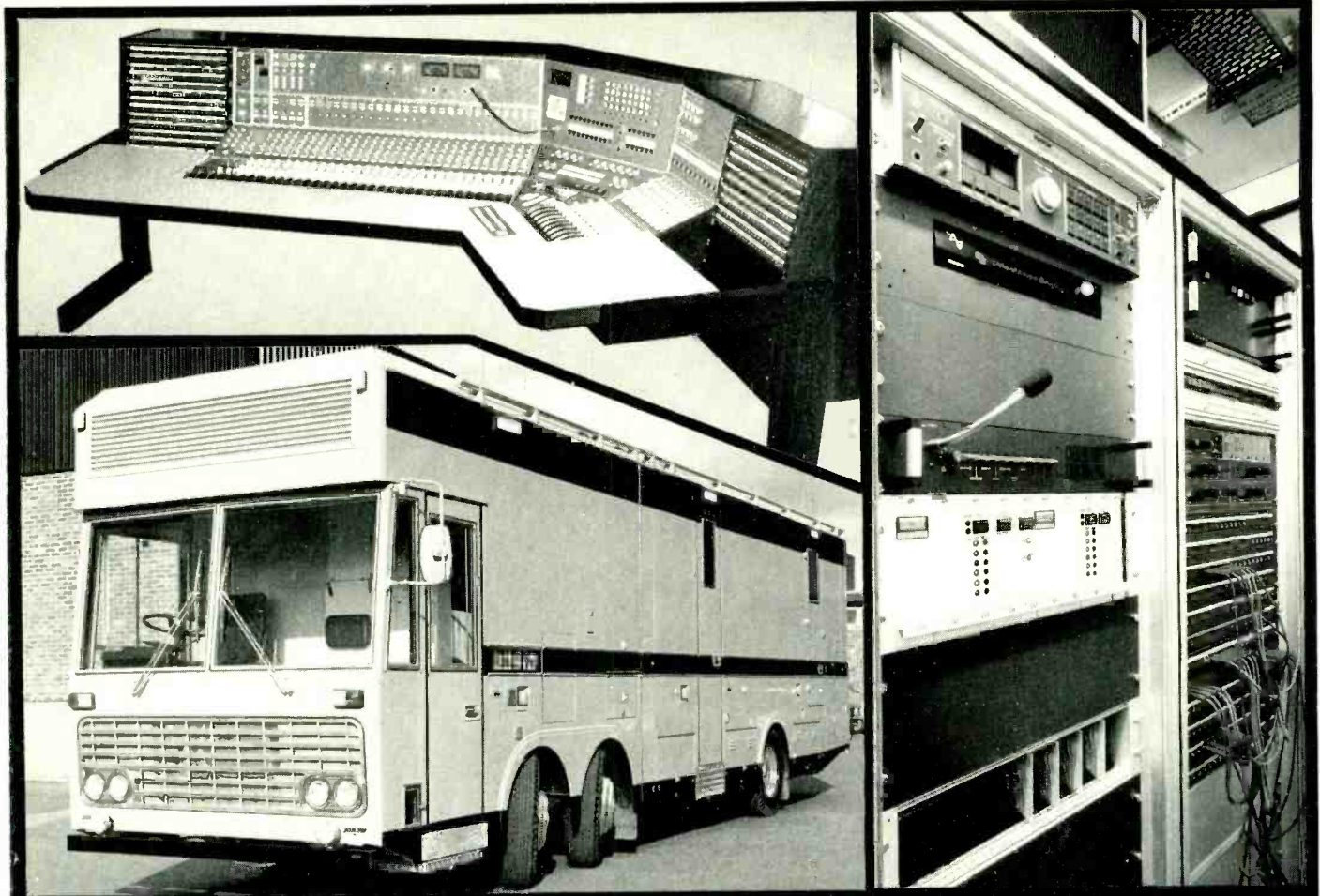
**ALSO FIRST SHOWING** of a new **BRITISH MIXER** for 16 track budget studios  
**FIRST SHOWING** of the **MK2 MOVEMENT PERCUSSION COMPUTER**, a programmable computer with built in Video Screen and real and synthesised drum sounds. With the sound programs on plug in modules the number of sounds are limitless.

**COME AND SEE, COME AND HEAR AT THE OVER THE ROAD SHOW. (After 6.00 pm equipment can be heard through studio monitors)**

- \*A selected range of used professional recording equipment will also be on show.
- \*Equipment demonstrated in as near studio like conditions as possible
- \*Some equipment available for purchase ex-stand
- \*Conference area
- \*Refreshments and Bar

*OPEN 12.00 TILL LATE*  
FREE ENTRY FOR APRS VISITORS — OTHERWISE £2

For further details, telephone (0582) 27195 or 26693



# Jacks & Jackfields for Recording and Broadcasting

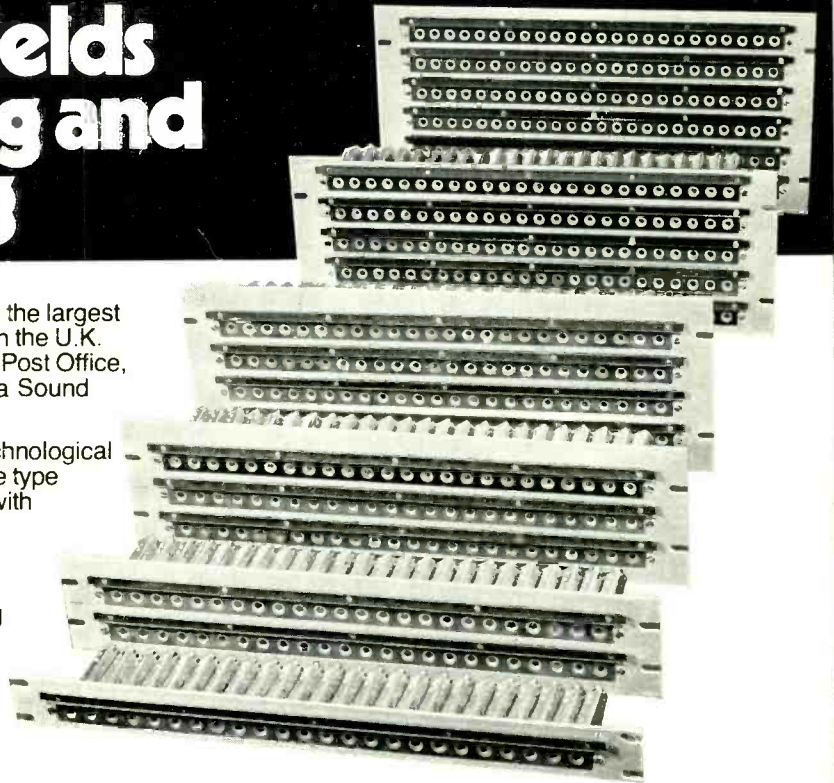
Mosses and Mitchell are recognised as being the largest manufacturer of Audio Jacks and Jackfields in the U.K. We are approved suppliers to the B.B.C., the Post Office, Pye T.V.T., Pye Telecommunications, Mercia Sound and many other major users.

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Approx. two years old	£12,000
TRIDENT TSM 40/24/40 Three years old	£25,000
TRIDENT TSM 32 way Frame fitted 28/24	P.O.A.
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CADAC 28/24/24 Wrap-around Console with double Patchbay	£12,000
CADAC 24/24/24 current in use	£7,000
MCI 600 Series with VCA's and Computer. 36 input Frame fitted 28 in/output Modules. 5 months old	£27,000
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RAINDIRK 8 input Stereo Broadcast Mixer	£1,200
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MCI JH16 24 track with Auto-Locate	£10,000
AMPEX MM1200 24 track	£12,000
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Fitted in a Flight Case—ideal for Stage and Studio use. 16 mic. inputs/ 16 line inputs, 3 band E.Q., 3 auxiliary sends, 2 echo returns, routing to 8 sub-groups and remix buss. A/B monitoring from stereo machine.

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### \* DRAWMER DUAL GATE

A new idea in noise gates in that the internal or external key signal used to operate the gate can be equalised at the unit.



2 Channel Unit

A must for gating drums e.g. can be set so snare or Toms cannot open gate on Bass drum track and vice versa. E.Q. can be monitored on output.

STEREO LINKABLE

**FEATURES: External Key, Gate or Duck, E.Q. section variable threshold, Attack, Hold, Decay and Range**  
**ALL FOR ONLY £225 + VAT**

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Professional Multitrack tape machines. Very high quality at realistic prices.

8 Track 1", 16 Track 1" & 2", 24 Track 2". They cover all requirements.



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Acc.  $\pm 1\% \pm 1\%$  fsd  $\pm 1\mu$ V at 1kHz,  
-100, -90... +50dB.  
Scale -20dB/+6dB ref. 1mW/600 $\Omega$ .

type  
TM3A

**£130**

RESPONSE  $\pm 3$ dB from 1Hz to 3MHz,  
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TM3B filter switch; LF cut 10Hz.  
HF cut 100KHz, 10KHz or 350Hz.

type  
TM3B

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INPUT IMPEDANCE Above 50mV: 10M $\Omega$  <20pF.  
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-50, -40... +20dB.  
Scale -10dB/+3dB ref. 1mW/50 $\Omega$

type  
TM6A

**£199**

H.F. RESPONSE  $\pm 3$ dB from 300kHz to 400MHz.  
 $\pm 0.7$ dB from 1 MHz to 50MHz.

type  
TM6B

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L.F. RANGES As TM3

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It might sound Double Dutch to you, but the D & R range of professional mixing consoles and ancillary equipment actually do offer unbelievable value for money considering the high quality, reliability, flexibility and versatility.

D & R Electronica (The Netherlands) was founded over 10 years ago with the aim of developing and manufacturing high quality mixing consoles for the studio and entertainment industry with a special emphasis on value for money design engineering. This has resulted in a range of five basic models, with a large number of channel configurations and options.

SERIES 200—a small mixer specially designed for four track recording.  
SERIES 400—a range of basic 'In-Line' mixing consoles for budget 4, 8 or 16 track recording.

SERIES 600—a range of mixers for live amplification, broadcast studios and two track recording.

SERIES 1000—a range of comprehensive 'In-Line' consoles for professional recording studios.

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A large number of ancillary signal processing units complement the D & R programme.

Talk some Double Dutch with our resident Dutch expert, Steve Michaelis, by contacting him at the address below, or just return the coupon for further details.

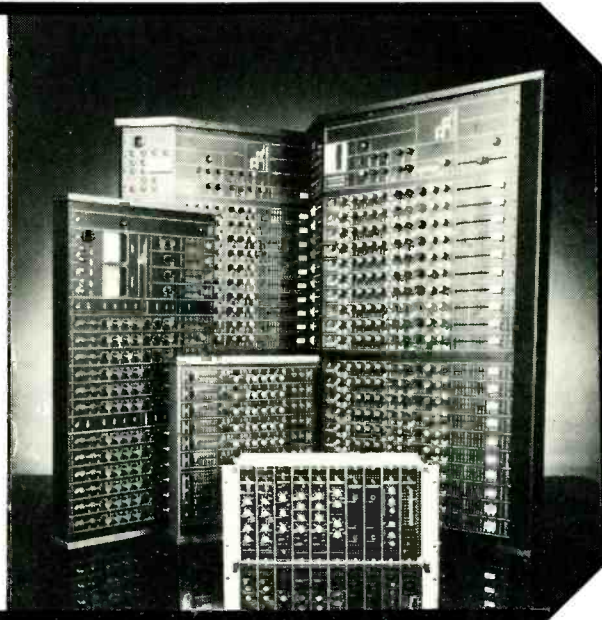
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D & R

## PROFESSIONAL MIXING CONSOLES



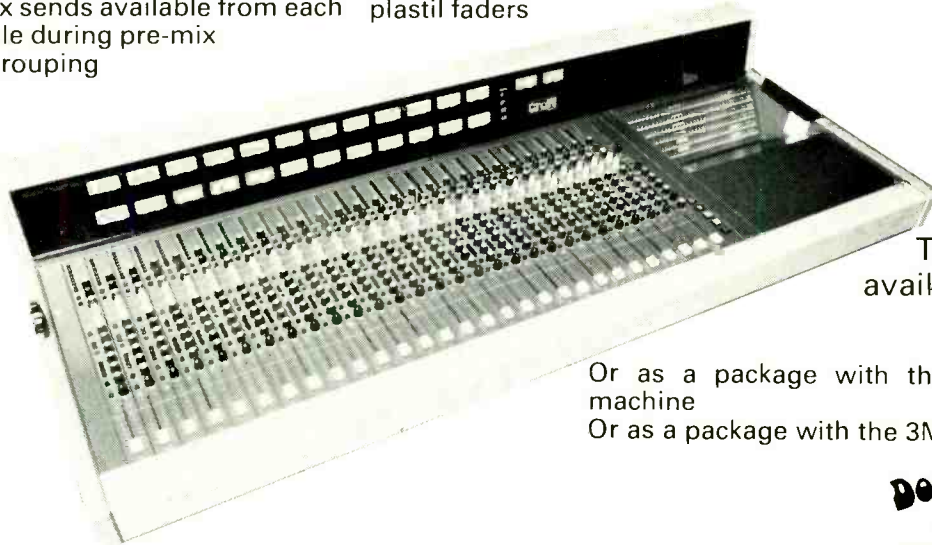
# CONCORD S.2000 28x28 RECORDING CONSOLE WITH PROM SWITCHING LOGICAL CHOICE

CAN BE SEEN AT THE OVER THE ROAD SHOW

The Concord S2000 is more versatile than mixers twice the price

## FEATURES

- |  |                               |
|--|-------------------------------|
| In line system   | 4 band EQ plus H/P filter     |
| Silent Prom switching                                  | Full patch bay                |
| 56 line Inputs   | Attractive wooden console     |
| 28 mic. Inputs   | Audifad long throw conductive |
| 20 Aux sends available from each module during pre-mix | plastil faders                |
| Sub grouping   |                               |



The Concord S2000 is available in 2 formats:

- 20x20 @ £6,500
- 28x28 @ £8,500

- Or as a package with the Soundcraft 24 track machine £17,500
- Or as a package with the 3M M79 24 track machine £22,000

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# HISS-OFF



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- No switching • No Line up required
- Capable of decoding DBX tapes
- Available in 8 track and stereo versions

## HATS-OFF TO HORIZON

Horizon Studios, Coventry, the studio that produces the Two-Tone hits, was one of the first to install the BEL Noise Reduction System, producing hits for bands like Selecta, Bad Manners, Modetts and Reluctant Stereotypes.

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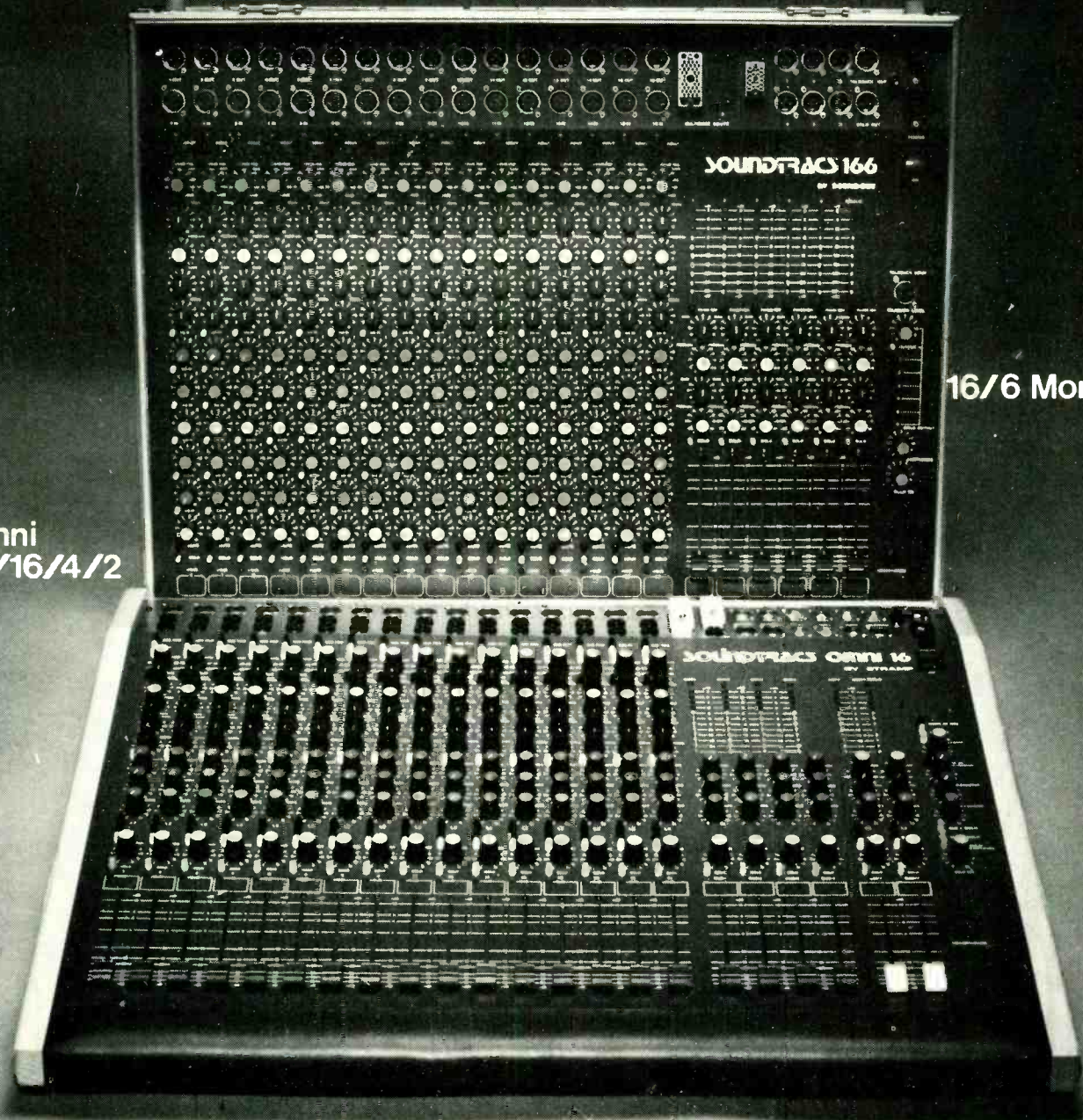
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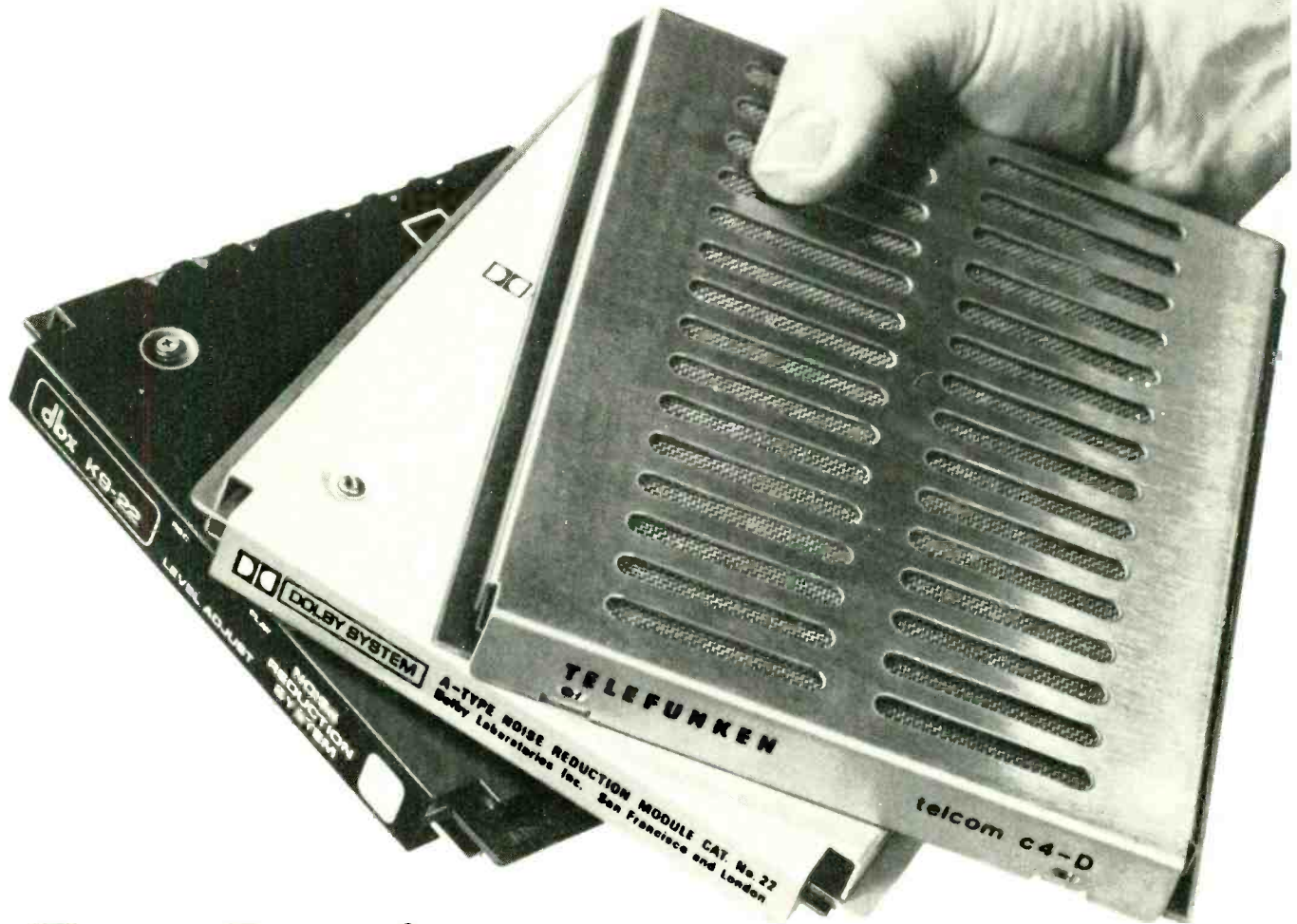
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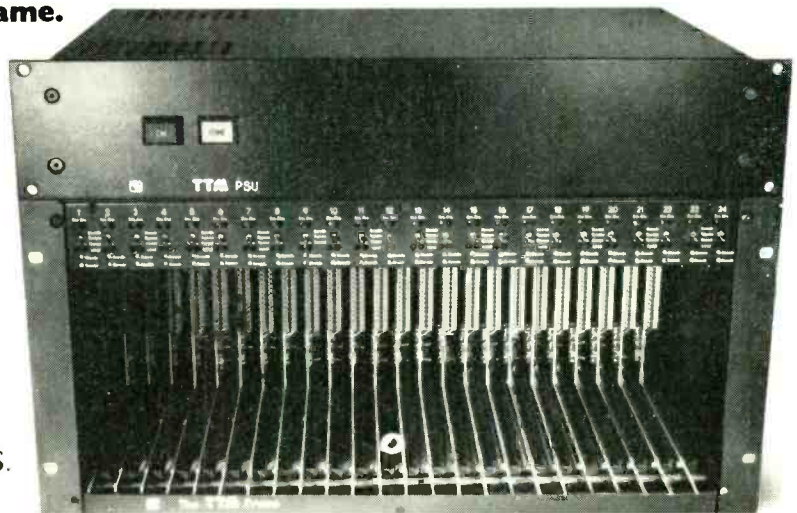
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- Separate mic and line gain controls.
- Precision five L.E.D. level indicator on each input module.

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- Comprehensive monitoring facilities including monitor pan, monitor level and mute for each group output/machine return.
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- V.U. metering as standard, L.E.D. column P.P.M.'s available as an option.
- Can be 'Fadex' automated at any time.
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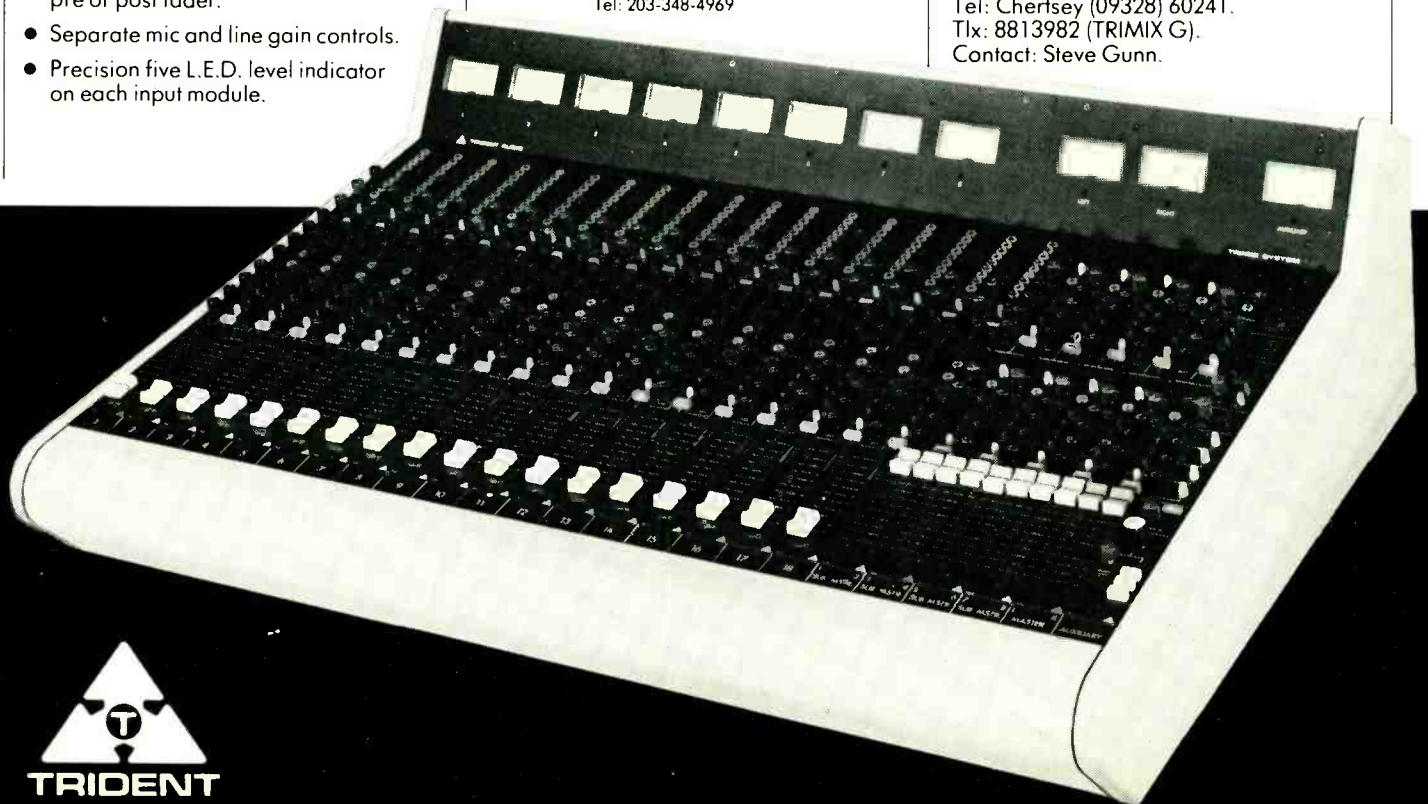
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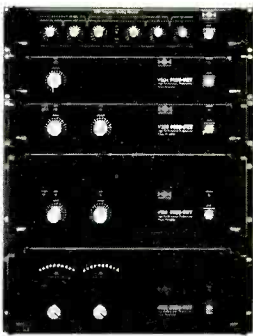
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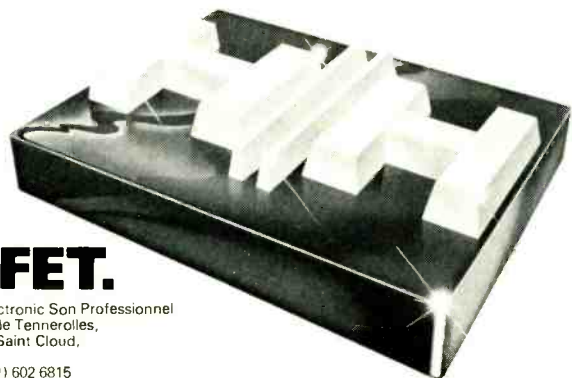


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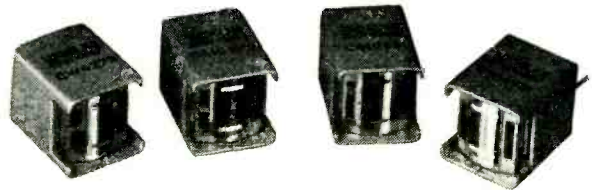
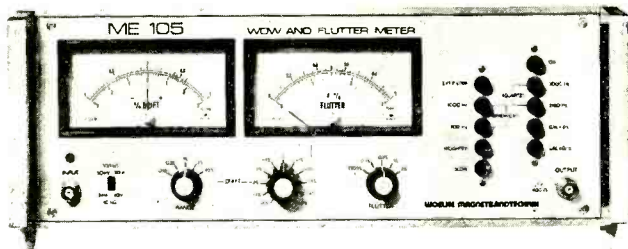
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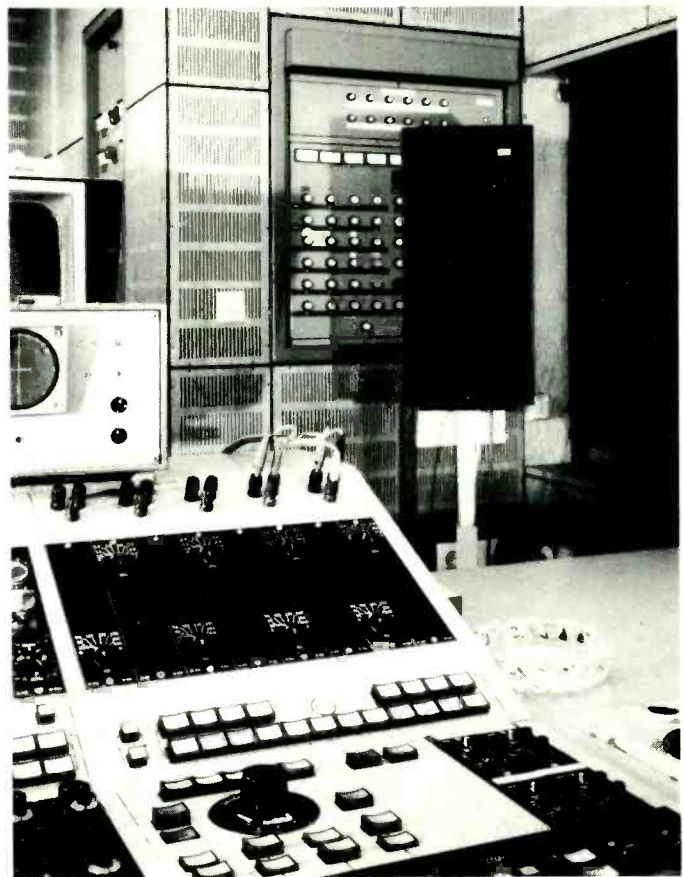
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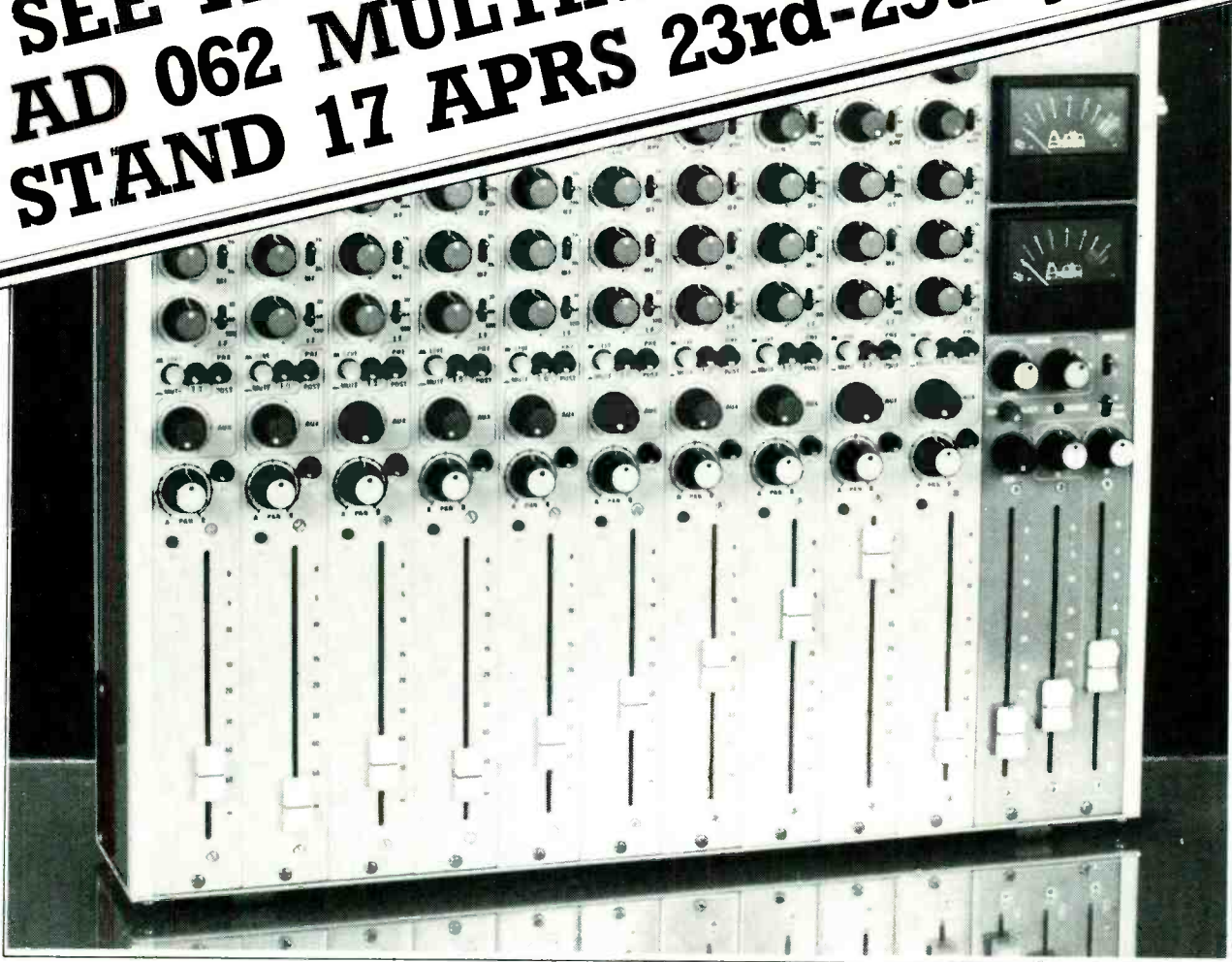
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## PRECISION



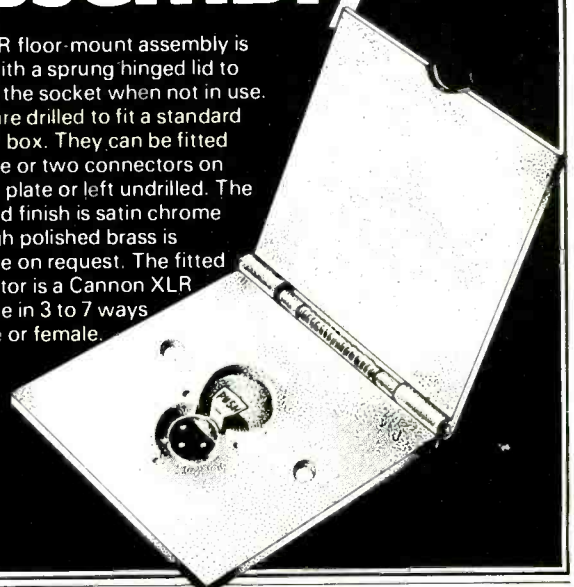
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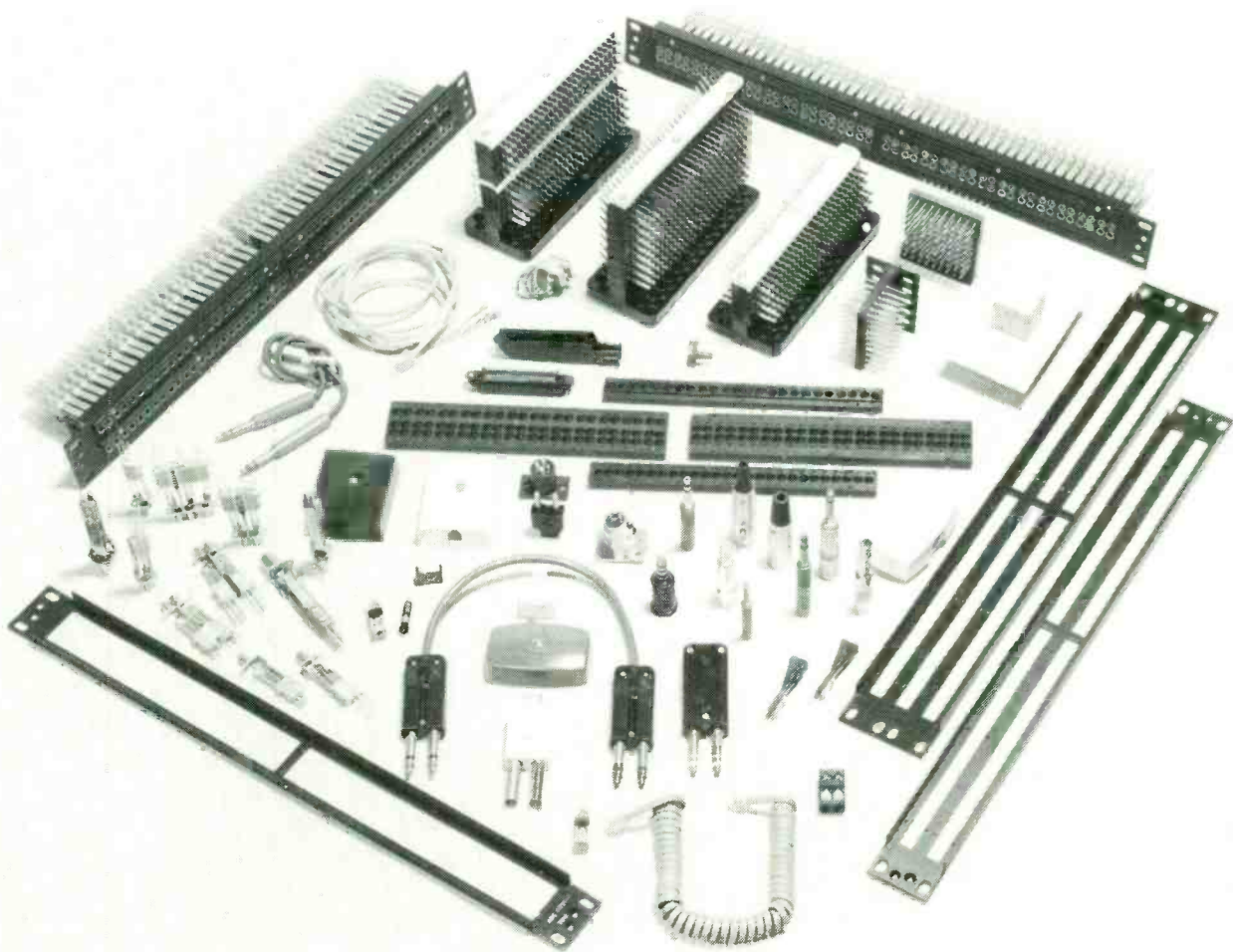
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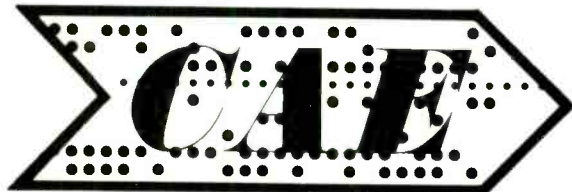
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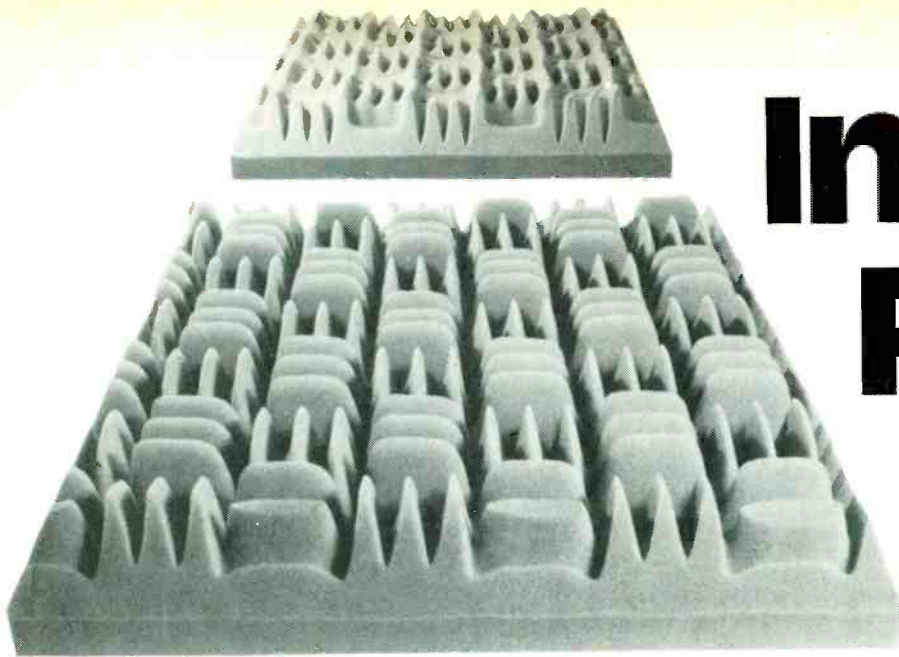
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# Infinity Panels

**A sculptured acoustic treatment, that 'absorbs' sound as effectively as an open window.**

An open window is the most effective sound absorber you can have. But it's not a practical solution for studios or control rooms. So all manner of bulky and costly treatments, that range from Helmholtz resonators to fibreglass, have been used to achieve some degree of acoustic control, yet till now, nothing has come close to the open window. The lightweight Infinity Panel is four times as effective as carpeting or acoustic ceiling tile, and it's an instant solution for many acoustic problems.

## Absorbing, the truth

Sound 'absorbing' materials don't in fact 'absorb' sound. Two phenomena occur when sound level is reduced by a treatment or structure. Firstly, sound energy is converted by friction, into noiseless heat energy and dispersed in the material. Secondly, kinetic sound energy is dissipated by the process of multiple reflections and deflection. Simple material fibres offer some degree of one or both of these characteristics. The Infinity Panel combines an optimised material and shape for maximum effectiveness, producing the closest approximation to an open window with an acoustic panel.

## New Processes

This new product is the result of several advanced technologies.

The base foam is produced by a technique known as open cellular foaming. Air cavities created in the material, have 'absorbing' characteristics which are a great improvement over those attributed to those of conventional tiles.

Blocks of material are then cut, by a highly guarded process into a mating pair of panels with identical acoustical properties. The three dimensional contour is based on the 'anechoic wedge' profile, a standard accepted by scientific research and acoustic laboratories. The Infinity Panel presents a total surface area up to 450% greater than a flat material of the same dimensions.

## Not a total Panacea

The panels have an overall depth of 100mm, maintaining their remarkably high 100% absorption characteristic right down to 250Hz. You can locate them in your control room and discover how troublesome reflections instantly disappear and sounds becomes clearer as separation improves. In the studio, the effect's the same, enabling you to get greater isolation between microphones used for multitrack, or the stereo spread across a drum kit.

Low frequency problems are a function of your particular room size and geometry. Our 'Acoustics Cookbook' includes the basic formulae to analyse these and provides charts for simple 'gobo' construction.

Infinity Panels, used in conjunction with these low frequency 'absorbers' offer entire room treatments that are both easy and economical.

## Instant applications

You can quickly correct your control room, or simply create a live end, dead end environment in your studio. Acoustic screens are simply made by attaching Infinity Panels to a

simple ply or blockboard frame. The result is an effective screen that's half the size of any equivalent conventional partition, and probably several times lighter.

Install Infinity Panels with any convenient method. Use panel adhesive, contact adhesive or mechanical fasteners. They can be glued to plaster, panelling, masonry or simply stapled to stud walls.

## Cost Effective

Infinity Panels are not cheap. They are made by Illbruck, one of Germany's market leaders in noise control products. At £28.00 (plus VAT) for a square metre, they may appear to be the most expensive treatment on the market. Yet because they are twice as effective as any other treatment, and can be applied in less than half the time, Infinity Panels are an economic way of controlling acoustics in studios and control rooms.

If you need to achieve cost effective acoustic control for your studio or control room, we urge you to evaluate the Infinity Panel for yourself.

Write or call now for a copy of the 'Acoustics Cookbook' that shows you how it's possible to attain a high degree of control without excessive cost or complication.

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## AES Anthologies

The Audio Engineering Society has asked us to remind readers of the availability of its Anthology Series of collected reprints of significant papers from the AES Journal. Current anthologies available include *Disc Recording* (two volumes) edited by Stephen Temmer, dealing with pickups, tone arms, turntables, groove geometry, cutter-heads, styli and lacquer blanks, record pressing and high density disk technology; *Loudspeakers* edited by Raymond Cooke, covering design, construction and operation; *Microphones* edited by Louis Abbagnaro, covering calibration and testing, general purpose, directional and miniature types, plus associated circuitry; *Quadraphony* edited by John Woodward, providing a historical perspective and basic understanding of multichannel sound recording and reproduction; and *Sound Reinforcement* edited by David Klepper, dealing with significant aspects of sound reinforcement technology and various sound system design and installation applications. Each anthology costs \$19.00 (\$22.00 to non-members). In addition, the AES has also just published a Cumulative Index, a reference guide to articles published in the AES Journal over the last 31 years. Price of the index is \$7.50 (\$9.00 to non-members).

**Audio Engineering Society, 60 East 42nd Street, New York, NY 10165, USA. Phone: (212) 661-8528. Telex: 620298.**

## Advision expansion

In addition to the comprehensive facilities Advision Studios offer for sound recording, film dubbing and recording to picture, Advision has now installed a video post production suite. Concept of the new facility is that of a 'customer self drive operation' and Advision has even produced a pre-recorded video instruction cassette which takes the first time user through the whole editing process. The new suite is based around the new Sony 5850 front loading *U-matic* video cassette recorders which are controlled by an *RM440* edit controller, allowing automatic rehearsals and edits to be performed in assembly or insert modes. Video monitoring is via new Sony *PCM 200PS* 20in monitors and a high resolution caption camera is provided to allow captions to be superimposed over pre-recorded material. In addition to the stereo sound facilities on the 5850, live and pre-recorded music, effects and commentary can be mixed into the final programme from either a cassette, open reel recorder, cart machine, or from a live microphone source.

## Acoustical consultants

The American National Council of Acoustical Consultants has provided us with a copy of its 1981-1982 directory. This directory, which is published bi-annually, lists members by state and country, and in a special member profile section, by the types of services they perform and typical projects they have undertaken. In



## Celestion quality control

Celestion, the Ipswich loudspeaker manufacturer, has completed a major factory refit, including a £150,000 investment in new production equipment designed to maintain and ensure the quality of its products. The equipment—all of it designed and built in-house—is of two kinds: general purpose manually-operated test rigs to check sub-assemblies; and a sophisticated computer-controlled system, which as an integral part of the company's anechoic chambers at the end of its

main production lines, gives each loudspeaker a rigorous final quality check. This final test system uses a microcomputer to store standard performance data which is then referred against the individual loudspeaker under test. An oscilloscope display then simply shows whether the tested unit matches the required standard and is within specification—in addition a Bruel & Kjaer plotter provides a printed response curve as a permanent record of the test.

## Cassette copying

Gateway Cassette Copying has recently installed a large bank of Nakamichi 5 Series cassette machines for the purposes of real time cassette copying. Prices and full details are available from: **Gateway Cassette Copying, 1a Salcott Road, London SW11 6DQ, UK. Phone: 01-223 8901.**

addition, the directory gives practical advice on how to select an acoustical consultant and explains the broad categories of acoustics which members practice. Copies of the directory are available at a cost of \$5.00 from: **National Council of Acoustical Consultants, 66 Morris Avenue, Springfield, New Jersey 07081, USA. Phone: (201) 379-1100.**

## SPARS standard

SPARS, the American professional recording studio organisation, has published the first of its recommended technical engineering procedures for all recording studios. The first standard covering recommended alignment tones for master audio tapes is designed to provide a uniform method of preparing and recording alignment tones for master tapes, and is intended for recording engineers with responsibility for ensuring the accurate reproduction of material produced under an engineer's technical direction. Tapes covered by the procedure include session tapes, multitrack masters, original masters, production masters (international), copy masters and safety copies.

### PROCEDURE:

#### 1 Specific tones and duration

	Frequency		Duration	
	30in/s	15in/s	2-/4-track	Multitrack
Band One	1kHz	1 kHz	30s	60s
Band Two	10kHz	10kHz	30s	60s
Band Three	15kHz		30s	60s
Band Four	100Hz	100Hz	30s	60s
Band Five	50Hz		30s	60s
Band Six	Dolby tone (if applicable)	Dolby tone	30s	60s
Record Pad	N/A		N/A	5s

#### 2 Recorded level

- All tones to be recorded at normal operating level with playback deviations noted in decibels of change from the 1kHz reference (ie 50Hz = -2dB).

- All tones to be recorded with noise reduction bypassed.
- Legends to indicate recorded level relative to a standard reference flux level (ie +3dB/185nWb/m).
- Legends of tapes to be used for mastering should notate the peak recorded level above the extended reference (ie Audio Peaks = +5dB).

#### 3 Preparation (2-track masters)

- On single release masters leaded tones to be provided at the front of the reel.
- On album release masters leaded tones to be provided at the head of each side of the master.
- On extended 30in/s album masters, when sufficient space for tones on the master is not available, a separate 'Tone Reel' should be provided.
- In the case of 'Production', 'International', 'EQ' or 'Cutting' masters, tones are to be regenerated by the mastering facility and not copied from the original master tones.
- Identification markings to be added to all metal reels (ie Original Master).

#### 4 Preparation (multitrack masters)

- Tones and record pad to be provided on a separate master reel whenever possible. Tones to be leaded at the head of the reel followed by the record pad.
- Legends for multitrack masters must indicate the type of tape used (ie 3M-250, Ampex-456, etc).
- Identification markings to be added on all multitrack reels (ie Master, Slave, Tone Reel, Record Pad).
- Legends for tapes that utilise partial noise reduction should be indicated ('Partial Dolby') on the master legend and the specific tracks identified.



# YOU CAN JUDGE US BY THE COMPANIES WE KEEP

We've always made a point of associating with the very best names in the world of audio.

In the field of equipment rental, for instance, we provided a sound system that satisfied the exacting requirements of Genesis.

That system was driven by Amcron power amplifiers—arguably the best in the world.

And Amcron appointed us to handle their business in the UK, including the launch of their revolutionary Pressure Zone Microphone system.

After amplifiers, it was logical that we should also supply the best in loudspeakers—Gauss. Their unequalled power handling capability and superb sonic accuracy make them first choice for many PA,

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musical instrument and studio monitoring applications.

In the recording equipment line, we stock Fostex. They've revolutionised the field of personal multi-track recording, with 4 and 8 track machines which are well within the means of even the enthusiastic amateur.

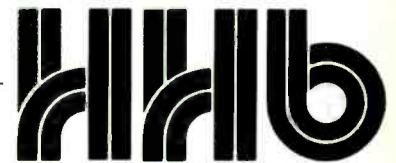
We could carry on dropping names all day. Sony Professional. Amek/TAC

concert and studio mixing consoles. Dbx, Eventide, Lexicon effects. JBL components, monitors and spares. Revox/Studer tape machines. Brooke Siren Systems. Beyer and Shure microphones and accessories.

So you can be sure that if we're prepared to sell or hire it to you, it's got to be the very best of its kind.

Because in the end, we know our reputation depends on it.

For more details of our services for artistes, studios, film and TV companies, music venues and in the fields of industry and education, call Ian Jones on 01-961 3295.



## Multitway connectors catalogue

Highland Electronics has produced a new 20 page brochure (Publication No HCG 1 Part 2) detailing its various types of multitway connectors. The brochure includes D-type metal flanged plugs and sockets 9-50 poles; DIN 41615 assemblies with floating mounted pins 7-50 poles; PCB connectors in three forms to DIN 41612 with two or three rows of contacts up to 96 poles; ribbon cable connectors with insulation displacement termination 10-50 poles; double row pin bar

connectors for PCB interconnection 13-31 poles; and PCB connectors with a single or double row spring contacts 4-178 poles. Copies of the brochure are available from: **Highland Electronics Ltd, Highland House, 8 Old Steine, Brighton BN1 1EJ, UK. Phone: 0273 693688. Telex: 87616.**

## Panduit catalogue

Panduit has produced a comprehensive catalogue detailing its wide range of cable ties and wiring aids. The catalogue describes and illustrates a variety of products

including marker, clamp, push-mount and heavy duty ties, plus aerial support ties, ducting, wire retainers and numerous cable mounts. Copies of the 44 page catalogue are available from: **Panduit Ltd, Lordswood Ind Estate, 61/65 Revenge Road, Chatham, Kent ME5 8YT, UK. Phone: 0634 660811/5. Telex: 965393.**

## APRS studio engineering course

The Association of Professional Recording Studios has provided us with details of its 9th International

Course for studio engineers. As with previous courses the venue is the University of Surrey in Guildford, and it runs from September 11 to 17.

The course provides a thorough grounding in all aspects of studio engineering, and includes sessions on digital recording and the *Compact Disc*. Cost of the course is £345 for APRS members, £368 for non-members. Application forms are available from: **The Secretary, The Association of Professional Recording Studios, 23 Chestnut Avenue, Chorleywood, Herts WD3 4AH, UK.**

## Agencies

● Redwood Marketing has announced that the Barth range of signal processing equipment, the Woelke range of tape heads and test equipment, and the *Param* computerised equaliser system, all previously marketed by Audicon, are now being marketed by: Redwood Marketing, 820 Redwood Drive, Nashville, Tennessee 37220, USA. Phone: (615) 331-4743.

## People

● Acoustic Technology Ltd has appointed Bernard Postlethwaite to the board of directors.  
 ● The IBA has announced that John Whitney, at present managing director of Capital Radio, is to succeed Sir Brian Young as its next Director General.  
 ● Larry Lamoray, formerly with MCI Inc, has joined Auditronics Inc as its international marketing manager.  
 ● Dr Jorg Sennheiser has formally taken over from his father Dr F Sennheiser as head of Sennheiser Electronic KG.  
 ● Emilar has announced a series of new appointments—Harold Mosier has been appointed general manager and vice-president; Pat Everidge has been appointed vice president of engineering; and George Meals has been appointed sales manager.  
 ● Feldon Audio has appointed John Didlock as a senior sales consultant.

## Contracts

● Aphex Systems has supplied *Aphex II* units to a number of radio stations including WHYI Fort Lauderdale; KMJQ Houston; KLAZ Little Rock; KFI and KRLA Los Angeles; KEBC Oklahoma City; and KMJM St Louis. Units recently supplied to recording studios include The Lion's Share, owned by Kenny Rogers; Eddie Rabbit's Briar Patch; Buller Recording Studio in Nashville; CBS in Mexico City; Neil

Young's Broken Arrow; Sound Labs, owned by Frankie Valli and Bob Gaudio; Hansa Studios in Berlin; Rediffusion in Kuala Lumpur, Malaysia; and two studios in Canada, Morgan Earl in Toronto and Son Quebec in Quebec.

● Wilson Audio, Franklin, Tennessee has supplied Music Mill Recording Studio, Nashville with a Trident TSM 24-track console with *Fadex* automation.

● Denis Tyler Ltd has been awarded a £125,000 contract by RTV Sarajevo for the supply of recording equipment to assist in the coverage of the next Winter Olympics. Heart of the contract is a Neve 48-channel microprocessor controlled audio control console.

● The Foreign and Commonwealth Office has ordered a specially designed Standard B satellite earth station from Marconi for broadcasting BBC Overseas Service programmes to Pakistan, India, Iran and the Middle East.

● Neve has announced that the BBC has now formally ordered a DSP digital console, a 48-channel model for use in a specialist OB vehicle. In addition, CTS Studios (The Music Centre), Wembley has also ordered a DSP console.

● Eastlake Audio has completed a number of projects including a disc cutting room for the Ministry of Information of the African Republic of Togo, adjacent to the Eastlake designed studio completed in 1980; new control rooms and studios for Rogers All Stars and International Record Industries in Nigeria; and in the UK, control room and studio reconstruction projects for The Music Centre, Wembley, RG Jones, Wimbledon, and Revolution Studios, Manchester. Projects currently underway include Instituto Ninos Cantores Del Zulia in Maracaibo, Venezuela, and a complex for Socodi Recording and Disc Cutting in Brazzaville, Congo.

● Alangrove Builders has recently completed the following projects:

Frank Farian's control room and studio near Frankfurt; four video editing suites for Molinare, London; and a control room and studio for Atomic Records, Munich. Current commissions include a control room and studio for Molinare; video editing suites for Atomic Records, Munich; an update for Rock City, Shepperton; and the design and construction of a private studio and control room for Jon Hiseman in Sutton, Surrey.

● Court Acoustics has recently completed reconstruction and installation work at the new South London concert venue, Fair Deal, involving a 24-track studio/live control room, provision of a 20kW Court-JBL sound system, plus full video recording facilities. Other recent projects have included a 4-channel sound system for the Piccadilly Xenon and a system for the new Camden Palace.

## Address changes

● Loudspeaker manufacturer Tannoy has changed its head office address: Tannoy Ltd, 21 Canterbury Grove, West Norwood, London SE27 0PW, UK. Phone: 01-670 1131. Telex: 291065.

● Raindirk Ltd has a new telephone number: 0366 382165.

● French console and tape machine manufacturer Enertec can now be contacted at: Enertec SA, 1 rue Nieuport, F-78140 Velizy-Villacoublay, France. Phone: 946 9650. Telex: 697430.

● Dell Technical Vehicles has moved to a new factory and can be contacted at: Dell Technical Vehicles Ltd, Brokenford Lane, Totton, Southampton SO4 4DX, UK. Phone: 0703 860044/860045. Telex: 477426.

● Sierra Audio has relocated its offices to 293 South Grand Avenue, Pasadena, Cal 91105, USA. Phone: (213) 793-1900. According to president Kent Duncan, the move has been precipitated by a need for additional space as the company has

expanded its operations to include the video field.

● Toa Electronics Inc, the San Francisco based commercial and professional sound equipment company, has moved to 480 Carlton Court, South San Francisco, Cal 94080, USA. Phone: (415) 588-2538. Telex: 331332.

● The United Scientific Corporation has moved to 4800 Patrick Henry Drive, Santa Clara, Cal 95054, USA. Phone: (408) 988-7722.

## Financial

● After several months of negotiations, it has been announced that Bill Allen, David Rettig and Bob Rodgers have purchased MicMix Audio Producers Inc. The new owners are all long-time employees of the company. Following the purchase Bill Allen has become president, David Rettig becomes vice-president/secretary, while Bob Rodgers becomes vice-president/treasurer. The company's existing product range is unaffected by the acquisition.

● Agra Investments BV based in the Netherlands, a subsidiary of The Agra International Group, a Middle Eastern and European trading and industrial conglomerate with interests in shipping, manufacturing, raw materials, construction and marketing of consumer and industrial products, has acquired a controlling interest in InterMagnetics Corp. The Agra International Group, which is based in Dubai, has not disclosed the terms of the transaction. InterMagnetics Corp, which is based in Santa Monica, California, is a worldwide manufacturer of audio and video tape machinery and a specialist in building tape plants. The company has audio cassette licensing partners and manufacturing plants in Singapore, Indonesia, Hong Kong, Taiwan, India, Thailand, Transkei, Egypt and Turkey; and audio/video technology-marketing centres in the USA, Japan and England. 44 ▶

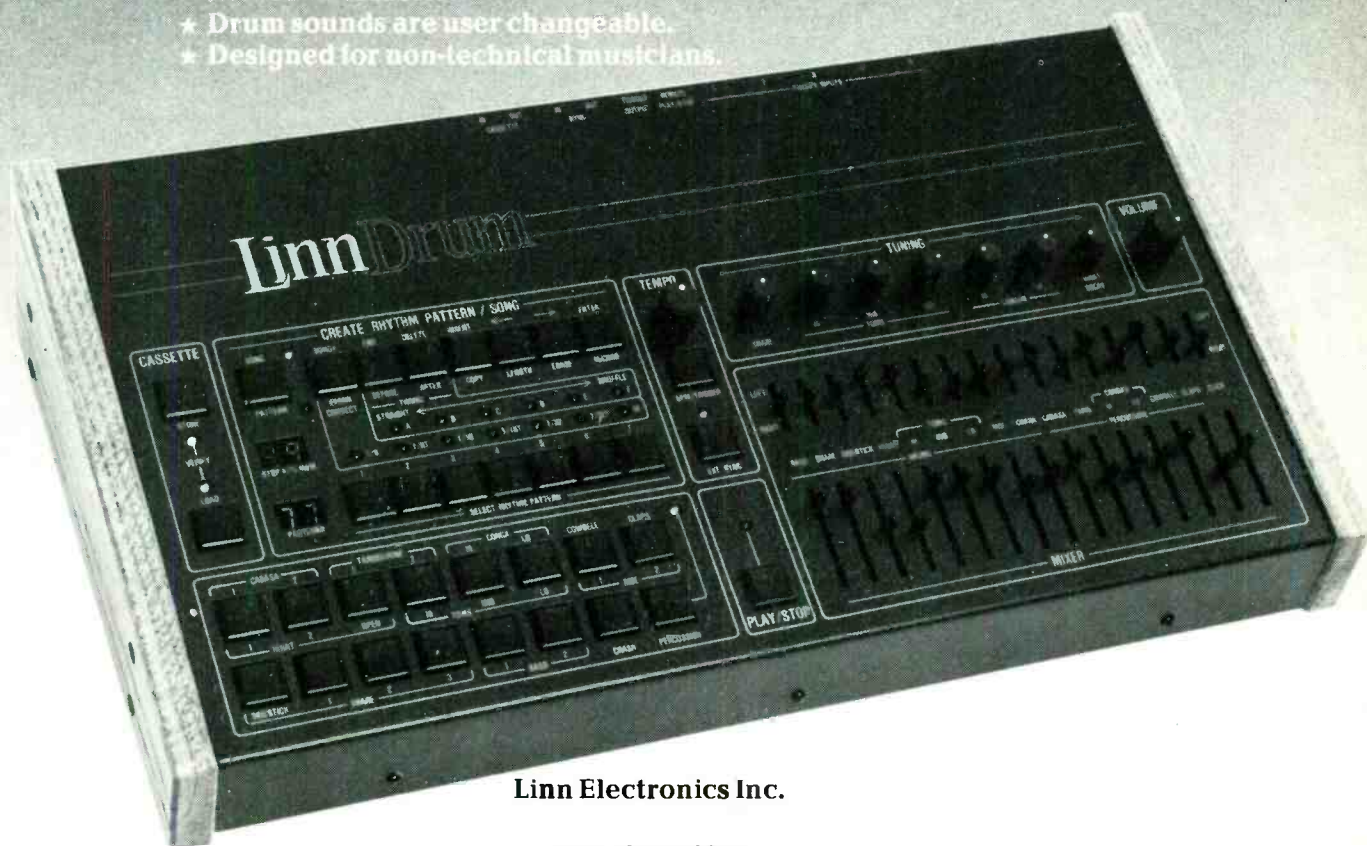
# The best gets better!

## Linn Drum

successor to the much acclaimed LINN LM1

The playable drum computer featuring:

- ★ Real drum sounds of studio mastering quality stored digitally.
- ★ Crash and ride cymbals, bass, snare, sidestick snare, open and closed hi hat, cabasa, tambourine, 3 toms, 2 congas, cowbell and hand claps.
- ★ 49 rhythm patterns – all programmable in real time with adjustable error correction.
- ★ Stereo mixer with volume and pan sliders, plus separate outputs.
- ★ Dynamics, song structure, time signature and 'human rhythm feel' are all programmable.
- ★ Drums tunable by front panel controls or control voltage inputs.
- ★ Drums may be externally triggered by drum synthesiser pads or any audio source.
- ★ Will sync to tape/sequencers/synthesisers.
- ★ Programmed data is retained with power off, or may be off-loaded to cassette.
- ★ Drum sounds are user changeable.
- ★ Designed for non-technical musicians.



Linn Electronics Inc.

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## Computer Music Conference

The Sixth International Computer Music Conference (ICMC 82) is to be held for the first time in Europe, in Venice, Italy, from September 28 to October 2, 1982. This conference will cover such topics as computer composition, synthesis techniques, computer music systems, music input languages and data structures, and digital audio. A wide variety of papers will be presented, numerous computer music compositions will be played, and computer music systems will be on display. Full details are available from: **La Biennale di Venezia, ICMC 82, Settore Musica San Marco, Ca' Giustinian, 1-30124 Venezia, Italy. Phone: 041 70.03.11. Telex: 410685.**

## Court Acoustics

Court Acoustics Ltd of Britannia Row, London, has now relinquished its partnership with Pink Floyd Music. Despite this change the company will retain its professional relationship with Britannia Row Production and Britannia Row Studios, while Stephen Court will remain as the company's managing director.

## Forthcoming exhibitions

**June 3 to 6**  
AES Digital Audio Conference, Rye, USA ((212) 661-2355).

**June 23 to 25**  
APRS Exhibition, London (09237 72907).

**September 18 to 21**  
International Broadcasting Convention, Brighton (01-240 1871).

**September 28**  
Sound Broadcasting Equipment Show, Birmingham (0734 53411).

**October 22 to 25**  
AES 72nd Convention, Anaheim, USA ((212) 661-2355).

**January 24 to 28, 1983**  
Midem '83, Cannes, France (505.14.03).

**March 15 to 18, 1983**  
AES 73rd Convention, Eindhoven, Holland ((212) 661-2355).

**April 10 to 13, 1983**  
NAB Convention, Las Vegas ((202) 293-3500).

**October 9 to 12, 1983**  
AES 74th Convention, New York ((212) 661-2355).

## Oops!

Due to an editorial oversight we omitted the Rebis *RA201* from the noise reduction and gating product

guide in our March issue. The *RA201* noise gate which forms part of the *RA200 Series* modular sound processing system offers between 2 and 40dB of attenuation, has an attack time variable from 20µs to 4ms, and a release time variable from 50ms to 10s. It also has facilities for external triggering.

The *RA200 Series* also includes the *RA210* RIAA disc preamplifier which was omitted from our May product guide on record reproduction equipment. This unit features gain, LF and HF  $\pm 12$ dB EQ, and L-R balance controls, plus an EQ and balance bypass facility.

We apologise to Rebis Audio and to our readers for any inconvenience caused by these omissions.

## Trident Studios

Following the recent demise of Trident Studios which went into liquidation late last year, it is heartening to hear that the studios have been bought by another company, and recommenced operations in mid-December of last year. The studios which retain the name Trident Studios, have been purchased by Mel Morris of Stallmint Ltd, who

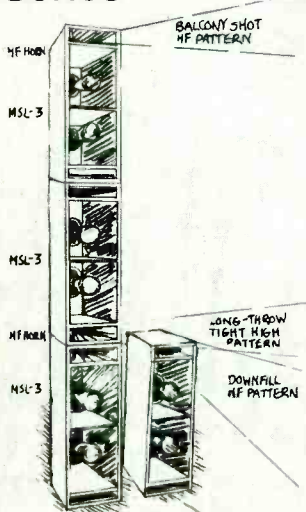
manages various bands including Visage.

At present the studios are operating as before although it is intended that an update programme will be undertaken on them later this year. Current staff at Trident are Stephen Short, studio manager; Colin Green, engineer; Ray Staff, cutting engineer; and Carol Staff in charge of bookings. It should be noted that these developments in no way affect the position of console manufacturer Trident Audio Developments Ltd which was and remains an independent entity from Trident Studios.

## 3M Scotch 226

3M has released a comprehensive datapack for its recently introduced *Scotch 226* audio mastering tape. The pack contains full details of both the magnetic and electromagnetic properties of the tape, together with line up instructions for the most commonly used professional tape machines. Copies of the pack are available from: **Martin Luddington, 3M UK Ltd, 3M House, PO Box 1, Bracknell, Berks RG12 1JU, UK. Phone: 0344 26726.**

## 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 cross-over 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 pro-

ducing 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.

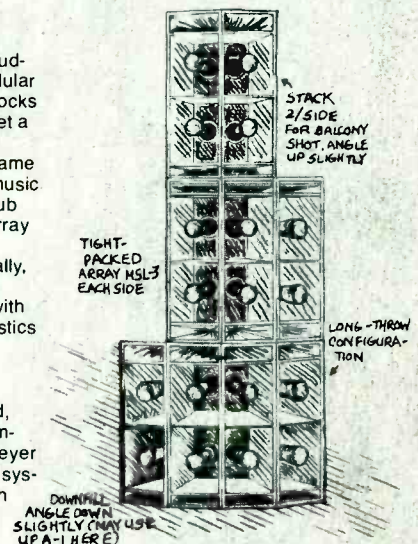
### Modular Design

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

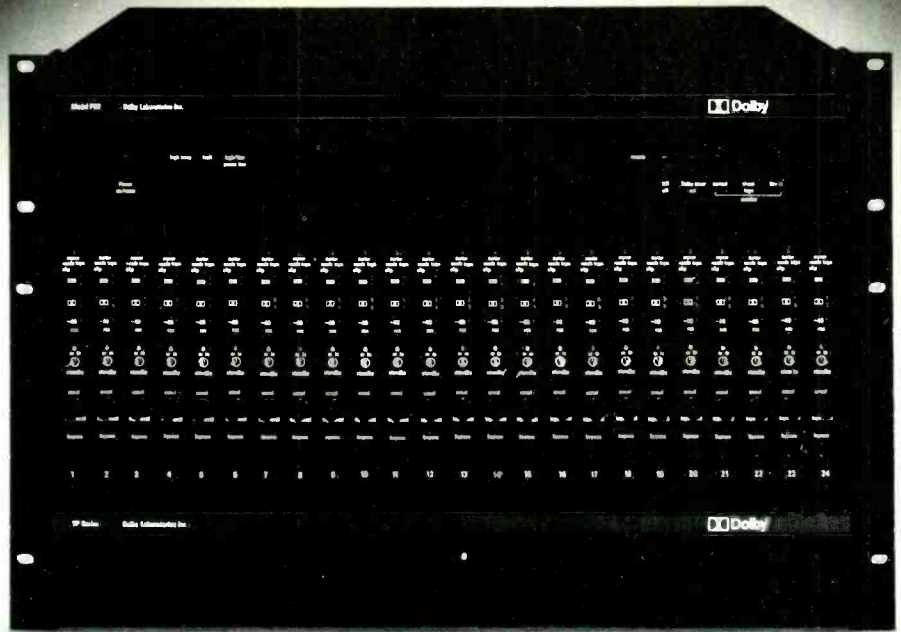
achievable. If you would like more information on the theory behind our arrayable systems, and how these systems can be made to work for you, call or write us today.



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New from Dolby Laboratories:

## The Dolby SP Series Multi-track noise reduction unit

Dolby noise reduction is an integral part of professional multi-track recording practice in music, radio and TV broadcasting, and film studios throughout the world. A new noise reduction unit, the Dolby SP Series, has been developed for these and other applications, and provides up to 24 tracks of Dolby A-type noise reduction in only 12 $\frac{1}{4}$ " of rack space. The SP Series' combination of compact size, ease of operation, and new features makes it ideal for equipping new recording facilities and upgrading existing ones.

For further information on the SP Series and other professional noise reduction equipment, contact Dolby Laboratories.

### Highlights of the Dolby SP Series:

- Up to 24 tracks in only 12 $\frac{1}{4}$ " of rack space, including power supply.
- Dolby A-type noise reduction characteristics utilizing standard Dolby Cat. No. 22 modules.
- Separate regulated power supply unit with electronically-controlled output protection.
- Low-noise fan cooling.
- LED display for each track permits accurate Dolby level calibration (within  $\pm 0.1$  dB if desired) by matching intensity of LED pairs; further LEDs

indicate the presence of signals and clipping, and assist alignment with high-level reference tapes.

- Front-panel "UNCAL" control for each track permits rapid resetting of Dolby level for playback and punch-in on nonstandard-level tapes, then instant restoration of preferred preset studio Dolby level without recalibration.
- User-selectable option of "hard" or electronically-buffered bypass of individual tracks and of all tracks simultaneously.
- Snap-fit connectors on rear panel for rapid disconnection and reconnection.
- Balanced and floating input stages.
- Output stages drive either single-ended or balanced 600-ohm loads at levels up to +28 dB (19.5 V) before clipping.
- Ultra-low-distortion input and output amplifiers.
- Remote ground-sensing output configuration minimizes hum pickup when driving single-ended loads.
- Discrete FET switching for reliable, noise-free routing of audio signals.

Dolby Laboratories, 731 Sansome Street, San Francisco, California 94111, Telephone 415-392-0300, Telex 34409. 346 Clapham Road, London SW9, Telephone 01-720-1111, Telex 919109. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. S81/3621

# new products

## Eddor radio mic systems

American manufacturer Eddor has produced new high and low band radio mic systems. The *E-Com* high band systems (150 to 210MHz) feature new improved circuitry, new switches minimising RF 'pop', battery life indicators, phantom power, new antennas, new simple battery changing facility, improved durability, new high power multiple input transmitters, new diversity circuits and new styling. The *PM* low band systems (30 to 50MHz) similarly have been improved with the provision of new distortion correcting circuitry, receiver signal strength indicators, new diversity circuits and new styling. **Eddor, 16782 Hale Avenue, Irvine, Cal 92714, USA. Phone: (714) 556-2740.**

## MicMix XL-210A

MicMix has announced the release of a new version of the popular *XL-210* reverb system. The new model, designated the nomenclature *XL-210A*, retains the features of its predecessor, the major changes being in the unit's cosmetics and sound. As far as the sound is concerned the use of improved technology has given the unit more HF reverberation as well as an improved transient response, whilst on the cosmetic side the positioning of some of the controls has been altered.

**MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220, USA. Phone: (214) 352-3811.**

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

## Harrison preview TV console

The *TV-3* console from Harrison, previewed at the Montreux AES prior to full exposure at NAB, is specifically designed for the TV audio post-production market, with full multitrack audio recording capability. An interesting feature of the console is that it is specifically designed for stereo, as well as mono TV sound; a facility which will become increasingly more important with the advent of stereo TV broadcasting and the appearance of domestic VCR units with stereo audio capability. Stereo line input modules as well as mono modules are available, and various Harrison ancillaries, including the *Auto-graph* cinema-type graphic may be incorporated in the main frame. The *TV-3* automation interface is Melkuist, *Auto-set* and *65K*-compatible, and a long list of features adds up to an impressive, compact package.

Standard features include 104mm conductive-plastic VCA faders; PFL, AFL, Mute and Cue switch-selected functions; automation control switching; VCA group selection; VCA level-match LEDs; 3-band EQ with overlapping ranges; HPF and LPF; four aux sends with individual level and pre/post switching; input selector switch; phase reverse; patch-point pre/post and in/out switching; signal presence LED and peak-level LED indicators.

**Harrison Systems Inc, PO Box 22964, Nashville, Tennessee 37202. Phone: (615) 834 1184.**

**UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091.**

## Agfa PEM 428

Agfa-Gevaert has introduced a new professional studio tape, type *PEM 428*. The new tape is claimed to be particularly suitable for use in conjunction with the existing *PEM 468* tape, as it has exactly the same bias setting and identical technical properties. An advantage of the new tape is that it offers the bonus of a longer playing time, since the tape base is only two-thirds the thickness of standard play tape. A further advantage is that when used in conjunction with video programmes it allows users to have a soundtrack tape of the same duration as the video tape, thereby eliminating the need to use

two reels of tape and two tape machines as was previously the case.

*PEM 428* is available in 1/4in, 1in and 2in tape widths on 10 1/2in NAB or 14in spools.

Agfa has also announced that *PEM 468* is now additionally available on 12in and 14in spools. **Agfa-Gevaert AG, D-509 Leverkusen, West Germany.**

**UK: Agfa-Gevaert Ltd, 27 Great West Road, Brentford, Middx TW8 9AX. Phone: 01-560 2131. Telex: 28154.**

**USA: Agfa-Gevaert Inc, 275 North Street, Teterboro, New Jersey 07608. Phone: (201) 288-4100. Telex: 0134410.**



## Eela S 2000-L

Eela Audio has introduced a new in-line mixing console with digitally controlled status switching. The *S 2000-L* is suitable for stationary or mobile recording studios, broadcast production or OB usage, and theatre and sound reinforcement applications. The new console has a frame accepting a maximum of 32 input/output modules and a central master/monitor section. I/O, master, monitor and communications modules are available.

The I/O module features group assignment switches for routing to 16 outputs with odd/even panning and direct facility; a transformer balanced mic input (optional differential input) with phantom power, phase reverse, 20dB pad and gain control facilities; line input with fixed +4dBm sensitivity; 12dB/octave highpass filter; 4-band EQ section with fixed HF and LF shelving curves and two sweepable MF  $\pm 15$ dB sections, plus a bypass facility; cue level and pan stereo mix buss available as effects sends in remix; two aux sends (optionally four); monitor level and pan controls; module status switches; and a 105mm conductive plaster fader. Other facilities include PFL and post fader switching on the aux sends with a special CHN switch to enable AUX 1 to be fed from the mic channel in REC or TAPE modes instead of from the normal monitor chain. The status switches which control the operational mode of the module include four local buttons which deselect the central status selection housed in the master module, to allow for functions such as subgrouping. Other status switches include automute select, solo and mute, the mute being channel mute in REC or TAPE and monitor mute in MIX. When subgrouping is used the monitor level control acts as the group fader.

The master module houses the central status

switches (REC, TAPE, MIX and BC) and selects the mode of operation of all the I/O modules which have not been deselected. The BC mode is the broadcast mode which brings the mic signal through the EQ section and fader to the stereo busses, thus forming a simple stereo mic mixer, the same signal also being group assignable. Other facilities on this module include master cue and aux controls; stereo balance control; stereo master fader; and an automute master which will mute all previously selected I/O modules.

The monitor module includes studio monitor controls; CUBES selector for an alternative set of loudspeakers such as the ubiquitous *Auratones*; mono switch; DIM switch; and a bank of control room selector switches for selecting the source for the monitors and main meter block. This block consisting of two VU meters, a stereo PPM bargraph and a phase meter. Metering for the I/O modules consists of 19 segment LED bargraphs with their displays being controlled by the status switching. In remix mode, for example, the meters can be switched to read the multitrack output.

Finally the communications module has a 10kHz, 1kHz and 100Hz line up oscillator with level control and routing switches to send the signal to the stereo outputs or to all group outputs. Other features include an echo return and the usual talkback facilities.

**Pieter Bollen Geluidstechniek BV, Hondsruglaan 83a, NL-5628 DB Eindhoven, Holland. Phone: 040 42.44.55. Telex: 59281.**

**UK: Eela Audio Industries Ltd, 13 Molesworth, Hoddesdon, Herts EN11 9PT. Phone: 09924 68674.**

**USA: Audicon Inc, 1200 Beechwood Avenue, Nashville, Tennessee 37212. Phone: (615) 256-6900. Telex: 554494.**

# The **SONY**® range of professional audio equipment by **FELDON AUDIO**

From the new C-48 studio condenser to the ECM-50 miniature microphone Sony's range covers every conceivable application. Included is the new 989 stereo microphone that employs three capsules and incorporates a facility for changing the directional axes both remotely and electronically.



**TC-D5 PRO Cassette Recorder**  
Sony's constant commitment to technological excellence is culminated in this extraordinarily compact unit, the TC-D5 PRO, with fully professional quality and long term reliability.



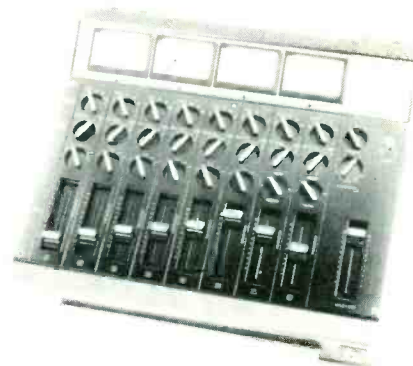
## **MX-P42 Mixer**

Sony makes the difficult easy in field production with the ALC (automatic level control) equipped M x 542 4 x 2 portable mixer. Direct VTR interface. Ganging facility, Pan Pots, Phantom power facility for condenser mikes.



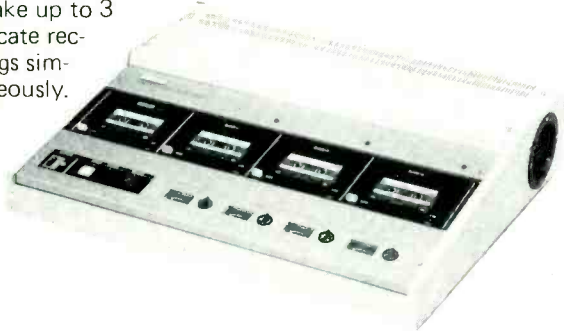
## **MX-20**

A fully professional microphone mixer with 8 channel inputs and 4 channel outputs.



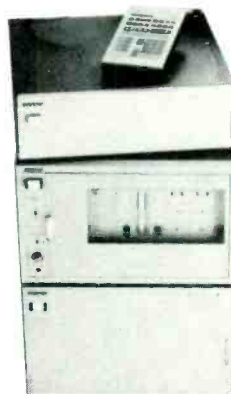
## **Sony Audio Duplicators**

High speed, high quality-sound duplication at eight times normal speed. The CCP-13A is a cassette to cassette duplicator designed to make up to 3 duplicate recordings simultaneously.



The Sony range of professional Digital Audio equipment now includes:-

- PCM-1610**, 16-Bit Digital audio recording system.
- DRE-1100**, digital audio editing system.
- DRE-2000**, digital reverberator.



For further information or demonstration of the superb range of audio equipment, or of any other Sony professional audio products please contact us at Feldon Audio

**FELDON AUDIO**

126 Great Portland Street, London W1N 5PH Tel: 01-580 4314. Telex: London 28668

# new products

## Olsen power amp

On 'static' demonstration at AES Montreux was a new power amplifier, the *Olsen O2* from Olsen Electroacoustics of Norway. The amp delivers 200W/channel into 8Ω at 1kHz, both channels driven; input sensitivity is 0dBm, and the input impedance is quoted as greater than 10kΩ, resistive at audio frequencies. Frequency response is given as within 0.5dB throughout the audio range, and the harmonic distortion is reckoned at 0.01% at -1dB referenced to full power. The slew rate is greater than 60V/μs.

A significant aspect of the amplifier is a new circuit configuration, known as 'conditional feedback', one of whose functions is to ensure that a clean signal is delivered even during momentary overload. The amp also features modular construction; sturdy mechanical design; dual paralleled inputs wired as per IEC/BS specs, connected direct to the PCB, eliminating low level signal wiring; capability of standing 200V overload on the inputs without damage; electronically balanced inputs; and easy conversion to bridged mode, which offers over 400W into 8Ω. An added feature of the amp is that it appears to have very little, if any, overall negative feedback.

In addition to the *O2* amp, the company also manufactures the *Olsen O1* phase-corrected crossover network, which is available in 3-way and 2-way plus centre-bass configurations. Crossover frequencies may be user specified.

**Olsen Electroacoustics, Elveveien 26-28, N-1472 Fjellhamar, Norway.**

## Sennheiser headphones

Sennheiser has released two new headphones, the *HD 40* and the *HD 230*. The *HD 40* is a compact type weighing only 60gm, has a light contact pressure, and earpieces that can be revolved on the headband by 90° for ease of storage. Specifications include frequency response 22Hz to 18kHz, impedance 600Ω, characteristic SPL 90dB, and typical distortion <1.2%. The *HD 230* is Sennheiser's answer to the problem of designing a 'closed' type headphone with good acoustic isolation from external noise, but with the same kind of sound quality as an 'open' headphone. This model, Sennheiser claim, achieves the above objective by using a dual system whereby a

special dynamic treble system handles frequencies between 10kHz and 30kHz, with a bass system handling frequencies between 10Hz and 10kHz. The *HD 230* has a low contact pressure, weighs 260gm, has a nominal impedance of 600Ω, a characteristic SPL of 94dB, and <0.1% distortion.

**Sennheiser Electronic, D-3002 Wedemark 2, West Germany. Phone: 05130 8011. Telex: 0924623.**

**UK:** Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Gerrards Cross, Bucks SL9 9UG. Phone: 02813 88447. Telex: 849469.

**USA:** Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018. Phone: (212) 239-0190.

## Studer push digital and analogue

On show at AES Montreux for the first time was the new Studer digital recorder, featured in our March issue. The unit demonstrated at the show was the 8-track recorder featured in our exclusive cover picture, other models only existing currently as mock-ups. In addition, the company premiered a new medium-cost analogue recorder, the *A810*. This elegant unit features micro-processor control (2 × 6803) which optionally permits total handling of timecode and synchronisation facilities, plus the ability to store audio parameters which may also be accessed via serial data link. Fitted as standard is a zero locator and 4-address autolocate, including three user-programmable extra function keys. The recorder is designed to interface with automation systems via serial data linkup, and also includes an integrated self-test system which may be accessed remotely.

All the electronics are accessible from the front of the recorder, and feature floating balanced ins and outs, with or without transformers. Sync

repro and safe/ready switching is standard and a drop in/out delay is incorporated. The metering is switchable peak/VU and the amps feature phase correction. There are no trimmers, the audio parameters being programmable. Calibration selection for two types of tape is included.

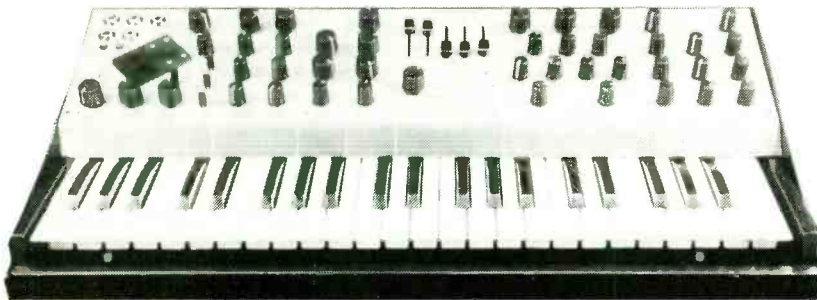
Options for the recorder include SMPTE inter-track timecode recording, mono/stereo level switching and an AF test generator with five frequencies.

The transport features servo-loop control, pulse-modulated spooling motors, four spooling speeds and a modular headblock assembly which may be supplied for mono, 2-track or 2-track plus timecode. The timecode-capable variant of the machine is designed for sound-to-picture, broadcast automation and logging applications, and timecode crosstalk is eliminated, claim Studer, by making the code-head system completely independent of the audio heads.

**Studer International AG, CH-8105 Regensdorf, Althardstrasse 150, Switzerland. Phone: 01 840 29 60.**

**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091.

**USA:** Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, Tennessee 37210. Phone: (615) 254-5651.



Synton's Syrinx

## Synton handle new Big Briar synth controllers

Synton Electronics BV of Holland have announced that they have obtained the exclusive distributorship for Big Briar products in continental Europe. Big Briar is the new company created by Dr Robert Moog, one of the pioneers of voltage-controlled sound synthesis. The company's speciality is controllers for synthesisers which enable the synth player to control many more dimensions of expression than were previously possible on keyboard instruments. Two of the major new products from Big Briar are the *Touch Plate*, which enables multi-parameter fingertip control, and a *Theremin*; following shortly is a touch-sensitive keyboard exploiting the *Touch Plate's* control facilities on every key; this will be available around September.

At the Montreux AES, Synton showed the *MXS804*, an 8/4 mixer for the home and small studio market. It features balanced mic inputs

(XLR) and unbalanced line ins which may also be used as insertion points in the mic channels. Each channel has a 3-band fixed-frequency equaliser. An effects return fader is fitted to each output group and remix switches eliminate patching for mixdown.

Also on show was the *Syrinx*, a new monophonic lead synth from Synton. It features a unique filter section with a 24dB/octave LPF, and two formant peak filters. All filter centre frequencies may be dynamically controlled, and an independent gain control for each formant peak is fitted. Serial or parallel filter routing may be switch-selected. The instrument also offers two VCOs plus LFO, noise generator and ring modulator. A special controller pad offers pitch-bend and filter cutoff frequency control plus amplitude and LFO speed control. Two full-parameter ADSR envelope generators are also included in the compact package.

**Synton Electronics BV, Box 83, 3620 AB Breukelen, Holland. Phone: 03462-3499.**

## New Melkuist items

Console automation manufacturer, Melkuist Ltd, has announced two new products. The first is a VCA grouping only version of the company's automation fader system for users who do not require mixdown automation. The new fader retains the invaluable VCA bypass facility for recording and non VCA group mixdown, while in the VCA mode it has both a mute switch and a true solo function. The second new product is a stand alone, 32-channel event unit with battery supported memory offering up to 250 memorised combinations of the 32 events programmed relative to SMPTE/EBU timecode. This system may be easily interfaced to the Melkuist *G7800* automation system for storage of events, while data may also be dumped to an audio tape recorder.

**Melkuist Ltd, 35A Guildford Street, Luton, Beds LU1 2NQ, UK. Phone: 0582 416028.**

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

**USA:** Studio Maintenance Service Inc, 12438 Magnolia Boulevard, North Hollywood, Cal 91607. Phone: (213) 877-3311. Telex: 674901.

**USA:** Trident (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 357-8337. Telex: 643678.



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# new Solid State Logic products

Premiered at the Dallas NAB Convention, but previewed at the Montreux AES, was Solid State Logic's new *Real Time System* and *Events Controller*. The new software/hardware subsystems are designed to be integrated within the existing *SL4000E* console. The systems are controlled by means of a compact alphanumeric keyboard plus named special function keys, the latter differing significantly in their functions from those on the standard studio version, as the new subsystems are specifically designed for use in film and video post-production and large-scale live broadcasting.

As the requirements of F/VAPP and broadcasting include the necessity to control a number of outboard devices, up to five panel areas in the centre of the console are allocated to the new

## Richard Elen

control systems. These include the *Real Time System*, the *Events Controller* and the *Synchroniser*. In addition, an *Effects Controller* is mounted in the patchbay.

### Real Time System

Unlike the familiar dynamic mix automation system, which operates in conjunction with SMPTE timecode off tape, the *RTS* offers an alternative way of handling a mix, which does not necessarily require timecode operation. Indeed, on a broadcast, for example, recordings may not be involved at all. Central to the concept of the *RTS*, therefore, is the preset, which contains a 'snapshot' of static fader levels. Any combination of fader positions and mute settings may be stored under a preset, plus up to 40 external voltage-controlled devices, whose operational control voltages may be interfaced via the *Effects Controller* mounted in the rack.

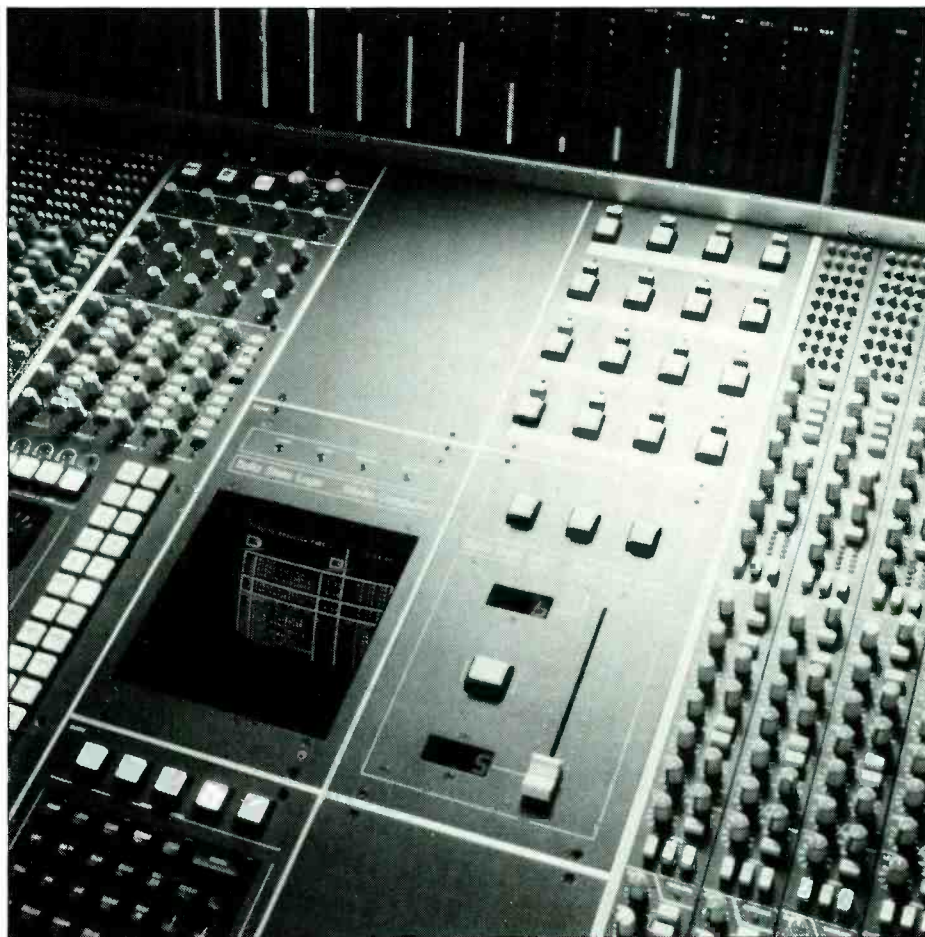
In a large-scale live mixing environment, a number of presets can be stored, each containing complete fader and mute data. These can be named individually, for example during rehearsals, and the resulting collection of presets may be assembled either directly (if the presets have been stored in their actual running order) or via an editing routine (if they require re-ordering) into a sequence. Presets may also be called individually, if, for example, an out-of-sequence preset is required at the last moment.

The software is able to recognise a preset name from as few characters as are necessary to identify it uniquely; as a result, when a given preset is required several times during a sequence, there is no need to type the full preset name when putting a sequence together. In the event that there are two presets with, say, the first character the same, the software prompts the user by asking which is required.

The actual sequence is very simple to run. Once assembled, a single button on the *RTS* controller allows the engineer to single-step through the sequence in either direction. In addition, a crossfade control enables one preset to be faded into the next, once again in either forward or reverse modes. This simple combina-

# Special feature

## Real time and Events System from SSL



The central control area of the SSL master studio system

tion of controls offers a great deal of flexibility without confusion or complex operational routines. As the sequence is run, the TV display shows its name, direction of play, the current and next preset numbers (with a pointer which moves between the two as the crossfader is operated), plus a list of preset names and numbers which may include timings and a box to highlight the current and next preset data. As the sequence moves on, the list of presets scrolls up (or down) the screen, giving an instant reference for the engineer.

In addition to the video display, 7-segment LED readouts at each end of the crossfader duplicate the 'current' and 'next' preset numbers.

As each preset is called, the desk is configured such that all mutes and fader positions are in the conditions they were at when the preset was stored (typically during rehearsal) with the controls in 'Trim' (update) mode, so that spontaneous alterations to the balance may be performed at any time without destroying, of course, the stored values of the preset.

It is possible to edit the sequence during a performance with no problems, allowing last-minute alterations to running order, and so on, to be swiftly integrated. In addition, the forward and reverse buttons may be used to skip in either direction through the sequence without altering the list.

Individual faders may be dropped into manual mode, and in addition, absolute status can be selected on all channels, enabling the engineer either to cut or crossfade to complete manual control during a performance. Fadeouts may also be accomplished at any time. Thus manual intervention is very easy, enabling the engineer, on the one hand, to simplify 'routine' cutting and crossfading between predetermined balances, while on the other allowing for instant alterations to a preset schedule, in the case of last minute changes of plan, or even changes which have to be made after the performance has started.

So far, we have examined the *Real Time System* in the mode which would most likely be used primarily for live performances and the live broadcasting environment. However, the *RTS* also has applications in post-production, typically for film and video sound dubbing, by utilising timecode. This facility enables the engineer to enter times and durations of each preset, so that both cuts and crossfades (with programmed duration) can be predetermined with relation to the timecode. The video display for a sequence includes four 'fields', which contain, from left to right, preset number, preset name, crossfade duration (which may be left blank if required) and the time at which the preset is to be called. The absence of a crossfade duration in the third

# The Unlimited Limiter.



In keeping with MXR's expanding commitment to the professional recording industry, our engineers have designed and built the Dual Limiter. A world class mono-stereo limiter offering total flexibility and ease of operation, the Dual Limiter produces a musically natural response in any compression-limiting application. All of this versatility is built into a compact, rack-mountable package.

The totally unique VCAs at the heart of the Dual Limiter provide an exceptionally wide dynamic range with low levels of distortion. Continuous bass distortion is much lower in level than typical compressor-limiters, allowing more freedom in setting release characteristics.

The Dual Limiter is also a forgiving limiter. Attack and release characteristics dictated by the front panel controls are modified by program dynamics and compression requirements. The slope increases smoothly past the threshold point, allowing a *gradual* transition into compression. Varying the Dual Limiter's threshold region produces a variety of intermediate slopes with the primary slope being that chosen by the slope switch. These features permit apparent dynamics to be maintained even though the dynamic range is being controllably limited.

The Dual Limiter's remarkable versatility is based on the fact that it can be viewed as two independent mono limiters that can be patched together via front panel switches for stereo limiting applications. Each channel has an In/Out switch, Slope switch, Input, Output, Attack and Release controls and an LED display, showing the amount of gain reduction. On the rear are

both XLR and 1/4" phone jack (ring-tip-sleeve) input and output connectors. Each channel's detector is accessible via rear panel phone jacks to permit external tailoring of the detectors' frequency response. This feature allows for de-essing (reduction of vocal sibilance) and a wide variety of frequency dependent limiting needs.

Because virtually every form of musical signal was used to evaluate the Dual Limiter's response during the initial stages of development, its sophisticated internal circuitry enables it to sound musically *natural* — even at extreme compression settings.

Balanced inputs, the ability to drive 600 ohm loads, +19 dBm input and output and standard rack dimensions (1 3/4" high) allow the Dual Limiter to be easily integrated into any professional system. With an extremely rugged case, metal knobs and reliable internal construction, the new MXR Dual Limiter reflects the highest professional standards and has been fully designed and built in the U.S.A.

The Unlimited Limiter — MXR's natural response to the question of performance and versatility in a space-efficient and cost-effective package. See the MXR Dual Limiter at your nearest MXR dealer.

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# new Solid State Logic products

field will cause a cut from the previous preset to the next at the time specified in the fourth field.

Usefully, all the preset names and sequences may be assembled, with their timecode values, off-line on a separate computer, thus reducing set-up time in the dubbing theatre. Off-line sequence assembly can be performed with reference to shot lists and frame-counts. Normally, the shot lists and other data will enable the sequences to be assembled right down to the crossfade durations, leaving the engineer to the creative task of programming correct balances only in the dubbing suite.

## Events Controller

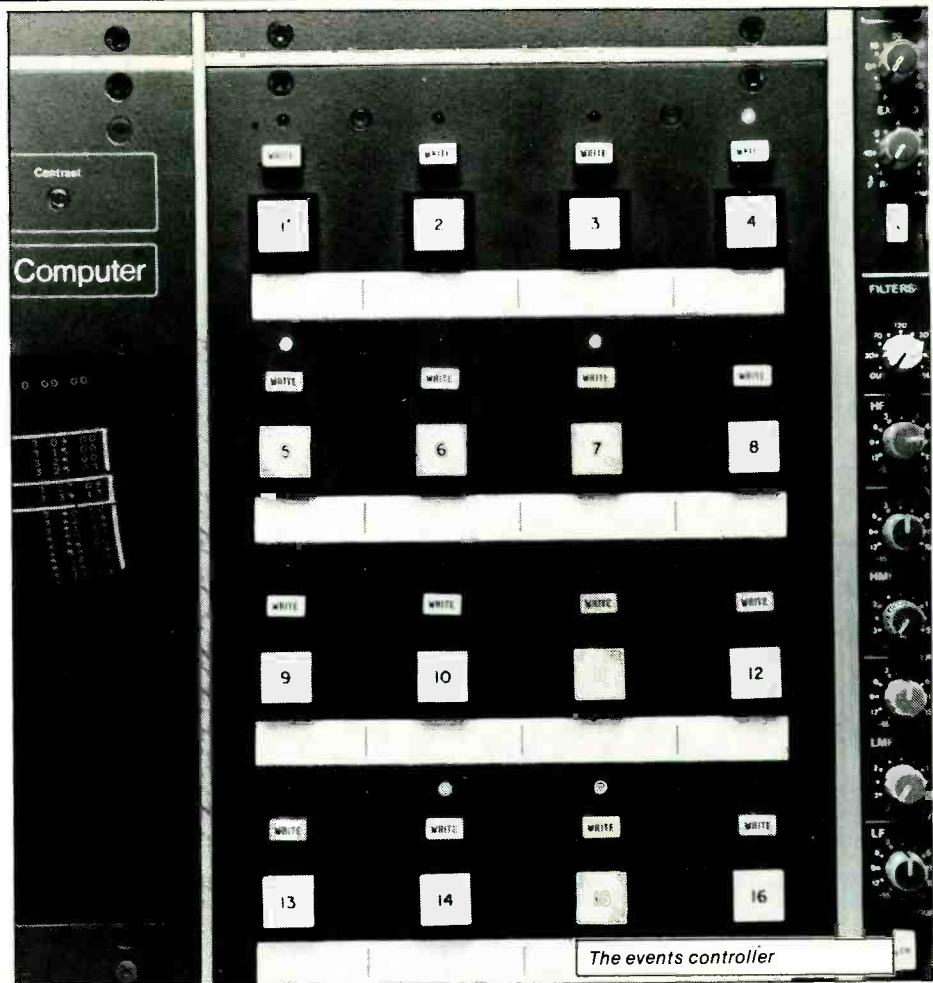
This system enables the video or film sound engineer to control the various cart machines and tape recorders required for complex sound-effects dubbing in post-production. The *Events Controller* allows the programming of up to 32 timecode-triggered relays, which may be used to actuate replay units on cue, or to switch any other studio equipment. Any number of relays can be fired at once, and the events controller also allows the entering of cues 'on the fly' by hitting the appropriate buttons. Up to two *Events Controllers* may be hooked up to one SSL computer. Keyboard entry of events is also possible, and, once entered, the timings may be trimmed forwards or back, or retimed altogether.

An events list can be created with appropriate timecode displays, and this can be operated independently of all other functions, or integrated into either the *Dynamic Mixing System* ('Studio recording') or the *Real Time System*. In the latter case, the events are integrated into the presets in a sequence, whereas in the recording environment, events lists may be copied and edited from one mix to another.

## Effects Controller

This unit is specifically designed to handle voltage-controlled devices under computer control. Up to 40 devices—be they synthesisers, DDL units, pitch-shifters or other outboard systems—can have their control voltages stored and recalled with reference to timecode. This extends the SSL computer automation system to outboard gear, including mix-listing and off-line editing. In addition to recording applications, the *Controller* may also be used with the *Real Time System*.

The *Effects Controller* is a 19in, 2U high rack-mounting unit which operates in the same manner as the channel faders, each set of



analogue I/O lines having its own status controls and indicator LEDs.

## Synchroniser

This device offers the necessary interfaces and controls for multi-machine operation, whether for 46-track recording or for video/film post-production, where a number of video and/or audio machines must be locked together. The unit is controlled from the main keyboard, centrally mounted on the console, thereby obviating the use of separate controls. However, each machine is given an individual set of remotes and a sync button, which hooks it up to the *Synchroniser* unit. The system can handle up to three machines, sync being achieved with standard EBU/SMPTE format data signals recorded on the tape. The SSL console controls may be used to control the machines independently, including offset programming, making the synchronisation operation almost entirely automatic, with no distraction to the engineer. All autolocate functions are handled from the keyboard, and offsets may be stored on disk for later recall, thus avoiding the need to reprogram offsets when the tapes are used again. The system

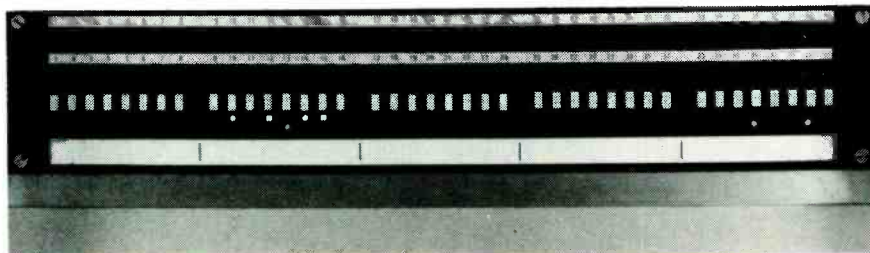
is user-transparent, appearing to the operator as a single machine.

A specialised, separate processor system is used to handle synchronisation, although commands are still entered into the main keyboard in the regular SSL 'language' (which is not entirely unrelated to English). The commands are interpreted by the main computer and downloaded into the synchronisation processor, thus avoiding the need for engineers to learn either a new command language or an altered or additional hardware configuration.

The release of these new systems and devices by SSL enables the Solid State Logic *Master Studio System* to operate not only in the recording studio, but in a multi-machine environment, in live or broadcast sound, or in video/film audio post-production. The systems are totally integrated and our quick examination indicates that SSL has done an excellent job of designing the new systems, in terms of hardware design, software and, most important of all, in the area which one is rather forced to term, somewhat jargonistically, the 'man-machine interface'. Even though some people may have originally been put off by the presence of an alphanumeric keyboard on SSL systems, these automation systems are in fact exceptionally easy to use and offer almost unique controllability, flexibility and ease of operation. SSL are to be congratulated on this latest enhancement of their system.

**Solid State Logic, Churchfields, Stonesfield, Oxford OX7 2PQ, UK. Phone: 099 389 8282. Telex: 837400.**

**USA: Musicworks International, 2352 Wisconsin Avenue, Washington, DC 20007. Phone: (202) 333-1500. Telex: 440519.**



The effects controller

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# The sound of Neve is worldwide

## Turnkey Systems

The complexity of assembling and commissioning complete audio systems is often so great that many organisations have found it expedient to delegate the responsibility for planning, procuring, installing and commissioning the total requirement to a single qualified supplier. In-depth experience in the supply and installation of audio systems gained over many years has placed us in a leading position to offer such services.



## Service and Installation

Our Technical Service Department maintains fully equipped base service facilities in England and throughout North America. They also operate an on-site installation and maintenance service anywhere in the world, in conjunction with our network of subsidiary companies and agents. Training for operational and maintenance staff is normally provided at our central facility or can be arranged at customers' locations.

## Special Orders

The Neve Special Orders department provides an efficient and fast design and manufacturing facility for a miscellany of small custom products or small repeat orders. Being a self-contained unit within the Neve organisation, the service provided is quick and cost-effective whilst maintaining the usual Neve standards of quality and reliability.

## Custom Engineering

In addition to our wide range of standard products, our Custom Engineering Department offers a fully consultative service to customers requiring designs to their own specification. As the world's largest specialist manufacturer of sound control consoles, we have a wide range of modular units already designed to fulfill most of the facilities requested by our customers. These can be used to produce many different system configurations and console layouts to suit every requirement at costs lower than normally expected.



## Ancillary Units

A wide range of ancillary units are available for the professional audio user, including limiter compressors and distribution amplifiers.

## Neve Today

Neve has been supplying Sound Control Systems to the world's broadcast, music recording and film industries since the early 1960s. Neve today is a dynamic, progressive company, with the enthusiasm, maturity and expertise needed to give a first-class professional service to any organisation requiring an audio system, whether it be a small portable mixing console or a complete studio installation. Employing over 400 personnel in Great Britain with subsidiary operations in the USA and Canada, and with a world-wide network of agents and representatives, Neve is the world's foremost specialist manufacturer of sound mixing consoles and second-to-none when it comes to after-sales service and support.

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Rupert Neve Inc.

7533 Sunset Boulevard, Hollywood, California 90046, U.S.A. Tel (213) 874-8124 Telex 194942

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P O Box 120907 Nashville Tennessee 37212 U.S.A. Tel (615) 385-2090

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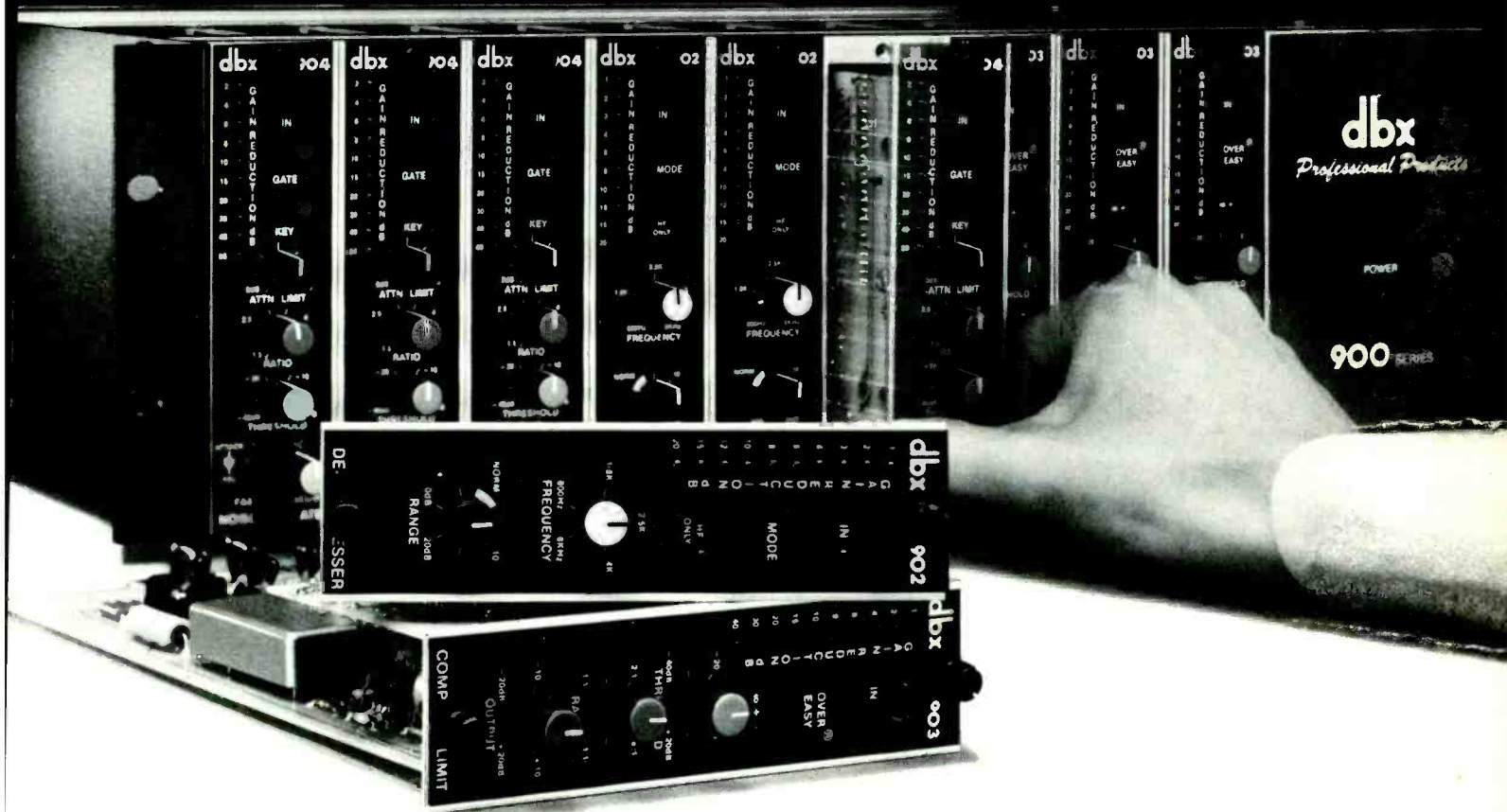
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Audio Bauer AG Bernerstrasse Nord 182 Zurich CH 8064 Tel: Zurich 016 43230  
LydRommet St Olavsgate 27, Oslo 1 Tel: 02 1140 85

# product Power amplifiers guide

This product guide includes professional power amplifiers for both monitoring and PA applications, together with a few 'hi-fi' types which overlap into these applications.

Note: all power output ratings are quoted as being into 8Ω unless otherwise specified.

## AB SYSTEMS (USA)

AB Systems Design Inc, PO Box 754, Folsom, Cal 95630. Phone: (916) 988-8551.

UK: Autograph Sales Ltd, Stable 11, British Rail Camden Depot, Chalk Farm Road, London NW1 8AH. Phone: 01-267 6677.

- 105A: 2 channel, 50W/channel, bridgable.
- 205C: 2 channel, 125W/channel.
- 410C: 2 channel, 250W/channel.
- 710C: mono biamp, LF 350W, HF 100W, internal assignable crossover.
- 730C: mono triamp, LF 350W, MF 100W, HF 75W, internal assignable crossovers.
- 1200A: 2-channel with interchangeable power modules, 300W/channel, bridgable.
- 1200B: 2-channel with interchangeable power modules, 400W/channel into 4Ω, bridgable.
- 1210A: 2-channel with interchangeable power modules, 250W/channel, bridgable.

## ACCUPHASE (Japan)

Kenonic Laboratory Inc, 2-14-10 Shin-Isikawa, Midori-Ku, Yokohama 227. Phone: 045 901-2271. Telex: 3823780.

Europe: PIA Hifi Vertriebs GmbH, Ludwigstrasse 4, D-6082 Morfelden-Walldorf, West Germany. Phone: 06105 76995. Telex: 4185785.

USA: Teac Corp of America, 7733 Telegraph Road, Montebello, Cal 90640. Phone: (213) 726-0303.

- M60: mono, 300W.
- P260: 2-channel, 130W/channel, MOSFET output stage, Class A with reduced power.
- P400: 2-channel, 200W/channel, similar to P260.

## ACES (UK)

AC Electronic Services, Broad Oak, Albrighton, Nr Shrewsbury, Shropshire SY4 3AG. Phone: 0939 290574.

Worldwide marketing: Intersound Ltd, 103 Layston Park, Royston, Herts SG8 9DY, UK. Phone: 0763 44470.

- ACSP150: mono, 100W.
- ACSP300: 2-channel, 100W/channel.
- ACSP600: 2-channel, 300W/channel into 4Ω.
- ACSP1000: 2-channel, 170W/channel.

## ADVANCED TECHNOLOGY DESIGN (USA)

Advanced Technology Design Corp, PO Box 27096, Los Angeles, Cal 90027. Phone: (213) 661-4733/761-8656.

- 221: mono, 150W, built-in lowpass filters selectable 50/80Hz, selectable highpass filter at 20Hz.
- 421: mono, 400W, similar facilities to above plus variable VLF EQ.
- 821: mono, 800W, same facilities as 421.
- 222: 2-channel, 50W/channel.
- 422: 2-channel, 100W/channel.
- 722: 2-channel, 200W/channel.
- 344: 4-channel, 50W/channel.
- 644: 4-channel, 100W/channel.
- 512: mono biamp, LF 350W, HF 100W, includes dividing networks, highpass filters, LF EQ and HF driver compensation.
- 712: mono biamp, LF 300W, HF 100W, facilities as 512.
- 524: 2-channel biamp, LF 100W/channel, HF 50W/channel, facilities as 512.
- 513: mono triamp, LF 350W, MF 100W, HF 50W, facilities as 512.
- 713: mono triamp, LF 300W, MF 100W, HF 100W, facilities as 512.
- 7132: three output biamp with single LF output and two HF amps, LF 300W, HF 100W/channel.

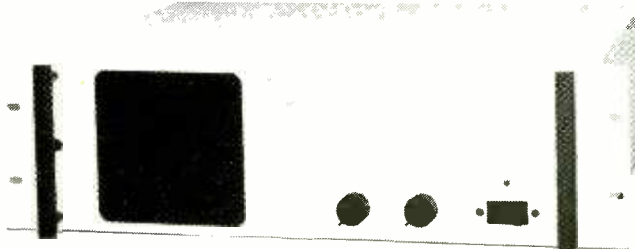
## ALTEC LANSING (USA)

Altec Corp, 1515 South Manchester Avenue, Anaheim, Cal 92803. Phone: (714) 774-2900. Telex: 655415.

Europe: Altec Lansing International Ltd, 17 Park Place, Stevenage, Herts.SG1 1DU, UK. Phone: 0438 3241. Telex: 825495.

UK: Rank Strand Sound, PO Box 51, Great West Road, Brentford, Middx TW8 9HR. Phone: 01-568 9222. Telex: 27976.

- 9440A: 2-channel, 200W/channel, bridgable.
- Incremental Power System 2200: rack-mounted frame accepting up to eight 75W (16Ω) or four 150W power amps, an electronic crossover, bal or unbal input card, and special driver amps with matrix switching for signal processing. May be used in parallel mode up to 600W.



BGW 7000

## A & R (UK)

Amplification & Recording (Cambridge) Ltd, Denny End Industrial Centre, Waterbeach, Cambridge CB5 9PB. Phone: 0223 861550.

### new

- SA60: 2-channel, 35W/channel.
- SA60X: identical to SA60, but with 2-way electronic crossover.
- SA200: 2-channel, 100W/channel.

## ASHLY (USA)

Ashly Audio Inc, 100 Fernwood Avenue, Rochester, NY 14621. Phone: (716) 544-5191.

UK: Atlantex Music Ltd, 1 Wallace Way, Hitchin, Herts SG4 0SE. Phone: 0462 31511. Telex: 826967.

### new

- FET-200: 2 channel, 100W/channel, bridgable, MOSFET output stage, balanced or unbalanced inputs, LED meter display.

## AUDIONICS (USA)

Audionics of Oregon, Suite 160, 10950 SW 5th Avenue, Beaverton, Oregon 97005. Phone: (503) 641-5225. Telex: 910-467 8728.

- BA150: hybrid 2-channel with Class B valve (tube) output stages with logic auto biasing control circuitry, 150W/channel.
- CC2: 2-channel, 70W/channel, bridgable.

## BGW (USA)

BGW Systems Inc, 13130 South Yukon Avenue, Hawthorne, Cal 90250. Phone: (213) 973-8090. Telex: 664494.

UK: Court Acoustics Ltd, 35 - 39 Britannia Row, London N1 8QH. Phone: 01-359 0956. Telex: 268279.

- 50A: 2-channel, 25W/channel, bridgable.

### new

- 75: 2-channel, 25W/channel.
- 100B: 2-channel, 50W/channel, bridgable.

### new

- 150: 2-channel, 50W/channel.

250D/250E: 2-channel, 100W/channel, bridgable. 250D has clip indicators, 250E has LED light ladder VU meters.

- 300: 2-channel, 100W/channel, bridgable.
- 320: same as 300, but has line output transformers.
- 600: 2-channel, 175W/channel, bridgable.
- 620: same as 600, but has line output transformers.

750B/750C: 2-channel, 225W/channel, bridgable. 750B has LED light ladder VU meters. 750C has clip indicators.

1250: 2-channel, 400W/channel, bridgable, has line output transformers.

### new

- 7000: 2-channel, 200W/channel.

## BIAMP (USA)

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

- TC60: 2-channel, 60W/channel, bridgable
- TC120: 2-channel, 120W/channel, bridgable

## BOGEN (USA)

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

- TCB-60: mono, 65W into 4Ω, transformer output
- TCB-125: mono, 135W into 2Ω, transformer output
- TCB-250: mono, 275W into 1Ω, transformer output
- TCB-S160: 2-channel, 80W/channel.
- TCB-S320: 2-channel, 160W/channel.
- MT-60A: mono, 60W into 2.8Ω, transformer output
- MT-125B: mono, 125W into 1.4Ω, transformer output
- MT-250: mono, 250W into 0.8Ω, transformer output

## BOSE (USA)

Bose Corp, Professional Products Division, The Mountain, Framingham, Massachusetts 01701. Phone: (617) 879-7330.

UK: Bose (UK) Ltd, Trinity Trading Estate, Sittingbourne, Kent ME10 2PD. Phone: 0795 75341/5

- Model 1800: 2-channel, 250W/channel, LED level indication.

## BOZAK (USA)

Bozak Inc, PO Box 1166, Darien, Connecticut 06820. Phone: (203) 838-6521.

- CMA-2-65: 2-channel, 65W/channel.
- CMA-2-80: 2-channel, 80W/channel.
- CMA-2-150: 2-channel, 150W/channel.
- CMA-1-80: mono, 80W.
- CMA-1-120: mono, 120W.

## BRYSTON (Canada)

Bryston Mfg Ltd, 57A Westmore Drive, Rexdale, Ontario M9V 3Y6. Phone: (416) 746-1800.

UK: ITA Ltd, 1-7 Harewood Avenue, Marylebone Road, London NW1. Phone: 01-724 2497. Telex: 21879.

- 2B: 2-channel, 50W/channel, bridgable.
- 3B: 2-channel, 100W/channel, bridgable
- 4B: 2-channel, 200W/channel, bridgable

## CARLSBRO (UK)

Carlsbro Sales Ltd, Cross Drive, Kirkby-in-Ashfield, Notts NG17 7LD. Phone: 0623 753902. Telex: 377472.

- M150: mono, 105W, LED level indication.
- M300: mono, 200W, LED level indication
- S800: 2-channel, 200W/channel, bridgable, LED level indication.

### new

- S300M: 2-channel modular power amp, 105W/channel, accepts either of two signal processing modules (either CLXF compressor limiter/electronic crossover/highpass filter module, or SCLF stereo compressor limiter/highpass filter module).
- S600M: 2-channel modular power amp, 200W/channel, same facilities as above. 56 ▶



# The Drum Kit you can't beat



The LinnDrum is the ultimate drum machine. By just tapping a button you have real drum sounds. From crash/ride cymbals to rimshot, to toms.

The LinnDrum sounds are not synthesised but real drum beats digitally recorded and stored in memory for you to play with stereo panning and all in real time.

It's also surprisingly simple to operate. Unpack it, plug it in and it's ready. Trigger it externally, or play it in real time. Either way –

with auto correction – you'll be laying down perfect rhythm tracks in a matter of minutes. Just hit 'record' and let your fingers do the drumming.

Come to 20 Conduit Place and see the LinnDrum for yourself. And at only £1,995 + VAT you just can't beat it.

Sycos Systems Ltd,  
20 Conduit Place London W2  
Tel 01-723 3844 for an  
appointment.



## Let your fingers do the drumming!

# product Power amplifiers guide

## CARVER (USA)

Carver Corp, PO Box 664, 14304 NE 193rd Place, Woodinville, Washington 98072. Phone: (206) 487-3483.

UK: DW Labs, 88-90 Grays Inn Road, London WC1X 8AA. Phone: 01-404 5140.

### new

M400: 2-channel, 200W/channel.

## COURT (UK)

Court Acoustics Ltd, 35-39 Britannia Row, London N1 8QH. Phone: 01-359 0956. Telex: 268279.

### new

DA200: 2-channel, 100W/channel, LED level indication.

DA400: 2-channel, 150W/channel, LED level indication.

DA1200: 2-channel, 280W/channel, LED level indication.

## CREST (USA)

DMI Inc, 150 Florence Avenue, Hawthorne, New Jersey 07506. Phone: (201) 423-1300.

UK: Martin Audio Ltd, 54-56 Stanhope Street, London NW1 3EX. Phone: 01-388 7162.

1001: 2-channel, 35W/channel, bridgable.

P-1500: 2-channel, 60W/channel, bridgable.

2500S/2501S: 2-channel, 125W/channel, bridgable. 2500S has LED level indication, 2501S has clip indicators.

3500S/3501S: 2-channel, 225W/channel, bridgable, configured as previous entry.

5000: 2-channel, 350W/channel, bridgable.

## CROWN/AMCRON (USA)

Crown International Inc, 1718 West Mishawaka Road, Elkhart, Indiana 46514. Phone: (219) 294-5571. Telex: 810-295 2160.

UK: HHB Hire & Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Phone: 01-961 3295. Telex: 923393.

D75: 2-channel, 35W/channel, bridgable.

D150A: 2-channel, 80W/channel, bridgable.

D300A: 2-channel, 155W/channel, bridgable.

M600: mono, 600W.

M2000: mono, 2kW, (two M600 bridged).

PS2A: 2-channel, 220W/channel, bridgable. Includes high- and lowpass filters, test tone generator and adjustable compressor.

PS200: 2-channel, 90W/channel, bridgable.

PS400: 2-channel, 165W/channel, bridgable.

## CUSTOM SOUND (UK)

Custom Sound Solid State Technology Ltd, Custom House, Arthur Street, Oswestry, Shropshire SY11 1JN. Phone: 0691 59201.

PPA1: 2-channel, 150W/channel, bridgable, VU meters.

PPA2: 2-channel, 100W/channel, bridgable, VU meters.

## DB (USA)

DB Systems, PO Box 187, Jaffrey Center, New Hampshire 03454. Phone: (603) 899-5121.

DB-6: 2-channel, 40W/channel.

DB-6M: mono, 140W.

## DUKANE (USA)

Dukane Corp, Communications Systems Division, 2900 Dukane Drive, St Charles, Illinois 60174. Phone: (312) 584-2300.

1A901B: mono, 50W, output transformer options.

1A911B: mono, 110W, output transformer options.

1A921B: mono, 200W, output transformer options.

2A85B: 2-channel line-monitor amp, 25W/channel, output transformer/mic preamp/VU meter options.

## DYNACORD (West Germany)

Dynacord Electronics GmbH, Siemenstrasse 41-43, D-8440 Straubing. Phone: 09421 3101.

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

USA: Dynacord Electronics Inc, PO Box 26038, Philadelphia, Pennsylvania 19128. Phone: (215) 482-4882.

A 1001: 2-channel, 80W/channel, bridgable, LED level indication.

A 2002: 2-channel, 170W/channel, bridgable, LED level indication.

A 3003: 3-channel, channel 1 170W, channels 2/3 75W, LED level indication.

AX 303: mono triamp, LF 170W, MF 75W, HF 75W, adjustable electronic crossover frequencies, LED level indication.

## EDCOR (USA)

Edcor, 16782 Hale Avenue, Irvine, Cal 92714. Phone: (714) 556-2740.

PA Series: modular mono power amplifiers accepting a wide variety of input modules. Three modules available with outputs of 50, 100 and 150W. Versions for transformer or direct outputs.

## ELECTROCOMPANIET (Norway)

Electrocompaniet A/S, PO Box 92, N-1473 Skaarer. Phone: 02 70.64.10.

UK: Gotham Audio Ltd, 12 Glendoline Avenue, London E13 0RF. Phone: 01-471 1512.

Amplifier 1: 2-channel, 200W/channel.

Amplifier 2: 2-channel, 50W/channel.

Ampliwire 1: mono, 200W.

## HEIL SOUND (USA)

Heil Sound, No 2 Heil Industrial Drive, Marissa, Illinois 62257. Phone: (618) 295-3000.

Pro-series 200: 2-channel, 150W/channel into 4 $\Omega$ .

Pro-series 400: 2-channel, 250W/channel into 4 $\Omega$ .

## HH (UK)

HH Electronic, Viking Way, Bar Hill, Cambridge CB3 8EL. Phone: 0954 81140. Telex: 817515.

USA: Audio Techniques Inc, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 359-2312. Telex: 996519.

S500-D: 2-channel, 210W/channel, bridgable.

V150L: mono, 105W, MOSFET output.

V200: 2-channel, 65W/channel, MOSFET outputs.

V500: 2-channel, 150W/channel, MOSFET outputs.

V800: 2-channel, 260W/channel, MOSFET outputs, LED level indication.

TPA25D: mono, 45W.

AMB/12: BBC version of the TPA25D.

TPA50D: mono, 75W.

TPA100D: mono, 180W.

## HILL (UK)

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

DX 140: 2-channel, 80W/channel, VU meter option.

DX 200: 2-channel, 175W/channel, VU meter option.

DX 350: 2-channel, 115W/channel, VU meter option.

DX 500: 2-channel, 185W/channel, VU meter option.

DX 700: 2-channel, 260W/channel, VU meter option.

TX 400: mono triamp, LF 200W, MF 100W, HF 100W, electronic crossovers.

FM 800A



## EXPOSURE (UK)

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

Exposure IV: 2-channel, 75W/channel, available in two versions (either single power supply or separate power supply for each channel).

## FM ACOUSTICS (Switzerland)

FM Acoustics Ltd, Tiefenhofstrasse 17, CH-8820 Wädenswil. Phone: 01 780.64.44. Telex: 56058.

UK: FM Acoustics, 2 Kempston Road, Weymouth, Dorset DT4 8XB. Phone: 0305 784049.

USA: Win Laboratories, PO Box 332, Goleta, Cal 93017. Phone: (805) 968-8741.

FM 300A: modular 2-channel, 100W/channel, LED level indication.

FM 600A: 2-channel, 200W/channel, bridgable, LED level indication.

FM 800A: 2-channel, 400W/channel, bridgable, LED level indication.

## HARMAN/KARDON (USA)

Harman/Kardon, 55 Ames Court, Plainview, NY 11803. Phone: (516) 681-4000.

UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD. Phone: 0753 76911. Telex: 849069.

Citation 16: 2-channel, 150W/channel, bridgable, LED level indication.

Citation 19: 2-channel, 100W/channel, bridgable, LED level indication.

Citation XX: 2-channel, 320W/channel, includes input filters.

HK770: 2-channel, 65W/channel, LED level indication.

## ICE (UK)

IC Electrics Ltd, 131/2 Blackdown Rural Industries, Haste Hill, Haslemere, Surrey GU27 3AY. Phone: 0428 2015.

S200: 2-channel, 115W/channel, VU meters.

## IVIE (USA)

Ivie Electronics Inc, 500 West 1200 South, Orem, Utah 84057. Phone: (801) 224-1800. Telex: 910-971 5884.

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

5805/5806: 100W, part of the 5000 Modular System. 5805 master (bridgable), 5806 slave may be paralleled with the master.

## JBL (USA)

James B Lansing Sound Inc, 8500 Balboa Boulevard, Northridge, Cal 91329. Phone: (213) 893-8411. Telex: 674993.

UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD. Phone: 0753 76911. Telex: 849069.

6007: mono, 60W into 4 $\Omega$ , VU meter, direct and transformer outputs.

6008: mono, 60W into 4 $\Omega$ , VU meter, direct output.

6011: mono, 100W into 4 $\Omega$ , VU meter, direct and transformer outputs.

6012: mono, 100W into 4 $\Omega$ , VU meter, direct output.

6021: mono, 200W into 4 $\Omega$ , VU meter, direct and transformer outputs.

6022: mono, 200W into 4 $\Omega$ , VU meter, direct output.

6233: 2-channel, 200W/channel, bridgable, illuminated level indicators.

58

# Before you invest in new studio monitors, consider all the angles.

No one has to tell you how important flat frequency response is in a studio monitor. But if you judge a monitor's performance by its on-axis response curve, you're only getting part of the story.

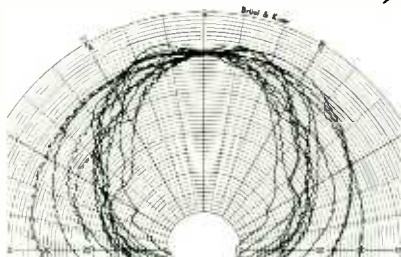
Most conventional monitors tend to narrow their dispersion as frequency increases. So while their on-axis response may be flat, their off-axis response can roll off dramatically, literally locking you into the on-axis "sweet spot." Even worse, drastic changes in the horn's directivity contribute significantly to horn colorations.

## Introducing the JBL Bi-Radial Studio Monitors.

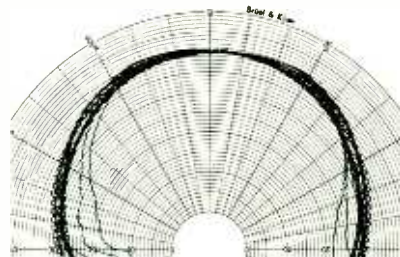
At JBL, we've been investigating the relationship between on and off axis frequency response for several years. The result is a new generation of studio monitors that provide flat response over an exceptionally wide range of horizontal and vertical angles. The sweet spot and its traditional restrictions are essentially eliminated.

The key to this improved performance lies in the unique geometry of the monitors' Bi-Radial horn.<sup>1</sup> Developed with the aid of the latest computer design and analysis techniques, the horn provides constant coverage from its crossover point of 1000 Hz to beyond 16 kHz. The Bi-Radial compound flare configuration maintains precise control of the horn's wide 100° x 100° coverage angle.

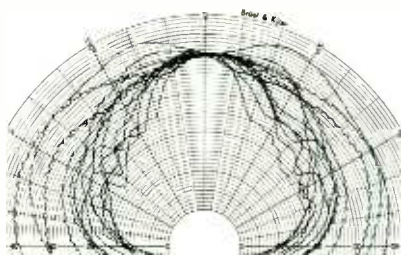
1. Patent applied for.



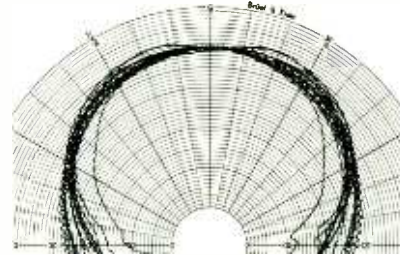
Typical horizontal



JBL 4430 horizontal



Typical vertical



JBL 4430 vertical

And the Bi-Radial horn's performance advantages aren't limited to just beamwidth control. The horn's rapid flare rate, for instance, dramatically reduces second harmonic distortion and its shallow depth allows for optimal acoustic alignment of the drivers. This alignment lets the monitors fall well below the Blauert and Laws criteria for minimum audible time delay discrepancies.

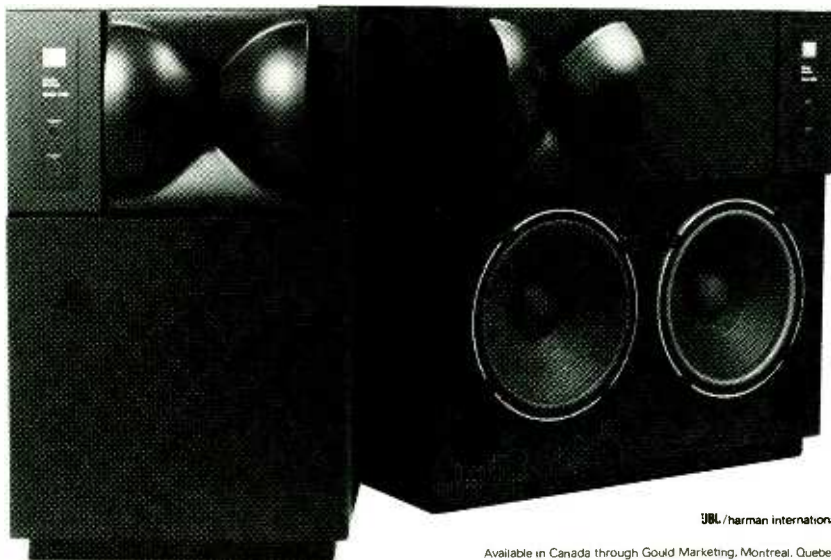
But while the Bi-Radial horn offers outstanding performance, it's only part of the total package. The new monitors also incorporate JBL's most advanced high and low frequency transducers and dividing networks. Working together, these

components provide exceptionally smooth response, high power capacity, extended bandwidth, and extremely low distortion.

## Judge For Yourself

Of course, the only way to really judge a studio monitor is to listen for yourself. So before you invest in new monitors, ask your local JBL professional products dealer for a Bi-Radial monitor demonstration. And consider all the angles.

James B. Lansing Sound, Inc.  
8500 Balboa Boulevard  
P.O. Box 2200  
Northridge, California 91329 U.S.A.



**JBL** Professional Products Division

JBL/harman international

Available in Canada through Gould Marketing, Montreal, Quebec.

# product Power amplifiers guide

## JPS (UK)

JPS Associates, Belmont House, Steele Road, London NW10 7AR. Phone: 01-961 1274.

- 1002: 2-channel, 100W/channel into 4Ω. LED level indication.
- 2002: 2-channel, 200W/channel into 4Ω. LED level indication.
- 3002: 2-channel, 300W/channel into 4Ω. LED level indication.
- 5002: 2-channel, 500W/channel into 2Ω. LED level indication.

## JVC (Japan)

UK: JVC UK Ltd, Eldonwall Trading Estate, Staples Corner, London NW2. Phone: 01-450 2621. Telex: 923320.

USA: US JVC Corp, 58-75 Queens Midtown Expressway, Maspeth, NY 11378. Phone: (212) 476-8300.

- M-3030: 2-channel, 105W/channel.
- M-7050: 2-channel, 150W/channel, VU meters.

## LUX (Japan)

UK: Howland West Ltd, 3-5 Eden Grove, London N7 8EQ. Phone: 01-609 0293. Telex: 299710.

M4000: 2-channel, 180W/channel. VU meters and LED level indication.

## MARANTZ (Japan)

UK: Marantz Audio UK Ltd, Debmarc House, 203 London Road, Staines, Middx. Phone: 0784 50132. Telex: 935196.

USA: Superscope Inc, 20525 Nordhoff Street, Chatsworth, California. Phone: (213) 998-9333. Telex: 910-494 2760.

- SM1000: 2-channel, 400W/channel, VU meters.
- SM6: 2-channel, 120W/channel, also may operate in Class A mode (30W/channel), VU meters.
- MA5: mono version of the SM6. 120W Class AB. 30W Class A.

## McINTOSH (USA)

McIntosh Laboratory Inc, 2 Chambers Street, Binghamton, NY 13903. Phone: (607) 723-3512.  
UK: Uniliet Products Ltd, 35 High Street, New Malden, Surrey KT3 4BY. Phone: 01-942 9567. Telex: 8814591.

- MC 75: mono, 75W, valve (tube).
- MC 275: 2-channel, 75W/channel. bridgable. valve (tube).
- MC 2105: 2-channel, 105W/channel. VU meters.
- MC 2125: 2-channel, 120W/channel, bridgable. VU meters.
- MC 2205: 2-channel, 200W/channel. bridgable. VU meters.
- MC 2300: 2-channel. 300W/channel. bridgable. VU meters.
- MC 3500: mono. 350W.

## McMARTIN (USA)

McMartin Industries Inc, 4500 South 76th Street, Omaha, Nebraska 68127. Phone: (402) 331-2000. Telex: 484485.

- LT-500D: mono, 50W, direct or transformer output.
- LT-1000D: mono, 100W, direct or transformer output.
- LT-2000D: mono, 200W, direct or transformer output.
- LT-3500D: mono, 350W, direct or transformer output.

## METEOR (USA)

Hammond Industries Inc, 155 Michael Drive, Syosset, NY 11791. Phone: (516) 364-1900. Telex: 961396.

Powermaster 190: 2-channel, 90W/channel. peak LEDs.

## MILLBANK (UK)

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

PAC System: modular mono amplifiers to suit PAC rack, 40, 60, 120 and 250W amps available.

## MM (UK)

MM Electronics, PACE Musical Equipment Ltd, 63 Kneesworth Street, Royston, Herts SG8 5AQ. Phone: 0763 45321. Telex: 817929.

- AM240: 2-channel, 90W/channel. peak LEDs, VU meter option.
- AM400: 2-channel, 125W/channel. peak LEDs, VU meter option.
- AM640: 2-channel, 200W/channel. peak LEDs, VU meter option.
- AP360: 2-channel, 130W/channel.

## MUSTANG (UK)

Mustang Communications, Industrial Estate, Cayton Low Road, Scarborough, North Yorks YO11 3UT. Phone: 0723 582555.

- SS50: mono 80W, VU meter.
- SS100: mono, 150W, VU meter.

## OLSEN (Norway)

Olsen Electroacoustics, Elveveien 26-26, N-1472 Fjellhamar.

O2: 2-channel, 200W/channel. bridgable.

## PEAVEY (USA)

Peavey Electronics Corp, 711 A Street, Meridian, Mississippi 39301. Phone: (601) 483-3565.

UK: Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX. Phone: 0825 5566. Telex: 957098.

- CS400: 2-channel, 150W/channel, clipping indication.
- CS800: 2-channel, 280W/channel, bridgable. clipping indication.

## new

M-2600: 2-channel, 75W/channel.

## QMI (USA)

QMI, 21356 Deering Court, Canoga Park, Cal 91304. Phone: (213) 340-1313.

UK: Music Laboratory, 72-74 Eversholt Street, London NW1. Phone: 01-388 5392.

GC500: 2-channel, 200W/channel.

## QUAD (UK)

Quad Electroacoustics Ltd, Huntingdon, Cambs PE18 7DB. Phone: 0480 52561. Telex: 32348.

- 303: 2-channel, 45W/channel.
- 405: 2-channel, 100W/channel, current dumping output circuit.

## RAMSA (Japan)

UK: National Panasonic Ltd, 308-318 Bath Road, Slough SL1 6JB. Phone: 0753 34522. Telex: 847652.  
USA: Professional Audio Division, Panasonic Co, 1 Panasonic Way, Secaucus, New Jersey 07094. Phone: (201) 348-7000. Telex: 710-992 8996.

WP-9210: 2-channel, 200W/channel, peak LEDs.

## ROLAND (Japan)

UK: Roland (UK) Ltd, Great West Trading Estate, 983 Great West Road, Brentford, Middx TW8 9DN. Phone: 01-568 4578. Telex: 934470.

USA: Roland Corp US, 2401 Saybrook Avenue, Los Angeles, Cal 90040. Phone: (213) 685-5141.

- SPA120: 2-channel, 60W/channel.
- SPA240: 2-channel, 120W/channel.

## RSD/STUDIOMASTER (UK)

Recording Studio Design Ltd, Home Farm, Northall, Dunstable, Beds. Phone: 0525 221331.  
USA: Studiomasster Inc, 1365C Dynamics, Anaheim, Cal 92806.

- 400C: 2-channel, 115W/channel, VU meters.
- 800B/C: 2-channel, 220W/channel, VU meters.

## SAE (USA)

Scientific Audio Electronics Inc, PO Box 60271, Terminal Annex, Los Angeles, Cal 90060. Phone: (213) 489-7600. Telex: 674062.

- 3100: 2-channel, 50W/channel, LED level indication.
- 2200: 2-channel, 100W/channel, LED level indication.
- 2300: 2-channel, 150W/channel, LED level indication.

## OVERSEAS AGENTS

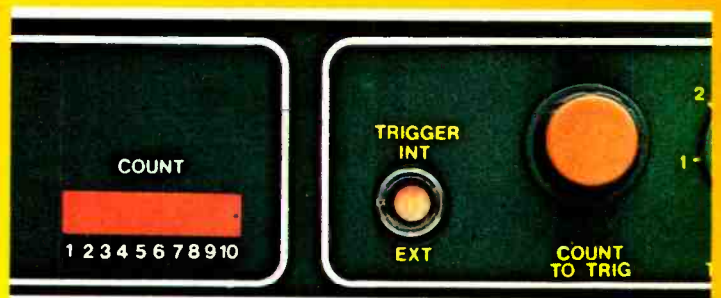
- AUSTRIA**  
Soundmill Vienna  
Herbstasse 22, 1160 Vienna, Austria  
Contact: Peter Mueller  
Tel No: (010 43 222) 986998 Tlx No: 131294  
SPOA
- AUSTRALIA**  
Audio & Recording Pty  
132 Rundle Street, Kent Town Adelaide, South Australia  
Contact: Ian Richardson  
Tel No: (010 61 81) 42 5344
- BRAZIL**  
Serion Ltda  
Rua Antonio de Godoi 122 - 12º, Sao Paulo, Brasil  
Contact: Sergio Petrescu  
Tel No: (010 55 11) 222 11183 Tlx No: 1123979
- CANADA**  
Gerr Electro-Acoustics  
363 Adelaide Street East, Toronto, Ontario, Canada  
Contact: Bob McKibbin  
Tel No: (010 1 416) 868 0528 Tlx No: 065 24385
- CARIBBEAN**  
Dynamic Sound Recording  
115 Bell Road, Kingston 11, Jamaica  
Contact: Byron Lee  
Tel No: (010 1 809) 923 9138 Tlx No: 2296 A/B  
Dynasound
- DENMARK**  
SLT, Studie- & lydteknik ApS  
Højvej 9 - 11, DK-2000, Copenhagen F, Denmark  
Contact: Ole Lund Christensen  
Tel No: (010 451) 34 1284 Tlx No: 22924 SLT DK
- EASTERN EUROPE**  
Dennis Tyler Ltd  
59 High Street, Great Missenden, Buckinghamshire  
Contact: Dennis Tyler  
Tel No: (02406) 6262 Tlx No: 837088 TYLER G
- FINLAND**  
Studiotecknik  
Eijakesentie 9, 00370 Helsinki 37, Finland  
Contact: Peter Strahlman  
Tel No: (010 358 0) 90 556 252 Tlx No: 125284  
Stute SF
- FRANCE**  
3M France  
Boulevard de l'Osse, 95000 Cergy, France  
Contact: Nicole Thuillier  
Tel No: (010 331) 031 6436 Tlx No: 695185
- WEST GERMANY**  
Elmus GmbH  
Herderstrasse 16, D1 Berlin 12 W, Germany  
Contact: Henry Kerner  
Tel No: (010 49 301) 312 2012
- HONG KONG**  
Studer Revox Far East Co  
5th Floor, Parklane Building 223 - 5 Queen's Road Central, Hong Kong  
Contact: David Lung  
Tel No: (010 852 5) 441 310 Tlx No: 60185 SRFEL HX
- HOLLAND**  
Peter Bollen Geluidstechniek BV  
Horsruglaan 83a, 5628 DB Eindhoven, Holland  
Contact: Peter Bollen  
Tel No: (010 39 2) 415 4141 Tlx No: 59281
- ITALY**  
Raja Telecommunications  
Via S. Maria Annunziata 15, 20147 Milan, Italy  
Contact: Alberto Albertini  
Tel No: (010 39 2) 415 4141 Tlx No: 332201
- JAPAN**  
Nissin Iwai Co Ltd  
Bastion House, 140 London Wall, London EC2Y 53T  
Contact: Steve Stephens  
Tel No: (01) 628 6030 Tlx No: 885881
- JAPAN**  
Nissin Electronics Corp  
12 - 22 Tsukuba, Chome, Chuoku, Tokyo, Japan  
Contact: Mr Takenaka  
Tel No: (010 81 3) 544 8311
- KOREA**  
Yushin Co Ltd  
PO Box No 2, Yeu-Eui-Da Post Office, Seoul, Korea  
Contact: Mr Chough  
Tel No: 693261 Tlx No: Cable: audiosupply Seoul
- NEW ZEALAND**  
General Video Co  
63 Miramar Avenue, Miramar, Wellington, New Zealand  
Contact: G Warwick Jenness  
Tel No: (010 64 4) 881 169 Tlx No: NZ 30129
- NORWAY**  
Sving Benum & Co  
Boks 2493, Solli, Oslo 2, Norway  
Contact: Bjorn Benum  
Tel No: (010 47 2) 44 2255 Tlx No: 17681
- SINGAPORE, Thailand, Sri Lanka, Malaysia, Indonesia**  
Ultralinear International (Pte) Ltd  
4201 International Plaza, Anson Road, Singapore 2  
Contact: Donald Wong  
Tel No: (010 65) 0021 6378 Tlx No: ULTRA RS 23860
- SOUTH AFRICA**  
Eltron (Pty) Ltd  
PO Box 23656, Joubert Park, Johannesburg 2044  
Contact: Paul Horber  
Tel No: (010 27 11) 29 3066 Tlx No: B-9416
- SPAIN**  
Fading  
C/Servando Batanero 8, Madrid 17, Spain  
Contact: Felix Mayori  
Tel No: (010 34 1) 408 6808 Tlx No: 44330 FADI E
- SWEDEN**  
Tal & Ton AB  
Kampgatan 16, S-41104 Gothenburg, Sweden  
Contact: Jan Setterberg  
Tel No: (010 46 311) 31 80 3620 Tlx No: 274982 TALO  
Ton S
- TAHITI**  
Oceanic Garage  
PO Box 39, Papeete, Tahiti, French Polynesia  
Contact: R Guibert  
Tlx No: 437 CABTX
- USA**  
Audio & Design Recording, Inc  
PO Box 786, Bremerton, WA 98310, USA  
Contact: Nigel Branwell  
Tel No: (010 1 206) 275 5009 Tlx No: 230 152426  
ADR INC
- GREECE**  
Bon Studios S/A  
14 Zami Str., Athens 148, Greece  
Contact: Manolis N. Bofilakis  
Tel No: 3633 942 Tlx No: 21 8725 BON GR

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**U.S.A.: Audio & Design Recording, Inc.**  
P.O. Box 786, Bremerton, WA 98310 U.S.A. Tel: (206) 275 5009. Telex: 152426 ADRUSA

# product Power amplifiers guide

**2400L:** 2-channel, 200W/channel LED level indication.  
**2600:** 2-channel, 400W/channel, VU meters.

## SERTEC (France)

Sertec SA, 2799 Avenue John Kennedy, F-83140 Six Fours. Phone: (94) 87.18.50.

## new

**SR 1000:** 2-channel, 300W/channel, bridgable.

## SHURE (USA)

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

**SR105:** mono, meter level indication, optional transformer output, 200W into 4Ω direct, transformer 150W.

## SOLIDYNE (Argentina)

Solidyne Srl, Tres de Febrero 3254, 1429 Buenos Aires. Phone: 701-8622.

**7000A:** 2-channel, 230W/channel, peak LEDs, mono, stereo or biamp with internal electronic crossover. Drives 70 and 100V lines directly.

## SOUNDTRACS (UK)

Soudout Laboratories Ltd, 91 Ewell Road, Surbiton, Surrey KT66AH. Phone: 01-399 3392. Telex: 8951073.

**400S/200S:** 2-channel, 130W/channel, 400S identical but separate power supplies for each channel.

**420S/260S:** 2-channel, 130W/channel, LED peak indicators, 420S identical but separate power supplies for each channel.

## SPECTRA SONICS (USA)

Spectra Sonics Inc, 3750 Airport Road, Ogden, Utah 84403. Phone: (801) 392-7531.  
UK: Sun Recording Services Ltd, 34-36 Crown Street, Reading, Berks. Phone: 0734 595647.

**Model 701:** modular amp system with eight modules fitting a rack-mount, 80W into 2Ω, bridgable in pairs for 160W into 4Ω.

## S & R (UK)

S & R Amplification, 6 Tanners Hill, London SE8. Phone: 01-692 2009.

## new

**PA 500/1000:** 2-channel, 300W/channel, bridgable. Mono and studio versions available; studio version may be configured with VU meters, balanced line, etc.

## STATUS (UK)

Raindirk Ltd, 33A Bridge Street, Downham Market, Norfolk PE38 9DW. Phone: 0366 382165. Telex: 817737.

**USA:** Audicon Inc, 1200 Beechwood Avenue, Nashville, Tennessee 37212. Phone: (617) 256-6900. Telex: 554494.

**USA:** ACI/Filmways, 7138 Santa Monica Boulevard, Hollywood, Cal 90046. Phone: (213) 851-7172.

**500:** 2-channel, 250W/channel, bridgable, MOSFET output stage, optional LED level indication.

## STUDER/REVOX (Switzerland)

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf. Phone: 01 840.29.60. Telex: 58489.

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

**USA:** Studer Revox America Inc, 1819 Broadway, Nashville, Tennessee 37203. Phone: (615) 329-9576. Telex: 554453.

**A68:** 2-channel, 100W/channel, bridgable, overload indication.  
**B740:** 2-channel, 100W/channel, VU meters.

## TANDBERG (Norway)

Tandberg A/S, Feteveien 1, N-2007 Kjeller. Phone: 02 71.68.20. Telex: 71886.

UK: Tandberg Ltd, Unit 1, Revie Road Industrial Estate, Elland Road, Leeds LS11 8JG. Phone: 0532 774844. Telex: 557611.

**USA:** Tandberg of America Inc, Labriola Court, Armonk, NY 10504. Phone: (914) 273-9150. Telex: 13757.

**3003:** 2-channel, 150W/channel, LED clipping indicators.

## TAPCO (USA)

EV-Tapco, 3810 148th Avenue NE, Redmond, Washington 98052. Phone: (206) 883-3510. Telex: 910-449 2594.

UK: Gulton Europe Ltd, Electro-Voice Division, Maple Works, Old Shoreham Road, Hove BN3 7EY. Phone: 0273 23329. Telex: 87680.

**CP120:** 2-channel, 50W/channel, bridgable.

**CP500:** 2-channel, 150W/channel, bridgable.

**CP500M:** 2-channel, 150W/channel, bridgable, VU meters.

## TOA (Japan)

UK: Toa Electric Co Ltd, Castle Street, Ongar, Essex CM5 9JY. Phone: (02 776) 4333. Telex: 995554

**USA:** Toa Electronics Inc, 1023 Grandview Drive, San Francisco, Cal 94080. Phone: (415) 588-2538. Telex: 331332.

## new

**P-906:** mono, 60W, direct and transformer outputs.

**P-912:** mono, 120W, direct and transformer outputs.

**P-924:** mono, 240W, direct and transformer outputs.

These form part of the modular 900 Series PA system. All have provision to accept a wide variety of plug-in input modules, allowing the units to be used as integrated amps.

## TRESHAM (UK)

Tresham Audio Ltd, 32 Tresham Road, Orton Southgate, Peterborough, Cambs. Phone: 0733 234340.

**SR202:** 2-channel, 160W/channel, MOSFET output stage, peak LEDs.

**SR402:** 2-channel, 220W/channel, MOSFET output stage, peak LEDs.

## TURNER (UK)

Turner Electronic Industries Ltd, 175 Uxbridge Road, London W7 4TH. Phone: 01-567 8472.

**B302:** 2-channel, 100W/channel, VU meter and EQ options.

**B502:** 2-channel, 190W/channel, VU meter and EQ options.

**A300:** 2-channel, 100W/channel, VU meter option.

**A500:** 2-channel, 190W/channel, VU meter option.

## UREI (USA)

United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352. Phone: (213) 767-1000. Telex: 651389.

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

**6150:** 2-channel, 80W/channel, bridgable, overload LEDs.

**6250:** 2-channel, 150W/channel, bridgable, overload LEDs.

**6300:** 2-channel, 225W/channel, bridgable, overload LEDs.

**6500:** 2-channel, 275W/channel, bridgable, overload LEDs.

## YAMAHA (Japan)

UK: Ban Electromusic, 89-97 St. John Street, London EC1M 4AB. Phone: 01-253 9410. Telex: 25960.

**USA:** Yamaha International Corp, PO Box 6000, Buena Park, Cal 90620. Phone: (714) 522-9105.

**P2050:** 2-channel, 45W/channel, bridgable, switchable highpass filter.

**P2100:** 2-channel, 85W/channel, bridgable.

**P2200:** 2-channel, 200W/channel.

**P2201:** 2-channel, 200W/channel, peak reading meters.

# product Monitors guide

This product guide includes loudspeaker systems suitable for studio monitoring. For a listing of manufacturers producing PA and sound reinforcement loudspeakers, plus drive units, please refer to the product guide which appeared in our June 1982 issue.

## ACOUSTIC RESEARCH (UK)

Teledyne Acoustic Research, High Street, Houghton Regis, Beds LU5 5QJ. Phone: 0582 603151. Telex: 825467.

**USA:** Teledyne Acoustic Research, 10 American Drive, Norwood, Massachusetts 02062. Phone: (617) 769-4200. Telex: 924310.

**AR9:** 4-way system with two 12in side firing woofers, an 8in lower MF unit, a 1½in dome upper MF unit and a ¾in dome tweeter.

**AR90:** 4-way system, smaller configuration of AR9 with two 10in side firing woofers.

**AR15:** 3-way system with 12in woofer, 1½in MF driver and ¾in tweeter.

**AR93:** 3-way system with two 8in side firing woofers, an 8in MF driver and 1½in tweeter.

**AR94:** 3-way system with 8in woofer, 8in MF unit and 1½in tweeter.

**AR38:** 2-way system with 10in woofer and 1½in tweeter.

**AR28:** 2-way system with 8in woofer and 1in tweeter.

**AR18:** 2-way system with 8in woofer and 1½in tweeter.

## ALTEC (USA)

Altec Corp, 1515 South Manchester Avenue, Anaheim, Cal 92803. Phone: (714) 774-2900. Telex: 655415.

UK: Rank Strand Sound, PO Box 51, Great West Road, Brentford, Middx TW8 9HR. Phone: 01-568 9222. Telex: 27976.

**9842-8A/D:** 2-way system with 12in bass driver and HF compression driver/horn assembly with *Tangerine* radial phase plug and *Mantaray* horn.

**9844A:** 2-way system with twin 12in LF units and an HF compression driver with aluminium horn.

**9845A:** 2-way system with 15in LF unit and an HF compression driver with aluminium horn.

**9849-8A/D:** 2-way system with 12in LF unit and HF sectoral horn.

**A7X:** 2-way system with 15in LF unit and 1in HF compression driver with horn.

## ATC (UK)

Loudspeaker Technology Ltd, Westwood House, Great West Trading Estate, 979 Great West Road, Brentford, Middx TW8 9DN. Phone: 01-568 8224.

**S50:** 3-way system with 9in LF unit, 3in dome MF driver and 1in dome HF unit. Bass reflex.

**S85:** 3-way system similar to S50, but two 9in LF units. Infinite baffle.

## AUDICON (USA)

Audio Consultants Inc, 1200 Beechwood Avenue, Nashville, Tennessee 37212. Phone: (615) 256-6900. Telex: 262741.

UK: Trad Electronic Sales Ltd, 149b St Albans Road, Watford WD25BB. Phone: 092347988. Telex: 262741.

**Alpha One:** biamplified 3-way system using JBL components, designed by John Storky. System supplied as pair with BGW amps, crossovers and UREI filters. Two 15in bass units, 2in MF compression driver with horn and HF slot type compression driver.

**Alpha Two:** smaller version of above with twin 12in LF units and 1in horn and lens assembly.

## AUDIO MARKETING (USA)

Audio Marketing Ltd, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 359-2312. Telex: 996519.

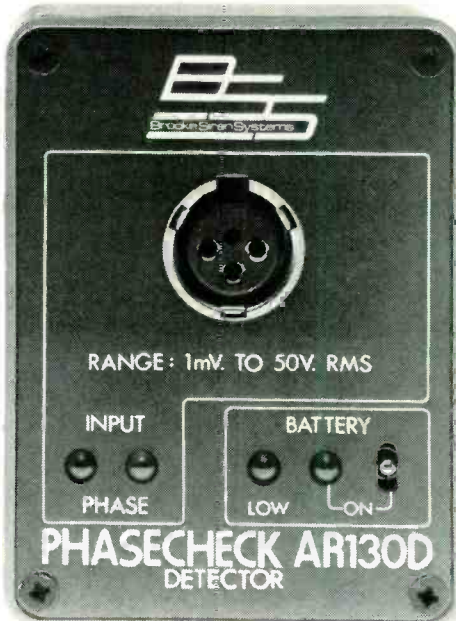
UK: Edward Veale & Associates Ltd, 16 North Road, Stevenage, Herts. Phone: 0438 50023. Telex: 825211.

**Super Red:** uses Altec 604-E2 duplex driver with additional extended range woofer. Infinite baffle.

**Big Red:** basically similar to *Super Red*, but less

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**AGENTS:**  
**France:** Regiscene, Paris 374 58 36. **Belgium:** T.E.M. Brussels 569 18 23. **Holland:** Ampco BV Utrecht 433 134. **Germany:** Audio Vertrieb, GmbH Hamburg 524 51 51. **Spain:** Lexon Distribuciones, Barcelona 203 48 04. **Italy:** Ivo Cabrini, Parma 698 144. **Australia:** Audio Mix Systems, Roe Bay, Sydney. **South Africa:** Colosseum Acoustics, Johannesburg 23 4541. **Austria:** Bourke & Dissertori GmbH Wels 52242 7147. **Canada:** Gerr Electro Acoustics, Toronto 868 05 28. **America:** Klark Teknik Inc. N.Y. 249 3660. **Japan:** Matsuda Trading Co. Tokyo 255 3047.  
**UK AGENTS:**  
 HHB Hire and Sales, London 961 3295, Scenic Sounds, 01 734 2812, Music Laboratory 01 388 5392, Turrikey 01 440 9221, Wigwam Acoustics 0706 68766, Autograph Sales 01 267 6677.

**Brooke Siren Systems, 92 Colney Hatch Lane, London N10. Tel: 01-444 7892. Telex: 912881 BSSAUDIO**

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 3011 ST Rotterdam, The Netherlands. Tel. 010-3110-140013. Telex 26324  
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# product Monitors guide

extended range woofer. Bass reflex.

**Little Red:** smaller version of *Big Red*. 2-way system with 12in LF unit, 1/2in dome tweeter, MF and HF frequency equalisers.

**Tiny Red:** check or squark loudspeaker. Bass reflex.

## AUDIO PRO (Sweden)

**Audio Pro AB**, Kemistvägen 28, S-18334 Täby. Phone: (08) 756.73.50.

**UK:** Audio Pro HiFi Ltd, Brook House, Crewe Road, Wheelock, Sandbach, Cheshire CW11 9HT. Phone: 09367 7520.

**USA:** Intersearch Inc. 4720-Q Boston Way, Lanham, Maryland 20801. Phone: (301) 459-3292.

**A4-14:** biamplified (two x 40W) loudspeaker system. System incorporates two downward firing 5in sub-woofer units in a bass reflex enclosure, plus a 4in MF unit and a 1in dome tweeter.

**B4-200:** subwoofer system covering the frequency range 30Hz to 200Hz. Comprises four 8in drivers in a bass reflex enclosure, with built in 150W power amp and adjustable crossover filter.

## AURATONE (USA)

**Auratone Corp.** PO Box 698, Coronado, Cal 92118. Phone: (714) 297-2820.

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

**5C:** recording/mixing comparative monitor with 5in full range driver.

## BARCO (Belgium)

**Barco Electronic NV**, Sevenslaan, B-8500 Kortrijk. Phone: 056 21.11.24. Telex: 85105.

**USA:** Rohde & Schwartz Sales Co Inc. 14 Gloria Lane, Fairfield, New Jersey 07006. Phone: (201) 575-0750.

**MLS1:** 3-way system with LF, MF and HF dome units, self-powered electronic limiter operates when distortion exceeds 1%.

## B & W (UK)

**B & W Loudspeakers Ltd**, Meadow Road, Worthing, West Sussex BN11 2RX. Phone: 0903 205611. Telex: 87342.

**USA:** Anglo American Audio Co Inc. PO Box 653, Buffalo, NY 14240.

**801:** 3-way system with 10 1/2in LF unit, 4in MF unit and 1in dome tweeter, each unit effectively mounted in separate enclosures vertically in-line.

**802:** basically similar to 801, but more compact and

with two 7 1/4in bass units.

**DM7:** 2-way vertical in-line system with 160mm bass/MF driver and 26mm dome tweeter.

**DM11:** 2-way system with 160mm bass/MF driver and 26mm tweeter.

**DM12:** 2-way system with 150mm bass/MF driver and 26mm tweeter.

**DM14:** 2-way system with twin LF/MF drivers and a separate HF unit.

## CELEF (UK)

**Celef Audio Ltd**, 130-132 Thirsk Road, Boreham Wood, Herts. Phone: 01-207 1150.

**RT1:** 3-way system with 9in bass unit, 8in MF driver and ribbon tweeter.

## CELESTION (UK)

**Celestion International Ltd**, Ditton Works, Foxhall Road, Ipswich IP3 8JP. Phone: 0473 73131. Telex: 98365.

**SL6:** compact 2-way system with 6 1/2in woofer and 1 1/4in metal alloy dome tweeter.

## CORAL (Italy)

**Coral Electronic SNC**, Strada Rivalta 73, I-10043. Phone: 901.52.73.

**Cemark 1:** 3-way system with 250mm woofer, 38mm dome MF unit and 25mm dome tweeter.

## COURT (UK)

**Court Acoustics Ltd**, 35-39 Britannia Row, London N1 8QH. Phone: 01-359 0956/5275. Telex: 268279.

**JM5:** 4-way system using JBL drivers and designed for bi-amplification. Uses twin 14in bass drivers in a distributed port reflex enclosure, plus a 12in upper bass driver in a sub enclosure and MF and HF units. **JYM3:** compact 3-way system using JBL LF and HF units and a dome radiator for MF.

## EASTERN ACOUSTIC WORKS (USA)

**Eastern Acoustic Works**, 59 Fountain Street, Box 111, Framingham, Massachusetts 01701. Phone: (617) 620-1478.

**MS50:** 2-way system with 8in LF unit, 8in auxiliary bass radiator and 1in dome tweeter.

**MS200:** 3-way system with 15in bass driver, MF driver and HF driver with conical horn.

**MS300:** similar to *MS200*, but with improved efficiency and power handling.

## EASTLAKE (UK)

**Eastlake Audio Ltd**, 97-99 Dean Street, London W1V 5RA. Phone: 01-262 3198. Telex: 27939.

**USA:** Sierra Audio, 293 South Grand Avenue, Pasadena, Cal 91105. Phone: (213) 793-1900.

**TM-3 Series:** 2 or 3-way system usually only fitted to facilities designed and constructed by Eastlake Audio. Drive components may be specified by the client, versions being available as 2-way with 15in bass units and a single MF/HF unit, or 3-way with

*Gauss Model 7351*

separate MF and HF. System employs a dense timber segmented horn for MF. Systems are normally supplied with a pre-wired 19in rack assembly containing power amps, White *Model 4001* equaliser sets, White *Model 4016-800* 18dB/octave 800Hz crossovers, and input/output connector panels.

**TM-7:** smaller 2-way version of the *TM-3* using twin 12in bass drivers. Uses same MF wooden horn.

## EASTMILL (UK)

**Eastmill Ltd**, Unit 8, Worton Hall Trading Estate, Worton Road, Isleworth, Middx TW7 6ER. Phone: 01-568 4646.

## new

**T3:** 3-way system with 230mm LF driver, 75mm dome MF driver and 32mm dome tweeter, suitable for passive or bi-amplified usage, bass reflex, also available as a baffle mount.

**T4:** 3-way system with 380mm LF driver, 75mm dome MF driver and 32mm dome tweeter. Other features as *T3*.

**T5:** 3-way system with twin 380mm LF drivers, 75mm dome MF driver and 32mm dome tweeter. Other features as *T3*.

## ELECTRO-VOICE (USA)

**Electro-Voice Inc**, 600 Cecil Street, Buchanan, Michigan 49107. Phone: (616) 695-6831.

**UK:** Gulton Europe Ltd, Electro-Voice Division, Maple Works, Old Shoreham Road, Hove BN3 7EY. Phone: 0273 23329. Telex: 87680.

**Sentry 100A:** 2-way system with 8in direct radiator LF unit and dome tweeter.

**100S:** 2-way system housed in a compact one-piece plastic cabinet of sandwich construction. Uses a 12in direct radiator woofer and 1 1/2in dome tweeter.

## FOSTEX (Japan)

**Main distributors:** RWO Fostex Division, Interlake Audio Inc, 620 King Edward Street, Winnipeg, Manitoba, Canada R3H 0P2. Phone: (204) 775-8513. Telex: 07-55725.

**USA:** Interlake Audio Inc, 2432 North Cedarwood Circle, Simi Valley, Cal 93063. Phone: (805) 583-0540.

**LS/4:** 4-way system with twin 15 1/4in LF units, 12in MF unit, HF unit with radial horn and UHF unit with diffraction horn.

**LS/3:** similar to *LS/4*, but less MF unit and only one LF driver.

**LS/2:** similar to *LS/3*, but 12in LF driver.

## FOSTEX (Japan)

**UK:** Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9304. Telex: 25769.

**USA:** Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, Cal 90650. Phone: (213) 921-1112.

## new

**6301:** compact personal monitor with 4in driver and in-built 10W power amp. May also be externally amplified.

## GALE (UK)

**UK:** DW Labs, 88-90 Grays Inn Road, London WC1X 8AA. Phone: 01-404 5140.

**GS401A:** 3-way system with twin 200mm bass woofers, 100mm MF driver and a 19mm dome tweeter.

## GAUSS (USA)

**Cetec Gauss**, 13035 Saticoy Street, North Hollywood, Cal 91605. Phone: (213) 875-2669. Telex: 910-499 2669.

**UK:** HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Phone: 01-961 3295.

**7480:** 4-way system requiring bi-amplification. Uses 18in woofer, plus 12in lower MF, 4in upper MF compression driver and 1 1/2in HF compression driver.

**7350:** 3-way system requiring bi-amplification. Uses 15in woofer, plus 10in MF and an HF compression driver.

**7351:** similar to *7350*, but housed in an enclosure for horizontal wall mounting.

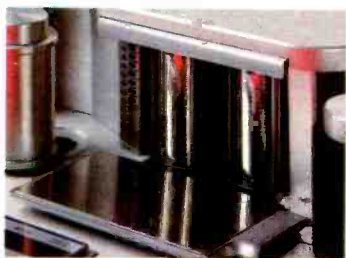
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# SPOILT FOR CHOICE.



When you come to choose your new multitrack, deciding on a Studer will probably be easy. What will be a little more difficult will be *which* Studer to take - the new A80/VU Mk III or the new A800.

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narrow head block that cuts the travel distance between the erase and record heads to 88 milliseconds at 30 ips (now available as a conversion for existing A80/VU models). And both are available in several tape width/channel number configurations.

Whatever your criteria, choosing between the

A80/VU Mk III and the A800 won't be easy. But then Studer never have been in the habit of taking the easy way out when it comes to performance.

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# product Monitors guide

## GENELEC (Finland)

Genelec Oy, Satamakatu 7, SF-74100 Iisalmi.  
Phone: (9) 77 24942. Telex: 4404.

UK: Future Film Developments, 36-38 Lexington  
Street, London W1R 3HR. Phone: 01-437 1892. Telex:  
21624.

**Triamp S30:** 3-way system with integral power  
amps, (LF 50W, MF 40W, HF 40W). Utilises 8in long  
throw LF driver, 3in MF unit and direct radiating HF  
ribbon unit.

**Triamp 1024A:** similar to S30, but 15in LF driver.  
Power amps LF 90W, MF 90W, HF 60W.

**Biamp 1019A:** compact 2-way biamplified  
(10W + 10W) system with 5in LF unit and 3/4in dome  
tweeter.

## HARBETH (UK)

Harbeth Acoustics, 2A Nova Road, Croydon CR0  
2TL. Phone: 01-681 7676.

USA: William McCabe Audio Systems Inc, 916 NE  
64th Street, Seattle, Washington 98115.

**HL MkIII:** 2-way system with 8in LF driver and 1in  
tweeter.

**ML:** compact 2-way system with 5in LF driver and 1in  
tweeter.

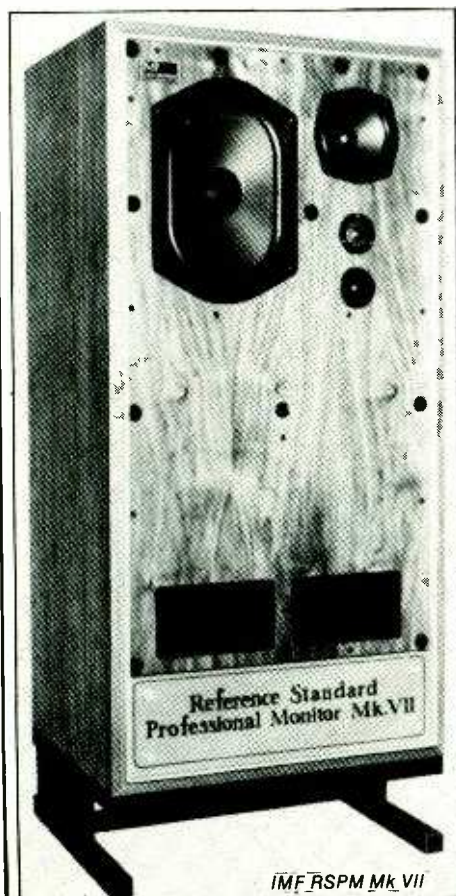
## IMF (UK)

IMF Electronics Ltd, Westbourne Street, High  
Wycombe, Bucks HP11 2PZ. Phone: 0494 35576.  
Telex: 83545.

**RSPM MkIV:** similar to RSPM MkVII but with drive  
units differently configured on the front panel.

## new

**RSPM MkVII:** 4-way system with 300 x 210mm LF  
unit loaded by a transmission line, 130mm MF unit,  
45mm tweeter and 20mm HF tweeter.



IMF RSPM Mk VII

## new

**SACM:** 4-way system using the same drive units as  
above, but with the MF and tweeter units mounted  
vertically in-line above the bass enclosure. The MF  
and tweeter sections may be suspended or mounted  
separately from the bass transmission line  
enclosure.

**Professional Monitor:** compact 4-way system  
based on the RSPM Mk VII.

**Studio Monitor:** 3-way system with 200mm LF unit  
loaded by a transmission line, 100mm MF unit and  
20mm tweeter.

**Compact Monitor 3:** compact 3-way system with  
200mm bass unit, 100mm MF unit and 25mm  
tweeter.

**Compact Monitor 2:** compact 2-way system with  
200mm bass/MF unit and 25mm tweeter.

**MCR-2:** compact 2-way system with 130mm  
bass/MF unit and 34mm tweeter.

## JBL (USA)

James B Lansing Sound Inc, 8500 Balboa Boule-  
vard, Northridge, Cal 91329. Phone: (213) 893-8411.  
Telex: 674993.

UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2  
5DD. Phone: 0753 76911. Telex: 849069.

**4301B:** 2-way broadcast monitor with 8in woofer and  
1.4in tweeter. Also available as 4301BE with built-in  
10W amp.

**4311B:** compact 3-way system with 12in woofer, 5in  
MF unit and 1.4in tweeter.

## new

**4312:** compact 3-way system based on the 4311B,  
but improved dividing network and available in  
mirror image pairs.

**4313B:** 3-way system with 10in woofer, 5in MF driver  
and 1in dome tweeter.

**4315B:** 4-way system with 12in woofer, 8in MF driver,  
5in tweeter and a UHF transducer.

**4331B:** 2-way system with 15in LF unit, plus HF  
compression driver with horn/lens assembly.

**4333B:** 3-way system similar to 4331B, but with  
additional UHF transducer.

**4343B:** 4-way system similar to 4333B, but with  
additional 10in MF driver.

## new

**4345:** 4-way system based on the 4343B, but with an  
18in LF unit, an improved 10in MF driver and with an  
improved dividing network.

**4350B:** 4-way system designed for biamplification.  
Uses twin 15in LF units, 12in MF driver, HF com-  
pression driver with horn and acoustic lens, plus a  
UHF transducer. May be mirror image mounted.

## new

**4355:** 4-way system designed for biamplification,  
similar to the 4350B. Available in mirror image pairs.

**4411:** compact 3-way system developed from the  
4311. Uses 12in woofer, 5in MF driver and 1in dome  
tweeter. Available in mirror image pairs.

**4430:** 2-way system suitable for biamplification.  
Uses a 15in LF driver and an HF compression driver  
coupled to a bi-radial horn.

**4435:** 2-way system suitable for biamplification.  
Larger version of the 4430, but with twin 15in LF  
drivers.

## KEF (UK)

KEF Electronics Ltd, Tovil, Maidstone, Kent ME15  
6QP. Phone: 0622 672261. Telex: 96140.

**105 Series II:** 3-way system with 12in bass driver in  
separate enclosure, plus 4in MF driver and 2in  
tweeter mounted in vertically aligned enclosures  
above.

**101:** compact 2-way system with 4 1/2in bass driver  
and 1in dome tweeter.

## KLEIN & HUMMEL (West Germany)

Klein & Hummel, Kemnat, Postfach 3102, D-7302  
Ostfildern 4. Phone: 0711 455026. Telex: 723398.

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.

**092:** 3-way system triamplified with crossovers,  
bass 120W, MF and HF 60W each. Uses twin 10in LF  
drivers, 3 1/2in MF unit, 1in dome tweeter.

**096:** 3-way system triamplified with crossovers, all  
amps 60W each. Uses a 10in LF driver, 2in MF unit  
and 3/4in dome tweeter.

**OY:** 3-way system biamplified with crossovers, bass  
30W, MF and HF 30W (MF and HF separate at high  
levels). Uses 10in LF driver, 4in MF driver, plus an HF  
dome tweeter.

## KLH (USA)

KLH Research and Development Corp, 145  
University Avenue, Westwood, Massachusetts  
02090. Phone: (617) 326-8000.

UK: Webland International Ltd, 4 Cromwell Place,  
London SW7 2JJ. Phone: 01-584 7735. Telex: 25570.

**327:** 3-way system with 10in LF driver, 4in MF unit  
and 2 1/2in tweeter.

**KLH-1:** 3-way system 'computer controlled' with  
twin 8in LF drivers, 4in MF unit and 1in tweeter.

## LOCKWOOD (UK)

Lockwood & Co Ltd, Lowlands Road, Harrow, Middx  
HA1 3AW. Phone: 01-422 3704.

**Universal Major:** 2-way system using Tannoy K3808  
or K3838 15in dual concentric drivers.

**Studio Academy 1/2:** 2-way system version 1 uses  
Tannoy DC386 15in dual concentric, version 2 uses  
Tannoy DC316 12in dual concentric.

**Miniature Monitor:** similar to the Studio Academy,  
but uses Tannoy DC296 10in dual concentric.

## MEYER (USA)

Meyer Sound Laboratories Inc, 2194 Edison Avenue,  
San Leandro, Cal 94577. Phone: (415) 569-2866.

UK: Autograph Sales Ltd, Stable 11, British Rail  
Camden Depot, Chalk Farm Road, London NW1  
8AH. Phone: 01-267 6677.

**ACD/Meyer Monitor:** 2-way system, biamplified, LF  
150W, HF 75W. Uses a 12in LF driver, plus an HF  
horn/driver.

## MISSION (UK)

Mission Electronics Ltd, PO Box 65, London SW7  
1PP. Phone: 01-589 0048. Telex: 8813188.

Canada: Mission North America Corp, 89 Galaxy  
Boulevard, Unit 10, Rexdale, Ontario M9W 6AY.  
Phone: (416) 675-7730.

**770:** 2-way system with 8in woofer and 1in dome  
tweeter.

**730:** 3-way system with 10in LF driver, 4 1/2in MF  
driver and 1in dome tweeter.

## KEITH MONKS (UK)

Keith Monks (Audio) Ltd, 26-28 Reading Road South,  
Fleet, Aldershot, Hants. Phone: 02514 20568. Telex:  
858606.

USA: Keith Monks (USA) Inc, 652 Glenbrook Road,  
Stamford, Connecticut 06906. Phone: (203)  
348-4969. Telex: 643678.

**LS1/8:** compact self powered monitor with in-built  
10W power amp. Uses 6 1/2in LF driver and twin 3in  
HF units. Version available with XLR inputs.

**LS1/9:** similar to the LS1/8, but may be powered by an  
external DC power supply.

## PHILIPS (Netherlands)

NV Philips Gloeilampenfabrieken, Eindhoven.  
Phone: 040 79.11.11. Telex: 511121.

UK: Philips Audio, 420 London Road, Croydon CR9  
3QR. Phone: 01-689 2166. Telex: 946169.

USA: Philips Audio Video Corp, 91 McKee Drive,  
Mahwah, New Jersey 07430. Phone: (201) 529-3800.



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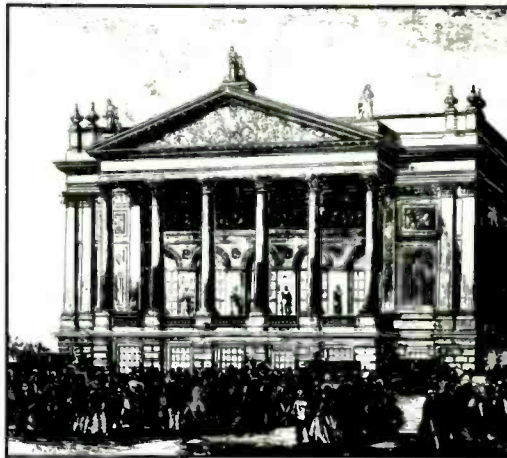
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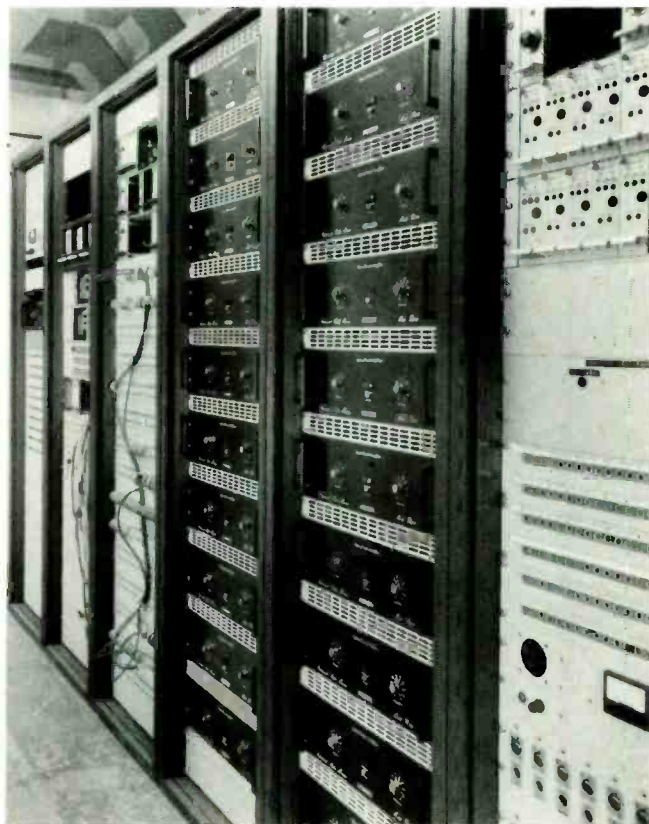
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# product Monitors guide

**RH545:** 3-way system triamplified, LF 50W, MF 35W, HF 15W, with motional feedback for the bass. Uses 12in LF driver, 2in dome MF driver and 1in dome tweeter.

## PWB (UK)

**PWB Electronics Ltd, 1 Norfolk Gardens, Leeds LS7 4PP. Phone: 0532 682550.**

**Active System:** actively driven loudspeaker system with separate bass enclosure housing a 200mm driver. MF and HF handled by a 'tower' unit with 105 low mass orthodynamic diaphragm drive units. Stereo system uses four active drive amplifiers with MOSFET output stages. Uses electronic crossovers.

## QUAD (UK)

**Quad Electroacoustics Ltd, Huntingdon, Cambs PE18 7DB. Phone: 0480 52561. Telex: 32348.**

## new

**ESL-63:** electrostatic loudspeaker with a light thin membrane suspended between two acoustically transparent electrodes.

**ELS:** original Quad electrostatic monitor loudspeaker.

## RCF (Italy)

**Radio Cine Forniture, I-42029 S Maurizio (Reggio Emilia), Via Notari 1/a. Phone: 0522 40141/33346. UK: RCF Covemain Ltd, Dunchurch Trading Estate, London Road, Dunchurch, Rugby, Warwickshire CV23 9LL. Phone: 0788 815020. Telex: 837537.**

**BR200:** 2-way system with 15in LF driver, plus HF compression driver with horn and acoustic lens.

## RED (UK)

**Red Acoustics Ltd, 15 Lots Road, London SW10 0QH. Phone: 01-351 1394. USA: Red Acoustics (USA) Ltd, 65 East 55th Street, Suite 902, New York, NY 10022. Phone: (212) 888-0892.**

**A-4 Pro Monitor:** 2-way system biamplified. Uses twin 8in LF drivers with separate 100W power amps and Tristar acoustic lens, plus twin angle mounted 1in dome HF units fed by a 50W power amp.

**A-3 Monitor:** 2-way system with in-built 150W power amp. Uses a single 8in LF driver with Tristar acoustic lens, plus twin angle mounted 1in dome HF units.

**A-2 Pro Compact:** 2-way system with 8in LF driver and co-axially mounted 1in dome HF driver.

## new

**Studio Monitor:** system comprising the A-4 Pro Monitor plus a sub-bass system. Sub-bass system housed in a separate enclosure with four 8in drivers fed by separate 100W power amps. Frequency range of sub-bass system 24Hz to 150Hz.

## REVOX (Switzerland)

**Revox ELA AG, Althardstrasse 150, CH-8105 Regensdorf. Phone: 01 840.29.60. Telex: 58489. UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.**

**USA: Studer Revox America Inc, 1819 Broadway, Nashville, Tennessee 37203. Phone: (615) 329-9576. Telex: 554453.**

**Triton:** 4-way system with combined LF enclosure, but separate stereo MF/HF enclosures. Bass enclosure houses two 9½in LF drivers, MF/HF enclosure houses 7in lower MF driver, 1¼in upper MF driver and ¾in HF driver.

**BR 530:** 3-way system with 12½in LF driver, 2in dome MF unit and ¾in HF driver.

**BR 430:** 3-way system with 9½in LF driver, 2in dome

MF unit and ¾in HF driver.

**BX 4100:** 3-way system with separate enclosures for LF/MF/HF. Enclosures vertically aligned. LF section comprises eight parallel connected 120mm woofers, MF single 175mm driver, HF single 19mm dome tweeter.

## new

**Piccolo:** compact 2-way system with a 122mm LF/MF driver and 18mm dome tweeter.

## ROGERS/CHARTWELL (UK)

**Swisstone Electronics Ltd, 4-14 Barmeston Road, London SE6 3BN. Phone: 01-697 8511. Telex: 847777. USA: Reference Monitor International Inc, 2380 Camino Vida Roble, Carlsbad, Cal 92008. Phone: (714) 438-1214.**

**LS3/5A:** compact 2-way system to BBC design with 4in LF driver and ¾in dome HF unit.

**LS5/8:** 2-way system to BBC design, biamplified with modified Quad 405 power amp. Uses 12in LF/MF driver and a 34mm dome tweeter.

**Studio 1:** 3-way system with a 200mm LF/MF driver, plus 12mm lower and 19mm upper HF tweeter units.

**Chartwell PM55:** 2-way system with 5in LF/MF driver and 19mm dome tweeter.

**Chartwell PM110 Series 2:** 2-way system with 170mm LF/MF driver and 25mm dome tweeter.

**Chartwell PM210 Series 2:** 2-way system with 200mm LF/MF driver and 25mm dome tweeter.

**Chartwell PM310:** 2-way system with 205mm LF/MF driver and 25mm dome tweeter.

**Chartwell PM410:** 3-way system with 12in LF driver, 5in MF driver and 25mm dome tweeter.

**Chartwell PM510:** 2-way system with 12in LF/MF driver, and 25mm dome tweeter.

**Chartwell PM450P:** 2-way system with 12in LF/MF driver and 25mm dome tweeter.

## SMC (UK)

**SMC Loudspeakers, 76 Bedford Road, Kempston, Beds MK42 8BB. Phone: 0234 854133.**

**AS40:** 3-way system with 10in LF driver, 4½in MF driver and 1in dome tweeter.

**AL50:** 3-way system with 12in LF driver, 5in MF driver and 1in tweeter.

## SPECTRA SONICS (USA)

**Spectra Sonics Inc, 3750 Airport Road, Ogdens, Utah 84403. Phone: (801) 392-7531.**

**Model 3000:** 3-way system externally triamplified.

## SPENDOR (UK)

**Spendor Audio Systems Ltd, Station Road Industrial Estate, Hailsham, Sussex BN27 2ER. Phone: 0323 843474.**

**BC1:** 3-way system with 8in LF/MF driver, 12mm lower HF driver and 19mm dome upper HF driver. Also available with built-in power amp.

**BC3:** 4-way system with 12in LF driver, 8in MF driver, 12mm lower HF driver and 25mm dome tweeter. Also available with built-in power amp.

**SA1:** compact 2-way system with 4½in LF driver and 34mm dome tweeter.

**SA3:** biamplified 2-way system, LF 100W, HF 50W, includes electronic crossover. Uses 12in LF unit and 34mm dome tweeter.

## TANDBERG (Norway)

**Tandberg A/S, Feteveien 1, N-2007 Kjeller. Phone: 02 71.68.20. Telex: 71886.**

**UK: Tandberg Ltd, Unit 1, Revie Road Industrial Estate, Elland Road, Leeds LS11 8JG. Phone: 0532 774844. Telex: 557611.**

**USA: Tandberg of America Inc, Labriola Court, Armonk, NY 10504. Phone: (914) 273-9150. Telex: 13757.**

**TML3005:** 4-way system with 13in LF unit, 6in lower MF driver, 1¼in upper MF driver and 1in tweeter.

## TANNOY (UK)

**Tannoy Ltd, 21 Canterbury Grove, West Norwood, London SE27 0PW. Phone: 01-670 1131. Telex: 291065.**

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

**Dreadnought:** 3-way active time compensated system with electronic crossovers. Uses twin 15in bass drivers in a reflex enclosure, plus a separate chamber with a dual concentric unit handling MF and HF.

**M1000 Super Red:** 2-way system using a 15in dual concentric driver.

**M2000 Buckingham:** 3-way system with twin 12in LF drivers and a 10in dual concentric for MF/HF.

**M3000 Classic:** similar to the M1000, but with extended LF response. Uses a modified 15in dual concentric driver.

**SRM15X:** similar to M1000, but more compact. Uses same 15in dual concentric driver.

**SRM12X:** similar to SRM15X, but uses 12in dual concentric driver.

**SRM12B Little Red:** compact 2-way system using the Tannoy 12in dual concentric driver.

**SRM10B:** similar to the Little Red, but more compact and uses a 10in dual concentric driver.

## UEP (UK)

**Unique Electronic Products, 26 Woodstock Road, London NW11 8ER. Phone: 01-458 8118. Telex: 922488.**

**Dynaribbon Pro:** 2-way system with 8in LF driver and ribbon/horn HF unit.

**Compact Pro:** 3-way system with 8in LF driver, Coles 3000 modified tweeter and 4001 super tweeter.

## UREI (USA)

**United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352. Phone: (213) 767-1000. Telex: 651389.**

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

**Model 811:** time aligned 2-way system with a single woofer with a co-axial HF horn. Available as mirror image pairs.

**Model 813:** time aligned 3-way system similar to the Model 811, but with an additional 15in LF driver.

**Model 815:** similar to the Model 813, but with twin 15in LF drivers.

## VISONIK (West Germany)

**UK: Uher Sales & Services Ltd, 30-31 Lyme Street, London NW11 0EE. Phone: 01-485 0943.**

**USA: Visonik of America Inc, 701 Heinz Avenue, Berkeley, Cal 94710. Phone: (415) 548-4005.**

**David:** compact recording/mixdown monitors available as 2-way or 3-way systems in various configurations.

## WESTLAKE (USA)

**Westlake Audio Inc, 7265 Santa Monica Boulevard, Los Angeles, Cal 90046. Phone: (213) 851-9800. Telex: 698645.**

**HR-1:** 4-way system requiring HR-1X active crossover and quad-amplification, 400W to 1kHz, 80W to 4kHz, 30W above. Uses twin 15in woofers, 10in MF driver, 4in compression driver/horn for upper MF, and 2in compression driver/horn for HF.

**TM-1/2/3/4:** 3-way systems requiring either biampification or triamplification. Use twin 15in woofers, 4in compression MF driver/horn, and 2in compression driver for HF. (TM-3 and TM-4 HF driver is horn loaded). TM-1 and TM-3 require biampification. TM-2 and TM-4 require 3-way electronic crossovers.

**TM-5:** 2-way system with 15in woofer, 15in passive radiator and 2in MF/HF compression driver.

**TM-6:** 2-way system with twin 15in woofers and 4in MF/HF compression driver.

**TM-7:** 3-way system with twin 12in woofers, 2in MF compression driver/horn and HF compression driver.

**HR-7:** 4-way system with twin 12in woofers, 10in lower MF driver, 2in MF compression driver/horn and HF compression driver.

**BBSM-12:** 3-way system with twin 12in woofers, 7in MF driver and 1½in dome tweeter.

**BBSM10:** 3-way system with twin 10in woofers, 5in MF driver and 1½in dome tweeter.

**BBSM-8:** 3-way system with twin 8in woofers, 3in MF driver and 1in dome tweeter.

**BBSM-6:** 3-way system with twin 6in woofers, 3½in MF driver and 1in dome tweeter.

## YAMAHA (Japan)

**UK: Natural Sound Systems Ltd, Strathcona Road, North Wembley, Middx HA9 8QL. Phone: 01-904 0141.**

**USA: Yamaha International Corp, PO Box 6000, Buena Park, Cal 90620. Phone: (714) 522-9105.**

**NS1000M:** 3-way system with a 300mm woofer, 85mm dome MF driver and 30mm dome tweeter.

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

# product Acoustic materials and furnishings guide

## AUDIO KINETICS (UK)

Audio Kinetics (UK) Ltd, Verulam Road, St Albans, Herts AL3 4DH. Phone: 0727 32191. Telex: 299951.

**Acoustic screens:** range of three acoustic screens for improving separation between musicians, etc. Includes a unit with an observation window.

**Sonapanel acoustic system:** system of modular absorbers for wall and ceiling mounting.

## AURAL DESIGNS INC (USA)

PO Box 81067, Pittsburgh, Pennsylvania 15217. Phone: (518) 521-1104.

Manufacture low frequency and broadband panel absorbers, reverberation chambers and reverberation enhancement systems.

## AUTOCUE (UK)

Autocue Products Ltd, 265 Merton Road, London SW18 5JS. Phone: 01-870 0104.

**809 signal system:** portable cue system with two slave signal screens.

## BE (USA)

Broadcast Electronics Inc, 4100 North 24 Street, PO Box 3606, Quincy, Illinois 62301. Phone: (217) 224-9600.

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

**Control room furniture:** range of broadcast studio furniture comprising single and double turntable cabinets and desk top table.

## BRABURY (UK)

Brabury Electronics Ltd, 119A Loverock Road, Reading RG3 1NS. Phone: 0734 52434. Telex: 848760.

T 802: tally light unit for 19in rack mounting.

T 702: status light unit for wall mounting.

T 115: adjustable script light unit.

## CANFORD AUDIO (UK)

Canford Audio, Stargate Works, Ryton, Tyne & Wear NE40 3EX. Phone: 089422 4515. Telex: 537792.

USA: Canford Audio (USA) Inc, 652 Gienbrook Road, Stamford, Connecticut 06906. Phone: (203) 348-4969. Telex: 643678.

**Studio acoustic tables:** range of tables for use in broadcasting studios. Hexagonal or rectangular shapes, circular hole in table centre of hexagonal version. Optional jack plugs.

**Acoustic script lecterns:** script panels designed to match the company's range of tables.

**Illuminated signs:** range of illuminated signs, rectangular with screen printed legends.

**Control room chairs:** range of chairs manufactured in Italy by Vertebra. Available with or without arm rests.

**Equipment racks:** range of 19in rack mount casings with aluminium panels.

**Custom joinery:** Canford offer a custom joinery service and can quote for all types of console cabinet, rack, screens, etc, construction to customer requirements.

## CUSTOM AUDIO (USA)

Custom Audio Electronics, 2828 Stommel Road, Ypsilanti, Michigan 48107. Phone: (313) 482-6568.

**Littlite:** gooseneck lamp for lighting control panels turntables and work areas. Available in two versions.

## DUNLOP (UK)

Dunlopillo Division Dunlop Ltd, Coronation Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3SB. Phone: 0494 26210.

Dunlop produce a wide range of polyurethane foams for sound absorption purposes. Thicknesses and formats can be supplied for almost any application ranging from acoustic panels, and loud-speaker linings to foam wedges for anechoic chambers.

## ELRACK (UK)

OK Machine & Tool (UK) Ltd, Dutton Lane, Eastleigh, Hants SO5 4AA. Phone: 0703 610944.

**Elrack enclosures:** range of 19in DIN rack systems and accessories. Units include cabinets, chassis units, cooling systems, module kits, extrusions, desks and consoles.

## ENCLOSURE TECHNOLOGY (UK)

Enclosure Technology Ltd, Unit G, Southampton Airport, Southampton SO2 2HG. Phone: 0703 614533. Telex: 477045.

Wide range of 19in rack mounting enclosures including ready made units and chassis kit configurations.

## FUTURE FILM DEVELOPMENTS (UK)

Future Film Developments, 36-38 Lexington Street, London W1R 3HR. Phone: 01-437 1892. Telex: 21624.

Range of instrument cases, racks and cabinets constructed from mild steel and with a wide range of accessories. Numerous heights and depths of cabinet are available all to the standard 19in instrument housing width.

## GRESHAM WOOD (UK)

Gresham Wood Industries Ltd, Stanstead, Essex CM24 8HS. Phone: 0279 813132. Telex: 817444.

Range of standard wood consoles and cabinets to house mixers, tape machines, etc. Also design and manufacture custom units. Additionally, offer a range of steel 19in equipment racks with aluminium front and rear panels.

## J-WRAP (USA)

J-Wrap, 135 N Parkview Street, Los Angeles, Cal 90026. Phone: (213) 384-3704.

**new**

**Cable Tamer:** velcro cable tie for storing coiled cables.

## LEXOR (UK)

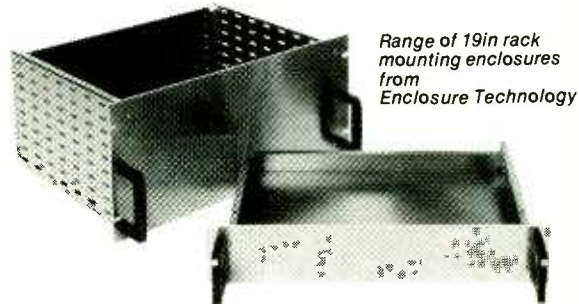
Lab-Aids Ltd, New Lodge, Ashorne, Warwick CV33 9QN. Phone: 092-685 209.

**Quiet-Chamber MkIII:** totally enclosed sound-insulated booth which is transportable, fitted with lighting, power points and 2-speed ventilation all ready to use.

## MICRO-TRAK (USA)

Micro-Trak Corporation, 620 Race Street, Holyoke, Massachusetts 01040. Phone: (413) 536-3551. Telex: 955497.

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



Range of 19in rack mounting enclosures from Enclosure Technology

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- Recording Studio Control Rooms and other Small Volume Rooms tend to have more acoustic problems below 1000 Hz than above. Models 4301 and 4303 offer 28, 1/6 Octave bands from 40 Hz through 900 Hz plus 13, 1/3 Octave bands from 1000 Hz through 16 kHz.
- As the volume of rooms increase to Auditorium or Gymnasium sizes, the acoustic

problems tend to rise in frequency. Models 4310 and 4311 offer 29, 1/6 Octave Bands from 180 Hz through 4.5 kHz plus 12, 1/3 Octave bands from 31.5 Hz through 160 Hz and 5000 Hz through 10 kHz.

- We have a 1/6 Octave equalizer OPTIMIZED FOR SPEECH. The Model 4240 concentrates DOUBLE RESOLUTION in the SPEECH INTELLIGIBILITY band with broader bandwidth filters to trim either side.
- Quick and efficient installation of these new equalizers is made possible by the MODEL 200 SIGNAL ANALYZER which features inexpensive, field plug-in, INTERCHANGABLE FILTER SETS.
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# Quality.



**A.M.S. have consistently provided the industry with the ultimate quality audio processors. Quality of design, quality of construction, but most of all quality of performance.**

To the range of flangers, digital delay lines, digital pitch changers has now been added the RMX 16 digital reverberation system. This system is a 19" 2U high rack mount unit capable of offering 9 standard reverberation programs from the smallest room to the largest hall. The programs are non-volatile as are up to 99 memory locations where user modified variations of any program may be stored. The

mainframe displays tell the user the program selected and indicate all the user modifiable parameters, allowing fast and easy program updating. A remote terminal is available for the unit which is a micro computer in its own right and can hold user modified programs as well as accepting a bar code wand which is used as a software reader for updating standard programs. The remote's memory is non-volatile and it may be removed from use with one RMX 16 and interfaced with any other unit anywhere in the world.

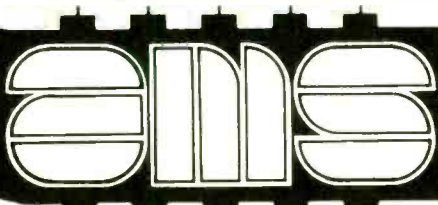
And the quality – well of that you are assured. The system offers 18kHz bandwidth with a 90dB dynamic range and distortion typically 0.025%.

Whatever type of audio processing you need, all we ask is that you check our systems out in your own studio before making your decision. Compare us with the competition and discover why anyone who has used our products before will always ask for them again first.

## THE AMS DIGITAL FAMILY

- DMX 15-80** .....mono input dual output digital delay with optional pitch changer.
- DMX 15-80S** .....true stereo digital delay line with up to 16 seconds delay per channel and optional pitch changers for each channel.
- DMX 15-80SB** .....true stereo broadcast digital delay line.
- DMX 15SYNC** .....audio delay compensator for use with video field/frame synchronisers.
- DMX 16E** .....digital editing system for use with digital audio recorders.
- RMX 16** .....9 program digital reverberation system.
- DM-DDS** .....27kHz 16 bit linear disc mastering preview delay line.

FOR WORLDWIDE DISTRIBUTORS, BROCHURES, MANUALS OR ADDITIONAL INFORMATION  
PLEASE CONTACT A.M.S. HEAD OFFICE IN ENGLAND



**ENGLAND**  
Advanced Music Systems,  
Worsthorne Village,  
Burnley, England.  
Telephone: [0282] 36943  
Telex 63108

**U.S.A.**  
Quintek Distribution Inc.,  
4721 Laurel Canyon Boulevard,  
Suite 209, North Hollywood,  
California 91607.  
Telephone: [213] 980-5717

# product Acoustic materials and furnishings guide

**Series L broadcast furniture:** complete system of furniture for broadcast studio applications allowing assembly into wide variety of formats. Range includes single and double bay turntable cabinets, console table surfaces, and table, corner console table and a wide range of accessories.

**Tape cartridge racks:** range of three racks *Lazy Susan L-72* holds 72 carts in a rotary format for use at a console, *L-90* for wall or free standing holding 90 carts, *L-18* wall or console mounted with space for 18 carts. All three models match the *Series L* furniture.

## PANDUIT (UK)

**Panduit Ltd, Lordswood Industrial Estate, 61-65 Revenge Road, Chatham, Kent ME5 8YT. Phone: 0634 660811. Telex: 965393.**

Wide range of cable ducts, mounts, clips and cable ties.

## PRITEX (UK)

**Pritex (Plastics) Ltd, Wellington, Somerset TA21 8NN. Phone 082347 4271.**

**Audiprene acoustic foam:** range of acoustic foams specially formulated to give specific absorption characteristics over a wide range of applications including anechoic wedges, loudspeaker cabinet linings, etc.

**Auditex acoustic laminates:** range of laminates incorporating *Audiprene* foam with different facings. Available in roll, sheet or pad formats.

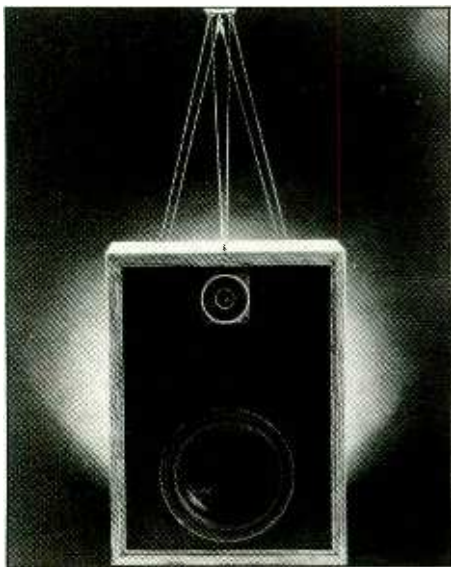
## PYRAMOUNT (USA)

**USA: Audiovisual Systems, 725 Lorraine Boulevard, Los Angeles, Cal 90005. Phone: (213) 934-3006.**

**new**

**Pyramount:** suspension system for hanging monitor loudspeakers from a ceiling. Allows monitors to be rotated through 360° and tilted up to 120°.

*Pyramount suspension system*



## QRK (USA)

**Broadcast Electronics Inc, 4100 N 24th Street, Quincy, Illinois 62301. Phone: (217) 224-9600. Telex: 250142.**

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

**Broadcast furniture:** range of furniture for broadcast applications. Range includes heavy duty desk,

single turntable bay *FP-1*, double turntable bay *FP-2*, turntable plinth for desk top operation *SB-1*, semi-portable console with room for double turntables and mixer *SP-1*, portable console similar to *SP-1* without storage space; lightweight portable version of *P-1* known as *P-2*; matching tape carousels with 72 or 200 cart capacity *TC72* and *TC200*.

## RAT (UK)

**RAT Manufacturing, 17-18 Great Sutton Street, London EC1. Phone: 01-251 2437.**

**Music stands:** versatile range of music stands constructed from black nylon covered steel. Various configurations can be produced from the basic stand and a number of interchangeable accessory parts.

## ROCKWOOL (Denmark)

**Rockwool A/S, DK-2640, Hedehusene, Denmark. Phone: 03 16.16.16. Telex: 58157.**

**UK: Rockwool Co (UK) Ltd, Wern Tarw, Pencoed, Nr Bridgend, South Wales. Phone: 0656 862621. Telex: 497346.**

Range of products made from mineral wool with the principal advantage of being non-combustible. Acoustic uses are only a small part of total applications of Rockwool.

**Rockwool Slabs:** resin bonded Rockwool in flexible and rigid slabs. Flexible slabs suitable for insulation of ceilings and partition walls while the rigid slabs are used for impact isolation of floating floors.

**Rockwool Firebatts:** semi-rigid Rockwool fire insulation slabs for continuous use at temperatures up to 825°C. Acoustic uses for sound absorption in high temperature areas.

**Rockwool Rocklit Board:** high density rigid and self-supporting board. Acoustic uses include insulation of ceilings, walls and ductwork.

**Rockwool Rollbatts:** resin bonded insulation in rolls for acoustic insulation of ceilings and partitions.

**Rockwool Wingmats:** resin bonded Rockwool mat insulation faced on one side with windproof paper and on the other with plastic coated paper vapour barrier. Sound insulation of partitions.

**Rockwool Noise Absorbers:** semi-rigid Rockwool slab enclosed in white plastic sheeting or in galvanised framework with mineral tissue facing. Acoustic application is noise reduction in industrial premises by suspending vertically from ceiling.

**Rockwool Rockfon Acoustic Ceilings:** sound absorbent panels and tiles in a range of facings. Intended for mounting in suspended ceilings.

## RUSLANG (USA)

**Ruslang Corp, 247 Ash Street, Bridgeport, Connecticut 06605. Phone: (203) 384-1266.**

**RL300 tape transport console:** table-top tape transport console of wooden construction. Unit will accept any 19 x 15 3/4 in tape transport. Also the *RL350* rack base mounted on castors. The units may be used in tandem as a roll around console.

**System 23:** range of modular cart racks in a variety of configurations including a rotatable system.

## SHONE (UK)

**Shone Sound Ltd, 16 Bentley Way, Whitehall Road, Woodford Wells, Essex IG80SE. Phone: 01-504 9796.**

**Modular Acoustic Boxes:** modular sound absorbers of three different types. Designed by the BBC and made under licence.

**Acoustic Door Unit AD/1:** door and frame unit in single or double sizes with each door adapted to customers requirements. Includes internal lead sheet to add mass. Can be supplied with a double glazed 9in observation window.

**TLW 1/2:** table cue lights, *TLW/2* has two cue lamps. **FLW 1/2:** floor standing cue lights with tripod base. *FLW/2* has two lamps.

**WLF/WLS:** wall mount cue lights available in versions with one, two or three cue lights. *WLF* is, flush mounted, *WLS* surface mounted.

**TWLS:** similar to *WLS*, but with larger lens to increase light intensity. Especially suitable for TV studios.

**Illuminated signs:** range of illuminated cue signs. Wording may be customised. Multiple units available.

**TMS/W:** table microphone stand.

**Acoustic talks table AT/1:** hexagonal acoustic table with circular centre hole. Optional jack plugs. *A/2* similar but rectangular and no central hole.

**Custom joinery:** Shone can provide a wide range of custom furniture and fittings to order.

# Q-LOCK WORLD- WIDE

AUDIO KINETICS (UK) LTD—OVERSEAS AGENTS

## AUSTRALIA

Magna Technics (Aust) Pty Ltd  
14 Whiting Street Artarmon New South Wales 2046  
Australia

Contact Ray Sheldrick  
Tel No 24383377 Tlx No (007 72) 24310+

## CANADA

Gerr Electro Acoustics Ltd  
363 Adelaide Street East Toronto, Ontario, Canada  
Contact Bob Sneigrave

Tel No (010 1) 416 8680528 Tlx No (007 21) 06524385+

## FINLAND

Studiotec Recording Equipment  
Porttintuntie 13B, 02180 Espoo 18 Finland

Contact Peter Strahlman  
Tel No 90520604 Tlx No (0083) 121394

## FRANCE

3M France  
Boulevard de L'Oise 95006 Cergy France

Contact Nicole Thuillier  
Tel No (010 33) 03161 Tlx No (0022) 695185

## GERMANY

3M Germany  
4040 Neuss PO Box 643, Carl Schurz Strasse 1, West  
Germany

Contact Harald Viering  
Tel No (010 49) 2101141 Tlx No (003) 8517511

## ITALY

Audio International  
Viale Compania 39, 20133 Milan, Italy

Contact David Butterworth  
Tel No (010 39) 2 716970 Tlx No (0023) 335230

## JAPAN

General Traders Ltd  
Marukoshi Building 2-19 Kanda Tsukasa Cho

Chiyoda Ku, Tokyo, Japan  
Contact Mr T Yamada  
Tel No (010 81) 3 2912761 Tlx No (007 72) 24754

## NORWAY

Siv Ing Benum AS  
Boks 2493 Oslo 2, Norway

Contact Bjorn Benum  
Tel No (010 47) 2 442255 Tlx No (0025) 17681

## SINGAPORE

Kinetex  
9 Wan Thos Avenue, Singapore 1334

Contact Arthur Symons  
Tel No (010 65) 482244 Tlx No (007 87) 33555

## SOUTH AFRICA

Eltron (Pty) Ltd  
PO Box 23656 Joubert Park Johannesburg 2044

South Africa  
Contact Paul Horber  
Tel No (010 27) 11 293066 Tlx No (007 958) 9416+

## SPAIN

Telco SL  
Gravina 27 Madrid 4, Spain

Contact Joaquin Escrig  
Tel No (010 34) 2317840 Tlx No (0061) 27348

## SWEDEN

Ericot AB  
S-183 21 Taby Stockholm Sweden

Contact Fredrik Ericsson  
Tel No (010 46) 8 7680795 Tlx No (0023) 13800

## USA

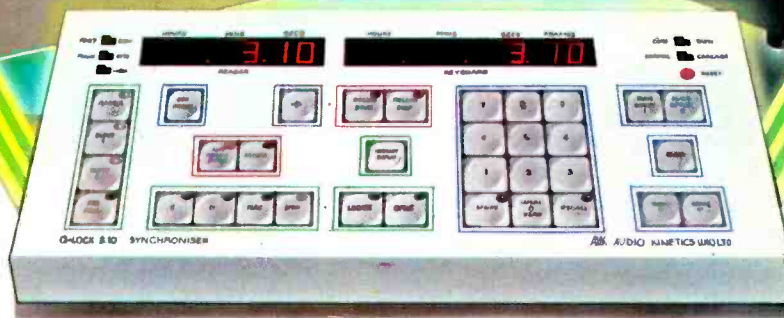
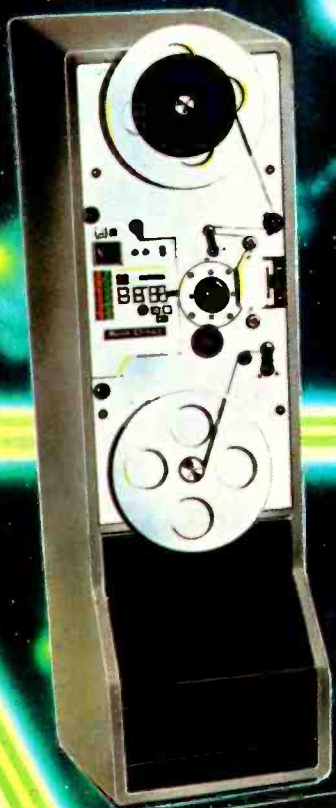
Quintek Distribution Inc  
Suite 209, 4721 Laurel Canyon Boulevard, North

Hollywood, California, USA  
Contacts Rodney Pearson/Sandee Allen  
Tel No (010 1) 213 980 5717 Tlx No (007 230) 194781+

**AK** AUDIO KINETICS



# HARNESSING SOUND AT THE SPEED OF LIGHT



With the rapidly expanding video market comes the increasing demand for better sound quality. Simple extension of existing audio facilities through the addition of a video cassette machine, a colour monitor and a Q-LOCK Synchroniser offers a new dimension to your market.

Q-LOCK enables you for the first time to have precise synchronised control over an audio, video or film machine matrix in any combination.

Amongst the numerous features designed for maximum efficiency with minimum operational complexity are:

- Q-SOFT dedicated software packages tailored to your individual requirements and readily upgradable without the need to replace hardware.
- Integral multi-standard SMPTE jam sync code generator with NEW GEN-LOCK option for regenerating code.
- Use of tach pulses in 'Wind' and time code in 'Parking' and 'Play' obviates the need for machine modifications.
- Optional hi speed readers.
- Hierarchy of control assigns machine commands to any combination of machines, or any individual machine without complex replugging.
- Manual or automatic record entry and exit.
- Complete system locator with ten cue point memories.
- Cycle (looping) facility for sound to picture repeat.
- Five time code events.

- Can be integrated with external computers utilising RS232/422 protocols.
- User orientated design by graduates of post production.
- Supplied complete with generator, readers, machine interfaces and all necessary cabling and connectors.

Effectively combining any three

machines, be it video, audio or film, the Q-LOCK System controls the whole machine matrix as a single piece of equipment, giving you greater flexibility, easier sound editing and improved accuracy. More machines can be added on a chase basis.



To find out how Q-LOCK can streamline your existing facilities, simply use the coupon or contact Audio Kinetics direct.

## AUDIO KINETICS

Kinetic House, Verulam Road, St. Albans, Herts. AL3 4DH, England  
Tel: St. Albans 32191. Telex 299951

Please send me full details on Q-LOCK

Name .....

Company .....

Address ..... Post Code .....

Telephone no .....

Type of business Audio Video Film Broadcasting

# product

## Acoustic materials and furnishings

# guide

### SONEX (USA)

Illbruck USA, 3800 Washington Avenue North Minneapolis, Minnesota 55412. Phone: (612) 521-3555.

USA: Alpha Audio, 2049 West Broad Street, Richmond, Virginia 23220. Phone: (804) 358-3852.

UK: Canford Audio, Stargate Works, Ryton, Tyne & Wear NE40 3EX. Phone: 0894224515. Telex: 537792.

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

**Sonex Acoustic Foam:** open-cell urethane plastic foam available in panels of 4sq ft with standard thicknesses of 2, 3 and 4in. The exposed surface is contoured with an anechoic wedge pattern to increase the effective absorption. Available in a range of colours.

### SOUNDEX (UK)

Soundex Ltd, Park Lane, Broxbourne, Herts EN10 7NQ. Phone: 09924 64455. Telex: 897255.

**D882:** metal cased studio illuminated sign with standard legends (others to order).

**D883:** twin lamp, metal cased, signal light.

**D650/G:** similar to **D883**, but single lamp and flush mounting.

### TRANSRACK (France)

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

**Synthese:** modular desk and 19in racking system formed from a steel frame with structural foam panels.

### TURNKEY TWO (UK)

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

Turnkey Two are suppliers of panel, cavity, slat and porous acoustic absorbers, including full range panels for concert halls. A wide range of door and window furniture is also available. The company can also supply custom designed studio and equipment furniture. Other facilities include the provision of ventilation and lighting equipment.

### ULTIMATE SUPPORT SYSTEMS (USA)

Ultimate Support Systems Inc, 1808 E Lincoln, Fort Collins, Colorado 80524. Phone: (303) 493-4488.

**Versa-Table:** lightweight portable table for mixing consoles, projectors, sound equipment etc. Each leg is independently adjustable. Can be used to straddle rows of auditorium seats or uneven surfaces.

**Portable loudspeaker stand:** lightweight portable loudspeaker stand of foldable design. Capable of supporting narrow column or wide bass enclosure loudspeakers weighing up to 300lb.

### VARITONE (UK)

Industrial Acoustics Co Ltd, Walton House, Central Trading Estate, Staines, Middlesex. Phone: 0784 56251.

**Varitone absorption system:** system of rectangular sound absorption panels suitable for wall or ceiling mounting. Available in lengths up to 12ft and in thicknesses of 2 or 4in.

### WADSWORTH ELECTRONICS (UK)

Leonard Wadsworth & Co (Electronics) Ltd, Unit F, Imber Court Trading Estate, Orchard Lane, East Molesey, Surrey KT8 0DA. Phone: 01-398 4288. Telex: 892335.

**Cable trunking:** range of PVC cable trunking available in 12 sizes and featuring a double locking cover. Special fixing kit required.

### WHARTON (UK)

Wharton Electronics, 42 High Street, Princes Risborough, Bucks. Phone: 08444 3849.

**401 display clock:** large display clock suitable for wall or console mounting. Uses 2in high 6-digit LED display and has a quartz crystal time base. Automatic brightness control for various ambient light conditions.

# service

## Designers and consultants

# guide

This guide gives a listing of all studio designers, constructors and audio consultants known to us. Should any designers or consultants be omitted from this listing, if they contact us with details of the services they offer we will include them in our next guide on this subject.

### ABADON/SUN INC (USA)

PO Box 6520, San Antonio, Texas 78209. Phone: (512) 824-8781.

### ACOUSTIC TECHNOLOGY LTD (UK)

58 The Avenue, Southampton SO1 2TA. Phone: 0703 37811. Telex: 47156.

### ACOUSTILOG INC (USA)

19 Mercer Street, New York, NY 10013. Phone: (212) 925-1365.

### ALANGROVE BUILDERS LTD (UK)

9 Lancaster Mews, Hyde Park, London W2 3QQ. Phone: 01-402 7071. Telex: 261705.

### ALICE (STANCOIL LTD) (UK)

38 Alexandra Road, Windsor, Berks. Phone: 07535 51056. Telex: 849323.

### ANGEVINE ACOUSTICAL CONSULTANTS INC (USA)

7349 Davis Road, West Falls, NY 14170. Phone: (716) 652-0282.

### AUDICON CONSULTANTS INC (USA)

1200 Beechwood Avenue, Nashville, Tennessee 37212. Phone: (615) 256-6900. Telex: 554494.

### AUDIO ASSOCIATES (USA)

319 Bonnavue Drive, Hermitage, Tennessee 37076. Phone: (615) 883-1405.

### AUDIO DATA LAB (Sweden)

Katarinavagen 18, S-11645 Stockholm. Phone: 08 44.58.65/23.34.35.

### AUDIO GRAPHIC SERVICES (USA)

1516 Ferris Avenue, Royal Oak, Michigan 48067. Phone: (313) 544-1793.

### AUDIO INTERNATIONAL (USA)

424 Grant Avenue, Scotch Plains, New Jersey 07076. Phone: (201) 322-4466.

### AUDIO VISUAL SYSTEMS (UK)

Unit 2, West Parade Industrial Estate, Halifax HX1 2TF. Phone: 0422 58600.

### THE AUDIO WORKSHOP (UK)

7 The Grove, Harrogate HG1 5NN. Phone: 0423 57653/57751.

### AURAL DESIGNS INC (USA)

PO Box 81067, Pittsburgh, Pennsylvania 15217. Phone: (518) 521-1104.

### BERATUNGSBURO FUR BAU-UND RAUMAKUSTIK GmbH (West Germany)

Niendorfer Hohe 36, D-2000 Hamburg 61. Phone: 040 551 5355.

### BROADCAST CONSULTANTS INTERNATIONAL (UK)

PO Box 10, Twickenham, Middx TW1 1BQ.

### BROADCASTING & SOUND CONSULTANTS (UK)

16 Bentley Way, Whitehall Road, Woodford Wells, Essex IG8 0SE. Phone: 01-504 9796.

### BROADCAST TRAINING & SERVICES LTD (UK)

2 Hills Road, Cambridge CB2 1JP. Phone: 0223 62392. Telex: 817978.

### SANDY BROWN ASSOCIATES (UK)

6 Fareham Street, London W1V 3AH. Phone: 01-439 8391. Telex: 28365.

### JEFF COOPER (USA)

22627 Cavalier Street, Woodland Hills, Cal 91364. Phone: (213) 887-9100.

### COURT ACOUSTICS LTD (UK)

35/39 Britannia Row, London N18QH. Phone: 01-359 0956. Telex: 268279.

### CLYDE ELECTRONICS LTD (UK)

Ranken House, Blythwood Court, Anderston Cross Centre, Glasgow G2 7LB. Phone: 041-221 5906/041-248 3001.

### J. H. A. CROCKETT & ASSOCIATE (UK)

83/87 Wallace Crescent, Carshalton, Sutton SM5 3SU. Phone: 01-647 1908. Telex: 884671.

### DALY ENGINEERING COMPANY (USA)

11855 SW Ridgecrest Drive, Beaverton, Oregon 97005. Phone: (503) 646-4420.

### CHIP DAVIS AND ASSOCIATES (USA)

3364 Clandara Avenue, Las Vegas, Nevada 89121. Phone: (702) 731-1917.

### DYMA ENGINEERING (USA)

PO Box 1697, 213 Pueblo Del Sur, Taos, New Mexico 87571. Phone: (505) 758-8686.

### EASTLAKE AUDIO (UK) LTD (UK)

97/99 Dean Street, London W1V 5RA. Phone: 01-262 3198. Telex: 27939.

### ELLIOTT BROS (AUDIO SYSTEMS) LTD (UK)

9 Warren Street, London W1. Phone: 01-380 0511.

### EMPIRICAL AUDIO (USA)

3A Todd Place, Ossining, NY 10562. Phone: (914) 762-3089.

### EVERYTHING AUDIO (USA)

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

### FLUTEL ASSOCIATES (UK)

2 Warren Road, Bexleyheath, Kent DA6 7LU. Phone: 01-303 4401/8177.

### GARY HEDDEN LTD (USA)

911 S Grove Avenue, Barrington, Illinois 60010. Phone: (312) 381-8360. 74 ▶

# STEREO DISC AMPLIFIER 2

THE MOST THOROUGHLY RESEARCHED DISC AMPLIFIER THERE IS

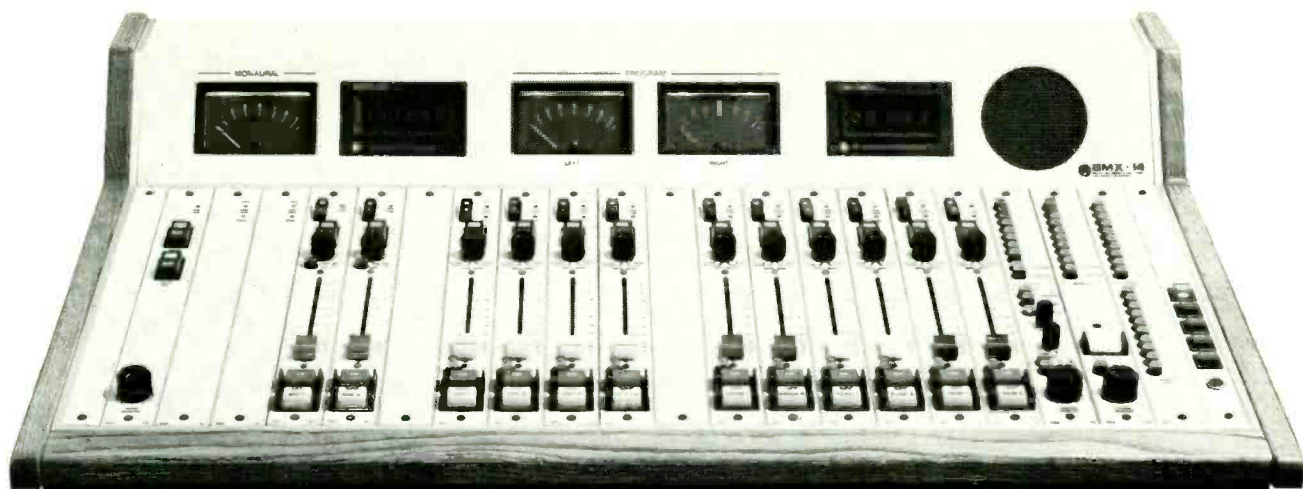
for broadcasting, disc monitoring and transfer with the highest quality  
1 kHz at 5mV set for 0dBV.7 output. Loaded 600 ohms.

Total harmonic distortion:  
Output +10dBV.7 30Hz-20kHz below noise 0.004%  
Output +20dBV.7 1kHz 0.03%  
30Hz-20kHz 0.03%  
Static intermodulation distortion 5%  
Output +10dBV.7 30Hz-20kHz 0.03%  
Dynamic intermodulation distortion 3%  
wave (single pole) -3dB at 100kHz + 15kHz sine  
4:1. Relative to 15kHz components.  
Pre-emphasised input 500mV pk-pk -70dB, 0.03%  
Frequency response RIAA accuracy  
30Hz-20kHz Within 0.5dB

Cartridge impedance interaction on frequency response  
High inductance cartridge, 1H + 1kΩ Less than 0.2dB  
Clipping at 1kHz Output +24dBV.7  
Clipping point complementary to RIAA curve  
30Hz-20kHz Within 1dB  
Frequency response determined by onset of peaky distortion products  
-80dB.  
-shift  
Within 0.5°  
Within 5°  
turnovers

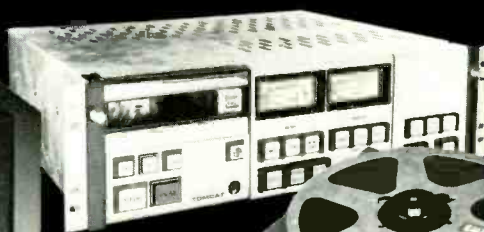
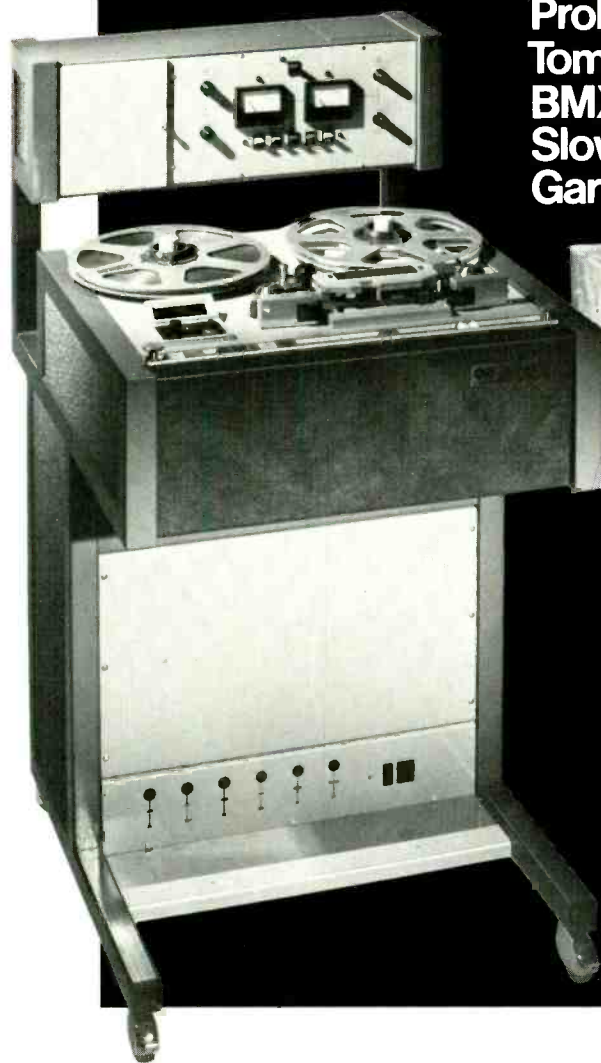
Ring or write for full specifications of this or: 10 Outlet Distribution Amplifier 3 \* Moving Coil Amplifier \* Stabilizer  
\* Frequency Shifter Circuit Boards \* PPM Drive Circuits and Ernest Turner Movements \* PPM Boxes \* Peak Deviation  
Meter \* Programme and Deviation Chart Recorders \* Broadcast Monitor Receiver 150kHz-30MHz.

Surrey Electronics Ltd. The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG. Tel. 04866 5997



# 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 Leavers Erasers



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

**service**  
Designers and  
consultants  
**guide**

**W. A. HINES & PARTNERS (UK)**

The Red House, 37 The Broadway, Stanmore, Middx HA7 4DJ. Phone: 01-954 2008/0995.

**JOINER-PELTON-ROSE INC (USA)**

10110 Monroe Drive, Dallas, Texas 75229. Phone: (214) 350-2384.

**MIKE JONES (consulting engineer) (UK)**

31 Parkfield Avenue, Eastbourne, East Sussex BN22 9SE. Phone: 0323 52300.

**DAVID H KAYE (USA)**

156 West Newton Street, Boston, Massachusetts 02118. Phone: (617) 262-2428.

**L&L AUDIO ENTERPRISES (Canada)**

4101 San Dominique, Montreal, Quebec. Phone: (514) 843-6443.

**LAKE AUDIO (UK)**

33 Church Street, Rickmansworth, Herts WD3 1DH. Phone: 09237 70488.

**LAKESIDE ASSOCIATES (USA)**

306 West Third Street, Suite 300, Los Angeles, Cal 90013. Phone: (213) 843-6916.

**LEISUREPLAN (UK)**

4 Great Pulteney Street, London W1. Phone: 01-434 3905.

**MALDWYN BOWDEN INTERNATIONAL LTD (UK)**

PO Box 112, Brighton BN2 2RS. Phone: 0273 607384. Telex: 267727.

**MBM ASSOCIATES INTERNATIONAL (UK)**

Triumph House, 1096 Uxbridge Road, Hayes, Middx UB8 8QH. Phone: 01-573 8333. Telex: 934271.

**MODULAR PERFECTION (USA)**

18917 NE 5th Avenue, North Miami Beach, Florida 33179. Phone: (305) 945-9774.

**JAMES MOIR & ASSOCIATES (UK)**

16 Wayfield, Chipperfield, Herts WD4 9JJ. Phone: 09277 62955.

**LESLIE F. MOORE ASSOCIATES (UK)**

22 Devonshire Avenue, Dartford, Kent DA1 3AW. Phone: 0322 21527.

**NEVE ELECTRONICS INTERNATIONAL LTD (UK & USA)**

UK: Cambridge House, Melbourn, Royston, Herts SG8 6AU. Phone: 0763 60776. Telex: 81381.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801. Phone: (203) 744-6230. Telex: 969638.

**NEWMAN/LUSTIG & ASSOCIATES (USA)**

1050 N State Street, Chicago, Illinois 60610. Phone: (312) 642-5364.

**PAOLETTI/LEWITZ ASSOCIATES INC (USA)**

40 Gold Street, San Francisco, Cal 94133. Phone: (415) 391-7610.

**ANDRE PATROUILLIE/AUDIOTECHNIK (Belgium)**

Boereboomlaan 39, B-3072 Nossegem. Phone: 02 511.66.48.

**PERCEPTION INC (USA)**

Box 39536, Los Angeles, Cal 90039. Phone: (213) 660-9351.

**PLAN AUDIO (UK)**

9 South Street, Epsom, Surrey KT18 7PJ. Phone: 03727 41822.

**PROJECT 2000 (UK)**

Flat 4, Windlemere House, Westwood Road, Windlesham, Surrey. Phone: 0990 26600.

**RABIT LTD (UK & France)**

UK: 2 Orchard Road, Kingston, Surrey. Phone: 01-642 0139.

France: 18 rue de Beudant, F-75017 Paris. Phone: 294.94.86.

**RDW ASSOCIATES (UK)**

23 Montgomery Road, Edgware, Middx HA8 6NS. Phone: 01-952 1850.

**RECORDING STUDIO SERVICES (USA)**

156 Chambers Street, New York, NY 10007. Phone: (212) 964-4097.

**PETER SARONY & ASSOCIATES (UK)**

30 Old Bond Street, London W1X 3AD. Phone: 01-493 2046.

**DAVID SCHWIND (USA)**

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**SINGLETON PRODUCTIONS (Spain)**

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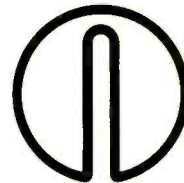
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# APRS exhibition preview

The 15th annual exhibition of the Association of Professional Recording Studios will be held from Wednesday June 23 to Friday June 25 at the Kensington Exhibition Centre, Derry Street, Kensington, London W8. Over 90 exhibitors will be displaying their product lines.

## A

● **AC Electronic Services:** range of mixers, crossovers, graphic equalisers and power amps including the *ACSP1000* stereo power amp, *ACSM 16/6* mixer and *SCM 24/16/2* mixer. Also the recently introduced *ACTR16* 16-track tape machine. ● **Agfa-Gevaert:** comprehensive range of audio tapes for broadcast and studio mastering purposes including *PEM 428* extended play version of the company's established *PEM 468* tape. Also cassette tape, bulk tape for cassette mastering, magnetic film, video cassettes and video tape, plus test tapes. ● **AKG:** wide range of equipment including mics, headphones, phono cartridges, mixers and reverb units. Featured units will include the new *C460B* mic preamp and *CK1X* cardioid and *CK2X* omni capsules for the company's existing modular condenser mic system. Other featured units will include the *C414 P48* phantom powered mic, the *BX5E* and *BX25* reverb units, and the company's *Micro Mass Technology* phono cartridges. Additionally, on display, the **Aphex** range of ancillary processing equipment including the *Aphex II Aural Exciter*. Also the *SAM 82* and *SAM 42* compact mixers from **SATT**. ● **Allen & Heath Brenell:** *Syncon Series B* modular in-line expandable console and the *Syncon M24* 2in multitrack tape machine. AHB intend introducing new additions to its range of transportable mixers, plus a new accessory unit, but no details were available at the time of going to press. ● **Alice (Stancoil):** custom-built version of the *2000 Series* (a *2012* with stereo PPM), plus examples from the *828* and *828S* ranges, an *STM 8* portable self-op on-air mixer, and a custom-built *ACM 2* modular broadcast mixer. ● **Ampex:** recently introduced *ATR-800* tape

machine, plus the company's range of professional audio tapes including the *466* digital audio mastering tapes. ● **AMS (Advanced Music Systems):** first European showing of the *A/V Sync* 18kHz bandwidth digital delay system for audio/video synchronisation. Recently introduced *RMX 16* digital reverberation system with remote and 99 addressable memories; plus the *DMX 15R* digital reverb system for use with the *DMX 15-80* programmable DDL; *DMX 15-80SB* stereo broadcast delay line; *Digital Loop Editing System* for the *DMX 15-80 Series*; a digital audio store for film overdubbing of sound effects; the *DM-DDS* digital disc mastering delay line; and the *DM2-20* phaser/flanger. ● **Atlantex Music:** wide range of products from the **Ashly**, **Furman Sound**, **MXR** and **Sescom** ranges of audio processing equipment, plus cables and connectors from **Whirlwind Music**. New items will include the *FET-200* MOSFET power amp and *SC33* stereo noise gate from Ashly; the **Furman Sound** *SG10* sweep graphic equaliser; the **MXR** *Model 170* dual octave 10-band graphic equaliser; and a

a new series of *Medusa* power stage boxes from **Whirlwind**. ● **Audio & Design (Recording):** wide range of signal processing equipment including the full range of *Scamp* modules and racks. New items will include an improved version of the *Express Limiter* stereo comp/limiter; an Ambisonic decoder; the *Scamp S28* dual VCA module; and the recently introduced *601 Superdynamic* limiter. Other products on display will include the *Transdynamic* tri-band signal processor, the *Compex* limiter, and the *Vocal Stressor*. ● **Audio Developments:** *ADO55* comp/limiter; *ADO31 Micro* mixer, *ADO49 Mixette* mixer, and *ADO62 ENG* mixer. Also the *ADO45 Pico* in a new format with improved facilities, and an updated version of the *ADO60 ENG* mixer. ● **Audio Kinetics:** *Q-Lock 3.10C* synchroniser; *Q-Lock 210* synchroniser; and the *XT-24 Intelocator*. Demonstration of *Q-LOCK* system for post production and film dubbing usage; also details of the *Q-Soft* range of dedicated software machine interfaces. ● **Audix:**

78 ►

Alice 2008 mixer



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## APRS preview

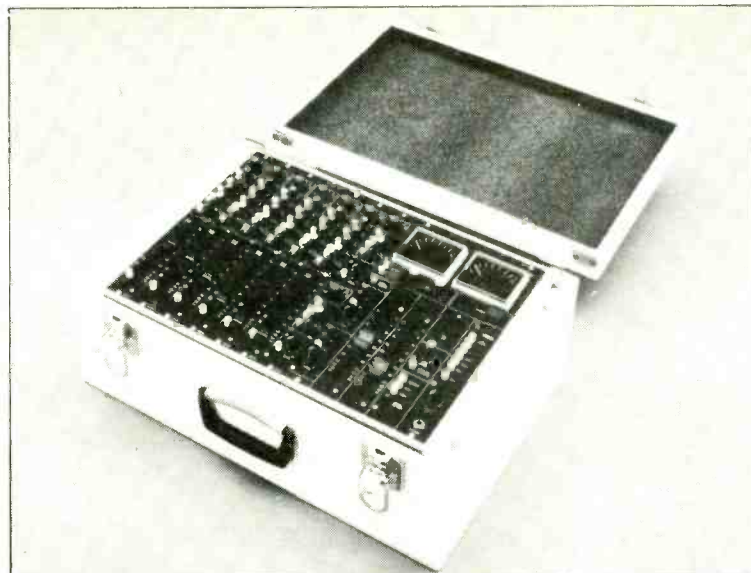
**MXT-500** portable mixer and the **MXT-1000** broadcast mixer. New items include the **MXT-1200** developed from the **MXT-1000**, with improved EQ, 2-, 4- or 8-groups, and improved facilities; plus the **3BO6** sound distribution amp system for 19in rack mounting. ● **Avcom Systems**: Telex high speed cassette duplication equipment, NAB cart machines, radio mic system, and **Audiocom** intercom system. ● **AVM (Audio Video Marketing)**: **Ferroglyph RTS2** and **ATU1** audio test units; **Milab** dynamic and condenser mics including two new models, the **LC25** transformerless line-level mic, and **MP30** pressure zone hemispherical mic; plus the **NEAL 312** Dolby HX stereo cassette deck and **NEAL 330/340 3-** and 4-channel cassette recorders.

### B

● **BASF**: range of professional tapes, cassettes and magnetic film including calibration and test tapes. New products include a new CrO<sub>2</sub> duplicating tape, plus new ranges of ferric and CrO<sub>2</sub> cassettes. ● **FWO Bauch**: wide range of products from **EMT**, **Harrison**, **ITC**, **Klein & Hummel**, **Leunig**, **Lexicon**, **Melkuist**, **MRL**, **Neumann**, **Revox**, **Studer**, **Switchcraft**, **UREI** and **Valley People**. Highlighted items include a new **EMT** direct drive broadcast turntable, the **EMT 938**: the recently introduced **Harrison TV-3** post production/on-air broadcast console; the **Param** computerised equaliser system; the **Lexicon Model 97 Super Prime Time** effects unit; the **Melkuist** events selector with up to 256 SMPTE controlled outputs; the new **Studer A810** range of 2-track tape machines with microprocessor control; and the **Dyna-mite**, **Dyna-mic** and **Maxi-Q** audio processors from **Valley People**. Also mono and playback-only versions of the **Revox PR99**, and new console and carrying case options. ● **Beyer**: range of dynamic and condenser mics, plus various headphones. Beyer also intends showing a range of radio mic systems. ● **Bruel & Kjaer**: comprehensive range of test and audio measurement instruments.

### C

● **Calrec**: range of professional condenser mics including the **Soundfield** Ambisonic mic; a microprocessor controlled OB switching unit; and the company's range of sound control consoles. ● **Canford Audio**: wide selection of studio furnishings and ancillary studio equipment including cables, connectors, editing accessories, 19in rack units, and the **Niverco** stereo auto reverse cassette machine. ● **Cetec International**: high speed cassette duplication system. ● **Cliff Electronics**: **BOFA** screened cables; **Capital Components** LED VU meters and LED bargraph **Improved Audio & Design Express Limiter**



Audix MXT500 portable mixer

display unit; plus a range of jack plugs and sockets. ● **Clyde Electronics**: wide range of broadcast orientated products including the recently introduced **CEDUB** rack mount dubbing mixer; the **Alpha Series** on-air mixer; and a selection of 19in rack mount broadcast ancillary units. ● **Court Acoustics**: range of studio and sound reinforcement loudspeakers and associated equipment. Highlighted units will include the recently introduced **Proflex** sound reinforcement loudspeakers; the new **Proflex DA 200** and **DA 400** power amps; and the **BGW** range of power amps. ● **Cummings Recording Associates**: **Ferroglyph Studio 8** tape machine, plus a pilot tone synchroniser, pulse rate converter and tape tension gauge.

### D

● **Dolby Laboratories**: wide range of noise reduction equipment including the new **SP-Series** multitrack noise reduction unit. Also modules for use with C-format videotape recorders. ● **DSN Marketing**: **D & R Electronica** range of



Ursa Major 8X32 from Feldon

mixing consoles and ancillary equipment including **Series 200**, **Series 400**, **Series 600** and **Series 1000** mixers. Also new **8000 Series** modular in-line console range.

### E

● **Eardley Electronics**: comprehensive range of **Neutrik** products including **XLR**-type connectors; the **K-Check** cable tester; and the **Neutrik** audio test instrument range. ● **Eela Audio**: **Concord** expandable multitrack console; plus the **S200** and **S100** compact consoles; and the recently introduced compact **S41** ENG mixer. First UK showing of the **S2000-L** modular in-line console with digitally controlled status switching. ● **Electro-Voice/Tapco**: **Sentry 100** monitor loudspeaker and recently introduced **Panjo** mini-mixers. New items include the **Entertainer 100** sound reinforcement system; **S15-2** 2-way horn loudspeaker for stage use; **EX-18** electronic crossover; and two new graphic equalisers, the **Model 2210** dual channel single octave equaliser and **Model 2230** 1/3-octave equaliser. Also full range of **Electro-Voice** mics and loudspeakers; plus the **Tapco** range of mixers and amps. ● **Ernest Turner**: comprehensive range of VU and PPM meters including bargraph display units.

### F

● **Feldon Audio**: wide range of products from **Eventide**, **Inovonics**, **Marshall**, **Ortofon**, **Pulse Designs**, **Sony**, **Sphere Electronics**, **Synton** and **Ursa Major**. Highlighted will be the **Sony** digital recording systems and professional mics; the **Marshall 5402** time modulator and new **AR-300** tape eliminator; the **Eventide SP2016** programmable effects processor; the **Synton** range of vocoders; the **Travis** fader from **Sphere**; and the **Ursa Major 8X32** digital reverb system with recently introduced remote controller. Also on display the full range of **Commodore Pet** computer systems. ● **FM Acoustics**: **FM300A**, **FM600A** and **FM800A** power amps; plus the **FM240** preamp and the **FM212A** moving coil phono step-up preamp. ● **Formula Sound**: **S19G** graphic equaliser and **SG19A** equaliser/analyser. Also the **Mini-mix** modular production



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## APRS preview

mixer and the *QUE-4* studio foldback system.

● **Fraser Peacock Associates:** extensive range of *Sony* and *Wollensak* cassette duplicating equipment; the company's range of blank audio cassettes; plus details of the company's cassette duplication service. ● **Future Film Developments:** comprehensive range of cables, cords, connectors, jackfields, wiring aids and associated components; plus a wide range of audio accessories including 19in racks. Also *Soundex* meters and illuminated studio signs.

## G

● **Clive Green & Co:** Cadac multitrack in-line consoles available with modules suitable for broadcast or recording applications. Also a wide selection of ancillary units. ● **Gresham Wood:** range of standardised wood consoles and cabinet racks; plus details of the company's custom building service.

## H

● **Harman (Audio) UK:** *JBL* range of monitor loudspeakers and drive units including the recently introduced *4430* and *4435* bi-radial studio monitors. Complete range of Teac Tascam units including the recently introduced *Series 30* 2-, 4- and 8-track tape machines and 8-track mixer. Also the new *Model 244 Portastudio* 4-track mixer/cassette unit. ● **Hayden Labs:** wide range of products from *Nagra*, *Sennheiser* and *Telefunken*. Highlighted products will include the *MX-80*, *MX-80A* and *MX-800* digital tape machines and *MXE-1* digital editor from *Telefunken*; the recently introduced *Nagra TA* tape recorder; and from *Sennheiser* new additions to the range of electret mics and the latest version of the *Mikroport* wireless mic system with *Hidyn* noise reduction. ● **HHB Hire & Sales:** *Crown/Amcron* range of amps and active crossovers, plus the *PZM* range of mics. Also the *Gauss* range of professional loudspeakers and drive units including the recently introduced studio monitors. ● **HH Electronic:** *TPA Series* and *S500D* professional power amps and the company's *MOSFET* power amps. Also electronic echo units and portable stereo sound control mixers. ● **Hill:** *DX Series* of power amps, plus the new *B2 Series* modular mixer, *J2 Series* modular sound reinforcement console, and *M2 Series* on-stage monitor console.

## I

● **Industrial Cassette Developments:** *Graff* range of cassette format tape machines including the *HSCD* high speed cassette duplicator and *JM* cassette jingle machine. ● **ITA:** equipment from *Itam*, *Otari* and *D & R* will be shown. New products will include the *Itam Stereo 8 8/2* mixer; the *Itam Location Mixer* PA mixer available in 8/2 and 16/2 configurations; the *Itam 1200 Series* 12/4 mixer with 8-track monitoring; the *Itam Sigma Mk II* 18/8 mixer with 16-track monitoring; an 8-track 1in version of the *Itam 1610* tape machine; the *Otari MTR90-II* 2in multitrack tape machine; the *Otari MkIII-8* 1/2in 8-track tape machine with full function remote and microprocessor controlled transport; and a range of modular signal processing equipment from *D & R*.

## J

● **Jackson Recording:** details of the company's

used equipment retail operation. ● **James Yorke:** details of the company's cassette recording, production and packaging services; its tape coating and tape slitting operation; and micro-computer program duplication service.

## K

● **Keith Monks:** new studio turntable unit; producer's playback turntable; wide range of mic stands; *LS1/9* monitor loudspeaker with built-in power amp; plus record cleaning machines. ● **Kelsey Acoustics:** *NG4* 4-channel rack mount noise gate; flexible multicore stage boxes; the *Missing Link* multiple crosspatching stereo unit with in-built cable test facility; the *Telex Audiocom* intercom system; plus a wide variety of ancillary equipment including *Swan* mic stands, various connectors, mic splitters and DI boxes, and the *Yamaha* range of power amps and crossovers. ● **King Instruments:** self-feed cassette loaders and various video tape loaders. ● **Klark-Teknik:** wide range of graphic equalisers and effects units; plus the recently introduced *DN772* stereo digital profanity delay unit. Also the *DN60* realtime spectrum analyser and *DN80* 16-bit realtime audio computer.

## L

● **Leavers-Rich:** *Proline 2000TC* and *Proline 1000* 1/4in tape machines; plus *Garner* bulk erasers; *Tomcat* cart machines; and *BMX* broadcast consoles. ● **Lennard Developments:** complete range of *Woelke* professional record, playback and erase heads; plus wow and flutter meters, wave analysers, and bias/distortion meters. Also recently introduced cue-track heads for 1/4in tape usage. ● **Lindos Electronics:** *LA1* audio analyser test unit and the *LR1* turntable test unit. ● **Lyrec:** *TR55* 1/4in tape recorder; *TR532* multitrack recorder and *ATC* remote controller; and the *P-2000* high-speed cassette duplicator.

## M

● **3M:** 32-track digital mastering system and 4-track digital recorder; digital delay disc cutting preview unit; and digital editor with crossfade facility. Also *M79* 24-track analogue recorder; *Wollensak* cassette duplicators; and *Scotch* audio tapes including *Scotch 265* digital mastering tape. Additionally, new *Scotch 226* audio mastering tape. ● **Magnetic Tapes:** *Chilton* portable mixing desks and the *QM2* range of consoles. ● **MCI:** introduction of the *JH-800*, a compact portable general purpose 12 channel audio console. Also a variety of consoles, tape

machines and autolocates. ● **Mega:** range of sound reinforcement loudspeakers and cabinets. Also the *AV60* active loudspeaker enclosure. ● **Midas:** *PR System* consoles for sound reinforcement applications; plus *TR System* modular theatre consoles. Also, new *Concert Series* with following features: inputs assignable to eight stereo subgroups, eight auxiliary groups, stereo and mono master groups with independently controlled multiple outputs and programmable mute system with non-volatile memory and complete editing facilities. ● **Mosses & Mitchell:** range of jacks and jackfields including the *440* range of miniature jack sockets and jackfields. Also new video jackfield. ● **Music Labs:** *PSE* range of ancillary equipment including effects units. Also the *Master 8* 1in 8-track tape machine.

## N

● **Neve:** the company will not be displaying any products this year, but will provide a 'rest' area for visitors. Full details of the company's console ranges including the *DSP* digital console system, however, will be available.

## O

● **Otari:** *MTR10* 2- and 4-track tape machines; *MTR90* multitrack tape machine; the *MX5050 Series* of 2-, 4- and 8-track tape machines; and the *DP4050* cassette duplication system.

## P

● **Penny & Giles:** recently introduced *3000 Series* faders; plus the established range of faders, including digital faders, and the company's quadraphonic panpots. ● **Philip Drake Electronics:** *7000 Series* broadcast modular amplifying equipment; *Commsbox* ring intercom system; *Mini Mobile* talkback system; and modular OB commentator equipment. ● **Precision Audio Marketing:** *Sound Technology* test equipment including the *1500A* microprocessor controlled test system; the *STL* range of calibration tapes; and radio mic systems from *Cetec-Vega*.

## R

● **Radford:** range of audio test equipment and loudspeakers, plus a new range of power amps. ● **Raindirk:** *400 Series* broadcast console; new *System 200* stereo film, TV and general purpose mixer; plus the *Status* range of power amps and preamps. ● **Rebis Audio:** *RA200 Series* compact modular signal processing system; plus the *RA402* parametric equaliser and *RA301* comp/limiter.

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## APRS preview

● **Red Acoustics:** *A-4 Red Professional* monitor loudspeaker; plus two new monitors, the *A-3* with built-in 150W amp, and the *Red Studio Monitor* which includes a sub-bass system. ● **Roland:** wide range of equipment including power amps and rack mount effects units. Highlighted

● **Don Larking:** this company will be exhibiting a wide range of products in The Small Hall, at Kensington Town Hall, close to the APRS Exhibition centre. Products will be shown from **Trident, Soundcraft, Tannoy, Raindirk, Teac, Fostex** and **Roland**. Of particular note will be a new 24/16 non-modular console from **BEL Electronics**.



New Soundcraft Series 1600 console

products will include the *SDE-2000* digital delay unit; *OP-8/OC-8* interface for linking the *Jupiter 8* polyphonic synthesiser with the *MC4B* micro-composer; the *MTR-100* digital cassette unit for use with the *MC4B*; a range of mixers available in configurations up to 16 channel; and the *TR-606 Drumatrix* compu-rhythm unit linked to the *TB-303* computerised auto-bassline. ● **RSD:** **Recording Studio Design** and **Studiomaster** ranges of PA and sound reinforcement mixers; plus power amps and crossover units.

### S

● **Scenic Sounds Equipment:** wide range of products from **Amber, Amek, APSI, dbx, Deltalab, Editall, Emilar, Lexicon, Linn, Mic-Mix, Orban, Publison, Schoeps, TAC, 360 Systems** and **White Instruments**. Highlighted products will include the new *Linndrum* drum computer; the *bix Shadow* synchronising system; *dbx 160 Series* comp/limiters and *150* noise reduction units; *Amek BCO1* broadcast mixers, the new *TAC16* stage monitor mixer; the *Amber 3501* distortion analyser; and new *Orban 424A* gated de-esser/comp/limiter. ● **Shure:** recently introduced *Model 711* loudspeaker system and *Model M267* 4-way mic mixer. Also the company's ranges of condenser and dynamic mics; *Pro Master* sound system; and ranges of phono cart-ridges. ● **Sifam:** wide range of VU and PPM meters, control knobs, switches and transformers.

New Roland SDE-2000 DDL



● **Solid State Logic:** *SL-4000E Series* automated multitrack console with *Total Recall* system and *SSL* dynamic mixing system. Introduction of new software and hardware for post production and live mixing applications including a realtime system for sequential preset fader level editing; an events controller for remote control of sound effects sources from tape; an effects controller allowing integrated computer control of external voltage controlled devices; and a synchroniser based on the **Audio Kinetics Q-Lock** system allowing multi-machine synchronisation from the *SSL* command keyboard. ● **Sonifex:** *RB102* broadcast console; plus the *Q-PAC* and *uHS Series* of broadcast cart machines. ● **Sony:** *DAE-1100* digital editor for the *PCM-1600* and *PCM-1610* digital processors and *U-matic* based digital recording systems; *Compact Disc* digital audio disc player; *PCM-3324* stationary head digital multitrack recorder; various ancillary digital studio units; plus a wide range of mics and radio mics. ● **Soundcraft:** *Series 2400* 24/16 or 28/24 console; new *Series 1600* console in 16-, 24- and 32-channel formats, plus a 24-channel version with patchbay; new *Series 800B* console, an updated and improved version of the *Series 800*; new *Series 400B* console in 16/4 and 24/4 formats with 8-track monitoring; and the *Series 1S* consoles. Introduction of the *Series 2400* automation package. Also the *SCM 381-8* 8-track tape recorder and *SCM762* 16- or 24-track tape machines. ● **Statik Acoustic:** range of

ancillary equipment including *SA30* electronic crossover; *SA10* graphic equaliser; *SA100* dynamic delay/flanger; and *SA20* dual reverb system. ● **Surrey Electronics:** stereo RF clipper; broadcast monitor receiver; stereo disc amps; PPMs; 10-outlet distribution amplifier; plus various ancillary audio units.

### T

● **TAM Studio:** disc cutting demonstration utilising a Neumann lathe. ● **Tannoy:** wide range of professional monitor loudspeakers including the *Dreadnought*, *Super Red*, *Little Red* and *SRM Series* monitors. Also the company's hybrid passive/active crossover unit. ● **Theatre Projects:** wide range of standard and custom-built equipment for film, TV, radio and sound reinforcement applications. Equipment to be displayed will include LED meter displays; a distribution amplifier system; the *Multipan* programmable panning system; a *Series 3000* broadcast console, a *Series 4000* post-production console; the new *Series 5000* modular production console with modules for radio, TV and on-air use; the *Command* intercom system; the **HM Electronics** range of radio mics and wireless intercom system; and the **MJS Electronics** range of audio test equipment. ● **Toa:** recently introduced *RX-7 Series* of modular mixers; plus a comprehensive range of communications and PA equipment. ● **Trad: Sound Workshop** modular consoles and automation systems, the *242* and *262* reverb systems, and the *Diskmix* automation storage system. Also details of the company's used equipment retail operation. ● **Trident:** first UK showing of the modular, expandable 8-group *Trimix* console. Also the company's *TSM* and *Series 80* consoles; plus the *TSR 24-track* tape machine with autolocate; and a range of ancillary equipment. ● **Turnkey:** wide range of products including the **Fostex** range of personal multitrack units; the **EXR Exiter**; the **Wright** microphone; *Auratone* recording/mixdown monitor loudspeakers; the **ASA** range of *Goldline* audio analysers; and the **Annis Magnetometer**. Also *Accessit* budget signal processing systems; *Seck* mixers; the *Great British Spring* reverb unit; and a display of 8- to 24-track studio systems mounted in association with **Soundcraft** and **Studer**. ● **Turnkey Two:** details of the company's acoustic design service. ● **Tweed Audio:** range of mixers for broadcast or recording studio applications; plus details of the company's custom design and manufacturing service.

### W

● **Walter Luther:** range of mic stands and magnetic film; plus **Capps** range of cutting styli including the new *Scoop* stylus. Also recording blanks from **Allied Recording**.

### Z

● **Zonal:** range of audio tapes and cassettes; plus magnetic film stock.

● **Studio Sound:** editor Richard Elen and assistant editor Noel Bell will be attending the Convention together with executive advertisement manager Phil Guy. Copies of *Studio Sound* will be available from our stand.



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# Studio monitor design

Neil Grant of Eastmill Ltd examines the techniques behind the design of monitor loudspeakers, and introduces the Eastmill T Series monitors with new approach mid range drivers.

Neil Grant



Prototype Eastmill T-Series monitor

FOR a number of years now many of those companies marketing domestic loudspeaker systems have chosen to label them as 'monitors', 'reference monitors', 'monitor series', or similar, in order to confer an image of professionalism and professional acceptance—for surely every consumer would wish to use, at home, the loudspeakers that were used as *the* reference when the very records and tapes in his collection were engineered, mixed and mastered?

Unfortunately, under pressure from the professional market, the monitors used as the reference in contemporary control rooms have evolved in a direction that has led to a situation whereby a number of domestic devices substantially outperform their professional equivalents—a state of affairs that should be intolerable to engineers, studio owners and their clientele.

How can you justify spending your working day with a client using a source reference inferior to that which he will use for relaxation on

returning home in the evening? Fundamentally, the problem has arisen over the last two decades, as pressure from the audio marketplace has forced monitor manufacturers to produce devices of increased sensitivity and increased sound pressure level capability.

Designing loudspeaker drive units has always been a matter of mastering the art of compromise. At the conceptual stage, a series of decisions must be taken, all of which substantially influence the other design factors that should be considered. It is not yet, for example, possible to build a highly sensitive loudspeaker with exceptionally low distortion, or a broad bandwidth device with high sensitivity. It is in juggling the eventual performance criteria that the good designer effects the best compromise to suit that particular market requirement his product is aimed to satisfy. This holds equally for the complete broad bandwidth integrated system, though here of course, the decisions through which the designer must thread his compromise are

that much more numerous.

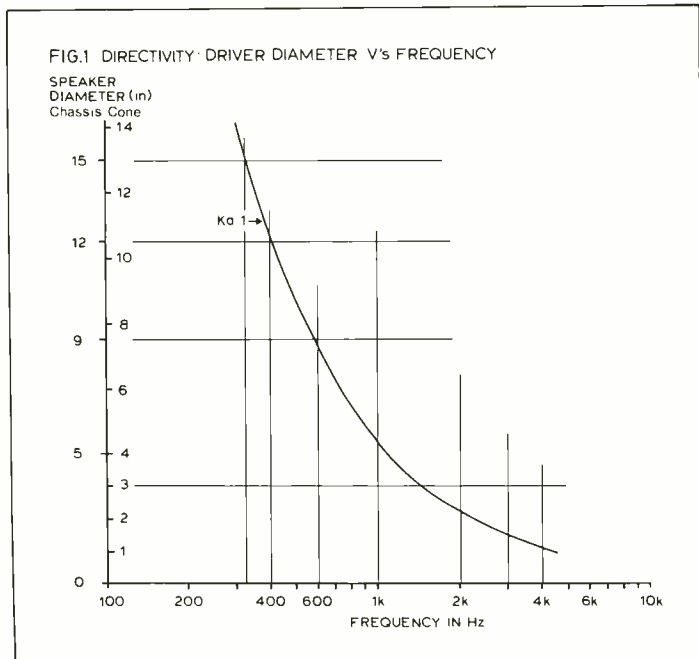
Engineering a system for maximum sound pressure level (SPL) and high sensitivity tends to compromise distortion and directivity to the extent that a number of hi-fi designs far outstrip their professional equivalents which use components more at home in the sound reinforcement music systems they so closely resemble.

Historically, the solutions chosen by designers were variations on only one or two themes. Having recognised that the entire audio bandwidth could not be generated by a single drive unit without unacceptably high distortion and low sensitivity, early solutions used two devices, sometimes arranged co-axially, to improve the response. The low and mid frequencies were usually handled by a 380mm cone driver and the high frequencies by a 44mm diaphragm, 25mm throat, compression driver. The fundamental problem with 2-way systems is that the cone driver is required to generate both bass and mid frequencies to avoid unpleasant over-extension of the compression driver, and over 200/300Hz the 380mm diameter cone becomes increasingly directional as the frequency rises (see Fig 1). This leads to midband beaming and an increase of directionality to the extent that at the crossover point, the distortion and dispersion characteristics are radically dissimilar. Additionally, it is necessary to load the compression driver in some way and in the case of the co-axial system the passage through the pole piece forms the first section of a horn. The designer then has to choose whether to allow the curvilinear cone of the woofer to function as a horn boundary or pro-

vide a horn extension rigidly mounted to the pole-piece tip. Allowing the bass cone to provide the horn extension is not ideal—it hardly forms the rigid boundary necessary for a smooth impedance characteristic and proper loading, whilst also increasing the problem of inter-modulation distortion. In the second case the now-rigid horn interferes with and masks the higher frequencies radiated by the cone causing discontinuities in the polar response—so called shadowing. Sections of the horn can be removed to alleviate the problem, but loading deteriorates and diffraction problems increase—the on-axis amplitude response worsens.

All 2-way loudspeaker systems, therefore, inherit a number of unsatisfactory design compromises. The bass section will always become directional in the mid-band and lowering the crossover point is an inadequate solution, as it further stresses the compression driver. Using two bass drivers to increase sensitivity only worsens the problem by lowering the frequency at which the bass section becomes directional. Co-axially mounted systems additionally compromise the mid-band by placing a horn in the centre of the driver, so expecting the bass cone to function as a horn. In reality, in the latter case, the only real loading is provided by the channel through the pole—a short and over-directional circular horn.

As designs have evolved from this point, the system designer has logically chosen to use three components and dedicate one device to handle the entire mid range band. These have either been horn loaded pressure units or conventional direct



radiating cone drivers.

To give a good acoustical performance a cone mid range driver should have a nominal diameter of 70 to 100mm—directivity at the lower crossover point (around 3/400Hz) will match the bass driver and rise smoothly enabling the high frequency compression driver to be crossed in, perhaps as much as two octaves higher than in the equivalent 2-way system. However, power handling is inadequate for the level required, being limited by the necessarily small coil. The immediate solution is to use one of the many 200mm, 225mm or 250mm drivers that use a larger coil, but the directionality of these devices is increasingly poor in the upper to mid range. Also, unfortunately, the trade off for a larger coil and higher power handling is a decrease in HF bandwidth.

These problems aside, the fundamental weakness in both the systems discussed is the HF pressure driver. Designed in the 1930s and improved little since (though occasionally much worsened) the typical driver consists of a dome segment, usually of a hard and theoretically rigid material, driven at the outer edge while being confined in a small volume chamber. The radiated sound from one side of this diaphragm is routed via a phase coupling device, to ensure a maximally

flat response by minimising phase anomalies at the throat, to a horn which loads the diaphragm to the surrounding environment. Due to the very high sound pressure levels generated in the pressure chamber between the diaphragm, the phase plug and the throat of the horn, the air no longer responds linearly to the forces applied to it and even at relatively low input levels the resultant rise in harmonic and intermodulation distortion is dramatic.

Fig 2a illustrates the on-axis performance of a typical small compression driver, the JBL 2420 unit, terminated by an Eastmill VH horn, swept with a sinewave. At first sight, the performance appears encouragingly good, but if we now examine Fig 2b we note a dramatic change. The input voltage has been lifted from 4V (1W) to 15.5V (15W). Measured at 1m from the horn mouth on-axis, these produce sound pressure levels respectively of 105dB and 117dB. This latter is equivalent to an SPL of around 108dB at the mixer in most typical control room environments. However, it is most noticeable that the HF response is now tailing, to the extent that there has been a loss of some 2dB at 5kHz, 5dB at 10kHz and 6dB at 15kHz.

How many engineers notice a loss of HF information after a period of relatively high level monitoring? It's not all due to just going deaf.

More importantly Fig 2b also illustrates distortion—the second harmonic component representing some 20% of the fundamental.

Again—how many engineers would dream of tolerating distortion levels of this order in any other piece of equipment in the audio chain—especially that which is supposed to provide the one fixed reference, by which all others are monitored?

Further inaccuracies are supplied by the discontinuities in the airloaded impedance characteristics of the horn itself, resonances and, curiously—since it is so avoidable—diffraction arising from the large lips currently fashionable on American horns. It is unavoidable on co-axial units, but manufacturers of integrated systems could at least mount their horns flush to the surface and minimise their difficulties. Information is re-radiated from lips and baffle and recombines with the original in a non phase coherent manner, with resultant image masking. Due to the way a horn propagates sound it is necessarily a directional device—wave guides worsen the diffraction problems and are not sufficient to substantially improve directivity. At their very best, horns are far from constantly directional broad bandwidth devices—poor dispersion only increases awareness of the sound source. Frequency response, impedance and Q all vary as a function of

input power—loudspeakers are truly dynamic devices in every sense.

Clearly, then, the pressure unit, at the current state of the art, is fundamentally unsuitable to a monitor loudspeaker designer or user, yet SPL requirements have allowed the manufacturer to use this easy solution rather than achieve a more elegant compromise.

We have therefore to fundamentally reconsider the first design compromises we have to make. To considerably simplify, the four major requirements are:

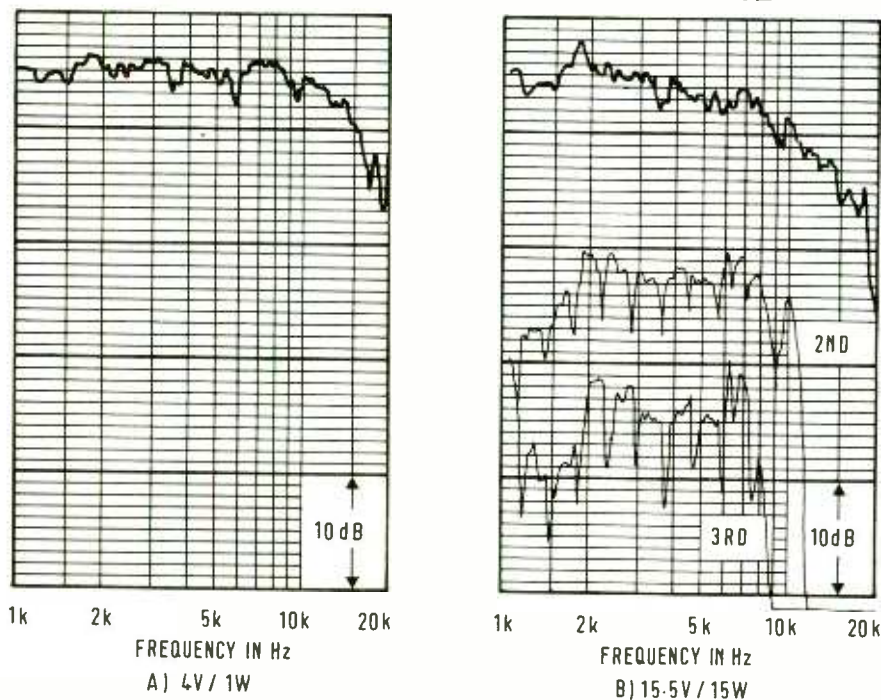
- (a) reduction of distortion;
- (b) increased power handling;
- (c) increased sensitivity;
- (d) improved directivity.

The limiting factors in the specification are the mechanical and thermal limitations of the system and the threshold level of distortion. As we have gone to some length to illustrate, any significant alteration of one of the factors above will affect at least one other requirement and using conventional technology as discussed, locks the designer into an unacceptable series of decisions.

More recently, however, transducer development in one area has provided the designer with a number of new devices, and one in particular (an ATC unit), which allows results orders of magnitude superior to that achieved previously. The Eastmill T Series monitors use this soft dome radiator technology.

The mid range decade from 3/400Hz to 3/4kHz carries the bulk of information we are interested in monitoring, and we utilise a unique, large segment 75mm soft dome device to cover this entire band. This provides a totally new solution since the piston diameter is consistent with air dispersion and directivity requirements, yet, because the edge of the dome is driven, we can use a full 75mm diameter coil and start to gain the power handling we require. Optimising sensitivity and power handling maximises the available sound pressure level—the two factors are inter-connected, a decrease in one requires an increase in the other to maintain consistent maximum SPL figures. Sensitivity is a measure of efficiency and maximum SPL is reached when either the mechanical or thermal limits are reached and the device is destroyed, or distortion rises to unacceptably high levels. The high sensitivity (95dB/W/m) of the 75mm dome is achieved by using a large ceramic magnet, with Swedish iron front plate and pole piece, and the tightest tolerance gap possible on a 75mm voice coil. This additionally raises the thermal limit by providing a better heat path away from the coil through the magnet structure—the pole tip and front plate are chemically blacked to assist in this. One form of distortion that is little understood is due to

FIG.2 JBL 2420 COMPRESSION DRIVER/  
EASTMILL VH HORN ON AXIS PERFORMANCE



# Studio monitor design

the rise in temperature of flat wound coils and the corresponding rise in impedance. Fig 3 shows the loss in output against temperature rise—this effect is also frequency-specific as we saw earlier in Fig 2b, By pro-

viding an efficient thermal path this distortion is minimised. There are two other major sources of distortion in domes—the first is due to the magnet gap and coil geometry, a primary source of harmonic distortion; and the second is due to resonances in the diaphragm structure as a result of either unstable wobbling of the whole assembly or by resonances occurring in the dome

itself.

The ATC unit utilises a short (3.5mm) flat wound coil operating in a 5mm long gap. The coil will, therefore, during normal operation always remain within the primary magnetic field—minimising harmonic distortion and increasing power handling. The dome has a dual suspension system which virtually eliminates wobble to the extent that it causes no audible distortion. The diaphragm material is impregnated with a viscous damping medium which controls the resonant break-up modes which occur at high frequencies and therefore reduces the time domain problems which result from undamped, high Q, resonances.

The resultant improvements are more than just one order of magnitude. Distortion is now of the order of 0.3% at 1W input and less than 1% at 15W input (Fig 4). We have applied the same technology to the bass drivers in the system—thick front plates and short coils loaded in vented enclosures to control the LF resonance of the system. To complete the integrated system we use a 34mm dome for the high frequencies, a small enough coil to avoid too much increase in directivity at the highest frequencies, yet large enough to dissipate the power required to produce the desired sound pressure levels. A distortion plot of one complete integrated system is shown in Fig 5—15W input.

All the drive units are mounted flush in the baffle, to minimise diffraction problems and the baffle itself is laminated with a composite material to reduce the re-radiation of information and its non-phase related recombination with the original source.

Much has been said and publicised about the importance of time-aligning the drive units in a system or aligning the acoustic centres of the units equidistantly from a specific listening position. Somewhat to our surprise, for in no way was it a design consideration, the T Series

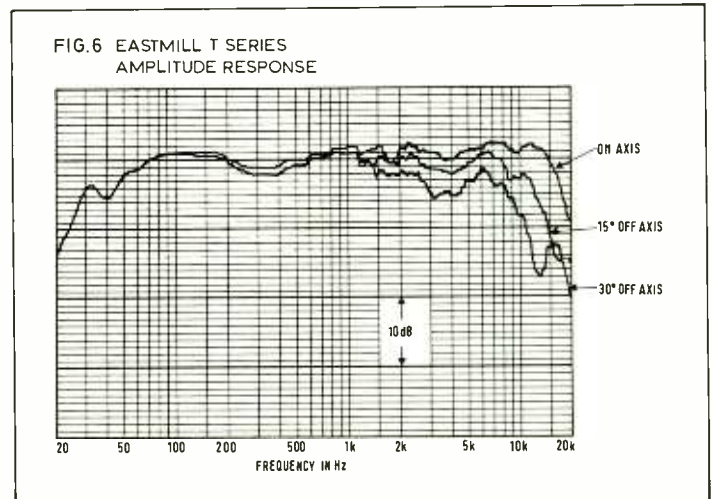
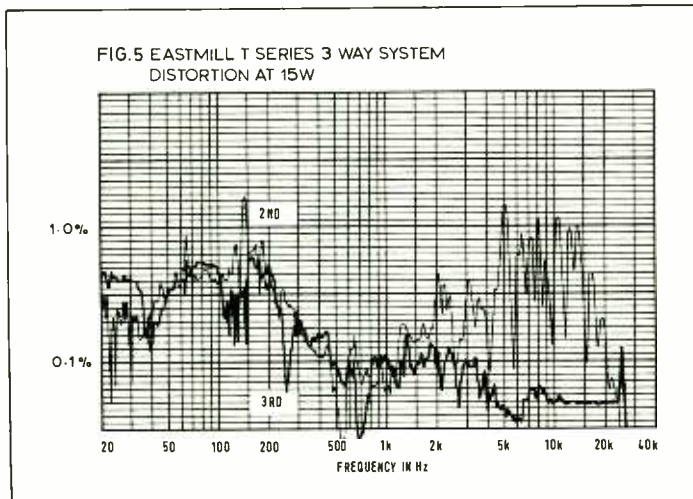
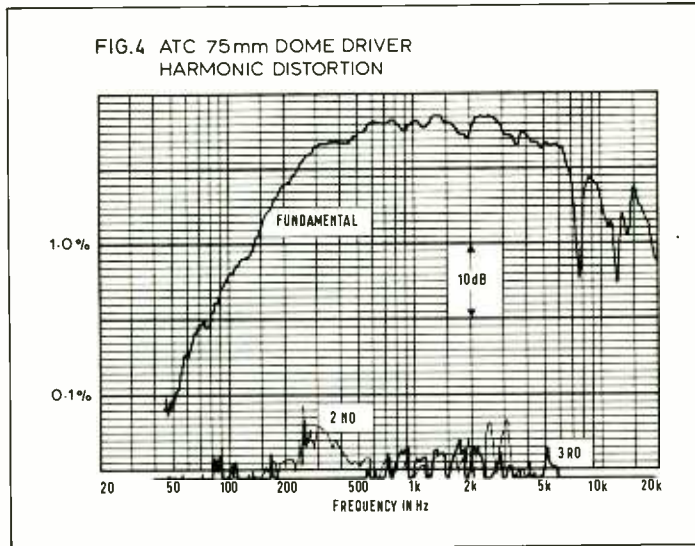
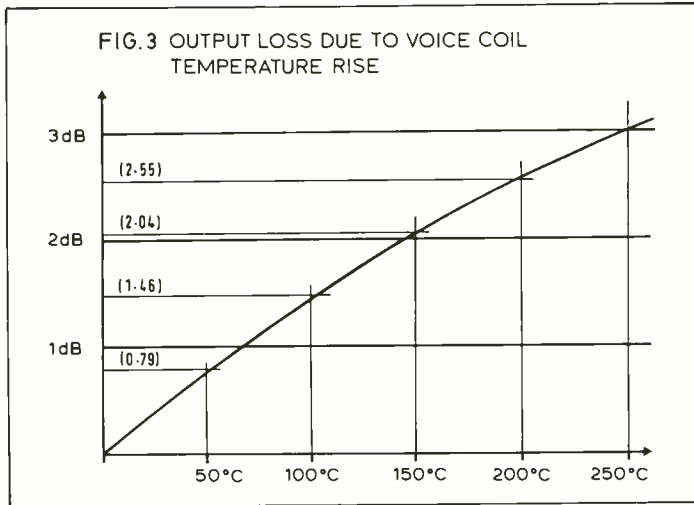
monitors meet the criteria for perfect time alignment.

Unfortunately time-alignment is little more than good marketing. Many tests have now been conducted and published showing that provided one is listening in any environment other than the completely anechoic, then the drive units can be moved up to 1m (corresponding to a 4ms anomaly) relative to one another before an observer can detect any deterioration of the signal. A single microphone, measuring on-axis might detect a deterioration in amplitude response, but the human ears listening to both direct and reverberant fields detect no difference.

Any delays or compensations built into a crossover to compensate for mechanical misalignment of a few centimetres, play no useful role, in performance terms. Indeed their effects may be totally overshadowed by active crossovers, phase distortion and the reactive elements in the cabinet itself.

The final design consideration was purely visual. Where monitor manufacturers actually supply acoustic grilles, many studios prefer to remove them and leave all, or some, of the speaker components exposed. We have designed and supplied a complete speaker cover to hide, as well as protect, all drivers. This prevents any, even subconscious, localisation of the sound and assists in maintaining good imaging.

Fig 6 illustrates the end result. Because a polar response curve can be so easily manipulated to the manufacturer's advantage, and misinterpreted by the user, we prefer to provide off-axis measurements on the amplitude response. We feel most confident that we are marketing studio reference devices for a completely new generation of engineers and studios—sensitive, efficient systems with a high maximum SPL capability but, and much more importantly, a level of distortion so low as to have been previously unobtainable.





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**3M**

# Studiofile:1

## A tour of Canada's Wonderland

The very model of the modern North American amusement park is now, and ever shall be, Disneyland, that home of America's favourite fantasies and cartoon characters that still brings millions to Southern California. Its predominance has been eclipsed recently by its younger brother, Disney World, in Florida, but the original lives on, unchallenged by upstarts like Freedomland, Great Adventure, Six Flags Over Missouri, and many others, either still open or long forgotten.

Canada, however, has for better or worse been pretty much left out of this. The largest collections of rides and attractions till now have been the Canadian National Exhibition on Toronto's lake shore, and the various provincial fairs. But now the second largest country in the world boasts its very own super-park, courtesy not of the Disney organisation, but of one of their competitors—Taft Broadcasting Company, of Cincinnati, Ohio, USA. One of Taft's subsidiaries is Hanna-Barbera, the creators of Yogi Bear, Fred Flintstone and Scooby-Do.

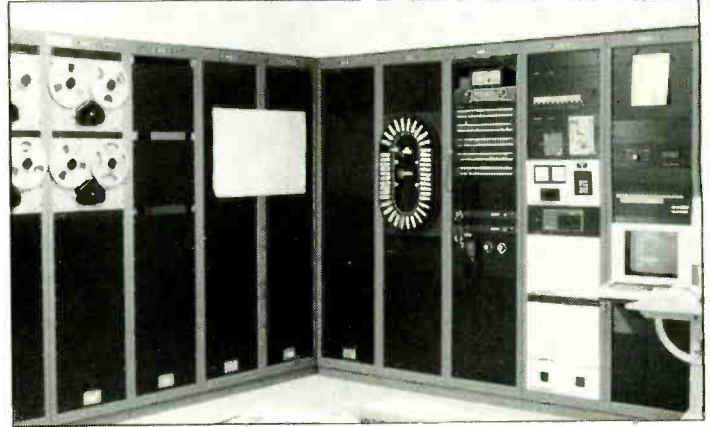
Canada's Wonderland is situated 19 miles due north of downtown Toronto, in the unremittingly flat agricultural glacial plain that characterises southern Ontario. Its 370 acres are divided into five areas: International Street, Medieval Faire, International Festival, Grande World Exposition (a reconstruction of the 1890 World's Fair), and the kiddie-sized Happyland of Hanna-Barbera. A sixth section, Frontier Canada, is in the planning stage. There was quite a bit of grumbling among the local populace when the original plans were announced for the park, in that there was nothing uniquely Canadian about the place—a sensitive point for many Canadians who feel their country unduly tied economically to the United States. The Frontier section was announced partially to allay that criticism, but there has been no official word on when it will open, and there are rumours that it never will.

The five areas, which opened with great fanfare in May of this year, feature rides, shops, restaurants, and exhibits, including an artificial mountain with a 150ft waterfall, an aquatic circus, and several stationary theatre spaces, as well as troupes of strolling musicians, jugglers, and clowns. Among the rides are four rather frightening roller coasters, a log flume, and a few carousels. Each area has its own background music emanating from weatherproof speakers, camouflaged on the ground and in trees, connected to a

central PA system, and it is there that we began our tour of the audio technology that is the lifeblood of Canada's Wonderland.

At the time of our visit Adrian Berry, a soft-spoken Englishman with a background in applications engineering, held the post of electronics and communications manager at the park but during the winter Berry left the company and Ashley Clarke took his place. The electronics and communications manager presides over a section of the operations building in which is also housed a sophisticated security command post and a well-equipped infirmary. Berry's domain includes a production studio, a comprehensive test bench and repair shop, and the computer-controlled PA system.

"Our system was originally designed as an automated radio station," says Berry, "although it never saw service that way. It was modified for our purposes by Paramount Studios, who have in the past designed and built equipment for all of the Taft parks." The computer, designed around Intel chips by IGM of Bellingham, Washington, handles the complex selection of input busses that feed the 18 Paramount power amplifiers, and also triggers the 42-stage *Go-Cart*, on which ride recorded announcements of upcoming live events. "At 30min before a show," Berry explains, "we will announce it over the whole park system. At 15min, we'll restrict it to the section near the theatre, and at 5min, we'll announce it just at the theatre itself. If there is a long line for the show, which often happens, we'll tell the computer to bypass the last



Audio control centre with TapeAthon decks, Go-Cart cart carousel, and IGM computer

announcement."

Background music, supplied by Taft Broadcasting, is played on four *TapeAthon* reversing ¼-track decks, each track feeding a separate area of the park with music appropriate to the setting. "In some areas, the background music interfered with the sound from the live shows," says Berry, "but we found a solution—we just disconnected those speakers."

The inputs of the stereo amplifiers are bridged, and the outputs are paralleled to 4Ω transformers and wired through a comprehensive mono patchbay before being sent to the 70V distribution transformers. "We originally set it up for 200V lines," Berry says, "but we found out that wasn't legal unless we replaced the plastic conduits all over the park with steel."

"We have stereo capability on the International Street, but we haven't

found any use for it as yet." The power amps have a combined output of approximately 8kW, and they feed over 300 speakers.

Next to the CRT that displays the computer's minute-by-minute log is a printer connected to the park's *IDS 440* security computer. The same entry appears several times: "ticket booth hold-up". Berry explains: "Actually, we've never been held up—the girl just keeps kicking the switch accidentally."

Berry's production studio is used to record the announcement carts, as well as to prepare and edit the various music and sound effects tapes that are used at the park. Most of the actual music is prerecorded in the US and Toronto. The board is a Yamaha *PM-1000*, and outboard equipment is not elaborate: dbx 160 limiters and noise reduction, and Orban stereo parametric EQ and reverb. Tape recorders abound, however, and include two MCI *JH-110* 4-tracks, a Teac 3440, a Revox B77, and a Philips, as well as Teac C-1 and Pioneer cassette decks and two Broadcast Engineering cartridge recorders. There are four JBL 4313s for monitoring, but only two are hooked up, powered by Paramount-modified AB Systems amps. There are two Technics *SL-5200* turntables with Shure cartridges. The microphone collection, some of which is shared with the live theatres, includes Neumann U87s, Electro-Voice RE20s, and Sennheiser shotguns.

The test bench, which must be capable of repairing every piece of sound equipment in the park, boasts an Ivie spectrum analyser, an Amber 4400A test set, and a Simpson SPL meter, among many other gadgets. "We take the SPL meter out," says Berry, "when anyone complains about sound levels. We can turn it on and say to them, 'See? This meets industrial standards.'"

Bjarne Christensen, the technical director for the live shows at



International Showplace, the park's main outdoor stage, 'Singing to the World' in full sway

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# Studiofile:2

## Canada cont'd

Canada's Wonderland, joins us to guide our tour through the park proper. Christensen, whose Danish family emigrated to Canada when he was a child, left a faculty position in theatre production at Ryerson Polytechnic Institute in Toronto, the best training school in the country for technical work in radio, TV, and performing arts, to work at Wonderland. "I love it," he says. "There's so much going on here, it's a constant challenge."

What's going on here are two major theatre spaces with fairly complex sound reinforcement systems, the dolphin and bird shows, which use one live mic over a music bed on a cartridge, and the pirate ship.

*The Plight of the Landlocked Pirates* is a stunt and acrobatic show that takes place in full costume (one player is in full drag) on a life-size replica of a two-masted frigate parked in a large pool. Music and dialogue for the show is pre-recorded, and played back on a Nikko cassette machine through a Yamaha EM-200 mixer, and then to Paramount bi-amped speakers on shore and hidden in the ship itself—the bass bins are just above the waterline, while the horns are up at the bow. Six Shure mics are concealed in the ship's rigging for picking up the screams of the performers that would be difficult to coordinate on to the tape.

Controls for the propane-oxygen-compressed air cannons on the ship are next to the mixing board, as is a telephone for communicating with the ship. The show is fun and, when the cannons go off, very loud. "We've calibrated the sound system so that there is a fairly constant 96dB SPL on shore," says Christensen, but obviously the cannons don't know anything about that.

The major indoor performance space at the park is the Canterbury Theatre in the Medieval Faire section. Although from the outside it resembles a Chaucerian castle, the inside is completely modern. A show called *Those Magnificent Movies* is performed there three times daily, which features fancy choreography and a 32-piece orchestra—on tape. "An MCI 4-track feeds the house system," explains Christensen, "But there are also two live musicians in the house: the conductor, who plays acoustic and electric piano, and a drummer. They get a monitor mix where they are under the stage, and the conductor also gets a click track through headphones. The effect is that of an entire live orchestra. It's very difficult to make taped drums sound live."

The soundman's station, halfway up the audience, centres around a

highly-modified Yamaha PM-1000 mixer. The desk has been rewired for 28 inputs, eight fadeable sends, and four main outputs. An on/off switch and pre-/post-fader switches for each send have been installed on each input module. "We feed the stage and pit monitors through echo send 1, and the click track through 2, and then loop the whole thing back through the inputs," says Christensen.

Two Yamaha PM-180s are in place to provide extra input capability, but they are rarely used. There are two Orban stereo parametric equalisers, an Orban reverb, two dbx 160s, dbx noise reduction, and a set of White 1/3-octave room equalisers. A full patch panel is provided with normalling, but the current sound engineer apparently didn't agree with the wiring, and so the bay resembles the proverbial rat's nest.

Four subwoofers are located around the walls of the house, and four Altec bins along with four Altec horns make up the main ceiling cluster above the stage. There are also speakers set in the floor of the stage which help in bringing the image down to earth. Paramount-built columns at the sides of the apron and backstage serve as monitors. AB Systems amps are used throughout. The whole show is mixed in mono, and the four board outputs are routed in turn to the main cluster, the subwoofers, the monitors, and through a Lexicon digital delay to the locator speakers.

On the apron is a forest of AKG 451 microphone capsules on black-finish VR2 gooseneck extension tubes. There are some 50 mic inputs on the stage, but most of the sound comes from six handheld Vega wireless mics. "The choreography is so complicated that cables are out of the question," says Christensen. "We have the body packs, but we don't use them—the handheld mics look just fine."

Wireless mics are used as well at the International Showplace, the park's main outdoor stage. Here, no less than 12 Cetec-Vega Performer II mics are in place, feeding two Antenna Specialists diversity arrays at the very back of the audience benches. The mics broadcast in the 180 to 210MHz band, and each receiver is equipped with signal comparator circuitry and automatic antenna switching. "They shift much too often," says Christensen, "because the antennas are so far away. I don't know why they were put there, but we are planning on moving them right behind the stage."

The wireless mic transmitters are equipped with compressors, and complementary expander circuitry in the receivers allows for an improved S/N ratio. "The systems work pretty

well," says Adrian Berry, "but there are still some bugs to be worked out. For instance, the wireless mics on the two stages use some of the same frequencies, and there is an occasional problem with cross-pickup when the mic is switched off and the receiver gain is cranked all the way up. It can be a little disconcerting to the sound person when all of a sudden one of his singers is doing a different show."

The system here is simpler than at the indoor theatre. A stock PM-1000 handles the mixing chores, aided only by an Orban reverb. The music is all live, but, ironically, the drum sound is isolated from the audience by a 3-sided plexiglass booth. "We had some problems mixing to the live sound," explains Christensen, "so we surrounded him." The onstage keyboard player has a monitor coming off his own EM-200 mixer, which is also direct-fed to the main board. The speakers consist of three clusters of Altec drivers and Mania Ray horns, and Altec stage monitors. Another of the ubiquitous Nikko cassette decks supplies music between shows.

The show we see, *Singing to the World*, is performed by a troupe of incredibly young, fresh-faced, energetic, and reasonably talented singers, dancers and musicians. Our travelling companion from the States snidely whispers that if one is seeking that 'All-American look', the place to come is Canada, and indeed, all of these people can probably look forward to long careers advertising toothpaste. The choreography is flashy and none too subtle, and the favourite move for the young ladies seems to be the hip thrust. "Gotta give the daddies something after they've spent all day dragging their kids around," remarks a Canadian friend.

Yes, there is something for everyone at Canada's Wonderland, whether it's a walking, talking Huckleberry Hound, or not very

exotic 'foreign' food, or the numerous advertisements for (and a couple of opportunities to consume) Labatt's beer. And, boy, is this place clean. It's also oppressively hot and hazy, but the 30,000 or so people here today seem to be enjoying themselves, and the children, although predictably rambunctious and curious, are remarkably well-behaved, at least by US standards. For the audio orientated, there is quite a bit of ingenuity at work here to be experienced as well, and considering the other technical fields that have ultimately contributed to the world of audio, like the development of computerised warfare, the atmosphere of commercialised innocence in which these systems are being field-tested seems rather benign.

Paul D Lehrman

## ICC, Eastbourne

ICC stands for International Christian Communications, but don't let the name put you off if you're not particularly religious. Although the studio was originally built to do work within the Christian community, after going 24-track a couple of years ago, they received so many requests from outsiders for studio time that they decided to open their doors to the public. Studio manager Dave Aston is the driving force behind the two music studios, and has as healthy an interest in, and as sound a knowledge of, the recording industry as any studio manager I've met. The studios are run at a professional level and shouldn't be taken for an extension of the local church hall as the name might imply they are.

Studio One control room is about 18 x 12ft and can accommodate six people in reasonable comfort. The acoustic treatment was designed and installed by Acoustic Technology, with membrane bass traps and mineral wool based broad band

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ICC Studio One

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# Studiofile:3

## Eastbourne cont'd

absorption around the walls, all covered in a deep red hessian with pine panelling and trim. The ceiling is acoustic tiling with plywood wedges to aid diffusion.

UREI 813 monitors are built into the walls either side of a good size communication window, and have a pair of Klark Teknik graphics in circuit boosting the bass a little to help develop a full bottom end in what is a fairly small control room. Auratone cubes are provided for alternative monitoring, and BGW power amps are used throughout.

The console is a 32/24 Trident Series 80, while the 24-track machine is a Lyrec which Dave has modified to allow a faster, gapless drop in and drop out. The stereo machine is an MCI, and up to nine Revoxes can be provided for effects and copies.

Auxiliary equipment includes four new Kepex IIs, AMS delay line with pitch change, Eventide Harmonizer 910, Audio and Design Panscan auto-pan device, a Trident stereo compressor, two UREI 1176 compressors, a Delta Lab DDL and an EMT 240 Gold Foil echo plate. No noise reduction is available for the multitrack, although there is Dolby-A for stereo mastering if required.

The studio floor is about 700sq ft and can accommodate up to 20 musicians. Acoustic treatment is in the same style as the control room. At one end the carpet tiles can be removed to reveal a concrete floor surface which, together with a few Audio Kinetics double sided screens, creates what Dave describes as a 'very bright' live end. Behind this is an isolation booth, large enough to contain a moderately sized drum kit, with a large window and fairly dead acoustic.

A lot of natural woods, fawns and greens are used in the cosmetic make-up of the room and they combine to create a very simple and relaxing environment to work in. Both studio and control room are air conditioned.

Included in the extraordinary price of £30.00 per hour is the use of a 6ft 1in Yamaha grand, a Fender Rhodes 73, a Korg Mini 700 monophonic synth, a set of tubular bells and a small Greisch drum kit. A discount of 15% is given on block bookings, bringing the bill for a 72hr week to a very reasonable £1,836 plus tape.

Studio Two is presented as a low budget, 8-track demo studio, and at £8.00 per hr (no deals) it's also very good value. The control room is about the same size as Studio One, but due to a less careful acoustic design, doesn't share the benefit of such a well-controlled acoustic. Dave is the first to admit this and is

at the moment in the process of investigating the exact nature of the problem, in order to rectify it. However, according to Dave, it is still capable of producing quite good results once you've got used to the room and, in fact, compared to most other 8-track studios, it is still above average.

The desk is an Allen and Heath Mod 3, the multitrack a Brenell Mini 8 and the mastering is done on a Studer B62, with the same vast selection of Revoxes being available for copies and effects. The monitors are Lockwood HPD 385As plus Auratone cubes, all powered by Quad 303s. A pair of dbx 165 over-easy compressors, an MXR dual 15-band graphic, and a pair of patchable PPMs by Soundex completes the auxiliary equipment list.

The studio floor area is about 500sq ft, with one bare concrete block wall and the other three treated with hardboard and Rockwool-type broad band absorption. It is a little 'liver' than Studio One and also has an acoustically dead isolation booth large enough to take a kit. The piano is an Ibach 6ft 5in grand.

The studios have a good selection of Neumann, Beyer, Sennheiser and AKG mics including a fine collection of old Neumann and AKG valve mics which Dave is always looking to augment.

A comfortable, self-catering flat is

the many religious recordings that they carried out each year in Eastbourne and at large Christian rallies or conferences.

They soon discovered that the sale of cassettes could be boosted if they duplicated them at the event but one of the problems was that it placed a great deal of strain upon the equipment. Helmut Kaufmann, one of the executives of ICC, started looking around for a more robust in-cassette copying machine which brought him into contact with John Gardner of Tape Automation (previously Crowmay) who were at that time developing a heavy duty in-cassette copier.

One of the main concepts in designing this new copier was its reliability under arduous conditions so the master transport and slaves were built into heavy duty flight cases. It was obvious that the transport would have to take a lot of punishment because of the moving around and the high speed at which they would be working. So the Papsi dual capstan cassette deck was used throughout which was modified and fitted with a heavier capstan motor to run at 16 times normal speed. The electronics were the same as had been proven in Tape Automation's reel-to-reel duplicators. The frequency response extends from 60Hz to 12kHz and the wow and flutter is kept to below

precise length they required and secondly, they could use a wider variety of tape.

So ICC bought an automatic cassette loader from Tape Automation which was based on that originally designed by Decca for their own loading operation. One of the main features is that it is extremely gentle on the tape and avoids damaging the edge of the tape, which can lead to premature failure in use.

The next stage was to upgrade the duplicating process and for this ICC once again returned to John Gardner for a high speed copier consisting of one 1/4in master loop bin and two reel-to-reel slaves operating at 32 to 1. This particular system was microprocessor controlled to maximise the yield from the tape. Apart from an immediate improvement in quality, this facility meant that ICC could now produce over 15,000 pre-recorded cassettes per week. Although this figure is not large, when compared to some of the larger plants, it does mean that they can accommodate small to medium sized runs on a competitive basis.

They only use top grade tape and brands that have a reputation for reliability and consistency, such as Agfa, BASF and Ampex, although supplies have sometimes been a little difficult.

The duplication facility, housing both the in-cassette and reel-to-reel duplicators plus a Wollensak, used for very small runs, is housed in a couple of rooms above Studio One. A great deal of emphasis is placed upon checking the quality of the incoming materials and the sound quality of every cassette is checked before despatch to customers. Obviously there are great benefits from the close co-operation that exists between the duplication staff and the recording engineers, who are always on hand if needed.

At the present time solvent labelling is used although ICC do plan to change over to direct printing as soon as possible which will speed up this part of the operation and reduce the labour costs. They have also started to produce high speed copies of computer cassettes and have had very successful runs on both the in-cassette and high loop bin copiers. Like many others they know that this part of the market has tremendous potential and having done the leg work they are now in a position to reap full benefit from the exploding microcomputer market.

ICC claim to be 1 1/2hr away from London, but this is of course contingent on road conditions and can take a lot longer in heavy traffic.

James Betteridge and Mike Jones  
ICC Studios, Silverdale Road, Eastbourne, Sussex BN20 7AB. Phone: 0323 26134. 94 ▶



ICC Studio One control room with Trident Series 80 console

also available to artists, next door to the studios; prices and details on application.

Studio Three is a radio and voice studio, equipped with four A77s, two of which are modified for more convenient editing, a Chilton 12/2 desk and a QRK cassette deck. Vivian Fisher, the Studio Three engineer, is chiefly responsible for the studios' technical direction, and is in the process of designing a new signal switching console to improve the ergonomics and general capability of the studio.

ICC also have extensive cassette copying facilities. Some years ago they started an in-cassette duplicating operation to supply copies of

0.15% DIN weighted.

Despite its size this unit proved to be very reliable in service and despite all the carting about it was able to maintain the above specification without any major problems. One of the limiting factors on the performance of any in-cassette copier lies with the quality of the C-Zero itself, especially the tracking accuracy which can seriously affect the high frequency performance of the duplicated cassette. However, suppliers of high quality C-Zeros were soon found although this meant it was necessary to load the tape into the cassettes themselves: but this had two advantages. Firstly, they could load the cassettes to the

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# Studiofile:4

## Wave, London

In 1942 Peter Inds was already scraping a living, playing piano in pubs and bars in and around London so I think it is fair to say that we are not dealing here with a young man. However, there is a very positive youthfulness about everything he says and does which shows itself in his latest project of which Wave Studio is but a part.

Although he began his career as a pianist, it is as an exponent of the string bass that he is best known, and for which he earned a strong reputation around the British jazz circuit during the late 40s. His work on the SS Queen Mary, Southampton to New York run, brought him in contact with the excitement of the New York jazz scene, and so in 1951 having obtained a green card, he moved out there to live and work. In those days a lot of recording was still being done direct-to-disc and when in 1956 he opened a recording studio on Long Island he was hailed as gimmicky for installing stereo equipment. In 1959 he moved his operation to an area now known as East Village in Lower Manhattan. He worked there until 1961, when due to exhaustion and general ill-health, he was forced to close the studio, and together with his newly found wife he moved in semi-retirement to California.

In 1966 he moved back to England where he has based himself ever since. His work in the studio, in television and live, financed the purchase of his house in Twickenham, which he bought in 1980. The large, 30 x 15ft, back room was an ideal place for a 16-track studio, in which were recorded a lot of demos and a few masters including albums for Stephane Grappelli and Robert Wyatt.

Early last year Peter started making moves to purchase Wave's Hoxton Square property and by the summer, Studio One on the ground floor had been completed and was in operation. Since that time bookings have been good and the business thrives.

The desk is a Soundcraft 2400 Series, the multitrack a 3M M79, and there are also two 3M stereo machines together with a little used Studer A66 which originally belonged to John Lennon. The monitors are Tannoy Ardens powered by a Quad 405, with no equalisation, and the auxiliary equipment includes an EMT 140 plate, Ursa Major Space Station, Eventide Harmonizer 910, AMS DDL, MXR DDL, MXR flanger and Soundcraftsman graphic equaliser. The piano is a 6ft 7in Ibach grand. The studio is a fair size, the control room and studio floor area combined being in the region of 1,000sq ft. The

acoustic treatment in terms of absorbers is sparse, in fact the majority of surfaces are simply painted brick work, including the control room, and so the sound is very live and bright. In the construction of new walls, parallel surfaces have, as far as possible, been avoided, and curtains are soon to be hung around the periphery of the room to reduce reverberation. However, having done the course and read the book, one is left in some doubt as to the flatness of the control room's response; although the room hasn't been analysed, Peter assures me that extensive listening tests have shown the acoustic to be acceptable.

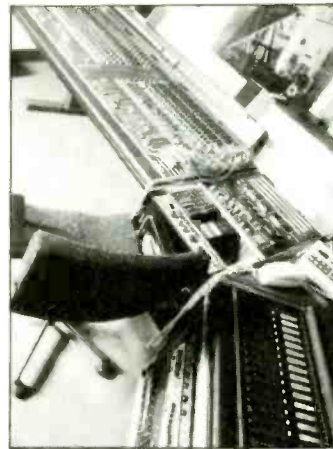
As a matter of interest I listened to a rough mix of a band called Bronze that happened to be up on the board at the time, and then to a mix that I had done at another studio. In both cases, although the sound was noticeably live and bright, there were no disturbing flutter echoes or ringing resonances, and the imaging was acceptable. Without actually doing a session there it is difficult to say whether any problems would arise or not, but suffice it to say that everyone who has used the studio has apparently been pleased with the results, what I heard of the Bronze backing track sounded very good and the studio continues to be well booked. At £30.00 per hour plus deals for block bookings, it has to be pretty good value.

It is important to point out that the studio is only a part of a much bigger project which is to eventually fill the other three available floors in the Hoxton Square building, and that it is the project as a whole that makes it special.

In the basement there is to be a club/recital room with an adjustable stage set-up, a bar and a small restaurant area. Here music of all



Wave Studio One, control room and below...  
...the drunken view



kinds will be promoted, any music that is, in the words of Peter, that 'makes it'. There will be video facilities available and the stage will have tie lines going up to the studio, thereby making the production of live video tapes or discs possible.

On the first floor, above the 24-

track studio, is to be a budget 16-track studio, for use by anyone who wants to hire it, but especially for bands who are hopeful of getting a deal and want to do good quality low cost demos, and then having secured the recording contract, return to the 24-track to do the masters.

Having lived for a number of years in America, Peter is very aware of the difference between there and England in terms of opportunity to learn and work with contemporary forms of music, and feels very strongly that we lack something in that department. He has spent a lot of his time teaching both here and in The States, but although his courses were very successful over here in terms of attendance, cuts in grants for education and other complications made it impossible to continue. Therefore on the second floor above the 16-track studio there is to be a teaching facility, including classrooms and rehearsal rooms, in which Peter hopes to put more effectively into operation his own teaching methods.

Finally, on the third floor will be the offices, a cassette copying room, a games/relaxation room, a bathroom and a couple of small bedrooms for those who stay over.

At the moment only the 24-track studio is completed but everything is running to plan and there seems to be no reason why the rest of the project shouldn't be realised in the course of time. Peter emphasises that it is most important that the place is filled with energy, enthusiasm and new ideas. It seems to me to be an extraordinarily exciting project and I will be following it through stage by stage, with avid interest.

James Betteridge

Wave Studios, 1 Hoxton Square,  
London N1. Phone: 01-729 2476.  
James Betteridge



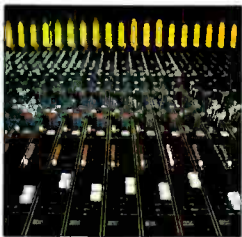
Wave Studio One



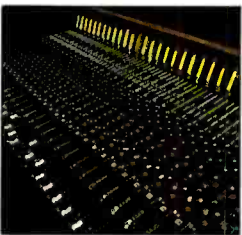
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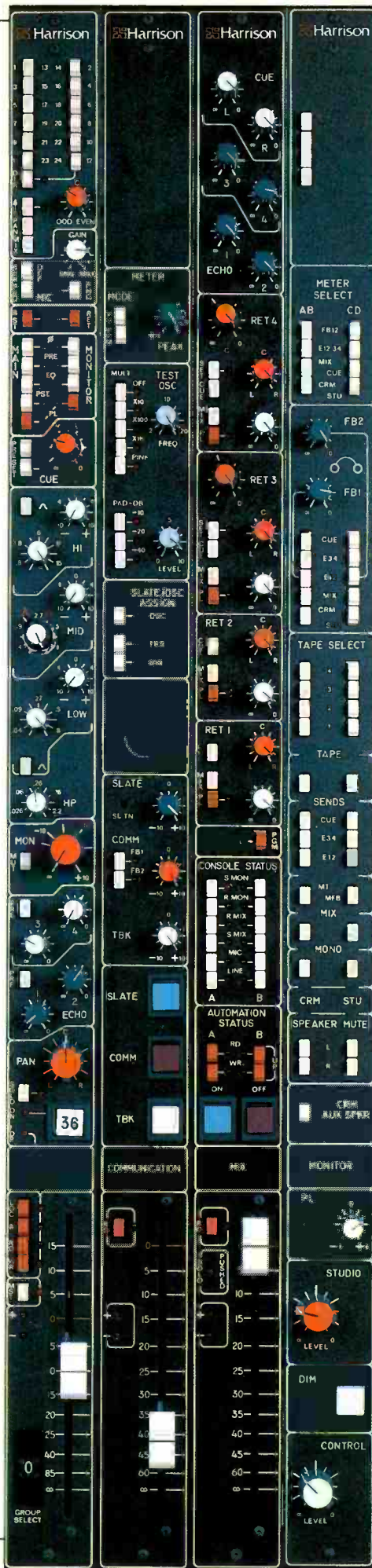


In addition, each module offers six auxiliary sends and a direct assign button for multitrack recording.



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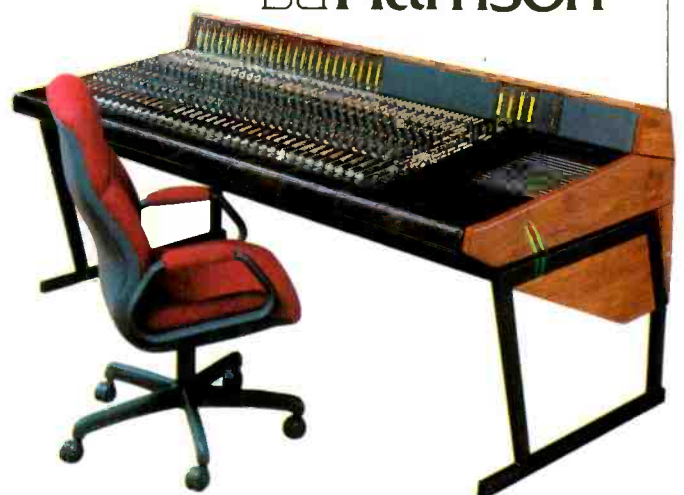
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## Eddie Veale

in conversation with Harry Mangle

**Eddie Veale is one of the best known and respected studio designers in the recording industry. In the following interview with Harry Mangle, he details the strange route that took him from the aircraft industry to his involvement with the professional audio world as an acoustic consultant. In addition, he discusses a number of projects with which he has been involved including Gus Dudgeon's studio project, The Mill. Finally, as a summation of his long experience of studio design he outlines the techniques he uses and comments on a variety of topics including the development of acoustic theory and practices, the design of studios and control rooms, and the thorny topic of monitoring and equalisation.**

### Getting started

I was interested in and studied acoustics at college, my original aim being to get into architectural acoustics, but I ended up in industrial noise control working on aircraft noise for de Havilland.

When Hawker Siddeley took de Havilland over I got a bit disillusioned. However, my social life had brought me into contact with Terry Brown who worked for Olympic at Marble Arch, and I mentioned that I might be interested in working in the recording business, so I asked him to look out for anything of interest for me.

I thought initially that any involvement would be more on the maintenance/project engineering side, since I had acquired a National certificate in telecoms which de Havillands had been kind enough to

assist me in getting (they seemed to think it would be useful). Mind you, it was mostly theory, molecular theory etc., not terribly practical but enough to give me a basic feel for the subject.

### Entering the pro-audio industry

Anyway, I finally ended up with Advision. At that time Dag Felner was chief engineer, the studio was 4-track and Dag was in the process of building an 8-track desk and he had hopes for a deal with Scully to bring the first of their new 8-track machines into the country. My job was to complete the console but I had never seen the inside of a studio console before. Dag had actually designed the audio recording console and started the project off, but was now more tied up with Scully and didn't have time to do that as well as finish the

*Studio One, Advision, Gosfield Street project. It had been going on for about a year and Kevin Hibberd was getting frustrated because the job wasn't getting completed, plus Dag had been wanting an assistant to help, freeing-up more of his time to get involved in sales (Feldon Audio).*

The project took about six months to complete, by which time Dag had got the Scully and was busy trying to impress the rest of the industry with it so he could sell them. With the assistance of Roger Cameron, studio manager, we installed the desk and the machines and got the studio running.

The next major project was moving Advision to Gosfield Street, during which Dag introduced a Swedish acoustician, Stellan Dhalstedt, to the company, an interesting guy, about 60 years old, who had been in acoustics most of his life. He proved very useful in getting to grips with studio acoustics and provided me with my first real experience of how you apply noise transmission control, isolation and room acoustics. Prior to that my experience had been all theoretical with very little practical application and it very quickly came home to me that theory had very little relevance to recording studios. Indeed, I had tried to solve a couple of problems in the studio at Bond Street by applying text book solutions, which didn't work quite the way that theory led one to believe that they should work, and it was a year or two later before I began to realise why they didn't work.

Specifically, human engineering is quite different from the applied physics of acoustics. Whereas you can take an environment and in essence control that environment by

acoustical engineering, it may sound complete rubbish because what the human ear accepts and what instruments might say are quite different. Basically we have two ears and a brain in the middle that does all sorts of wonderful analytical stuff that even today, with all our realtime analyses, fast fourier transforms and all the rest of it, we still can't emulate to the same degree and complexity.

It was very fascinating, most revealing and a very interesting exercise. It also brought me into contact with a very interesting young architect called Derek Norris. My job as basically project engineer working for Advision entailed making sure that Bond Street remained operational whilst getting Gosfield Street together both from the building and technical side, so I had enough to do and it was nice working with a team of people who had the right sort of experiences and disciplines. Very educational.

The opening party proved very useful too, since it happened very quickly after the project was completed and the word had gone out around the industry that Advision were up to something. During the move Advision had updated to 16-track so everybody had to come and have a look (especially since Advision had blazed the trail to 8-track). People wanted to see what they were doing to the business. It was quite a good scoring studio too, and although the film industry in the UK took a bit of a dive at the time, Roger still did a fair bit of scoring, although not as much as was anticipated when the original plans were put together. Overall the studio was very sophisticated for its time because not only was it designed as a comprehensive music studio, but also as a good scoring studio and I think Roger Cameron was quite pleased with the end result. It's had its problems, because it was done in a great rush on a limited budget, but proved very successful.

Unfortunately, though, having been involved in such a great project, it wasn't easy to get back into the normal routine and I was feeling frustrated that, having been into such an interesting scene, it wasn't going to continue. Anyway, as a result of the studio 'open day', a few people rang up saying 'would you like to come and work for me'. Most of them weren't really much different from what I was doing anyway, except for Adrian Kerridge at Lansdowne who subsequently turned out to be my first client, although the person who really sealed my fate was John Lennon.

### Making the break

I had become friendly with George Harrison through a mutual friend, Mike Vickers, for whom I had been doing some work maintaining his synthesisers in my spare time.



Completed studio at The Mill and restoration work in progress

Anyway, George Harrison had bought a Moog synthesiser which had a keyboard problem and was working at EMI at the same time as Mike, so he asked if he could do anything and Mike couldn't, so he gave George my 'phone number. George Harrison rang me up out of the blue and said 'can you come and fix my synthesiser' which I found really hard to believe. All the same I did go and have a look but didn't have the tools to do it there and then. The fault was actually used on *Here Comes The Sun*, there's a glide which is in fact the keyboard fault.

This brought me into contact with the group and a short while later I got a call from the Apple offices saying that John had bought a house out in Ascot, wanted a studio building and would I do it? John wanted me to completely build the studio, buy the equipment, organise the building, everything. I didn't really appreciate what I was getting into, being still employed by Advision, but after about a month I realised that this would require all my attention, besides which it was a conflict of interests with Advision so I had a lunchtime chat with Kevin Hibberd and a mutual parting of the ways was agreed.

This then enabled me to take up with Adrian Kerridge at Lansdowne to build the control room that still stands virtually unaltered today. After that I then got seriously into the studio for John Lennon. This studio was used to record *Imagine* with Phil Spector and then subsequently dismantled and shipped to New York to be John's contribution to Butterfly Studios.

### The Mill at Cookham

The biggest studio project, and probably the most interesting, was Gus Dudgeon's place at Cookham, The Mill (Sol). I was responsible on that job for everything from civil engineering through to final interior decor.

The site, of course, sits by a river which had to be taken into account,



and the Local Authority were refusing to allow any redevelopment. The main building was entirely taken up with the studios etc, and some dilapidated outbuildings could be used to provide additional living accommodation. Overall the site had really become run-down but Gus fell in love with the place and gave me the job of restoring it, which was a wonderful challenge.

The objective was to retain as much of the original structure as possible. With the building dating back in parts several hundred years, this meant that we had quite a few inherent problems to solve.

Starting with the studio design, headroom was about 7ft nothing on two floors, which meant we needed additional height, yet the Local Authority would not bend on original appearance, ie that from the outside all elevations had to remain the same. Also in order to accommodate a studio, especially bearing in mind Gus's and more particularly Phil Dunne's appetite for loud sounds, the sound insulation was going to need to be pretty good. The brief they had for acoustical qualities was unusual too, insofar as Phil & Gus had a particular liking for the control room of one studio, the studio of another and the monitoring of yet another. Bringing all these various facets together proved very interesting and we spent quite a while, about six months, on the basic designs and calculations before we attacked the actual building.

This even involved us in measuring and taking notes from the studios

concerned, which did throw up a few interesting facts about the studios in question. Also, you have to bear in mind that a producer will usually say 'I like that room but get rid of this particular characteristic', so you have to relate what a producer is saying in musical terms to what that is likely to involve acoustically. You have to relate acoustics to what is wanted physically to hear, which brings us back to the human engineering argument. Bear in mind also that Gus had his own ideas concerning interior appointments and decorations which were all going

them up so we could dig down 7ft and rebuild the foundations.

To keep water out, we built fairly thin concrete walls within the existing walls, mainly to stabilise them, then within that we put a waterproof tanking, and within that fairly hefty reinforced concrete walls to hold back the tanking and take the weight of the water. In fact, if you were to take away the peripheral building you would have a marvellous concrete boat and it would definitely float.

The actual procedure we used was to put the walls and floors in, then all the services, ie concrete ducting under the floor. Then we concreted over that and it became the floor of the control room upon which the studio and corridors were built. The studio itself took about eighteen months in the building. What took all the time was excavation/stabilising work which had to be done in sections. If you just dug out the foundations, the soil, being gravelly, would just fall apart under the weight of the building and everything would end up in a big heap so we had a very elaborate underpinning job to do, with in places the need to come down in front. Remember too, that concrete takes a time to cure and obtain its strength so there was a necessary delay between sections as they dried out before carrying on.

Once this slow front end stage had been completed, we could really press ahead.

Acoustically, we trod new ground in several respects. It was the first time we had been asked to model on another studio, yet this room was a completely different shape and size. Also we did have fairly limited space so best use had to be made of that. Quite a lot of experimentation had to be done to make sure that the treatments we had designed would work. Most of this work was done in anechoic chambers and test cells, using the facilities of Hurst Research at Wembley, and also Building Research at Garston's test facilities for testing materials as sections of acoustical construction. On this or any job, acoustics breaks down into two main areas, sound insulation and room environment, and the two

to affect the overall audio picture.

Once we had established all this we could actually tackle the building. Having regard to the planning constraints placed upon us, the only way we could go to increase headroom was *down* which, when you are right next to a river is not terribly clever. Also the building was actually sitting in a declared flood plane, so not only did we have to protect the control room from flooding, but also to consider the mechanical engineering of the whole thing — how to stabilise walls that had no foundations because they were built in the year dot, where the practice was to dig down until you hit something reasonably firm, plant your bricks and off you go—and make the whole thing waterproof. What we had to do was scaffold round the original walls, holding

Finished control room at The Mill with MCI console

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## Eddie Veale

really are quite independent of each other so there are really no situations where one can fix the two together for any useful benefit.

For sound insulation the most efficient and least expensive method is to apply mass technology, that is you take a sledgehammer to crack a nut. It is cheaper to set up form work and pour in concrete than it is to create lightweight structures of plasterboards, timbers and all the rest of it. Lightweight structures work very nicely but they are very labour intensive and take up lots of space. What you can do with a lump of 12in thick concrete you would need nearly three feet and many man hours to do with lightweight structures. Although concrete does pass sound, with a bit of ingenuity you can make it pretty inefficient. A better material than concrete is actually concrete blocks since dissimilarities are produced by the material and joints which create acoustical impedances and allow you to lose the high frequency transmission problem that is commonly encountered with reinforced concrete.

Overall, it's probably reasonable to suppose that at no point in the Mill did the concrete ever go to less than 18in thick. The perimeter was constructed of concrete and damping materials which worked very well and for the rest of it we used very small air gaps and heaps of concrete. Bearing in mind the location of the site (at the end of a narrow lane), it was better to spend a day running in lorry loads of concrete and get it over and done with than to have a protracted procession of workmen.

### Studios

Development-wise, I've gradually diverted away from the very dead approach towards a moderately live mid-band. Taking studio acoustics as distinct from the control room you need good communications for musicians to perform well, and you need control of the acoustics for the engineers to get good separation on mics. If you look at the characteristics of a mic it is very directional at HF, reasonably directional at MF and really awful at LF; it is a small device and cannot discriminate at low frequencies. It is exactly the same problem with our ears, they are not far enough apart to discriminate at low frequencies. For directional information we use mid and high frequencies, we are able to tilt our heads and the frequencies arrive at different times and we can locate things. If you blindfold somebody and put 50 or 100Hz on a sound system and ask them to tell you where it's coming from, unless the system is producing harmonics or other rubbish to work on they will just be guessing. It's purely and simply the problem that our ears are not wide enough apart to get any phase shift.

Mics are even smaller so their cutoff point must be about 200Hz, anything below must be omnidirectional.

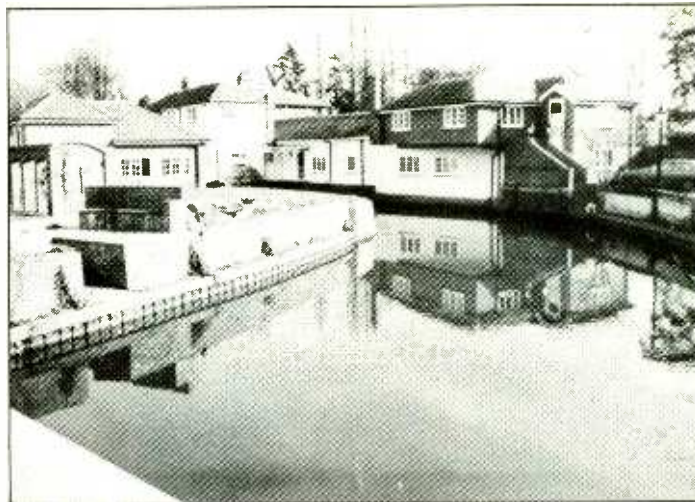
Bearing in mind these constraints it is possible to start working out an overall plan for the studio. A mic demands tight control over low frequencies, but being directional at mid frequencies you can put a barrier in the way so it's possible to put a drum kit or brass in the middle of a studio and allow the directional character of your mics to sort out separation. This mid-band liveness enhances studios in terms of their musical qualities, that is their ability to faithfully reproduce instruments and also from the human point of view in that musicians are better able to communicate, so improving timing and tempo. It has always been my feeling that one should be able to do more with a studio than just suck everything out and kill it-stone dead, then put it all back with the toys in the control room. Musicians ought to be used to better advantage, ie going back to the early days when musicians got it together or you did it again. I first practised this idea at a Lansdowne revamp in about 1972 and was prompted by Adrian Kerridge wanting to get a better brass sound. Basically all he wanted to be able to do was just put out a couple of mics. Since then I have used the technique quite extensively.

### Control rooms

Let's turn now to the requirements of a control room. The idealistic room is one where you have a listener and a set of monitors and you present to that listener the truest possible sound un-influenced by that room. This amounts in practice to a living room environment of infinite proportions to which the ear of the listener is well accustomed and can work happily, without strain, interpreting and creating a sound picture in its mind's eye. The aim being to make listening in that environment the same in perspective as any other reasonable environment. So the trick, after treating the room acoustically, is to fool the ear into believing that it is operating in a normal environment, so that the engineer/producer can concentrate on the sound, without undue stress, allowing the brain and perceptory functions to assemble the incoming information in a pattern to which they are accustomed.

When you try to apply the living room environment to a control room, all sorts of strange things happen. In a living room, if you put the loudspeakers at one end, open the doors for bass relief and play music you have good perspective, good reinforcement from the walls and overall a good sound picture. If you then take a mixing console and put it in the middle of the room the whole thing is destroyed, the whole sound picture is altered.

Suddenly you have introduced a



The Mill restored

large acoustical impedance into the room and created, acoustically, two rooms linked by a window which is the gap above, between, around and under the console. What's more these gaps are of different sizes and acoustical values. Suddenly the loudspeakers are feeding their energy into one room, where things are happening and bits of that information are filtering into another room, which has another effect. And all because you've brought this console in. If you could make the console acoustically transparent, wonderful, but unfortunately you've got these knobs and faders and things that the console needs, in all a fair amount of metal and timber. Also, there are other bits and pieces lying around like tape machines, equipment cabinets etc, all contributing their own turbulence to the acoustical behaviour.

What you do (or try to do) is to treat the front end of the room as the sound propagation area and encourage sound to flow through the room as evenly as possible past the listener and then lose it once you're finished with it. In the ensuing period introduce all the reflections in time that are required to deceive the ear into believing that it is in a bigger, more reverberant room.

If you look at the way the ear behaves, it looks at the original direct signal which it promptly forgets. Then it starts to look at the following signals—you could say that the initial signal arriving creates the outline and subsequent arriving reflections fill in the colour and texture. In a brief period of time a picture of sound is created. This can be proved very easily by taking somebody, putting them in an anechoic chamber and feeding them, over a loudspeaker, the sound of an instrument or a human voice that has been recorded in an anechoic chamber, so all you get is the original sound and no reflections. At first, anybody subjected to this will find it very difficult to concentrate, then after a couple of seconds they will begin to acclimatise and

start to actually hear the sound. Then after a couple of minutes it will become very stressful because they are concentrating very much on what they are listening to, which is very unnatural. This in turn is pressure on the brain or central processor which then upsets the nervous system and the whole body reacts.

In constructing the environment, therefore, there are targets to achieve. First you need the original and, say, three successive reflections within a particular time domain. It is necessary to work out angles and make sure that no signals arrive sufficiently close to the original direct sound, or the ear confuses these as the same signal and produces a bathroom effect. Conversely if the time gap is too long then there is the association with a big hall and the question of dislocation ie "I'm not sitting in a big hall, I'm sitting in a small room, it sounds funny?" — you don't relate. It's human acoustic engineering in terms of creating an environment that somebody that's not worked in that environment before, can go in, sit down, listen to a sound that's presented to them and relate to it. Within certain constraints you can adjust for differences between studios, since from early childhood the brain has in each of us been building up its own particular reference library of sounds and sound situations, enabling it to more easily adjust to different environments provided there is no major dislocation.

### Overall approach

In conclusion, the general approach I take is to go through the ground rules with the client/engineer, bounce off him the pros and cons, approach to design, different ways, different techniques and get a feel for his attitude/aptitude towards sound recording and what his desires are and with what respect to state of the art he wants his studio to be. All the subtleties allow me to engineer into the concept a room unique to that client, more so with regard to the

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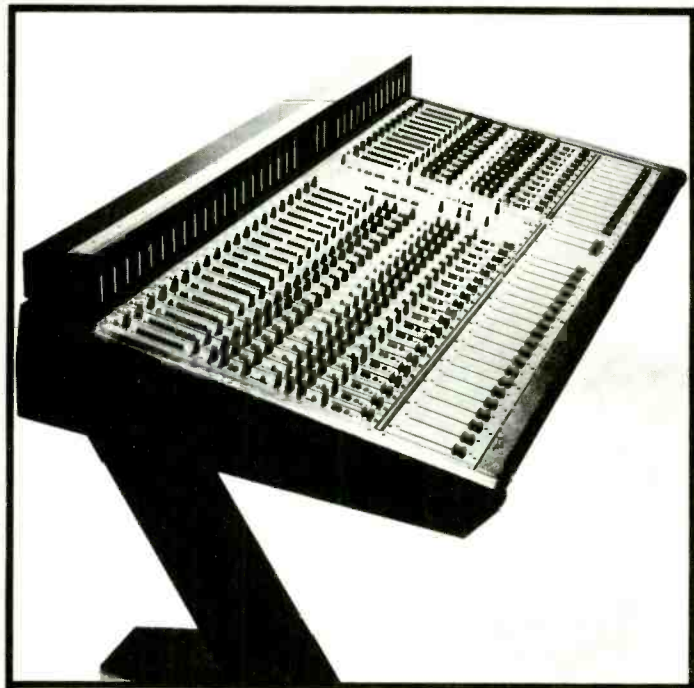
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## Eddie Veale

studio than the control room since the control room has to be one that other people can walk into and feel OK, it can only be coloured to a certain degree. With the studio of course, one can be more flexible.

The other aspect is, of course, the psychological design where one is dealing with appointments, shapes, colours, etc, and this is where the client can participate enormously, but all this has to be at the front end since these choices will have to be taken into consideration when working out the nature of the acoustical design (absorption etc). Mind you, whereas you put the client under pressure to make decisions on this subject it is also slightly unrealistic to expect a client to make a decision that he's going to stick to, so you must hedge your bets to a certain extent by doing the basics. Having determined the shape of the room it is unlikely to change so the low frequency work can be dealt with and mapped (shapes, surfaces, etc for low frequency propagation and LF absorbers to reduce potential problems). Then when it comes to finishes and other contours, it's all mid and top end and the human ear-type information, where unless there is some dramatic change like a different console or arrangement, the work that one has done hitherto is

valid. Work progresses and the client begins to get a feel for and contribute more valuable information and ideas. The thing starts to shape-up enabling mid band work which just leaves the high end. This is the easiest area since it is little if ever required, the air itself begins to absorb above 8kHz, and can be modified easily.

### Monitoring and equalisation

Many of the time aligned systems meet with mixed feelings from users. I did a fair bit of work on phase alignment about 12 years ago which was subsequently utilised in the big Cadac monitoring systems. The problem with time aligned boils down to the design of the drivers. What I think has happened, and this is really a bit of a personal assessment, is that people have used standard drivers, instead of designing new ones. If you backtrack a little and compare domestic systems versus professional systems, domestic systems have advanced in design quite considerably, mainly because manufacturers have been using modern measuring techniques, time delay spectrometry in particular, to look at the phase coherent content of loudspeaker systems and developed drivers to compensate in terms of mechanical arrangement for phase anomalies. They have done that because it is a volume market. It is expensive

research though, and to apply that research to the relatively small top end of the market is difficult. Professional manufacturers have been working on this for some time, but it takes a long time to develop and show through with new equipment. From their point of view, they have an established product, heaps of stock and a great reluctance to change, particularly on the small volume stuff. Of necessity, development tends to be relatively slow. Having come to the conclusion, though, that loudspeaker systems can be improved by phase or time alignment, and lacking the components that will do the job in their own right, then you look at the possibilities of electronically modifying it, which is what they do. Of course you are taking a wrong to counteract a wrong and two wrongs don't make a right.

A similar thing applies to graphic equalisation. Certainly, graphic equalisation is a useful tool. The ideal loudspeaker system in the ideal room is, of course, the ultimate, but unfortunately that rarely exists. Given time, loudspeaker systems will get better (they have improved greatly over recent years). There is currently great abuse of graphic EQ on monitors. I have noted that people without better experience have put up microphones in control rooms and tried using graphic equalisers to combat deficiencies in room

acoustics, quite honestly there is no way you can do that because if you move the mic a few centimetres the results will vary. Generally one tries to engineer the listening area as wide as possible, but it cannot go outside the confines of the room and specifically, I confine the critical listening area across the operational area of the console and about 5ft behind the console. Sticking up a microphone where the engineer sits and graphically equalising that point to be right only stands a chance of working if you can then erect a clamp at the spot and clamp the engineers head into it every time he works. Besides which you stand a very good chance of overdriving the monitors.

Graphic EQ is a valuable tool for finely adjusting a monitoring system as an electronic system, but must not be used for tailoring or modifying acoustics because that works for only one or discreet points in a room. It doesn't work in a broad fashion. Also you are using a microphone, which is a single point, and the human ears, of which we have two, interpret things in a totally different way.

You have to use microphones in quite discriminative ways when setting up monitors using equalisers in control rooms.

I would like to record my grateful thanks to all friends in the industry and apologise to those not mentioned here - space is limited and it would take a whole issue. ■

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## The Blumlein saga

Exactly 40 years ago, on June 7th, 1942, Alan Dower Blumlein was killed in a plane crash, testing radar in South Wales. As reported in our recent feature on Bell Labs, Blumlein's old employer EMI (now Thorn-EMI) has done pitifully little to honour the man's memory apart from sponsoring the GLC Blumlein plaque ceremony. But news of Thorn-EMI's lack of interest is spreading. Recently I heard from American electronics journalist Ivan Berger. He and some colleagues had read about the historic roll of nitrate film, with stereo optical soundtrack, that Blumlein made in the mid-30's. This is the film which Thorn-EMI has been promising, for at least the last five years, to transfer on to modern acetate stock for safety and long term security. Berger proposed that if Thorn-EMI wouldn't do anything there should be a subscription scheme, amongst journalists and engineers concerned with audio history, to raise whatever it would cost to transfer the film on to modern safety stock. So I asked David Sowter, Thorn-EMI's corporate affairs manager (responsible for trying to get the word Thorn spelled in capitals), to tell us how much it would cost to preserve the film for posterity. His reply was not encouraging: "In the current economic climate, our first concern must be today's sales and tomorrow's products." But, he reassured me, "this work is underway, but has yet to be finished . . . the Thorn-EMI Central Research Laboratories have been allotted the task of arranging the transfer".

The snag is that CRL has been supposedly arranging the transfer for several years now, and it's still not finished. "How can it possibly take a period of years to copy one short film from nitrate to acetate?" I asked Thorn-EMI. "The work is being done by an expert in the field," I was told, "but he's busy doing other things and the Central Research Laboratories are not pushing him."

"Well who is this expert?" I asked, "and why is it taking him years?" No comment.

So I checked with the National Film Archive. The NFA is part of the British Film Institute and now spends £100,000 a year on the transfer of old nitrate film on to modern stock. The NFA knows nothing about the Blumlein film, but would be only too happy to preserve it free of charge if it were donated to the Archive. In any case the NFA would advise Thorn-EMI. And the cost for transfer would only be around £200 per 1,000ft reel.

Thorn-EMI had again reassured me that "the film is in good condition, so there's no hurry". But the NFA's experience suggests otherwise. The average lifespan for nitrate film is around 50 years if it's good quality stock and stored at low temperature. But cheap stock (as used in the war years) only lasts 20 years and careless storage shortens the life of even the best stock. The real snag is that you can't tell whether nitrate stock is degrading, until it feels sticky to the touch. But by then it may be too late. The image will probably have become watery and the film sticks to itself. So it is very difficult to save. The Film Archive checks film before it goes sticky, by taking small samples and putting them through an accelerated age check. The sample is boiled in a test tube and the bleach effect of its fumes checked on litmus paper. Has Thorn-EMI done

any of these tests? No comment.

Meanwhile it seems that the 40th anniversary of Blumlein's death will pass without any commemoration by Thorn-EMI and without publication of the long-awaited biography on his life. The 1973 September issue of *Wireless World* carried a letter from audio consultant and writer Rex Baldock which reported: "the full story of Alan Blumlein's contribution to technical history will appear in the forthcoming biography by Mr F P Thomson, written in conjunction with Simon Blumlein" (A D Blumlein's son). The letter went on to suggest: "anyone with information likely to be of value should write to Mr Thomson at 39 Church Road, Watford WD1 3PY, Herts, England".

On June 1, 1977 the Greater London Council unveiled a plaque in the memory of Blumlein at his last London home in Ealing. At the unveiling ceremony a speech was given by Mr F P Thomson OBE. He was referred to as Alan Dower Blumlein's biographer. In his speech Mr Thomson said: "I was persuaded to write a biography."

I for one reported the unveiling (for instance in *Studio Sound*, September 1977, and its sister magazine *Hi-Fi News* (August 1977), duly referring to Mr Thomson as biographer. When I spoke to Thorn-EMI about the film transfer the corporate PR office thought that the biography had already been published. But apparently it has not.

I wrote to Mr Thomson at the address given in *Wireless World*, asking if he would like to let me know what was happening. I received back a letter from Mr Thomson's secretary in which it was said that he was "astonished" by my "impertinent demands". Further correspondence produced no hard facts on a likely publication date for the biography. Curiously the 1982 edition of *Who's Who* contains an entry for Francis Paul Thomson which lists several publications including "(with S J L Blumlein) A D Blumlein (1903-1942): engineer extraordinary, 1977".

Francis Paul Thomson was born in December 1914. He now sometimes uses notepaper headed with the words 'Alan Dower Blumlein 1903-1942, engineer extraordinary, a biography by F P Thomson OBE'. He has accumulated about 1½cwt of material about Alan Blumlein and his activities, and traced his ancestry back to the 14th century. Mr Thomson has previously published (in 1968) a book on *Money in the computer age* (Pergamon Press) and in 1973 he edited a partially revised edition of *The History of Tapestry*. In 1980 he published *Tapestry: Mirror of History*. The jacket of this book depicts the 14th-century Blumlein armorial tapestry woven in Strasbourg, which is now in the Boston Museum of Fine Arts, Massachusetts, USA. There is also a colour plate of it facing page 56 and, on page 130, there is a black and white photograph of Edmundus de Dummer, an ancestor of microcircuit, former TRE expert, G W A Dummer.

Mr Thomson began investigative work on Blumlein, his work and his ancestry, circa 1971. In 1976, 2½ years after publication of the appeal for material, the Central Library of EMI Ltd told an enquirer that a biography of Blumlein was being written at the moment. The next

year, in June 1977, Mr Thomson described himself at the plaque ceremony as Blumlein's biographer.

Dr Burns of Trent Polytechnic also began research work on A D Blumlein in the early part of 1971. But his work was the basis for a PhD thesis. Dr Burns says he was contacted by Mr Thomson who subsequently told him that he hoped to write a book on Blumlein and it would be finished inside the four years allocated for the thesis. Under the University of Leicester statutes this ruled out the possibility of a PhD thesis. Thus, although during the period March 1971 to March 1972 Burns had read all 128 of Blumlein's patents, and at considerable expense had travelled around Britain meeting many of Blumlein's former associates, he had to change the topic of research to the history of British television. He was subsequently awarded a PhD by the University of Leicester in 1976. "Had Mr Thomson not approached me in 1972," says Dr Burns, "my thesis would have been on the life and work of A D Blumlein".

So, unless anyone has news to the contrary (in which case let's hear it), there is still no biography after 10 years, no doctoral thesis, and no public access to original documents on the life and work of the man who is arguably the best electronic brain ever to come out of the British Isles.

## Record industry blues

Whatever happened to all those grandiose plans for an all-industry record and music business conference? Wasn't it supposed to have taken place earlier this year, to air new ideas and breathe new life into the record industry? And whatever happened to that plan for a massive publicity campaign to get the public back into the habit of buying records again, instead of taping them? Wasn't that also supposed to have happened earlier this year? Perhaps most important of all, whatever happened to the BPI's technical sub-committee that was set up in May 1981 "to appraise current manufacturing standards in the record and pre-recorded tape industry and to establish much more uniformity of quality amongst pressing and duplicating plants". The committee also hoped that its activities would "lead to a general upgrading of pressing and duplicating quality in the UK".

All this sounded very grand, although those with memories of longer than a year had a feeling of déjà vu and wondered whether there might be an ulterior motive. Like for instance pre-empting the Government's rejection of a levy on blank tape on the grounds that if the record industry improved its pressing and duplicating standards there would be less incentive for the public to tape. You see, the May 1981 announcement followed a June 1980 announcement by the BPI that "a working party on technical matters recently met at the request of the BPI Council . . . to explore ways in which member companies could best work together to ensure that standards are maintained in UK pressings".

The June 1980 committee produced a first report "which contained several recommendations and (the BPI Council) will soon be announcing which of these will be followed through". But instead of making any such



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## Blues cont'd

announcement, the BPI followed the good old British practice of just setting up another committee.

This, the May 1981 committee, was to look at "the introduction of a special British Standards Institute approved hallmark on records and pre-recorded cassettes, to denote that they had been manufactured to certain predetermined standards". After a while, I phoned the British Standards Institution to find out what was going on. But they had never heard of the BPI idea. At the time of writing, a year after its creation, the committee still hasn't made so much as a squeak. According to the BPI this is because the committee has been quietly making considerable headway on a number of fronts. Apparently they have been conducting a survey of record shops to find out how many new records are returned as faulty. The survey was due to be completed by the beginning of March so presumably the results are so unhappy that they've been equally quietly shelved. A report from the BSI on the feasibility of manufacturing specifications for records, pre-recorded cassettes and record sleeves, was also due at around the same time. There's also been nothing heard of that.

Meanwhile record quality continues to disappoint. Customers have given up taking back duds. So any return survey figures will underestimate the real problem. Shops like Virgin are now racking Japanese pressings alongside British and US pressings of the same titles, instead of in separate import racks. The Japanese pressings cost two or three times the price of their Western equivalents, but sell like hot cakes. Oblivious to all this some companies continue to churn out pressings with their now traditional lack of care and attention.

It isn't just middle-aged hi-fi nuts who notice the difference. A 16-year-old fan of the pop group Madness doesn't have to be a hi-fi nut to realise that there is something wrong when a brand new copy of the group's latest album sticks in the groove through a pressing fault. And I was in a British radio station last year when the presenter wanted to play a track from a new Denis Waterman LP. His own new copy was too noisy to be playable. So the station pulled another new one out of the library. This was equally bad. So another record by another artist was played in its place. In many respects it's astonishing that the record industry is doing as well as it is. An interview with Kim Wilde revealed that she has already sold more records than her father Marty Wilde through the whole of his career.

While on the subject of whatever happened to all those industry ideas, whatever happened to the cassette and crossbones logo that the BPI unveiled in October 1981? With the slogan 'Home taping is killing music—and it's illegal' this was to have been used on record sleeves and a wide range of industry publicity. But almost no record companies have been using it, even those managed by the BPI members who unveiled the slogan. One music trade paper dutifully offered a bottle of champagne for any car seen carrying the sticker. How odd that an industry that embarks on a publicity campaign to save its

future needs to be bribed with bottles of champagne to sport the campaign logo on their cars. How odd also that the record companies won't even put the logo on their own records.

One explanation is that a stark monochrome cassette and crossbones logo doesn't exactly do much for the aesthetics of an artistic sleeve. Another is that the record companies have become far more interested in getting a tax on tape than curbing home taping. Either way, there's an interesting story behind the cassette and crossbones logo.

On October 11, 1981, one of the Sunday colour mags carried an article on home taping. I know, because I wrote it. The article was



illustrated by some artwork commissioned and drawn in late August. That's the magazine artwork on the left. The industry's logo is on the right. This was unveiled on October 28.

The whole case for the record industry's demand for a tax on blank tape rests on the wickedness of unauthorised copying. So I asked the BPI to comment on the obvious similarity between the two logos. "At first glance there is a resemblance," acknowledged the BPI's legal adviser, "although closer examination shows them to be quite different in a number of material respects".

It's easy to forget that the issue of home taping is only one of many areas covered by the Government's Green Paper on copyright law reforms. Another issue is that of 'moral rights' for creative artists, composers and writers. Moral rights has nothing to do with Mrs Whitehouse. Under the Berne Copyright Convention, which I understand the BPI would like Britain to follow, composers, artists and authors have the right to claim authorship of a work, for instance by putting their name on it. This is quaintly known as 'right of paternity'. The artist can also stop people producing distorted or modified copies which prejudice honour or reputation. But under current British law there's only copyright infringement when someone makes an exact, or Chinese, copy. The Government Green Paper recommends a change in the law to give artists, composers and authors much tighter control over their artistic creations, ie moral or paternal rights.

I asked independent copyright lawyer Alistair Kelman what he thought about the BPI's adoption of a similar, but not identical, logo to the one drawn several months, and published several weeks, before the BPI's unveiling. According to Kelman: "The BPI have produced a drawing which expresses the identical idea... without copying a single dimension or feature in the original drawing." So there's no Chinese



copy and no room for complaint under current British law. Doubtless this is why the BPI lawyer told me in his letter that: "I can assure you that there is no question whatsoever of our having copied the artwork."

Perhaps the most interesting point to emerge from all this is that the chairman of the BPI PR and Profile Committee hadn't seen the original article and logo until I raised the matter of similarity with him. Nothing wrong in that of course. No one can read everything. But doesn't the BPI have a press cuttings agency or a press officer to keep an eye open for articles on their industry? Is the record industry so busy lobbying for a levy that it hasn't got time to read what's written about it? This would of course explain a lot about the industry's failure to move with the times and respond to the public's feelings, for instance over the quality of discs and pre-recorded tapes.

Meanwhile, the Government is now moving towards a change in copyright law. Dr Vaughan, the Minister now responsible, has put an August deadline for comments on the Green Paper. The Government will then negotiate with the other Common Market countries. A debate in the House of Lords earlier this year kicked around the idea of a levy of 50p on a C90 cassette, which is exactly one quarter the rate proposed by the BPI. As the BPI has now offered to donate one third of any tape tax to an industry fund for new talent etc, there isn't going to be much left over from a 50p levy after administration and distribution costs have been deducted.

Meanwhile the National Consumer Council has come up with a very firm proposal. The NCC says: "The Government is right to be unconvinced by the case for a levy (and) believes that the law should be changed so that people who have bought a recording should have an absolute right to use what they have paid for for their own personal use. This includes re-recording it. In addition there should be freedom to re-record, for personal use, copyright recorded material which is broadcast, in the same way as any other broadcast material."

"Unenforceable law is bad law," says the NCC's Maurice Healy.

But all this is academic. If the British Government has to negotiate with the European Community before changing UK copyright laws, we could still be arguing the toss at the end of the decade.

Since their introduction in 1977, the UREI 800 series monitors have steadily been replacing old-fashioned loudspeakers. In studios throughout the world, they've become the accepted standard — the critical standard by which all other professional loudspeaker systems are now judged.

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- Shadow Slots have been added to further improve the mid-range magnitude regularity and overcome the classic "shadow effect" characteristic of some coaxial systems.

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- All models now feature a BNC type connector to accommodate the Conductor Compensation™ feature of UREI's model 6500 Power Amplifier.

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# Control room acoustics

Andy Munro (Turnkey Two)

This is the first section of a two part article detailing design and acoustic techniques for small control rooms. In the second part, Andy Munro, will explore measurement techniques used to assess the performance of small control rooms.

THE last ten years has seen the growth of many small recording and broadcast studios serving an expanding and increasingly cost conscious music industry. The arrival of video and audio visual studios has also swelled the numbers considerably. Historically, acoustic measurement and design has been based almost entirely upon statistical analysis of large rooms resulting in constants applicable on an empirical basis to any geometric shape providing the volume was sufficient to produce a truly reverberant sound field.

It is generally agreed that a room which does not generate at least 100 reflections of an original sound within a 60dB decay time will not establish a steady reverberant sound field. It is the purpose of this article to examine the acoustic performance of small control rooms in the light of recent theoretical and instrumentation developments.

A control room of 5m length, 4m width and a height of 3m will be used as an example. Room volume will therefore be 60m<sup>3</sup> and the total surface area of the room 94m<sup>2</sup>, if considering only its basic geometric shape without additional boundary surfaces. Thus, L=5m, W=4m, H=3m, V=60m<sup>3</sup> and S=94m<sup>2</sup>.

The mean free path of a sound travelling within any room of any size is given by:

$$\text{MFP} = \frac{4V}{S}$$

$$\therefore \text{MFP} = 2.55\text{m.}$$

If the room was covered by evenly distributed absorbing material of, for

example, coefficient  $\bar{a}=0.41$ , then traditional Sabine analysis would predict a 60dB decay time of:

$$\text{RT}_{60} = \frac{0.161V}{S\bar{a}} = 0.25\text{s.}$$

Sound travelling at 343.24m/s (Vs) will experience  $\frac{Vs}{\text{MFP}}$  reflections per second and therefore the average number of reflections (NR) within the defined reverberation time is given by:

$$\text{NR} = \frac{Vs \times \text{RT}_{60}}{\text{MFP}} = 33.67;$$

ie insufficient reflections to remotely satisfy the Sabine formula requirement for statistical accuracy.

For a truly reverberant sound field (100 reflections) and an RT<sub>60</sub> of 0.25s, MFP must equal:

$$\frac{343.24 \times 0.25}{100} = 0.858\text{m.}$$

An MFP of 0.858 would require in a room of volume 1,000m<sup>3</sup>, a surface area given by:

$$S = \frac{4V}{\text{MFP}} = 4,662\text{m}^2.$$

Now an average room with V=1,000m<sup>3</sup> has room dimensions in the order of L=20, W=10, H=5, giving surface area S=700m<sup>2</sup>. It can be seen therefore that any approximation of an RT<sub>60</sub> of 0.25s can only be achieved by devious means with a geometrically contorted boundary surface. It is also obvious that by increasing the effective surface area of our small room by geometric changes to say 300m<sup>2</sup> the NR value will be:

$$\text{NR} = \frac{Vs \times \text{RT}_{60} \times S}{4V} = 107.26.$$

RT<sub>60</sub>=0.25s, V=60m<sup>3</sup> and S=300m<sup>2</sup>, satisfying Peutz' equation<sup>1</sup> for sound field density.

However, the absorption coefficient requirement now becomes:

$$\bar{a} = \frac{0.161V}{S \times \text{RT}_{60}} = 0.128.$$

While it is theoretically possible to achieve a room design of the above parameters, several important and undesirable effects would result unless certain modifications are carried out.

With reference to Fig 1, in a truly reverberant acoustic environment there is a point Dc where the sound radiated from a source at Do equals the reverberant sound field and beyond this point no further change in level will occur (B). Under anechoic conditions curve (A) will decay to zero with constant slope. However, in our small room a less predictable curve will occur (C) which falls between the definite limits of A and B.

Dc is defined from inverse square and room reverberation<sup>2</sup> as:

$$Dc = 0.141 \sqrt{\frac{Q S \bar{a} M}{N}}$$

where:

Q = the directivity of a monitor loudspeaker; S $\bar{a}$  = the room absorption; M = an 'architectural' modifier; and N = a multiple source modifier.

M is a correction factor for uneven placement of acoustic absorption  $\bar{a}$  and will be discussed later.

N relates to additional loudspeaker sources not usually relevant in control rooms.

Q is a non dimensional expression

of loudspeaker directivity ranging from 1 for omnidirectional free standing bass loudspeakers to 50 for horn loaded HF drivers. Variation of Q with frequency must be taken into account in both monitor and acoustic design.

Now consider our small room with  $\bar{a} = 0.128$  and  $S = 300\text{m}^2$ . The chosen monitor loudspeaker claims a Q of 2.5 in the 1kHz octave band.

$$D_c = 0.141 \sqrt{\frac{2.5 \times 300 \times 0.128 \times M}{N}}$$

Let M and N = 1.

$$D_c = 1.38\text{m}$$

Critical distance can be regarded as an ideal position from which to mix as the engineer will experience both direct and reverberant energy equally, but it is desirable that early reflections within the time window from  $D_c$  to +10ms should be attenuated so as not to cause comb filtering of the monitor loudspeaker response. For  $D_c = 1.38$  this time window is given by:

$$\Delta t = \Delta t_1 + \Delta t_2$$

$$= \left[ \frac{1.38 \times 1000}{343.24} \right] + 10 = 14;$$

where  $\Delta t$  is the total time delay of the indirect path;

$\Delta t_1$  is the direct path time;

$\Delta t_2$  is the desired delay for minimum interference (in this case chosen as 10ms).

Therefore, the earliest path to  $D_c$  by indirect means should be at least 14ms or 4.8m. This is clearly difficult to achieve in a room  $5 \times 4 \times 3\text{m}$ , but some compromise can be made to satisfy both initial time delay and reasonable room 'ambience'.

Some consideration must be given

to the materials used to eliminate early interfering reflections as these should be reduced by at least 10dB.

Table 1 shows the sound energy level reduction of a single reflection from a given acoustic boundary.

Table 1 Acoustic energy absorption

Absorbency coefficient $\bar{a}$	Attenuation (-dB)
0.5	3.0
0.6	4.0
0.7	5.1
0.8	7.0
0.9	10.0

It is interesting to note that an acoustic absorber of 99% effectiveness (ie reflecting 1% of incident energy) will reduce level by:

$$\frac{1}{10 \log 100} = -20\text{dB}$$

Therefore, by decibel law, sound pressure of a reflected signal will also be -20dB SPL relative to the incident signal:

$$\text{ie } 20 \log \frac{\text{Reflected SPL}}{\text{Incident SPL}} = -20$$

$$\therefore \frac{\text{SPL R}}{\text{SPL I}} = 0.1 \text{ or } 10\% \text{ SPL}$$

Even an acoustic absorber of  $\bar{a} = 0.99$  will ensure 10% sound pressure will be reflected. It is obvious, therefore, that to reduce individual reflections by 10dB or more requires specialist acoustic materials of the highest specification (No account has been taken of frequency dependence at this stage.)

By introducing enough absorbency to attenuate reflections with time delays of 10ms or less it can be seen that the overall  $\bar{a}$  must be modified, but it is possible to make use of the areas directly within the coverage

angle of the loudspeakers to increase apparent reverberation. The modifier Ma in the critical distance formula is defined as:

$$Ma = \frac{1 - \bar{a}}{1 - a_c};$$

where  $a_c$  is the absorbency coefficient within the direct coverage angle of a monitor loudspeaker.

Suppose the overall  $\bar{a}$  has increased to 0.4.

If for example:

$$a_c = 0.01, Ma = \frac{1 - 0.4}{1 - 0.01} = 0.6;$$

then,

$$D_c = 0.141 \sqrt{\frac{2.5 \times 300 \times 0.4 \times 0.6}{1}}$$

$$= 1.89\text{m};$$

and without Ma,

$$D_c = 0.141 \sqrt{\frac{2.5 \times 300 \times 0.4}{1}}$$

$$= 2.44\text{m}$$

Therefore Ma may be used to offset the apparent effects of reduced room reverberation and keep  $D_c$  to a lower value. In rooms with 'dead' rear walls  $Ma = \text{infinity}$ , and monitoring is effectively anechoic, even if some areas of the room are decorated in exotic 'reflective' stone.

## Conclusion

By assuming that a reverberant sound field can be generated at least at mid and higher frequencies, it is possible to design a room capable of psychologically representing a larger volume than is actually there.

The performance of the sound field will be critical and require detailed analysis to achieve constant energy/frequency/time relationship.

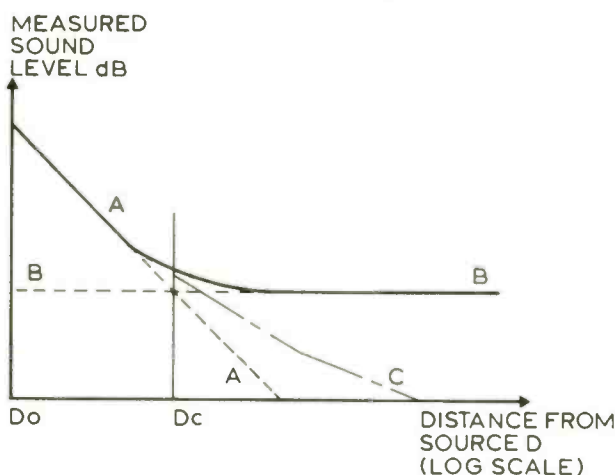
The critical distance in a small reverberant room will necessarily be small, dictating a nearfield monitoring position similar to that frequently occupied by *Auratones*. This is an obvious reason why small single source loudspeakers are so popular, often used by knowledgeable engineers and producers in preference to the main 'blood and thunder' monitors. A control room doesn't have to be small to be awful. The acoustic treatment of small rooms is critical with small numbers of units capable of at least 95% absorption required instead of blanket cover. The geometric room design will dictate both S in relation to V and also LF performance. This will be covered in a following article which explores measurement techniques in relation to small room performance. ■

To be continued

## References

1. V. R. Peutz modified Hopkins Stryker Equation.
2. Reference data published by Synergetic Audio Concepts is duly acknowledged as being source material for this article although the approach is, to the best knowledge of the author, original.

FIG.1 SOUND FIELD DEVELOPMENT



# NAB 60th Convention—a report

Harry Mangle

The National Association of Broadcasters (NAB) annual convention and exhibition, held at the Dallas Convention Centre, Texas from April 4 to 7, took as its theme 'The Sky's The Limit', with a whole parking lot full of clone-like satellite receiving dishes to underline the theme. Those with the temerity to pass these by and actually venture into the Convention were treated to the usual spectacle of 'megabuck' TV exhibits jostling for attention, with sundry other booths making up the numbers.

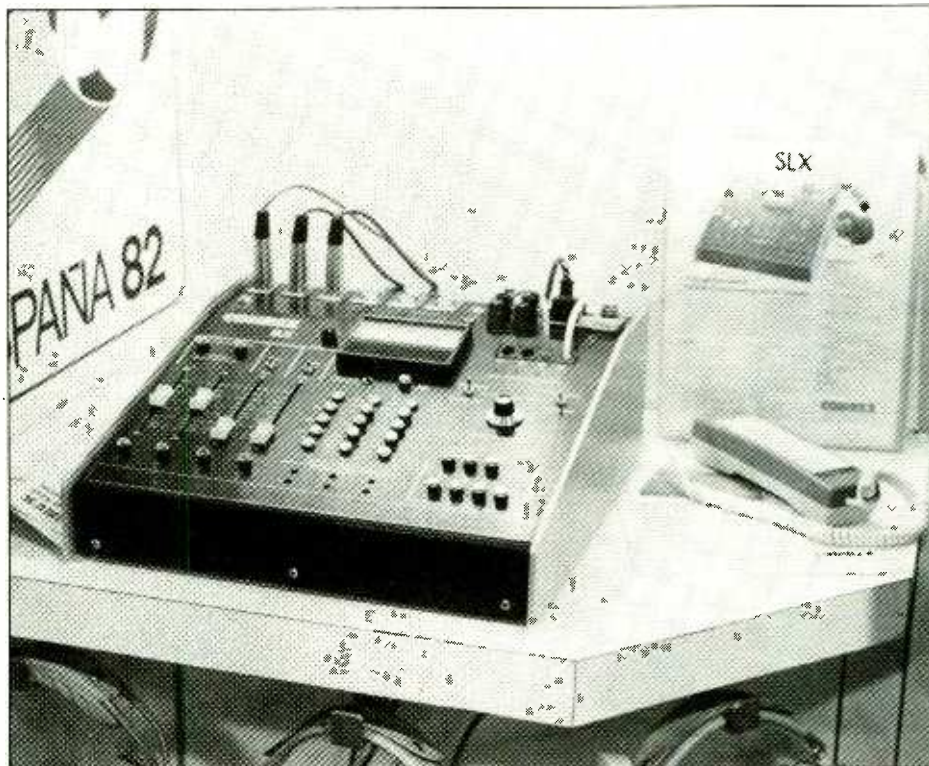
RUNNING a few numbers through the trusty pocket calculator, it didn't take long to work out that, with over 460 exhibitors in over 200,000sq ft of space a gruelling schedule of under 4.17min per booth would be required to totally 'do' the show. So let's dispense with TV and look at what's new and/or of note in sound and radio broadcasting.

## Reportage equipment

**Scribe Recorders**, a new venture formed by Erik Horvitz and Frank Beaman, had their *Scribe One 'Newscorder'* on show. This cassette recorder was spawned at a Radio/TV News Directors Association (RTNDA) meeting in New Orleans where one forum session was devoted to creating a 'wish list' of features required for news reporting. Besides being rugged, having Cannon *XLR*-type connectors and no external 'twiddlies' (mic in, line out) the main feature of the *Scribe One* is its hot mic facility enabling talk-over-play operation. The mic circuit is mixed in at the amp which means that in doing reports down a phone line, having found the bit he wants to play, a journalist can hit play and pause and, using the live mic, do a link, thereafter releasing the pause button for the actuality. Other features are 1-button record (and its end one!), cue on FF/REWIND if relevant button semi-depressed (locking on full depression with tape lifted).

Input to the *Scribe One* can be mic/line, level preset with AGC and frequency tailored from 150Hz to 7kHz. Output is controlled by one (the only) knob which also adjusts headphone monitoring level (1/4in jack). Power is supplied by internal 'C' cells or external 6V DC and the price includes canvas carrying bag with pockets for accessories and shoulder strap. For desk top reporting there is also a gooseneck mic accessory for hands free operation.

**Telfax Communications** were showing a new 'sports box' portable setup with touch tone or pulsed dialling, switchable phone or off-air cueing from internal Ni-cad or mains power. Also



Comrex SLX reporter's mixer

**Comrex** were showing their frequency extenders for 'phone reporting applications. (The demo was very impressive.) Latest addition to the family was the *SLX*, a reporter's mixer with built-in frequency extending transmitter, which makes provision for two tape and four mic inputs and three sets of headphones. On the output side, up to two telephone lines and two programme loops (radio link or music circuit, etc) can be fed simultaneously with a third telephone line for talkback. 'Custom' monitor mixing on the headphones gives programme constantly in one ear with any input source selectable to the other and a 'solo' facility on talkback.

## Tape machines

**Ampex** had their new *ATR 800* which features continuously variable shuttle back and forth, three speeds and varispeed, switchable NAB/IEC EQ and bias, cue amp and electronic tape timer (H.MM.SS) with single point search-to-cue. Other points of note: fader start, VU/peak metering, quick change head assembly, rack mountable. **Nagra/Kudelski** had their *T-Audio* transportable studio recorder, featuring four speeds, twin capstan, open loop transport, digital tape counter (H.MM.SS), varispeed and non-latching 'skip' at 2x speed without tape lift.

**Otari** were featuring heavily on the *MTR-10* (see *Studio Sound*, December 1981) and **Studer**

were expounding the delights of the new *A810*. Taking for granted Studer's ability to make transports and electronics of excellent quality, the major point of note on the *A810* is the use of a microprocessor to adjust all amps with digitally controlled pad networks eliminating presets. The micro has a memory which can hold setup information for up to four tape-types, recallable or for storage on external media via optional serial interface. In addition, the micro memorises tape counter reading, speed selected and locator addresses.

## Desks

**Tweed Audio** had a desk on show but professed to be more and more into custom designing. **Clyde Electronics** on the other hand were going over in a big way. Their display consisted mainly of two *Alpha Series* mixing consoles, one for on-air use, the other for commercial production. Other products included a talkback unit, 4-channel headphone amp (5W/channel), oscillator test set for checking-out telephone lines and a station monitor unit allowing step through to all positions (up to four selected from 10) automatically.

Surprisingly, another first timer at NAB was **Soundcraft** although they have been selling in the USA for years. The *Series 1600*, *Series 2400* and

110 ▶

# MIDAS the professionals' choice

Frank Zappa with his split 36 into 8/2 MIDAS Live Sound Console on the 1980 Zappa World Tour. Impressed by MIDAS performance and reliability on that tour, he then ordered a 36 into 8/8 Theatre Sound Console with special modifications to allow every concert to be recorded on 24, 8 and 2 tracks simultaneously. Why MIDAS? Because MIDAS experience and design philosophy provide highest quality signal processing in a compact and rugged modular frame built to withstand years of use. Frank Zappa is a professional. MIDAS is the professionals' choice.



## NAB report

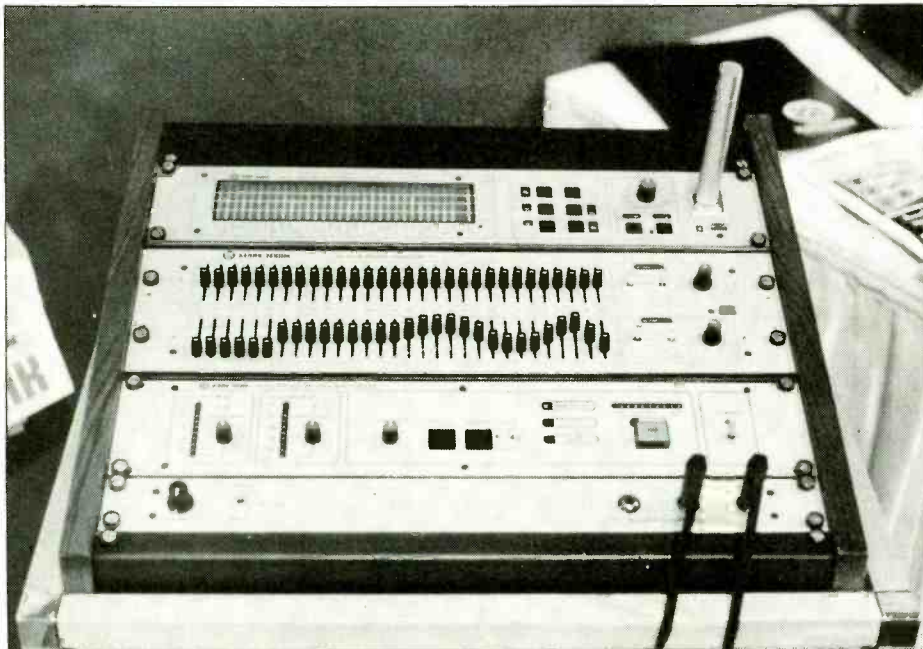
*Series 1S* were all on show and creating quite a lot of interest. Other manufacturers included **Neve**, **MCI** with a new, small, general purpose mixer which can be ganged for bigger operations, **Howe**, **ADM**, **Microtrak**, **McCurdy**, **Harrison**, **Logitek**, **Audio Developments** with **ENG** mixers, **Shure**, **Pacific Recorders** and **Trident** with their *Series 80* console suitable for commercial production.

### Audio processing

**Audio & Design Recording** are veteran NAB exhibitors and were showing, as well as the *Transdynamic*, *Scamp*, *Vocal Stressor* and *Compass* limiters their new *Superdynamic* limiter with precision calibrated controls and operation. For demonstrations and A/B proofing of their *Transdynamic* package they were transmitting (dummy load!) a local syndicator's programme through **Rood** generator and **Continental** transmitter to be picked-up by an AM car radio. **Klark Teknik**, conversely a first timer at NAB, were creating a lot of interest with their *DN772* stereo profanity delay system (>7s delay at 18kHz bandwidth). Also on show were the usual array of graphic equalisers including the new *DN30/30* equaliser with identical frequency centres to the *DN60* realtime analyser.

Most impressive of the home grown audio processing companies was the **MicMix Dynafex** single-ended noise reduction system. Given the constraints of listening on headphones in an exhibition hall, no noticeable effects could be detected. **MicMix** claim 30dB of noise reduction with the system by use of a dynamically variable lowpass 'sliding' filter controlled by the input signal. **Orban** were showing their *AM/FM/TV Optimod* packages, stereo synthesiser, EQs, reverb and de-esser and featuring the new *424A* compressor/limiter/gate system. **Inovonics/Marcom** had a new version of their multiband audio processor, *MAP II*, which was being offered together with a **Rood** stereo generator and **NECFM Exciter** as a 'Synergistic FM Transmitter Up-date'.

Also in the field of audio processing were **Straight Wire Audio**, offering various excellent specification amps/phono preamps, both built **Klark-Teknik ancillary units**



Clyde Electronics Alpha Series mixer

latching solenoid for better controlled pressure roller tension, plus splice locator has greater stability and is positioned at the top now for easier maintenance. Also new erase coil, improved

and kit form, matrix encoder/decoder unit and stereo line amplifier. Also being promoted heavily on the SWA stand was Telefunken's *High-Com* noise reduction system for telephone lines, radio links, etc.

### Cart machines/carts

Major focal point was the 3M takeover of ITC and products of note were the **ITC 99B** cart machine and new **3M Scotchcart**. Demonstration of the **ITC 99B** and *Scotchcart* was made by running identical material on this combination in sync with a **Studer B67**. Again, given the constraints of exhibition demos, the difference was barely discernible. The *Scotchcart* will be available in Europe this autumn and the main features are: no pressure pads, no rotating hub, a life extension system to 'take-up' slack tape, hum shield and a tape derived from *Scotch 226*.

Modifications to the ITC 99 include non-ball



Ramko Phasemaster RPS-1 cart machine

azimuth control adjusted for average phase disregarding instantaneous jitter, simultaneous detect of 1kHz/150Hz/8kHz cue tones and a redesigned input circuit 5532/5534).

**Ramko** were showing their new, improved *Phasemaster* with proprietary circuits that copy/compare/adjust tracks for phase shift elimination and **John A Steven** had their new *APL* cart machine on the Audio & Design booth.

### Miscellaneous

**CBS Byline Magazine** was a new service launched to produce short features on such subjects as medicine, science, business and religion packaged with log and available on a subscription basis to use as regular features in programming. **Nexis** was also represented showing their computerised access to the full text of newspapers, magazines, wire services, etc. Once again available on a subscription basis, but very useful in the news room, when a major story is breaking, for ascertaining relevant background related information.

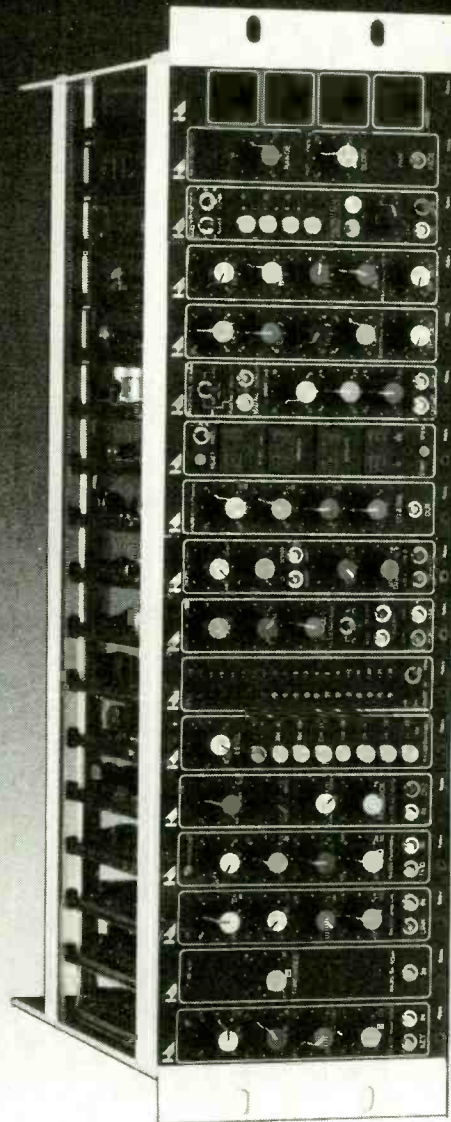
Finally, a very useful product being effectively demonstrated was **Alpha Audio Sonex** acoustic wedge foam. The range consists of two products, 4ft x 4ft foam sheets of 2, 3 and 4in thickness, die cut from anechoic foam available in blue, silver, orange, brown, green and natural grey (but for large quantities, any colour) and 14in x 14in *Audiotiles*. These latter tiles are only available in 2in thickness and more for hi-fi use. Both items are fire retardant and will not sustain a flame. ■



# Rebis

# RA200 Series

## The N<sup>o</sup>1 Gate



## The N<sup>o</sup>1 System

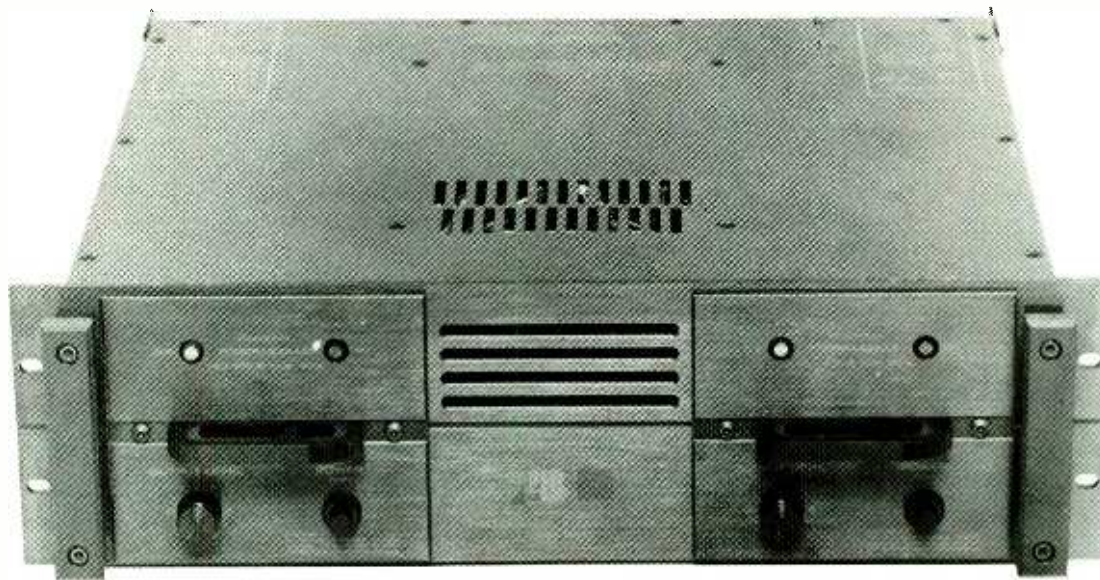
Get the full facts on the most creative modular system in the world.

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Tel: 0384 71865. Telex: 335494.

**Australia;** Audio Mix Systems, Sydney 371-9009. **Belgium;** S.E.D., Bruxelles 522-7064. **Canada;** Heint Electronics Inc., Ontario 495-0688. **Denmark;** Kinovox APS, Lyngø 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 Jürgen 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.

# AB Systems Model 1200



THE AB Systems *Model 1200 Series* power amplifiers are of an unusual design as the two separate channels take the form of plug-in modules with four interchangeable types of module available.

The chassis occupies 3U of a 19in rack and is of solid steel construction with an alloy front panel into which the two modules slide at either side of the chassis, each module being secured with two non-captive Allen screws.

Power is supplied from the central section of the amplifier which houses two separate supplies using separate laminated core transformers with their own rectifiers and smoothing capacitors. An unusual feature is that either power supply can be switched to two rail voltages for the different modules or for limiting the output power to 70% maximum rail voltage (ie half power).

The available modules, which are mechanically identical, consist of 4 to 8Ω and 2 to 4Ω modules of quasi-complementary or fully complementary design, the review amplifier having two of the former 4 to 8Ω modules.

At the front of each module there is a separate power on/off switch with a red LED power indicator and a yellow LED clipping indicator plus a level pot. The modules are based on a finned heatsink which extends the full depth of the amplifier with a fan for each module at the rear of the amplifier. Cold air is drawn through a washable filter at the rear of the amplifier and blown the full length of the individual heatsinks to emerge through slots in the module fronts and at the centre of the front panel. Whilst it is understood that later production has 2-speed fans, the fans in the review sample were exceedingly noisy and both mains transformers suffered from excessive hum.

Reverting to the modules, the 12 output transistors mount on to the heatsink and connect directly to a PCB which extends the length of the

## MANUFACTURER'S SPECIFICATION

**Power output:** *Model 1200A* – 300W into 8Ω, 500W into 4Ω, 1kW bridged into 8Ω. *Model 1200B* – 400W into 4Ω, 600W into 2Ω, 1.2kW bridged into 4Ω. *Model 1210A* – 250W into 8Ω, 350W into 4Ω, 700W bridged into 8Ω. Minimum continuous power per channel, both channels driven, with no more than 0.1% total harmonic distortion or IM distortion from 0.25W to the rated output at any frequency from 20Hz to 20kHz.

**Frequency response:** 20Hz to 20kHz  $\pm 0.25$ dB.

**THD or IM distortion:** typical 0.05% with no more than 0.1% from 0.25W to full rated power, 20Hz to 20kHz.

**Transient IM distortion:** < 0.02%.

**Hum and noise:** > +105dB below rated output.

**Input sensitivity:** 1.0V RMS for rated output.

**Input impedance:** 25kΩ unbalanced or optional 15kΩ differential balanced.

**Crosstalk:** – 80dB.

**Damping factor:** 125:1 at 50Hz.

**Power supply:** transformers – two independent 1.2kW square stack. Capacitors – four (40,000μF).

Primary fuses – two 10A each. DC rectifiers – two 35A (300A surge). AC control – two 15A 600V triacs.

**Turn-on delay:** 5s output delay relays (optional).

**Power:** 120/240V AC, 50/60Hz, 1.5kW max.

**Connectors:** XLR and ¼in jacks; dual 5-way binding posts; 16 (or optional 14) gauge international AC cord on 1200A and 1200B.

**Thermal protection:** thermal sensor activates full module shutdown at 85°C.

**Direct current protection:** direct current sensor activates full module shutdown if direct current exists.

**Heatsink and cooling:** high efficiency, forced-air cooling utilising massive heatsink extrusions.

**Semiconductors:** 15 transistors, 16 diodes, fully discrete front-end with 12 150W power transistors per channel module on 1200B and eight on 1210A.

**Controls and indicators:** gain control; clip LED; power-on LED.

**Construction:** 14 gauge cold-rolled steel, compartmentised with 3/16in heavy aluminium front panel.

**Dimensions:** (whd less handles) 1210A – 19 × 5¼ × 11in, 1200B – 19 × 5¼ × 15in.

**Shipping weight:** (inc modules) 1210A – 48lb, 1200B – 72lb.

**Manufacturer:** AB Systems Design Inc, PO Box 754, Folsom, Cal 95630, USA.

**UK:** Autograph Sales Ltd, Stable 11, British Rail Camden Depot, Chalk Farm Road, London NW1 8AH.

module and houses all the amplifier channel components.

Tidy wiring connects the amplifier channel to a gold plated module connector beneath the printed circuit which did not have any component identifications. Furthermore no circuits were provided in the owner's manual which gave little information about the amplifier design.

At the rear panel the signal inputs took the form of XLR sockets in parallel with tip, ring and sleeve jack connectors providing unbalanced input connections. The outputs being at terminals/banana sockets on the standard ¼in spacing.

Power input is via an IEC connector with separate 10A line fuses for each channel at the centre of the rear panel which had not had its ident-

ification changed from 120V to 240V operation. Blanked off holes allow for an unswitched service outlet and for a remote AC control connector.

As the power to the channels is thyristor switched a low current remote control circuit can provide time delayed switching of banks of amplifiers to avoid severe switch-on surges.

The standard of both electrical and mechanical construction was good with the mechanical features giving good protection to all controls and terminations.

## Power output and distortion

Throughout the measurements a stabilised power supply was used to provide 240V  $\pm 0.5\%$  with the

114 ►

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The unique construction of the Tannoy Dual Concentric places all of the HF horn behind the LF cone, with the flare of the cone continuing the horn flare. Unlike even other co-axial monitors, therefore, the Tannoy Dual Concentric provides smooth transition at crossover, and extremely wide dispersion at all frequencies, enabling you to monitor an accurate stereo image from any point at the desk.

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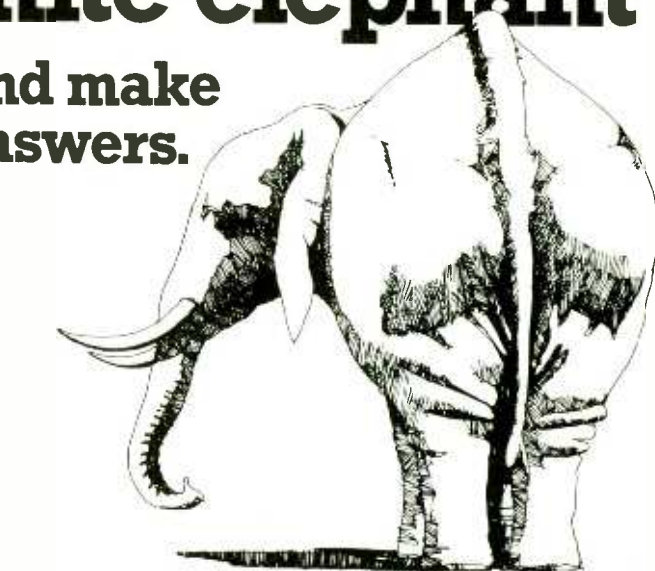
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load resistors consisting of four 300W 1% units with forced air cooling.

Initial attention was directed to the power output at the onset of serious distortion with single or both channels working into the rated loads of 8Ω or 4Ω in addition to the capability of single channels driving half the rated load of 4Ω—a condition that may be met with some nominally 4Ω loudspeakers.

**Table 1** shows the measurement results which gave power outputs well in excess of the rated outputs of 300W into 8Ω or 500W into 4Ω. The table shows minimal interaction between the two channels with a very good drive capability into 2Ω.

As an indication of the music amplification capability, and capability of the power supplies, the output power at the onset of clipping of 10ms bursts of 1kHz sine wave every 100ms was determined (**Table 2**). Both the continuous and the burst performance was well balanced between the two channels with 8Ω or 4Ω loads. Differences occurring when working into 2Ω are presumably due to differences in current limiting.

Investigations into the overload recovery capabilities using asymmetrical tonebursts in the presence of a low level continuous tone showed the amp to have an excellent performance. However, the amp is capable of providing its full power output at low frequencies and this is a potential hazard for loudspeakers.

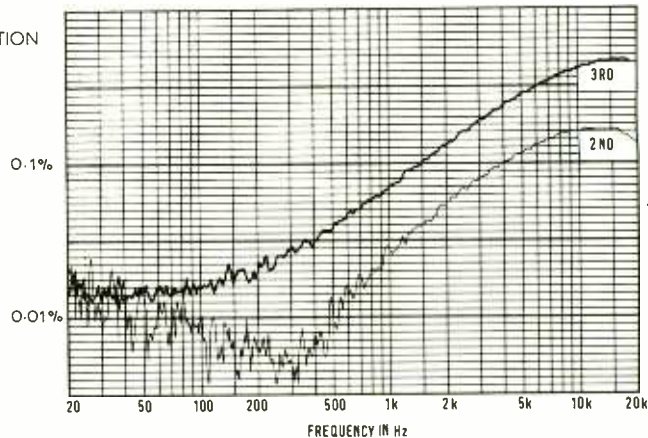
The front panel LED clipping indicators were found to be very fast in action giving a readily visible indication with only one cycle of 10kHz approaching clipping.

The power bandwidth was measured in terms of the 0.1% total harmonic distortion points at half the rated power output into 8Ω and found to extend from below 10Hz to 35/36kHz for the two channels—a good performance. Individual second and third harmonic distortion was measured at various output levels and found to decrease with increased output below the onset of clipping, the situation at 1W output into 8Ω being shown in **Fig 1** demonstrating harmonic levels generally below 0.1% up to 20kHz.

Intermodulation distortion to the CCIF twin tone method using tones separated by 70Hz showed the IM distortion to rise with output level as shown in **Fig 2a** and **Fig 2b** for 1W output and the rated output of 300W into 8Ω the second and third order intermodulation products being shown.

Similar to the individual harmonic distortion,

FIG.1 AB MODEL 1200 HARMONIC DISTORTION



the total harmonic distortion decreased with increased output level with the total harmonic content at 1W into 8Ω being 0.035%/0.025% at 1kHz or 0.24%/0.18% at 10kHz with crossover

products predominating. **Fig 3** shows the crossover products for 1W into 8Ω at 1kHz.

Measurement of the fifth harmonic distortion using an asymmetrical waveform showed the

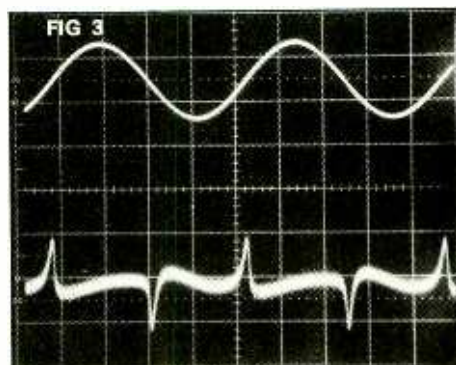


TABLE 1

Load	Output power			
	Single channels		Both channels	
	Left	Right	Left	Right
8 Ω	378W	372W	378W	370W
4 Ω	571W	556W	545W	536W
2 Ω	551W	590W	—	—

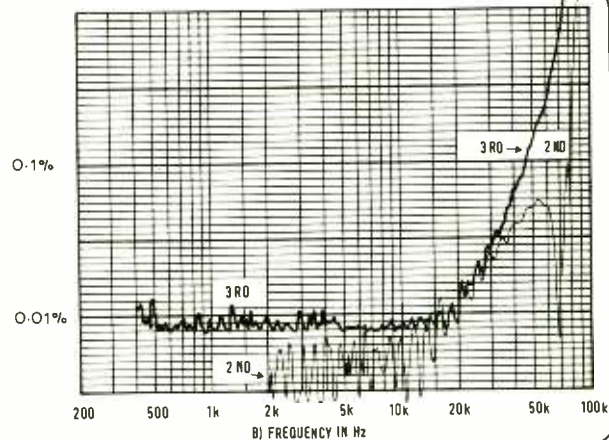
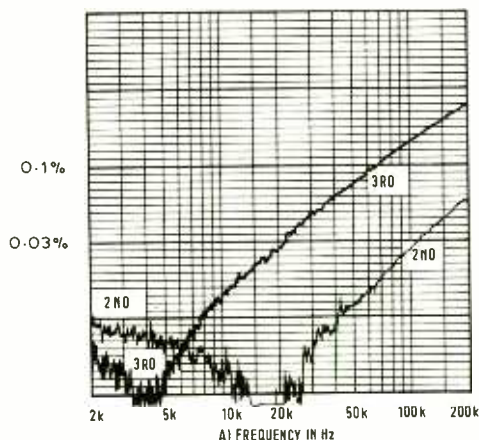
TABLE 2

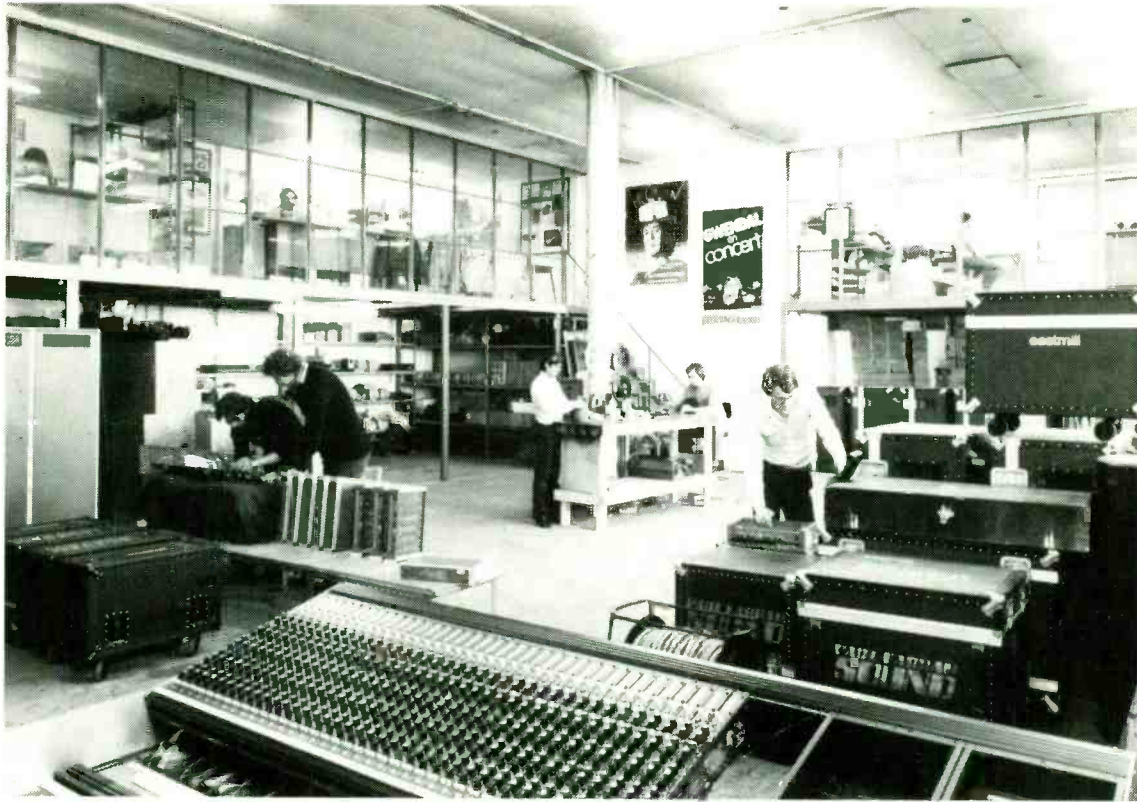
Load	Toneburst drive capability			
	Single channels		Both channels	
	Left	Right	Left	Right
8 Ω	420W	420W	420W	420W
4 Ω	684W	684W	684W	684W
2 Ω	506W	670W	—	—

TABLE 3 Rated output (300W into 8Ω) to noise Measurement method 22Hz to 22kHz RMS unweighted

Gain setting	Left		Right	
	MIN	MID	MAX	MAX
MIN	105.0dB	73.4dB	103.2dB	73.9dB
MID	73.4dB	99.6dB	73.9dB	100.8dB
MAX	99.6dB	114.8dB	100.8dB	117.8dB
A-weighted RMS	MIN	114.8dB	MAX	111.6dB
CCIR weighted RMS	MIN	105.2dB	MAX	112.2dB
CCIR weighted quasi-peak ref 1kHz	MIN	104.2dB	MAX	108.2dB
	MIN	102.2dB	MAX	107.2dB
		101.2dB		104.7dB

FIG.2 AB MODEL 1200 IM DISTORTION





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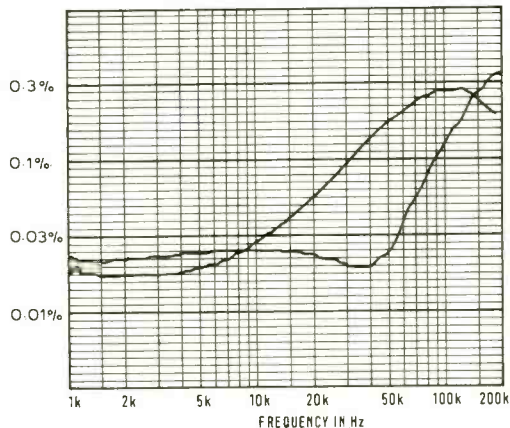
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FIG. 4 AB MODEL 1200  
FIFTH HARMONIC DISTORTION



amplifier to be fairly insensitive to asymmetry below 10kHz but to be asymmetrical at supersonic frequencies as shown in Fig 4 for 1W into 8Ω.

Driving the amplifier with a 1kHz squarewave into a load of 8Ω in parallel with 2μF gave excellent results with minimal overshoot as shown in Fig 5.

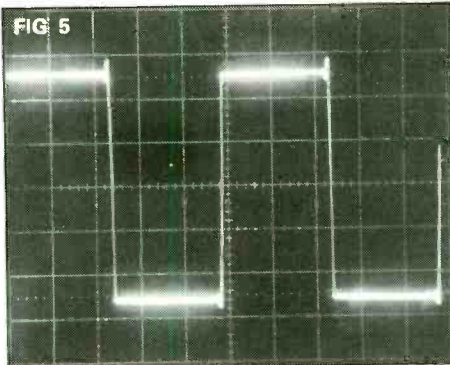
### Frequency response and noise

Measurement of the frequency response at the rated output of 300W into 8Ω gave the upper plot shown in Fig 6, this being within +0, -0.3dB from 30Hz to 20kHz. Above 50kHz the amplifier's power consumption increased sharply with severe triangulation of the output waveform. At 1W output the HF performance was as shown in the lower trace of Fig 6 with the -3dB points at 6.5kHz and 100kHz.

Measurement of noise in the outputs relative to the rated output of 300W into 8Ω showed that noise was highly dependent upon the gain control settings, in addition to differences between the two channels. Table 3 shows noise related to the gain control settings using unweighted, A-weighted and CCIR weighted methods.

With the gain control at its mid position there was a severe increase in both random noise and in hum. Clearly from these results the input circuitry is not very satisfactory with the situation not being improved by the use of 50kΩ input level potenti-

FIG 5



ometers giving a high impedance amplifier input at their mid setting.

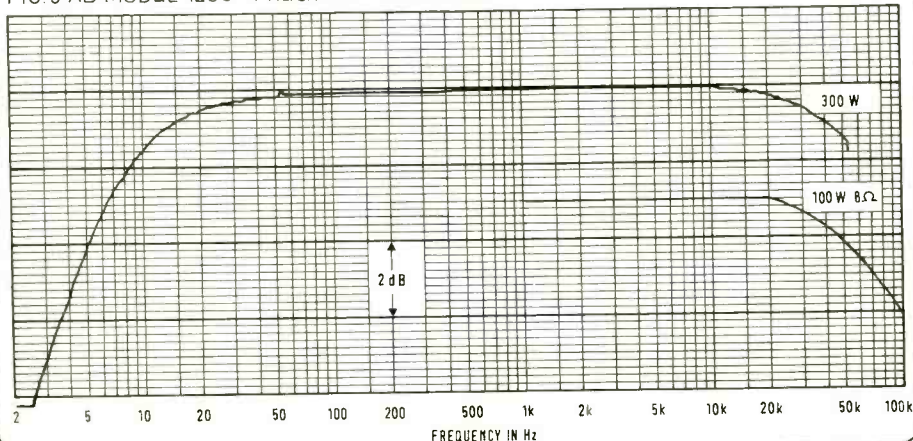
### Inputs and outputs

From the above it is not surprising that the input impedance varied widely, with the gain setting being 45kΩ in parallel with 225pF at minimum gain and falling to 15kΩ in parallel with 620pF at maximum gain.

The maximum input sensitivity for the rated output of 300W into 8Ω was 1.190V for one channel and 1.178V for the other, an imbalance of approximately 0.09dB. At the outputs the damp-

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FIG. 6 AB MODEL 1200 - FREQUENCY RESPONSE



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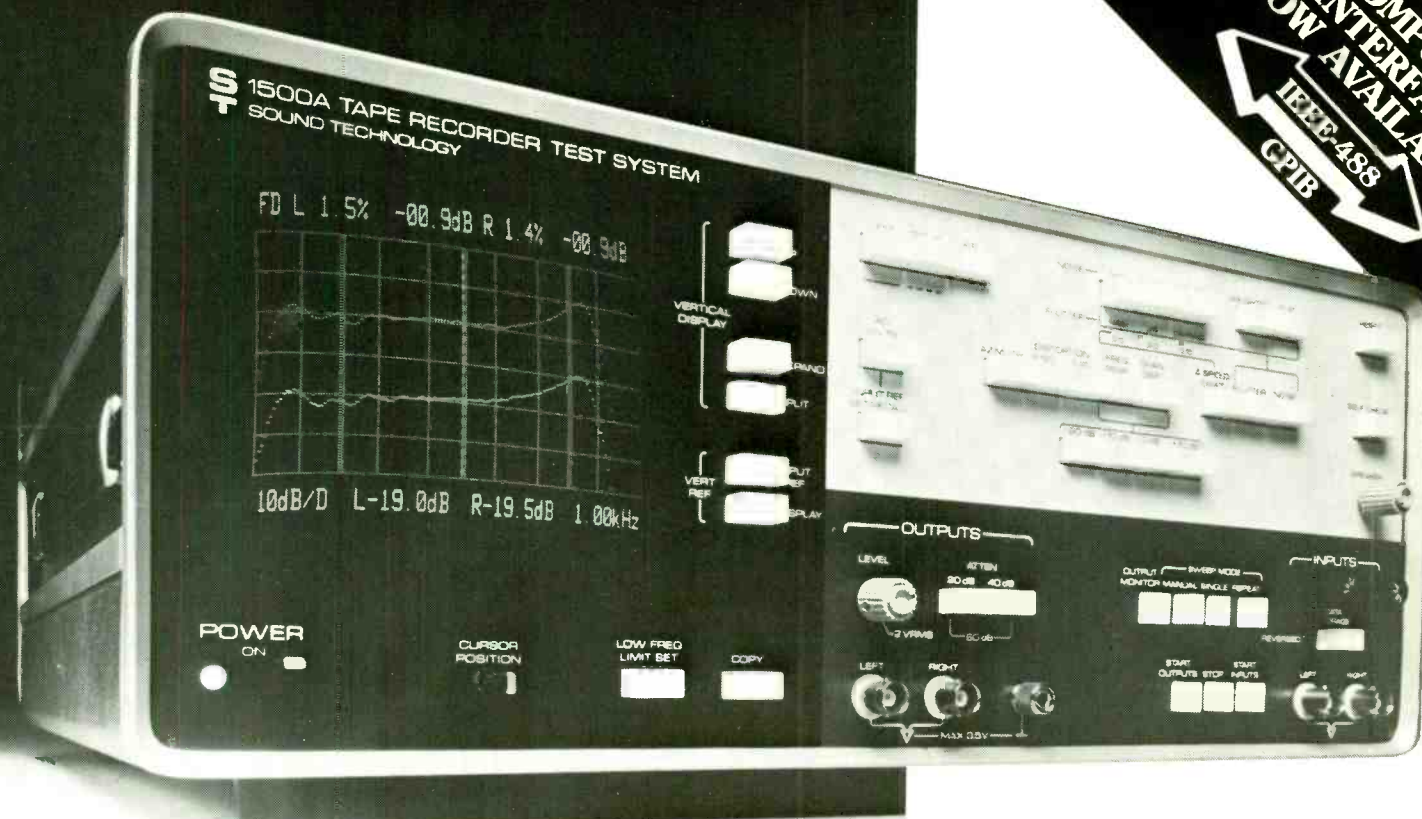
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- One-third octave spectral analysis

- Evaluation of audio quality for VTR's
- Acoustical room analysis including microphone and loudspeaker measurements
- Quality control for high speed tape duplication systems
- Semi-automated production testing
- Research and development for the audio tape manufacturer
- Quality assurance for the audio distribution network
- Exclusive asynchronous inputs and outputs for remote location testing (satellite, transmitter, studios, etc.)

Here's the kind of data you can get:

- Frequency Response
- Azimuth at 4 discrete frequencies
- 2nd and 3rd Harmonic Distortion Vs. Level
- Wow & Flutter; noise; weighted or flat
- Channel Separation 20Hz - 20k
- Delta Speed & Drift

Because of the modular plug-in design, the 1500A is designed to grow with you. Many accessories are now available which include a 1/3 octave spectrum analyzer card (noise: 20Hz-20kHz, Wow & Flutter, .5Hz-200Hz) that easily plugs into the mainframe; a hard copy printer; a comprehensive test record that lets you test cartridges, tonearms and turntables; a balancing system that will allow you to interface balanced I/O test applications; and a heavy-duty transport case. There's even a kit for rack mounting.

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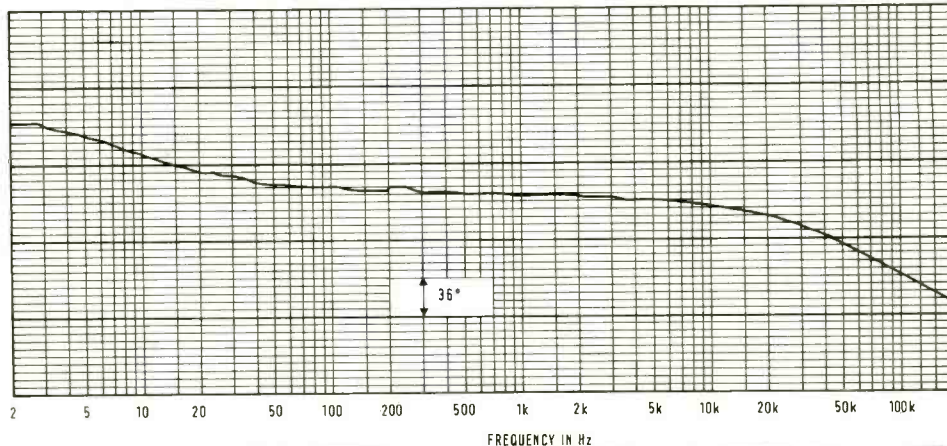
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FIG.7 AB MODEL 1200  
OVERALL PHASE SHIFT



ing factor at 50Hz was found to be adequately high at 207 related to  $8\Omega$  with DC offsets at the outputs of  $-40mV$  and  $+29mV$ , which appeared to be stable.

#### Other matters

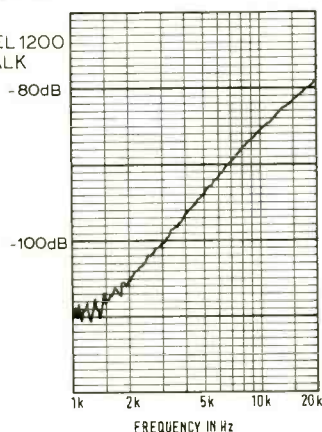
Measurement of the overall phase shift showed this to be minimal within the audio band as shown in Fig 7 which shows satisfactory phase shift from 2Hz to 200k Hz. As might be expected from the use of completely separate twin power supplies and separate amplifier modules the crosstalk is extremely low as shown in Fig 8. The application of fast squarewaves showed the rise and fall times to be identical at  $3\mu s$  with a slew rate of  $25V/\mu s$ .

#### Summary

This AB Systems power amp had a good standard of construction and finish with its design making it particularly suitable where rack mounted amplifier banks are required. The cooling arrangements and the modular approach make it attractive for such applications as PA and theatre use. However, both the fans and the mains transformers were excessively noisy.

Turning to the performance, noise was a let down, but this problem should be simple to rectify.

FIG 8  
AB MODEL 1200  
CROSSTALK



The amplifier will then offer a good but not outstanding performance. However, it would appear that the amplifier is of rugged design and capable of taking severe punishment.

Only under the most severe conditions did thermal overload occur, but then the thermostats tripped the fans and recovery took a long time.

**Hugh Ford**

#### Editor's comment:

The Model 1200 provided for review was not supplied by the new UK agents and was not a current production model, which differs in a number of respects from the unit reviewed here. The latest version includes the provision of 2-speed fans,

improved circuitry, and 240V AC mains switching. Future models will incorporate a switch to isolate signal ground from chassis ground. We hope to be able to examine the latest export version of the Model 1200 in a future issue.

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Frequency bands	31 x one third octave & wide band
Display range	up to 30 dB
Resolution	To 1 dB
Display format	32 x 10 LED matrix bargraph
Noise generator	1 V r.m.s. into 600Ω

The CI III is a portable one-third octave real time audio analyser. With its inbuilt pink noise source it forms a complete transmission path response analyser. Applications include analysis of filters, equalising networks, recording media, studio acoustic environments and production line testing of audio equipment elements. General acoustic testing of sound reinforcement and public address systems can also be undertaken. Being powered by rechargeable batteries, the CI III is fully portable.

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## Electrocompaniet

### Ampliwire 1M



#### MANUFACTURER'S SPECIFICATION

**Output impedance:** <math>500\text{m}\Omega</math> measured at 1kHz.  
**Nominal input impedance:** 20k $\Omega$ .  
**Recommended source impedance:** <math>600\Omega</math>; coupling capacitor of source should have a value >100 $\mu\text{F}$ .  
**Input sensitivity:** 0.5V for rated output.  
**Maximum peak current:** 40A.  
**Recovery time:** <math>0.1\mu\text{s}</math> (amplifier driven into 1dB (12%) overload).  
**Slew rate:** 250V/ $\mu\text{s}$  (measured without load to avoid effect of output filter with a 1MHz signal at full output swing).  
**Frequency response:** 1W into 8 $\Omega$ , DC - 20kHz, -0.05dB; 1W into 8 $\Omega$ , -3dB point above 1MHz.  
**Rise time:** <math>350\text{ns}</math>.  
**Phase shift:** DC - 20kHz, <math>2</math> degrees.  
**Power bandwidth:** (measured at half power) >100kHz, (defined as 3dB below the level where the THD is 1.0% at the frequency where THD is 1.0%).  
**Total harmonic distortion:** <math>0.002\%</math>, 1W into 8 $\Omega</math> measured at 1kHz and 10kHz; <math>0.01\%</math> THD$

measured at half power 1kHz and 10kHz into 8 $\Omega$ .  
**IM distortion:** 1W into 8 $\Omega$  250Hz/8kHz mixed 4:1 <math>0.005\%</math>. Measured at half power into 8 $\Omega</math> <math>0.03\%</math>.  
**Transient IM distortion:** <math>0.01\%</math> measured with 3.18kHz squarewave and 15kHz sinewave mixed 4:1 at half power into 8 $\Omega</math>; <math>0.01\%</math> measured at 1W into 8 $\Omega</math> (measuring equipment residual).  
**Difference frequency:** (19/20kHz sinewave mixed 1:1) <math>0.01\%</math> measured at half power into 8 $\Omega</math>; <math>0.01\%</math> at 1W into 8 $\Omega</math> (measuring equipment residual).  
**Noise:** (measured with both inputs shorted) 400Hz to 30kHz <math>100\text{dB}</math>; 10Hz to 30kHz <math>97\text{dB}</math> (with both inputs open, the S/N ratio improves with 6dB).  
**Rated output power:** at 1kHz to a level where total harmonic distortion equals 0.2%, 200W into 8 $\Omega</math> (300W into 4 $\Omega$ ).  
**Manufacturer:** Electrocompaniet A/S, PO Box 92 N-1473 Skaarer, Norway.  
**UK:** Gotham Audio Ltd, 12 Glendoline Avenue, London E13 0RF.$$$$$$

**T**HE *Ampliwire 1M* power amplifier is a professional monophonic version of the Electrocompaniet domestic amplifiers using the same chassis and power supplies. The latter consist of a large 560VA toroidal transformer providing two  $\pm 36\text{V}$  stabilised supplies for the low power sections and two  $\pm 30\text{V}$  supplies for the driver stages.

The amplifier in fact consists of two separate power amps operating in the bridge mode which gives a potential of almost 60V peak to peak output. Electrically the design of the amps are unusual as there are several feedback loops within them and no overall feedback from the output to the input. The latter stages are balanced, with the

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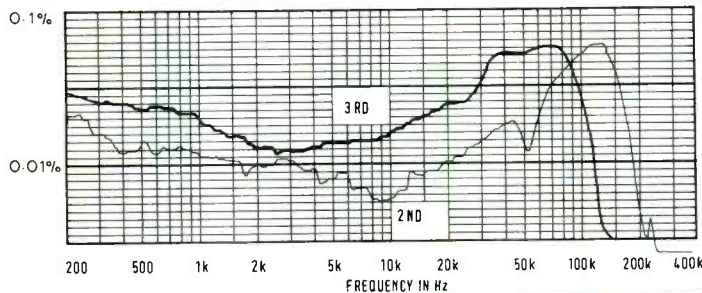
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**FIG.1**  
AMPLIWIRE 1M  
HARMONIC  
DISTORTION AT  
HALF POWER



amps being effectively balanced throughout.

Physically the unit is a standard 19in rack mounting configuration 3U high with a thick alloy front panel and extruded sides, the top and bottom being perforated covers which slide into the side extrusions.

The only control is the front panel press type power on/off switch with an inbuilt LED power indicator.

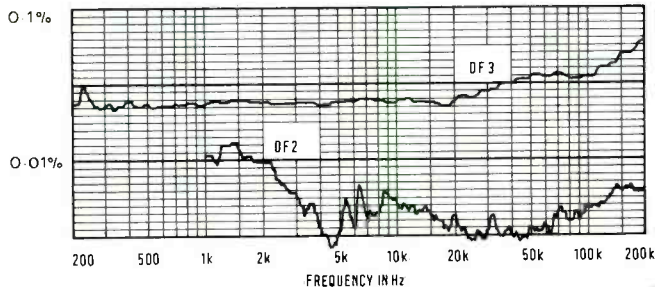
To the rear the output is at banana sockets/terminals on the standard 1/4in spacing and irritatingly these did not have the terminal holes aligned. In the review sample the input was unbalanced at a phono

**TABLE 1**

Measurement method	Noise referred to clipping
Band limited 22Hz to 22kHz RMS	-103.2dB
A-weighted RMS	-109.8dB
CCIR weighted RMS	-103.7dB
CCIR weighted quasi-peak ref 1kHz	-99.7dB

Each power supply is mounted on a PCB with clear component identifications, each board having two 5-way pin connectors. In the domestic version these allow two amplifier modules per power supply board, but in the professional version only one amplifier module is used with each power supply board.

**FIG.2**  
AMPLIWIRE 1M  
IM DISTORTION  
AT HALF POWER



socket, but alternative input configurations can be electronically balanced at an XLR connector.

The mains power input is via an IEC connector with a nearby power fuse and four further internal fuses protecting the power transformer secondaries - no further protection is provided other than thermal.

Thermostats on both amplifier modules disconnect the mains in the event of excessive temperature.

Within the unit the mains transformer is mounted at the centre front of the unit with separate rectifiers and power supplies for each amplifier module either side.

The amplifier modules comprise a large finned heatsink pointing towards the cooling fans in the sides of the amplifier, the components being mounted on a PCB fixed to the flat side of the heatsinks. All components are clearly identified with good quality components being used. Servicing is simple in view of the use of connectors rather than soldered joints and access to all components is excellent.

Overall the standard of mechanical and electrical construction is good, but the cooling arrangements are such that the amplifiers should not be kept in racks without space between units.

#### Power output and distortion

All tests were undertaken using a 240V  $\pm 0.5\%$  stabilised input with non-inductive 1% load

resistors with special precautions being taken to cope with the bridged output configuration as both output terminals are at a potential relative to the input ground connection.

As the amplifier is intended for driving 8 $\Omega$  loads the power capability was measured into 8 $\Omega$  and 4 $\Omega$ , the latter because some nominally 8 $\Omega$  loudspeakers have impedance characteristics which fall close to 4 $\Omega$  at some frequencies.

Initial checking of the drive capability into 8 $\Omega$  showed the onset of clipping to occur at 155W with a 1kHz sine wave, this figure being rechecked with a second module which gave the same result considerably below the manufacturer's specified 200W. Attempts to check the drive capability into 4 $\Omega$  at 1kHz resulted in a pop and a small cloud of smoke which eliminated a fuse and output transistors.

The UK agent having promptly replaced the defunct module the burst power capability was investigated using 10ms bursts of sine wave every 100ms. This resulted in the amplifier delivering 169W into 8 $\Omega$  or 276W into 4 $\Omega$ , again below specification.

Measurement of the power bandwidth in terms of the 0.1% total harmonic distortion points at half power showed this to be excellent at above 100kHz.

Similarly the total harmonic distortion was extremely low, being less than 0.009% at 1W into 8 $\Omega$  at 1kHz or 10kHz with the residual being largely noise. At half power into 8 $\Omega$  the total harmonic remained good at 0.01% at 1kHz and 10kHz with the residual being mainly third harmonic. At no time was there any sign of crossover distortion.

Fig 1 shows a plot of the individual second and third harmonic components showing that they remained at a very low level even at ultrasonic frequencies.

Measurement of the intermodulation distortion to the CCIF twin tone method with tones separated by 70Hz, gave Fig 2 when working at half power. This is again an extremely good performance giving little increase in distortion products right to the upper limit of 200kHz - a sign that no transient distortion problems exist.

Measuring the fifth harmonic distortion, produced from an asymmetrical waveform in its normal and inverted forms, showed almost perfect symmetry as can be seen in Fig 3.

Driving the amplifier with a 1kHz square wave into a load of 8 $\Omega$  in parallel with 2 $\mu$ F gave mild overshoot as shown in Fig 4 without any ringing.

#### Frequency response and noise

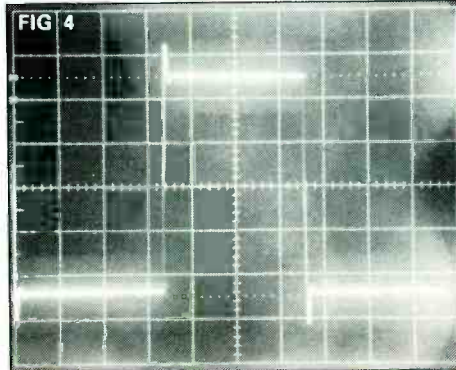
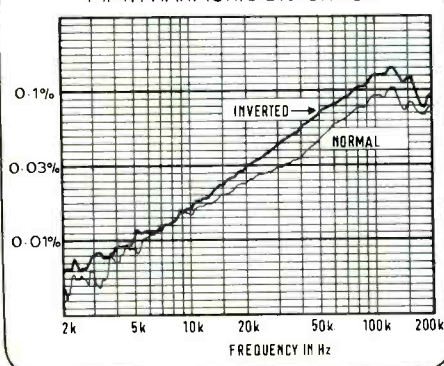
The overall frequency response from the input to the output loaded into 8 $\Omega$  at 1W is shown in Fig 5 where the low frequency roll off is controlled by the amplifier's input capacitors. Little change occurred in the HF response until just below clipping with no sign of triangulation even at high powers at 200kHz.

Noise referred to the measured output clipping level at 1kHz was measured band limited, A-weighted and CCIR weighted with the amplifier's input short circuited (Table 1). In all cases the noise measured was found to be completely free from power line hum or its harmonics.

#### Inputs and outputs

The input was found to have a satisfactorily high impedance of 10.5k $\Omega$  in parallel with only 75pF

**FIG.3** AMPLIWIRE 1M  
FIFTH HARMONIC DISTORTION



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# reviews

and required an input level of 1.1V for the onset of output clipping into  $8\Omega$ .

At the output the impedance was  $0.39\Omega$  at 50Hz and 1kHz giving a damping factor into  $8\Omega$  of 20.6 which is generally satisfactory.

## Other matters

The very flat phase response from the input to the output is shown in Fig 6 with only the input capacitors being responsible for the phase difference at low frequencies.

DC offsets at the output were around 40mV which is quite reasonable and appeared to remain relatively constant.

Measurement of the rise and fall times showed a symmetrical performance with the amplifier giving a 10% to 90% rise time of 1.5 $\mu$ s into  $8\Omega$ . However, attempts to measure the slew rate with a 100kHz squarewave into an open circuit load again provoked disaster.

## Summary

This 'professionalised' version of the domestic *Ampliwire* amp certainly offers an excellent distortion performance and other good features. However, the review samples took grave exception to heavy duty use and I suspect that this may be connected with the high operating temperature of the output transistors—an idling temperature 44°C above ambient is rather high. If the manufacturer can improve reliability in this respect it will be a very good amplifier but as it now stands I cannot recommend it for professional use.

Hugh Ford

## Manufacturer's comment

Because of the tight deadline we were only able to supply a preproduction sample of our professional model. Although production of this model will commence in August, we supplied the review unit for appraisal as its sonic performance will be unchanged. However, the production model incorporates as standard a protection circuit which was not fitted to the reviewed model. This protection circuit should solve the objections raised, as specifically a shorting of the output can no longer damage the amplifier.

The production model also has a number of changes to its specifications:

**Output impedance:**  $<80m\Omega$ ,

**Input impedance:**  $10k\Omega$ .

**Recovery time:** 4 $\mu$ s.

**Phase shift:** 50Hz to 20kHz,  $<5^\circ$ .

**Power bandwidth:**  $>100kHz$  for 0.2% THD.

**Total harmonic distortion:**  $<0.005\%$ , 1W into  $4\Omega$  at 1kHz and 10kHz;  $<0.02\%$ , 25W into  $4\Omega$ .

**Rated output power:** at 1kHz to a level where THD equals 0.2%, 150W into  $8\Omega$ , 210W into  $4\Omega$ .

Regarding specific points raised in the review, we would like to make the following comments. Firstly, with regard to the damping factor, theoretical as well as real output impedance is  $<80m\Omega$  which gives a damping factor of 100. The discrepancy between the review figure and  $80m\Omega$  must be due to the measurement equipment used or to some other unknown factor. Secondly, with regard to the drive capability into  $4\Omega$ , our standard quality control test procedure is at full power into  $4\Omega$ . This is a guaranteed specification and we have

never encountered any problem before in this respect. Finally, with regard to the slew rate, measuring the slew rate with a 100kHz squarewave is in our opinion not a valid test signal. Our amplifiers will always be damaged under such conditions unless of course circuit protection is employed. A 10kHz squarewave would give the required results.

The response from studios which have evaluated our amplifiers has been extremely positive. Engineers and producers claim to be delighted with their accurate and detailed reproduction. This being reflected in the low-static and dynamic-distortion levels described.

## Hugh Ford's reply

While the incorporation of protection circuitry will undoubtedly solve the problem of output shorting, its inclusion may affect the sound quality. Whether this will be to its detriment, however, naturally will depend on the exact nature of its implementation. A particular problem which the amplifier exhibited was a tendency to 'blow up' when HF content was present with an open circuit load. This could be a serious problem if a tape is rewound while the amplifier is still connected and has no load. Under loaded conditions the amplifier also failed and it is not clear whether the new protection circuitry will cure this.

With regard to the drive capability into  $4\Omega$ , it is not normal to test at full power for worst case heat dissipation, rather the FTC requirement for preconditioning at a lower power should be followed.

FIG.5 AMPLIWIRE 1M  
FREQUENCY RESPONSE

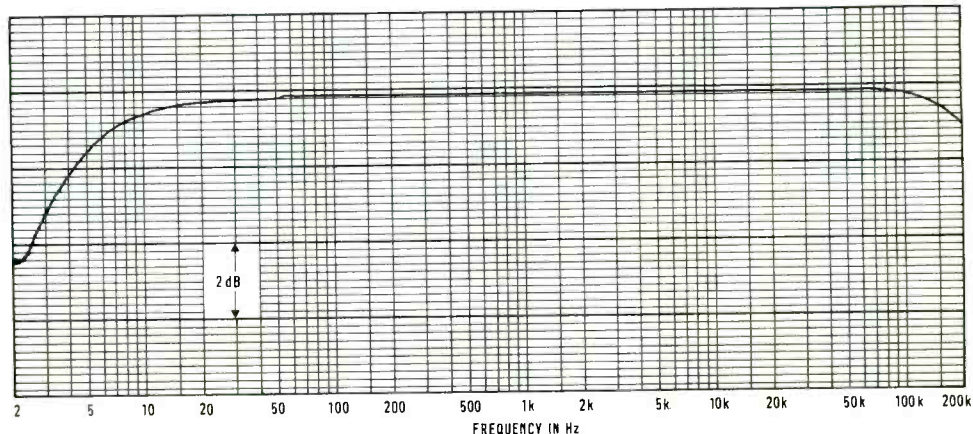
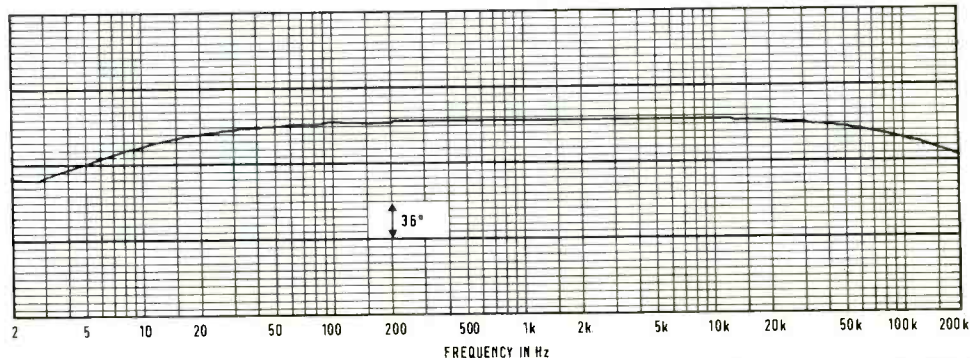


FIG.6 AMPLIWIRE 1M  
PHASE RESPONSE



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## Nakamichi T-100 audio analyser

**T**HE Nakamichi T-100 audio analyser is a small test unit primarily designed for the maintenance of hi-fi equipment, especially tape recorders.

Supplied complete with a carrying case and shoulder strap the unit is portable but is mains powered for all the normal power line voltages.

The functions provided are voltage measurement, weighted noise measurement, distortion measurement at a single frequency, speed measurement and either weighted or unweighted wow and flutter measurement.

To the left of the unit six phono sockets connect the unit to the device under test and to an oscilloscope for monitoring, the connections being left and right oscillator outputs, inputs and monitor outputs. To the right hand side a standard IEC connector provides the mains power with a nearby slide switch applying the power with a properly identified power fuse at the rear.

In operation the unit can be used flat on the bench or tilted with inbuilt feet, also as the rear is fitted with small protective feet the unit can be used face up.

The left half of the front panel consists of two horizontal plasma bar displays which are calibrated from +10dB to -20dB in linear 1dB increments. In addition the top display is calibrated  $\pm 3\%$  in 0.1% increments for speed measurement and the bottom display from 0.1% to 3% on a logarithmic scale for wow and flutter and for total harmonic distortion measurement. An overlay provided with the instrument gives an alternative voltage scale from 1V to 30V and wattage scaling from 0.1W to 100W into 8 $\Omega$ , these scales being logarithmic.

Proceeding to the right a clearly identified 9-position rotary switch selects the function in use. One position of this switch is for speed calibration in conjunction with a potentiometer below the switch with the next switch positions displaying unweighted speed or IEC weighted peak wow and flutter, the latter having two ranges with 3% or 0.3% full scale and a minimum indication of 0.01%.

The following two positions allow the automatic measurement of total harmonic distortion for the left or right channel inputs with the upper display showing the input level and the lower display the total harmonic distortion. A 2-position lever switch selects a 3% or 0.3% full scale distortion range with the minimum indication being 0.01%.

The next two switch positions display simultaneously the input levels at the left and right inputs with one switch position offering 20dB more gain and operating in conjunction with the 3-position lever type gain switch. The two extreme gain switch settings provide a sensitivity between 10V and 1mV for 0dB indication allowing levels between 30V and 100 $\mu$ V to be measured



### MANUFACTURER'S SPECIFICATION

#### Oscillator

**Spot frequencies:** 20, 40, 63, 100, 160, 250, 400, 630, 1k, 1.5k, 2k, 3k, 4k, 5k, 6.3k, 8k, 10k, 12k, 15k, 18k, 20kHz plus pink noise ( $\pm 2$ dB 20Hz to 20kHz).  
**Output voltage:** 1.2V max (variable).  
**Level deviation:**  $\pm 0.2$ dB (20Hz to 20kHz).  
**Output distortion:** less than 0.3% (20Hz to 20kHz). Less than 0.01% at 400Hz to THD measurement.  
**Frequency accuracy:**  $\pm 2\%$ .  
**Output impedance:** 600 $\Omega$ .

#### Level measurement

**Range:** -80dB to +30dB (ref 0dB = 1V).  
**Frequency response:** 20Hz to 20kHz  $\pm 0.3$ dB.  
**Ballistics:** average (RMS) 0.3s (VU). Peak 10ms rise time, 2s fall time (DIN peak).

#### Wow and flutter measurement

**Centre frequency:** 3kHz.  
**Input level range:** 3mV to 30V.  
**Indication:** DIN peak (weighted or unweighted, selectable).  
**Frequency range:** 0.2Hz to 200Hz.  
**Calibration (test signal):** 3kHz  $\pm 4.5$ Hz ( $\pm 0.15\%$ ).  
**Tape speed range:**  $\pm 3\%$ .

#### Distortion meter

**Measurement frequency:** 400Hz.  
**Input voltage range:** 100mV to 30V.  
**Distortion range:** 0.01% to 0.3%, 0.1% to 3%.

**Automatic input control range:** 20dB (-10dB to +10dB).

**Frequency characteristics:** 800Hz to 10kHz ( $\pm 0.3$ dB).

**Residual noise:** 90dB (input range 0dB), 85dB (input range 20dB).

**Fundamental frequency rejection:** 400Hz  $\pm 0.3\%$ , -100dB (0.001%); 400Hz  $\pm 0.5\%$ , -70dB (0.03%).

#### Noise level measurement

**Frequency characteristics:** IHF A curve.

**Range:** -100dB to -10dB (0dB = 1V).

**Indication:** average value.

#### General

**Input impedance:** 50k $\Omega$ .

**Oscilloscope output:** low impedance.

**Power requirements:** 100, 120, 220 or 240V, AC, 50/60Hz.

**Power consumption:** 15VA.

**Dimensions:** (whd) 13 1/2 x 3 x 9 1/2 in/343 x 75 x 240mm.

**Weight:** 9.5lb/4.3kg.

**Manufacturer:** Nakamichi Research Inc, 1-153 Suzukicho, Kodaira, Tokyo, Japan.

**UK:** Natural Sound Systems, 10 Byron Road, Wealdstone, Harrow, Middlesex.

**USA:** Nakamichi USA Corp, 220 Westbury Avenue, Carle Place, NY 11514.

**Nakamichi USA Corp,** 1101 Colorado Avenue, Santa Monica, Cal 90401.

unweighted.

The penultimate switch position inserts a further 20dB of gain and also inserts the noise weighting network which as standard is the IEC

A-weighting but optionally may be the CCIR weighting with average rectifier and unity gain at 2kHz.



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Finally there is a 'peak' switch position for level measurement with the displays having peak reading ballistics. Also in this position two multiturn gain setting pots are inserted in circuit with the minimum readable signal level being 1mV.

At the far right of the instrument a multiturn pot controls the output levels with a rotary switch selecting the oscillator frequency in 21 steps between 20Hz and 20kHz plus a position for a pink noise output.

### Oscillator performance

The flatness of the oscillator output was found to be within +0, -0.1dB over the full frequency range from 20Hz to 20kHz, however, when switching frequencies there was considerable bounce which could lead to at least 6dB overshoot in amplitude and at low frequencies the amplitude could take up to 2s to stabilise. Whilst for many measurements these matters are of little consequence the amplitude overshoot could be undesirable when testing power amps.

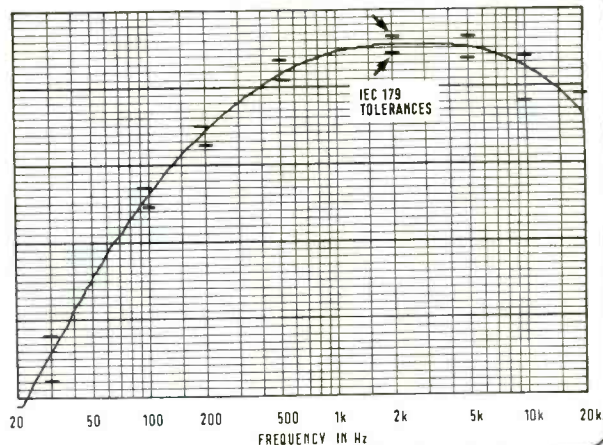
Whilst these are penalties for using R/C oscillators they have the advantage of potentially very low distortion, **Table 1** showing samples of the frequency accuracy and second and third harmonic distortion performance. All these figures are far better than the manufacturer's specification as was the frequency and harmonic distortion in the distortion measurement mode where the actual frequency was 399.92Hz with both the second and third harmonic contents being less than 0.003%.

The constant bandwidth spectrum analysis of the pink noise output shown in **Fig 1** demonstrates that this is substantially better than the manufacturer's specification of  $\pm 2$ dB from 20Hz to 20kHz but that there is a small power line hum content at 50Hz and 150Hz.

The maximum oscillator output level was found to be 1.18V RMS from a source impedance of 600 $\Omega$ , the two outputs being wired in parallel. RMS pink noise level was found to be 1dB above the sinewave level.

The multiturn output level control allowed reasonably accurate setting of output levels down

FIG. 2  
NAKAMICHI T-100  
A-WEIGHTING CURVE



to 20mV when the function switch is in the level mode or -2mV with the function switch in the -20dB position. For some measurements further attenuation would be useful.

In the noise measurement mode the oscillator outputs remain terminated in 600 $\Omega$  and also remain in parallel, it being felt that the latter feature can cause ground loop troubles.

### Amplitude measurement

At 1kHz the accuracy of the unweighted voltages indication was found to be within the readability of the display from 10V down to 1mV with the LF limit being controlled by flicker of the display which became significant below 10Hz. On all ranges the flatness was within 0.1dB up to 40kHz with the -1dB point on all ranges occurring at 3Hz and 68kHz and the -3dB points at below 2Hz and 93.4kHz.

In the normal level measurement mode the rectifiers had an 'average' characteristic as a VU meter, the characteristic in the peak mode being a genuine peak detector.

Likewise, in the normal measurement mode the rise and fall times of the displays was 300ms corresponding to a genuine VU meter; whilst in

TABLE 1

Nominal frequency	Actual frequency	Distortion	
		2nd	3rd
20Hz	20.07Hz	0.08%	0.10%
100Hz	99.24Hz	0.06%	0.035%
400Hz	399.4Hz	0.03%	0.01%
1kHz	992.6Hz	0.016%	0.007%
5kHz	4.967kHz	0.004%	<0.003%
10kHz	9.965kHz	0.009%	0.004%
20kHz	19.77kHz	0.016%	0.009%

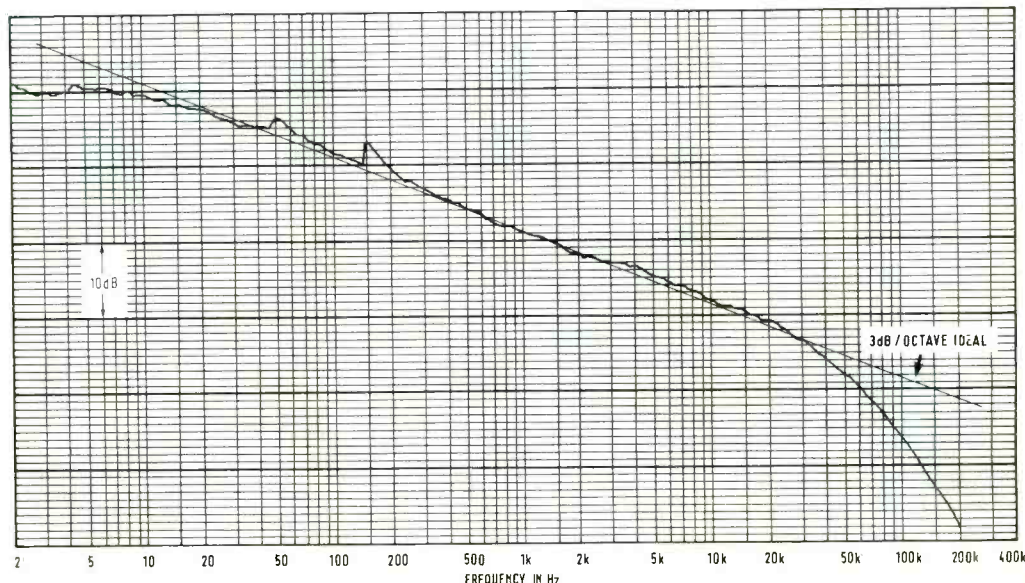
the peak mode the rise time was substantially faster at 10ms with an associated fall time of 1.6s which is slightly faster than the specified 2s.

### Noise measurement

Entry into the noise measurement mode showed that the internal A-weighting network has its unity gain point correctly aligned at 1kHz. **Fig 2** shows the frequency characteristics of the weighting network together with the IEC recommended tolerances which are easily met by the instrument.

130 ►

FIG. 1  
NAKAMICHI T-100  
PINK NOISE SPECTRUM  
ANALYSIS



# The Professional Choice\*



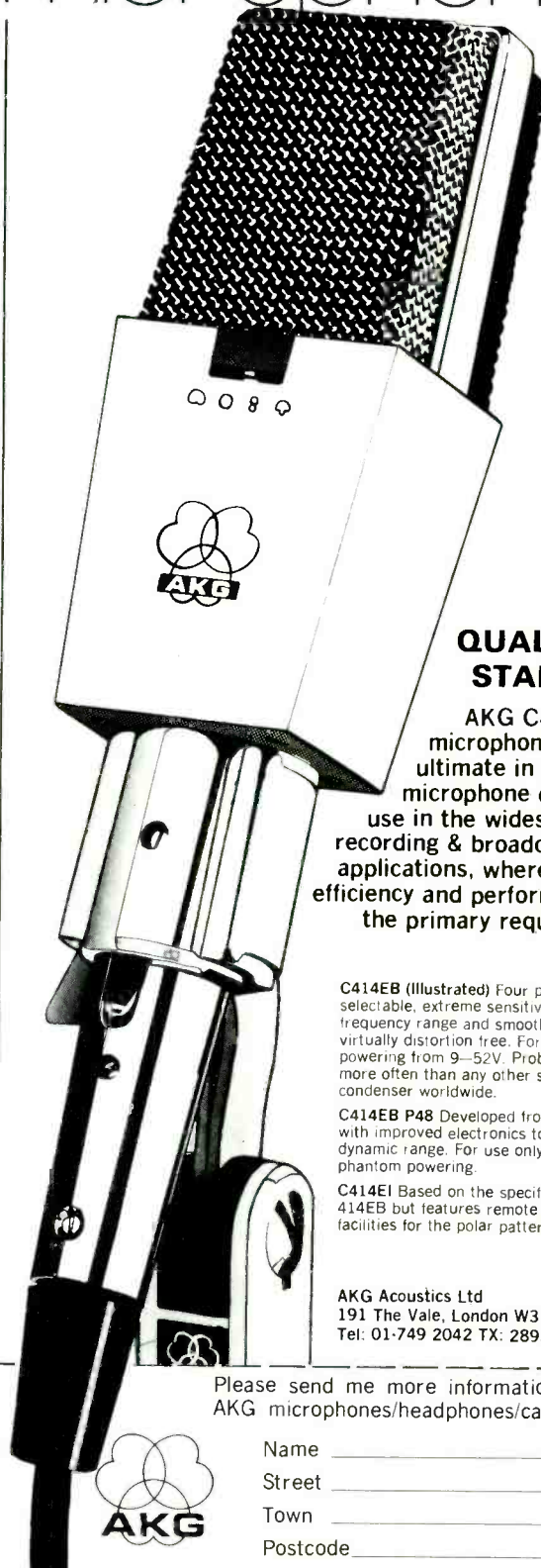
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Insertion of the optional CCIR/ARM noise measurement board showed that as supplied the gain at 2kHz (which should be unity) was 0.6dB too high on both channels.

The instrument's weighting curve in comparison with the CCIR Recommendation 468 tolerances is shown in Fig 3 which demonstrates that all is well in this quarter. Using either the A-weighting or the CCIR/ARM weighting the residual noise allowed accurate measurements down to the lower limit of readability ie 10µV (-100dBV).

### Distortion measurement

It was found that the instrument could accept input frequencies between 370Hz and 450Hz with the distortion residual indication remaining below 0.01%. Similarly this residual indication required a minimum input level of 50mV. In the distortion mode the top display indicates input level and the bottom display the distortion content with the left and right oscilloscope outputs matching the displays so the residual can be displayed on the oscilloscope together with a scaled version of the original.

Input level tracking was found to be excellent with accurate distortion contents being shown at any input level sufficient to activate the input level display — a range of +10dB to -20dB. Applying accurately known amounts of distortion gave results accurate to within the readability of the display, the instrument's sensitivity to harmonics being shown in Fig 4 which shows only a ±0.15dB variation from the second harmonic up to the 25th harmonic at 10kHz. As can be seen the attenuation above 20kHz sensibly attains a rolloff of 6dB/octave.

### Speed, wow and flutter

Measurement of the internal reference frequency which is nominally 3kHz showed it to be stable around 3001.05Hz which in round terms is 0.03% too high. Whilst this is well within the instrument's specification it is thought that improved accuracy is desirable.

Measurement of the speed indicator at five points over its ±3% range showed it to be accurate relative to its zero indication which could be offset by ±1.5% from 3kHz (see Table 2).

FIG 4  
NAKAMICHI T-100  
RESPONSE TO HARMONICS

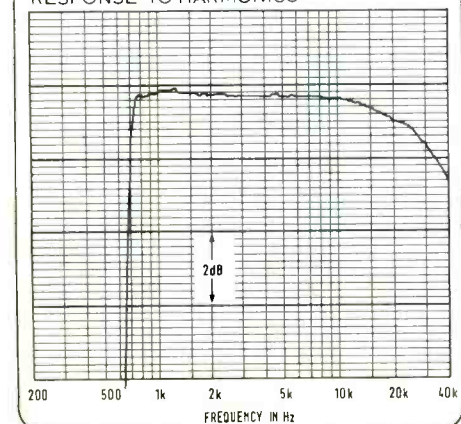


FIG 3  
NAKAMICHI T-100  
CCIR WEIGHTING CURVE

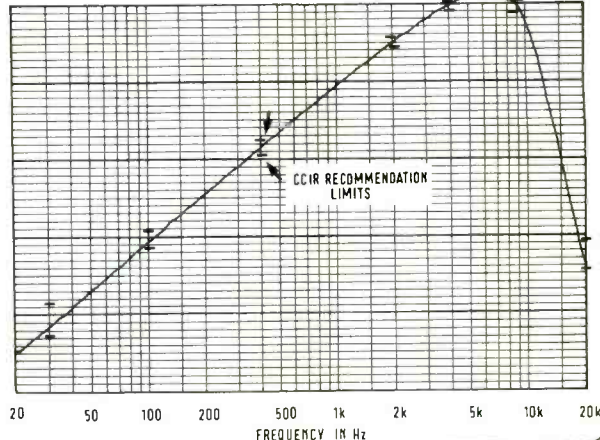


TABLE 2

Indicated error	+3%	+2%	+1%	-1%	-2%	-3%
Actual error	+2.97%	+2.02%	+1.0%	-0.96%	-1.99%	-2.96%

Both the speed indication and the wow and flutter section required a minimum of only 1mV input for proper operation with the residual wow and flutter indication being less than 0.01% weighted or unweighted. The weighted and unweighted wow and flutter frequency characteristics are shown in Fig 5 which shows that the weighting curve is within the IEC standard limits which correspond to DIN and other standards.

Testing with unidirectional pulses of frequency variation to assess the ballistics of the measuring system showed the instrument to be within tolerances as shown in Table 3.

### General

The overall standard of construction was found to be good with access to individual plug-in circuit boards under a cover at the rear of the instrument.

All controls are clearly identified and the unit is very easy to use. However, no servicing information of significance is provided in spite of a good owner's manual which contains details of the common test connections for tape recorder and

TABLE 3

Burst length	% steady state indication	Standard
100ms	100%	100%
60ms	90%	90 ± 6%
30ms	57%	62 ± 6%
10ms	19%	21 ± 3%

other servicing.

### Summary

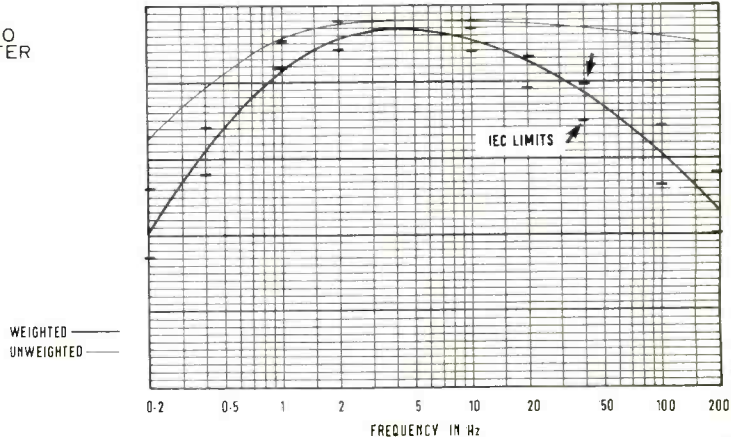
The Nakamichi T-100 is an excellent unit for servicing non-professional tape recorders and other devices which do not require high oscillator output levels. It is also of course good for checking other pieces of audio equipment for frequency response, noise and total harmonic distortion at 400Hz.

In general the accuracy of all measurement facilities was far better than the specification would suggest and the instrument can be easily used by any competent engineer.

Overall a very nice instrument within its limitations.

Hugh Ford

FIG 5  
NAKAMICHI T-100  
WOW AND FLUTTER  
WEIGHTING



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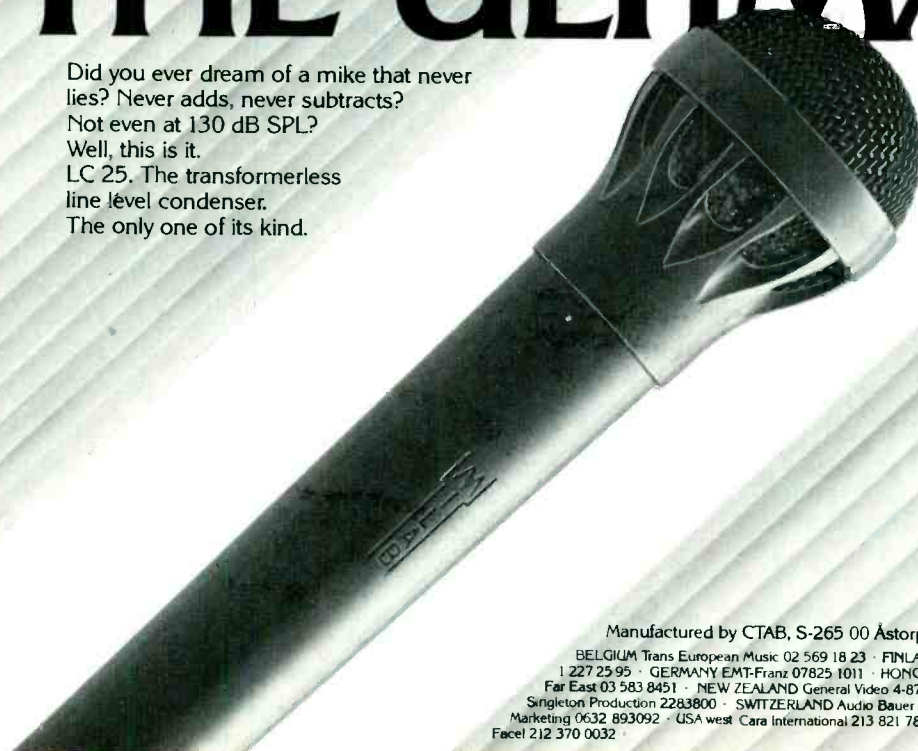


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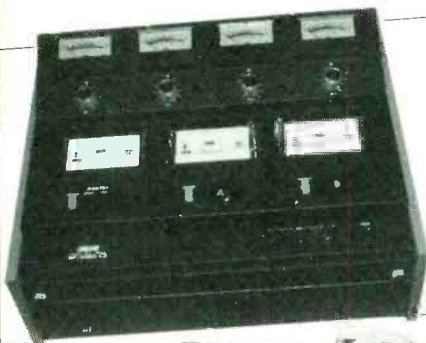


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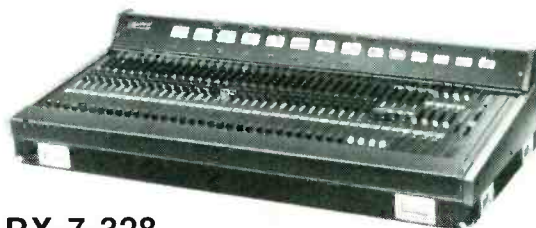
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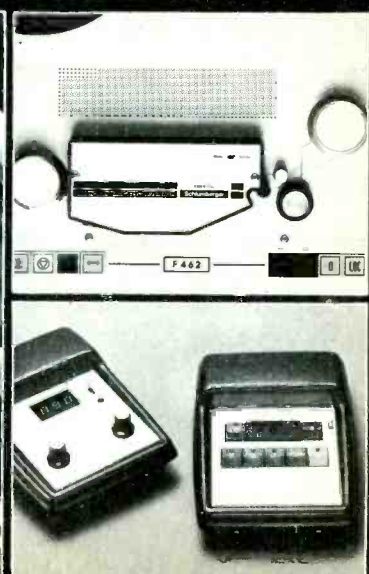
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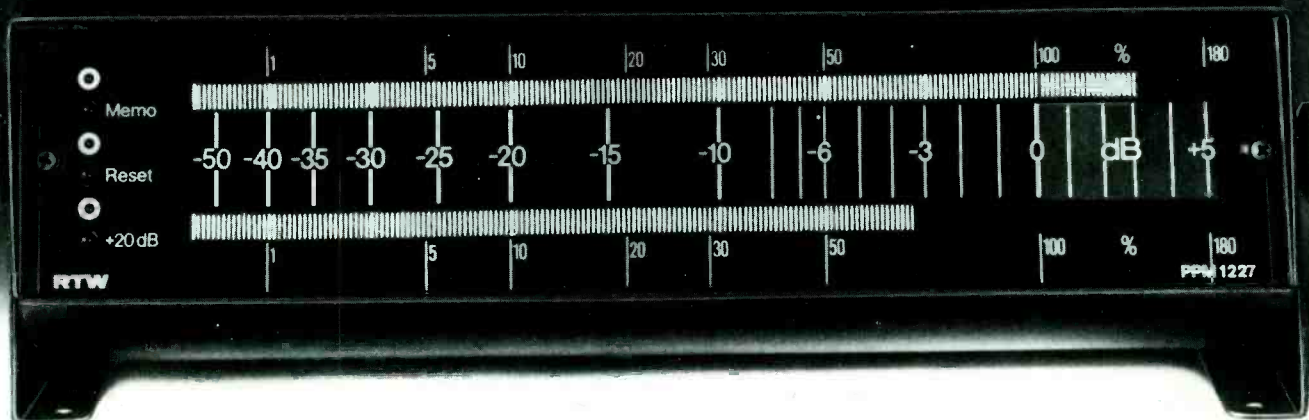
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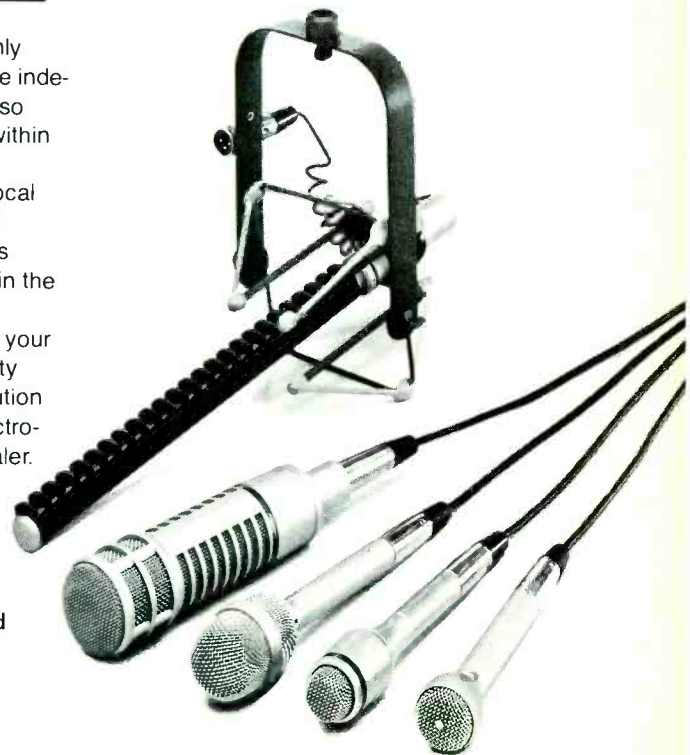
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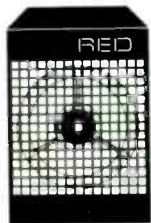
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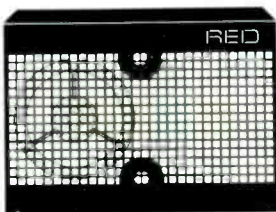
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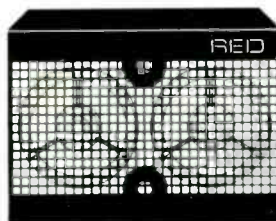
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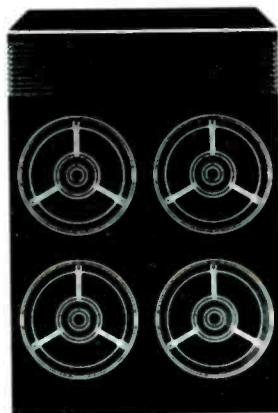
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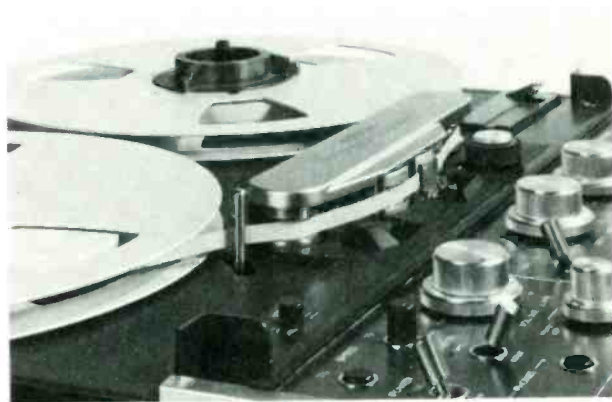
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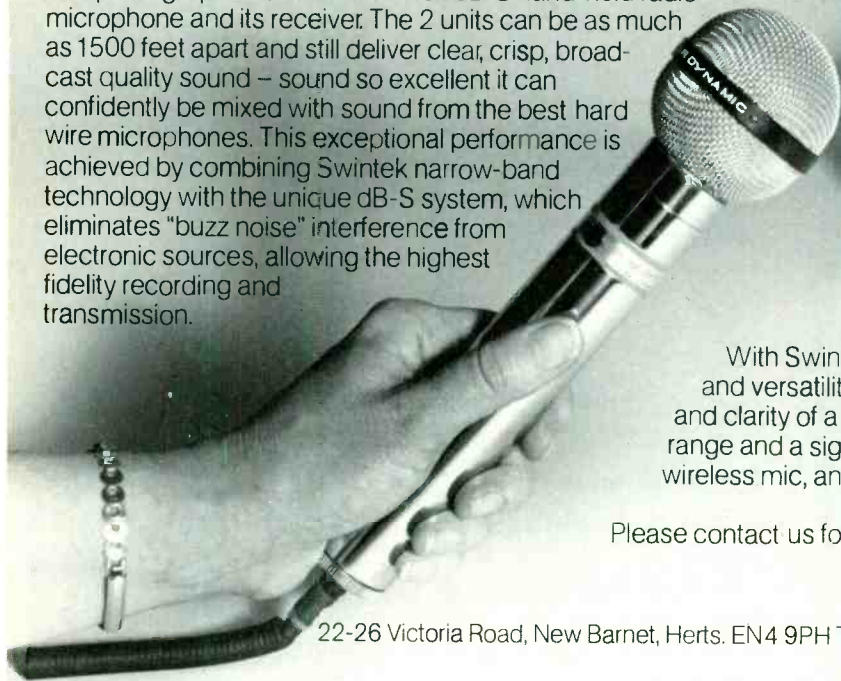
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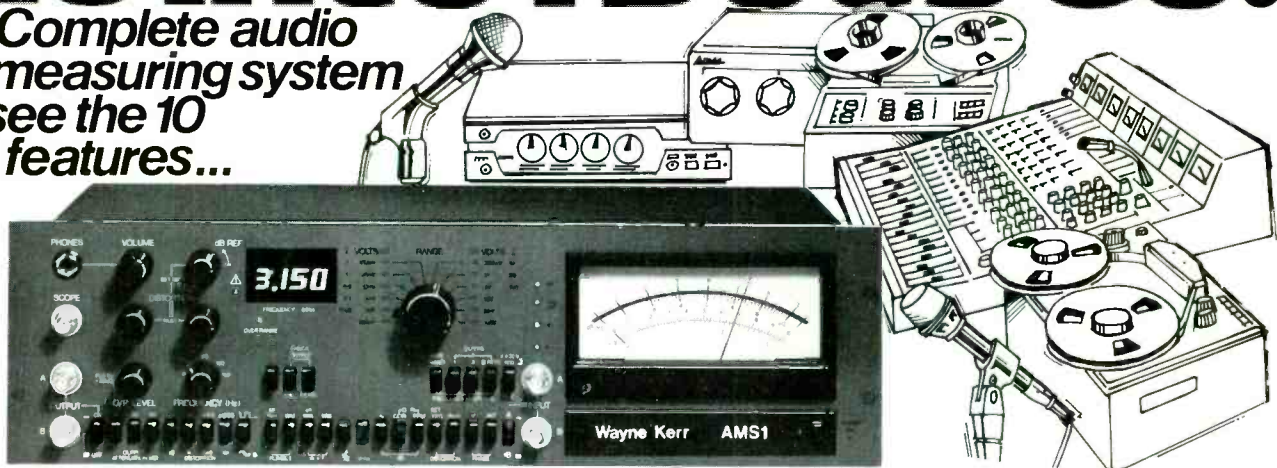
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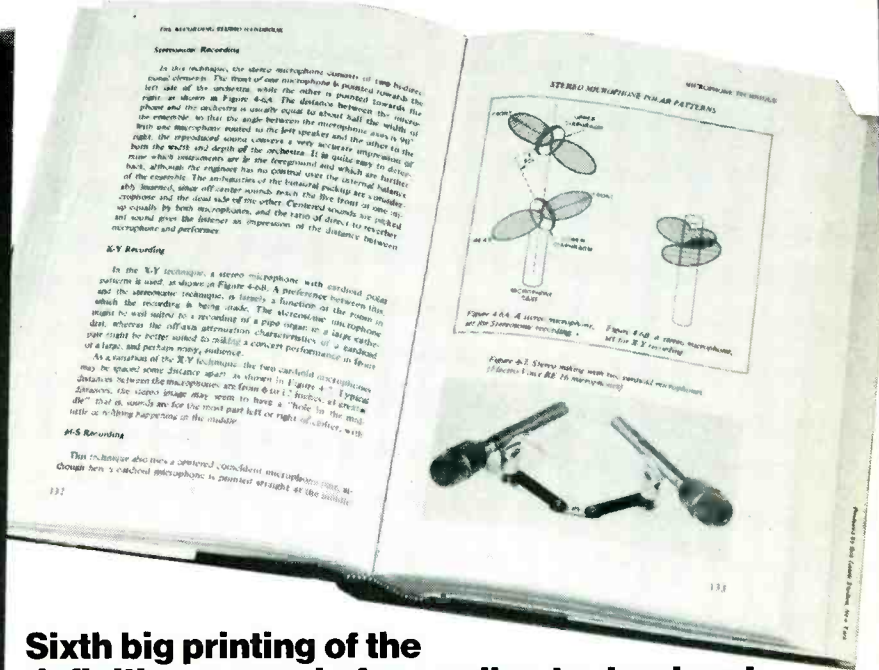
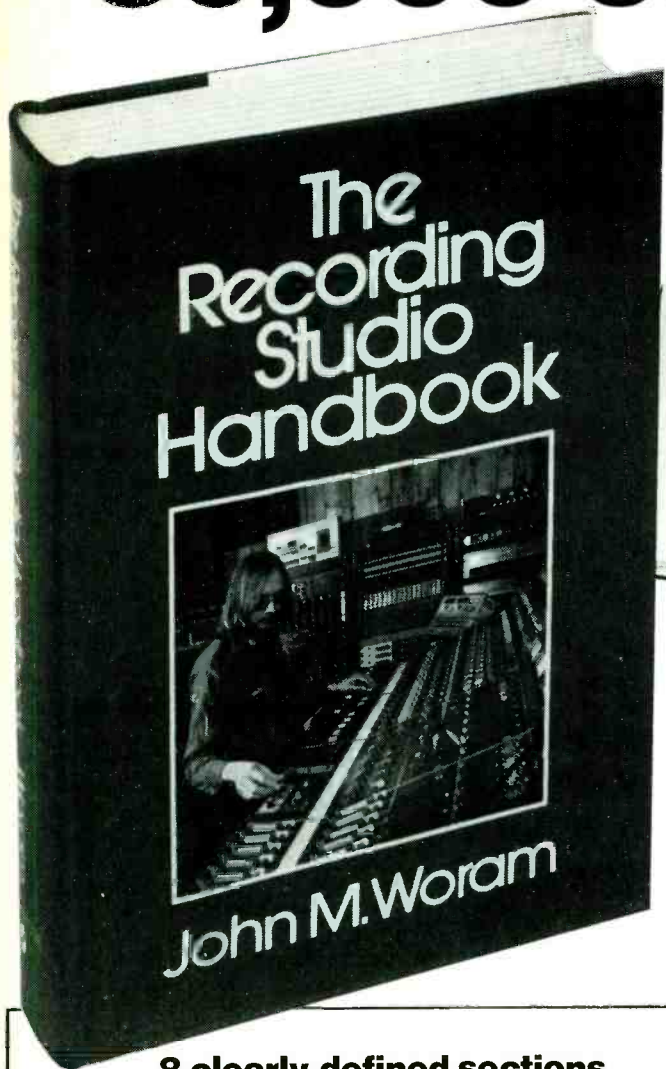
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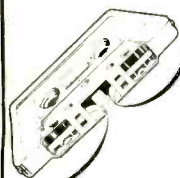
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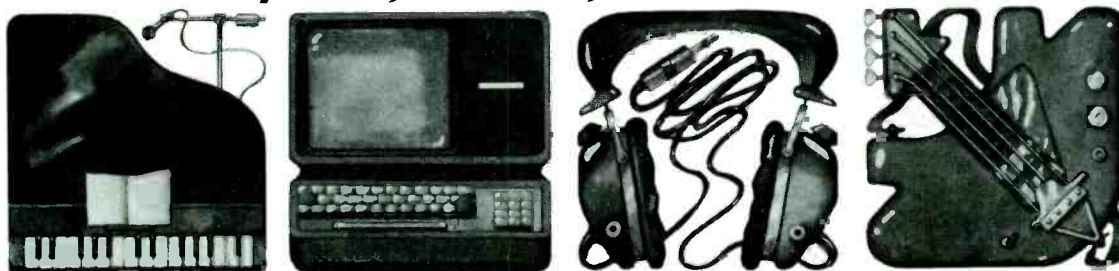
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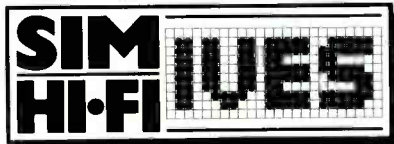
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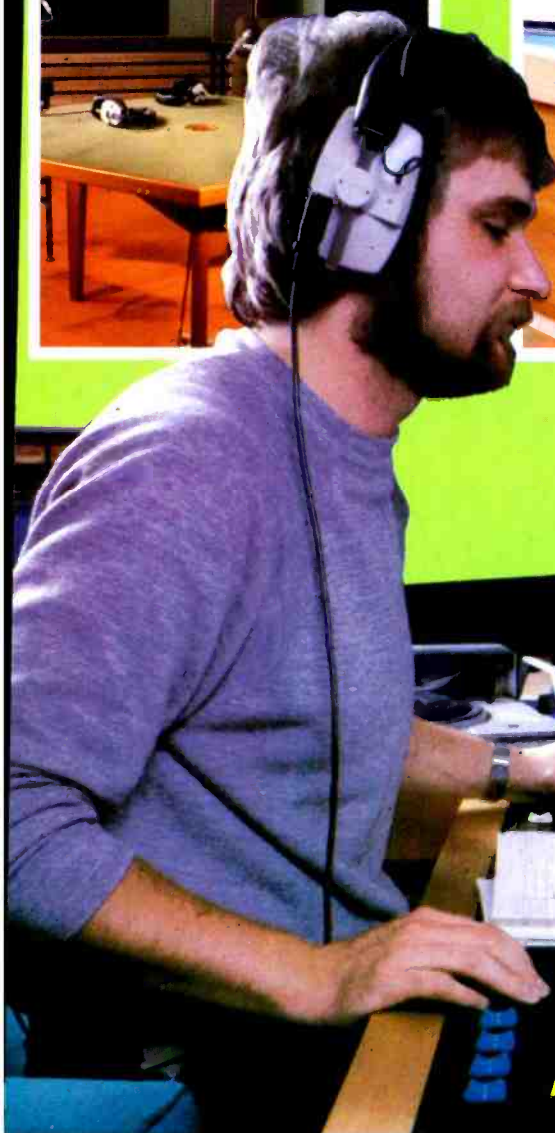
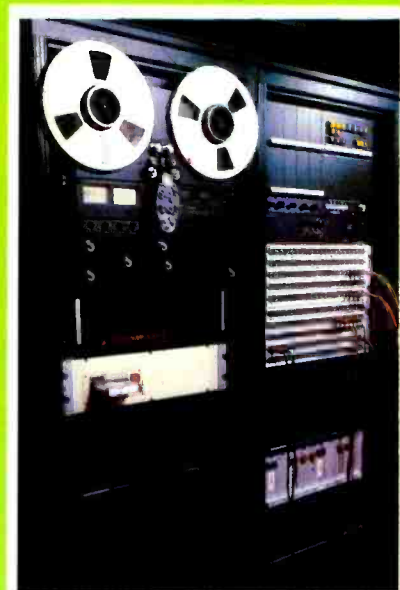
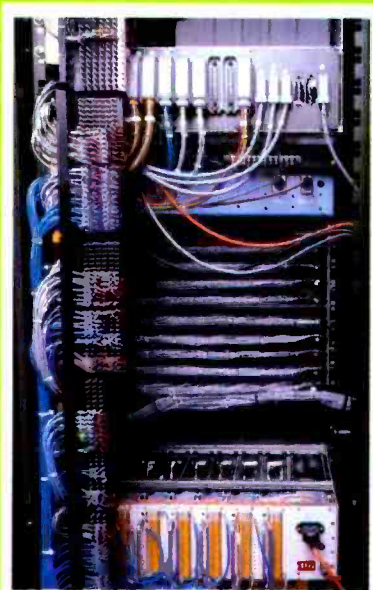


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