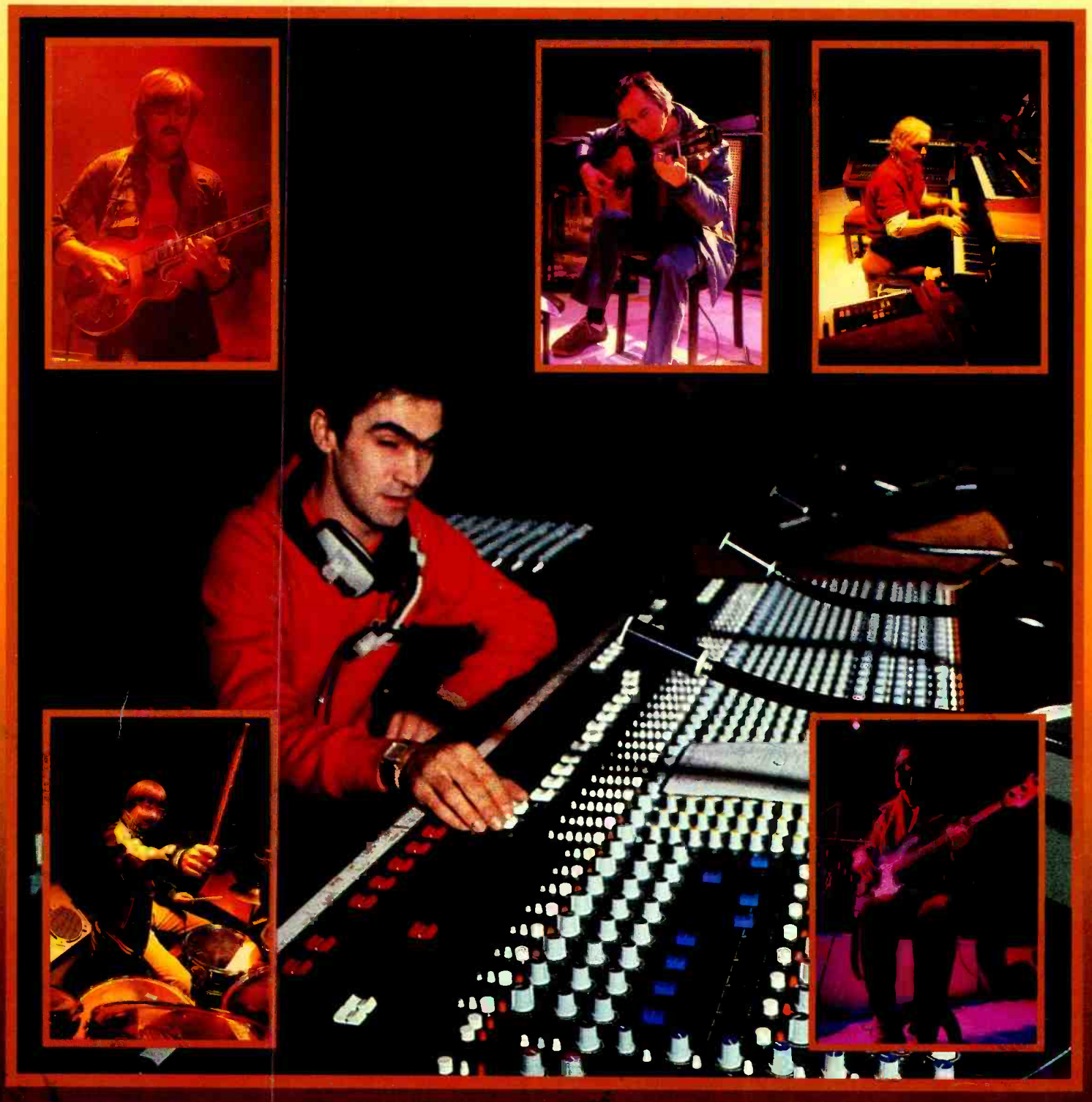
May 1983 £1

studio sound

AND BROADCAST ENGINEERING



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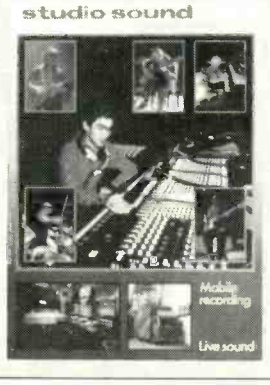
studio sound

AND BROADCAST ENGINEERING

MAY 1983 VOLUME 25 NUMBER 5 ISSN 0133-5944

Cover: Andrew Jones, chief sound engineer Sky, with insets of band (top); interior and exterior Rolling Stones mobile (lower). All photography Ralph Denyer.



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Editorial

Lo and Behold!

Yea, verily, and the *Compact Disc* came to pass upon the land (or Europe at least). And *Sony* didst display it unto the Press with loud videos and Noel Edmonds, and *Philips* did not, taking over instead the great Sound House of CTS with Audio Visuals and an Songe which taketh after the Brochure in its Lyrics. And Graham of Cirrus didst come forth and conduct his Musick before the *Philips* dealers, who saw that it was good, and did go forth and sell unto C's and D's and other socio-economic groupings. And the *Compact Disc* players from *Sony* and *Philips* manifested in the Audio Stores, along with other devices of the same sort with a multitude of other brand names, although their internal essences be also of *Sony* and *Philips* with the exception of the cases and the labels.

And lo, also came there forth *Software*, on many labels, including *Toshiba-EMI* but not *EMI* unto itself, they being faint of heart. And recording engineers of great note came forth upon the Television, saying: "EMI, being run by lawyers and accountants, is like unto a soccer team which brimmeth over with goalkeepers". And most of the industry did laugh up its collective sleeve and did note that EMI artists applied pressure unto their record company, saying: "Thou wilt let us record an *Compact Disc* or we will go elsewhere". And the rest of the industry did hold its breath and wait.

But behold, there were also voices of dissent heard in the Industry, apart from those who sayeth that *Digital* was like unto a crock of excrement. There came forth those who said: "But, verily, the Punters and the Record Reviewers will cometh over all confused, having purchased an *Compact Disc* made from a tape recorded in 1977, which haveth modulation noise and distortion, and they will not know its cause, being kept in ye dark about the fact that it be *Analogue* in nature. And they will blame their *Discs* and will take them back to the Shops as duff, and will blame also the mighty *Inventors* at *Philips* and *Sony*, saying: 'Thy *Players* worketh not satisfactorily', and: 'Thy machines are like unto a crock of excrement when I play this *Disc* upon them'." And they noteth also that Reviewers did give such *Discs* bad Reviews, knowing not their *Analogue* nature.

And those dissenters put forth questions unto the Record Companies, saying: "Perhaps thou mightest consider labelling thy *Discs* according to their station, be they *All Digital*, *Slightly Digital* or *Not Digital At All*, such that all will know and understand what they are getting". And some of the Record Companies did bullshit the dissenters, saying: "Thou shalt find our *Discs* labelled *Digital Recording* if they be indeed All Digital, or *Digitally Mastered* otherwise, and this be quite sufficient. Thou shouldst think thyself lucky that we tell you *that* much." But the dissenters accepted not this idea, saying: "But all *Compact Discs* be, by their innermost nature, *Digital*, even if their Master be but *Analogue*. Thus the term *Digitally Mastered* should henceforth be regarded as Nonsense. Many years will come to pass before Recordings on Multitrack are *All Digital*, as many Studios are not equipped with the foresight or capital investment capability of the great *Harris* of CTS, who shall be seen to be installing the *DSP* and *3324* before this year is laid to rest, and his recordings shall be truly wondrous and capable of exploiting the full potential of ye *Disc*, except in that ye Punter will be able to hear the string players folding their copies of the dreaded *Sun* newspaper before they come in at Letter B, the *Disc* being made in the Image of the *Digital Master*, and being exactly alike unto it in its quietness and lack of rumble, hiss, distortion and other untoward phenomena." But behold, the Record Companies said nothing, being used to losing sales and blaming other people.

Then, however, came forth the great *Nimbus*, makers of the most wondrous vinyl discs in Europe, if not in other places, who could also make their conventional pressings very nearly like unto the Master, even though they be lowly *Plastick*. And the great *Nimbus* spake unto the dissenters, saying: "We are in total agreement, being of like mind. We also use both *Digital* and *Analogue* techniques, and maketh also *Compact Discs* which be recorded *Ambisonically* in *UHJ* and sound truly amazing."

And *Nimbus* brought forth their Demonstration *Disc*, and it was a *Disc* of many colours, and many Tracks also (including a Tone which maketh *Players* quake unto their transit screws and their Lasers to falter) and the *Disc* did glitter in pretty rainbow colours under the flashing of powerful Television lamps. And the dissenters did look at this *Disc* and were truly amazed, and did listen unto it and were truly amazed also, despite the Hanover factory having messed up the *CD P-Q-Cue Code* in its Preamble, Postamble or Midamble such that Ambience at each end of each Track was removed. And they did look at the Packaging and, Lo and Behold, they saw under each Title a note on its origin, be it *Super Analogue Master, Digital Recording* or whatever. And they marvelled at this, saying: "*Nimbus* has got it right again", and hoping that everyone else would take the hint.

Richard Elen

STUDIO SOUND is published on the second Friday of the preceding month. The magazine is available on a rigidly controlled requested basis only to qualified personnel (see back page for terms) or for an annual cost of £12.00 UK, $40 US surface mail, $75 US airmail, £17.50 overseas surface mail or £32.50 overseas airmail to non-qualifying readers or where more than two copies are required in a studio or small organisation. *All* subscription enquiries, including changes of address (which should be *in writing* and preferably including an old address label or at least the 7-digit label code) should be made to the **Subscription Department** at the above address.

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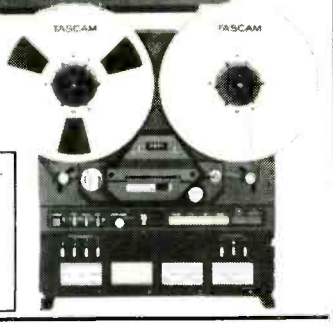
ITA. The One

BUDGET PACKAGES

Tascam 4 track systems

A variety of small systems for the cost conscious, from the M244 Portastudio, complete on its own; or



currently on special offer — the 34 recorder with the Seck 10×4 Mixer.

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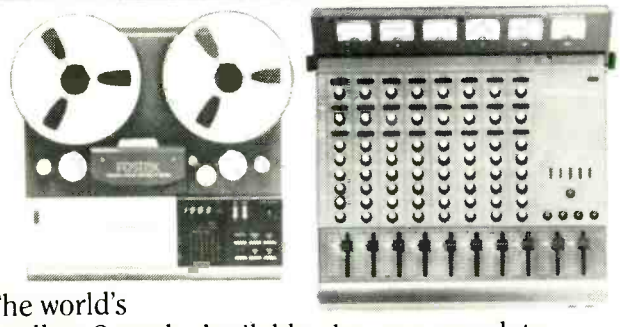
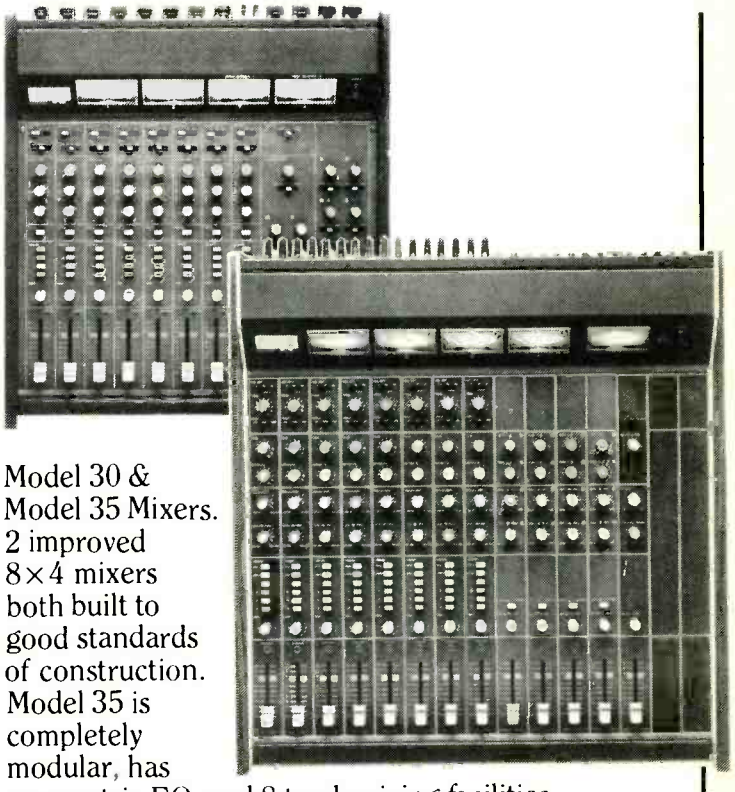
Fostex



The world's smallest 8 track. Available also as a complete system, with the 350 Mixer. NEW LOW PRICES.

Tascam 8 track systems

38 — the sensational new half inch 8 track has shattered price barriers. Yet performance is better than ever, with digital counter, lower noise electronics, and pitch control.



Model 30 & Model 35 Mixers. 2 improved 8×4 mixers both built to good standards of construction. Model 35 is completely modular, has parametric EQ, and 8 track mixing facilities.

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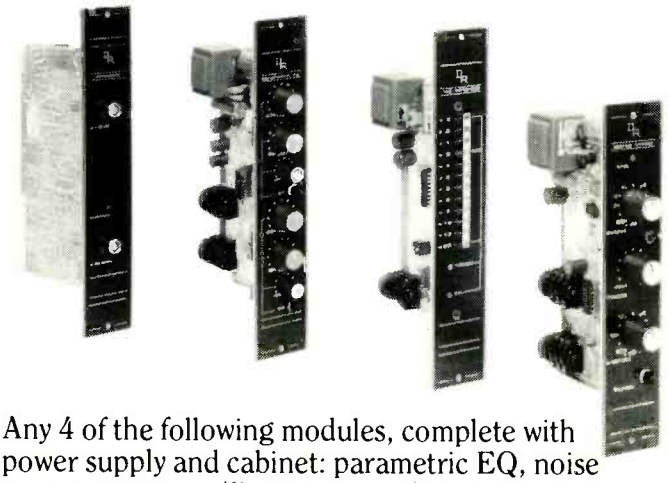

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Tascam 38 8-track ½"	90	50	30
Otari Mk.III-8 8-track ½"	110	60	40
Itam 8-track 1"	150	80	50
Itam 16-track 1"	200	120	75
Otari MTR90 24-track 2"	600	400	150
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Tascam Model 30 8×4	40	25	10
Fostex 350 8×4	35	20	10
Itam Stereo 8 8×2	45	25	15
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MCI JH114 24 track	£12,500
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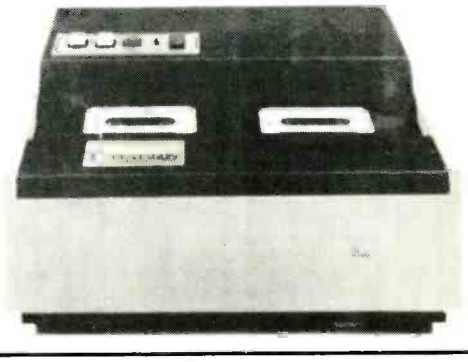
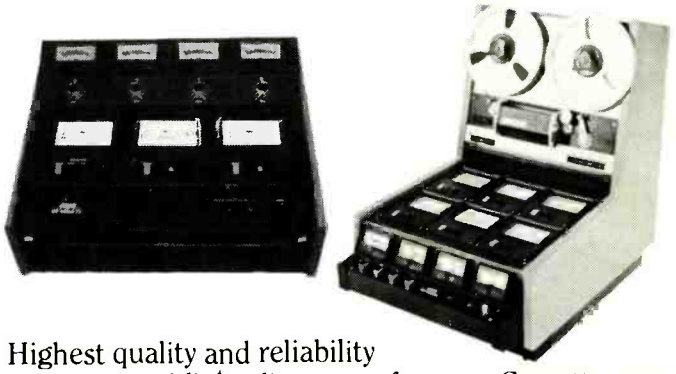


OTARI



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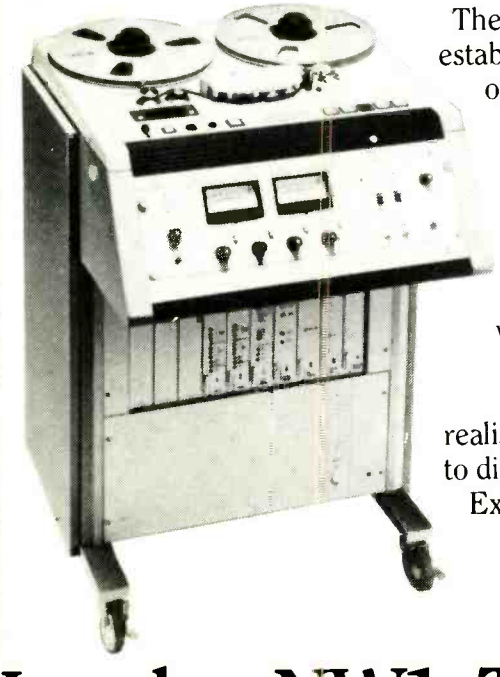
MTR10-2 Half inch 2 track



The MTR10-2 has established itself as one of the most user-friendly mastering machines on the market. The new half inch 2 track version runs at 30/15/7½ ips making it a realistic alternative to digital recorders. Excellent editing facilities.

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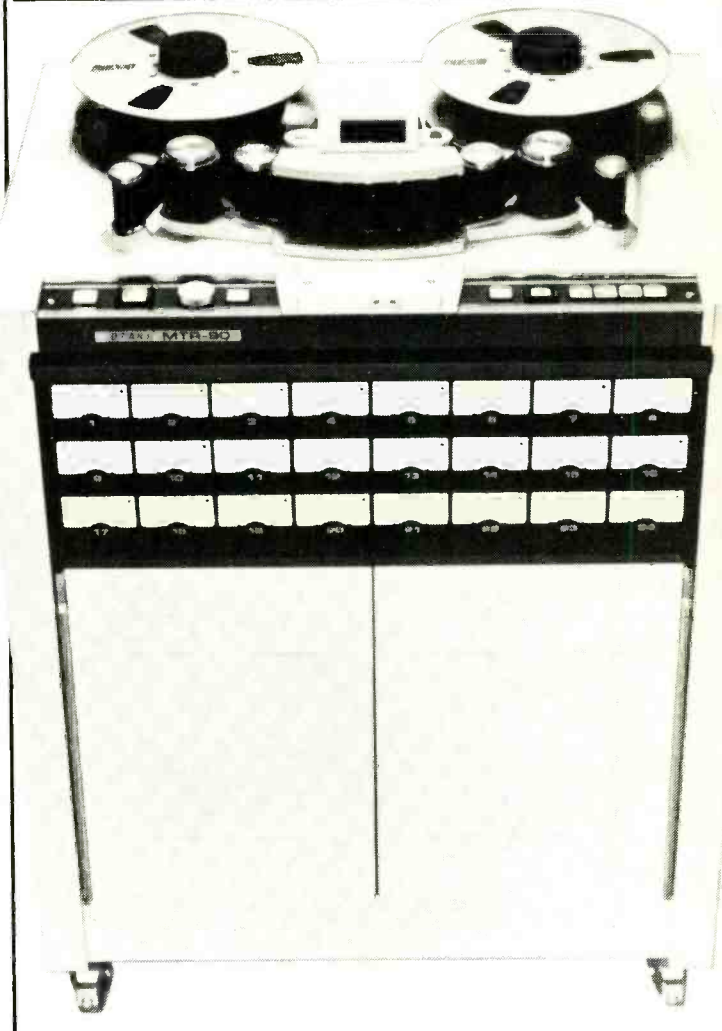
OTARI MTR90-II



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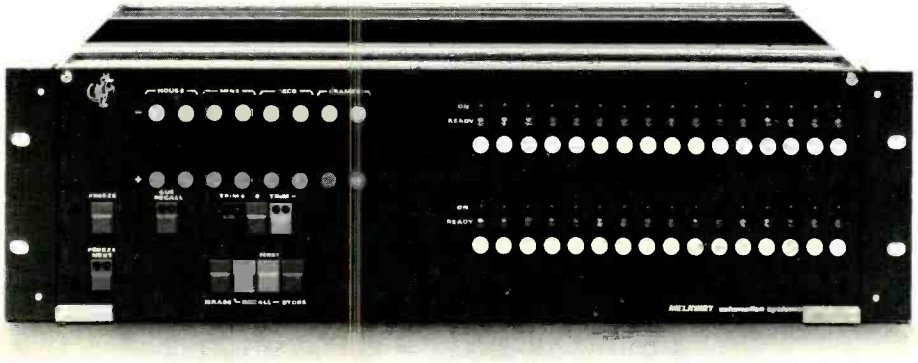

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Working with virtually any variable-speed tape recorder, projector or videotape recorder, the Lexicon 1200 can compress recorded material by up to 25% or expand it by up to 10% retaining full 15K bandwidth. The best 'take' can be time-adjusted easily to fit the available time slot.

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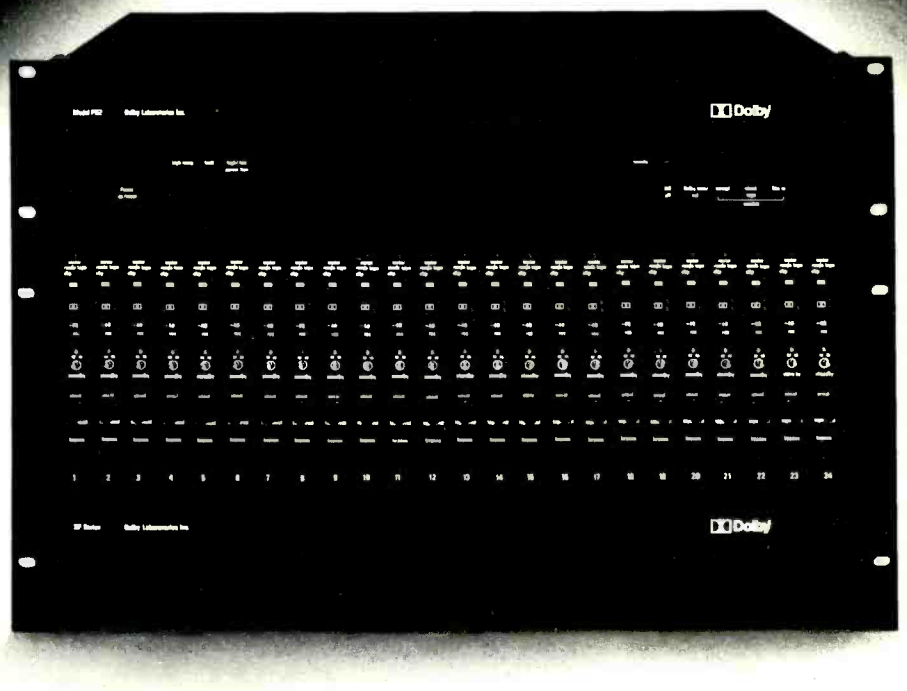

The Dolby SP Series Multi-track noise reduction unit

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 12¼" 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 12¼" 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 ±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.
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- 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.

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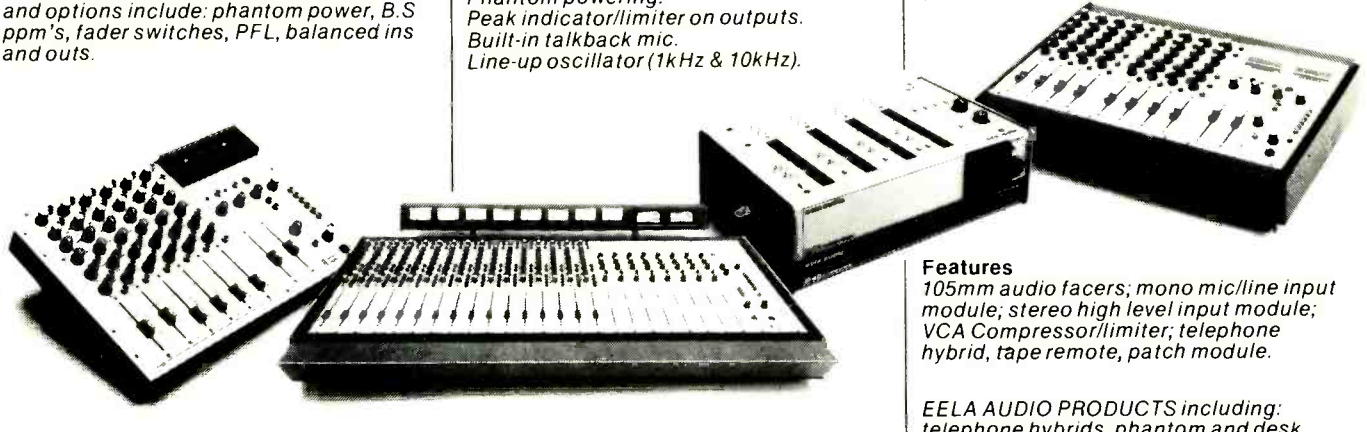

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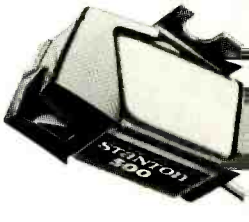

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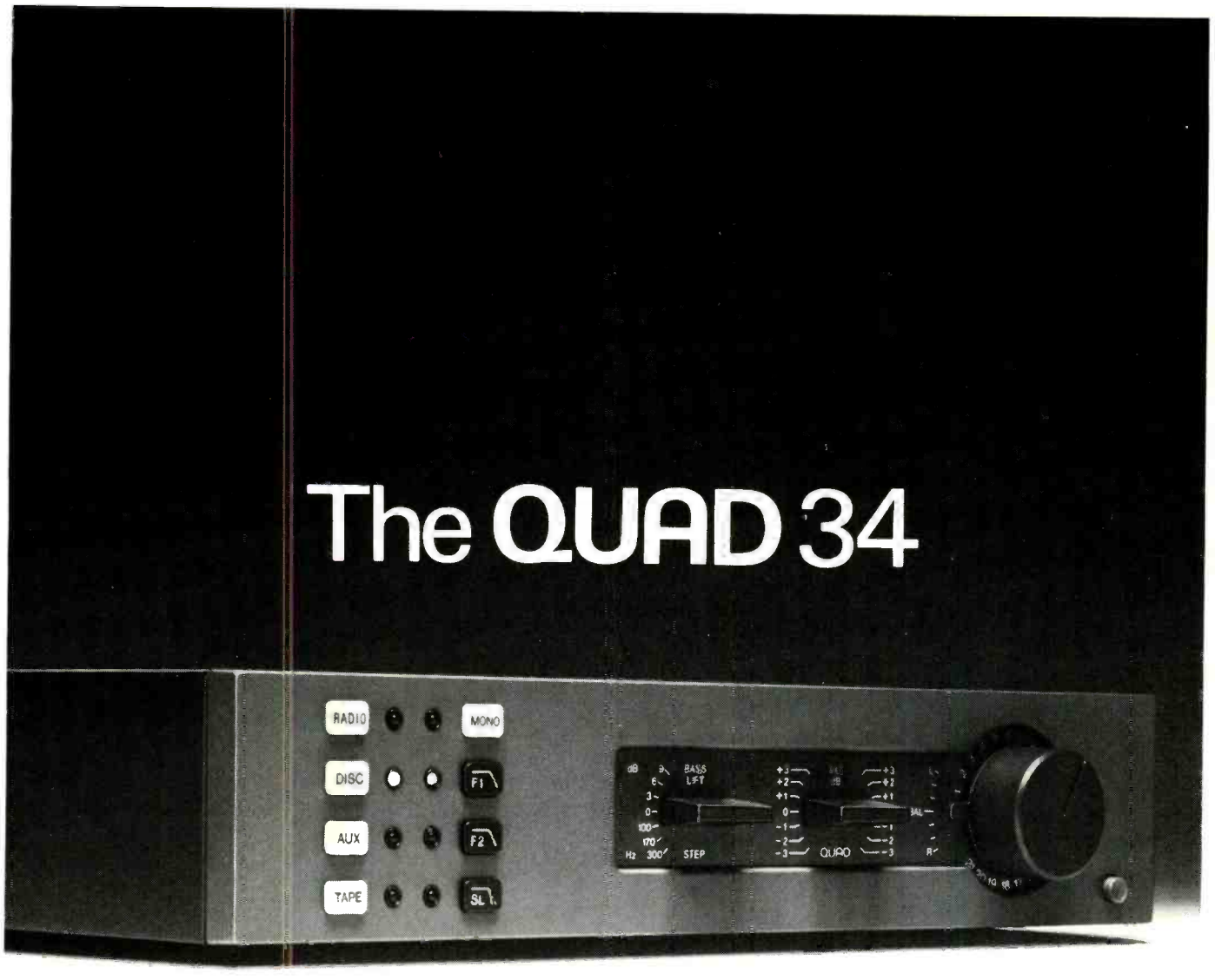

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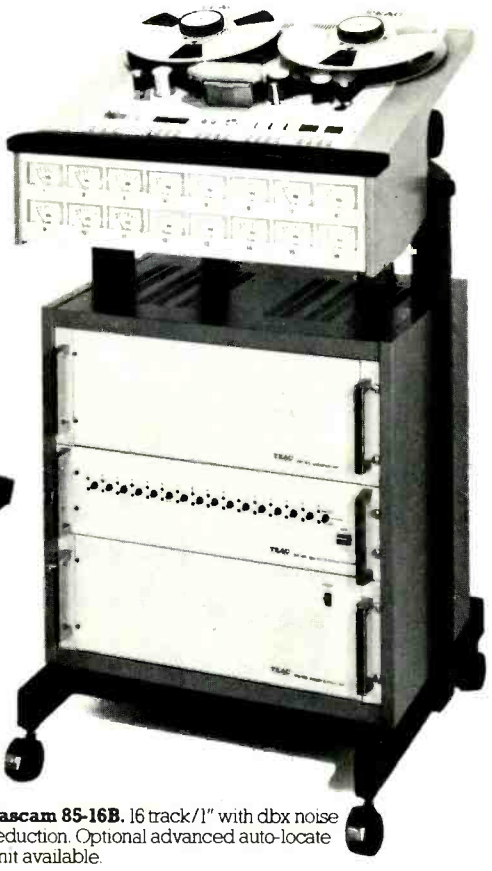

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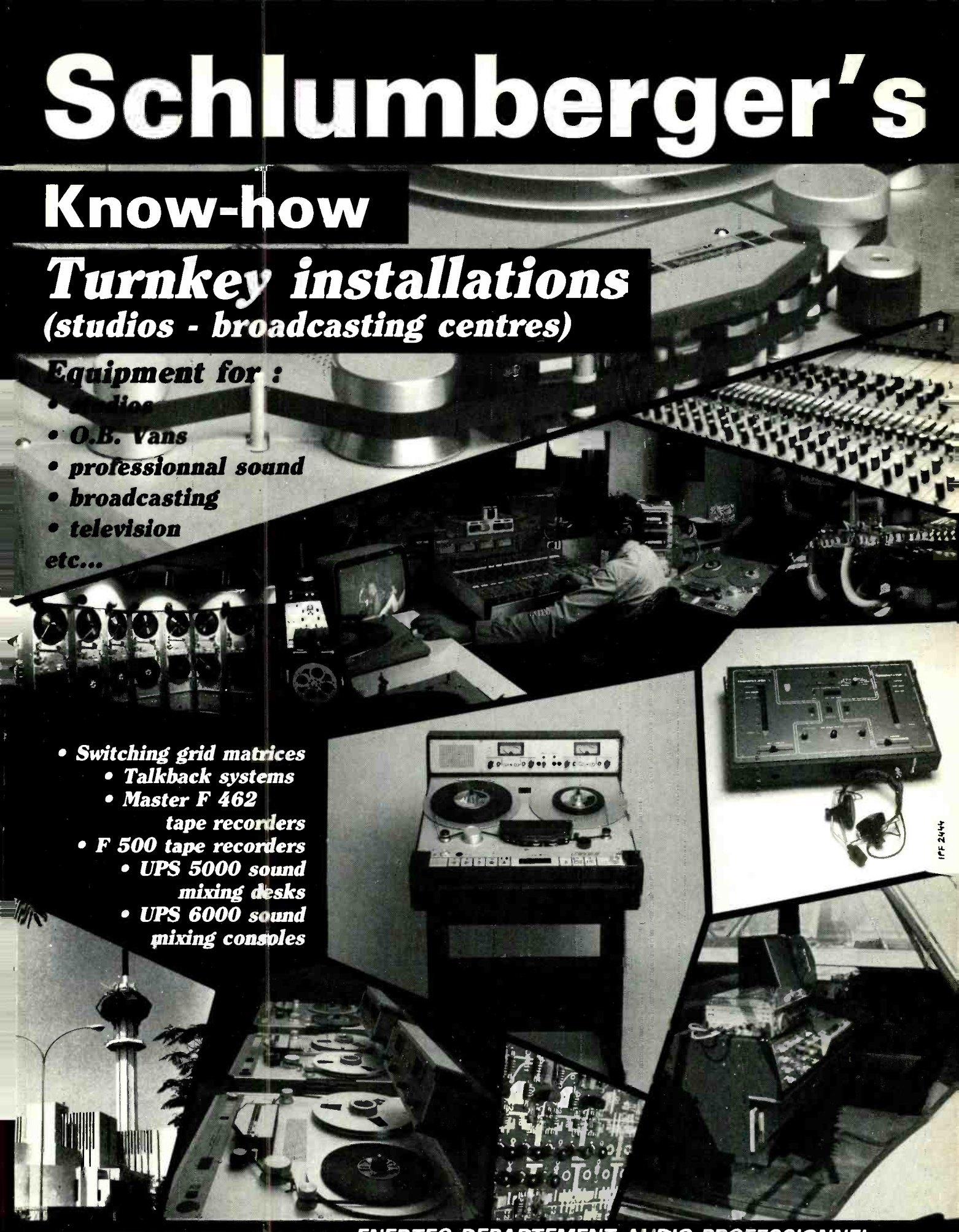

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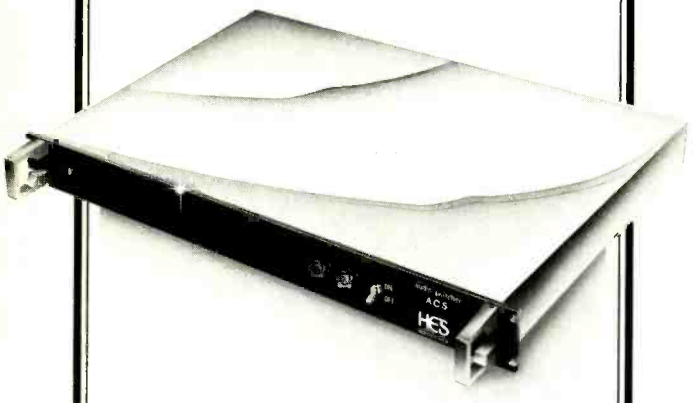

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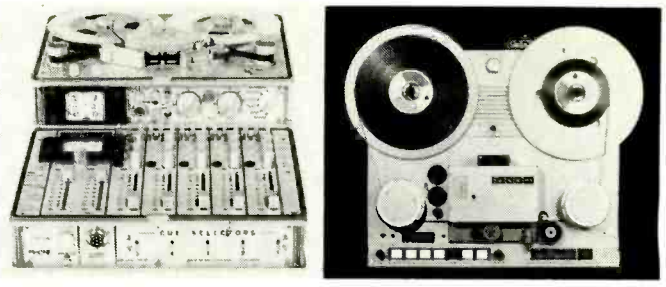

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APRS course for studio engineers

The UK has a world-wide reputation for the quality of service given by its studios, and for the technical standards in these studios. British audio engineers are spread around the world in much the same way as were the younger sons of inventive Empire-building Victorian families.

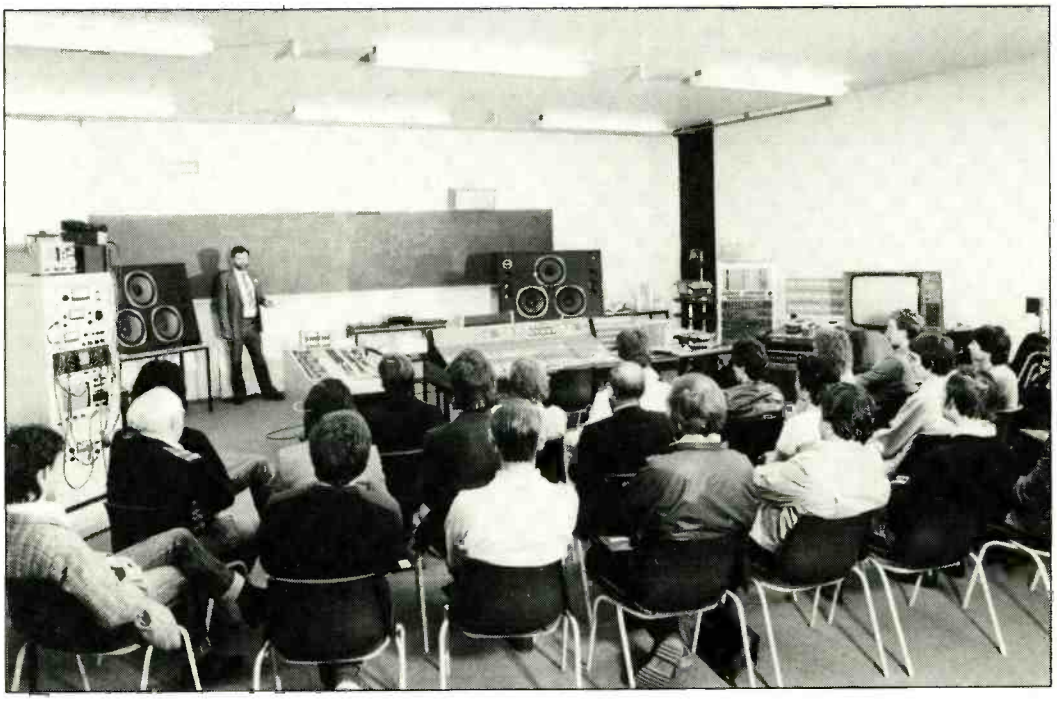
In view of today's UK engineers' international reputation it might seem unnecessarily carping to point out that Britain has woefully inadequate facilities for training new engineers for tomorrow. For a profession which combines a need for creativity, great sympathetic understanding of sound, and technical knowledge (particularly among those who specialise in maintenance rather than balance engineering) the lack of formal training courses in the UK strikes those in other technical professions as odd—bordering on lunatic.

Audio and video recording technology is now moving ahead too quickly for the old studio apprenticeship system to be fully adequate for much longer. This applies to both balance engineering and maintenance engineering. But while improved technology tends to make the balance engineer's work at the console easier, it makes the job of maintenance more complex. It is not an overstatement to say that in maintenance engineering a staffing crisis is looming (and may already have arrived).

The problem of training the audio engineers to cope with the audio/video recording industry's demands in the future will have to be tackled by colleges and universities—because what is needed is properly-funded full-time courses, preferably within the national education system and probably as an adjunct to an electrical engineering degree or a music course such as Tonmeister.

But the problem of keeping today's engineers well-informed and fully-competent is one which is annually tackled by the APRS. Unable to provide a full training course, for obvious practical reasons, the association offers the answer to the increasingly urgent question—'How does an audio engineer keep his (haphazardly acquired) knowledge up to date?'.

That answer takes the form of the APRS Engineer's Course, a refresher which is now in its 10th year. It is well-established, generally agreed to be excellently planned and put across, and is the only course of its kind available here. All those factors should combine to create, by now, a massive demand for places from studios and manufacturers (at engineer and at management level, because management needs to know first hand the direction of technical development in order to re-equip wisely and to talk on equal terms with clients and their own technical staff).



Pic: University of Surrey

'. . . the lack of formal training courses in the UK for studio engineers is odd . . . bordering on lunatic.'

It's a sad comment on the current economic situation that engineers cannot be spared to attend courses, and studios imagine that even the small fees of such a course as this cannot be justified in their budgets. It's an equally sad comment on general attitudes that the increasingly urgent need for technical expertise to keep pace with the state-of-the-art does not yet seem to have been fully grasped by the recording industry.

Keeping pace with the thoughts of fellow engineers, enjoying cross fertilisation of ideas on a personal and international scale, is a vital part of this process. Attendance on the APRS refresher is possibly most valuable in providing the opportunity to do both; it seems generally agreed that the evening chat sessions in the bar are as valuable a part of the proceedings as the daytime lectures, seminars and hands-on sessions.

The mixture of students varies from year to year, including broadcast, music studio, manufacturing—and recently video—engineers; and from tape ops to managing directors. The mix is also international. Countries represented over the years have included Belgium, Brazil, Chile, Canada, Egypt, Finland, France, Germany, Holland, Italy, Iceland, Israel, India, Japan, Kenya, Malaysia, Malta, Norway, Nigeria, Portugal, Switzerland, Spain, Trinidad, and Zambia. And the total number of students to date has been 297. They have been predominantly male, but there is no male chauvinism—women are welcome and do attend, as rarely as their rarity in the profession would predict.

Clive Green, who heads the APRS Education Sub-Committee, and who is chiefly responsible for the organisation of the refresher course (also the digital course and a possible future maintenance engineer's course), stresses: "We organise very good courses. The industry needs these courses, and we need more people to come to them.

"Generally, the reasons why the studio industry needs training for its engineers are the same as why any industry needs training. Ultimately it is a question of making money. The more time a studio can sell, the more money it will make. A good resident balance engineer helps to sell time, and to build relationships with regular clients. If equipment suffers breakdown and there is no sufficiently well-trained maintenance engineer on hand to cope quickly with repairs the amount of down time is increased and the possible income decreased.

"Balance engineers can to some extent be trained like creative artists; they can be apprenticed in studios and learn as they work with more experienced engineers. But they

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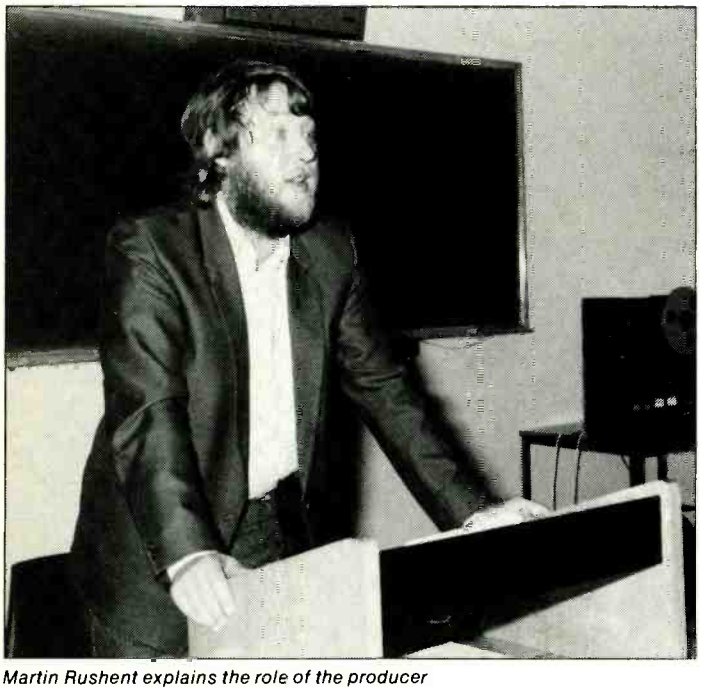
APRS course for studio engineers



Pic: Doug McKenzie, PPS

Martin Rushent explains the role of the producer

would obviously benefit from more formal training as well, and would certainly benefit from an APRS refresher once every few years.

"But the greatest need is for properly trained maintenance engineers. The maintenance engineering side of studio work demands much greater technical knowledge and practical experience. As head of my own equipment company, selling to studios, I always talk first to the technical man. In my travels I notice a marked difference in competence and understanding on the technical side.

"The industry badly needs people with degrees in electrical engineering plus special training (if that were available, which it is not), plus training with specific equipment manufacturers. With digital equipment coming in now, and the *Compact Disc* which will require digital recording, there will be more and more instances of studios relying on manufacturers—not just for installation but also for lining up, and then for maintenance and repairs. This is not a good prospect."

The APRS course is held at Surrey University, in two lecture rooms in the teaching block. These are big rooms with easy access for movement of equipment in and out at road level. UK manufacturers are very generous in their loans of equipment for the course, so it is very well supplied with consoles, amps, speakers, tape machines, effects boxes, etc. The teaching block being quite isolated on the campus, the APRS sessions can be very loud, if necessary, without disturbing anyone else.

This year the course will include, for the first time, a special 'basics' refresher, on the first Friday afternoon. This is optional, being in the afternoon of the opening day, and 'gets right back to Ohm's Law' Clive Green promises.

Course entrants do not need to have been working for any specific length of time, nor have had any specific amount of experience. However, the students on any course will predominantly be engineers who have been sent by their employers, and they usually already have a good grasp of the subject. But there are also some self-employed (and unemployed) people who come at their own expense, one from as far away as Egypt last year.

Apart from studios and equipment manufacturers, various broadcast companies and authorities have supported the course well over the years.

The refresher is an opportunity for the APRS organisers and the lecturers to bring new ideas and new technology to engineers' notice—new developments in acoustics, new pieces of equipment, new techniques.

One year the APRS students saw a prototype of a new piece of test equipment developed by Bruel & Kjaer to analyse the reverb in a room in real time. The following year B & K were able to lend a production model of the equipment. Also, for example, one of the earliest demonstrations of the *Compact Disc* was at an APRS course.

On last year's course there was a highly successful new variation of an old idea on show. Students found themselves confronted with that ingenious precursor of the recording, the player piano. The originals used paper rolls, with playing power being provided first by foot and then by electric motors.

> 'It's a sad comment . . . that studios imagine that the small fees of the course cannot be justified . . .'

This new model was electronic. The hammers were worked by solenoids, and the piano roll is replaced by a floppy disk on which the musical information is stored. While the instrument gave everyone considerable pleasure there was more reason for its being there than aesthetic uplift all round. The instrument was part of an attempt to discover whether there is any discernible difference between digital and analogue recordings in the first generation (there being no argument that digital quality wins convincingly when there are several generations of recordings). The experiment demanded a consistent source of live sound, and a 'musically interesting' sound was wanted. Composer/arranger and co-owner of Lansdowne Studio Johnny Pearson played a tune and the piano played it back—as did the analogue tape recorder. There was no difference . . . and it had been proved in the most entertaining way possible.

Pearson, a veteran in the record business, announced that he had not attended the APRS course before, but intended to sign up again for 1983 immediately.

The courses have, over the years, remained general in content, with no particular area of interest, and no fixed pattern of requirements from the students. New lectures are added as the need arises—for example in 1981 a video post-production seminar was added to the programme because requests for it had been made.

This year's course will take place from Friday, September 9th to Friday 16th. Details may be obtained from **E L Masek, APRS, 23 Chestnut Avenue, Chorleywood, Herts WD3 4HA, England. Tel: 09237 72907.** ■

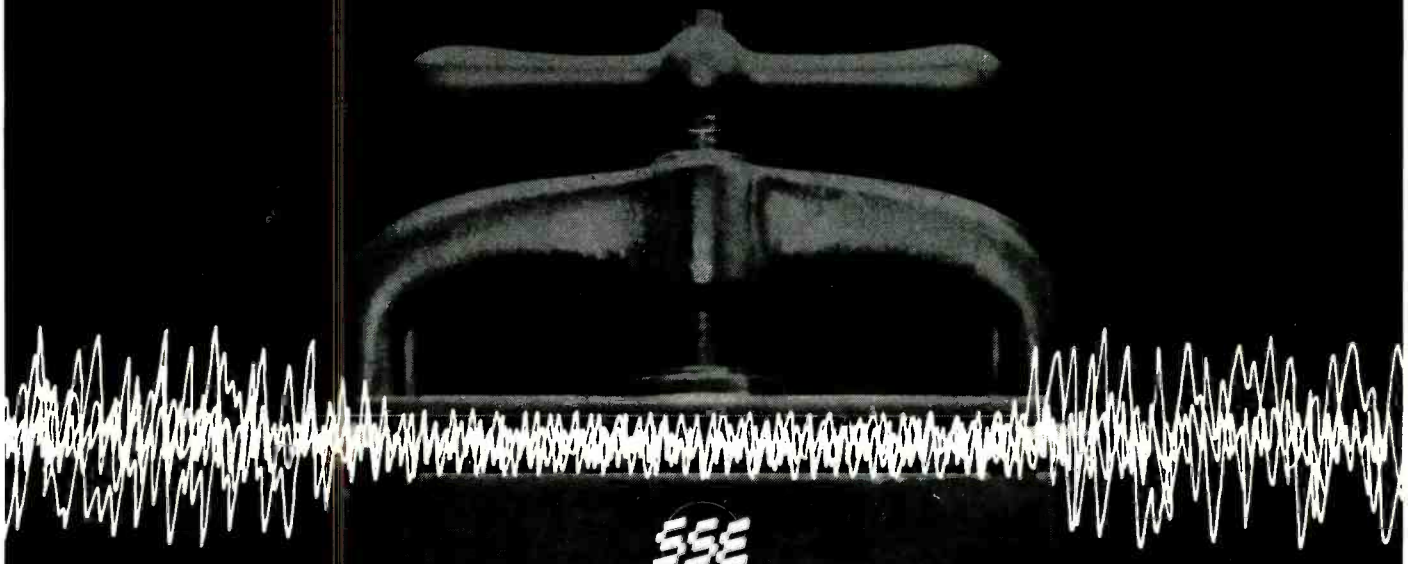
The class of 1980 visits EMI

Pic: Jayne Fincher, Photographers International

Its never too late for noise reduction

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

dynafex



SSE

Scenic Sounds Equipment Limited
97-99 Dean Street, London W1V 5RA Telephone: 01-734 2812/3/4/5 Telex: 27 939 SCENIC G

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The Amber model 3501 is quite simply the highest performance, most featured, yet lowest cost audio distortion and noise measurement system available.

It offers state-of-the-art performance with THD measurements to below 0.0008% (−102dB), maximum output level to +30dBm and noise measurements to below −120dBm.

It has features like automatic operation, optional balanced input/output and powerful IMD measurement capability. It includes comprehensive noise weighting with four user changeable filters. Unique features like manual spectrum analysis and selectable bandwidth signal-to-noise measurements.

The 3501 is fast, easy to use and its light weight and small size make it very portable. It can even be battery powered.

amber Amber Electro Design Inc. 4810 Jean Talon West. Montreal. Canada H4P 2N5. Telephone (514) 735 4105

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new products

Economical Autolocator

A new addition to the Applied Microsystems range of tape timing products is the *CM50 Autolocator*, which may be fitted to machines which have real-time counters, or, with the addition of a *Spin-Time* (see March 1983) to other recorders. The unit carries out normal autolocate functions such as cue search, memorise cue, and multiple play.

The control unit includes transport controls, locate, cue and mode-switching buttons, a numeric keypad and an LED display which indicates actual time, target time, cue number and other data. Nine cues may be memorised either by loading the desired time or on the fly. It is possible to enter relative times—for example, the command '+30 FIND' will roll the tape on 30 seconds. Cues may be assembled and played in any order.

A more upmarket model is also available, the *CM55*, in which the LEDs are replaced by a 5 in video monitor. This model allows the display of a wide range of data in addition to autolocate functions, such as track data and artist information, which may be dumped to a printer together with timings to form a recording log. The unit has 99 cue memories.

Timecode capability will be added to the system in the near future. Being a primarily software upgrade, no major mods will be required.

Applied Microsystems Limited, 60 Baker Street, Weybridge, Surrey KT13 8AL. Tel: (0932) 54778.

New Westlake monitor

Westlake Audio has announced the availability of a new portable reference monitor, the *BBSM-12*. Rated as 'medium powered', the driver complement consists of two 12 in LF units, a 6½ in MF one and a 1¼ in dome tweeter. Crossover slopes are 24 dB/oct as used throughout the Westlake range of monitors. The *BBSM-12* is available in black or walnut finish.

Westlake Audio, 7265 Santa Monica Boulevard, Los Angeles, CA 90046. Tel: (213) 851-9800. Telex: 698645.

Frankfurt fair

This year's Frankfurt Musical Instrument Fair illustrated that the computer-based instrument has become completely accepted, not only by the pro- and semi-pro, but also by the musician in the street—the great buying public. You only had to look at the Casio stand to witness this.

There were many new variations on old themes to be seen on the literally hundreds of stands, but to qualify for adjectives such as 'revolutionary' and 'innovative' a new product has to be quite something these days.

One company stands out when it comes to pioneering new instrument techniques—Yamaha. We've discussed their *GS* and *CE* keyboards and the development of the FM system of voice generation in a past issue, but Yamaha have taken this technology a step further with 'Programmable Algorithm FM—Digital Synthesizers'. These manifest themselves in the form of the *DX* range of keyboards—the *DX-1*, *DX-7* and *DX-9*. All three models are polyphonic programmables and offer some extremely sophisticated control techniques.

Essentially the idea is to stack the FM equation generators into algorithms (the signal path) thus enabling the generator to act as a sound source or modifier. The result is an exceptionally fine-sounding signal output with the subtlety and expression that is typically Yamaha. The *DX-1* is not as yet priced, but the *DX-7* should be out at around £1,299 and the *DX-9* about £899.

Those of you who, like me, fell in love with the *CE-20* will be pleased to learn that there is a new *CE* machine—the *CE-25*. Whereas the *20* offered mostly monophonic presets, the new machine is equipped solely with polyphonic voicings, again utilising the FM technology. It is hoped that the *CE-25* will be in the shops for less than £1,050.

Also of interest is the fact that Yamaha are entering the home recording field with their *MT-44* 4-channel cassette deck. Also available is the *MM-30* 4/2 desk, *MS-10* 20 W monitor systems and Yamaha's first free-standing rhythm unit—the *MR-10*.

Roland seem to have been content to follow in many areas of electronic music. True, they have evolved certain products—guitar synthesis, modular synths and signal processors, but their synth line although superbly engineered, hasn't been instrumental in pushing back the frontiers of R&D. Instead, Roland have brought us stunning products at realistic prices and consequently are the most successful electronic instrument company serving the UK. At Frankfurt they revealed a new division—Roland DG—to handle their range of music-oriented ancillary computer equipment, which was previously to have been marketed under the Amdek banner.

One of Roland's 'slow-burners' over the years has been the *Micro-Composer*. The *MC-8* was released many years ago and was so ahead of its time that it sold only averagely. With the changes in the musical climate, the device has enjoyed increasing success—out came the *MC-4* and *MC-4B* to satisfy demand; and now we see the *MC-202* which, at £325, brings it within the reach of a greater number of people. It consists of an ultra-sophisticated dual channel sequencer with on-board voice module, and would be ideally matched to an *SH-101* for the second voice. It will sync up to rhythm and tape machines, and is an ideal central control device for a small studio.

Roland also announced two new poly synths—the *JP-6*, a 6-voice polyphonic programmable version of the *Jupiter 8*, with 61-note keyboard (rrp £2,000); and the *JX-3P*, also a 'poly-prog' although a *PG-200* programmer (£200) is required to load your own sounds. The *JX-3P* will sell for a remarkable £850—how do they do it? (see April 1983).

Other big news from Frankfurt concerns drum machines. They really do seem to represent the next big thing in the music world. In fact I'm not so sure about the 'next' because they really are happening now.

Emu Systems Inc are set to clean up with their *Drumulator*. They must take the wind out of Linn's sales (*sic*) with this machine which retails for a third of the price. Oberheim are obviously worried because they've introduced a low-cost version of their *DMX* machine—the *DX*—to fight off the Emu attack.

Many of you will have noticed that the *Kit* is doing big business, especially with the electronics bands working to a tight budget. Now comes the *Kit II* which is a complete system, utilising pads for real time playing but also with a sophisticated computer recording facility. A particularly intriguing aspect of the *Kit II* is that it can be linked to a Sinclair *ZX-81* to enhance vastly its programming facilities. I think that this is the first instrument to take advantage of Clive Sinclair's economic miracle.

In brief

PPG had their new processor keyboard and sampling sounds system ... **CBS** continue to do good business with the *Chroma* and can now supply *Apple* interface cards ... **Sequential Circuits Inc** still haven't managed to deliver their *Prophet-t8*; however, they did have the *Prophet-600* on show. This is a 6-voice version of the *Prophet 5* styled along the lines of the *Pro-One*. It utilises the none-too-popular membrane switches for the programmer/arpeggiator/sequencer controls, but at £1,600 (or thereabouts) it is well worth a look. **SCI** now have Reverb, Flanger and Digital Delay modules for their *Pro-fx* system ... **Korg** and **Kawai** both revealed similar types of new polyphonic programmables—the *Poly61* (Korg) and the *SX-210* (Kawai). Both sell for just under £1,000 and both utilise the incrementor control system which requires the player if he wishes to change a sound, to assign each parameter in turn, to a single control knob/switch; thus editing can be slow, but costs are kept down ... Look out for a new monophonic from the Dutch company **Synton**, it's called the *Syrinx* and has a unique dual-resonant-peak VCF which gives it a most interesting array of timbres ... Also on the monophonic front we saw the new OSCAR synth, which has been designed by **Chris Hugget**, the man responsible for the WASP ... **Simmons** drums are so popular that it hurts, they've now sorted out the production problems re the stands and introduced a remarkably versatile (if rather ugly) computer sequencing system.

In a world in which standardisation seems to be a rare phenomenon, **Roland** and **Sequential Circuits** have joined forces to provide a new interface known as the MIDI buss. MIDI stands for Musical Instrument Digital Interface, and the hope is that other manufacturers will join forces with Roland and SCI and fit the DIN socket interface to their computer-based polysynths and amend the software accordingly. If they do we will soon find it possible to link up different makes of synthesisers and control devices, thus opening up the market considerably. With the MIDI bus a small manufacturer of sequencers (say) could sell his product to owners of all makes of instrument. Unfortunately, though, some companies aren't too enthusiastic about the buss and consider it to be incapable of meeting future requirements for data communication between instrument and controller. We shall be hearing more about this system—of that I'm sure.

The Frankfurt Show is a monster, this year's was the largest yet—what a pity we can't organise a show on this scale in the UK. Fifteen years ago we led the world in musical instruments, now ...

David Crombie

38 ▶

When it comes to Price/Performance, MXR Equalizers are more equal than others.

The balance between the dollars you invest versus the quality you get is what you should weigh into your decision when choosing an equalizer. That's why many leading recording and broadcast engineers, sound contractors and sound reinforcement companies have made MXR the industry standard for world-class performance at sensible prices.

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MXR now offers three professional models—the 170 Dual Octave EQ (10 band), the 171 Dual 2/3 Octave EQ (15 band) and the 172 1/3 Octave EQ (31 band). All feature center-detent controls, a lo-cut filter and signal present and Power LEDs.

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MXR Professional Products Group

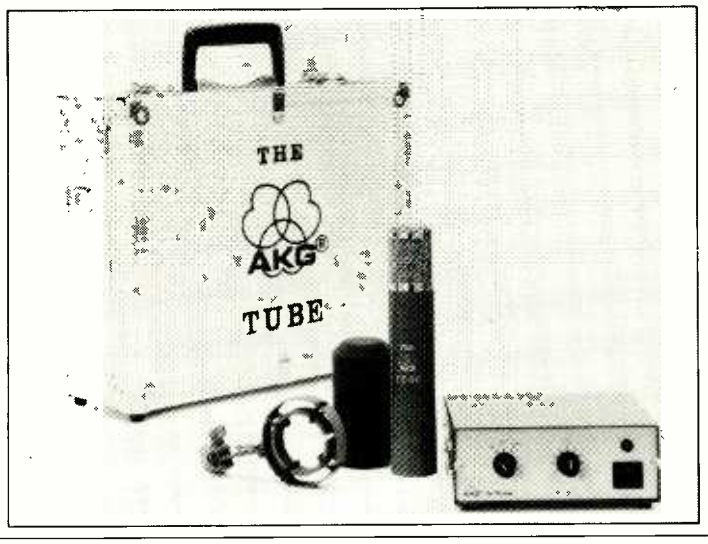
new products

The Tube

One of the most interesting microphones of recent years has to be *The Tube*, recently announced by AKG Vienna. While being very careful not to suggest that this mic is the 'way ahead' or a 'white hot technomiracle' AKG have introduced a valve mic, the first that they have built for many years.

The reasoning behind this mic can be easily seen. For some years now valve mics have been changing hands for vast sums and the aura surrounding certain models is immense. With this fact in mind, and that to their knowledge there is no manufacturer of similar mics in production, they decided to design a valve mic but using modern components and techniques. The heart of *The Tube* is a 6072 double triode. Early prototypes followed the method used in the past of utilising one side of the 6072 triode only. Field trials suggested that modern engineers were accustomed to rather more sensitive mics than this and so the design was altered to incorporate the other half of the triode. To this end there is an internal switch that allows the user to select the required operation. This addition gives an increase in level of about 10 dB. Due to the non-linear amplification characteristics of valves, this will also change the sound.

The Tube has its own power supply unit (48 V phantom powering not being applicable) that also incorporates 2-position bass cut and remote control of the polar pattern in 9 steps from omni through cardioid to figure of eight.



Inclusive in the price is a robust flight case, wind shield, shock mount and all the necessary cables. The mic is finished in a special brown non-reflective 'leather-like' enamel with brass trim and engraving.

AKG have made it quite clear that in terms of the specification it does not really compete with the best of current mics but have decided that in this case the sound is the important factor and the precise specification is only by-the-way. While a point of view with much to recommend it, this is not a step to change the shape of the recording industry as *The Tube* will be available in a limited edition and will also have a fairly high price tag, although probably less than the going rate for secondhand valve mics.

AKG GmbH, Brunhildengasse 1, A-1150 Wien, Austria. Tel: (43222) 9565170.

UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Tel: 01-749 2042.

USA: AKG Acoustics Inc, 77 Selleck Street, Stamford, CT 06902. Tel: (203) 348-2121.

Portable Mixer

The SELA *6F* portable mixer is a new unit from Audio Services Corporation, North Hollywood, California. It features six mic inputs, four line ins and three outputs plus foldback send. All the inputs are assignable to any or all of the four outputs and four extra mic inputs may be added.

The mic inputs feature 3-band EQ with parametric midrange plus HPF, the inputs being electronically balanced with phantom power, 'T' power and phase reverse facilities. Penny & Giles faders are used, and each channel has PFL capability.

The three line outputs have variable threshold limiters and patch points and there is a built-in oscillator which may be routed to any of the outputs, with two separate level setings. The slate mic adds a 33 Hz slate tone and is assignable to all outputs. Five monitor outputs allow separate headphone feeds which may pick up any of the outputs independently.

The mixer may be powered by internal 'D' batteries for 20 hours or by an external 18-35 VDC source. Overall noise is less than 2 dB and the response is quoted as 60 Hz to 30 kHz ±0.1 dB. THD is given as less than 0.01%.

Audio Services Corporation, 4210 Lankershim Boulevard, North Hollywood, CA 91602. Phone: (213) 980-9891.

Sound restoration unit

The *Owl 1* is a new product from Conductart/Owl in New York, designed to provide capabilities for the correct replay of all mono recordings regardless of age, and also to offer a useful range of filtering.

Controls on the unit allow selection of a number of source inputs—a Mode switch allows the monitoring of left-only, right-only and mono, plus 'vertical' (hill and dale); turnover selects the bass emphasis, RIAA or non-RIAA (including a 0 Hz setting for acoustic 78s); rolloff selects treble pre-emphasis correction and includes settings for no pre-emphasis (78s), late 78s with a little HF pre-emph, early LPs with 'excessive' pre-emphasis, as well as RIAA. In addition there are adjustable HPF and LPF controls.

The unit accepts magnetic cartridge and line-level inputs.

Conductart/Owl, PO Box 616, Ansonia Station, New York, NY 10023. Phone: (212) 580-2881.

Korg SDD-3000 digital delay

The SDD-3000 digital delay from Korg appears to be the start of a move into more studio oriented products. It is a standard 19in rack mounting design and claims a 20 Hz to 17kHz frequency response at all delay settings up to the maximum delay time of 1023ms which is possible without the use of extender modules.

Input and output connectors are at both front and rear and the unit has a 'true stereo' capability. Other features include delay bypass and hold switching, regeneration section with phase reverse and 4 high and 4 low filter positions on the feedback loop, final output phase reverse, square and triangle waveforms in modulation section with random and internal or external envelope control of the VCO, 3-position input and output attenuators, digital display of selected delay, most functions are programmable for quick changing between effects and the selected program is also displayed on the numerical readout.

UK: Rose-Morris & Co Ltd, 32-34 Gordon House Road, London NW5 1NE. Phone: 01-267 5151.

USA: Unicord, 89 Frost Street, Westbury, NY 11590. Phone: (516) 333-9100.

The Owl 1

The SELA 6F

ACES equipment

AC Electronic Services of Shropshire produce a wide range of cost-effective studio and live-sound equipment, all of which are detailed in their price list and brochures received recently. The range includes a number of crossovers, graphic EQ units and other ancillary equipment; a wide selection of power amps offering from 150 to 480 W per channel; a range of PA and studio consoles including units for 4, 8, 16 and 24-track applications (the top of the range being a 24-track in-line console with patch bay at £3,800—the ACML24/24), and a range of tape recorders which includes 16-track 2 in, 24-track 2 in, and stereo ½ in machines. Full details of the equipment available may be obtained from **AC Electronic Services, Broad Oak, Albrighton, near Shrewsbury, Shropshire SY4 3AG. Phone: (0939) 290 574.** ■

The funny-looking mike that's taken very seriously.

The PZM with its flat back plate, is as unconventional as it looks. Its revolutionary design eliminates phase-induced interference and provides a significant improvement in signal quality.

Indeed the PZM represents the most important advance in microphone technology of the last fifty years.

But why take our word for it? The PZM has won the utmost respect from sound engineers all over the world.

In a recent issue, Studio Sound examined the applications of the PZM in contemporary recording, and its conclusions are a glowing endorsement of all we've claimed for this remarkable microphone.

Top engineers were interviewed and confirmed that the PZM provided an undistorted output, free from comb-filtering.

They found that it gave a 180° pick-up with no off-axis problems and that it was ideal for reproducing anything from ambience to a grand piano.

They spoke of its extraordinary reach and clarity, of the way in which it simplified the business of miking-up and how its low profile made it ideal in hidden applications such as theatre and television.

All in all, the experts are deeply impressed by the PZM and already regard it as an indispensable tool in the creation of a transparently natural sound, free from non-linear characteristics, both on stage and in the studio.

For details of available models, including the new 3LV tie clip microphone, prices and suggestions for further applications of the PZM microphone, just telephone Mike Silverston on 01-961 3295.

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Ralph Denyer

SKY

SKY is a group whose very existence relies on achieving a successful blend of acoustic and electric instruments. As they all have very different musical backgrounds, there is a wide range of influences in their music. This also means they have to achieve what is at times a delicate balance of musical values and criteria. After many years as a top classical virtuoso guitarist, John Williams requires a far greater use of dynamics than is the norm with rock bands. Yet Sky's music employs many rock elements. Though also a classical guitarist, the major part of Kevin Peek's guitaristic input to the group is most definitely rock. The same can be said of bassist Herbie Flowers though his abilities to play virtually any type of music are legendary. Both percussionist Tristan Fry and keyboards man Steve Gray bring a wide range of musical expression to Sky.

With the exception of Tristan, they all play electric and acoustic instruments, and all are very discerning when it comes to amplification and recording of their music. As a result, there is a continuous dialogue between the group, their on-the-road sound crew headed by tour manager Andy Peacock and chief sound engineer Andrew Jones, the group's co-record producers Tony Clark and Haydn Bendall, and Malcolm Hill who designs, builds and supplies their touring sound systems.

The group, producers and sound crew worked together for two weeks at Abbey Road rehearsing for the group's *Sky Five Live* album, before the recording was made during a tour of Australia using the AAV-

THE group's chief sound engineer, Andrew Jones, has been with the group since their first tour. So how different is it for him working as sound engineer with Sky, a purely instrumental band?

"With an instrumental band, you are not masking the sound with a vocalist so therefore the quality of the sound on every instrument has to be that much better. So the approach is to go for more expensive microphones, using condensers when you normally wouldn't on the road. The DI boxes are all active instead of passive, so we don't get problems like saturation in the transformers and things like that. The approach is, in that way, more radical. With bands that have vocals, you tend to go for a certain quality which would be good enough.

"We can use a smaller system because we don't need the headroom for a vocalist over the top. We can use the whole system for the instrumentation which is why it can be small but loud."

At the other end of the scale the music can, at times, be very quiet indeed. During quiet sections such as Tristan's marimba feature, you could hear the proverbial pin drop. Andrew went on to explain the way in which he uses the gain structure in the system.

"You don't run the amps full out because you'd just amplify the hiss in the desk. We can drive the desk a little harder because, once again, we don't need the headroom. And we can turn the amps right down to a third power which is something you'd never be able to do with vocals, because you'd need a lot of headroom on the desk and need to get the amps turned up so you can do it. So the approach to how you use gain is different as well."

In fact, much of Sky's way of working on stage is closer to a recording studio approach.

Andrew continued: "I do go to the studio when they are recording and pick up on ideas. I talk to Tony Clark (co-producer of Sky's albums) about what to do on certain things. The whole live album was made easier because I've taken the studio approach on the road, everything was worked out in advance."

The live album was recorded with the AAV-Australia mobile. The only differences between the equipment used for the live recordings and British tour was that Neumann mics were used on the piano in addition to a *C-Ducer* transducer, Neumanns were used on the marimba and an extra mic was used on the snare.

On the subject of the Malcolm Hill sound system, let's hear more about the very low levels of background noise they have been able to achieve.

"The real noise comes off the stage amplification, Kevin's amps and effects. But there's virtually no noise at all from the system.

"Malcolm's worked really hard on the EQ, there are no phase problems between the bands. There are not many selection switches. The desk has eight bands of EQ so you can cut or boost virtually anything you want. It gives you much more versatility than a 4-way parametric or something like that. It makes life a lot easier; obviously it takes a little bit longer to set up because you've got more of a choice but it certainly works well. So Malcolm's really come up with the goods this time."

The Hill *J-2 Series* mixing console is one of the key elements in the success of the sound system.

"This desk seems to be the Rolls Royce so far but another one's in the pipeline already. We get the newest desk he's got every time we go out on tour."

Giving Sky his latest equipment to work with obviously provides advantages for both parties. Malcolm Hill gets a chance to check out the practicabilities of his designs while Sky get the best quality of equipment he can offer. And once again, the band's use of dynamic range gives Malcolm a chance to hear his equipment being stretched in ways that it wouldn't be with his rock band users such as AC/DC. If the desk is quiet enough for Sky, it will certainly be quiet enough for AC/DC or Saxon.

The System

Though the *M3* was originally designed very much to meet Sky's requirement for a high fidelity type of system, it is now used in all new Hill sound systems at the top end of the scale. Broadly speaking, previously the company had been making three types of systems. One type of system intended to meet the requirements of

LIVE

Ralph Denyer

Ralph Denyer

Australia Pty Ltd mobile. They are now seriously considering recording all future material live because they were so pleased with the sound of the acoustic instruments—acoustic guitars, harpsichord, grand piano and double bass—when making use of natural acoustics.

Sky's music covers a wide dynamic range in terms of sound levels which is more akin to that employed by a classical orchestra than a rock band. Whereas the monitor sound level on stage with most bands using the kind of amplification the group does is quite high, Sky keep theirs relatively low. To achieve this, Kevin's guitar amps are situated underneath the drum riser with the speakers heavily muted. Also perspex screens are placed around the drum kit. This is all done partly to give separation because of the acoustic instruments, but also because John doesn't like a high sound level on stage. Initially, as any rock guitarist would know, this made life extremely difficult for Kevin as he was not able to play at the volume required to produce an overdriven valve amp sound.

But together they worked on the problem and by means of their current stage set-up, achieve a solution acceptable to all. So John didn't leave the group, Kevin met the challenge and now plays with a degree of control that most guitarists should envy. Indeed, solving the problem added to the individuality of his playing.

During Sky's British tour in February, members of the band, sound crew and Malcolm Hill were asked about various aspects of the group's approach to live sound and recording.

high volume rock bands including AC/DC, one for Gary Numan and similar acts, and then one for Sky. They all make different demands on a sound system, so the drivers have to offer high sound quality, versatility and be robust.

Malcolm says: "Our attitude was that our job was to reproduce—as accurately as possible—what the artist was putting in at the other end so that it didn't matter what type of act you were dealing with, it should be possible to design a cabinet which would reproduce the heaviest rock and roll to the lightest classical music and we've got about 95% there."

Much development has gone into the *M3* cabinet, distinct in its design in that one cabinet houses all the drivers covering the bass, mid and high frequencies. Also the bass drivers are 12 in units whereas most large concert systems currently employ bass bins using 15 in units. Each cabinet is rated at a power handling capacity of 1 kW by means of three ATC 12 in long coil high excursion drivers to handle bass end, two Tannoy 10 in ferro-cooled dual-concentric drivers for mid-range and a Malcolm Hill designed dispersive flare glass fibre horn on a 1 in Renkus-Heinz throat. The bass driver section is heavily ported and the two Tannoy drivers set at an angle on either side of the horn. An interesting design feature involves crossing over from the horn into the high frequency tweeter in the Tannoy speakers. (The horn is a custom item designed to meet Sky's specific demands. Normally, a 2 in Renkus-Heinz throat is used in a similar horn.) More of the details of the speaker configuration and cabinet design will be covered later.

In terms of practical considerations, the cabinet has quite a lot to offer. The systems work on a simple modular basis. Each cabinet is driven by its own individual tri-amplifier and connected by one multicore connection. Andrew Jones told us that the actual wiring up of the Sky system takes literally 10 minutes after everything has been put in place.

The cabinets are relatively compact and pack together well for transportation purposes. On their last USA tour, AC/DC used a massive 80 kW Hill system. They were able to transport the entire rig in one trailer when usually a system with that kind of power handling capacity would require three vehicles. Continuing on the standard modular unit concept, all the cabinets incorporate a steel flying system. This does away with having two types of cabinet or separate hardware to fly sections of a rig.

Acoustic guitar

Moving on to the question of the sound of individual instruments, John Williams explained his requirements for his acoustic guitar in Sky.

"Well, I start from the ideal—which is obviously impossible but is the right aim to have—which is a completely faithful acoustic Spanish (or classical) guitar sound at unlimited volume with no intentional distortion."

The Spanish guitar produces a wide range of sounds with a strident bass, harmonically rich middle tones and a clear, sparkling treble. The traditional Spanish guitar sound is of course purely acoustic and it is a relatively quiet instrument. Because of the variety of tonal character within the instrument, when it is amplified problems are frequently encountered.

John's diverging musical activities, including solo concert performances, digital recording and working with Sky, have resulted in a keen interest in the questions of reproduction and amplification of the sound of the classical guitar. For his solo classical performances apart from Sky he uses light amplification, as the situation demands. His purely acoustic *Greg Smallman* classical guitar is miked up and he places two cabinets—similar to the monitors used with Sky—to face at an angle across the stage so that no one in the audience gets the direct sound from them. As a general rule he finds that the preponderance of harmonic overtones in the middle of the guitar's register frequently becomes over-accentuated in concert halls. To combat this he reduces the effect by an EQ cut at around 400 to 500 Hz. The third G string has a fundamental of 196 Hz and its first harmonic is at 392 Hz. The second B string has a fundamental of 246.9 Hz and a first harmonic of 493.8 Hz. So the 400 to 500 Hz cut makes sense. ▶

SKY LIVE

He then uses a boost at around 10 kHz to bring out the percussive elements of the sound of each note, including the nail striking the string as well as many of the characteristic sounds that make a guitar sound like a guitar. Following these basic guidelines, John achieves an amplified sound that he can live with.

His experience on the classical concert platform and with Sky (until recently playing an Ovation *Classic* model with a piezoelectric-type transducer built into the bridge of the instrument plus a built-in preamp) has made him well aware of the problems involved when trying to produce a true Spanish guitar sound through amplification.

John says, "Sky would not have existed without Ovation Guitars," but he now plays a Takamine *Hirade E9* classical model guitar about which he is ecstatic. The instrument is fitted with a piezoelectric transducer and preamp arrangement which is the same as that of the Ovation in principle. However, apart from the fact that it has a florentine cutaway, it is constructed on traditional lines.

During the time in which he was playing an Ovation with Sky, John was constantly trying to improve the quality of the amplified sound. This he did mainly by using an MXR graphic equaliser on stage and the EQ on the sound system desk.

The change to the Takamine came when, during the time they spent working on the material for the *Sky Five Live* album at Abbey Road, John was experimenting, trying to get a particular effect for a piece called *The Animals*. He couldn't get the sound he wanted from the Ovation. He tried out the Takamine he now plays and was so impressed he bought it on the spot. The guitar turned out to be ideal for his requirements. He now just has to plug directly into the mixing console via an active stage box. In fact Andrew Jones said that if there is anything amiss with John's sound at the soundcheck for a live gig, he immediately knows that something is not quite right in his lining up of the sound system to the acoustics of the hall.

By the end of the February British tour, they were just boosting around 200 to 250 Hz to compensate for the slightly light bass. The bottom E string fundamental is 82.4 Hz with a first harmonic of 164.8 Hz while the fifth A string fundamental is 110 Hz with a first harmonic of 220 Hz. John adjusts the active tone control on the guitar itself to take off a bit of top and that is it.

"So what you do by boosting the first harmonic is you add a little bit to the overtone warmth to the sound but you don't muddy it up by boosting the fundamental. The Takamine—compared to the classical Ovation—is a little bit light in the bass, which can be an extremely useful thing to have. Its sixth string is a little light whereas the Ovations are notorious for having quite a woofy sort of bass resonance.

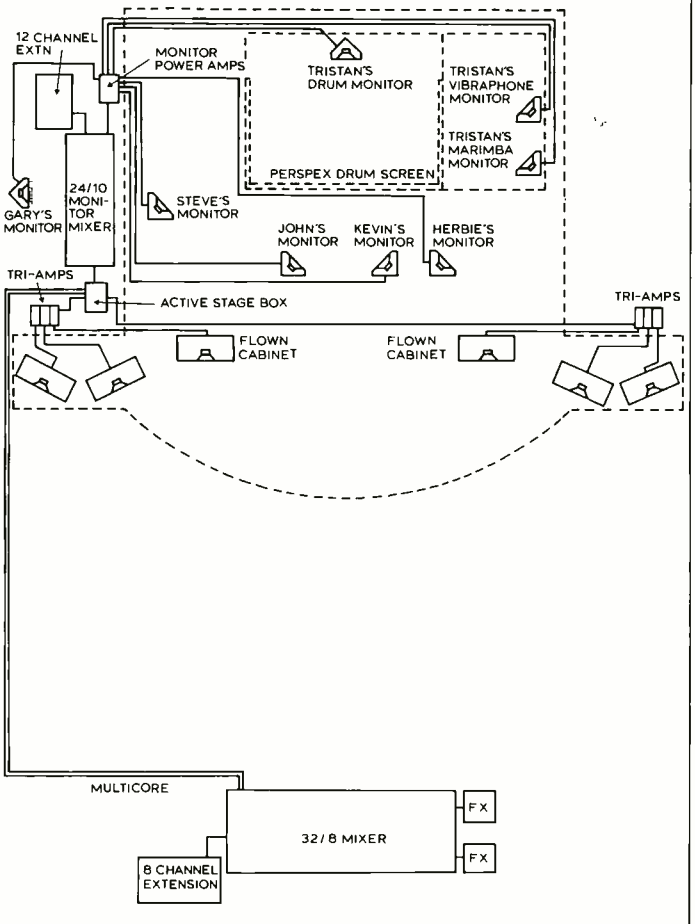
"The Takamine is a very good straightforward acoustic guitar; there's *life* in the sound. From my point of view, the Takamine is an enormous advance.

"We find that it's got all the warmth and harmonic content in the mid-range and it really *speaks*. Andrew says it's like a veil being lifted.

"To cover the general approach, I'd rather attempt the sound I want for the guitar within Sky on exactly the same principles as I do for a classical solo performance using a microphone. A lot of the acoustical problems are the same. The Takamine shows that you can successfully combine the natural ingredients of an acoustic sound which means overtones and harmonics. Those things which make a guitar sound like a guitar, sound like the *magic* of the guitar if you like.

"I think the main reason for them achieving this is they've made the guitar on absolutely traditional Spanish guitar lines. It's got a straightforward spruce top which is reasonably flexible, if you put your thumbs on it you can move it.

"It is the top of the guitar—as we all know—which produces 100% of the vibration. The fact that it is a proper Spanish guitar top means that crystal pickups are actually picking up wood movement as well as string vibrations through the bridge. Each harmonic the string sends is blended by the top of the guitar. If the top is not moving freely, it cannot integrate all those many harmonics and overtones." ■



Hill Audio Sound System

Sky at the Hammersmith Odeon

J2 Series mixing console 32/8 used in conjunction with 8-channel extension console
Six *TX 1000* tri-amplifiers, each powering one *M3* full range 1000 W cabinet (two *M3* cabinets were flown at balcony level)

Sound processing equipment:
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Four ADR *Compex* compressor/limiters for bass drum, snare top, double bass and electric bass guitar
One Lexicon *Prime Time* digital delay line
One Lexicon *224* digital reverberation unit
One Eventide *Harmonizer*
(Number of amps and cabinets varies with size of venue)

Monitor system:
J2 Series monitor mixing console 24/10 used in conjunction with 8-channel extension console
Four DX *701* dual channel amplifiers, each channel powering one of eight monitors of various designs, custom made for Sky

This feature continues in next month's *Studio Sound* and covers various aspects of recording live, live performance, the combined use of acoustic, electric and electronic instruments, the main sound system and the monitoring system.

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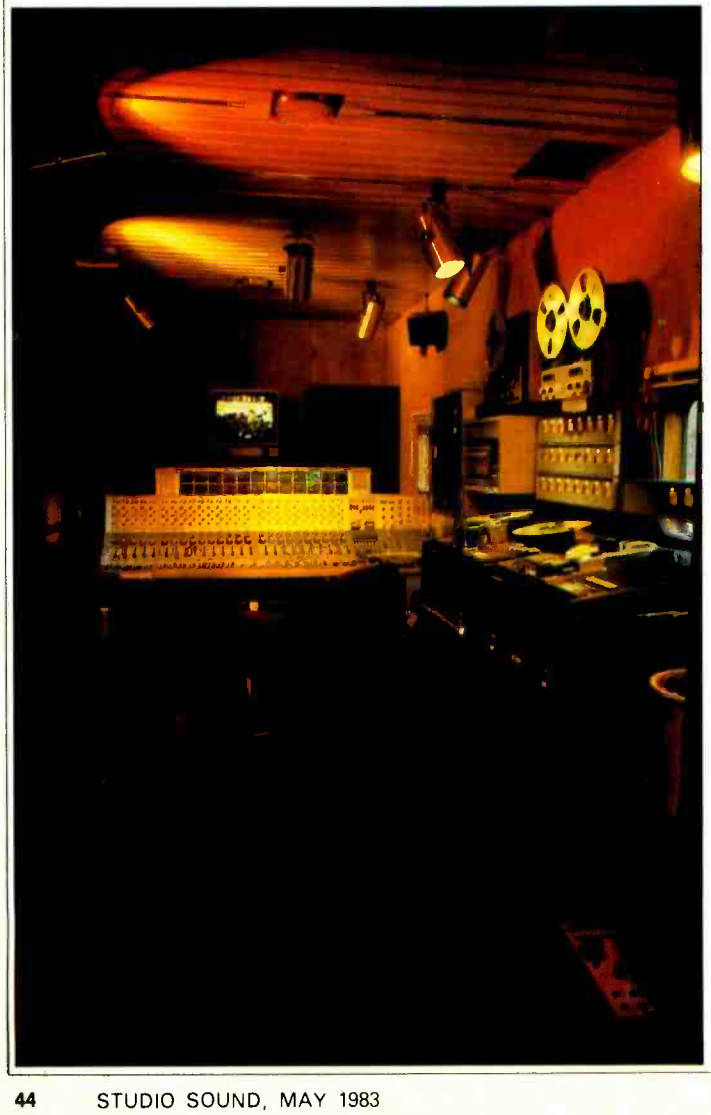
The Rolling Stones Mobile

Ralph Denyer

DURING the 12 years that the Rolling Stones' mobile has been operational, it has been consistently regarded as one of the top units of its type alongside those affiliated to well-known studios. The Stones do not have their own permanently located studio, so the mobile is booked through their London office. When not working, the vehicle lives in Shepperton where its handler—recording engineer Mick McKenna—feeds, maintains, modifies and generally cares for the mighty mover, occasionally even teaching it to do new tricks. Mick engineers many of the mobile's sessions, as he has for the past 10 years.

Pic: Ralph Denyer



The exterior of the unit is finished in genuine USA military matt camouflage green-and-brown colours with only a single small version of the Stones' logo giving any clue to the vehicle's purpose or famous owners. In fact the mobile's mysterious outward appearance gives it something of the ominousness of the truck in Spielberg's film *Duel*.

The original BMC Laird chassis, having clocked up some 160,000 miles, has recently been replaced by a new DAF 1600 Turbo unit with Air Ride suspension to protect the recording equipment from a bumpy ride over the UK's ever worsening road surfaces during transit. The mobile is air-conditioned and was blissfully warm inside during the afternoon in February when Mick showed us around.

Any thoughts of the Stones mobile being a rich group's plaything or tax write-off can be discounted. Though Mick is always more than happy when the word comes through to hit the road with the 'Guvnors' as he calls them, he quickly points out that The Mobile Studio Limited is primarily a business. The list of clients who have used the mobile is close to awesome and substantially backs up Mick's statement. They include Abba, Queen, The Who, Deep Purple, Led Zeppelin, Fleetwood Mac, AC/DC, Whitesnake, Ted Nugent and Motorhead. Also video, film and broadcast work fills a considerable part of the bookings diary, something Mick is keen to encourage in order to compensate for reductions in the amount of live albums being recorded of late.

The original acoustical design work was carried out by the late Sandy Brown. Past users of the mobile should note that recently Mick has been at work in the ceiling with "vast amounts of mineral wool and the like" with the result that the "somewhat messy bass end when monitoring" has been cleaned up considerably, allowing more accurate monitoring. Generally speaking, the interior of the mobile is attractive and comfortable with a surprising amount of space to move around in. This is partly due to the layout of the equipment which is positioned so that one engineer can operate everything if necessary. Interior dimensions are approximately 8 × 22 ft with 9 ft headroom.

Dick Swettenham of Helios designed the 32-in 24-out mixing console, still in use after 12 years. Mick says they do get a certain amount of flak about its age, particularly from musical acts conditioned to being lured into studios by state-of-the-art technology, unaware that many engineers are quite happy to work on an early but well maintained Helios, partly because the EQ facilities remain highly rated. Also the console has been modified considerably over the years. Ten years of mobile recording have taught Mick that flexibility is a key word. As and when he encounters a new demand, he responds by making sure that the next time the throw of a switch or some painless patching in will do the trick. The cumulative effect of this is that the mobile is able to meet a variety of requirements for a wide range of synchronisation modes, split feeds, video and such.

"My approach," says Mick, "is that if you can get the basic sound you want with mics, you shouldn't have to spend all your time messing around with EQ.

"That's an approach, my approach. The fact that the board does provide a very clean sound and

46 ▶

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There is a great deal to be said for Angela; so much, in fact, that there remains very little to say about the competition.

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The Rolling Stones Mobile

the fact that we very rarely go over 32 channels really puts me in the direction to keep this desk."

The feeling is that although a new desk could provide more channels as well as facilities such as parametric EQ, overall such a unit might not be as suited to the work as the Helios.

Mick continued: "In those situations when we've got more inputs than we've got input channels, we can run out up to 72 mic lines from the cable drums at the back of the truck.

"I've tried to work it out so that everything is flexible. So you could wind up with three different places having 20 inputs and another 12 with two of those groups of 20 or some similar set up. And we can then very quickly put another mixer in the mobile. All those lines actually appear *at* the Helios desk. So we just run out a couple of connections to patch in the additional mixer and Bob's your uncle."

The mobile has its own custom active splitter boxes with built-in monitoring, talkback and the like, that accept up to 10 inputs per box. This modular approach—which has grown out of *in situ* experience—is largely intended simply to make setting up quicker and easier. At the extreme, it allows the mobile to shuttle between completely separate locations which are ready and wired for sound.

There are two 3M 24-track recorders with 14 in spools, one 3M 2-track, two Revoxes and two 3-head cassette recorders. One Revox is usually consigned to the echo system. The Sony CCTV colour video system has a *U-matic* recorder which can be used in conjunction with a Sony PCM digital encoder when required, with the latter being hired.

On the subject of linking recorders together, Mick explained some of the many permutations possible with the Audio Kinetics *Q-Lock 310*: "All the machines can be linked so we can work 46-track, or link the stereo machine and one of the 24-tracks, or whatever combination is required. To give you an idea, with the *U-matic* running as the master with pictures and timecode, we could mix 46-track.

"We could lock one 24-track machine to the *U-matic* and then dub across to the other 24-track, say for instance, our mix tracks, two or three audience tracks and timecodes so that our mix tracks were on the other 24-track. Then we could instantly play all that back with the pictures without any further plugging or messing about."

The sound processing rack houses two Pye limiters, two Universal Audio *UA 1176* limiter compressors, two Audio & Design limiters and two compressors/limiters, Bel flanger, MXR phaser, two Roger Mayer noise gates, two *Kepex* noise gates, Orban Parasound parametric equaliser, vintage valve Pultec programme equaliser, and an Eventide *H910 Harmonizer*. Reverberation and echo is provided by a Lexicon digital reverb unit, Lexicon digital delay unit and two *Master Room* spring reverb units.

The mobile has a complete Dolby noise reduction system and a wide range of active and passive DI boxes. Virtually everything which is not screwed down is kept in stow boxes which can be quickly removed from the vehicle for setting up to leave it clear for clients as quickly as possible.

The main monitors consist of Tannoy *Super Red* speakers fitted in the Altec cabinets which originally housed their own speakers. They are powered by Cerwin Vega amplification and though EQ is available, it is not now used following the recent adjustments to acoustics. There are *Auratones* and the console's built-in talkback can be used as reference 'grot speakers', as Mick calls them. Also the Sony TV can be used for further mono reference monitoring.

The mobile currently carries a selection of over 100 microphones, including Neumann, Beyer, Sennheiser and Electro-Voice models. The Stones, as a group, have endorsed Shure microphones for many years, so not surprisingly the mobile carries a large number of them.

"We *do* use a lot of Shure mics but I think to great advantage. There are a lot of their mics I tend to use for fairly specific things. I've got good tom mics, good overhead mics. And there are certain Shure models—like the *SM 7*—if we only had *SM 7* mics it wouldn't be the end of the world because you can actually use them on anything and it will sound OK. They're a bit directional for vocals but you could get away with it if you had to. Actually, the *SM 7* is a great bass mic, that's the particular function I use it for." A hundred mics is a lot for anywhere, even a London studio. ■

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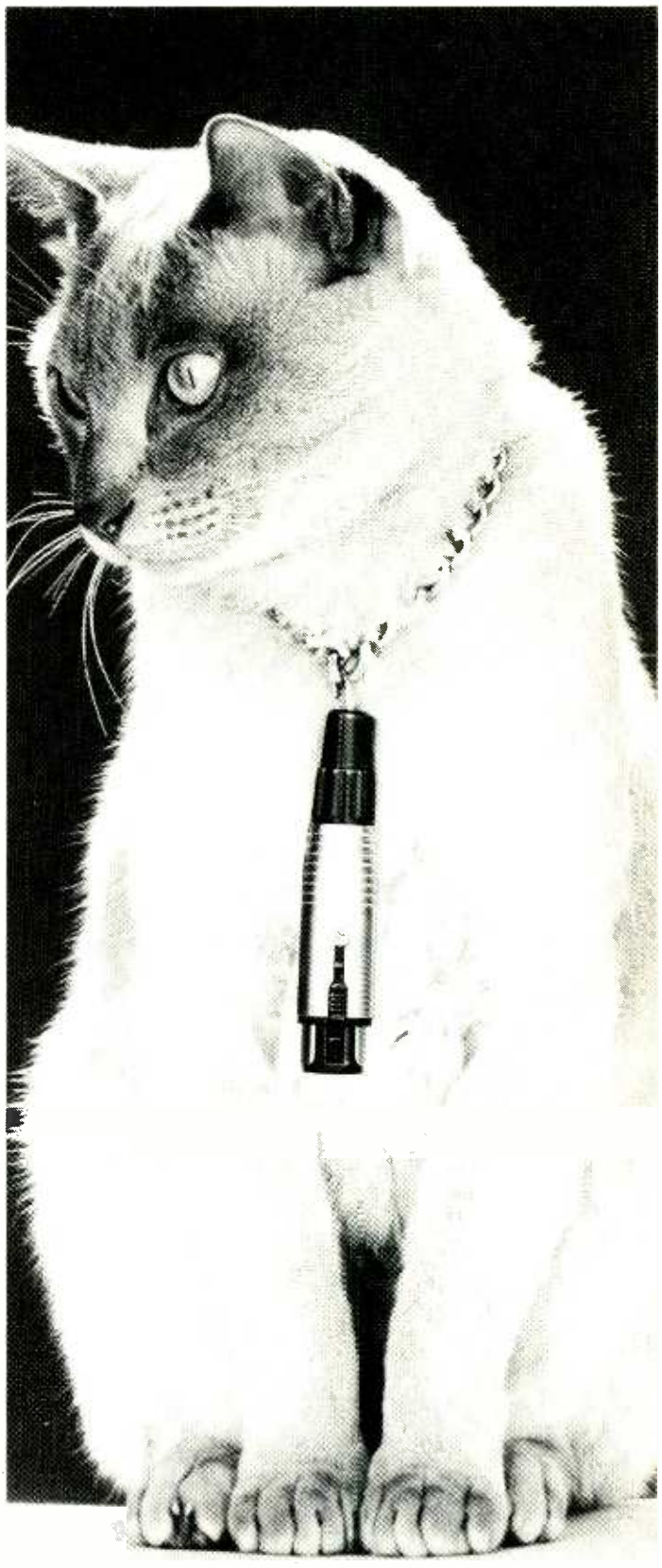

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Studiofile:1

Alpha Audio, Virginia

Alpha's composer Carlos Chafin and engineer Joe Sheets with client Dixie Merrian in Studio 1

Richmond, Virginia—although it was once the capital of the Confederate States of America, and is today the capital of the state of Virginia—is only the third largest city in the state, and despite its colourful history, is hardly the sort of place one would expect to find a thriving recording industry. Nonetheless, Alpha Audio, a world-class multi-room studio, and the numerous subsidiaries that fill its three-storey downtown headquarters, are doing very well.

Founded in 1970 as Virginia's first 16-track house, Alpha now boasts an automated 24-track room (the only one within 100 miles), a separate 8- and 16-track 'demo' studio slated for upgrading to 24-track, another ½ in 8-track room, a complete reel-to-reel and cassette duplicating facility, a multiple two-track voice-over and advertising production studio, a music production company (Candyapple Productions), a professional products division that does installation and custom design work as well as handling nearly 50 lines from AKG to X-Edit, and an in-house talent agency that draws musicians and actors from all over the mid-Atlantic region.

In addition, the company is the worldwide distributor to the recording industry of Sonex sound-absorbing panels. In his spare time, Alpha president Nick Colleran serves as treasurer (he was vice-president) of SPARS and sits on that organisation's Board of Directors.

Is there such a huge market for recording work in this lovely and peaceful city of 250,000? In a word, no—Alpha's clientele come from all over the East Coast, and as far away as Dallas and Los Angeles. Colleran calls his studio 'one of New York's largest ad agencies best-kept secrets'. There is, however, a large talent pool in the area, and the studio draws heavily from the Richmond Symphony. Artists who have made their living doing Alpha's jingle sessions in the past have included David Sancious and Pat Benatar.

About 60 per cent of the work done here is advertising and corporate audio/video. 'It's hard to find proficient engineers who are used to advertising work,' says staff producer Phil Coxon. 'The stuff here is tailored for agencies' needs. We do multiple two-track a lot because it's cheaper than multitrack. When they need copies, we have the dubbers in the next room. The engineers all swing between ad and record work, but Joe Sheets, our chief, does mostly advertising, because he's requested by the agencies so much. He's got the right personality for it, and he's the fastest guy with a razor blade I've ever seen.'

Coxon is in charge of Candyapple's operations, and is one of the few musicians/producers/arrangers employed full-time by any studio, anywhere. Besides his recording and musical duties, he travels widely, selling his and the studio's services. 'I can commit the studio to a project right there,' he says. 'I don't have to check back with the factory.'

It seems as if everyone on the 19-person staff here comes from a music background, from Colleran down to the shipping staff. Colleran, for example, worked with a band in the late '60s that sold a record to CBS. 'Thirty days later,' he recalls, 'our lead singer was drafted'. So he studied to be a Certified Public Accountant, but held on to the idea of remaining in the music business. The idea of a studio was hatched in 1968, and it took two years to come to fruition.

Today, the staff includes six full-time recording engineers. The operating philosophy throughout the organisation is that it's people who make a studio and bring the clients in. For example, when I arrived in town one Monday night, I was greeted at the hotel by a message from Alpha engineer (and former musician) Bobby Tulloh. He welcomed me to town, and invited me to go out with him and his girlfriend for some liquid refreshment—at 11 pm!

When I finally made it to the studio, bright and early Tuesday afternoon, Colleran, Coxon, Tulloh and general manager Eric Johnson were all eager to meet me. They even put off their bookkeeping (the auditor was due in the next morning) to spend the remainder of the day talking and showing me around.

Our tour began on the second floor with Studio IV. The building we were in, I was told, dates from 1913, and has served various functions, from a Railway Express Agency office to a synagogue. Some local clients, according to Colleran, get all misty-eyed when they come in here and remember that this was where they were Bar Mitzvah'd.

But back to Studio IV. It was built in 1979 around a (non-certified) LEDE-type design. It was constructed with music demo projects in mind, but lately advertising clients have taken to it as well. Equipment includes a Quantum *Gamma A* 16-input console, with an MCI 16-track deck convertible to 8-track, and Otari and Ampex ¼ in machines. Monitors are UREI *811A*s.

Studio II next door is almost exclusively used for advertising work. It features a Sphere *Alpha* 8-input board feeding several Ampex and Electrosound mono and stereo tape decks. Monitors are JBL *4311*s. Studio III is the dub room, with half a dozen stereo and mono Ampex machines, Otari ¼-tracks, a couple of Technics cassette decks, various equalisers and limiters, and Otari cassette duplicators. Reel-to-reel dubs are usually made at double speed, and run backwards to preserve transients.

On the third floor of the building is a large conference room and the main music studio. Studio I divides its time about equally between record and advertising projects. The control room, which is accessible either through the studio or by a back stairway, measures 16 by 18 ft, and is centred around a customised Sphere *Eclipse C* 32-input board, fitted with Allison *65K* automation. Multitrack tape is handled by a 24-track MCI with 16-track capability, while an Otari *MTR-10-2* does the mastering chores. A BTX *Shadow* SMPTE system locks audio up with a Sony *2860 U-Matic* video deck. The studio does a lot of tracks for TV and industrial video, but Colleran sees no need to invest in expensive video editing and layback equipment: with SMPTE, he can provide the client with a time-coded ¼ in master, which can then be processed at the client's video facility. The video monitor is a Sony *CVM-1900*, and audio monitors available include Urei *813*s, JBL *4313*s, *Auratones*, Yamaha *NS10M*s, and a speaker pulled from a wrecked '63 Chevy.

Dolby noise reduction is used all over the complex and the vast collection of outboard gear floats between studios. There are Pultec, Lang and Orban equalisers; DeltaLab, Loft, Marshall, Lexicon, Eventide and Cooper *Time Cube* delays; Teletronix, dbx, Orban, CBS, Allison, Urei, Eventide and Electrodyne dynamic processors; and Lexicon digital, EMT, AKG and MicMix reverb. The microphone inventory, 150 strong, is likewise shared by all the rooms, and includes an original *U47* mic, which Colleran got in exchange for eight hours of studio time, and a pair of *U67*s, which the studio received from a television station in exchange for four Shure *SM7*s. 'The prices for mics like that are ridiculous,' says Colleran. 'Those are the kind of deals I like to make.'

The studio room measures 65 × 35 ft, with 20 ft ceilings. It features a wide variety of acoustic environments, including one wall that is equipped with risers and reflectors to simulate a concert hall. There have been sessions that have called on the entire resources of the Richmond Symphony.

Instruments in the room (and beyond) include a 7 ft Yamaha grand piano and a tack piano, as well as a full range of electric keyboards and synthesisers, drums, amplifiers and assorted percussion. There is even (remember this one?) a *Coral* electric sitar in mint condition, which Colleran keeps in his office and uses to occupy his fingers when he talks with nosey trade magazines.

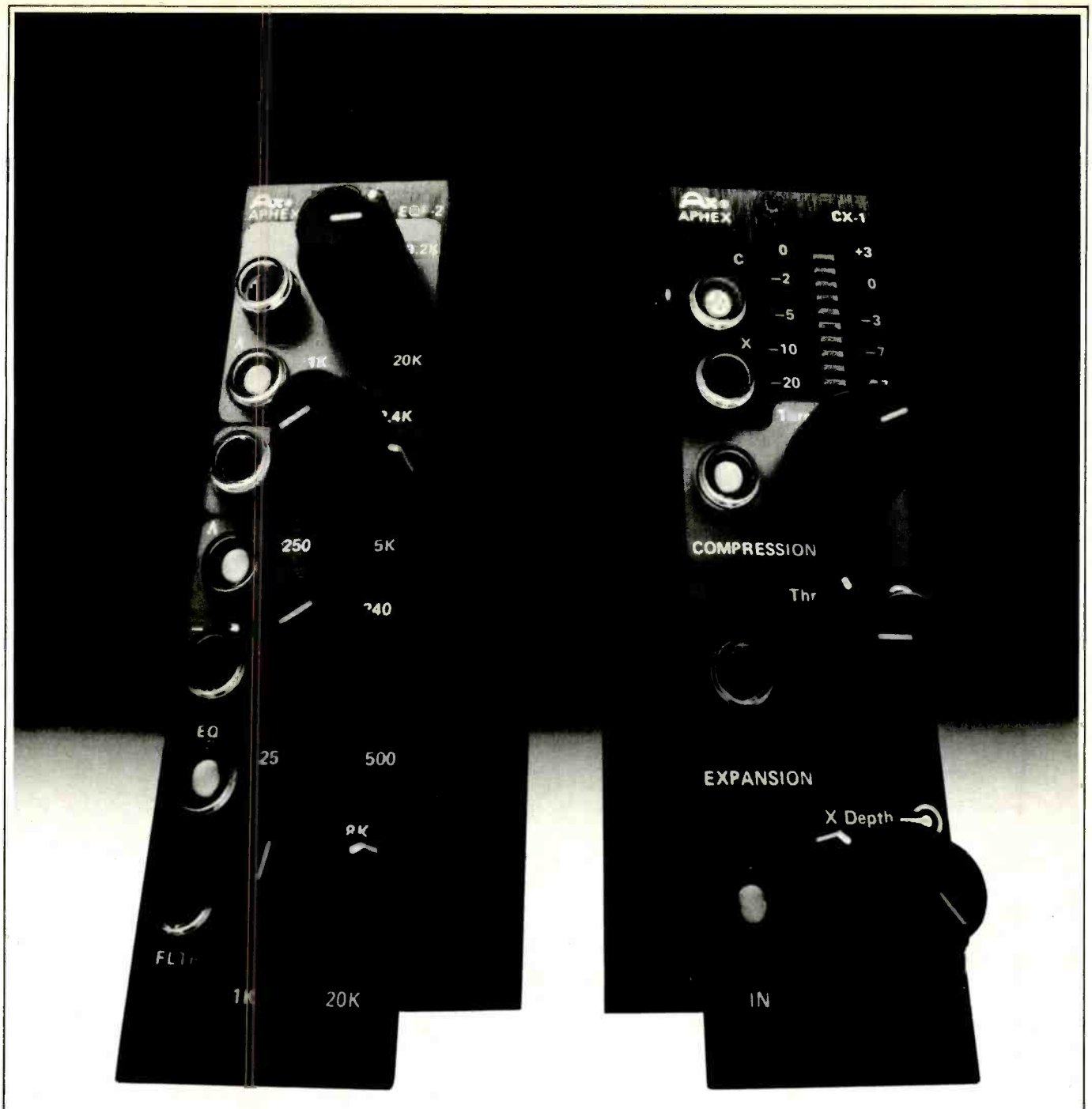
The one piece of equipment that Bobby Tulloh is most proud of is a set of custom cue boxes, designed and built by Alpha's staff, that allow each musician to mix and match up to eight cue sends.

Just completed is Studio V, a 'no-frills' room with a *Ramsa* console and an Otari ½ in 8-track tape deck.

As if the studios weren't enough, there is a suite of offices on the second floor, warehouse space behind the entryway on the ground floor, and a speaker-reconing and storage facility (Alpha sells and services JBL equipment) in the building next door.

Alpha Audio is doing remarkably well, and a lot of its success is attributable to the hustling that comes with almost everyone's job. Some feel that being the only game in town is something of a disadvantage, 'Rather than being the only 24-track here,' says Phil Coxon, 'we would have preferred five or six others to have opened when we did. It's like being the only gas station on a corner. If there were other teams of folks pulling in business, we would have people coming over here checking us out all the time.

Nonetheless, the clients are there. The studio recently won a gold record and an Ampex Golden Reel award for Fatback's *Backstrokin'*. Last spring, Snuff, who had come to Alpha after a horrid experience with a New York studio, finished up an 18-month-long project for Elektra. George Clinton, of Parliament/Funkadelic, was recently in producing Bootsy's ▶



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Studiofile:2

Rubber Band, and Colleran boasts that it was two weeks before any of their fans knew where they were.

Among corporate clients have been the Lee Myles auto-transmission chain, Mobil Oil (whose campaign won a Clio), Reynolds Metals (a live show), and Anheuser-Busch, who use Candyapple Productions both for jingle work and to do orchestra tapes for the live shows at the Busch Gardens theme park. "There's lots of recording business around," says Colleran, "which has nothing to do with making records".

One of the more unusual ways that Alpha has attracted clients has been with a self-produced audio 'tour' of the plant on a 45 rpm record, complete with follow-along colour photos, that was sent out to record producers, advertising agencies and other studios all over the country. Although it is now about four years out of date, copies of the record are still around, and Alpha's staff is still pretty proud of it. "The idea came to me," says Colleran, "when a friend of mine told me that reading about a recording studio is as useless as listening to a book". Of course, he's right, but if everyone followed his advice, a lot of nice people, like the ones who are bringing you this story, would be out of work.

Alpha Recording Corporation, 2049 West Broad Street, Richmond, Virginia 23220, USA. Tel: (804) 358-3852. New York tel: (212) 662-6711.

Paul D Lehrman

Joe Sheets in Alpha's Studio 4

Hispavox Studios, Madrid

To any of the millions of Spanish-speaking record buyers in the world the name Hispavox quickly brings to mind excellent classical records, collectors' items of Spanish music, a large list of modern day artists, and a number of worldwide hits in the pop music charts. Within the large complex which makes up Hispavox, SA, which is situated on the outskirts of Madrid, can be found the commercial offices of the record company, a modern 24-track Eastlake-designed recording studio for in-house recordings, a cutting room, record plant, printing plant, and a cassette manufacturing plant.

The direction of the studio has always been that of the company overall, which is to advance with the times, and if possible, be ahead of them.

Hispavox first opened its studio doors in 1963 and by anyone's standards, the original studio was very large with 5,000 m^3 in volume. Curtains and floating 'clouds' were used to regulate the reverberation of the room. Recording was live, of course, and monaural in format, however it wasn't long before experiments in stereo were being made. The control room was one floor up from the studio, overlooking the large floor area. The recording console was home-built by Hispavox employees.

In 1966 a new console was brought in from Germany, this being an EAB, 14 in/4 out valve unit which is still in operation today in another part of the complex. A surprisingly modern looking piece of equipment utilising the modular design of today's consoles, this was used in conjunction with an Ampex 4-track tape machine. The orchestra was still recorded live, as before, but the 4-track allowed for the addition of a voice later. The next move was to separate the recording of the loud parts of the orchestra from the softer elements, and the quest for more separation became important. To take more advantage of this dissection of the orchestra, the engineers began bouncing tracks and utilising several machines. This, of course, was a natural move away from what is natural. It's the same road everyone else travelled; turning away from naturalness and looking to technology for the answer. Of course, the possibilities of almost total control over what was to be recorded on to tape made this a very attractive road.

Due to the practice of bouncing, by 1969 Hispavox realised that they needed more tracks. The industry had taken up the 8-track format as a standard, but Hispavox felt they needed at least 12 tracks. They asked the Danish company, Lyrec, if they could design a 12-track machine with the same quality that others were getting on 8-track, and this brought about the building of what is believed to be the first 12-track tape recorder utilising 1 in tape. Each track benefited from the same recording head area as today's 24-track 2 in tape machines. Connected to the EAB console, it allowed 12 channels and 2 left over for echo. At the same time, Dolby was brought in for noise reduction, particularly for classical music recordings.

It was on this equipment that several worldwide hits were recorded. Many readers will remember *Beethoven's 9th, Song of Joy* sung by Miguel Rios (now today's undisputed No. 1 Spanish rock and roll star) and Mozart's *Symphony No. 40* by the late arranger/pianist, Waldo de los Rios. It was also the beginning of a very successful career for the Spanish crooner Raphael.

Not long after this a new console was purchased from Rupert Neve, a 24 in/8 out board. The old EAB was moved into an adjoining studio which was used for overdubs and small groups. The need for more tracks eventually demanded a change up to a 24-track, also from Lyrec.

By now it was obvious that the control room technology greatly outdated the studio; there was also a great change in the consumer's tastes —large orchestras were being used less and less to back the various artists in the Hispavox nest—so they decided to give up the large studio area and redesign it to record today's modern music. Tom Hidley of Eastlake was brought in for the job and the new studio was placed in the area of the original control room and the overdub studio. The overdub control room then became the control room for the new studio. The area left downstairs was soon put to use for storage and manufacturing.

The studio has a 'live' room with seating for approximately 18 musicians, an equally large isolation room which is half 'dead', half 'live' for percussion, acoustic guitar or voice during live recordings, and the main rhythm/brass room. For very large sessions requiring natural resonance, the recordings are moved to a concert hall, church, or theatre.

Updating was made complete with the purchase of a Harrison *40/32* console with Auto-Set, and eventually a Studer *A800* 24-track tape machine. Monitors were originally Tannoy, but these were later exchanged for JBL *4343*s.

The control room is very well equipped with an impressive rack including two UREI *LA3* compressors, dbx compressor, two EMT compressors, two Neve compressors, and an Eventide *Omnipressor*. Gates include four Kepex and two EMT filters. For effects they have an Eventide *Harmonizer H910*, a DeltaLab *Acousticomputer*, an Orban de-esser, and a Countryman flanger. Reverberation is by a monaural EMT plate, a stereo EMT plate, and an AKG *BX20*. Over the past 12 months the two in-house engineers have also taken advantage of a Lexicon *224* digital reverberator and more recently an Eventide *SP2016* digital reverb/signal processor on a rental basis which gives them a greater versatility in conjunction with their own reverbs. Various other equipment is rented depending on the demands of the particular producer and the monitor system can also be changed for the producer who might prefer close, medium sized monitors such as Tannoys or JBL *4311*s. There are also the ever-present Auratones.

Other equipment includes the older Lyrec 24-track machine, an Ampex *ATR100* 2-track, a Revox *A77*, a Studer *A62*, a Roland drum machine, and a new Akai *GX-F91* cassette recorder with a remarkable space-age front panel cover which automatically disappears on demand!

Hispavox Studios are well covered in the field of microphones as the following illustrates: Neumann *U67, U87, KM84*, AKG *202, 224, 414, 451*, Sennheiser *421, 441*, Shure *SM57, SM58, SM5, SM7*, Electro-Voice *RE20*, various Schoeps and two Crown *PZM*.

Amplification in the control room is by a Crown *DC300* and equalisation is with White ⅓-octave graphics. The metering system is an NTP TV monitor with 24 bars plus 4 bars for output. The same monitor is used as a closed circuit TV for more precise vision into the studio and also as a spectrum analyser designed by Hispavox technicians.

Studio instruments include a Steinway grand piano, electric/acoustic Yamaha piano, Fender electric piano, a complete drum set (Rogers), and amps by Fender, Roland and Yamaha. Headphones for the musicians are AKG.

From that impressive list one can readily see that Hispavox is a serious and very active studio. Basically, the record company's stars are Spanish, some of whom are the biggest names in Spain: Paloma San Basilio, Mari Trini, Juan Pardo, Jose Luis Perales, Raphael, and Enrique y Ana, who are now the top record sellers in the Spanish-speaking world after Julio Iglesias. Some of Spain's new groups have also found their home with this company and the two hottest items are Alaska y Los Pegamoides and male singer Ramoncin.

On occasions, Hispavox is involved in on-location recordings, particularly with a series of recordings of religious music at a monastery. This is an annual occasion and the outdoor recordings will be done this year on a Sony digital system.

Chief engineer Angel Barco expressed his pleasure at doing these recordings because he feels that it is a return to the 'natural' recording that has been lost with modern recording techniques.

Hispavox, throughout its years of history, has used all of the techniques we know today to improve its product without losing sight of the one necessary ingredient—naturalness. Whatever means must be taken to satisfy this criteria is offered to the producer at Hispavox Studios, Madrid.

Hispavox Studios, Torrelaguna 64, Madrid 27, Spain. Tel: Madrid 415-6350. **Jim Kashishian** ■

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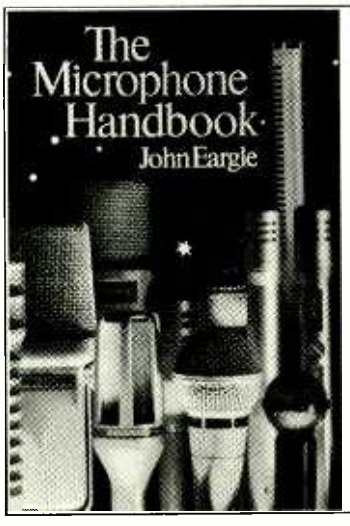
diary

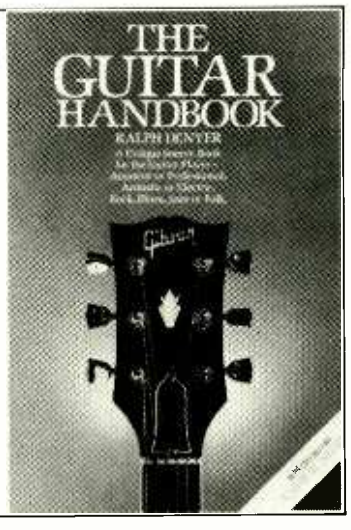
Book corner

Without a doubt it is a brave man (some say foolish) who puts pen to paper on the subject of microphones and their uses. There is not often much to criticise in chapters on the historical background and straight technical descriptions outside of style and down-the-line technical accuracy. Any references to mic technique and placement will however be the subject of much contention with there perpetually being 10 mic users ready to knock down the author for every one who will agree. And so it should be with any topic that is as subjective as the use of microphones. It is also true that the practising engineer views with suspicion the fact that few of the available books containing information on mic technique are actually written by regular practising engineers. In my experience mic technique is an art that grows with you and that you constantly have to refine and develop to changing musical and technical needs. Lack of practice means lack of knowledge because with mics, knowledge comes through practice. Happily there are exceptions.

● *The Microphone Handbook* is a reference book detailing in 14 chapters a very practical and consistent approach to all aspects of microphones. These chapters are further divided into four sections—fundamentals including basic transducer theory, directional characteristics, sensitivity ratings, care and maintenance; the microphone in its physical environment including use of patterns, proximity and distant effects, nearby reflections and multimic interference; the mic in its aesthetic environment with stereo techniques, live mic technique and use in the studio; and in the final section, electrical interface problems and accessories.

The author, John Eargle, is a man with a solid background in recording beginning in 1962 with RCA in a capacity giving him overall responsibility for the recording facilities; he has been chief engineer of Mercury Records; president of the AES; he is an accomplished musician and his present position is vice-president with JBL. His writing style is concise yet





very readable and I found it easy to just pick up and read even if I was not researching any particular point. Beyond this I found the approach to certain topics to be exceedingly well balanced and here I am referring to the miking sections. There is no bias towards close or 'traditional' techniques but a reasoned discussion of the facts with relation to a selection of instruments and without a 'this-is-where-you-place-it' attitude; more a 'this-is-what-may-happen' stance.

Take for instance the drums. Details on the specific mic positions are left to a simple diagram and the text actually goes beyond this to discuss track layout and panning arrangements, the use of minimal mics and then a technical approach to positioning with regard to the dipole response of a drum.

Illustrations are plentiful and photographic examples are chosen from a dozen manufacturers. Brief coverage is also given to newer and more specialised mic types such as the *PZM* and *Soundfield*. The ranges of topics covered necessitates some being less thoroughly detailed although further reference lists are given at the rear.

This is probably not a book that would be suited to a novice as it assumes a degree of familiarity with the topics covered but could be a highly recommended handy reference for the engineer seeking occasional guidance. We leave this book with a quote from the section on percussion instruments that could almost become the subject of a book in itself if you consider the logical inverse statement. 'It is a confident engineer or producer who will record the drum set on a single stereo pair of tracks.'

● Although not a subject directly connected to this magazine, *The Guitar Handbook* by Ralph Denyer will be of interest to anyone who comes into regular contact with guitars, either as a player or in a recording capacity. With construction techniques, a brief history of some of the important marques, adjustment, maintenance, customising, full electrical details, amplification, playing techniques, a chord dictionary, sound processing, sound reinforcement, home and multitrack recording—it is a very comprehensive work that can really only be faulted in minor areas. The necessary simplification to fit this very wide range of topics within the 256 pages which include liberal splashes of illustration, has meant that in certain areas wide generalisations are made.

If you record a lot of guitars—or even if you don't—an understanding of the instrument from construction to playing will always be a useful aid.

Ralph Denyer, author and occasional contributor to *Studio Sound*, has had a long association with the guitar both as a player and a knowledgeable writer on the topic. From this background he is able to convey an enthusiasm for the instrument and one area that the book may be useful in is as a reference to non guitar playing producers who know what they want but cannot communicate it to their musicians in musician terms—say no more. **KS-A**

Automatic panning equipment

We have been contacted by Richmond Sound Design Ltd, of 1234 West 6th Avenue, Vancouver, BC, Canada, with regard to our Product Guide in December 1982 entitled 'Autopanners', suggesting that the term 'Autopanners' infringes their alleged UK trademark 'Auto-Pan'. They request a 'retraction' of the use of the term 'autopan' (mentioned in the description of the Rebis *RA215*) and 'Autopanner' (used to describe the Survival Projects unit and as the section heading). While we believe that both terms are purely descriptive (unlike, perhaps, the word *Harmonizer*, which definitely *is* a trademark of Eventide Clockworks Inc) and note that it is uncertain exactly what standing the trademark 'Auto-Pan' has in the UK, or how widely it is defined, we have agreed to use other synonyms in the interests of goodwill unless it can be clearly demonstrated that those terms are *not* an infringement in the UK. Richmond Sound Design also wrote to the manufacturers in the Product Guide with a copy of their letter to us.

We would suggest therefore that manufacturers think carefully about describing automatic panning equipment and any names they might give to such units, in the same way as they consider pitch-shifters. Otherwise they might receive similar, unnecessarily heavy, letters from Vancouver. We respect the need to protect trademarks but regard it as stretching credibility somewhat to attempt to annex a descriptive term because your trademark is derived from it. If you made a *Compressotron*, would you expect to own the rights to the word 'compressor'?

Name change

Canford Audio (North America) Inc have changed their name to the Connectronics Corporation although all other operations of the company remain as before. Connectronics Corporation, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 324-2889. Telex: 643678.

Address changes

● Since February 1, 1983, the West Coast sales office of Gotham Audio Corporation and the Gotham Export Corporation has been relocated to the premises of Quantum Audio Labs Inc, a company recently acquired by Gotham.

The new address is 1909 Riverside Drive, Glendale, CA 91201. Tel: (213) 841-1111.

Contracts

● Otari UK have announced recent installations by Turnkey and ITA of MTR series recorders including a second *MTR90-II* 24-track and *MTR10* 2-track to Windmill Lane, Dublin; a 24-track and 2-track to Crescent, Bath; 24-track to Silk Sound, London and the private studio of the Human League; two *MTR10* 2-tracks to Chapell Music, and other *MTR10* 2-tracks to Paddy Kingsland, Revolution London, Rooster London, REL Edinburgh; and two *MTR* 4-tracks to Rediffusion.

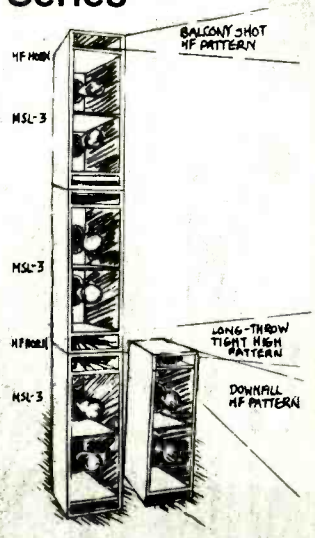
Forthcoming product guides

Each month *Studio Sound* carries several product guides and the occasional service guide. We depend on information supplied to us in the compilation and updating of these lists although in many cases we may well have the necessary information already in our files.

However, as a memory jogger for manufacturers and distributors with something new to be added to the guides (or an old product to be deleted) we will from now on publish the subjects to be covered in the next three available issues together with the final date for receipt of information for inclusion.

July:
tape recorders 16-track and above; autolocators; APRS Exhibition preview (29th April)
August:
test equipment; test tapes; metering; interconnection (27th May)
September:
mixing consoles (24th June) ■

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.

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

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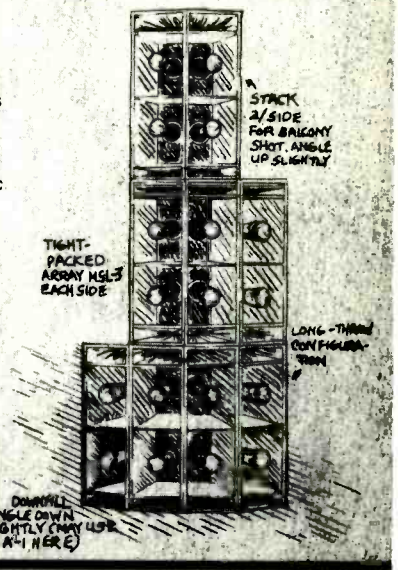
Meyer Sound reinforcement loudspeakers are designed as modular systems: full-range building blocks which offer the flexibility to meet a wide variety of demands. This means, for example, that the same product which serves for live music reinforcement in a 500-seat club can be used to make a large array 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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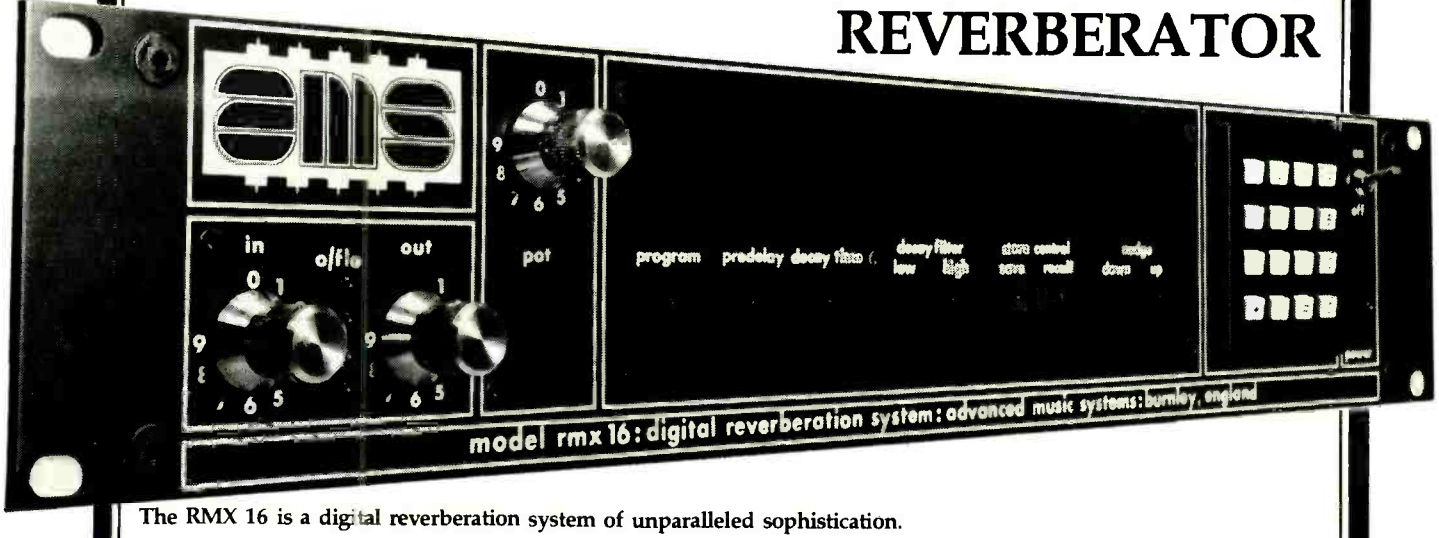
RMX 16 DIGITAL REVERBERATOR



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THE NEW OTARI MTR-90 SERIES II

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Hugh Ford, Studio Sound, November 1982

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The complete text of Hugh Ford's review, plus a comprehensive technical brochure and price details are available now. Further, should you desire your own

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letters

Disk or disc

Dear Sir, My sixth edition of the Concise Oxford Dictionary shows 'disc, disk . . .', and for 'disk' it shows 'see disc'!

Two US standards documents in my files (one from RCA, the other from RIAA) both use the form 'disc'.

The standardised logo for the CD uses the spelling "disc".

Our company dimensional standards for recordings also use the form 'disc', and looking around my office, I see that I have always used the 'disc' version.

So I vote for 'disc' is spite of the IEC and possible raised eyebrows at the logical extension to 'discette'! It seems the computer people win with 'disk' but the audio industry has well and truly adopted our beloved 'disc'. Perhaps one day we may see a third form, 'disq', when the French throw their hat into the ring and add to the confusion!

Yours faithfully, D Hudson, Studios 301, 301 Castlereagh Street, Sydney, Australia 2000.

Dear Sir, Disc for audio applications. Disk for computer applications. When using the more readily understood standards relating to tape speeds, I would have thought that 'ips' is more readily understood than 'in/s'.

Now then, my Hugo pocket dictionary says, micro—very small, phone—telephone. Telephone—instrument for transmitting conversation over a distance. So, by usage we get microphone, 'very small instrument for transmitting conversation'. Not 'mikrophone', unless perhaps you are of Germanic extraction. Mic looks OK to me. Mike could be mistaken for the engineer's name, so perhaps you should test the readership on this issue before continuing to use this standard.

Yours faithfully, Roger Norwood, Theatre Projects, 11-13 Neals Yard, Monmouth Street, London WC2H 2DP.

Experts' Errors

Dear Sir, Re: Experts' Errors by Don Davis (October 1982), and letters on this subject in the January issue, let me try to clean this matter up a bit more. The statement '0 VU = 1.228 V' has two errors to it if it is found on any part of a Standard Volume Indicator.

1. The most glaring error is the use of 'equal (=)' instead of 'equivalent (≅)'. VU can never be equal *to volt.*

2. The meter, as it is sold, should properly NOT be labelled at all, but if it must, then it should say '0 VU ≅ 0.775 V', but may not be so operated for the reading of program modulation.

It should be noted that the ANSI C16.5 standard describes a Standard Volume Indicator as consisting of two parts: (a) the meter, and (b) the attenuator (adjustable loss) or pad (fixed loss).

Incidentally, the term 'vu(sic) meter' (always lower case vu for the instrument) is never mentioned in the ANSI C16.5 standard. It is only a colloquialism. The proper nomenclature is Standard Volume Indicator. Mr John H Roberts is to be commended for his excellent and impeccably correct comments.

Yours faithfully, Stephen F Temmer, The Gotham Organisation, 741 Washington Street, New York, NY 10014 (Member, Working Group 4 (Programme Level Meters); Committee 29B, IEC).

Dear Sir, I have always appreciated your magazine because of its high level of technical accuracy, therefore I was amused but not alarmed when the ubiquitous Murphy got in a glaring typographical error in Don Davis's Experts' Errors article in your October issue. The error of course was the transposing of the lines 'A four-to-one change in power is 6 dB' and 'A two-to-one change in voltage is 6 dB. With this change the article becomes consistent.

Imagine my disappointment when in your December issue I found not a correction but Hugh Ford's letter. Mr Ford is correct in his discussion of the dB until he gets to the dBm. Here his error is in tying the dBm to 600 Ω, when the Standards define it as a power ratio with a 1 mW reference and no reference to any load impedance.

One could just as correctly speak of dBm delivered into an 8 or 75 Ω load. The dBV is in common use as a voltage ratio with a 1 V reference, and the dBu as a voltage ratio with a 0.7746 V reference. In America the dBv is often used instead of the dBu, but this leads to confusion with the dBV and therefore I would discourage its use.

As a person who has applied 0.7746 V to many VI meters, I must say that it has been a rare occurrence to find a meter that does not read 0 VU. Certainly, a good meter that meets most of the Standard, such as a Weston, will read 0. It appears that a few 'VU meters' have been made with a built-in meter attenuator for +4 dBu = 0 on the scale, but at least in America they are extremely rare. Any meter that will indicate 0 VU for a dissipation of +4 dBm in RL of Mr Ford's Fig 1 with the attenuator set to the +4 position, will also read 0 VU when 0.7746 V is applied directly to the instrument or as the 1940 Standard says: 'The reading of the volume indicator shall be 0 VU when it is connected to a 600 Ω resistance in which is flowing 1 mW of sine-wave power at 1000 cycles per second'. To make the point even clearer, the Standard further says: 'There should be no confusion because certain instruments deflect to a scale marking of 0 VU when a level of +4 VU is applied to them. As in previous volume indicators, the 0 VU point on the VU scale is merely an arbitrary point at which it is intended nominally to read the instrument, and the rest of the scale represents deviations from the 0 VU point. The volume level is read, not from the scale, but from the indications on the associated sensitivity control when the latter is so set as to give a scale deflection to the 0 VU mark. If a deflection other than 0 VU is obtained, the volume level may be corrected by the deviation from 0 VU shown on the instrument scale.'

In conclusion I am also disappointed in you and Mr Ford for the cheap shot taken at Mr Davis in the opening paragraph of the letter. Both of you have had higher standards than that in the past.

Yours faithfully, Ray A Rayburn, 64-08 68 Avenue, Glendale, New York 11385, USA.

Dear Sir, In your December issue, I am confronted by a special box containing Hugh Ford's arrogant ignorance regarding the dBm and the VU.

I can only pray that you have access to someone you trust who is at the same time competent to help you and Mr Ford understand the dBm and the VU.

1. The dBm in no way whatsoever relies on the impedance being specified. The dBm is a level *(a* power *level) expressed in decibels above or below a reference standard of .001 watt (one milliwatt) period.*

2. It is quite true "that 0 VU on the meter scale corresponds to a volume level *of +4 VU" because the level is* always *the sum of the meter reading plus* any attenuators associated *with the meter. The meter reading* is not the volume level.

That the recording industry frightfully misuses these venerable standards (dBm—1929; VU—1941) is evident from the correspondence generated by such a basic article.

Yours faithfully, D Davis, Synergetic Audio Concepts, P.O. Box 1115, San Juan Capistrano, CA 92693.

I thank Mr Rayburn for his constructive letter on the subject of VU meters and the dBm and might have had similar considerations for Mr Davis if he had refrained from accusing me of 'arrogant ignorance' and continuing with further personal insults.

My original letter was an attempt to clarify *current practice* in relation to the use of the dBm and to explain the original intended *modus operandi* of the instrument currently known as a VU meter, but defined in 1954 as a 'Standard Volume Indicator'.

In Mr Rayburn's letter he refers to documents 30 and 43 years old, and similarly Mr Davis goes back more than half a century for his 'standards'. The fact of the matter is that *current practice* often differs from historical practice even in such areas as spelling.

Whilst I agree that, historically, dBm referred to a power level of one milliwatt in a specified load, I am certainly not prepared to accept that this is current practice in the audio industry. To support my case I quote the Independent Broadcasting Authority in their *Technical Review No 10* (May 1978) as follows: 'It has become accepted practice in sound broadcasting to regard a power level of 1 mW in a resistance of 600 ohms, corresponding to a signal level of 0.775 V rms, as an absolute datum (0 dBm).'

Turning to the sensitivity of VU meters, I will not repeat the facts which I stated in my first letter. I would refer readers to IEC publication *268-10* (an international document) which, having explained that a Volume Indicator consists of three parts—an indicating meter, an attenuator and a fixed series resistor—states 'when a steady state sinusoidal voltage of 1000 Hz adjusted to develop 1 mW in a resistance of 600 ohms (0.775 V), is applied to the input of a vu indicator, the instrument will read −4 vu. The attenuator will then be in zero loss position, this position being marked +4 vu.'

So far as I am aware, all current VU meter specifications require calibration with the meter in series with 3600 Ω with zero VU being calibrated to +4 dB reference 1 mW in 600 Ω .

In this context I quote from the inscriptions of three different makes of VU meter in my possession. A 1955 vintage MIP instrument states 'USE EXT RES 3600 Ω F.S.D. 1.76 V A.C.'. Thus full scale corresponding to +3 VU is calibrated to +7 dBm with zero VU corresponding to +4 dBm. The two recent instruments manufactured by Ernest Turner and Sifam have the inscriptions '0 VU = 1.228 V = 7500 Ω' again zero VU being +4 dBm and 'F.S.D. 1.734 V EXTERNAL RES 3600 Ω'—again +3 VU corresponds to +7 dBm and zero VU +4 dBm.

Measurement on the Ernest Turner instrument with the 3600 Ω series resistance supplied with the instrument showed that zero VU corresponded to +4.16 dBm, but without the series resistance zero VU corresponded to −1.8 dBm. Get the point?

Hugh Ford

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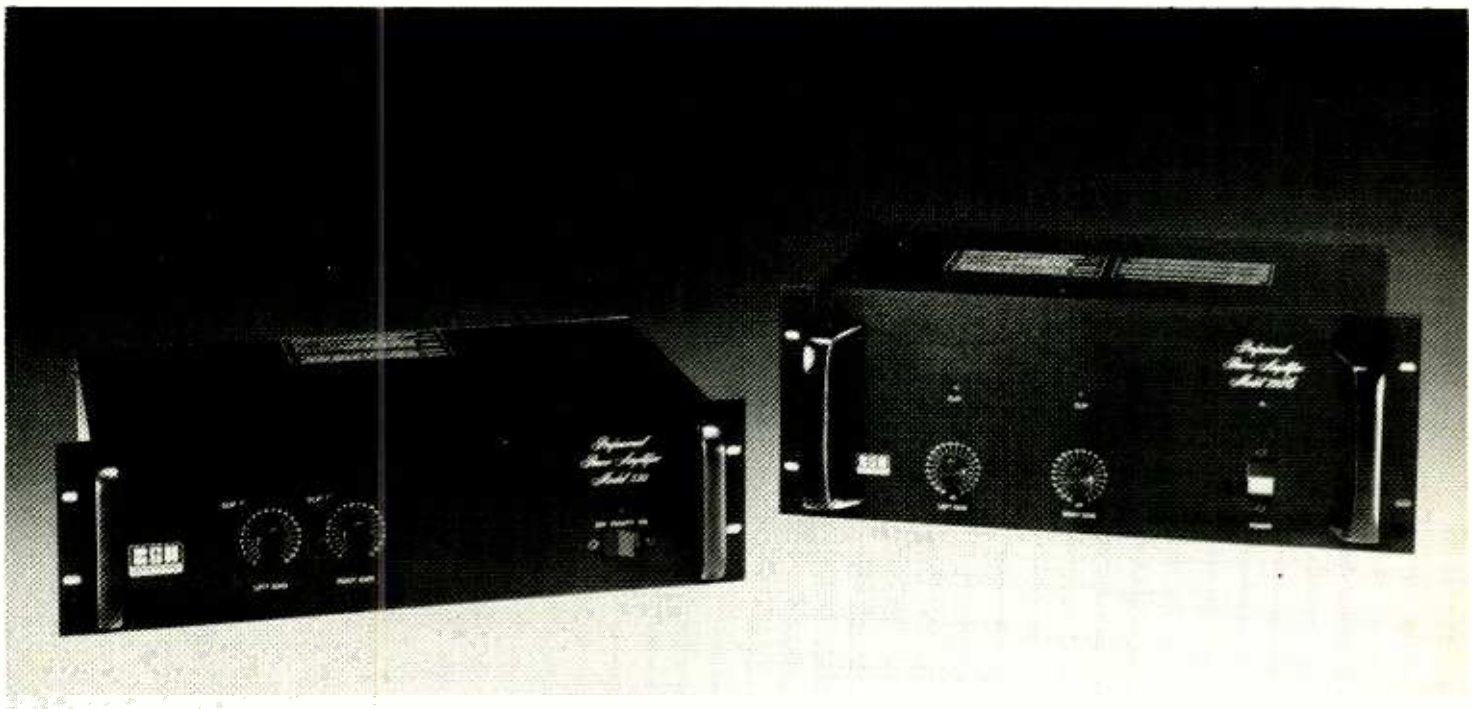

Specifications	Model 550	Model 750
Output power 8 ohms	200w	225w
4 ohms	325w	360w
Intermodulation distortion	Less than 0.03%	Less than 0.02%
Frequency response	20-20KHz	20-20KHz
	Fan Cooled	Fan Cooled

For further information contact:-

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Name

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product PA processing equipment guide

Electro-Voice model XEQ-2

AB SYSTEMS (USA)

AB Systems Design Inc, PO Box 754, Folsom, CA 95630. Tel: (916) 988-8551.
UK: Autograph Sales Ltd, Stable II, British Rail Camden Depot, Chalk Farm Road, London NW1 8AH. Tel: 01-267 6677.

Model 2400: 2-channel unit with separate gain and two fully adjustable crossover controls per channel; additional subwoofer output.

ACES (UK)

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

ACXV: 2-way and 3-way stereo electronic crossovers, fixed frequencies.

ACCUPHASE (Japan)

Kensonic Laboratory Inc, 2124-6 Motoishikawa-Cho, Midori-Ku, Yokohama. Tel: 045 901-2771. Telex: 3823780.
USA: Teac Corporation of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303. Telex: 677014.

Model F-5: 2-channel 3-way crossover with choice of 16 adjustable crossover frequencies.

ALTEC (USA)

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

Model 1630A: 2-way active system but can be operated in pairs for a tri-amped system.
Model 9025: 2-way passive low level crossover networks.

ASHLY (USA)

Ashly Audio Inc, 100 Fernwood Avenue, Rochester, NY 14621. Tel: (716) 544-5191.
UK: Atlantex Music Ltd, 1 Wallace Way, Hitchin, Herts SG4 0SE. Tel: 0462 31511. Telex: 826967.

Range of electronic crossovers with similar facilities but different formats; stereo 2-way *SC-22*, stereo 3-way *SC-77*, mono 3-way *SC-70* and mono 4-way *SC-80*.

AUDIOARTS (USA)

Audioarts Engineering, 286 Downs Road, Bethany, CT 06525. Tel: (203) 393-0887.

1400: parametric electronic crossover for 3- or 4-way systems, crossover depth control.
1500: tunable notch filter, feedback suppressor, $\frac{1}{6}$-octave bandwidth, five identical sections covering 52 Hz to 7.3 kHz.
2100A: tunable electronic crossover, parametric with crossover frequency continuously variable.

AUDIOMARKETING (USA)

Audiomarketing Ltd, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 359-2312. Telex: 996519.

Time/Sync: crossover designed to be compatible with Audiomarketing's *Red Series* studio speaker system, or any *604*-type loudspeaker; incorporates time delay in the lowpass section to align the output of the drive units.

AUDIX (UK)

Audix Ltd, Station Road, Wenden, Saffron Walden, Essex CB11 4L9. Tel: 0799 40888. Telex: 817444.

Custom design of rack systems including ambient-noise sensing amplifiers.

BGW (USA)

BGW Systems Inc, 13130 S Yukon Avenue, Hawthorne, CA 90250. Tel: (213) 973-8090.
UK: Theatre Projects, 10 Long Acre, London WC2E 9LN. Tel: 01-240 5411.

Model 10: single-channel 2-way crossover system with subsonic filter.
Model 5015: 2-channel, 2-way crossover with fixed subsonic filters.

BIAMP (USA)

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

M2/V: mono 2-way crossover includes low frequency filter and high frequency phase control.
SM23: stereo 2-way or mono 3-way identical to *M2/V* but lacks LF filter and HF phase control.

BROOKE SIREN SYSTEMS (UK)

Brooke Siren Systems, 213 Sydney Road, Muswell Hill, London N10. Tel: 01-444 7892. Telex: 912881.

MCS Series 200: modular expandable crossover system with integral limiting and output metering. Maximum capacity of 5-way stereo. Frequencies set by plug-in cards.
FDS 300 Series: frequency dividing systems, *FDS 320* 2-way; *FDS 340* switchable 3-way/4-way.

COURT ACOUSTICS (UK)

Court Acoustics (Sales) Ltd, 35-39 Britannia Row, London N1 8QH. Tel: 01-359 0956/5275. Telex: 268279.

EC-2/3/4: stereo 2-, 3- or 4-way system. Each crossover point has choice of four frequencies.

CROWN/AMCRON (USA)

Crown International Inc, 1718 West Mishawaka Road, Elkhart, IN 46514. Tel: (219) 294-5571. Telex: 810-295 2160.
UK: HHB Hire & Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Tel: 01-961 3295. Telex: 923393.

VFX-2A: stereo filter system that can be used to provide crossover network or bandpass functions. Two filters per channel high and lowpass. Setting both filters in one channel to a common frequency provides a 2-way crossover at that frequency. In mono it can be used as a 2- or 3-way system.
MX-4: mono electronic crossover, 3-way plus subwoofer.

CUTEC (Japan)

UK: MTR Ltd, Ford House, 58 Cross Road, Bushey, Herts WD1 4DQ. Tel: 0923 34050. Telex: 925859.

CX230: 2-way 2-channel or 3-way mono electronic crossover with 8 crossover points. Rack mount.

DDA (UK)

DDA Ltd, Unit 7B, Worton Hall Trading Estate, Worton Road, Isleworth, Middx TW7 6ER. Tel: 01-847 0363.
North America: Heinl Electronics Inc, 16 Mary Street, Unit 1, Aurora, Ontario, Canada L4G 3W8. Tel: (416) 727-1951.

DD1000: active frequency dividing network with plug-in programming modules. May be configured for 2-, 3- or 4-way stereo operation.
DD500: 2-channel, 2-way or mono 4-way crossover.

ELECTRO-VOICE (USA)

Electro-Voice Inc, 600 Cecil Street, Buchanan, MI 49107. Tel: (616) 695-6831.
UK: Shuttlesound Ltd, 200 New Kings Road, London SW6. Tel: 01-736 0907.

XEQ-1A: electronic crossover, 2-band, 5-position Thiele LF equalising network.
XEQ-2: 2-way active crossover/equaliser similar to *XEQ-1A*.

FURMAN (USA)

Furman Sound Inc, 616 Canal Street, San Rafael, CA 94901. Tel: (415) 456-6766.
UK: Atlantex Music Ltd, 1 Wallace Way, Hitchin, Herts SG4 0SE. Tel: 0462 31511. Telex: 826967.

TX-3: unit with 2 crossover points enabling use as stereo 2-way or mono 3-way system. Adjustable over 20 Hz to 20 kHz in three switch selectable ranges.
TX-4: identical to *TX-3* except switchable for either mono 4- or 5-way, or stereo 3-way operation.

GELF (UK)

Gelf Electronics Ltd, Unit 5, Mount Avenue, Bletchley, Milton Keynes MK1 1LS. Tel: 0908 77503/647262.

GX-24: electronic crossover for stereo 4-way operation; crossover frequencies are fixed with each of the outputs having a VU meter and level control.

HH (UK)

HH Electronic, Viking Way, Bar Hill, Cambridge CB3 8EL. Tel: 0954 81140. Telex: 817515.
USA: Audio Techniques Inc, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 359-2312. Telex: 996519.

X300: switchable 2- or 3-way stereo frequency dividing network with sub-bass filter.

HILL (UK)

Hill Audio Ltd, Hollingbourne House, Hollingbourne, Kent. Tel: 062 780 555.
USA: Hill Audio, 4204 Potter Hill Road, Saugerties, NY. Tel: (914) 336-6588.

3XMVF: stereo 3-way continuously variable crossover system. Rack mounting. Mono version available.

INTERFACE (USA)

Interface Electronics, 6710 Alder, Houston, TX 77081. Tel: (713) 660-0100.

XO 612: stereo 3-way crossover with high, mid and low level controls; usable in other mono formats.

IVIE (USA)

Ivie Electronics Inc, 500 West 1200 South, Orem, UT 84057. Tel: (801) 224-1800. Telex: 910-971 5884.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.

5202: modular 2-way crossover with continuously variable crossover points; selectable slopes for high and lowpass filters; optional equalisation for HF drivers and Thiele tuned LF enclosures; phase reversal and test points for real time analyser.
5203: 3-way crossover similar to *5202* with crossover frequencies adjustable between 200 Hz to

60 ▶

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Tel: 0256-794011 Terry Lyon

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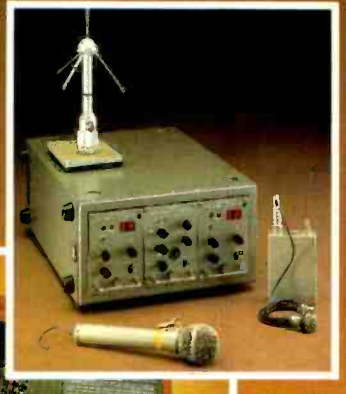
Tel: 0256-794011 Terry Leaphard

Studio Microphones

Wireless Microphone Systems



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Tel: 0256 794011 Telex: 858373

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Niederlassung Köln, Bleriotstrasse 1-3,
5000 Köln 30, Germany
Tel: 0221-59-3097/98 Telex: 8883042

Sony Broadcast Limited,
Case Postale 414, 1215 Geneva 15,
Switzerland
Tel: 41-22-985225/6 Telex: 28737

product PA processing equipment guide

2 kHz and 800 Hz to 8 kHz; can also be used as 2-way.
5306: six tunable notch filters in module matching other *5200* series modules; each notch has depth of 0 to 12 dB and tuning range of 50 Hz to 3.2 kHz; compressor to sustain feedback during tuning. Modules form part of *5000 System*.

JBL (USA)
James B Lansing Sound Inc, 8500 Balboa Boulevard, Northridge, CA 91329. Tel: (213) 893-8411. Telex: 674993.
UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD. Tel: 0753 76911. Telex: 849069.

5233/5234: electronic crossover systems for mono and stereo operation respectively; mono system 2-way and stereo 2-way or 3-way mono.

LINDSAY (UK)
Lindsay Electronics Ltd, Unit 5, Salome Works, Prospect Place, Trowbridge, Wilts BA14 8QA. Tel: 02214 64282.

7613: modular electronic crossover, compressor and delay system; max system capability is 5-way.

PROAUDIO (UK)
Proaudio Ltd, 30 Wolsey Drive, Walton-on-Thames, Surrey. Tel: 09322 21078.

PA23: crossover/limiter system for stereo 2-way operation; each band has separate level control, limiter and line-driver amplifier.

RSD/STUDIOMASTER (UK)
Recording Studio Design Ltd, Faircharm Trading Estate, Chaul End Lane, Leag, Luton, Beds. Tel: 0525 570621.
USA: Studiomaster Inc, 1365C Dynamics, Anaheim, CA 92806.

3- or 5-way stereo crossover systems; separate level controls for each band with adjustable crossover frequencies.

SCV (France)
SCV Audio, Batiment 3418C rue de la Jeune Fil, Zone de Fret Sud, F-10314 Roissy. Tel: (1) 862.43.04. Telex: 212940.

Stereo crossover for tri- or quad-amping systems; independent adjustment for output level and crossover frequencies on each channel in addition to limiters with LED indicators.

SOLIDYNE (Argentina)
Solidyne Srl, Tres de Febrero 3254, 1429 Buenos Aires. Tel: 701-8622.

ANTIR-305: anti-feedback system, introduces a 5 Hz shift in the audio spectrum.
251-IN: ambient noise controlled processor, expander/compressor/limiter, ambient noise controlled VCA changes output level tracking noise level.

TANNOY (UK)
Tannoy Ltd, Rosehall Industrial Estate, Coatbridge, Strathclyde ML5 4TF. Tel: 0236 20199.
USA: BGW Systems Inc, 13130 South Yukon Avenue, Hawthorne, CA 90250. Tel: (213) 973-8090.

XO 5000: dividing network incorporating single point parametric equaliser; separate plug-in modules for the optimisation of the crossover characteristics of different loudspeaker systems.

TAPCO (USA)
EV-Tapco, 3810 148th Avenue NE, Redmond, WA 98052. Tel: (206) 883-3510. Telex: 910-449-2594.
UK: Shuttlesound Ltd, 200 New Kings Road, London SW6. Tel: 01-736 0907.

CP-X: stereo 2-way and mono 3-way crossover.
EX-18: stereo 2-way or mono 3-way electronic crossover.

TEASER WIREWORKS (USA)
Teaser Wireworks, PO Box 59346, Dallas, TX 75229. Tel: (214) 233-9362.

Model 400/400A: fixed frequency 2-way stereo crossover; features clip indicators; 10 dB cut and boost for each channel; versions with preset controls or knobs. Version *400A* has adjustable crossover frequencies from 50 Hz to 15 kHz.
Model 600/600A: 3-way stereo crossover with the 'A' version having variable crossover frequency; fixed version available with any specified crossover frequency at 18 dB/octave; options include mono bass output and subsonic filters.

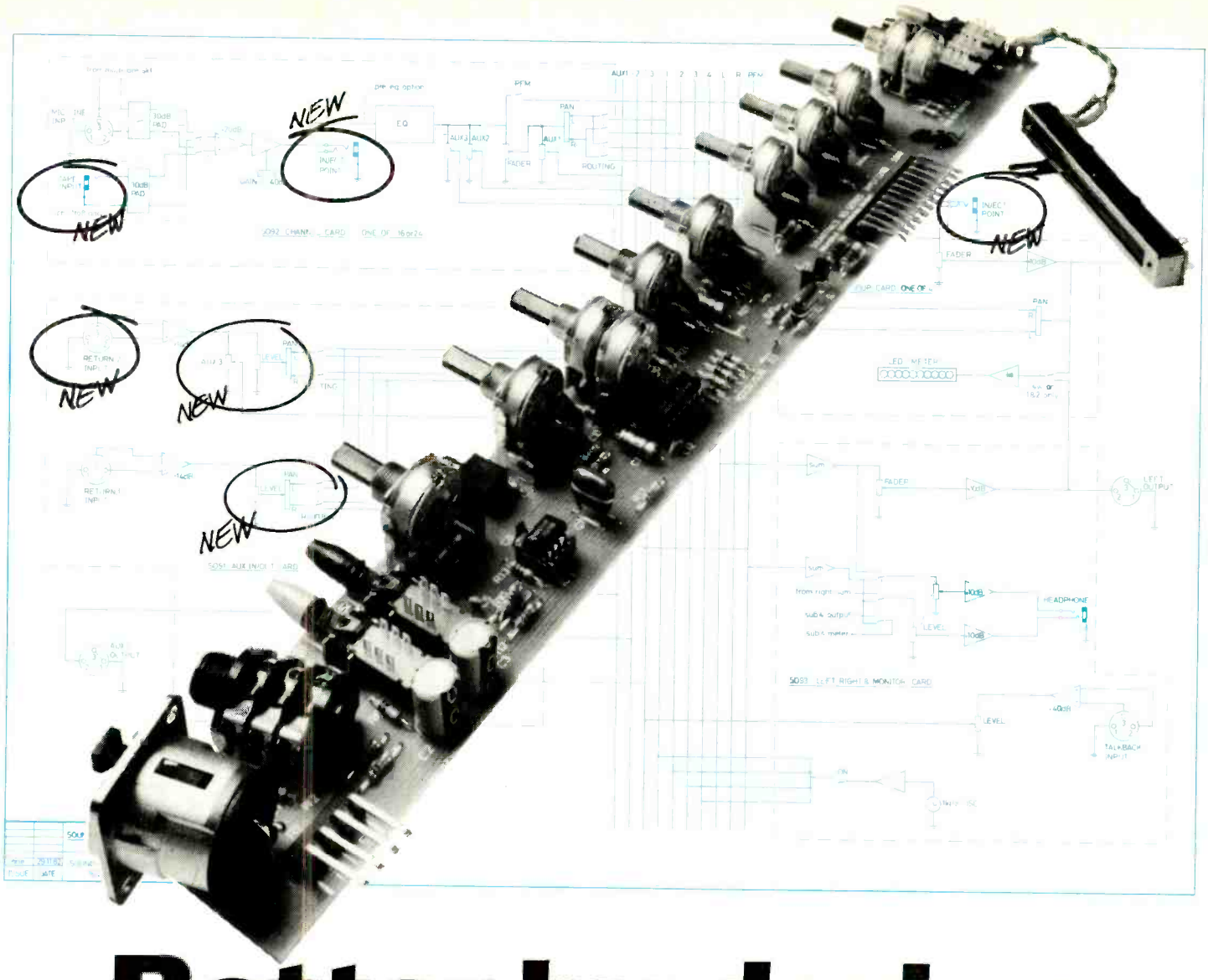
UREI model 525 electronic crossover

UREI (USA)
United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, CA 91352. Tel: (213) 767-1000. Telex: 651389.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.

521 Series: crossover system, *521 P* holds four crossover cards with integral power supply, *521 E* is identical but lacks power supply; two versions of the crossover cards are available with frequency ranges suited to high and low crossover points.
Model 525: switchable stereo 2-way, 3-way or mono 4-way or 5-way operation; integral frequency counter to measure crossover frequency under adjustment to nearest Hz; LED indication of active controls in selected mode; separate level controls for each output.
Model 562: feedback suppressor containing five active notch filters and continuously adjustable high and low cut end filters.
Model 567: PA processing system including input amplifier, headroom indicator, pink noise generator, 10-band graphic equaliser, four frequency feedback suppressor, 2-way electronic crossover with integral power supply.
Model 950: ambient noise controlled amplifier which monitors ambient noise through a room-noise sensing microphone (eliminating that portion related to the PA signal) and raises the PA level in exact proportion to fluctuations in the room-noise level.

YAMAHA (Japan)
UK: Yamaha Musical Instruments, Mount Avenue, Bletchley, Milton Keynes, Bucks. Tel: 0908 71771.
USA: Yamaha International Corp, PO Box 6000, Buena Park, CA 90620. Tel: (714) 522-9105.

F1040: 4-way crossover network with six switchable positions at each crossover point; separate output controls for each band; also available as *F1030* 3-way. ■



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service Mobile recording guide

This is a listing of mobile recording trucks, offering multitrack remote facilities categorised by the country in which the facility is based.

AUSTRALIA

AAV-Australia Pty Ltd, 180 Bank Street, South Melbourne, Vic 3205. Tel: (03) 699-1844.

CANADA

Filtroson Mobile, 4 Careé des Bois, St. Thérèse, Quebec J7E 2R3. Tel: (514) 733-8166.

FRANCE

Le Voyageur, Société d'Enregistrement Laurent Thibault, Le Château, F-95300, Herouville. Tel: 446.54.59.
Publison Mobiles, 5-11 Rue Crespin du Gast, F-75011 Paris. Tel: 357.64.08.

NETHERLANDS

Mirasound, Langstrasse 51, NL-8131 BB Wijhe. Tel: 1826.
Studio Janssen, Nusseleinstraat 19, NL-5966 NH America. Tel: (04764) 1207.

SWITZERLAND

Heubi Mobile, Audiocom AG, CH-3210 Kerzers. Tel: (31) 95.57.42.

UNITED KINGDOM

Abbey Road Studios (EMI), 3 Abbey Road, London NW8 9AY. Tel: 01-286 1161.
Blue Angel, 7 Derwent Road, Fulford, York YO1 4HQ. Tel: 0904 58436.
Manor Mobile, The Manor House, Shipton-on-Cherwell, Oxford. Tel: 08675 77551.
Mobile One, 29-30 Windmill Street, Tottenham Court Road, London W1P 1HS. Tel: 01-580 3744.
The Mobile Studio (Rolling Stones Mobile), 2 Munro Terrace, London SW10 0DL. Tel: 01-352 0005.
RAK Recording Studios, 42-48 Charlbert Street, London NW8. Tel: 01-586 2012.
Soundbox Mobile, 18 Clifton Villas, London W9. Tel: 01-286 5490.
Sutton Sound, 80 Queensway, London W2 3RL. Tel: 01-262 9066.

USA

Artisan Recorders, 1421-A SW 12th Avenue, Pompano Beach, FL 33060. Tel: (305) 786-0660.
Chaton Recordings, 5625 Nauni Valley Drive, Scottsdale, AZ 85253. Tel: (602) 991-2802.
Criteria Recording Studios, 1755NE 149th Street, Miami FL 33181. Tel: (305) 947-5611.
Fanta Professional Services, 1213 16th Avenue S, Nashville, TN 37212. Tel: (615) 327-1731.
Record Plant, 8456 W Third Street, Los Angeles, CA 90048. Tel: (213) 653-0240.
Record Plant NY, 321 W 44th Street, New York, NY 10036. Tel: (212) 581-6505.
Reelsound Mobiles, PO Box 280, Manchacha, TX 78652. Tel: (512) 472-3325.
Roadway Recorders, 51 Glendale Avenue, Livingstone, NJ 07039. Tel: (201) 325-2056.
Sanborn Productions, PO Box 120, Route 3, Ashland City, Nashville, TN 37015. Tel: (615) 254-6538.
Sound 80, 2709 E 25th Street, Minneapolis, MN 55406. Tel: (612) 721-6341.
Wally Heider Recording, 1604 N Cahuenga Boulevard, Hollywood, CA 90028. Tel: (213) 466-5474. (No current information available.)

WEST GERMANY

Dierks Studios, Hauptstrasse 33, D-5024 Pulheim/Cologne 33. Phone: (02238) 3333.

service Mobile Contractors guide

This guide provides a listing of contractors for the construction of mobile recording units. Our service guide on studio designers and consultants (April 1983) details companies capable of designing such vehicles.

AFA (USA)

AF Associates Inc, 100 Stonehurst Court, Northvale, NJ 07647. Tel: (201) 767-1000.

AMPEX (USA)

Ampex Corp, 401 Broadway, Redwood City, CA 94063. Tel: (415) 367-2011. Telex: 348464.
UK: Ampex International, Acre Road, Reading, Berks RG2 0QR. Tel: 875200. Telex: 847611.

AUDIX (UK)

Audix Ltd, Station Road, Wendon, Saffron Walden, Essex CB11 4LG. Tel: 0799 40888. Telex: 817444.

BOSCH (West Germany)

Robert Bosch GmbH, PO Box 429, Robert Bosch Strasse, D-1600 Darmstadt. Tel: 06151 808270. Telex: 419256.
UK: Robert Bosch Ltd, Rhodes Way, Watford WD2 4LB. Tel: 0923 44233. Telex: 935244.

BRABURY (UK)

Brabury Electronics Ltd, Smitham Bridge, Hungerford, Berkshire RG17 0QU. Tel: 048-86 3511. Telex: 848760.

CLYDE (UK)

Clyde Electronics Ltd, Ranken House, Blythswood Court, Anderston Cross Centre, Glasgow G2 7LB. Tel: 041-221 5906/248 3001.

DELL (UK)

Dell Technical Vehicles Ltd, Broken ford Lane, Totton, Southampton SO4 4DX. Tel: 0703 860044/5. Telex: 477426.

GERTENSLAGER (USA)

The Gertenslager Company, Wooster, OH 44691. Tel: (216) 262-2015.

HARRIS (USA)

Harris Corp, PO Box 4290, Quincy, IL 62301. Tel: (217) 222-8200. Telex: 404347.
UK: Dynamic Technology Ltd, Zonal House, Alliance Road, Acton, London W3. Tel: 01-993 2401. Telex: 935650.

MARCONI (UK)

Marconi Communication Systems Ltd, Marconi House, New Street, Chelmsford CM1 1PL. Tel: 0245 353221. Telex: 99201.
USA: Marconi Electronics Inc, 100 Stonehurst Court, Northvale, NJ 07647. Tel: (201) 767-7250. Telex: 9919752.

MVC & CROW (UK)

MVC & Crow Ltd, Darwin Close, Reading, Berks RG2 0RW. Tel: 0734-871654. Telex: 847056.

NEVE (UK)

Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU. Tel: 0763 60776. Telex: 81381.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744-6230. Telex: 969638.

RCA (USA/UK)

USA: RCA Broadcast Systems, Front and Cooper Streets, Camden, NJ 08102. Tel: (609) 338-3000. Telex: 834357.
UK: RCA Ltd, Lincoln Way, Windmill Road, Sunbury-on-Thames, Middlesex TW16 7HW. Tel: 09327 85511. Telex: 24246.

SIEMENS (West Germany)

Siemens Aktiengesellschaft, D-7500 Karlsruhe 21, West Germany. Tel: 0721 595 2428. Telex: 7826851.

THOMSON-CSF (France)

Thomson-CSF, Division Radiodiffusion-Television, 94 Rue Du Fosse Blan, F-92231 Gennevilliers. Tel: (1) 790.65.49. Telex: 620573.
UK: Thomson-CSF Equipment and Systems Ltd, Hunting House, Central Way, North Feltham Trading Estate, Feltham, Middlesex TW14 0UD. Tel: 01-751 6241. Telex: 934215. ■

"No noise, nor silence, but one equal music."

John Donne, 1571-1631.

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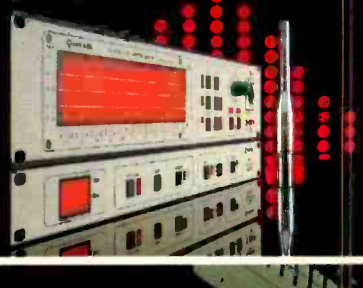


A personal view of psy

IT is now some time since any buyer of professional or semi-professional audio equipment has been able to say that when used properly, the 'Bloggs special phase-corrected delay line'—or anything—sounded bad. Modern equipment is generally excellent; it has to be, the competition is fierce. Because of the weight of innovation and the clamour for custom, some manufacturers write their specifications to show their equipment in the best possible light. Then a reviewer gets hold of it and gives sets of results that although accurate, are difficult to interpret without considerable study and knowledge of test procedures. The pet T. Fletcher hobby-horse is noise measurement and interpretation; closely allied to this is the subject of overload—and this is the area that separates the men from the boys—the Studer from the Sanyo, (the Aston from the Austin?) Overload margin is the amount of extra signal that a piece of equipment will handle above the normal operating level. This amount varies considerably in different equipment.

The human ear is a perverse instrument because of its logarithmic response—so for convenience, audio level measurements are also logarithmic, ie dB units. dBs are ratios—a figure of 6 dB merely shows that something is twice the signal voltage of something else. To get general understanding of absolute signal voltages between engineers, we use a device to refer everything to (a ratio of) a fixed signal voltage. In the UK this voltage is 0.775 V RMS; in the USA it is 1 V RMS—the difference between the two being about 2.2 dB.

The ear has an overall dynamic range of about 120 dB at mid frequencies. This statement has to be modified to include a time factor: there is no way at all that anyone can listen to a whisper at 30 ft immediately after Concorde has flown over (I get about 120 dBA in my back garden!) The ear possesses the extraordinary ability to apply an approximate 60 dB dynamic range 'window' to all it hears. Thus, on a quiet summer night, one can hear crickets about ½ mile away and if everything is extremely quiet, one can discern the sound of blood in one's own arteries. A noise of more than 60 (acoustic) dB higher than this will cause the 'window' to be moved up to accept the louder noise as comfortable. Once this has occurred, the low level sound will be placed below the threshold of hearing temporarily.

This effect is remarkably similar to a slow-reacting compressor—it is nature's own AGC with an attack time of less than 1 s and a restore time of between 5 s and several days.

There is no real answer to the question 'What is the absolute signal/noise ratio or dynamic range of the human ear?'—it depends on the programme content, the timing and dynamics of the input. Equipment that reproduces sound, ideally should be able to encompass everything that the ear can hear, with a safety margin.

Table 1 is an interesting look at what dB measurements mean in terms of volts: (0 dBu = 0.775 V RMS)

The calculation for volts from dBu is:

$$\text{RMS voltage} = .775 \left[\text{antilog}\left[\frac{\text{dBu}}{20}\right]\right]$$

this is derived directly from

$$\text{dB} = 20 \log\left(\frac{V1}{V2}\right)$$

where $\frac{V1}{V2}$ is a voltage ratio.

It has become convention to measure audio signals in RMS volts (root-mean-square). For a sine wave, this is the same as an average reading—a sum of the shaded areas in **Fig 1**.

Table 1

dBu	volts RMS	volts peak-to-peak
−100	7.75 μV	21.9 μV
−90	24.5 μV	69.3 μV
−80	77.5 μV	219 μV
−70	0.245 mV	0.693 mV
−60	0.775 mV	2.19 mV
−50	2.45 mV	6.93 mV
−40	7.75 mV	21.9 mV
−30	24.5 mV	69.3 mV
−20	77.5 mV	0.219 V
−10	0.245 V	0.693 V
0	0.775 V	2.19 V
+10	2.45 V	6.93 V
+20	7.75 V	21.9 V
+30	25.5 V	69.3 V
+40	77.5 V	219 V

A microphone amplifier

Without going into noise theory, suffice it to say that the noise measured from a microphone amplifier should be within a couple of dB of the theoretical residual noise of a resistor of equal value to the microphone impedance. For a 200 Ω microphone the noise at the microphone input will be approximately −128 dBu or 0.3 mV RMS. To this must be added the voltage gain of the microphone amplifier, say 50 dB. Then the noise at the output of the amplifier is −128 + 50 = −78 dBu. The maximum signal output of a microphone amplifier will be in the region of +20 dBu, so the signal range from noise to overload point is −78 dBu; 98 dB (note dB,—a ratio). This looks magnificent—however, it allows for no overload margin: all signals will be at the clip point of the amplifier. A realistic overload margin for a microphone amplifier is 22 dB—this allows for transient signals up to 12 times higher than peak level, so reducing our peak signal-to-noise ratio down to 98 − 22 = 76 dB—a respectable figure.

Mixers

With current (no pun intended) sophisticated mixing systems, basic mixing noise is down around the −88 dBu figure for smallish mixers. Given a signal handling capability of up to +22 dBu this represents an overload/noise ratio of 110 dB. This is an interesting figure in that it gives the lie to the argument that a 16-bit digital mixer is going to be the ultimate—the reality is that a good analogue path can be at least 14 dB quieter than a perfect digital one—and will not suffer from quantising effects, restricted HF bandwidth, phase horrors and an affinity for kilowatts of power consumptions not to mention the cost.

Line in to line out of a good mixer should show a signal-to-noise ratio (noise-to-peak signal) of approaching 96 dB. This is using the conventional +8 dBu as a peak level.

Intermediate stages and ancillaries

Mixer equalisers add or subtract gain at different frequencies, making overload margin extremely important. If 10 dB of gain is added then the overload margin is reduced by that amount—so it is essential that an equaliser has a margin at least as good as a microphone amplifier. Later in the sound chain, level correction can be made and overload margin becomes less important, but the practice is still to have about 12 dB in hand above peak level.

Limiters, compressors, delay lines etc, all have their own problems with overload margin. Most of these are sorted out—as far as the user is concerned—by the adoption of standard levels. Conventional professional equipment operates at 'nominal zero' indicating that +8 dBu is a sensible peak operating level while cheaper semi-professional equipment tends to work at '100 mV' which is approx −17 dBu. A good way of using this sort of equipment is to crank it up till it cracks, then drop back 12 to 14 dBu and call that peak operating level. The lower operating level equipment will inevitably be more noisy or more prone to overload problems or both, but this is just an example of getting what you pay for.

The tape machine

Analogue magnetic tape works by magnetically lining up oxide particles in a pattern. 'Playback' is the sensing of this magnetic alignment by a sensitive detecting head. If too much level is pushed on to the tape, then all the particles are lined up identically and the tape is saturated. Unlike electronic circuits, the approach to overload is gradual, and partial saturation occurs several dB before complete saturation. This effect is sometimes known as 'tape compression'.

At the other end of the scale, the noise generated by tape is an effect of random magnetic alignment of the tape particles and—like the microphone amplifier—has a limit. This varies proportionally with the track width and tape speed. ¼in ½-track tape running at 7½ ins has a noise/overload ratio of approximately 68 dB, overload in this case being defined as the signal level where distortion becomes unacceptable—3% total harmonic. Because of the 'tape compression' effect, it is possible to work with a narrower overload margin than with a mixer (where the onset of distortion is sudden, and very audible) and this is usually set at 6 dB. It is then a simple sum to show what the best possible signal/noise ratio is from our tape machine: 68 − 6 = 62 dB.

This is quite a difference from our 96 dB possible on the mixer and demonstrates clearly the weak link in the recording chain. A 16-bit digital machine is an entirely different bucket of bits; the earlier figure of 96 dB noise to overload of a digital mixer or processor is still valid, as the tape becomes merely a data storage medium and the ratio is a function of the digital system not the

:hoacoustics-Overload

Ted Fletcher

medium. Because overload is sudden and catastrophic, the overload margin needs to be more than for an analogue machine—similar to a mixer where the figure was 12 dB. A careful operator watching his levels could get away with 10 or even 8 dB making the signal/noise ratio 86 or 88 dB—a very acceptable figure and not only 4 dB than the best noise reduced analogue machine (¼ in stereo anyway) but with the added advantages of zero wow and flutter and excellent linearity.

Power amplifiers

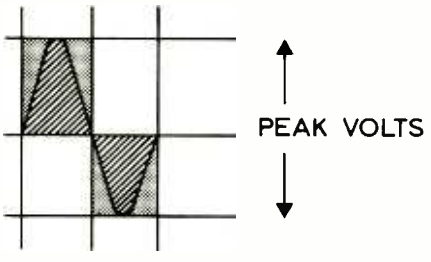
The arithmetic of overload margins with respect to power amplifiers is sobering if not frightening. Supposing that a system was designed so that at peak recording level a power output of 100 W is being delivered to the loudspeakers (not uncommon). This means that when listening to desk output, the possible overload drive before distortion could be 14 dB above this. In order to cater fully for this eventuality, the available power output from the amplifier would have to be 2,511 W! This is plainly not on for wage-earning mortals and luckily, psycho-acoustics come to the rescue to some extent. Transient clipping on power amplifiers does not get objectionable until the signal is well into distortion, so a figure of 5 times peak power is generally quite adequate for all but the most crystal-eared of our hi-fi half-brothers.

Disc systems

By disc, we mean round black things which revolve at 45 or 33⅓ rev/min. The record pick-up is an electro-mechanical device which is designed to reproduce deviations of the disc groove. The level from the disc is proportional to velocity. 'Standard level' on a test disc is 5cm/s and practically, this corresponds to a music level of about 10 dB below peak recording level for a 'hot cut' single or 10 dB above peak for a compilation album.

Disc cutting processes are very sophisticated and, in order to achieve maximum signal/noise ratios, they run very close to the absolute overload point on the disc—this, strangely enough, is usually determined by the high level, low frequency component of the signal—where the grooves deviate most. This little explanation throws a considerable brick at those who extol the virtues of enormous overload capability for disc pre-amplifiers. The range between extreme records is about 20 dB—10 dB above that is more than adequate, more than that is merely a waste of good headroom which could be used to reduce noise. Extreme transients do not exist on record—they never got past the limiter or cutter head.

FIG.1



$$\text{'AVERAGE'} = \frac{\text{SHADED}}{\text{(SHADED + DOTTED)}}$$

What does overload sound like?

Going back to the human ear, overload of acoustic power causes pressure and depression in the air adjacent to the ear drum to a greater extent than can be interpreted by the cilia in the inner ear. Information to the brain gets scrambled to an increasing extent with volume and even more interestingly, this effect is not equal for positive and negative going pressures. The 'overload' effect is not noticeable to the brain as a plainly distorted sound but in some way the asymmetric form of the information going to the brain gives a clear indication of the absolute volume level of the sound hitting the ear. This is a basic reason why signals which have significant second order harmonic distortion sound musically acceptable and partly why compressed material (tape compression or compressor/limiter) sounds louder than it ought to compared to energy level metering.

Mixer/amplifier overload

Modern circuitry is designed with a peak operating level and an overload margin. By their nature, feedback amplifiers (all solid-state audio amplifiers) reach to within a few millivolts of their clip level with little appreciable distortion. At clip level the output voltage can go no further positive or negative and so stays at maximum (or minimum) voltage until the overload part of the waveform disappears. The clip effect is similar to a squarewave: this produces acoustic products above and below the applied frequency which are not musically related to the signal. The effect is a tearing, crackling sound which is disturbing and extemely unpleasant. Severe clipping distortion is certainly the most obvious nasty distortion effect.

Another form of distortion less often met nowadays is 'crossover' distortion. This is (or used to be) caused by sad transistor output stages which do not respond properly during the transition between positive and negative going voltages or currents. The effect is less obvious but more pernicious because the distortion is at its worst at low levels. This type of distortion is predominantly odd order where the harmonics produced are not musically related to the signal; thus the effect is disturbing and accounts for a considerable amount of adverse critiscism levelled at transistor circuitry in the early days of solid-state electronics.

Tape

Magnetic tape (analogue) creates distortion, however well the bias works. The non-linearity of the recording/playback process is well controlled over the dynamic range from noise (no signal) up to average recording level, but above that, distortion increases over the last 12 to 14 dB of signal until saturation occurs. The distortion is in the form of some second order (asymmetric non-linearity) and third order (squashing at positive and negative peaks). The effect is one of increasing loudness due to a combination of the second order psycho-acoustic effect and a real compression, with the distortion limit being obvious by a rough or harsh quality caused by the rapid increase in non-musical harmonics.

Ancillary equipment

Most 'bolt-on goodies' suffer from the same distortion effects as mixers and amplifiers: the odd men out are the gain-controlling elements—the compressors and limiters. These fall into two distinct categories as far as distortion goes. The first is the asymmetric type: valve compressors, FET limiters etc. These have non-linear control circuits which produce second order distortion products when overloaded. The second category consists of VCA devices and some very elderly valve compressors. These both operate symmetrically and any non linearity produces third and other odd order harmonics. The 'second order' devices have two advantages in that they not only produce a musically-related distortion which is acceptable to the ears in small quantities; they also fool the brain into the loudness effect—seeming more effective than they really are. A 'third order' device has to be much more carefully designed to produce a similar effect.

Disc

Record distortion is a highly complicated subject due to the number of variables in the seemingly simple action of removing sound from a vinyl groove. The distortions present are manifold and it is sufficient to stand in awe of those who can produce grooves sounding so good, when my distortion analyser finds them so indigestible (we do not mention the compact cassette!).

Power amplifiers and loudspeakers

It is complete folly to try to consider the 'sound' of a power amplifier. The amplifier/loudspeaker combination is a complete system and can no more be separated than a recorder from its tape or a disc from its pick-up.

The loudspeaker produces both acoustic and electrical distortions. The acoustic ones we hear directly; the electrical ones affect the performance of the amplifier. The most significant distortions created from the playback system are phase-related and are minimised by choice of good loudspeaker/amplifier combinations and acoustic treatment. A graphic equaliser will mask phase deficiencies but will not cure them.

System overload shows up in the extreme as amplifier clip which, as mentioned earlier, is not necessarily disastrous—the loudspeaker sees a suddenly reduced damping factor and turns the squarewave into a soggy sinewave—much nicer on the ears in very small doses. At high levels loudspeakers tend to show slightly asymmetric response and produce even order harmonics—again it sounds acceptable in small doses. ■

business

BARRY FOX

Tape levy

In early February, I took part in a debate organised by the National Music Council of Great Britain. It was put together by Bob Montgomery of the Mechanical Copyright Protection Society. The subject? Whether or not there should be a levy on blank tape or hardware. First of all, congratulations to the National Music Council for actually doing what the record industry should have done long ago, and that's get people with conflicting views together to discuss those views in public. Although it's unlikely that anyone present changed their views, I'll bet that everyone learned something. I learned, for instance, that it's now official policy for the BBC to favour a levy, but on hardware rather than blank tape.

What a pity that so many of the people from the BPI and record industry press who have made the most noise about a levy weren't there to discuss their views. Were they afraid of learning something? But there was a good turnout from the music publishers and copyright bodies.

For what it's worth, the seminar hardened my conviction that the record industry, fragmented by in-fighting and handicapped by an appalling PR image, is the worst possible body to be lobbying for a levy. How different things might have been if the campaign for a levy had been engineered by the copyright bodies, particularly the Performing Rights Society and the Mechanical Copyright Protection Society. These bodies are already geared to distributing royalties. Whatever their faults, they seem altogether a far more professional bunch of people than the 'gee whizz' record company executives who've let a fortune in profits slip through their fingers and now, like everyone else, don't like the feel of the recession.

Secrets

Fish and chips, beer and skittles, eggs and bacon, PRS and Trevor Lyttleton. They all go together in the music business like a horse and carriage. So what is the PRS and who is TL?

The PRS, or Performing Rights Society, was established in 1914 to handle copyright on behalf of composers and authors. From the early 19th century, composers and authors have had the right to control the public performance of their works in Britain. In theory you have to ask the composer's permission before you perform his or her tune in public. Obviously this is impractical. Composers would spend so much time writing letters of permission and collecting fees, that they wouldn't have time to compose. That's why the PRS was created to act on their behalf. It's a non-profit-making society, with over 13,000 members, which in effect means virtually all British and Irish composers. By reciprocal agreements with similar organisations abroad, like BMI and ASCAP in America and GEMA in Germany, the PRS represents nearly half a million composers worldwide. If you run a radio station, or a restaurant, a dance hall or a bar, and you want to play any music in public, then one way or another you'll have to pay money to the PRS for a licence. The bigger you are, and the more music you play, then the higher the fee you pay. The only performances which are exempt are church services and occasional charity events. So every year the PRS pulls in around £40 million from Britain and abroad and it earns quite a few million more from investment.

Because the PRS is non-profit-making, all the money paid in has to be distributed to the composers, after administration costs (around 15%) have been deducted. In theory the people paying the PRS fill in forms which identify all the works performed, and so make it easy for the PRS to pay out royalties to the composers. A points system, which takes into account the length of the work (pop song or concerto) and the type of performance (village hall or Albert Hall) governs the amount of cash paid out. In practice, although radio stations and big concert halls are pretty accurate over their PRS returns, there is a vast pool of untraced and untraceable performances. On this score you've got to hand it to the PRS, they do their best at what is a virtually impossible task.

That's why, before Trevor Lyttleton started to row publicly with the PRS, few people outside the music business had heard of the society. But now, after over six years of editorial leaders in *The Guardian*, letters to the press from MPs, announcements in *The Times*, analysis in *Time Out* and snipes from *Private Eye*, the PRS is a household word. In fact the row has been going on for so long that most people have forgotten how it began.

Trevor Lyttleton is a lawyer and composer, best known for his contribution to the musical *A Day in Hollywood/A Night in the Ukraine*. This started life in a little theatre in Hampstead, transferred to Broadway and won a Tony Award. It also made headlines when the Marx Brothers' estate unhumourously sued all concerned because the production contained imitations of a Marx Brothers' act If the Marx estate had won, it would have put a stop to just about all entertainment on the American stage and screen, because almost everyone in comedy is impersonating someone else. Lyttleton the composer donned his lawyer's hat and together with a gaggle of American attorneys, successfully defended the show. But all this was 10 years after Lyttleton joined the PRS and started to find fault with the way it was run.

What he objected to was the lack of accountability. To cut a long and very complicated story short, the PRS operation is run by a council of directors made up from 12 composers and authors and 12 music publishers. These are elected by the members of the PRS. But only 14% of the total membership could vote, attend general meetings and receive corporate reports. The voting members were selected by the council and their identity was known only to the council. Not surprisingly, since 1914, when the PRS was founded, no one had been elected to the council unless they had been sponsored by the council. Lyttleton described this as a self perpetuating oligarchy and lobbied for a change.

The PRS argued that it is necessary to have a weighted system of voting to ensure that semi-professional composers, who write music in their spare time, don't have as much voting clout as the most successful professional writers and the publishing companies. This is why around 400 members, who earn the most, have 20 votes each (the so-called supervoters) while the rest have either 10 votes or one vote or no votes. The PRS also argued against revealing the names of the supervoters, who effectively controlled the society and whose names were known only to the council, because it would embarrass those who weren't supervoters. They would immediately be identified as earning less, and thus seen to be less successful as composers.

The whole thing blew up, in most colourful fashion, in 1976 when *Music Week* quoted Lyttleton as saying "All we want is that the society be run properly, honestly and openly . . . there is no doubt that in the past PRS decisions have been made behind closed doors without the membership being aware of what was going on." The sludge hit the fan and the next week *Music Week* published a grovelling apology to the PRS and Michael Freegard, its general manager. But Lyttleton wouldn't apologise. So Freegard, backed by the PRS council and PRS money, sued Lyttleton. As Lyttleton prepared his case he also started to muster support amongst MPs and journalists. If he ever tires of being a composer and lawyer, he could clearly do well as a PR man.

The libel case was dropped, one day before it came to court. Freegard and the PRS were ordered to pay costs. But Lyttleton wouldn't let things rest. He asked for a list of the supervoters, which the PRS promptly refused to provide. So Lyttleton sued the PRS. The High Court ordered the PRS to produce the list, but the PRS (with almost limitless funds available) appealed. Lyttleton buckled under the cost and backed down. Since then the PRS has been re-couping legal costs from Lyttleton out of PRS royalties payable to him for shows like the Broadway musical.' This has cost him over £2,000. But in all Lyttleton has spent six years of energy and tens of thousands of pounds on the campaign. The PRS has spent what must surely be hundreds of thousands in fighting back. Meanwhile the vexed question of the voting list went to the vote and the PRS members voted overwhelmingly to end the secrecy. So if you are a member of the PRS you can now ask to see the list of the 400 people who effectively control the society. Last year the law was changed with what became known as the 'PRS Amendment' to the Companies Act. As such, Lyttleton's campaign has been a victory for democracy. It's proved once again that if one man is prepared to spend enough time and money, and make enough noise, then immovable objects can be moved.

So how does Michael Freegard feel about the outcome? For anyone who has read or heard only Trevor Littleton's side of the story, Freegard's views come as something of a surprise. "Lyttleton had some good ideas on accountability," says Freegard. "And the matter he raised was going to be looked at by the council. But by that time Trevor Lyttleton was going to the courts." A little nervously I put the 64,000 dollar question to Freegard. Did he think he was right to sue Lyttleton, personally, using PRS money, and so unleash the full fury of a lawyer-composer-self-publicist scorned?

"With the benefit of hindsight I now know that I was badly advised to take personal action," says Freegard. "I should have withdrawn the writ, but by then the dispute was well under way. It wouldn't have resolved any problems."

Let's hope now that with the secret list no longer secret and Freegard big enough to say he was wrong to sue, the PRS can get on with its job of paying composers their royalties and Lyttleton can get on with his job of writing songs and earning money out of the law, rather than losing it. But let the last six years of trials and tribulations and expense for all concerned be an awful warning to any self-satisfied music business trade body which thinks it's too big to care about objections raised by individual members. ■

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Live Sound

OVER the last ten years the Rockpalast festival has undoubtedly become the premier European media rock event. It is staged at the Essen Grugahalle in West Germany in early April and is sponsored by the West German television service, WDR. The event has acquired something of a reputation for presenting only the very top internationally known bands, usually featuring two or three major acts in a 6 hr spectacular. In 1981 it was the Grateful Dead and The Who. The 1982 event featured the Rick James Band, Van Morrison and The Kinks, with no support acts to pad out the show. The concert itself starts at 10 o'clock on a Saturday night and runs through until about four in the morning, although the WDR television build-up gets underway about an hour earlier.

There is a real festival atmosphere about the whole thing with the audience in high spirits long before the first act takes the stage, having been warmed up by the television preamble which is relayed live to the audience over a large-screen projection system at the back of the auditorium.

From what I can make of the WDR running order it seems that live television coverage was taken by Denmark (DR), Norway (NRK), Sweden (SVT), the UK (BBC), French Switzerland (SSR) and France (A2F) and was recorded for subsequent use by Finland (YLE), Luxemburg (RTL), Austria (ORF), Czechoslovakia (CST) and Hungary (MTV). In addition to this, WDR also provided stereo radio coverage to nine German stations, two Swiss stations, and to Denmark, France and Holland. I was informed that apart from the Eurovision Song Contest and occasional special events like the Royal Wedding in 1981, Rockpalast attracts the largest international audience of any Eurovision networked programme, so this should serve to illustrate the scale of the event we are looking at. The entire presentation relies entirely on the technical competence of the crews and engineers responsible for the various aspects—sound, lighting, outside broadcast units, stage hands, etc—for its success. All of these, as well as the bands themselves, have to be co-ordinated and have to work together as one integrated team—especially with so much going on and with a very tight schedule to work to due to the live television coverage. Having set the scene, the remainder of this article deals therefore with the technical production of Rockpalast as I witnessed it at the Grugahalle in Essen in April 1982.

Venue

The Grugahalle is on the outskirts of the town and is a large, 10,000-seat arena which is not unlike Wembley except that it is much less spartan and is acoustically far better suited to the performance of music. The reverberation time of the building is surprisingly short for so large a space—to such an extent that WDR's sound engineers have to resort to special microphone techniques to capture any audience reaction from the hall at all. The general layout of the place is shown in **Fig 1.** All the essential facilities for rock music presentation are provided including a very large and rugged stage with direct truck access, full power supply for large lighting rigs, and ample dressing room accommodation. Immediately behind the stage is a large foyer which, for Rockpalast, was converted into a makeshift interview and discussion studio to provide fill-in material during the changeover periods between bands. Unfortunately the only access to the dressing rooms and admin offices was through this foyer, but I don't think anyone did actually come bursting through in the middle of a broadcast.

Lighting

The lighting system was provided by Tasco London and comprised a huge aluminium truss canopy covering the entire performance area of the stage and fitted with 400 1 kW 110 V lamps wired in series pairs across a 220/240 V supply. These were fed from three Avo 72-channel dimmer racks rated at 2 kW per channel, each rack having its own pinboard patching system to enable any dimmer channel to be assigned to any control channel from the desk. The desk was also by Avo Lights but has been customised to Tasco's specifications. It offers 84 channels via three preset groups and has 12 matrix masters. One of its special features is a 10-program computer-controlled chase facility, which enables up to ten complete 84-channel sets to be programmed in and brought up in sequence. WDR provided the lighting designer/engineer, Roger Searle, with an on-air TV monitor and four preview monitors all in colour to enable him to access the effectiveness of his plots as seen by the cameras.

Other lighting provisions included four follow spots with operators perched up in the lighting grid, a bank of motorised laser beam projectors and something like half a dozen super-trouper follow spots dotted around the sides and back of the hall on galleries as shown in **Fig 1.** It was quite a system and I am glad that it was not me who was paying the electricity bill.

Sound reinforcement

Tasco London also provided the sound reinforcement and it was one of the best systems I have heard at a live concert. The rig being used was Tasco's prestigious 40 kW Harwell system—which has a number of unique features and which is used only for tours by top international artists.

The loudspeaker system and its associated power amplifiers are based on a modular concept and are built up in sections to suit the size and layout of each auditorium. One complete section comprises separate cabinets for sub-bass, standard bass, low-mid and a combined high-mid/top and is fed from its own amplifier rack employing BGW *750* amplifiers for the low frequency cabinets, a BGW *250* driving the low-mid and an Amcron *DC300A* driving the high-mid/top cabinet. All the cabinets are of regular rectangular form, have identical base dimensions and scrim-covered fronts, so a complete system looks like a huge black wall, and is very stable when stacked. It is altogether neater and more convenient than stacking up piles of awkwardly-shaped bins and horns—not that the Harwell is by any means the first to adopt this concept, as TFA-Electrosound's Turbo system is similar and the old RSE systems were of this form 12 years ago.

The internal design and driver complement of these cabinets is also unusual and interesting. Inside the sub-bass cabinet is an 11 ft folded horn driven from the rear of the cones of two Gauss *4580* 15 in units, with the front of the cones working into a small compression chamber. The standard bass cabinets contain two folded horns driven by a pair of Gauss *4581* 15 in units, with the front of both drivers feeding into a 3 ft 6 in horn and the rear of both feeding a 7 ft horn—the general idea being that the ×2 path length difference between the two horns will produce a 180° phase shift thereby enabling the output energy from each driver to be maximised by driving from both sides of the cone simultaneously.

The entire mid and high frequency section is based on the ring transmission principle. Although this is not an entirely new concept, no one, to the author's knowledge, has tried this approach for anything other than small high frequency devices, and, certainly, Harwell have come up with some very original engineering designs. The low-mid cabinet accommodates a large moulded glass fibre horn flare which is terminated with an annular ring entry of something over 12 in in diameter, and has a large concentric phasing plug. This is driven off the edge gap of a pair of Electro-Voice *EVM-12L* 12 in cone loudspeaker units mounted face-to-face thereby providing an annular ring source with which to drive the horn. The high-mid cabinet is not dissimilar except that it is smaller in order to handle the shorter wavelengths, and the annular ring horn entry is converted to two diametrically opposite standard 2 in throat entries by means of an extremely complex aluminium casting. There is also a long throw version of this cabinet which has a different flare rate and four 2 in throat entries. Two or four JBL *2441* compression drive units are fitted as appropriate and

Rockpalast

Ken Dibble

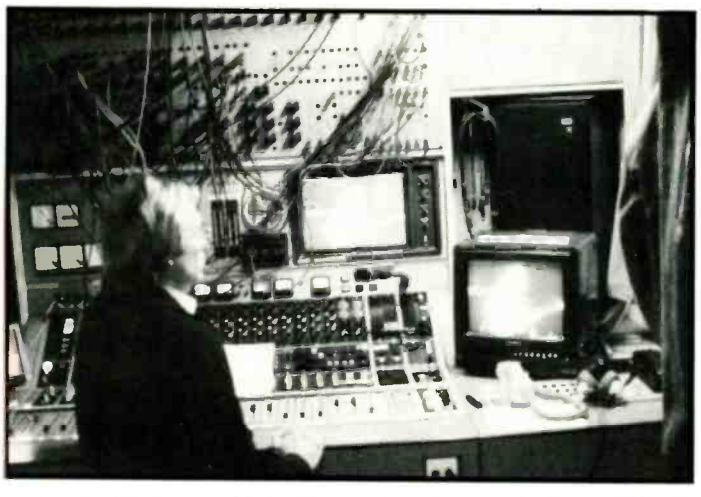
accommodated within the same cabinet are four JBL *2402* 'bullet' high frequency drivers which, of course, operate on the ring transmission principle anyway.

The sub and standard bass cabinets are the same physical size and are rated at an incredible 800 WRMS each. The combined size of a low-mid and a high-mid/HF cabinet stacked is also the same, but these are rated at 400 W and 200 WRMS respectively. The stacking arrangement as used for Rockpalast is shown in **Fig 2**. The entire system was stacked on either side of the stage and nothing was flown. Note that the only concession to near field coverage is the inclusion of just a single mid/HF section amongst the standard bass cabinets on the second tier of the stack, but it would seem that mid range level was intentionally rolled off at the front of the hall as previous experience has shown that apart from making communications difficult for the WDR cameramen over the intercom system, the SPL actually causes audio modulation of the pictures due to vibration of the camera lenses.

A Harwell *SFX* modular crossover system was employed to provide 4-way active crossover and an additional 80 Hz lowpass filter for the sub-bass cabinets. The crossover frequencies are—bass: up to 200 Hz; low-mid: 200 Hz to 1.6 kHz; high-mid: 1.6 kHz to 8 kHz; HF: 8 kHz up. The filters have an unbelievable slope rate of 36 dB/octave and are phase-aligned to the loudspeaker system, but do not contain any form of limiting or compression. This latter function is performed by a pair of the new dbx *165 Over Easy* compressor/limiters operating full band on the main outputs from the desk. A pair of Klark Teknik *DN27* ⅓-octave graphic equalisers in conjunction with a Klark Teknik *DN60* real time analyser were used for system alignment and auditorium EQ.

The main mixing desk was a fine example of the ubiquitous Midas *PR* series live performance consoles which had been extensively customised to Harwell specifications. It is a 40-channel, 8-group stereo monster built in two halves—a 25-channel input section and a 15-channel input plus subs and master section—and is very smartly finished with solid light oak trim. The input modules are the all-singing, all-dancing *PR/05*s with LED ladders alongside the faders and full parametric mid band EQ. The Harwell mods include the provision of an FX insert button on each module and the addition of four auxiliary send modules to each half of the desk which are interlinked to provide two groups of four auxiliaries or one of eight.

The effects and outboard processing facilities provided are extensive for a touring sound system. The effects rack houses a Roland *RE-555* chorus echo machine, an Eventide *H949 Harmonizer*, a Lexicon *224* digital reverb system with full remote control from the desk, and Eventide *1745M* and Lexicon *Prime Time* DDLs. The outboard processing rack housed two dbx *900* series main frames, one of which was filled with dbx *904* noise gate modules and the other with dbx *903* compressor/limiter modules, an Orban *672A* 4-band stereo parametric equaliser and two Klark Teknik *DN27* ⅓-octave graphic equalisers. In the main, the *RE-555*, the *H949* and the *224* were used on vocals and the two DDLs brought in on various instruments and backing vocals. The noise gates were used extensively on the drum kits, while the compressor/limiters were employed mainly on lead and bass guitars, saxes, etc. A full patch bay is the nerve centre of the system—an unusual feature of touring systems. A Revox *B77* tape machine was also provided for the Rockpalast fanfare and for the backing tracks to the Kinks' opening sequence.



Continuing our journey through the system, we end up back on stage where the stage box is to be found at the other end of a bundle of multicore cable emanating from the patch rack. This is a mammoth affair providing 80 transformer-coupled 3-way splits. The complex box of tricks accepts all the microphone and DI feeds from the stage and splits them to provide independent and fully-isolated input signals to the sound reinforcement desk, the monitor desk and to the fleet of outside broadcast and mobile studio vehicles parked up outside the hall.

The entire system was under the very capable supervision of Tasco senior sound engineer, John 'Skin' Gadenzi, who, besides having overall responsibility for the rig itself, mixed for the Rick James Band and assisted Van Morrison's engineer Peter Grainger and The Kinks' engineer Mike Ponszek, both of whom had travelled over with the bands from America. When working with the bands' own engineers, Skin generally looked after the masters, set up and operated the effects and outboard processing equipment and kept an eye on the umpteen VU meters and overload LEDs. Much of the working mix for a live concert is done on the subgroup faders and the eight groups were lead vocals, backing vocals, guitars, keyboards, bass, brass/wind, drums and other percussion and effects remix.

Monitors

The onerous responsibility for this not very rewarding (because you can never actually hear the result of your own endeavours) and largely unsung task fell to another Tasco staff engineer, Gary Marks. As there was no trace of any howlround and none of the artists complained about the monitor levels, he too must have done a good job.

The heart of the monitor system was one of those equally ubiquitous Midas *PR* series 28/8 monitor desks but in this instance, it was used as a 28/10 by pressing two unused auxiliary sends into service as two more main outputs. No oak trim this time, as this desk is usually tucked away behind the stage left loudspeaker stack out of sight. Each of the ten outputs from the desk was fed to a Klark Teknik *DN27* graphic and then either direct to BGW or Amcron power amplifiers or via crossover units as appropriate.

There was quite a variety of monitor loudspeaker types in use ranging from basic Martin Audio *LE200* 'wedges' with inbuilt passive crossovers and Martin 2 × 15 in plus horn 2-way bi-amped drum monitors, to a full 4-way side-fill system using a combination of bass and low-mid cabinets as used for the main auditorium system and JBL radial horns and compression drivers. In all there were 16 wedge-type cabinets, two drum monitors and two large side-fills—quite a system, and one which must have kept Gary pretty much on his toes throughout the night, especially with three bands to contend with.

Mobile Studio

Besides being broadcast live, the entire proceedings were being recorded for subsequent commercial use by the Dierks 24-track mobile from Cologne—a very impressive mobile indeed in the very experienced hands of Jürgen Krämer. Two recordings were being made, a 24-track for subsequent studio mixdown and a live 2-track stereo mix. A major German operator, Dierks has two permanent commercial studios, a research studio in Cologne and two mobiles. Whilst the desks, monitor loudspeakers, on-air and preview television monitors and certain other facilities are permanent to each mobile, the microphones, tape machines, outboard effects and processors are readily interchangeable between the two mobiles and the three permanent studios, so there is an infinite variety of facilities and equipment available.

Due to its 44-channel capability, the Dierks mobile was the first taker of the sound feeds from the Tasco stage box. In the mobile, some channels—tom-toms, miscellaneous percussion, brass, etc—were submixed and the rest were raised to line level before 28 line sends were provided for onward transmission to the WDR TV OB unit. The WDR radio OB was fed with the mixed-down stereo programme direct.

Dierks' desk is a rather fine and remarkably compact MCI *600* series console in 36/24 format. There are also K+H *OY* monitors, dbx *20/20* computerised analyser/equaliser, UREI stereo limiter and two 12-channel LED PPM 'ladders' used to monitor the 24-output groups from the desk. Additional facilities carried on this particular occasion included an Eventide *H910 Harmonizer*, EMT

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Live Sound - Rockpalast

reverb system and a Dolby noise reduction rack.

The multitrack tape machine was an Ampex *MM1200* 2 in unit using SMPTE timecode and the stereo mix was recorded on a Telefunken *M15A* ¼ in ½-track machine. There were other machines in the truck but these were not in use.

The truck itself is, of course, fully insulated with an acoustically designed interior and has all the essential facilities for creature comfort including a well stocked pantry and bar. It is very well laid out and comfortable to work in which is conducive to getting the best results.

Radio OB

Under the watchful eye (or should it be the listening ear) of WDR sound engineer Christoph Gronare, the radio OB received the live stereo mix from the Dierks' mobile, the house stereo mix from the sound reinforcement desk and feeds from a number of ambience microphones in the auditorium and, from these three sources, he produced the stereo radio broadcast. In addition to these, he also received feeds from the announcer's and interviewer's microphones in the temporary studio backstage, and the soundtracks from the films and videos used for interval material along with the studio presenter's comments and introductions from the main studio in Cologne, and these he used to mix the interval presentations between bands.

The desk was a custom 20-channel production console built by WDR's own engineering department using a variety of standard commercial modules including Siemens pan/auxiliary modules, Feiltek equalisers and Danner faders. Monitoring was on Spendor, Bosch and Sony.

The output from the OB was sent to a Deutsche Bundesposte (DBP) 'Messwagen' parked up alongside from where it was transmitted by landline direct to the Frankfurt Eurovision centre for international distribution.

Television OB

In total contrast to the radio OB, its television counterpart is a very large, busy and extensively-equipped articulated truck. It is divided into three separate compartments, sound at the rear, production control room at the centre and vision at the front. The sound control room has a window through to the production control room so that the sound engineers share the on-air and preview monitors next door with a saving in space and equipment.

The WDR television people prefer to do their own sound mix but the OB is only equipped with a 28-channel desk so some sub-mixing was necessary in the Dierks mobile and a further drum sub-mix was done in the TV OB on a Studer 16/2 outboard mixer before feeding the main console. In addition to the stage feeds received via the Dierks mobile, the TV OB also received feeds from the ambience microphones in the auditorium and these were sub-mixed in two small Sennheiser portable mixers—so the sound control room was literally bristling with mixing desks. The main console was a Telefunken 28/1 purpose-built television desk and the outboard equipment in use included a Lexicon *224* digital reverberation system, a Lexicon *Prime Time* DDL and an Eventide *H910 Harmonizer,* with a UREI peak limiter and a Universal Audio *565* band-stop filter/2-band parametric equaliser both used on the main output. The monitors were again Spendor and the control room was also equipped with two Telefunken *M5* ¼ in tape machines, one ½-track and one full-track, although these were not in use.

There were around 10 TV cameras in use including two portables for close-ups and in use in the interview room with six full size studio units in the auditorium.

The programme presenter and the video and cine interval material was fed in from the WDR main studio to the production control room in the OB and the produced programme was sent from there via the DBP messwagon and DBP landlines to the Eurovision Centre at Frankfurt for international distribution.

FIG 1: General layout of the Grugahalle

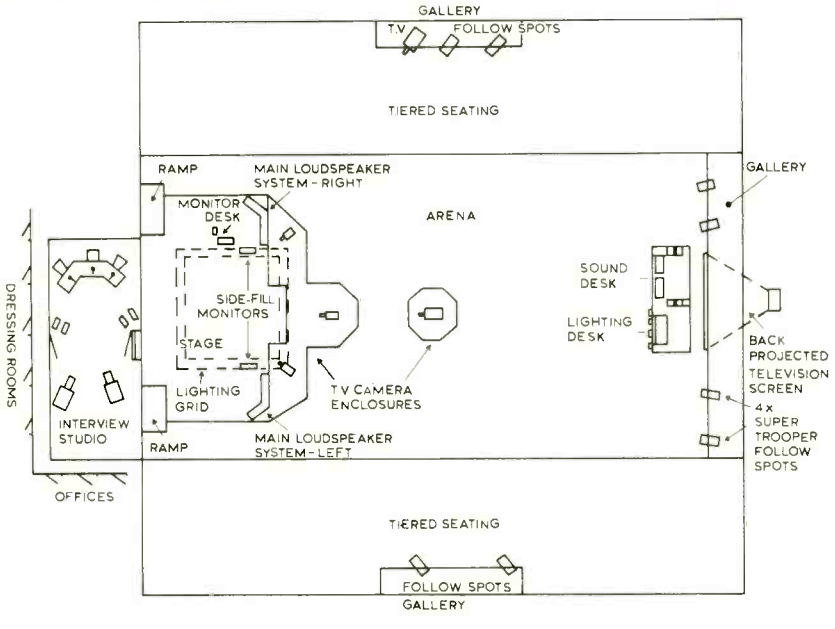
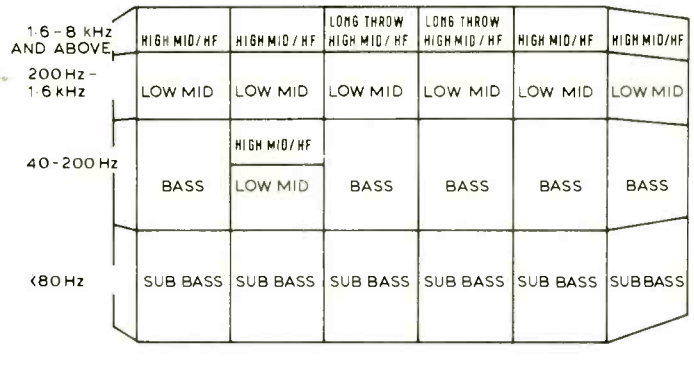


FIG 2: Stage left loudspeaker stack



Microphones

The microphone system was for the most part common to the sound reinforcement and monitoring systems, to the Dierks mobile and to the WDR radio and television coverage. Almost every microphone used on stage was by AKG and the general miking practice adopted was much the same for all three bands.

To start with, the band line-ups were as follows:

The Rick James Band:
front vocals, two keyboard sections, four brass, drums, large percussion section, electric bass, electric 6-string guitar and four backing vocals.

Van Morrison:
front vocals, backing vocals, trumpet alternating with *Prophet 5* synth, sax, flute, Irish pipes, keyboards section, grand piano, two drum kits, electric bass and electric 6-string guitar.

The Kinks:
front vocals, three backing vocals, two electric 6-string guitars, electric bass, full drum kit and a heavily amplified keyboards section.

Most of the front and backing vocal mikes were AKG *D330BT* hypercardioid dynamics with their response contour switches set for moderate bass roll-off (−15 dB at 100 Hz) and moderate presence lift (+2 dB at 4 kHz). The notable exception to this was Van Morrison, who was brave enough to experiment

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Live Sound - Rockpalast

with the new AKG *C535EB* super cardioid pre-polarised capacitor vocal mics with superb results. This same mic was used by their flute and Irish pipes—again with excellent results.

Rick James's and Van Morrison's brass section—comprising trombones, trumpets and saxes—used more AKG *D330BT*s, but this time set for a flat frequency response.

Most electric guitars were miked in front of the speaker cabinets using more AKG *D330BT*s, again set flat, although Shure *SM57*s were used on the Kinks' guitars. The electric basses were miked from the speaker with an AKG *D12* or DIed—or both.

The drum kits were all treated much the same way with some odd exceptions—again for The Kinks. The general pattern was AKG *D12* inside the kick drum with a damping cushion; floor tom-toms, all rack toms and snare drums miked from the top skin only using an AKG *D125* general purpose dynamic cardioid to each drum; more AKG *C535EB*s were used on the hi-hats and AKG *C414* condenser mics were used as overheads to pick up cymbals and the overall kit sound. The additional percussion instruments included a pair of pedal tympani which were miked with AKG *D202*s from the top skin, bongos miked with one *C535EB* between a pair of drums, congas miked with one AKG *D125* between a pair, shells—again a *D125* and timbales, with a *D125* inside each drum from beneath. There was also a full set of *Syndrums,* but these were wired to a Pollard *Syndrum Quad Control Unit* and DIed. The Kinks' variations were that Sennheiser *MD421*s were used on kick drum, floor tom and large rack toms, and Shure *SM57*s were used on the standard rack tom array and on the snare drum. The placings were as for the AKG microphones on the other kits.

That just leaves the various keyboard set-ups to consider.

The Rick James Band had two complete keyboard set-ups and these were positioned on risers, one on each side of the forestage just inside the main loudspeaker stacks. The stage left set-up comprised a Yamaha *CP80* stereo electric grand piano, a Rhodes *88* stage piano and a Hohner *D6 Clavinet.* These were sub-mixed on a Mavis 12/2 desk and DIed straight into the stage box, with the musician relying on one of the Martin *LE200* wedge monitors to hear what he was playing and using no backline amplification as such at all. The stage right set-up comprised an Oberheim *OB-Xa* programmable synthesiser, an ARP *String Ensemble* and a *Minimoog* synthesiser, again mixed down on another Mavis 12/2 and DIed. This musician also relied on the monitor system but had a small Fender combo at the rear of the riser facing offstage, and this was miked using an AKG *D330BT* set flat as a broadcast feed only. As regards the sound as heard on stage by the musicians, it should be noted that each keyboards riser was almost right in front of a large 4-way side-fill monitor stack in addition to the small wedge monitors, so there was probably no requirement for any additional backline amplification anyway.

Van Morrison's keyboard system comprised a Steinway grand piano and a Hammond *B3* electric organ. The Steinway was fitted with Magnasound transducers and DIed, and had an acoustically absorbent blanket covering the floor immediately underneath the instrument. The *B3* was equipped with two *Leslie L122*s, one of which was used on stage while the other was shut away in a spare room off stage and miked up using an AKG *D12* for the LF section and an AKG *D330BT* for the HF. Again, there was no backline amplification other than the Hammond *Leslie* and another monitor.

The Kinks used a Kawaii electric grand piano with Korg *Trident* and *Prophet 5* synthesisers. These were sub-mixed on a Yamaha 12/2 desk and besides being DIed into the stage box, were also fed to a large ML keyboards amplification system comprising an MXR 31-band graphic equaliser, an Ashley 3-way active crossover unit, large Yamaha power amplifiers and two 15 in, two 12 in and two compression-driven radial horn loudspeaker units.

In addition to the microphone set-up and DIs used on stage, the WDR radio and television OBs were using quite an extensive system of microphones to pick up audience reaction and the general ambience of the stage sound as heard in the hall over the main sound reinforcement loudspeaker system, and the signals from these microphones, were mixed in with the straight feeds from the stage microphones. WDR's television sound engineer, Winfried Pannel, was careful to explain that in the past they had experienced difficulties in achieving an acceptable degree of hall ambience due to the very dry acoustics of the auditorium, and if the microphone provision for this purpose seemed excessive, there was good reason for doing it that way. The audience reaction was recorded as it would have been heard by the bands on stage using four AKG *D224* 2-way dynamic microphones mounted in polished glass parabolic reflectors, mounted two on each side of the stage just inside the main loudspeaker stacks, while the hall ambient sound was picked up with four Sennheiser *MK810* shotgun microphones mounted up on the camera/lighting galleries. These were supplemented by three roving radio microphone systems used to provide specific accentuation of any particular part of the auditorium—for example, if one section of the audience burst out into song. The four reflector microphones certainly looked very impressive and futuristic perched up on stage facing back at the audience, but I'm afraid that besides reflecting sound, they are also excellent reflectors of light and my several attempts to photograph the installations were an utter failure.

Critique

Apart from the odd problem here and there — like the sudden breakdown of the television coverage resulting in a ten or 20 minute break in transmission which had technicians running frantically hither and thither—everything went fairly smoothly. The changeovers went well and the event generally ran to time. The atmosphere in the hall was absolutely electric from the time the Rick James Band came on until The Kinks brought the festival to a really highly-charged close after three encores and tumultuous applause and foot-stomping at around half past four. But for me, Van Morrison was the highlight of the night.

The sound was good for all the acts, and I was particularly impressed by the way Skin mixed Rick James—a band he had never heard until the Rockpalast rehearsals a day or two previously. Van Morrison's first couple of numbers were not at all together, but as the band settled down on stage and the two guys at the desk, Van Morrison's own engineer, Peter Grainger, ably assisted by Skin—got used to working together, the whole show just seemed to slip into place and produced one of the best live performance mixes I have heard for a very long time. You could actually hear Van Morrison's two drum kits tighten up as Skin worked his way through the rack of dbx noise gates and compressors—and in my experience, it is very rare indeed to find an engineer on the road who really knows what he is doing with noise gates. The Lexicon *224* was 'tuned in' to Van Morrison's vocals and a touch of desk EQ was used to give a little more bite so the vocals came clear and clean over the top of the band. Technically I found The Kinks somewhat disappointing with the engineer continually struggling to get any projection from Ray Davies' gravel-throated vocals. The Harwell rig is capable of a lot more than it was giving at that particular time, and I can only put it down to the mix. Using a freshly-calibrated SPL meter set to A-weighting and slow response, I measured a mean level of 100 dB at the back of the auditorium with peaks at 106 dB, while the *DN60* showed a reasonably constant level between 60 Hz and 4 kHz and a 6 dB/octave roll-off above, measured on a *C451/CK1* at the back of the hall.

The crowd, however, suffered no such technical reservations and obviously enjoyed every minute of a reminiscent hour and a half of solid rock and roll delivered with a lot of energy and excitement which had them stamping their feet, jumping up and down and clapping their hands above their heads at every available opportunity.

Meanwhile, outside in the Dierks' mobile, Jürgen Krämer was doing great things on his MCI 36/24, achieving a very tight, punchy stereo mix, and I would be surprised if the mixdown from the 24-track gets very much better. The sound in the mobile was quite different from that inside the hall, with generally better definition and detail, but over a pair of Spendors and in an acoustically designed control room, as compared to a huge, sectionalised loudspeaker system feeding a 10,000 seat auditorium, this would hardly be surprising. The Kinks' mix in particular was much better than in the hall. I was not so impressed, however, with the WDR television OB mix, which I found somewhat bland by comparison and lacking drive—even allowing for the fact that it was in mono—but when added to the picture, the overall broadcast did reflect the atmosphere of the occasion.

I must confess to having found my visit to Essen for Rockpalast most interesting. The event is quite unique and has no parallel in the UK, even though most of the technical support for the concert itself came from our own shores. It was very well organised indeed and everybody involved worked together as a team with excellent results. For my part, I would like to thank the Tasco sound, lighting and stage management team, the people from Dierks mobile, the WDR radio and television crews and the musicians and roadies with the bands themselves for their willing co-operation in providing the fodder for this article by answering all my questions despite language difficulties at times, and in allowing me free and unhindered access to all technical areas with my camera and notebook. I would particularly like to thank Tasco for their much appreciated hospitality in Germany. Later in the day, after the Grugahalle had been stripped out, the three trucks were rumbling their way across Europe back to London for the Country Music Festival at Wembley the following night and to start rehearsals for Status Quo's European tour which was scheduled to take to the road the following week. So who'd be a roadie, anyway? ■

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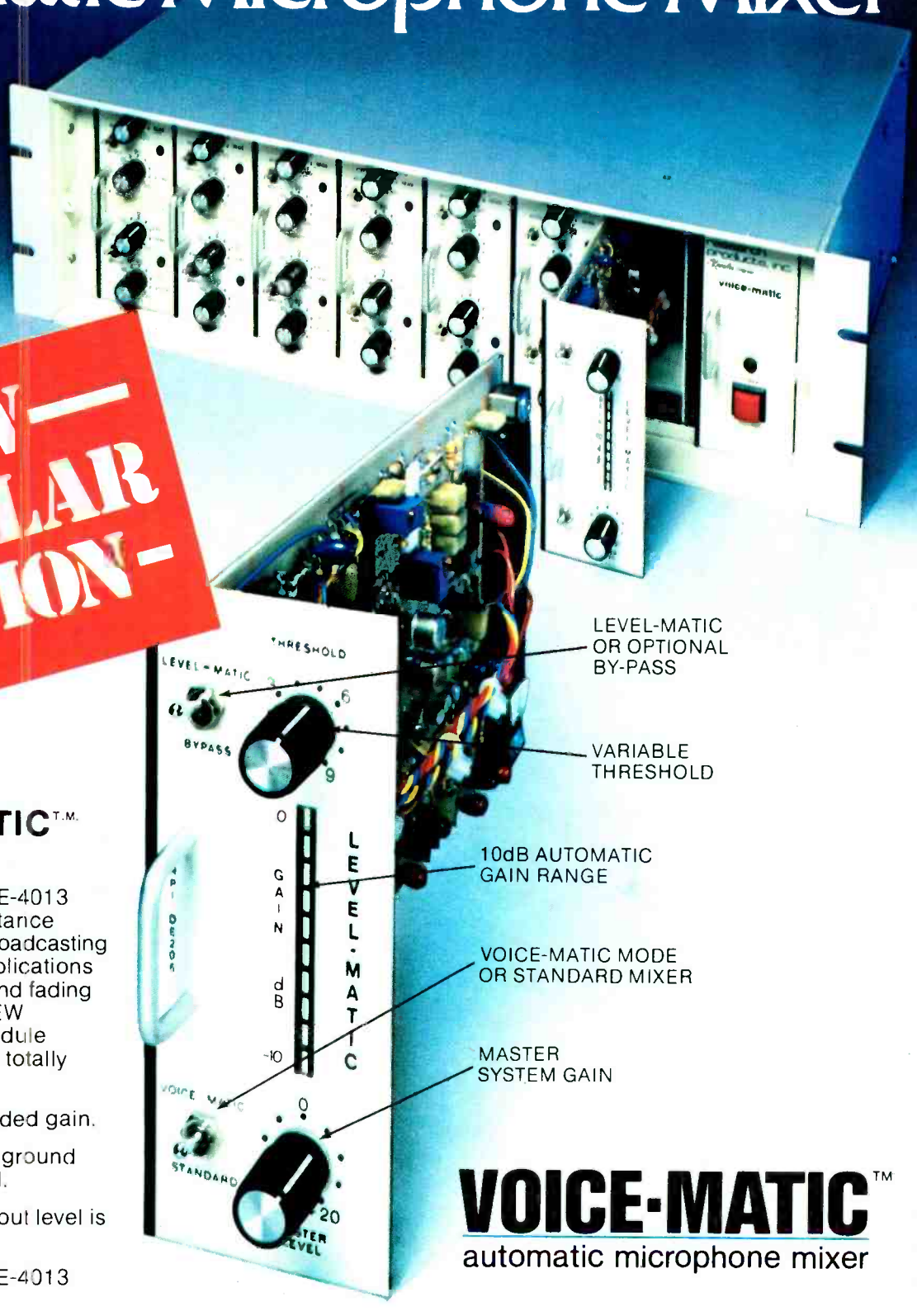
MANUFACTURER'S SPECIFICATION
Frequency response (measurement from source impedance of 150 Ω): +0 dB, —0.5 dB 50 Hz to 20 kHz; +0 dB, —2 dB 20 Hz to 30 kHz.
Total harmonic distortion: less than 0.5% at +4 dB output at 1 kHz.
Hum and noise (20 Hz to 20 kHz, input termination of 150 Ω, input level switches at —60 dB, input trim at 0): —128 dB equivalent input noise, —130 dB equivalent input noise, IHF A-weighted, —64 dB (68 dB S/N) group out, group and one input fader at nominal level, —64 dB (68 dB S/N) programme out, PGM master and group controls at maximum level, all group faders and one input fader at nominal level, 64 dB (68 dB S/N) fb out or echo send, fb master or echo send control and one fb or echo mix control at nominal level.
Maximum voltage gain: 84 dB ch in to group out, 84 dB ch in to program out, 84 dB ch in to fb, 94 dB ch in to echo send, 20 dB aux in to group out, 20 dB echo in to group out, 10 dB sub in to group out.
Equalisation (ch in, aux in, echo in): low 100 Hz shelving (±15 dB maximum), mid 200 Hz to 5 kHz, variable peaking (±15 dB maximum), high 10 kHz shelving (15 dB maximum).
High pass filter: 12 dB/octave roll off switchable for 3 dB down at 60 Hz or 120 Hz.
Oscillator/Generator: switchable sine wave at 400 Hz, 1 kHz and 10 kHz (1.0% total harmonic distortion at +4 dB output) or pink noise.
Inputs and outputs: see review.
Crosstalk: —60 dB at 1 kHz input to output.
VU meters (0 VU = +4 dB output): 4 large, illuminated meters, switchable for group or programme. 3 smaller, illuminated meters switchable for 2 foldback or 2 echo and cue or fb.
Peak indicators: LED built into each input turns on when the pre-fader level reaches 10 dB above nominal. LED built into each group, fb, echo and programme out turns on when the output level reaches 10 dB above nominal.
Phantom power: 48 V DC is applied to balanced input transformers for powering condenser microphones.
Finish: black panel, rosewood trim, padded armrest.
Power consumption: 120 VA maximum.
Dimensions: (wdh) 1026 mm × 822 mm × 353 mm (40⅜ × 32⅜ × 13⅞ in).
Weight: 78 kg (171 lb).
Manufacturer: Toa Electric Company Limited, Kobe, Japan.
UK Agent: Toa Electric Company Limited, Castle Street, Ongar, Essex.
Note: 0 dB is referenced to 0.775 V RMS.

THE Toa type RX-7-164 is a 16-input, four output version of the Toa RX-7 series of mixers which cover up to 32 inputs and eight outputs down to 16 inputs and four outputs.

All the RX-7 series are portable units constructed from a variety of seven modules including the external power unit which is common to all configurations. The mixers are based on a substantial wooden base to which are attached the fabricated steel side frames and cross frames at the front and rear. Attached to the side frames are heavyweight wooden sides finished in rosewood and equipped with two good quality recessed carrying handles either side. The modules are secured to the steel cross members and plug into a mother PCB which extends the full width of the mixer and carries the mixing busses and power supplies. 76 ▶

The VOICE-MATIC™ Automatic Microphone Mixer



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A VU meter panel is hinged at the rear of the mixer with a padded section fitting into spring clips at the front edge of the mixer.

All inputs and outputs are to the rear of the mixer and clearly identified, all connectors except the four group outputs and the pairs of echo send and foldback outputs being mounted on the removable modules.

To the left of the mixer are the 16 identical input modules each having a single balanced input at an XLR-type connector plus ¼ in unbalanced jacks for the accessory send/return breakpoint and the individual direct channel output.

There are next two group echo and two group foldback return modules which are identical. The group section of each module feeds the associated group buss (if required via a breakpoint at unbalanced jack sockets) to the transformer coupled group output behind the VU meter panel. The module also feeds the appropriate echo or foldback buss to the echo and foldback outputs behind the VU meter panel in the form of transformer coupled XLR connections.

Each of these four modules include a balanced XLR accessory input to feed any group buss plus a similar XLR connection to be added to the group output.

The following two modules are the programme output modules which each have two separate channels accepting their input from a combination of the group busses and providing programme outputs at transformer coupled XLR outputs.

There follows the phones module which is provided with two balanced XLR connections for off-air inputs. The phones output may be derived from these off-air signals, from any of the foldback or echo busses or from the programme output.

The final internal module is the talkback and oscillator module which can send talkback or the internal test oscillator to any buss except the cue buss and the group busses. A separate transformer coupled talkback/oscillator XLR output is provided.

The power input from the external supply is at a dummy module to the right of the mixer which incorporates a locking multi-pole power connector, a grounding post and a master phantom power on/off switch at the rear of the mixer.

Seven illuminated VU meters are fitted to the rear of the mixer, four of which may be switched between the programme and group outputs. Of the three remaining smaller meters, two may be directed to the echo or foldback output with the seventh meter being fed from the cue buss or the talkback output.

The power supply unit is a 19 in rack mounting unit 3 U in height and mounted into a substantial wooden case equipped with carrying handles at the front and also at one end, the other end being fitted with protective feet.

To the front of the power unit is the push-button on/off switch, an LED power indicator and recessed Imperial size fuseholder which is clearly identified with the correct fuse value. To the rear, the line input is via an IEC connector, a grounding post and the locking type multipole DC connector to the mixer.

Within the unit the standard of construction was satisfactory with a medium standard of soldering and reasonable identification on the printed boards which include six identified fuses. Much the same comments applied to all the mixer modules which had a clean layout but

78 ▶

FIG.1
TOA RX-7
COMMON MODE REJECTION

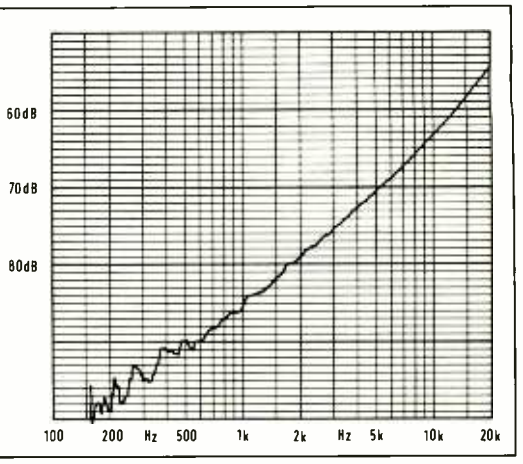


FIG.2 TOA RX-7 FREQUENCY RESPONSE

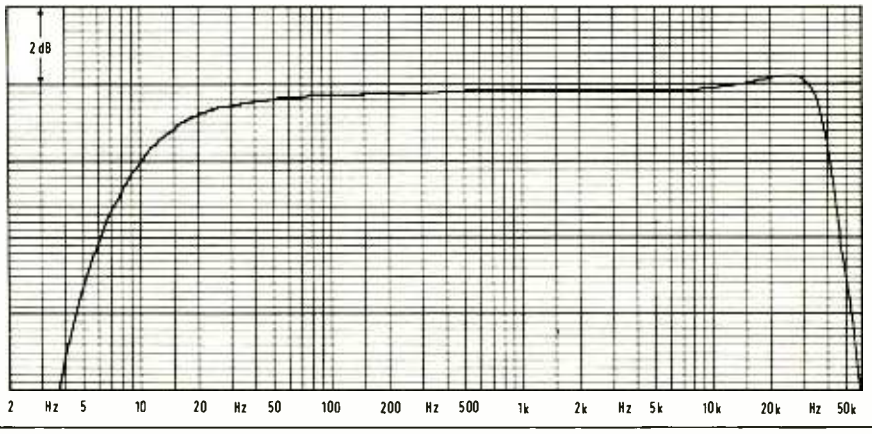


FIG.3
TOA RX-7
HIGH PASS FILTER

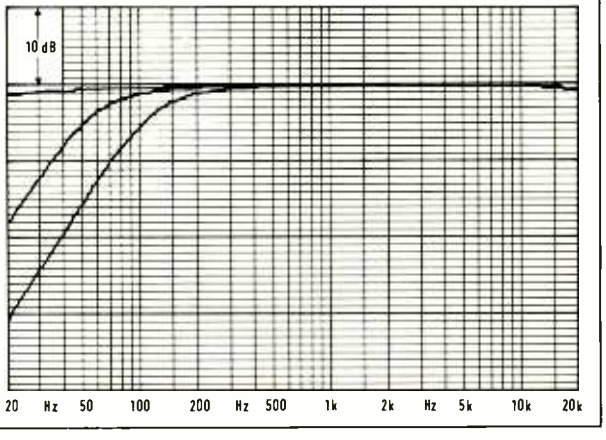
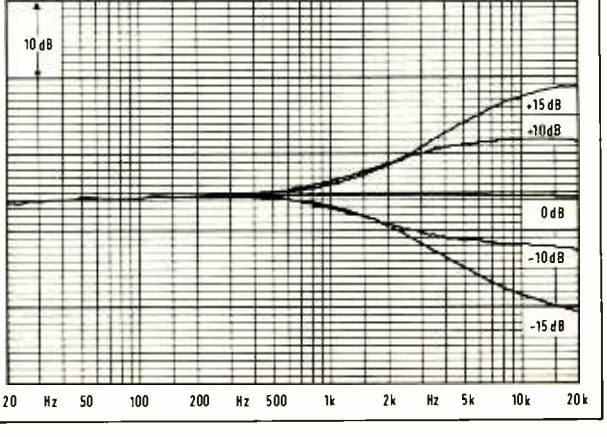


FIG.4
TOA RX-7
HF EQ



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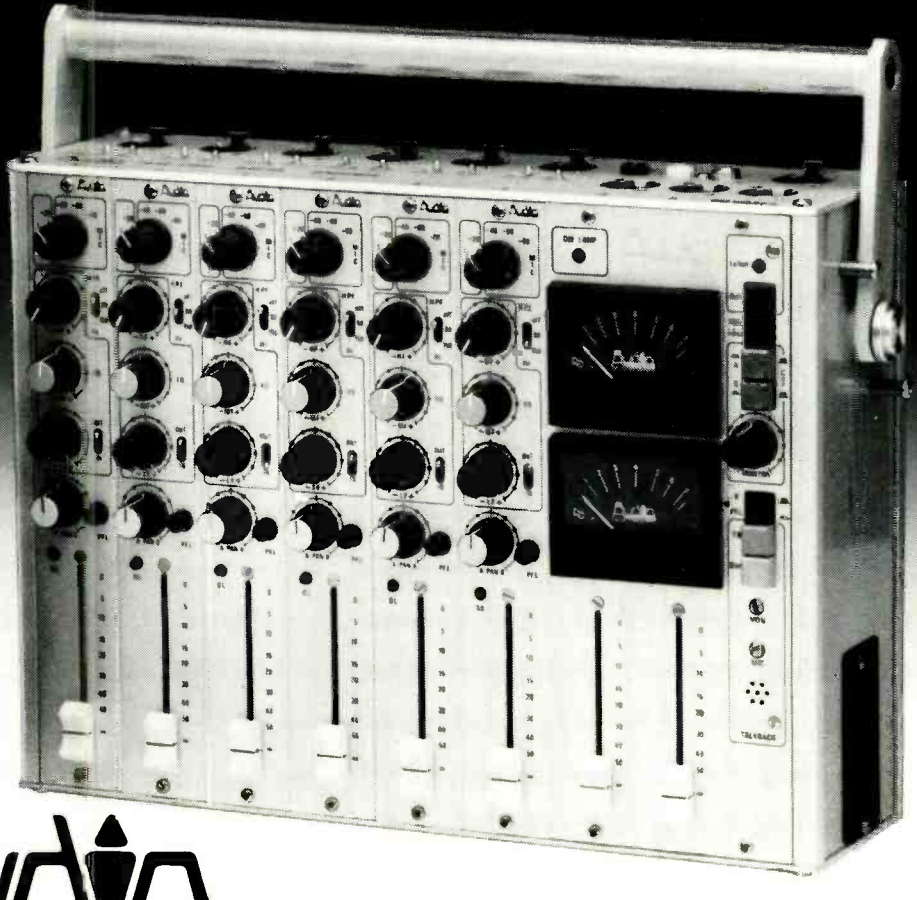

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lacked useful component identifications. Almost all components connect directly to the module boards, the exceptions being the rear connectors, some audio transformers and the faders which were particularly nice in action.

The input modules

The single balanced input is fed to three toggle switches at the top of the module which switch the phantom power on/off, reverse phase and provide 0, 20 or 40 dB attenuation before the input transformer. There follows a gain trim stage before the unbalanced breakpoint and the equalisers. These comprise a ±15 dB high frequency and ±15 dB low frequency cut/boost plus a 200 Hz to 5 kHz mid frequency section may be switched in/out by a toggle switch below the four equaliser potentiometers. Proceeding down the panel there follows a three-position toggle switch offering a high pass filter at 60 Hz or 120 Hz with an off position.

At this point the audio signal is fed to a red peak LED indicator above the channel fader, the locking self-illuminating type cue pushbutton at the bottom of the module and the channel on/off button with its nearby green LED indicator.

From the on/off switch the signal is fed two ways, to the channel fader and to the echo/-foldback send controls. The output from the channel fader feeds the individual channel output (unbalanced) and the pan pot which in turn feeds the four locking group assign buttons.

The foldback and the echo sends are identical, each having two send level potentiometers one of which is fixed post fade and the other which is switchable pre or post fade.

The group, foldback and echo modules

The group section of these modules accepts inputs from three sources, the individual group buss, the cue buss or a 'sub' input, the latter being a fixed gain transformer coupled input.

Both the group buss and the 'sub' input are combined and buffered before the unbalanced breakpoint which feeds the group fader at the bottom of the front panel before which the group signal is combined with the feed from the cue buss via a self-illuminating type locking push-button switch at the very bottom of the panel.

After the group fader the signal feeds a red peak indicating LED before the group on/off pushbutton with its nearby green LED. From here the group signal is fed to the individual transformer coupled group outputs and to the associated group buss.

The second function of the group modules is to deliver the foldback or echo sends derived from the foldback and echo busses as appropriate to the individual outputs. The appropriate buss is fed via a level potentiometer at the top of the module to a nearby red peak LED and thence to the transformer coupled foldback or echo sends.

The third function of the group modules is to feed the echo return (or auxiliary input) to any of the group busses and to the cue buss. The transformer coupled auxiliary input is first fed to an equaliser section at the centre of the front panel, the equalisers consisting of three ±15 dB sections covering fixed low and high frequencies plus a mid section tuneable between 200 Hz and 5 kHz, there being an equaliser in/out switch below the four potentiometers.

From the equalisers the signal feeds the self-illuminating and locking cue pushbutton and the four locking group assign pushbuttons feeding the group busses.

The programme modules

The two programme modules each accommodate two identical channels each of which are fed via four potentiometer level controls which derive their inputs from the group busses.

The combined signals are routed to the phones module via two locking pushbutton switches which feed the left, right or both channels in addition to feeding the programme master volume control.

This is followed by a peak indicating LED circuit, the programme on/off pushbutton with its associated warning LED and the transformer coupled programme output stages.

The phones module

The phones module has two sets of outputs, a pair of stereo ¼ in jack sockets on the front panel and a pair of mono (left and right) jacks on the rear panel. All these outputs are fed via a ganged stereo level potentiometer which derives its input from a number of sources.

If any cue button is pressed the input is automatically switched to a mono signal from the cue buss whilst without the cue feed in action the input is derived from a series of six inter-locking pushbuttons. These provide stereo feeds from the programme module (which itself can feed a combination of the group busses), any individual echo or foldback buss or from an off-air input connector at the rear.

The latter input is a low level input which is transformer coupled with switchable phantom powering and equipped with individual left and right gain trim potentiometers on the front panel.

The talkback and oscillator module

At the top of this module eight locking push-buttons allow the oscillator or talkback to be sent

80 ▶

FIG.5
TOA RX-7
LF EQ

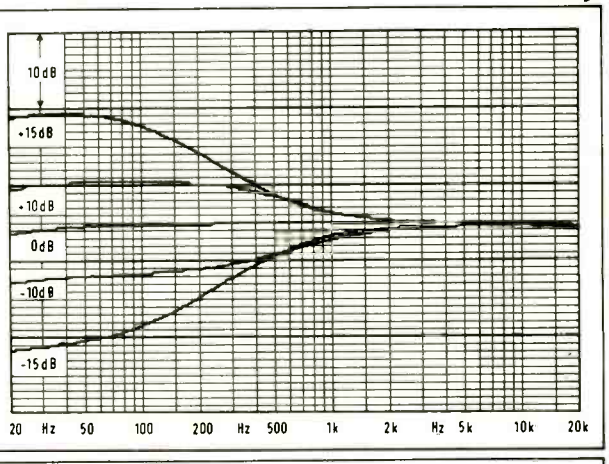


FIG.6
TOA RX-7
MID EQ RANGE

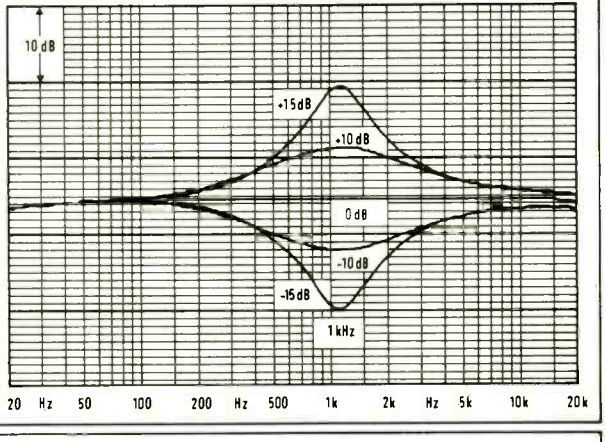
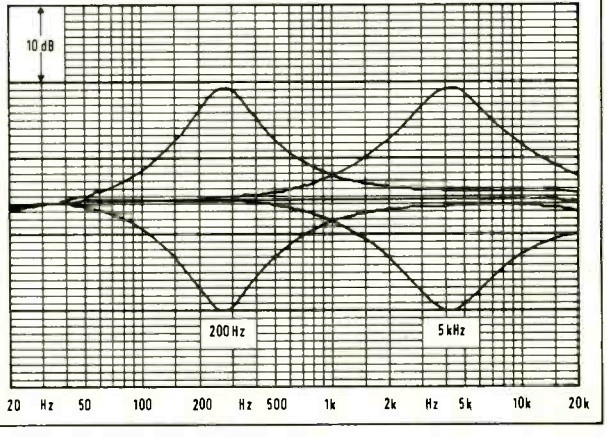


FIG.7
TOA RX-7
MID EQ FEQUENCY RANGE



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to any combination of the group and echo/foldback busses. The talkback input is a transformer coupled XLR connector on the front panel with a nearby gain potentiometer and press-to-talk button. The latter switches between talkback and the oscillator inputs which are then fed to the transformer coupled talkback output and to the eight buss selection switches.

The oscillator section at the middle of the front panel has a green oscillator on warning LED, an oscillator level potentiometer and five interlocking pushbuttons. These consist of an off button, three buttons selecting sinewaves at 400 Hz, 1 kHz or 10 kHz and a fifth button providing pink noise.

Inputs and outputs

The single channel inputs had a maximum gain of 84.5 dB to the group outputs, changing to −64.1 dB and −45 dB with the input attenuator switch, the trim control offering a further 31 dB reduction in gain with sensibly accurate calibrations. Depending upon the setting of the input attenuator switch, the overload input at maximum trim gain was +11/—8/—28 dBm which is quite adequate with the maximum input being more than +22 dBm.

Whilst the trim control had no effect upon the input impedance of 1120 Ω at the maximum sensitivity, this increased to 1240 Ω at the other attenuator settings. This is fine for all types of microphone (with the switched phantom powering being 47.8 V) although it is on the low side for some high level sources. As shown in **Fig 1** which is typical for the inputs, the common mode rejection was excellent at low frequencies.

The unbalanced channel insert points had a maximum gain to the group outputs of 20.4 dB with a satisfactory input impedance of 19.5 kΩ and a drive capability in excess of +22 dBm. Similarly the unbalanced group insert points had a high impedance of 29.7 kΩ with a drive capability in excess of +22 dBm and a maximum gain to the group outputs of 11.2 dB.

The remaining high level balanced inputs for echo return, auxiliary in and sub in all had an impedance approximating 2.4 kΩ which is on the low side for some applications but they could all handle in excess of +22 dBm with the maximum gain to the group outputs being 10 dB for the sub inputs and 18.8 dB for the auxiliary and echo returns. Typically the common mode rejection for these inputs was 90 dB at 20 Hz decreasing with frequency at 6 dB/octave.

An odd man out was the balanced off-air input with its switchable 47.8 V phantom powering, a constant input impedance of 5.9 kΩ and maximum gain of 60 dB—the overload input being only −8 dBm.

With the exception of the front panel stereo unbalanced headphone output with its drive capability of +13 dBm from a source impedance constant at 10 Ω, the outputs fall into two categories, unbalanced and transformer coupled floating. The unbalanced outputs all had a source impedance close to 100 Ω with a drive capability of +24 dB.7 V or +21 dBm loaded into 600 Ω. Similarly, the floating outputs had a source impedance approximating 80 Ω with a drive capability of +23 dBm loaded into 600 Ω or +24 dB.7 V into a high impedance — all outputs being completely satisfactory.

Frequency response

The frequency response from the channel inputs to the group outputs remained constant with changes in the overall gain, a typical response when using a low impedance source being shown in **Fig 2.** Very sensibly both the high frequencies and the low frequencies are rolled off at the edges of the audio frequency band.

Insertion of the channel module equaliser in the flat position had no significant effect upon the frequency response with the high pass filters having the characteristics shown in **Fig 3** with −3 dB points at 60 or 120 Hz and 12 dB/octave rates of attenuation. The performance of the shelving high and low frequency equalisers are shown in **Fig 4** and **Fig 5** for the 0 dB, ±10 dB and ±15 dB settings. It can be seen that the overall shapes are good but that the ±10 dB calibration is rather arbitrary. This is not a bad thing, however, as the control law is better than the calibrations would indicate.

Similar remarks apply to the peaking mid frequency equaliser as shown in **Fig 6** when set

82 ▶

FIG.8
TOA RX-7
HARMONIC DISTORTION

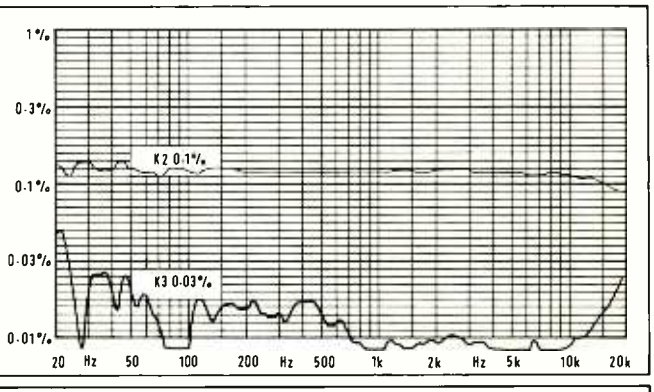


FIG.9
TOA RX-7
IM DISTORTION

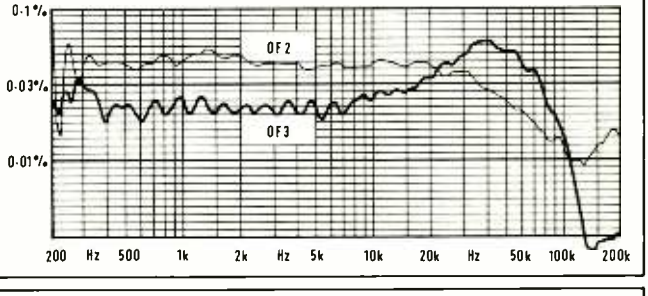


FIG.11
TOA RX-7
PINK NOISE OUTPUT

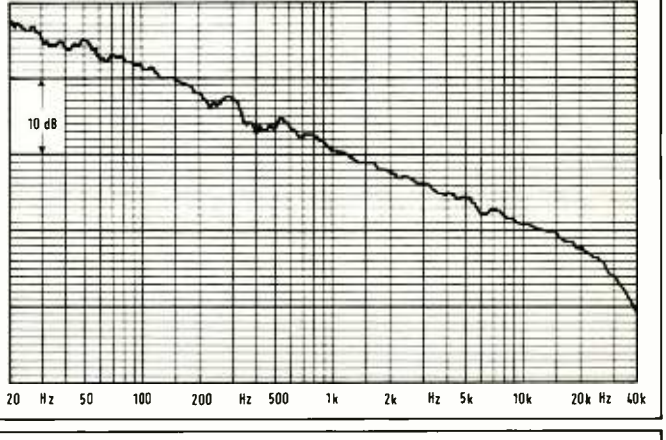


FIG.12
TOA RX-7
PHASE SHIFT

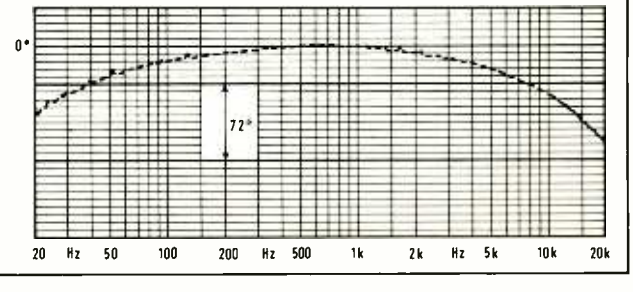
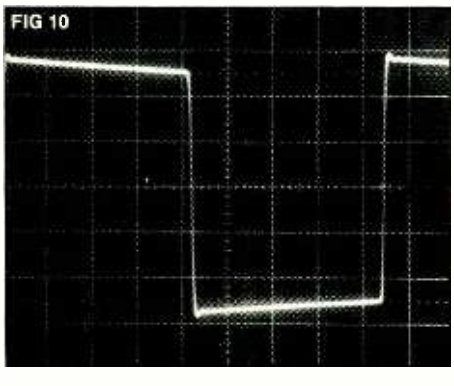


FIG 10



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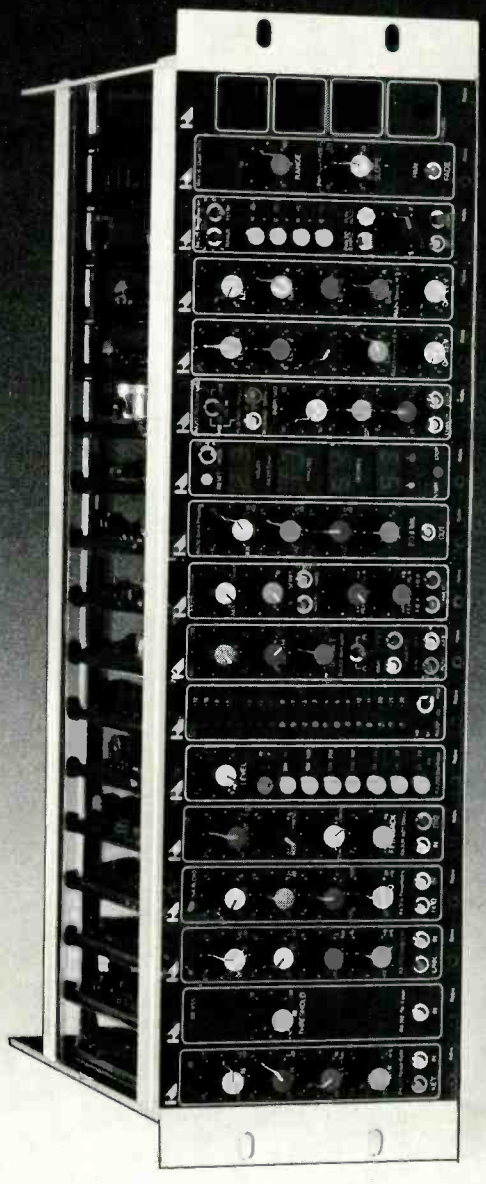

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for 1 kHz, the frequency range as shown in **Fig 7** being slightly short of the specified 200 Hz to 5 kHz. The equalisers in the group modules fitted to the auxiliary inputs offered a similarly good performance. The frequency response from other inputs and to other outputs was found to be completely satisfactory with various combinations of signal routing.

Distortion

Harmonic distortion remained remarkably constant with level below clipping and signal routing, a typical second and third harmonic distortion characteristic being shown in **Fig 8** for the channel input to the group output. As can be seen the distortion is well below the specified 0.5% with the less offensive second harmonic predominating at 0.1%. The higher harmonics were at insignificant levels.

Provided that the input module was run well below clipping, the intermodulation distortion to the CCIF twin tone method using tones separated by 70 Hz was good as shown in **Fig 9.** However, the second order component could rise by 10 dB at higher input levels before the overload LED operated. Like the harmonic distortion, the intermodulation distortion was independent of signal routing, and with the proviso above, generally insensitive to level and gain settings.

The effect of applying a 1 kHz square wave to the channel inputs and routing to the group outputs provided remarkably good results as shown in **Fig 10,** irrespective of the output loading and gain settings.

All peak indicator LEDs required about 5 ms to give a visable indication with no hold circuit being used. However, the peak indication occurred 6 dB below clipping in the channel modules and 10 dB below clipping in the group modules and the foldback and echo sends.

In all cases, zero VU corresponded to +4 dBm at the line outputs with the VU meters indicating the correct output level as determined by the loading conditions.

Noise

Hum in any input/output condition was at negligible levels, partially thanks to the sensible facility associated with most balanced inputs and outputs which have a slide switch for lifting the ground connection.

Noise generally behaved in a logically anticipated manner with the insertion of equalisers and the grouping of signals. So far as the channel inputs were concerned, the output noise remained almost constant with the switched pad setting, the pad being located before the input transformer and the variable gain input stage.

In **Table 1** the noise in a group output is referred to the appropriate input with the channel and group faders at maximum gain as was the trim control on the input modules.

Table 1 indicates a very good microphone input noise performance, the input being shunted by 200 Ω for the above measurements. **Table 2** shows noise referred to the input for the remaining inputs at maximum gain. Bearing in mind that all except the off-air inputs can accept in excess of +22 dBm this performance is perfectly satisfactory.

The internal oscillator

The internal oscillator which provides a variable level sinewave source in addition to pink noise was found to be a very useful feature with the level at the three frequencies being within ±0.1 dB. Frequency accuracy was good and whilst harmonic distortion was high for some purposes (and constant with output level) the maximum sinewave output level of +24 dBm at the group outputs was useful. (See **Table 3.**)

The RMS pink noise output level was found to be 1.2 dB above the sinewave output level such that at the maximum output the pink noise could readily clip the group outputs.

Fig 11 shows a spectrum analysis of the pink noise demonstrating that the spectrum with a constant bandwidth analysis closely follows the theoretical −6 dB/octave line from 20 Hz to 25 kHz above which the level falls.

Other matters

The VU meters were found to have the correct average rectifier characteristic but the rise time of the large group/programme meters was found to be on the slow side with the meters indicating −0.5 dB on a 300 ms toneburst. Also, the fall time of these meters was on the fast side at 200 ms as opposed to the desirable 300 ms.

Whilst the crosstalk between adjacent channels and groups was negligible, other forms of leakage or crosstalk were significant. In particular, leakage across the channel on/off switch was typically 70 dB up to 2 kHz, falling to 50 dB at 20 kHz. Leakage across the group on/off switches in the channel modules was found to be 70 dB at 200 Hz increasing to 6 dB/octave.

Although the addition of channels to a particular group had no effect upon level, the addition of group routing within a particular channel could shift level slightly, 1 dB or a little more depending upon combinations.

The pan controls were found to be smooth in operation with the law shifting one channel up by 3 dB and the other down by 3 dB—a good law. Phase shift from the channel inputs to the group outputs was independent of gain and channel routing as shown in **Fig 12.**

Summary

This Toa mixer was of conventional and highly practical design for sound reinforcement and basic recording purposes. All controls had a clean and uncluttered layout with good identifications.

The interfacing arrangements were generally good (but some inputs might usefully have a higher input impedance) with the input modules being particularly versatile.

Both frequency response and noise were to a good standard under all conditions but harmonic distortion does not compete with some products. Mechanically the construction was to a good standard for this category of mixer and the modular construction should make servicing a simple matter.

Overall, this is a sensible mixer at a reasonable cost, with the general standard of construction offering good value for money. **Hugh Ford**

TABLE 1
Measurement method

	Microphone inputs Noise referred to input		
Pad	0 dB	−20 dB	−40 dB
22 Hz to 22 kHz RMS	−126.7 dBm	−107.2 dBm	−87.9 dBm
A-weighted RMS	−129.5 dBm	−109.7 dBm	−90.5 dBm
CCIR-weighted RMS	−120.5 dBm	−100.5 dBm	−81.3 dBm
CCIR-weighted quasi-peak	−116.1 dBm	−96.4 dBm	−77.0 dBm
CCIR-weighted ARM	−127.0 dBm	−107.0 dBm	−87.8 dBm

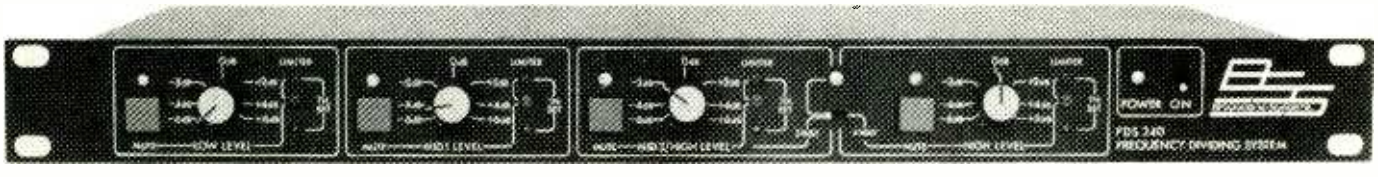
TABLE 2

Measurement method	Noise in dBm Channel insert	Echo/aux return	Sub in	Group insert	Off-air
22 Hz to 22 kHz RMS	−81.8	−84.3	−86.0	−85.9	−101.2
A-weighted RMS	−87.6	−86.8	−88.4	−98.4	−103.8
CCIR-weighted RMS	−78.6	−77.8	−79.5	−89.6	−95.2
CCIR-weighted quasi-peak	−74.4	−73.8	−76.0	−85.2	−91.4
CCIR-weighted ARM	−82.6	−84.3	−86.2	−96.2	−101.7

TABLE 3

Nominal frequency	Actual	Harmonic distortion K2	K3	K4	K5
400 Hz	391.7 Hz	0.16%	0.52%	0.032%	0.16%
1000 Hz	1006.2 Hz	0.16%	0.48%	0.032%	0.13%
10 kHz	9945.8 Hz	0.16%	0.36%	0.014%	0.063%

Brooke Siren Systems FDS 340



MANUFACTURER'S SPECIFICATION

Inputs: 10 kΩ electronically balanced; 24 dB/octave 30 Hz subsonic filter; 36 dB/octave 26 kHz high frequency filter; connector *XLR 3-31* or equivalent.
Outputs: unbalanced 50 mΩ current limited source to drive 600 Ω load; maximum output level +20 dBm; transformer balancing available as retro-fittable option; connector *XLR 3-32* or equivalent.
Gain: +6 dB as standard or to customer's specification (maximum +20 dB).
Noise: <—85 dBm, 20 Hz to 20 kHz unweighted.
Distortion: any level up to +20 dBm less than 0.1% total harmonic distortion; typically 0.01% total harmonic distortion at +6 dBm output level.
Frequency and slope: any frequency, as specified at time of purchase; slope 24 dB/octave Butterworth, unless specified as otherwise.
Limiter and level ind: one off red and green LED per section; red LED calibration set by 20-turn preset and indicates start of limiter action; green LED automatically set 15 dB below red LED, and indicates presence of programme on that section; limiter is feed forward type with attack and release times set depending on frequency band being covered.
Power: 190 V to 260 V or 95 V to 130 V 50/60 Hz; set by 2-position switch on rear of unit; approximately 50 VA consumption; anchored 2 m power cord; AC fuse on rear of unit; DC fuses inside unit.
DC fuse: two off inside unit; 250 mA quick blow 20 mm length.
Dimensions: (wdh) 19 × 7.5 × 1¾ in.
Manufacturer: Brooke Siren Systems, 213 Sydney Road, Muswell Hill, London N10 2NL.

THE *FDS Series 340* is a monophonic electronic crossover unit which may be switched to work as a 3- or 4-way crossover. In the latter case only the high mid filter is modified and the high filter, low mid and low frequency filters remain as they were in the 4-way mode. Designed for mounting into a 19 in rack 1 U high, the front panel has mounting holes with the electronics being based on a large PCB covering the base of the unit. A further PCB on to which the front panel controls and indicators are mounted, extends the width of the unit behind the front panel with the three filter boards plugging vertically into the main mother board.

Interconnections between the front board and the main board are hand wired as are the connections to the rear panel features and to the front panel gain controls, etc. Overall this wiring is rather untidy and the general layout unimpressive. Whilst the main board has a label identifying the value of the two DC rail fuses no other component identifications were provided with the review sample but a layout diagram was supplied together with circuits. The integrated circuits are socketed for ease of servicing. Whilst the unit includes 12 preset potentiometers of unknown function no alignment instructions

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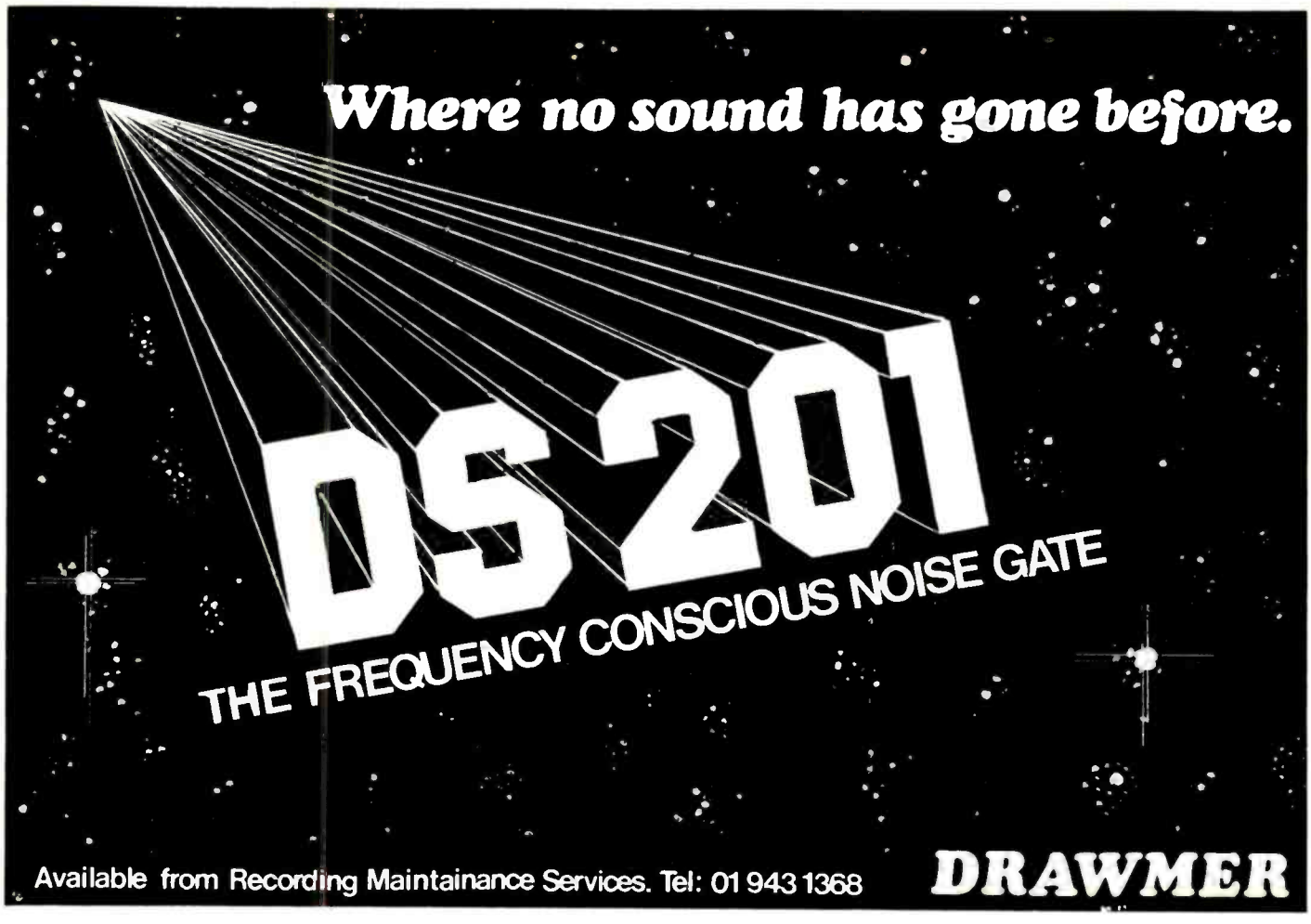

"....and the DD500 is just one of our outstanding achievements."

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DDA

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were provided.

A further aspect which is worrying is the standard of electrical safety—the clearance between parts directly connected to the mains input and parts connected to the chassis was far too small at the power on/off switch, the voltage tap switch and between conductors on the PCB. Furthermore the mains tap switch could be operated without the use of tools and possibly operated by accident.

Turning to the external features all controls and connections are clearly identified in white on the dark grey steel case. To the right of the front panel is the power on/off toggle switch with a nearby power on red LED. Near the middle a second toggle switch with a green LED switches between 3- or 4-way operation.

The remaining controls are divided into four identical groups, one for each filter channel. A momentary pushbutton is provided for muting each channel with the muted condition being indicated by a bright red LED. Finally, each channel then has an input level control potentiometer which is calibrated in 2 dB steps to ±6 dB. Each channel with its own feed forward limiter has a 20-turn screwdriver-operated potentiometer accessed through a hole in the front panel for setting the limiter threshold. The limiting action which cannot be switched out of circuit is indicated by a red LED in each channel with a green LED becoming illuminated nominally 15 dB below limiting.

To the rear the power input is via a fixed 2 m long lead with the 240/120 V tap change slide switch and a properly identified 20 mm mains fuse being located next to the power cord. The electronically balanced audio input is via an *XLR* connector at the rear with the four audio output channels being unbalanced connections on *XLR* plugs. Balancing transformers are available as an option.

Finally there is a 7-way remote control socket which permits remote switches to mute any of the channels and to individually cancel the limiters. The circuit for this in the instruction manual was incorrect!

Inputs and outputs

The balanced input could handle +32 dBm before the onset of clipping with the common mode rejection being 45 dB at 100 Hz, 60 dB at 1 kHz or 61 dB at 10 kHz. Whether balanced or unbalanced the input impedance was adequately high at 9800 Ω at 1592 Hz. At the outputs the impedance was less than 1 Ω with the unbalanced outputs being capable of delivering +21 dB.7 V or +20.5 dBm when loaded into 600 Ω.

Gain from the input to the outputs at the filter centre frequencies at the extreme gain control settings and at the 0 dB calibration was as shown in **Table 1.**

Frequency response and noise

The frequency response from the input to the four outputs is shown in **Fig 1** for the 3- and 4-way modes which change the upper mid filter alone. The 24 dB/octave highpass filter had its —3 dB point at 29.5 Hz with the 36 dB/octave lowpass filter being sensibly placed at 26,060 Hz. The remaining filters had a rate of attenuation of 24 dB/octave with their —6 dB points being matched at 249/247 Hz, 1572/1392 Hz and 5406/4957 Hz in the 4-way mode. In the 3-way mode the high frequency —6 dB point become 1572/1528 Hz giving close matching.

Noise in the outputs when working at unity gain was measured in the four outputs in the 3-

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TABLE 1

Filter frequency	Low	Low mid	High mid	High
Zero dB	+0.2 dB	—0.4 dB	—1.6 dB	+0.1 dB
Maximum gain	+5.6 dB	+5.6 dB	+4.0 dB	+5.8 dB
Minimum gain	—5.0 dB	—5.5 dB	—7.0 dB	—5.2 dB

TABLE 2

Output	Noise in dBm				
Measurement method	Low	Low mid	High mid 4-way	High mid 3-way	High
22 Hz to 22 kHz RMS	—98.5	—101.0	—96.6	—85.6	—86.0
A-weighted RMS	—104.8	—102.6	—97.3	—90.5	—91.4
CCIR-weighted RMS	—99.0	—97.5	—88.0	—83.2	—84.5
CCIR-weighted quasi-peak	—92.0	—93.0	—84.0	—79.0	—80.3
CCIR-weighted ARM	—107.0	—104.0	—95.0	—89.6	—91.0

FIG.1 FDS 340 FREQUENCY RESPONSE, INPUT TO OUTPUTS

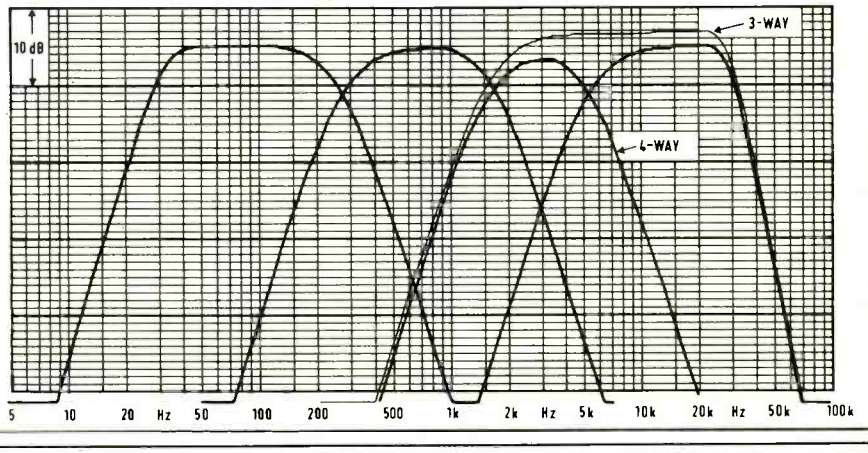


FIG. 2
FDS 340
HARMONIC DISTORTION
AT 0 dBm

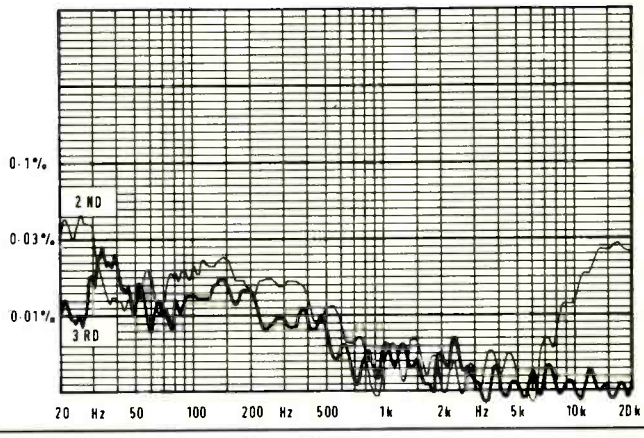
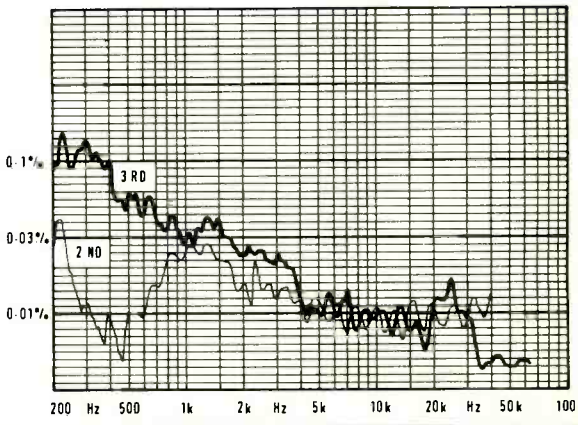


FIG.3
FDS 340
IM DISTORTION AT 0 dBm



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and 4-way modes, only the high mid output varying with the mode as should be expected (see **Table 2**).

Remembering that the effective output noise is the sum of the output channels and also that the drive capability is large, a good dynamic range is available. Noise varied in the worst case +3/−1 dB with gain settings and was not affected to a large extent by muting.

Whilst mains hum was always at a low level an undesirable ±2 mV spurious output at approximately 500 kHz was noted in the mid high and high outputs irrespective of control settings.

Distortion

In order to measure distortion the outputs of the four filters were summed with a resistive network as measurement of harmonic distortion within a particular frequency band would yield meaningless results in some cases. The second and third harmonic distortion for unity gain and 0 dBm output is shown in **Fig 2** to remain at low levels. At other gains and output levels below clipping there was little change in the harmonic distortion except that the high frequency second harmonic reduced with falling level.

Intermodulation distortion to the CCIF twin tone method using tones separated by 70 Hz produced **Fig 3** at 0 dBm output and unity gain. Whilst the intermodulation distortion is generally at a low level, the low frequency third order products (f2 + (f2—f1)) tended to rise.

Limiters

The threshold of limiting could be accurately set between the maximum output and —3.5 dBm output which might in some circumstances be inconveniently high. Once limiting was entered there was no measurable increase in output with increasing input level.

The attack and release times of the limiters appeared to be independent of the degree of limiting and the duration for which the threshold was exceeded with the fast attack and release times being measured as shown in **Table 3.**

TABLE 3

Frequency band	Low	Mid low	Mid high	High
Attack time	40 ms	7 ms	2 ms	1.5 ms
Release time	50 ms	8 ms	3 ms	2.5 ms

In the case of the high frequency band the limiter took 0.5 ms to operate and ignored 'overloads' shorter than this. The effect of subjecting the mid high section to tone bursts into 5 dB of limiting is shown in **Fig 4** where the upper trace is the input and the lower trace the output, the scale being 2 ms/division.

Limiting was always free from clicks and other defects with the red limiting LED being rapid in action and the green 'operating' LED becoming illuminated 15 dB below the limiting threshold.

Other matters

The unit sensibly entered the muted mode on switch-on in order to provide loudspeaker protection. Simple external switching connected to the remote socket enabled remote muting of individual channels and also the switching out of individual limiters.

Power line variations down to 200 V had no effect upon the performance and the steel case provided a good hum screen. This, together with the low heat dissipation, should allow units to be stacked into a rack mount without troubles.

Summary

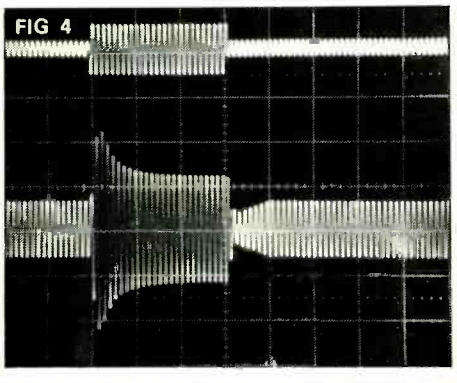
The Brooke Siren unit offers a generally good performance in terms of dynamic range and distortion with the accuracy of the filtering being good.

The limiters were effective and appeared to be free from defects while offering complete loudspeaker protection.

Whilst the mechanical construction was sound the layout was not impressive and the manufacturer must pay attention to the electrical safety of the unit.

Hugh Ford

FIG 4



Manufacturer's comment

We would like to thank Mr Ford for his review of our *FDS340* unit and take this opportunity to comment on some of the points raised.

The aspect of electrical safety needs some clarification, as we are unaware of any danger arising out of the use of this product. After speaking to Mr Ford, the problem seems to rest with the mechanical clearances provided by some of the panel parts carrying the mains voltages, in that their casing—which is at mains earth—is too close to their terminations which carry the mains voltage. Although adequately safe for 240 V operation, they would not resist the 1 kV to 2 kV flash-over test required for safety standards. After consultation with the component manufacturers, we will be taking steps to ensure that future products will use components carrying the full UL, VDE, CSA and BS approvals. We would like to point out that in our opinion the unit is in no way unsafe, as suggested by Mr Ford's comments, as existing users of the product would verify. At this point it is also worth mentioning that full protection is provided against mains over-voltage caused by inadvertent 120/240 V switch setting or the connection to 3-phase 415 V supply, by the fuse and internal VDR components, as proved by some of our customers.

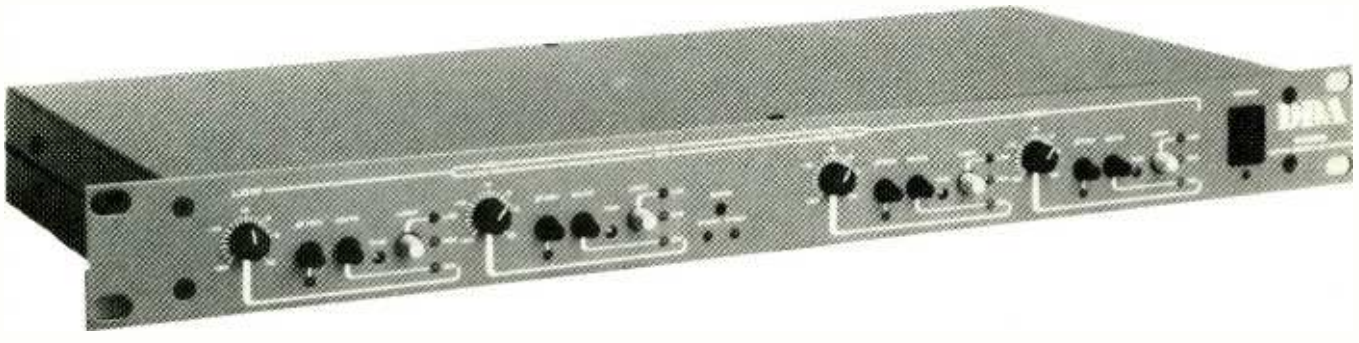
Returning to other points mentioned, we thank Mr Ford for pointing out the error on our wiring diagram for the 'remote' socket switch connections—it is surprising how the obvious errors are the ones that are always missed.

The limiter threshold lower setting point can be reduced to —20 dBV to order, if required. However professional high power amplifiers have input sensitivities of 0 dBV or higher, so the requirement to go lower has not arisen.

The untidy and unimpressive layout is obviously a personal opinion, and thus requires no comment. The unit contains both linear and logic circuit parts requiring careful layout to avoid spillage of the clocking waveforms. The design and layout used achieves excellent performance figures within a simple and professional package which supports the cost effective price.

Finally we apologise for not providing Mr Ford with the full alignment details for the mentioned 12 presets—we hoped that he would not require this information. Inspection of the provided circuit diagrams would have indicated their respective functions. Circuit descriptions and alignment procedures are provided as part of the servicing information released to our appointed servicing dealers. ■

DDA DD500



MANUFACTURER'S SPECIFICATION
Input impedance: >10kΩ (electronically balanced).
Input level: +4dBv (nominal), +20dBv (maximum).
Output impedance: <75Ω (electronically balanced).
Output level: +4dBv (nominal), +20dBv (maximum).
Noise: < −85dBv at any output.
Crosstalk: < −60dBv, 20Hz to 20kHz.
Distortion: <0.05% THD (ref +4dBv output).
Limiter: slope 10:1 Attack dependent on frequency band. Release dependent upon frequency band.
Input high pass filter: 12dB/octave, 30Hz.
Crossover slope: 12, 18 or 24dB/octave. Bessel or Butterworth selected on plug in cards.
Interface: *XLR*-type audio. IEC type mains.
Case: rack mount, aluminium.
Dimensions: 483 x 44.5 x 205mm.
Power requirements: 110−120V 50/60Hz or 220−240V 50/60Hz.
Manufacturer: DDA, Unit 7b, Worton Hall, Isleworth, Middlesex TW7 6ER, UK.
USA/Canada: Heinl Electronics Inc, 16 Mary Street, Unit 1, Aurora, Ontario, Canada L4G 3W8.

THE *DD500* is an electronic crossover unit designed for mounting into a 19in rack occupying one rack unit in height with the front panel having holes for mounting.

The unit may be configured either as a stereo two-way crossover or as a mono four-way crossover, the change being accomplished by operating an internal latching switch and changing the three filter boards which plug into the mother board.

These plug-in filter boards may be either Butterworth or Bessel filters with 12, 18 or 24 dB/octave rates of attenuation. Most sensibly the manufacturer includes tables for altering the filter's frequencies in the instruction book, and furthermore the component values specified use the standard E24 series of resistor and capacitor values which are readily available.

Finished in charcoal grey with white control and interconnection identifications, the unit is contained in a solid steel case. With the exception of the three plug-in filter boards all components are located on a single printed circuit board covering the full area of the case. All controls and connectors except the power input and on/off switch are mounted on this board.

Clear component identifications are provided with the printed circuit board layout and overall quality and presentation being outstanding. Similarly, the front panel layout in four groups − one for each filter − is clear and uncluttered. The features for each filter include a detented gain control with calibrations from −12dB to +4dB, three locking pushbutton switches with associated LEDs and a screwdriver operated multi-turn threshold control accessed through a hold in the front panel.

One pushbutton in each filter channel allows individual channels to be muted, a second pushbutton allows the phase of the channel to be reversed (each of these having a warning LED) with the third pushbutton switching a limiter into the individual channels.

Associated with the limiters are red and green LEDs, the red LED being illuminated when the signal reaches the threshold of limiting with the limiter switched on, and the green LED being illuminated at about 10dB below limiting with or without the limiter in circuit.

The remaining front panel features include two LEDs at the centre which indicate if the unit in configured for stereo or mono and the power on/off rocker switch with a nearby power indicator.

At the rear the audio inputs and outputs are electronically balanced *XLR* connectors with the power input being a combined IEC connector with voltage selector and power fuse.

Within the unit the input signals pass through a high pass filter before the four bandpass filters which are grouped in parallel or in pairs for mono and stereo use respectively. Following the initial high pass filter stage is a gain control element used by the limiter, with the feed to the gain control stage being derived from the filter output so that out of band signals do not affect the limiter which includes a light dependent resistor module.

The channel gain control follows the limiter which is in turn followed by the phase reverse stage and the low pass element before the balanced output stage.

Inputs and outputs

The review unit which was configured for 4-way mono operation used the left input, with the right input being unused. The input impedance in the balanced mode was 18.6kΩ and 13.7kΩ unbalanced.

Common mode rejection was good being 71dB at 100Hz, 70dB at 1kHz or 68dB at 10kHz with the onset of input clipping excellent at +27dBm.

Similarly the output performance was good with the outputs capable of driving +21dB.7V or +20dBm loaded into 600Ω with the source impedance satisfactory at 73Ω at 1kHz.

The detented channel gain control steps were found to be less than 0.5dB above −6dB gain, increasing to less than 1db at lower gains with the controls having reasonably accurate calibrations. The overall gain ranges at the filter centre frequencies were as shown in Table 1.

Frequency response and noise

The frequency response from the input to each of the four outputs is shown in **Fig 1**. The 12dB/octave high pass filter had a −3dB point at 20 Hz with the 6dB/octave low pass filter having its −3dB point at 73.4kHz.

Proceeding upwards in frequency, the −6dB points of the bandpass filters were well matched at 245/243Hz, 1503/1436Hz and 7705/7270Hz. The frequency response was found to be inde-

92 ▶

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pendent of gain and the use of the phase reverse switches.

Noise in the outputs was measured at unity gain for each output to the normal measurement methods and was found to vary logically with the channel gain setting. However, mains hum components in the outputs did vary with the insertion of the phase reverse stages with the band limited 22Hz to 22kHz, noise being degraded by 3dB in the high, high-mid and low frequency outputs but improving 1dB in the low-mid output. The manufacturers state that this problem has been overcome in current production.

Bearing in mind the drive capability of +20dBm, a good dynamic range is available even when it is realised that the noise outputs of the four channels effectively add together.

Distortion

Distortion was measured by summing the four outputs with a resistive network as measurement of harmonic distortion in the individual outputs would be meaningless because many harmonics would be outside the individual frequency bands.

The individual second and third harmonic distortion at unity gain and 0dBm output is shown in **Fig 2** where the low frequency second harmonic is the residual from the instrumentation.

Harmonic distortion at other levels below clipping was at a similar level irrespective of all control settings. CCIF twin tone intermodulation distortion was also measured in a similar manner and found to be very good at $< 0.01\%$ for the second and third order difference frequencies.

The limiters

It was found that the onset of limiting could be accurately set between −10dBm and +15dBm output with the compression above limiting being 10:1 with the limiter being located after the front panel gain controls.

The application of tone bursts to all four channels shows that the onset of any limiting action was delayed by 10ms such that inputs exceeding the limiting threshold had no effect if their duration was less than 10ms.

With longer 'overloads' the action of the limiters is shown in **Fig 3** where the upper trace is the input and the lower trace the output where the continuous tone is 5dB below limiting and the burst 5dB above the limiting threshold.

Whilst the limiters' attack was the same for the four channels and was insensitive to the 'overload' duration and amplitude the release time was programme sensitive. For short duration excursions into limiting the release was rapid, becoming longer with longer 'overloads'.

Limiting was always completely free from clicks or other undesirable features with the recovery from limiting being clean.

The red limit indicating LED was rapid in action being illuminated once limiting occured as opposed to when the threshold was exceeded with the green 'operating' LED being illuminated 10dB below the limiting threshold with limiting switched in or out.

Other matters

The unit was extremely tolerant to power line variations, operating quite happily with only 200 V input on the 240 V setting.

No problem should be experienced stacking the units in a rack mount as the heat dissipation was minimal and the case was a good hum screen.

Summary

This is an extremely well made unit with all connections and parts clearly identified. The limiters offered very good protection to loudspeakers whilst operating with the minimum of audible effects.

Overall, the performance was very good, with the mono/stereo feature and choice of filter frequencies making this a versatile crossover unit.

Hugh Ford

TABLE 1

Filter frequency	Low	Low mid	High mid	High
Maximum gain	+3.9dB	+4.5dB	+3.2dB	+3.5dB
Minimum gain	−12.4dB	−13.0dB	−13.3dB	−13.0dB

TABLE 2

Output	Noise in outputs (dBm) Low	Mid low	Mid high	High
Measurement method				
22Hz to 22kHz RMS	−93.4	−92.6	−94.8	−91.6
A-weighted RMS	−101.8	−98.0	−96.0	−94.8
CCIR weighted RMS	−97.5	−95.0	−87.0	−85.4
CCIR weighted quasi-peak	−92.5	−90.5	−83.0	−81.0
CCIR weighted ARM	−101.5	−102.5	−95.0	−93.0

FIG.1
DDA DD500
FREQUENCY RESPONSE FROM INPUT TO EACH OF THE FOUR OUTPUTS

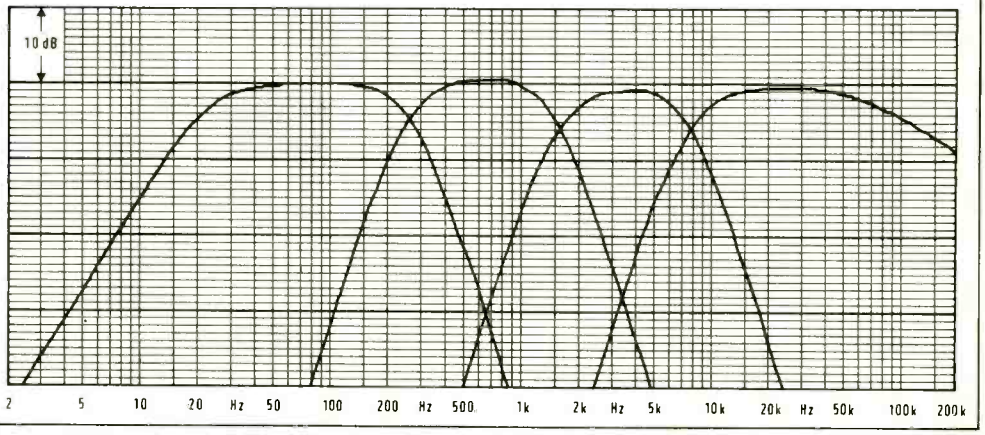


FIG.2
DDA DD500
HARMONIC DISTORTION AT 0dBm

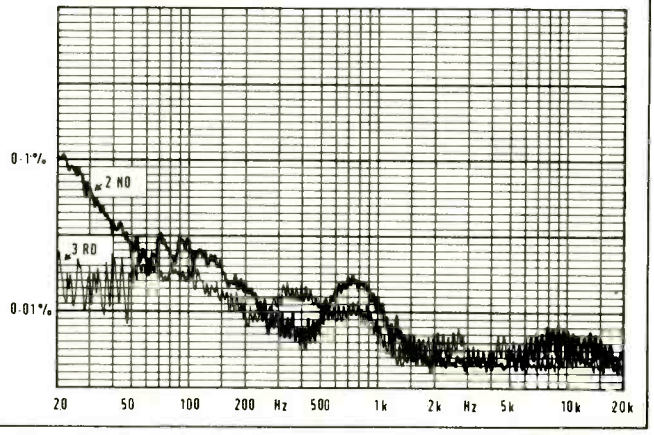
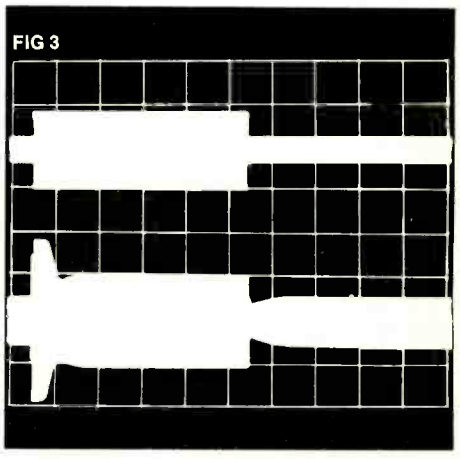


FIG 3



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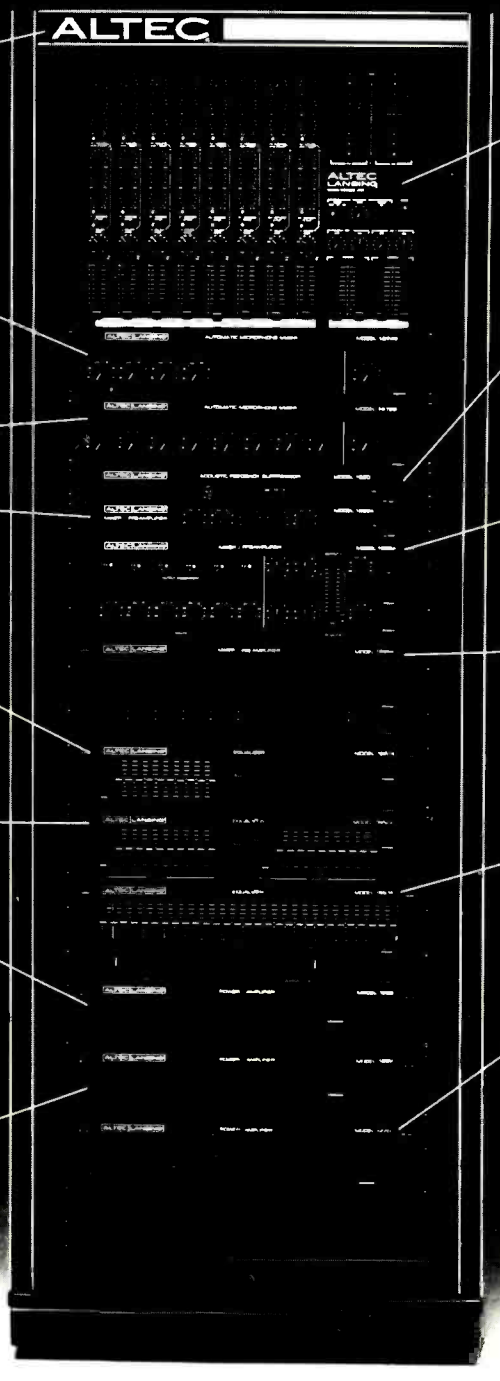
1269—Stereo Power Amplifier. 120+ watts/channel, 400/mono, with same performance and features as 1268.



1690—8-Channel Stereo Mixer/Preamplifier for sound reinforcement, recording and mixdown. Linking connectors allow coupling additional 1690s for expanded versatility.

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U.K. distributors for Altec Lansing loudspeakers and systems.
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Tel: 01-568 9222. Telex: 27976

Name _____

Address _____

Occupation _____

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CASSETTE DUPLICATING from 38p 1-1/hi-speed. "SSP were very good quality, the best value for money."—Sound International, July 1981. Simon Stable, 46 Westend, Launton, Oxon. Tel. 08692 2831. (X)

DISC CUTTING EQUIPMENT and systems bought, sold and installed. Competent engineering for any make or type. Tony Batchelor, 13a Hamilton Way, London, N.3. Telephone 01-346 0033. (F)

CASSETTE DUPLICATION-REAL TIME. Perfect copies from your original. Competitive prices. Phone 08692 3986. N.R.A. Recordings, 37 West End, Launton, Oxon. (E)

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REVOX, TEAC, UHER, NAGRA...

etc., servicing; repairing; line-up; re-biasing; head, guide and brake replacement. Revox varispeed, editing and speed change modifications. A swift and personal service by experienced engineers. Also equipment hire and sales.

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SOUND CASSETTE SERVICES LTD.
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Tel: 0460 20988

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100 C-60 cassettes beautifully copied in stereo
Just £59.50 (plus VAT)

We can copy from 100 to 5,000 high quality cassettes on our high speed loop-bin system, load them precisely into top-class shells. Price includes library case and all production work from your ¼in edited master. Any length C-5 to C-90. **NOW ALSO** cassettes in **GOLD** effect finish! Ring for price check.

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INDUSTRY SUPPLIES
EXACT LENGTH CASSETTES
SELECTA SOUND
18 BALMORAL ROAD
GIDEA PARK From
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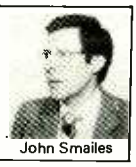
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High quality real time cassette copying at the lowest prices.

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Open reel, video and audio tapes. Professional and domestic at discount prices. Large selection of cassettes. Precision quality.

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A real alternative to noise gates for controlling noise in low cost effects.

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For super quality Master Discs, Demo Discs and Pressings. Scully lathe with our latest CR 82/01 Stereo Cutting System.

Also half speed cutting for that very special disc.

Dolby 'A', Dolby 'B' and DBX noise reduction.

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Tel. BRACKNELL (0344) 54935

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TEAC 244/34/38 discounts and HP and leasing. Erricks Bradford 309266 (Julian). (X)

FOR SALE: 16 channel, 8 buss, 16 track console with modifications to provide additional channels and monitor. Was NEVE type A246, £17,000 o.n.o. Also for sale: DOLBY noise reduction unit type M24 (24 channel), £7,000 o.n.o. Contact: Ladbroke Films Ltd. Tel. 01-727 3541. (E)

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12 input channels. 8 outputs. PPM metering. Fully balanced throughout. Modular system. Penny and Giles faders. 3-band EQ (switchable). 2 filters. 2 foldbacks/2 echo sends with pre/post fade. PFL/mute switching. Phase reversal. Oscillator. Many other extra facilities including echo on F/B. Excellent maintenance record. Very reliable, professional desk. Also comes complete with m odule extender card and spares. Comprehensive integral patchbay plus 20 × 10-way GPO jack, patchfield and patchcords. **£3,250** (inc. VAT) o.n.o. **Call GRAHAM 01-481 8615.**

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*We manufacture to order, ¼", ½", 1" and 2" tape heads and a wide variety of film heads at very competitive prices. Please specify machine type for an early quotation.
*We also offer a prompt RELAPPING service at standard prices.

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Tel. 01-864 1577

JACKFIELDS etc.

Bantam, ¼", Video, Pre-Wired and Connectorized, to your specification. Also Cable Assemblies, Patch-Cords and Custom Panels. Complete installations undertaken.

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Neumann VMS70/SX74, complete less monitors	$140,000
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Neumann VMS66/SX68 system, complete room	£24,500
Neumann VMS66/Ortofon 732 system, complete	£25,000
MSS lathe with mono head and amplifier	£950
Neumann VMS66/SX68 complete less monitors	£18,500
Neumann SX74 head	£4,500
Vari pitch Neumann with Grampian head and amp	£800
Neumann VMS66/SX68 lathe, VG66 amps, console	£15,000
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WANTED: Neumann SP77 console, urgent.
Various cutting consoles from **£1,200** to **£7,000.**
We have a stock of spare parts for lathes, cutting amplifiers, etc., including Neumann and Ortofon transformers, and Scully mechanical spares. We can supply the complete range of Ortofon equipment. If you have any equipment to sell, please contact us. Telephone for latest lists.
TAM, 13a Hamilton Way, London N3 1AN. 01-346 0033

N.S.F. Stereo reverb plates complete with remote and 19" rack mounted control unit **£520.00**
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Stratford-upon-Avon
0789-293674
0905-612750

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01-686 2599 ext. 111

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FOR HIRE

LTD HIRE
MULTITRACK
01-348-1339
STUDER A80's
24-16-8-4-2 track
DOLBY Q-LOCK FAIRCHILD 670

Specialists in Studio Equipment Hire

A whole range of digital and analog processing equipment

Phone Andy on **01-708 0483**

10 Steedman Street, London SE17

WANTED

VORTEXION RECORDERS Model VB required in good condition. Please write giving previous use and price to Box No 889 c/o *Studio Sound*. (E)

We need 24-track studio equipment for ready made, air conditioned studio, control room, etc. All sound proofing, wiring already done, even to a large stage for live recordings. Would consider a percentage basis, or any other reasonable proposition.

Box No. 891

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Introducing

THE SOUND EFFECTS LIBRARY FOR PROFESSIONALS

- 3000 STEREO EFFECTS
- 125 TAPES at 7½ or 15ips
- PRICED FROM $1500.00

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LOCATION RECORDING

to the highest standard: The Sound Advice 8 track Mobile (complete 1" studio installed in large trailer), from £78 per 8 hour day, plus mileage.
VHS colour video facilities available for additional £20 per day.
Telephone Malcolm on Northampton (0604) 403624

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EXPERIENCED MAINTENANCE ENGINEER required for small Studio complex in London N.W.1. Phone Pete Brown, 01-586 1271. (E)

WE HAVE A VACANCY for an experienced Sound Engineer to work full time or part time in our 24-track Studio and video production facility. Please apply to Q Studios, 1487 Melton Road, Queniborough, Leics. Tel. (0533) 608194. (E)

EXPERIENCED ENGINEER required by major West End commercial production studio. If you have a real interest in radio and television advertising please apply to Box No 890 c/o *Studio Sound*. (E)

WEST END 24T studio requires experienced freelance recording engineer. Tel. 01-437 5175. (E)

TRILION VIDEO LTD

Trilion Video Pty. South Africa, based in Johannesburg has a vacancy for

AUDIO DUBBING ENGINEER
AUDIO TECHNICAL ENGINEER

Top salaries negotiable. Good working conditions plus excellent pension, insurance and increment schemes.

Non ACTT position.

Please contact John Edwards, 36-44 Brewer Street, London W1. Tel. 01-439 4177.

TRILION VIDEO LTD

NATIONAL FARMERS' UNION

Radio and Video Studio

A junior vacancy (age 19-25) exists for a person with a good academic and/or relevant technical qualification to assist the person responsible for the NFU Studio. A basic knowledge of audio-visual equipment advantageous, but initial training given. The successful candidate will understudy senior with view to taking over on his retirement.

Application forms from:

The Director of Staff Relations, NFU, Agriculture House, Knightsbridge, London SW1X 7NJ

SOUND ASSISTANT

Kadek Vision have a vacancy for a Sound Assistant to work with the Sound Supervisor and assist in the everyday running of the Sound Department. Applicants should have a basic knowledge of sound recording and microphone technique. Salary as ACTT agreement. All applications in confidence to:

Ken Williams, Kadek Vision Limited, Shepperton Studio Centre, Post 21, Studios Road, Shepperton, Middlesex TW17 0QD. Telephone Chertsey (09328) 66941.

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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.

Both machines are superb examples of Studer precision. Both come with the new narrow head block that cuts the travel distance between the erase and record heads to 88 millisecs 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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INTERNATIONAL AG
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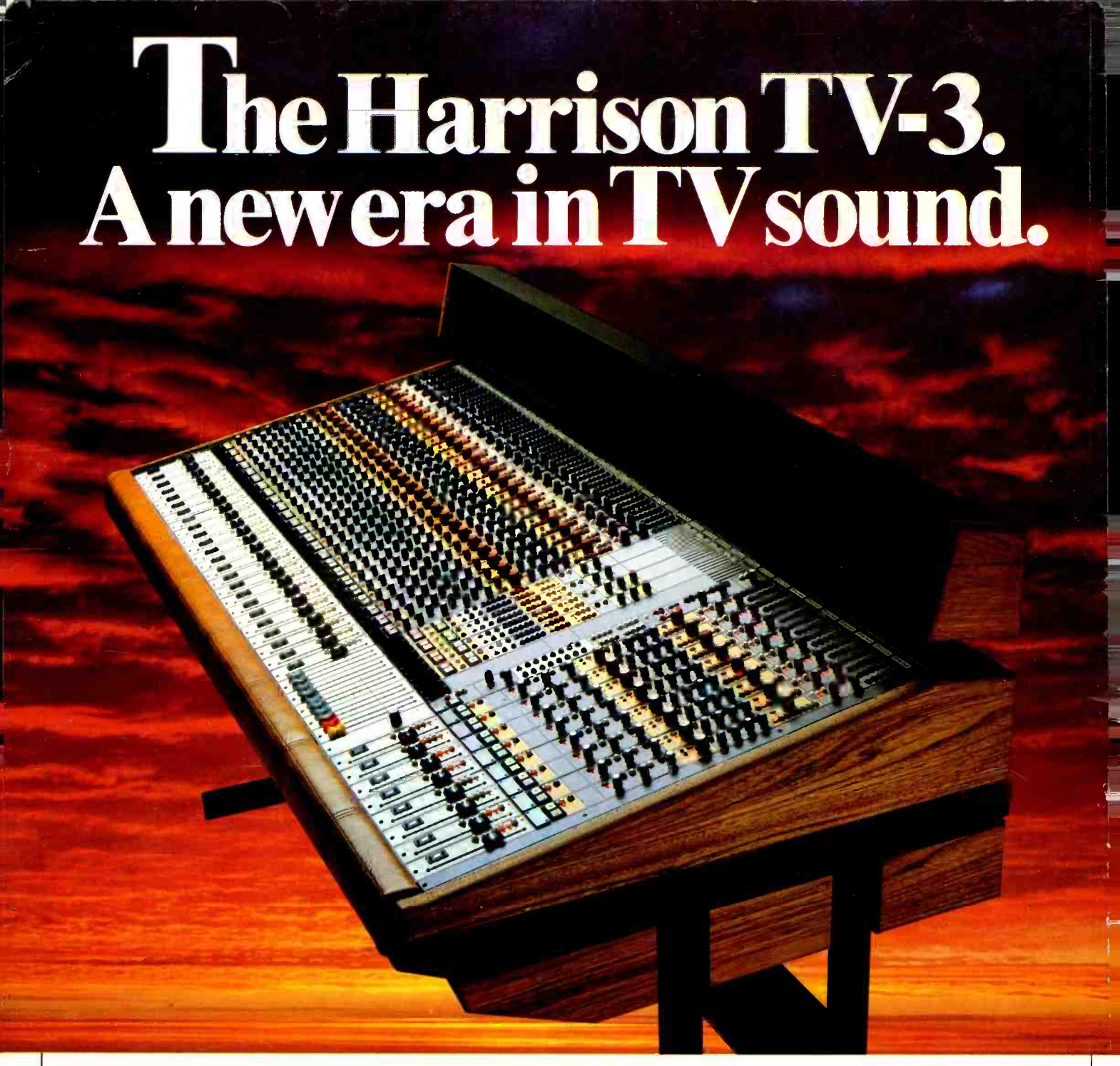
49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ
Telephone 01-953 0091, Telex 27502

STUDER REVOX AMERICA INC Nashville Telephone (615) 254-5651 STUDER REVOX S A R L Paris Telephone 533 5858 STUDER REVOX CANADA LTD Toronto Telephone (416) 423-2831

The Harrison TV-3. A new era in TV sound.



The new Harrison TV-3 stereo television console has been specifically designed to support audio production techniques for the video revolution of the 1980's.

Equally at home in remote/OB vans, fixed studio operations, audio sweetening or post-production suites, the TV-3 provides the highest standards of production facilities and signal performance.

With eight stereo audio groups, a versatile separate multitrack section, VCA input grouping and automation-ready, TV-3 heralds a new era in TV sound.

TV-3. The complete audio console for teleproduction.

Write or telephone for full details.

Harrison

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Telephone 01-953 0091, Telex 27502