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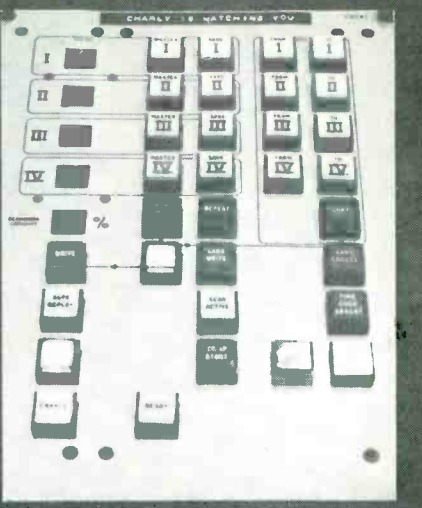

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AND BROADCAST ENGINEERING

October celebrates the fifth anniversary of commercial radio in Britain—London Broadcast was the first opening on October 8, 1973, while the London music station Capital Radio followed a week later on October 16. A further 17 stations commenced broadcasting around Britain over the next two and a half years finalising with Beacon Radio in Wolverhampton on April 12, 1976. Meanwhile, the BBC has been running some 20-odd local radio stations for about 10 years, and has recently given a regional identity to opt-out services on Radio 4 (such as Radio Scotland). In the White Paper published in July, the government recommended that both IBA and BBC should be permitted to open further stations as recommended by a Home Office working party. The IBA has suggested the following areas as suitable for new commercial stations (providing sufficient consortia are also interested): Cardiff, Tayside, Aberdeen, the Flyde area in Lancashire, Coventry, Northampton, Luton, Norwich, Huddersfield area, Peterborough, Southend, Gloucester/Cheltenham, Bournemouth, Exeter/Torbay, and the western side of Northern Ireland. The BBC has proposed specific towns for local radio: Alnwick, Barnstaple, Barrow, Cambridge, Canterbury, Dorchester, Exeter, Gloucester, Guildford, Lincoln, Northampton, Norwich, Plymouth, Shrewsbury, Swindon, Taunton, Truro, and York. Current thinking is for only one station in each new area, so some of the above duplication will be undoubtedly discussed by the working party when it eventually meets. The BBC is investigating local radio in Guernsey and Jersey, and also community stations in parts of Greater London.

The potential introduction of all these new radio stations will create numerous jobs, both technical and creative. However until training schemes are organised, these new positions will be filled by trained staff from other broadcasting organisations thus causing considerable problems. The BBC in particular has experienced hundreds of trained engineers defecting to ITV and ILR. Maybe now is the time to use some of the considerable profits being made by some commercial radio stations for some form of organised training scheme.

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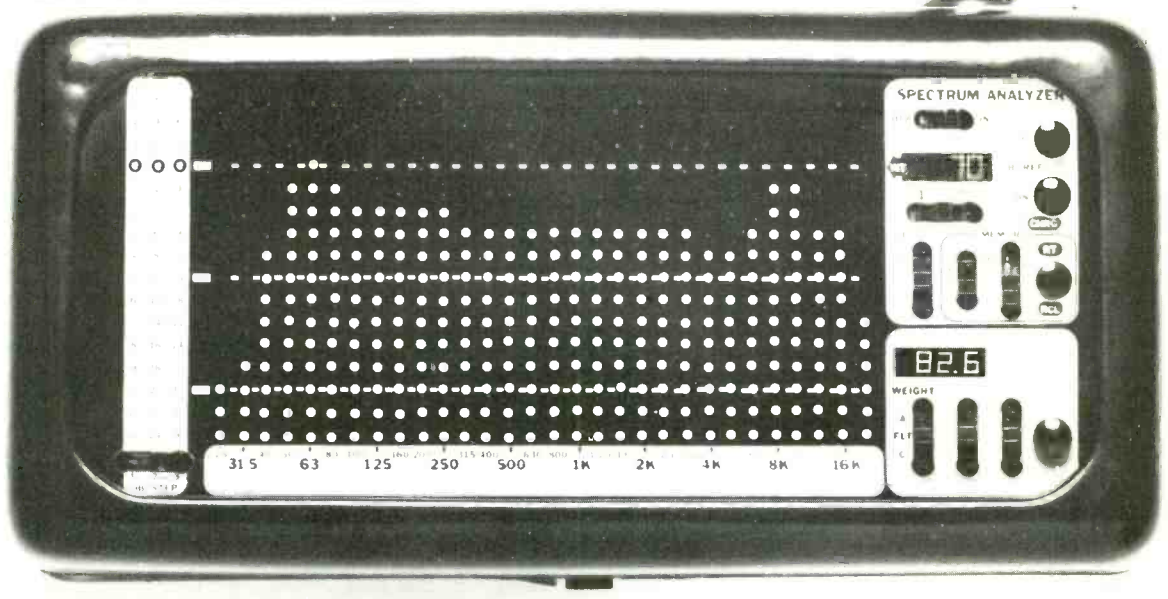

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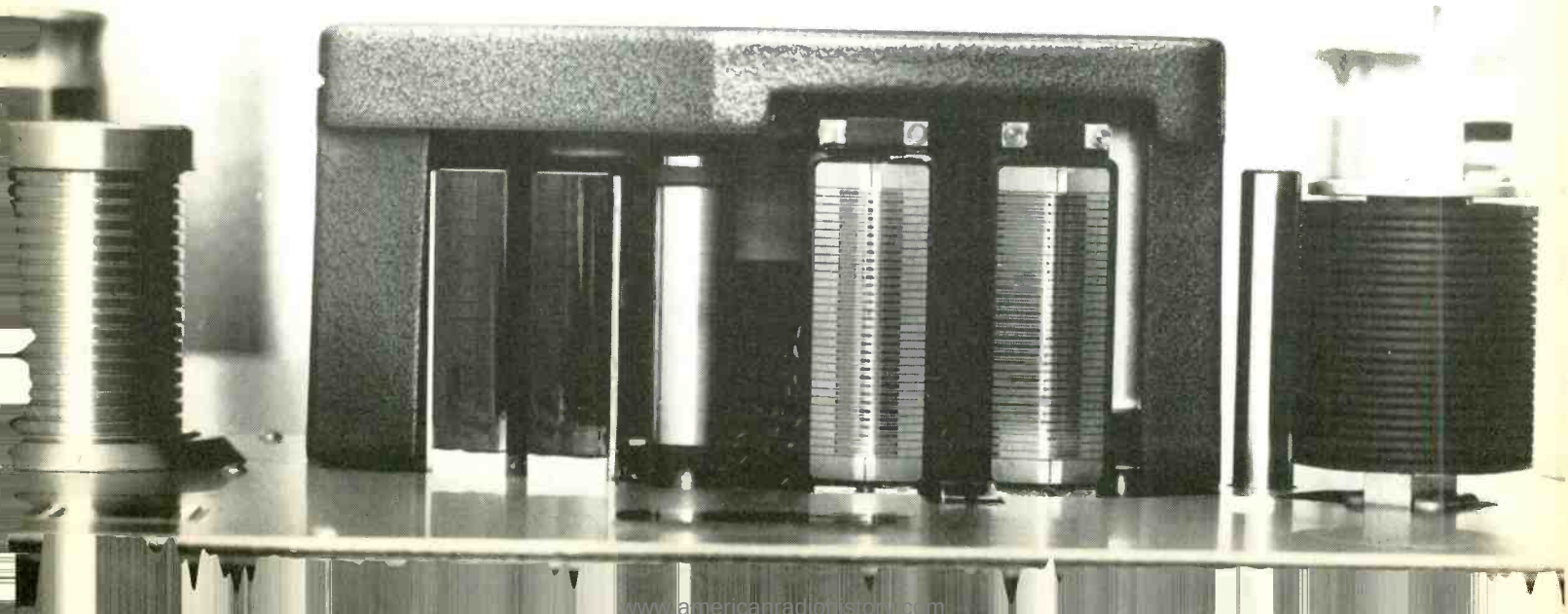

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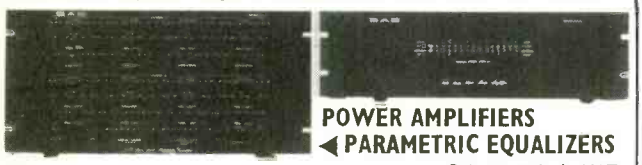

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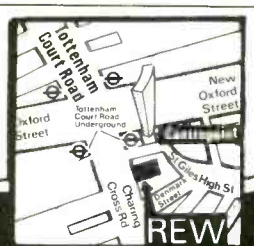

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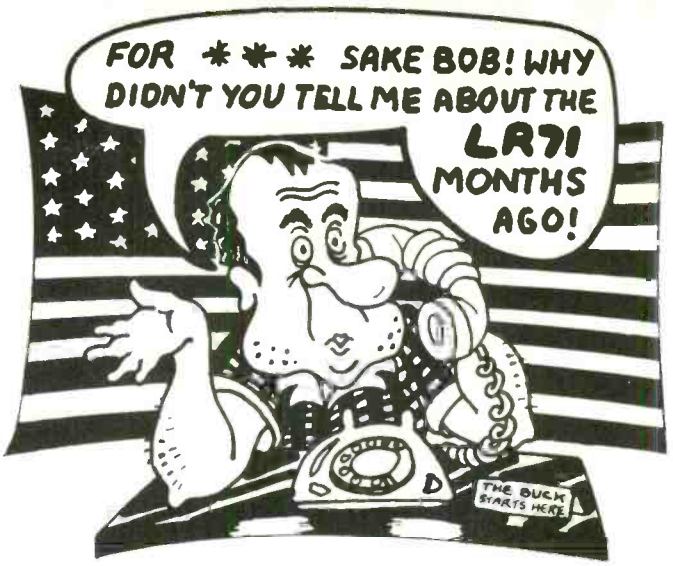

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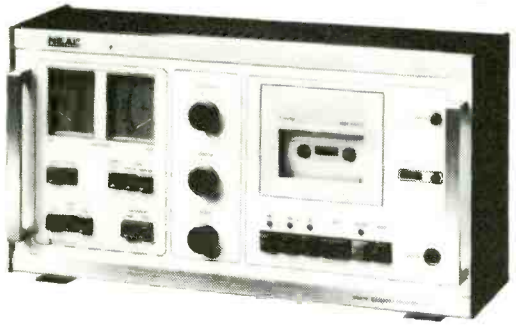

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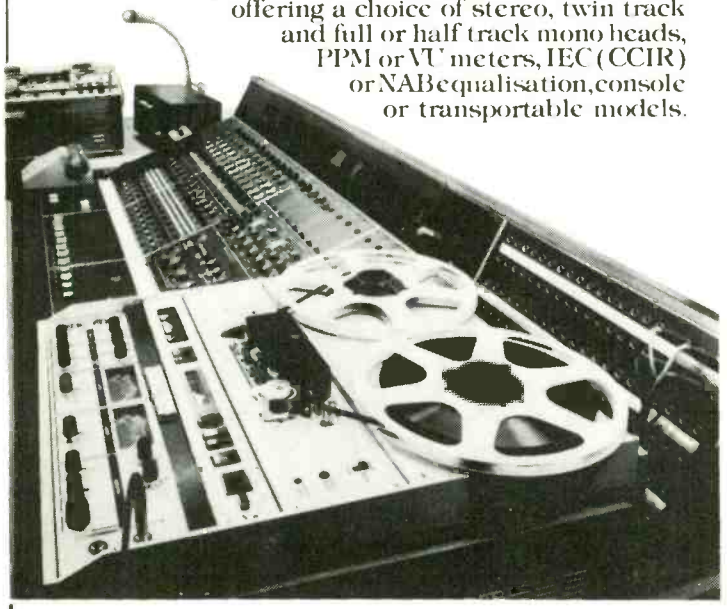

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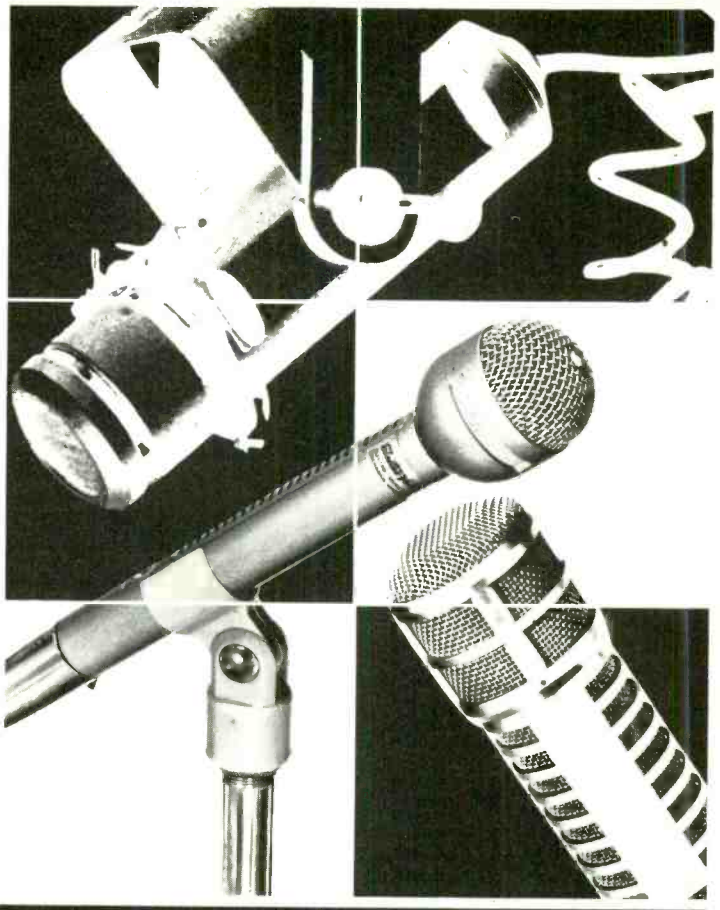

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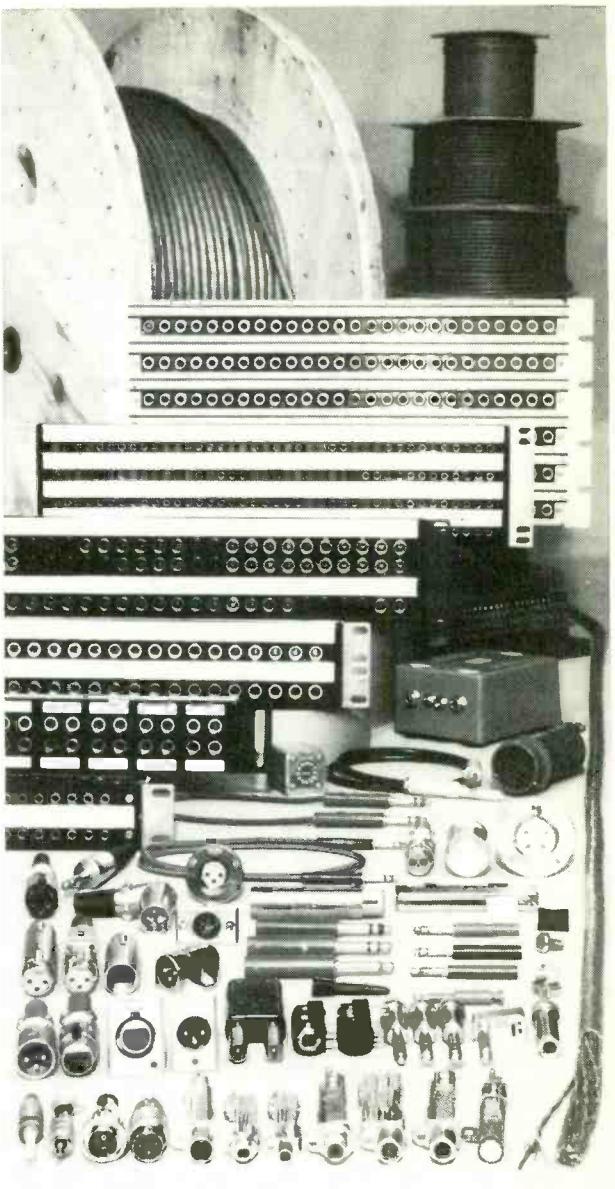

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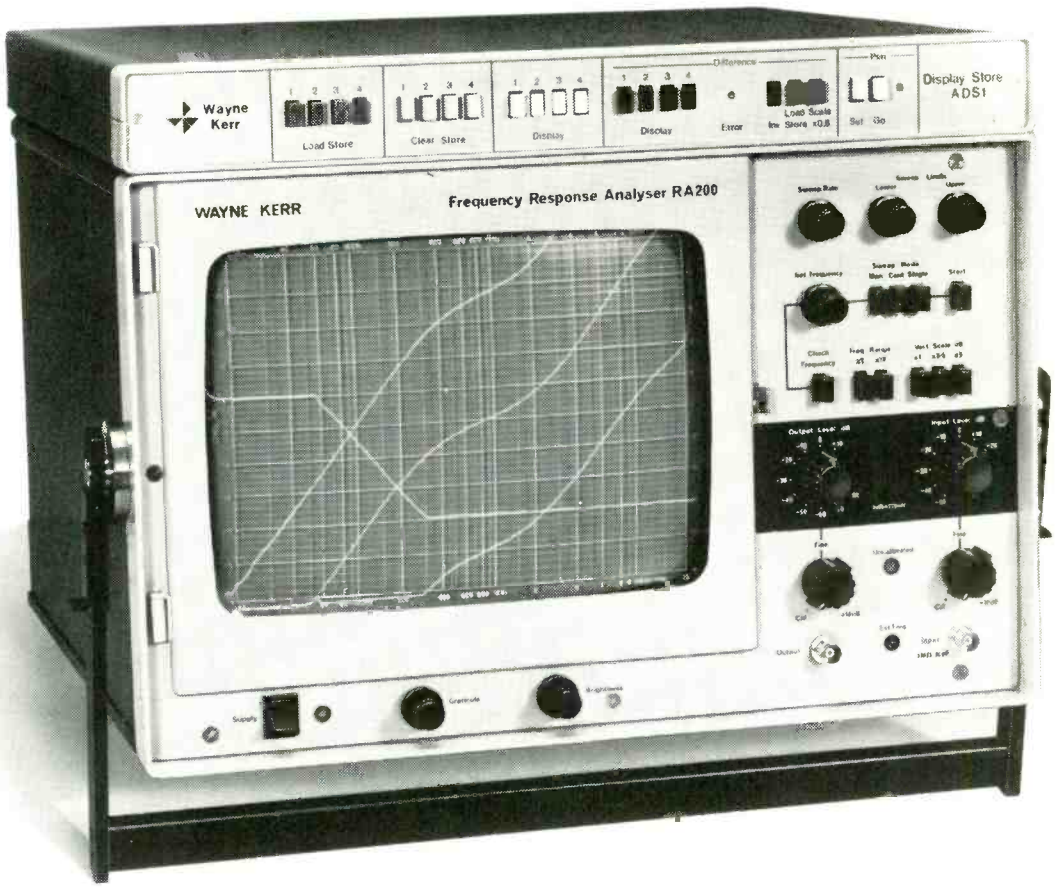

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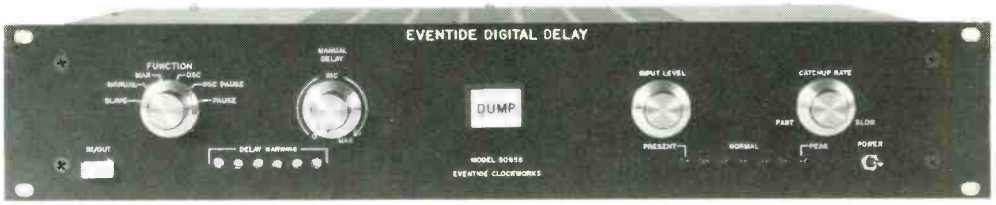

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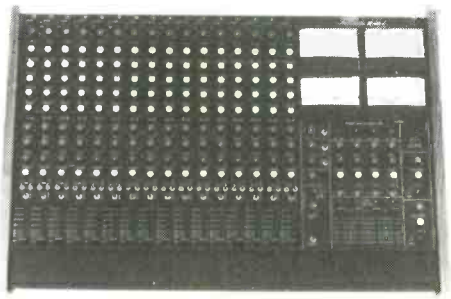

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news

APRS Studio Engineer course
The fifth in the highly successful series of technical courses organised for studio engineers, managers and directors is being run by the APRS and being held at the University of Surrey in Guildford between September 16 and 23. The programme includes sessions on location recording, acoustics, listening and monitoring, sound reinforcement, classical recording, microphones, cassette duplication, disc cutting, control desks, limiters, compressors and noise reduction, loudspeakers and room equalisation, use of effects units, tape as a medium, tape machines, automation, digital techniques, role of the record producer, and a multitrack mixing session in a London studio. Course fee is £122 non-resident with campus accommodation £28 extra. Applicants are selected for the course after completing a questionnaire-cum application form which is available from The Secretary APRS, E L Masek, 23 Chestnut Avenue, Chorley Wood, Herts WD3 4HA, UK.

New UK agents for MXR
The full range of professional products manufactured by MXR, including the new digital delay line, *AutoPhaser*, *AutoFlanger*, *Mini-Limiter* and recently-developed compander system (more details in next month's issue), are now being marketed in the UK by Atlantex Music Limited, 16 High Street, Graveley, Herts. Phone: 0438 50113.

Trident doing well with TSM
By the time this issue slaps onto your desk (or door mat), Trident should have sold (or be in the process of putting the finishing touches to the sale of) some six *TSM* desks. The first *TSM* was installed a couple of months ago at Soundtrack, Denmark, while the first installation in the USA will probably be at Cherokee in Los Angeles (see Sept Studio Diary). Sarm Studios, London, whose original Trident *B-Series* desk was damaged in a recent fire (May STUDIO SOUND, page 32), will be installing a monstrous 40/24/40 board. Other orders in the pipeline are from Radio Band of America, New York, for a 40/32 desk, Good Earth Studios, London, for a 32/24 desk and Majestic Studios, London, who have shown interest in a similar 32/24 console.

Inverters
Caracal Engineering of Biggleswade manufacture sine wave inverters that provide 120 to 300VA at 50Hz or 60Hz from 12V or 24V batteries and are ruggedly built in welded steel cases. Output voltages available are 240V, 220V and 115V, the frequency being controlled to within ±0.2Hz. Output voltage is stabilised against load changes and the unit resists overloading, short circuit and reverse battery connection. Automatic cut-out prevents battery damage when nearing exhaustion.
Caracal Engineering, 42-44 Shortmead Street, Biggleswade, Bedfordshire, UK. Phone: 0767 81361.

Eventide 6.4s broadcast delay line
Although primarily intended to provide a profanity delay on live phone-in radio programmes, the new *BD955* digital delay line from Eventide Clockworks can also be used for general production work such as effects or echo delay. Available in either 7.5kHz (for talks) or 15kHz bandwidth versions, the *BD955* is available fitted for a maximum delay of 1.6s, 3.2s or 6.4s using RAM memories. When used for profanity delay, normally the output would be fixed at say 6.4s after the input, but when triggered by pressing the dump button, the delay is lost and the programme continues in real time (the presenter having also lost the phone caller!). However, rather than using a jingle to commence the delay again, the delay period gradually extends from nil to full with no noticeable effect on the output. Prices range from $2,300 for a basic 7.5kHz 1.6s version to $6,300 for the full 15kHz 6.4s model.
Eventide Clockworks Inc, 265 West 54th Street, New York NY 10019. Phone: (212) 581-9290.
Europe: Scenic Sounds Equipment, 97-99 Dean Street, London W1. Phone: 01-734 2812. Telex: 27939.

Studer A800 in detail

Willi Studer is one of a select group of manufacturers whose new products are awaited with particular interest by critical users in the recording industry. The new Studer *A800* multitrack tape transport to supersede the much acclaimed *A80* multitrack is no exception. Referred to cryptically (and hungrily!) in certain well-heeled studio circles as 'the new Studer', it has already built up a reputation as being both revolutionary in concept and completely new in design—and the machine is not even available yet!

As with any new product from a manufacturer considered a giant in the field, reports tend to get a little distorted in the almost hysterical excitement of anticipation. In the sober light of morning the Studer *A800* should be seen as a transport based on proven design principles rationalised to interface with the recording industry's new found treasure, *the microprocessor;* and in this respect there have been some innovations. Not unlike 3M, for instance, whose 32-channel *M79* digital machine will be unveiled in Britain next year, Studer have decided to stay with analogue recording for the time being despite the introduction of a microprocessor based control logic. It seems probable, however, that the *A800* will be the company's last analogue machine.

Channel meters have been rearranged above the transport in strips of eight rather than the *A80's* paired configuration by mounting channel cards, containing all routine alignment adjustments, separately below the tape deck. Other obvious changes are 35.5cm reel capacity and new quick release hublocks. High torque DC spooling motors have been fitted which Studer claim, make for a 'very fast responding transport'. A microprocessor controlled 13MHz crystal reference is compared with the output from two tachos to maintain constant speed on the AC asynchronous capstan motor. The nominal speed can be varied by ±7 halftones on the new timer panel mounted to the right of the deck top. The panel includes a ±10 hour digital timer and a varispeed deviation digital display. The varispeed is operated by depressing 'down' or 'up' (coarse and fine buttons are provided) until the required speed is attained. Adjacent to the timer display are controls permitting the automatic location of timer zero and one pre-determined timer setting, or 'address' as Studer call it. To the left of the timer panel is the familiar 'edit' pot, featuring constant speed spooling at any given setting and to the left of this is the conventional grouping of basic transport command buttons. The edit pot is brought into circuit by a latching edit button.

Staying with the transport we now move into an area of subtlety afforded by the incorporation of microprocessor based logic revealed in all its breathtaking smoothness and sense only by operation. Having said that, I should make it clear that I haven't operated the machine—yet. Anyhow, the tape response is compared to machine status by the microprocessor via a number of sensors. A sensor roller positioned in the take-up path detects and quantifies tape motion, and specifies direction, by issuing a series of pulses derived from high resolution photo-electric devices. Precision pots in both arms of the tape circuit provide a voltage proportional to tape tension. The microprocessor is able to use information received from tension and motion sensors to achieve smooth mode changes. When play is selected for instance, the capstan pinch roller is placed in 'edit' position and spooling motors engaged to bring tape up to play

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Deltalab Research DL-1 Digital Delay Unit

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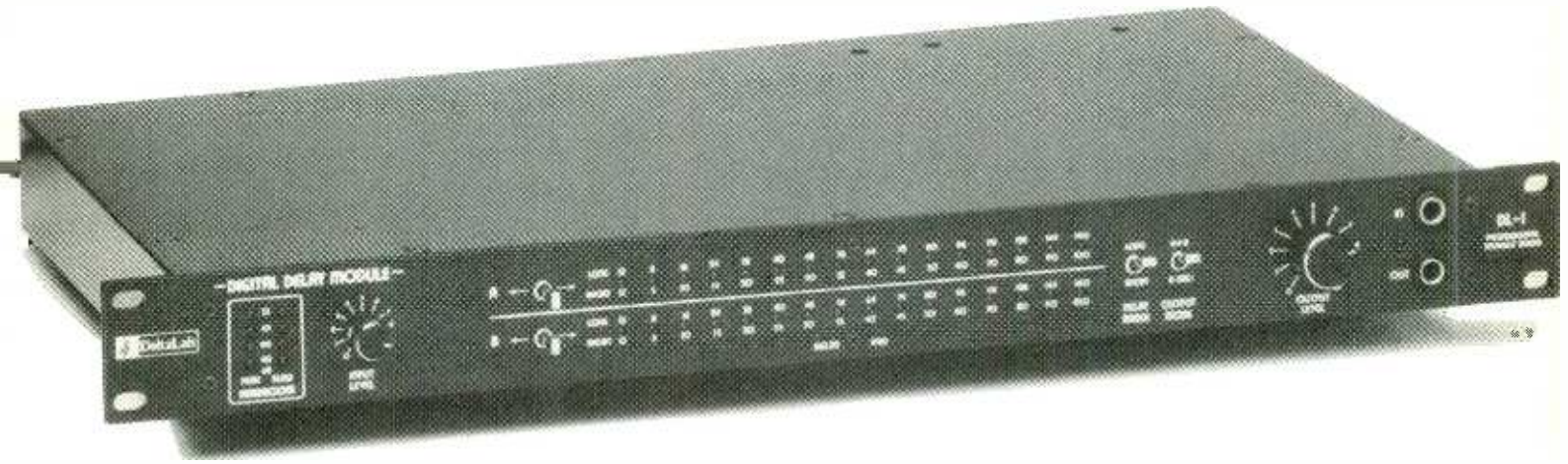


Fully professional 'no performance compromise' Digital Delay has at last become available at a reasonable cost with Deltalab Research's DL-1 Delay Unit. Equally suitable for high quality recording or PA use, the DL-1 is flexible (3 outputs each with selectable delays) easy to install (balanced input/outputs) and small in size (19″ × 1¾″).

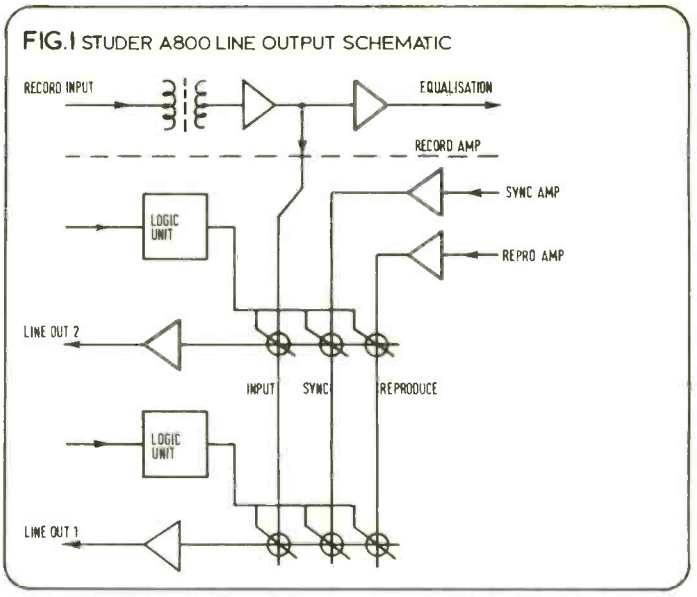
For full information on the Deltalab Research DL-1 please contact:

Scenic Sounds Equipment, 97/99 Dean Street, London W1V 5RA.
Tel. 01-734 2812. Telex 27939.

speed; once this has been achieved the pinch roller pulls in. Studer claim this minimises wear on the tape. Similarly, in going from a wind mode to play, tape is first brought to speed under tape motion control before the pinch roller pulls in to engage the capstan shaft. Record mode is postponed until capstan contact is achieved.

During deceleration when switching from a wind mode, the EMF from each spooling motor is measured and fed to the microprocessor. Combined with information received from tension and motion sensors, these signals permit smooth electronic braking. To protect the tape an optical 'end of tape' sensor and a 'head shield in position' microswitch are incorporated. In addition, each tension detector pot has a 'no tape' switch attached which trips at the minimum tension position. Start of machine is possible only if each of these sensors indicate 'ready'. I was rather mystified by the headshield interlock but Studer argue that when the headshield is in position, possible accidents due to the high torque of spooling motors are 'eliminated to a great extent'. In any event, the headshield may be disengaged after the machine has been started. A 'no start possible' condition is indicated by a flashing stop button. Electro mechanical band brakes are fitted to spool motors in a failsafe configuration and so operate only in the event of power shut down.

FIG.1 STUDER A800 LINE OUTPUT SCHEMATIC



Because audio electronics are located beneath the transport, plenty of space has been made available above the deck for the VU channel meters above which is the master panel. This is bracketed on the fascia into four control groupings (left to right); remote control, operating mode, code channel and audio master. The remote control section selects local or remote operation of transport, audio electronics and code channel by means of 'butterfly' fluorescent dot type push buttons, used extensively throughout the machine. LEDs above each button indicate completion of the command. The operating mode section provides a master mute button cancelling all playback outputs. The next four buttons in this grouping work only when the optional delay unit is fitted. Here, the microprocessor controls the sequential switch of erase and record heads going in and out of record mode producing what Studer claim to be 'the most perfect electronic edit'. So, the first button in this grouping is labelled 'rehearse'. This simulates such an electronic edit by switching playback electronics to input or mute when play and record buttons are depressed together—also of course it inhibits recording. The playback switching, however, is timed just as though an actual drop-in were being made. The next button 'drop in delay inhibit' disables drop in delay just described but retains delay on dropping out. To drop out you simply press play as on the *A80*. 'Auto input' switches playback electronics to input when stop or a wind mode is selected, and 'spot erase' disables the transport for manual erase editing purposes.

The code channel section relates to the bottom edge track (track 16 or 24) used for SMPTE time code locking to other multitrack machines. A 'safe' button protects the track from accidental erasure whilst another switches it out of the audio electronics. Studer's Tape Lock System (*TLS2000*) programmer interfaces with the code channel output and provides comprehensive locking between machines, including framer advance and retard, and code related external equipment cues. Additional buttons and LEDs control and indicate code channel mode. The last master panel section is labelled 'audio master' but before this is a set of retracted buttons secured behind a plastic slide. These comprise a master 'safe' button completely disabling record (useful for protecting expensive master tapes!), a master 'NAB/CCIR' button, a master 'output calibration' button and a master 'output +10dB' button which increases the gain of line amplifiers by 10dB for frequency response alignments with the VU meters on the machine.

Before describing the audio master section, it may be a good idea to outline Studer's line amplifier logic. **Fig. 1** schematically shows the two line outputs per channel—the 'logic unit' shown is micro-processor controlled and offers the following output possibilities: simultaneous (ie master) control of all 'no 2 outputs,' and simultaneous *or* individual control of all 'no 1 outputs.' This is borne out in the VU meter panel photograph; the mode select buttons and LED's relate to 'output 1' only. However, safe/ready status is selected individually from each VU panel except where the aforementioned 'master safe' button has been depressed. Also on each VU panel is a jack socket controlled by a two-way toggle switch, for headphone monitoring of either output (1 or 2).

And so onto the master panel's 'audio master' section. This provides master control of audio electronics, with the option of individual channel control of output 1 only. Returning to the channel cards racked beneath the transport, there may be one or two electronic features worth highlighting. Each channel is made up of four standard sized plug-in PCBs; reproduce, sync, record and HF driver. Each HF driver board is equipped with a single bias pot which is used to calibrate all channels to a reference level selected on a two-way switch in 'channel adjustment' position on the master oscillator board. The switch is then thrown to 'bias setting' position and the bias adjusted for all channels simultaneously from the master oscillator board for each of the two transport speeds. On the face of it, this feature looks like a boon for maintenance engineers that should make both routine adjustments and calibration to different brands of tape simple tasks. Studer also provides an LED in the bias section of HF drivers which indicates bias presence. The erase section of the master oscillator board has the conventional 'fast' and 'slow' pots, whilst on each HF driver is a

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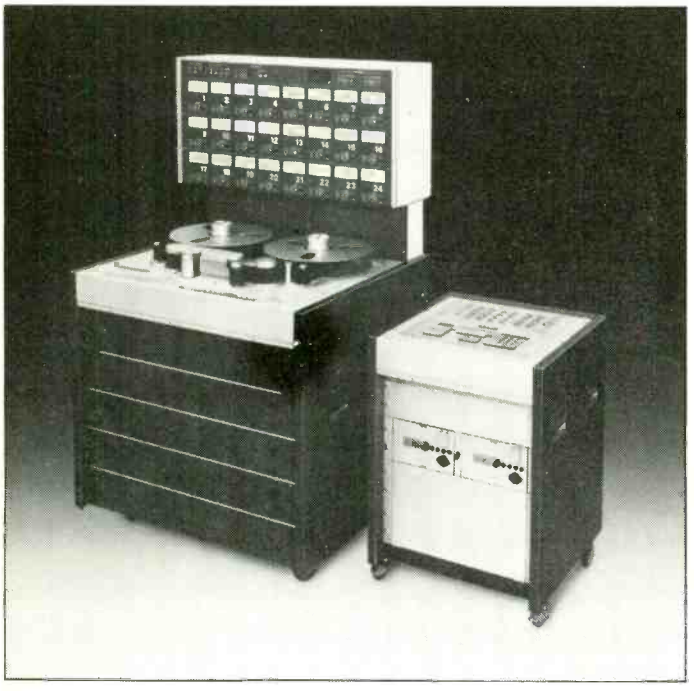

A800 24-track with remote control and TLS 2000

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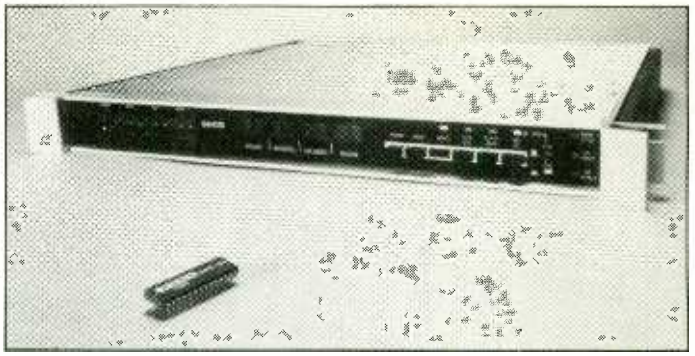
tuning pot with an LED indicating optimum resonance of that channel's erase circuit (LED on indicates out of tune condition). Bias frequency is 240kHz whilst the erase frequency is 80kHz, both derived from a 1.9MHz quartz crystal source.

Adjustments available on the three audio amp cards look pretty conventional. The repro amps are fed by plug-in pre-amplifiers mounted just underneath the deck in a shielded box. Transformerless high impedance matching with heads and short leads between heads and pre-amps, make for high crosstalk rejection and very low hum and noise pick-up, Studer claim. They have also phase corrected treble controls in record amps, and bass controls in repro amps, to give 'the best transient phase response.'

Finally, the Studer *A800* remote control unit. This provides all control possibilities for each individual channel excepting individual control of 'reproduce'—this seems fair enough as 'sync' is freely available for each channel, as would be used in most recording situations, and in any case repro outputs can be master selected. The unit does not, however, provide transport control and is evidently designed to complement the *TLS2000* tape lock programmer, which has these controls fitted. In fact, a trolley console has been produced to accommodate the two units and Studer has chosen to design the remote unit within the *TLS2000* dimensional constraints, and in so doing may have compromised it's ergonomics and facilities, I feel. The channel commands are grouped in four rows of six channels (for 24 track) consecutively numbered vertically. VU panels on the machine offering similar facilities are grouped in three rows of eight channels (for 24 track) consecutively numbered horizontally. For the sake of two channels of width, the remote unit could be that much more ergonomically appealing, wouldn't you agree? Similar dimensional constraints prohibited the inclusion of transport controls, I would suggest. In any event, I think they should have been incorporated; the implication otherwise being that every *A800* user should be operating 48-track—an option Studer has made very convenient on this impressive new beast.

Richard Dean



New SMPTE/EBU code generator

EECO has introduced the *MTG550* master timecode generator series which generates standard SMPTE/EBU timecode for both audio and video purposes. EECO has developed a large scale integrated circuit which contains all the logic necessary for presetting and display time, inserting user bit, locking to video or other reference sources, external selection of 25/30 frame rate and selection of drop or non-drop time codes. Although the *MTG550* is designed for rack mounting and is 4.4cm high, the LSI would enable a very compact portable generator to be produced. Price is $2,850 for NTSC, $2,990 for PAL/SECAM units, ie NTSC for USA, PAL/SECAM for Europe.

EECO, 1441 East Chestnut, Santa Ana, California 92701, USA. Phone: (714) 835-6000. Telex: 678420.

Worldwide: Ampex.

Raindirk v Central Recorders

In a High Court case against Raindirk Ltd on July 25, Central Recorders Ltd won the repayment of a £6,588 deposit for a mixer console that was never delivered. Mr Justice O'Connor said that Central Recorders ordered a *Quantum* mixing console and other ancillary equipment costing over £25,000 from Raindirk Ltd last year. Central Recorders paid the deposit and delivery was agreed for August, but Raindirk ran into difficulties and the delivery date was put back to September 15. At the end of August Central Recorders closed their studio down and dismantled it in readiness for the new equipment. But on September 1 they were told the mixer would not be ready for another ten weeks. Central Recorders could not afford to close down for three months and asked for their deposit to be returned. Raindirk said the return of their deposit had been subject to them selling off the equipment to another studio, but that the deal had fallen through. The judge said he was satisfied that no such condition had been put on the return of the deposit.

Press Association

Digital standards

This neatly points up the quite desperate and urgent need for some agreement on pcm standardisation. The BBC/3M fixed-head system uses a tape speed of 114 cm/s, with the blocks of data spread out serially along each tape track, so that dropouts will only matter if they extend an inordinate length along the tape. The Sony professional system proposes a tape speed of either 38 or 57 cm/s, with the data spread both serially and transversely over either three or two tracks (respectively). Soundstream use a sampling rate of 50 kHz and description by 16-bit linear words. The first Columbia pcm system used 50 mm tape at a speed of 38 cm/s and a 13-bit linear code. The next generation used 14 bits. The Sony *PCM 2* system, which bridges the gap between professional and semi-professional, records audio in either 14 or 16-bit code on a helical scan video recorder of semi-professional type such as the U-Matic.

All the systems are clearly incompatible with the Technics system and its tape speed of 38 cm/s and each channel of sound spread over some 30 tracks. The Sony *PCM 1* adaptor, which enables the owner of a domestic *Betamax* video recorder to tape stereo sound in digital form uses a 13-bit code (see Business August page 30). Technics now have a pcm adaptor for use with the Akai, JVC and National *VHS* video recorders. This is stated to be so far incompatible with the Sony *PCM 1*. Of course there are more systems of both fixed-head and helical-scan type. But enough is enough. Already it all adds up to a digital Tower of Babel.

Mercifully there is light at the end of the tunnel. Most of those now involved in pcm had their fingers badly burned over quadraphonics. They have thus already learned the bitter lesson that neither the trade nor the public will show any real interest in any system until it is standardised. On the very day that I visited Technics in Osaka, engineers from that company were talking in Tokyo with engineers from Sony about a domestic digital standard. And, of course, the AES is already struggling to find common agreements over codes, tape speeds and sampling rates to be used for professional digital recording. One suggestion gaining support both inside and outside the AES is that professional standardisation should be on 16-bit linear encoding. This would make it interfacing between industrial and business computers easier, and thus open the door to an all-digital studio with pcm recording a natural companion to computer mix-down.

Adrian Hope

Advent Soundspace controller

Designed to overcome the limited acoustics of a home listening room and to recreate electronically the kinds of acoustic environments in which music is originally performed and recorded, is a unit from the Advent Corporation of Cambridge, Mass. The *SoundSpace* controller works by digitally processing mono or stereo signals, and adding multiple time delays that are mixed and recirculated to expand and vary the acoustic space of a listening room. It models the way sound is delayed and reflected in large listening spaces according to a combination of variable and fixed parameters, and has continuously variable operating controls for size and reverberation. Size defines the audible room size using a displayed digital delay from 1 to 100ms while reverberation determines the 'liveness' of the acoustic space created by multiple reflections and echo. The *SoundSpace* controller can also be used in a delay-only mode.

NEWS

When used in a listening room, an extra amplifier and speaker pair at the room's rear are driven from the *SoundSpace* controller. Price is $595.
Advent Corporation, 195 Albany Street, Cambridge, Mass 02139, USA. Phone: (617) 661-9500.

Recording Arts courses

The Recording Arts and Sciences Institute of Canada, a non-profit educational foundation serving the Canadian recording industry, and Dawson College, one of Canada's largest colleges, has developed *Recording Arts*, a special programme in the art, science and technology of recording. The programme, which includes approximately a third of its time in recording studios, can be structured to different career orientations: record producing, sound engineering or recording industry management. It is hoped to accommodate 100 full time students in the first academic year beginning September 78. A full time student will spend two years (12 hours a week), 15 weeks per term, at a cost of $1,950 or $2,950 for non-Canadian students.

Dawson College, Victoria Campus, 485 McGill Street, Montreal, Canada H2Y 2H4. Phone: (514) 931-8731.

Helios 32/24 desk at KPM studios

Peak programme meters

Controversy and debate go hand in hand with VU and PPM meters. Eric Small & Associates Inc, San Francisco, are adamant supporters of PPMs and are, they claim, the only manufacturers in North America supplying such meters meeting BS4297, a BBC standard. Using a Weston movement, the PPM electronics are contained on a small board mounted on the meter's rear. The scale is white lettering on black, and is linear calibrated in dB reading –22, –16, –12, –8, –4, 0 and +4dB. Input is high impedance balanced and will directly replace a VU. Meters are available in 89mm or 114mm face widths and the one-off price is $198.
Eric Small & Associates Inc, 680 Beach Street, Suite 365, San Francisco, California 94109. Phone: (415) 441-0666.

Contracts

- Helios Electronics has delivered a custom 32/24 desk to KPM Studios in London, part of the EMI Music Group.
- Pye Business Communications has received an order from Queen's Medical Centre, Nottingham, for a Philips *M100/4C* microprocessor controlled intercom system.
- Neve is retrofitting a Necam computer-assisted mixdown system to an *8048* 32/32 desk at Glen Studios in Stockholm.
- Neve has completed a £120,000 turnkey order for ORF, the Austrian broadcast organisation, which included a 40/24/4/2 desk and numerous ancillaries.
- Soundmixers Recording Studios in New York have acquired a Sennheiser Vocoder designed to substitute musical instrument sounds for vocal vowel sounds.
- Brabury Electronics is to supply a 40-channel stereo sound recording mobile to RTV Novi Sad in Yugoslavia, including a VHF stereo relay transmitter and self power for five hours.
- Dell Technical Vehicles has supplied two complex OB vans to the German network ZDF, one a five camera mobile, the other a sound recording vehicle with 36/16 Telefunken desk and 16-track tape recorder.

studio diary

A concert with a difference

Flautist Stephen Preston was on stage at the Wigmore Hall recently with a few friends and some interesting ideas to coincide with release by Reflection Records of his solo album. The Reflection album, produced by another flautist, Tim Wheater, is somewhat out of the ordinary for several reasons. For one thing it has Preston playing all manner of odd 18th and 19th Century flutes. Some of these oddities are owned by Preston, and others (even odder) come from the stock of *The Sign of the Serpent*, a shop in Pond Street, Hampstead which specialises in old musical instruments and publishes Reflection Records as a side-line.

For both the record and the concert, Preston played an 1850 French flute that doubles as a walking stick and is thus "practical for impromptu serenades" and an 1820 glass flute also from France. Glass flutes are understandably somewhat rare. "They have a distinctly ethereal tone and one other characteristic quality—endurance until broken," explained Preston. The Reflection record is also unusual in that, while featuring music written over two hundred years ago, it relies on overdubbing to enable Preston to duet with himself and close miking to capture the sound of the instruments as they were often originally heard, at close range in a living room. As Preston explains, much of the music he plays was never intended for the concert hall.

On stage at the Wigmore Hall a flautist can't normally duet with himself. But Preston, with the help of John Shuttleworth who had recorded the Reflection album in Sussex, had a go. There is nothing new about an artist performing live alongside a pre-recorded backing track, but I can't recall ever seeing the artist lay down the track and then run segue into a duet with what he has just recorded but this is just what Preston did. First he played one half of Bordet's *Imitation du tremblant doux du l'Orgue* duet on a glass flute into a crossed pair of AKG *414* microphones. Backstage at the Wigmore Hall, John Shuttleworth recorded the part on a Nagra. As Preston finished he went into a trill and sustained note while out of sight Shuttleworth rewound frantically to the starting point, using two extra pair of hands to brake the Nagra spools. As Preston on stage ran out of breath on the trill, the Nagra recording was replayed through a Quad *405* and a pair of large cabinet speakers home-built to Radford design for domestic use. The result, instant self-duet. The audience loved it and I'll bet that instant-duets become a regular part, and even trade mark, of Preston's future stage performance. If so it might actually pay dividends to cut corners. Recording and replay was in stereo with the speakers at each side of the stage, but in practice this creates more problems than it is worth. Professional film makers have long ago learned that only a small fraction of the audience will be sitting in the centre of a cinema, and thus in an ideal stereo seat. So most stereo film sound dialogue is panned mono to the centre speakers. Likewise in a concert hall it might prove far better for instant duets to record in mono and replay in mono via a single speaker alongside the performing musician. Surely there isn't too much stereo in a flute recording anyway?

Finally an interesting side thought. The only noticeable difference between the sound of Preston live, and the sound of Preston off tape (other than a slight discrepancy in level) was the extra breathiness of the taped sound as captured by the relatively close mics. Yet another reminder of the very real difference between live sound as heard from a seat in the stalls and the liver-than-live sound of a close mic recording which the public at large is now accustomed to expect from the records they buy.

Adrian Hope

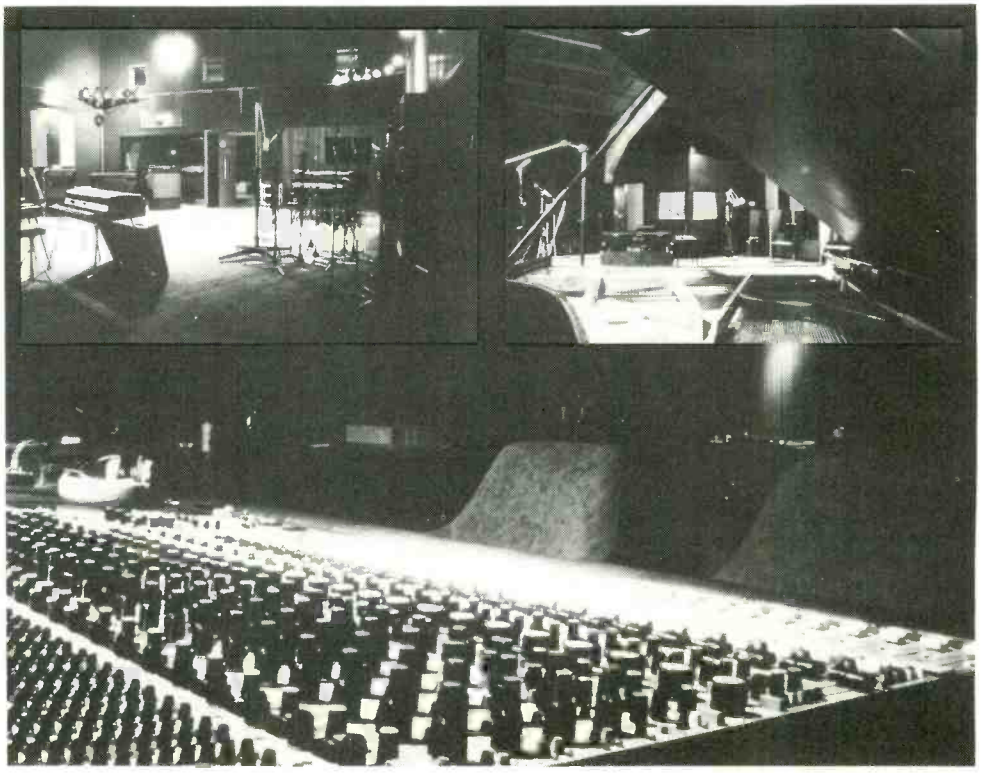
SARM bounce back

Remember that awful fire suffered by SARM (Sound And Recording Mobile) Studios of London we described so vividly in the May News column? Well, co-director Jill Sinclair tells us the studio has now recovered from the disaster. After months of dedicated stripping (the walls and floors, you fool!), the 'completely re-vamped' studio

30 ▶

Kritz International, Belgium

Based in Kuurne, Belgium, Kritz International recording studio 2 has recently been entirely redesigned and the control room now features an MCI *JH500* series console with plasma display, Lyrec 24-track with varispeed and autolocator, 2-track recorders from Studer (A80, A67, A700), monitoring from Studer, Amcron, ESS, Tannoy and Celestion, reverb from EMT and AKG, Eventide digital delay and *Harmonizer*, UREI limiters, DBX and Dolby noise reduction. The studio has capacity for 100 musicians, is fully airconditioned and features three separation booths and a wide range of instruments including Fender electric piano, Horner clavinet, Weber grand piano, Hammond organ and various drum kits, amps and effects boxes. Rates are £35 per hour, £200 per 8 hour session with extras for weekends and late working. Fritz International Recording Studios, Studio 2, Noordlaan 10, B-8720 Kuurne/ Belgium. Phone: 056 351184, 351654.



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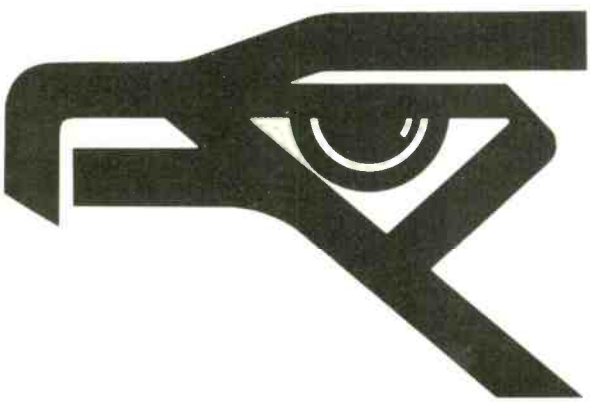

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SS1

will be ready to resume business at the beginning of August. "While we were stripping down walls and removing damaged cables we thought we might as well redesign the acoustics and layout," said Jill, "so the studio now seems bigger, and sounds better. But in fact we haven't changed the room structurally."

In addition to changes in finish, the studio will be reborn with an updated equipment inventory. "We're installing a Trident *TSM* console" (Jill again) "with 40 inputs and outputs, and 24 groups. This will drive two Studer *A80* 24-track machines linked by Studer's *TLS 2000* tape lock system for 46-track recording." SARM's collection of ancillary devices, reputedly among the most comprehensive in the country, were mercifully spared from the blaze. The 2.85m Bosendorfer *Imperial* piano has been sent back to Vienna for an overhaul.

Initially, the Stevens 32-track tape machine was considered as a master recording machine until it was discovered that the company has no franchise arrangement in the UK. So the Studer pair were selected instead. "It'll be a fabulous studio when it's finished", remarked Jill. "An established studio refitted with the best equipment available but retaining our hallmark of the personal touch." Quite SARM studio, by the sound of it. . . .

Richard Dean

DJM MCI OK?

There's no doubt about it, this sound business can be rather puzzling at times. Daily, radio boasts the prowess of recording studios around the world (well, some of them anyway), and yearly millions of people clammer to buy studio products. And that's not including film and TV soundtracks, of which there are many notable examples. Given that talented people enter the industry at the other end, one might look forward to a remarkable fusion of art and science somewhere in the middle. Well, of course, studios do rely on teamwork. But like a handful of other areas of work where several attributes combine to provide that modicum of glamour, a certain division by cliques is evident, and with it an instinctive nose for gossip. Whilst we don't cultivate gossip of the speculative variety in these pages (we haven't got the space), we're not averse to printing serious rumours that turn out to be untrue. So here goes.

An ostensibly informed 'squealer' recently told us a truly horrifying story. The MCI 42/32 desk at DJM had been supplied without the normal warranty, he claimed, so as to secure a more favourable price, and the worst possible thing had happened. The desk had extensively malfunctioned and was now no more than an expensive wreck!

If anybody knew the truth of the matter, it had to be DJM's studio manager, Alan Florence. So tactfully I confronted him with the story. "We're a new studio and as such it's inevitable that teething problems should be experienced with the equipment", he said. "Most of the bugs came from the automation system and it's interface with the desk. But now we've ironed out all the snags and are very pleased with the results. Apparently we did do a deal with MCI about the warranty—I've only just heard about that recently myself. But as for the desk collapsing into a pile of rubbish, that's ridiculous!"

Alan went further to dispel this by now obvious myth with a string of names recently visiting the studio, and by all accounts, happy with the results. "Since we opened early this year we've done some very satisfactory sessions", he said. "We've had names like Alan Price, Roy Wood, Maddy Prior, Johny Guitar Watson and Liverpool Express in here, to name a few. We also had a big name from Spain, Juan Pardo, a client I acquired while working at Sonoland Studios in Spain. In fact, a similar situation arose out there. Sonoland was a new installation, and my job as studio manager was to establish it as a major studio. When we first started, some of the stories going around about the place were unbelievable—pure fantasy most of them—knocking the studio and its facilities. Most of the stories came from competing studios, I feel sure. Yet when I left, having built the studio up over two years, to work for DJM, the place was choc-a-bloc with work. Now it's one of the busiest studios in Spain." Speaking as something of a studio veteran, with 18 years of recording experience behind him, Alan concluded, "I've got used to the stories that circulate in the industry. After all, in the end it's the sound that counts, and the sound at DJM is of a very high standard. Now I intend to build the reputation of the facility to that of a major international studio—I did it in Spain, and I see no reason why I shouldn't do it here."

Richard Dean

Sinus Sound, Switzerland

Automation comes to Switzerland, and in Berne not Montreux. Sinus Sound has recently taken delivery of the latest MCI *528* automated console with plasma display and Spectra-Vue real time analyser. The reconstructed control room has excellent acoustics and equalised JBL Tannoy Auratone monitors, and features MCI 24-track with full Dolby noise reduction and five 2-track machines. Ancillary equipment includes Eventide *Harmonizer*, *Instant Flanger*, *Omnipressor*, Klark Teknik *Analogue Time Processor*, six equalisers, and eight limiter/expanders. Instruments resident in the studio include Steinway Grand, Hammond organ, Fender and Ampex amplifiers, drums and various synthesisers and there is a separate drum booth. Video and sound lines enable recording in a local theatre using the Sinus Sound control room.

Located in the heart of Berne, sessions have included the top rock group Rumpelstilz who have recorded all their work at the studio, other top Swiss artists including Peter, Sue and Marc, Pepe Lienhard Band, Krokus, Sammy Price, Dick Wellstood, Wild Bill Davison, Victor Scott of Les Humphrey Singers, and Johnny Thomson Singers of Philadelphia. English songwriter and producer Micky Denne has also used Sinus Sound which is located at Munstergrasse 48, CH-3011 Bern, Switzerland. Phone: 031 229099.

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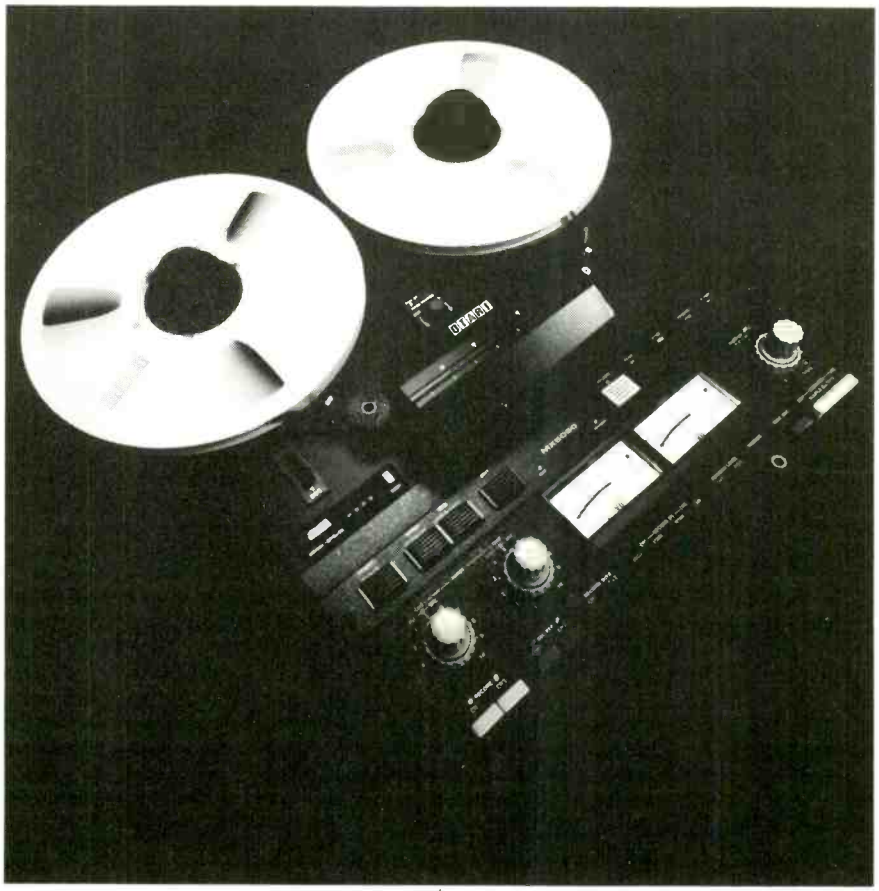

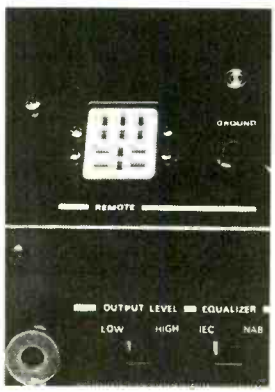

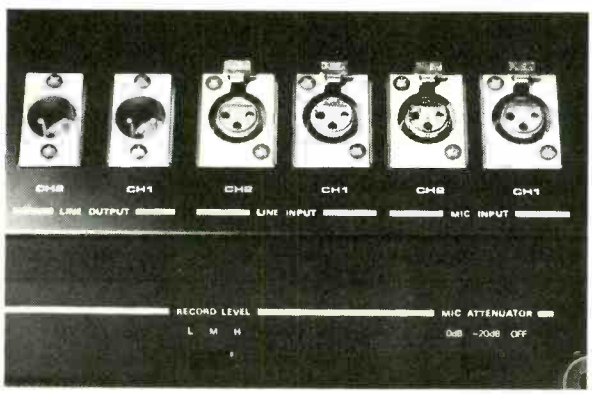

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Commercial radio in Britain

PART ONE – EARLY DAYS

Tony Attwood

Studios in Villa Louvigny, Grand Duchy of Luxembourg

During October, Commercial Radio will celebrate its fifth anniversary in Britain. In a three part series, we will first be examining the origins of Commercial Radio and how 19 stations came to be set up, next month we will be taking a much closer look at three totally different stations and how they are succeeding, and in the third part publishing varied 'suggestions' as to how the next *five years of Commercial Radio could develop. Music on radio was recently covered by Tony Attwood in* Wavepower, *published in July* Studio Sound.

WHEN Radio Luxembourg opened a long wave service in English on weekday afternoons (and all day Sundays) in 1934, it was not the first station to offer commercial radio to the British Isles, but it was the earliest station to survive up to the present day. Broadcasting continued from Luxembourg until the outbreak of war in 1939 whereupon after being closed down for several months, the station reopened carrying the delicate tones of Lord Haw-Haw (alias William Joyce) telling the British (in language that was never heard on the BBC) how, why, when, and where Germany was going to win the war.

This was obviously a severe embarrassment to the British government, and yet the lesson of Luxembourg was never learned. It must have been clear to everyone at the time that people only listened to the enemy's propaganda because it was more amusing than the regular broadcasts from the Beeb. Despite this there was no great expansion in radio broadcasting after the war. Luxembourg's English language service moved to 208 metres and that was about it.

Twenty years after the end of the war the government's entrenched policy once again resulted in a feeling of embarrassment, this time mingled with paranoia, with the coming of off-shore radio. The first commercially operated radio boat had appeared off the coast of Denmark in 1959, and thereafter others started popping up all over the place including, naturally enough, the Thames estuary, North Sea, Clyde, and Irish Sea.

The pirates combined the well established Luxembourg technique of sponsored advertising with the TV style of spot adverts. However the pirates generally avoided being sponsored by the record companies who had for years kept Luxembourg's early evening shows going, and instead picked up sponsorship from chain stores and (again during the off peak early evening slots) American religious organisations that believe that the world will end when everyone is able to hear God's word.

At about the same time as the pirates were setting up their sound blockade, the Isle of Man, making use of its constitution which conveniently allows independent action on purely internal matters set up its own commercial station, via an Act of Tynwald passed in 1964. Thus when the British government, doubtlessly wishing to save the human race from the impending end of the world, passed the Marine Offences Act in 1967, Manx Radio was able to carry on regardless along with the broadcasts from the Grand Duchy of Luxembourg (which in October that year started to go out live from the station, rather than being prerecorded in London), and one surviving radio ship, Caroline International.

And there the matter was once more left to rest. There were numerous campaigns around at the time to get legal onshore commercial radio introduced, but the Home Office would hear nothing of it. When the government had sought powers in Parliament to outlaw the pirates the centre of their case had been the problem of frequency space. It was argued that the radio ships were causing interference with emergency services, maritime communications and so on, and that even the offers by the station operators to go onto other frequencies was not acceptable as there were no other frequencies to move onto.

This, of course, was simply untrue. The Ministry of Defence had previously been allocated all sorts of frequencies which they were not using at all (although which ones cannot be reported as it is classified information). Some (but by no means all) of these unused frequencies have now been given up. This strange desire on the part of Government departments not to make proper use of the frequencies available was given greater prominence when, after the 20 BBC local stations had been set up, no-one seemed worried that most evenings many people could choose any one of five different frequencies on which to listen to the paired output of Radio 1 and 2, and the nearest local station. But this wilful waste of a finite resource by a government sponsored body has never deterred the government itself from using the old frequency limitation argument to hold back the development of commercial local radio in this country.

The first breakthrough on the question of frequencies came in the 1971 government white paper *An Alternative Service of Radio Broadcasting* in which a network of up to 60 stations throughout the UK is proposed to be administered by the then Independent Television Authority. Appendix A to the report suggested that article 8 of the Copenhagen Convention of 1948 could be utilised in a

Left: *Recent Neve console at Radio 210 Thames Valley.* **Right:** *Early Neve at Radio Luxembourg.*

way that the government had never previously admitted was possible, that is by asking countries that had been given certain frequencies under the Convention to allow British stations to operate on them using low power transmitters. In addition it was suggested that the BBC might give up some of its frequencies (in the event the Corporation gave up 251m and 194m). The development of directional medium frequency aerials completed the argument against the view that there were simply not enough frequencies to go round.

On the VHF band, the government's desire to hold on to everything it possibly could for its own (undefined) use had been equally apparent—although never challenged by the pirates who stuck to medium wave transmission. Britain had become (and still is) the only European country not making use of the whole 88 to 100MHz range for broadcasting, despite the fact that the BBC led the protests in pressing for the use of all frequencies up to 108MHz for local radio as is the case in some parts of the world. The white paper however envisaged that the 60 IBA stations could be accommodated between 95 and 97.5MHz after some rearrangement of the frequencies used by the local BBC stations. Those interested in pursuing the proposal further may like to read Appendix B of the white paper which lays down frequency planning standards for the proposed new stations.

The white paper put the responsibility of overseeing the setting up and day to day running of the new stations firmly in the hands of the IBA. The Authority had to decide where the stations should be, and exactly how many there should be (60 was merely the maximum number allowed), and then run things in accordance with the guidelines. These guidelines encouraged the IBA to develop stations not only serving the big conurbations but also small stations for country towns, with an eye to finding out just what the smallest community capable of sustaining a commercial station might be. In the event the smallest VHF catchment area of any IBA station is 200,000 people for Radio Orwell in Ipswich, which is a considerably larger area than that served by Manx Radio (total island population 68,000).

There were other suggestions too—the stations should be firmly rooted in their locality, and there was talk of an exchange of new music and other programmes through a network of stations. A major ingredient of the stations' output would be local news and information. In the longer term there was the suggestion that in the larger cities several stations could be set up, each offering a different service, whilst small stations in country areas might link up from time to time, carrying the same programme, possibly through the evening and night time hours.

These issues were taken up again and formalised in the Independent Broadcasting Authority Act 1973 which opened with the magnificent command:

> Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal and Commons, in this present Parliament assembled, and by the authority of the same as follows . . .

What followed was an act which gave the IBA the authority to set up the stations. The act contains a vast realm of details relating to programmes, advertising, contracts, finance, and even remarks on such matters as competitions, prizes and charity appeals. The Authority is charged with the responsibility of making sure that nothing is included in the programmes which offends against good taste, that proper proportions of the recorded and other matter included in the programmes are of British origin and British performance, and so on. This being enshrined in an Act of Parliament it meant that it was (and of course still is) open to any citizen to take the Authority to court on the grounds that it is not acting within the Act—as Norris McWhirter did in 1973 when he alleged that by allowing one of its TV companies to show an Andy Warhol film the Authority was breaking the television act. Although McWhirter lost, his action is a reminder that it is open to anyone to challenge the IBA's work at any time.

After the 1973 Act was passed, the IBA listed the areas where it wanted stations and put the franchises up for offer. Any organisation that fancied running a commercial radio station in one of the areas chosen by the IBA could apply, although the number of applications from companies received was much lower than many might expect—the highest number being eight applications to run the London General station. On the other hand only one application was received to run the Wolverhampton station.

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In the event the station at Wolverhampton was the last one to get under way, opening on 12 April 1976, for after coming to power in 1974 the Labour Government stopped the IBA from issuing any more franchises pending a government report on the matter. That left the IBA with just 19 stations to oversee. In order to facilitate this process, the IBA came up with their own 'Code of Practice for Independent Local Radio Studio and Outside Broadcast Performance' along with specifications of independent local radio broadcasting standards. The code of practice covers everything from signal paths and tape recorder tolerances to the operational requirements of the whole system.

It soon became clear that although the Labour Party jibe that the franchises were licenses to print money might be true in the long term, in the short term the newly formed companies were having to fork out large sums of cash in order to meet the requirements of the engineering code, for the use of copyrighted material and of course to pay the rent on the transmitters, all of which are owned by the IBA. The transmitter rental (which is the only source of income for the IBA) consists of a primary rental, which is a fixed sum revised each year for each station (thus allowing the IBA to charge a higher rental for transmitters situated in large conurbations than for those serving smaller populations) plus a secondary rental which the company starts to pay when its profits reach 5% of the advertising revenue. When the companies make a loss (as LBC did during its early years of operation) the primary rental may be deferred for a while, although it can't be written off.

In order to carry out its duty of overseeing the day to day programming of stations, the IBA requires the ILR companies to keep log tapes for up to three months of their programmes—these then being made available to the IBA should they be requested. In addition there are small local advisory committees attached to each station. One third of the membership of each committee is made up of nominees put forward by the local authority for the area, and the remainder are private individuals selected (as always) to reflect the make up of the local populace. Thus there has to be the statutory woman, the representative of the ethnic minorities, one man from the 'working classes' and so on. The committees, normally numbering between nine and 12 people are continuous, with a slow turnover caused by resignations and deaths, and report straight to the IBA although membership of the committee is not kept a secret from the stations.

Anyone really interested in altering the face of a local station could do worse than start making reports to the local advisory committee (the local station or the IBA should be able to tell you who the chairman is.) Persistence in making reports may well lead to you being invited to sit on the committee.

As to what the committees say to the IBA, that is up to them. Doubtlessly they get carried along by the whims of one or two strong-willed members, as do all small committees, and yet the IBA do take a lot of notice of them. The favourite areas of complaint and suggestion however seem to be in the fields of religion and drama—the last always being a thorny issue as anything other than a reading by one person in the studio of a novel is liable to cost a very large sum of money, which is something the IBA won't require the station to do if it is still struggling to pay its transmitter rentals. However any complaint dealing with a matter covered directly by the Act will meet with a quick response from the IBA, as with matters relating to the use of local material and the provision of a local news service.

The IBA insists (as it is obliged to by the Act) that all the ILR stations are truly local stations. This means that any thought of going over to automated programming is unlikely to meet with IBA approval as it is hard to see how such a system could cope with the spot inserts the IBA love so much (traffic news, weather reports, consumer advice and so on.)

However, even before the last ILR station went on the air, forces opposed to what the stations were doing (although not always opposed to ILR itself) were starting to make themselves heard. One of the main targets for attack was the fact that none of the stations was sticking to the promises made in the programme plans they submitted to the IBA when asking for franchises. Section 20 of the Act required the IBA to make these plans public and that was all the ammunition that some people needed.

Colin Slade in Radio Hallam Studio A.

On 22 January 1975, the Guardian published an article attacking ILR stations that it accused of deliberately misleading the public. It cited the example of Piccadilly Radio who had promised a policy of widely varied pop music, but instead played little but top 40. Hallam promised to employ DJs from Yorkshire, but instead recruited all they could get from the Beeb. In fact criticisms of this sort were so strong that by the time the Annan Commission started receiving submissions, a number of major organisations (including the Musicians' Union and the Liberal Party) were calling either for the further development of commercial stations to be stopped, or, in some cases, for the stations now operating to be closed down.

In the face of such criticism the IBA remains calm. Its main argument is that the companies seeking the franchises made proposals, not promises. They point out that the initial statements made by the companies were made in a different economic climate from the one that existed when the stations eventually started broadcasting; a factor which clearly affected their abilities to pull in advertising revenue. The IBA line is that after three years it is reasonable to expect the stations to be doing what they proposed to do, but at the same time there should be new ideas coming through as well.

Of course the IBA does retain the whip hand. The contracts are reviewed each year for the next three years, and thus any company could find itself with three years notice to quit—and if the IBA pull out the transmitter plugs there is no one else for a company to turn to. The white paper, engineering code, code of advertising (put out in consultation with the Home Secretary) and all the rest of the rules and regulations, leave the stations with little chance of suddenly moving off to explore new unchartered fields. Even the number of hours per day that the station broadcasts is subject to IBA approval. The Authority's Annual Report for 1976-7 for example reveals that Thames Valley Broadcasting was given a one hour extension on Saturdays and Sundays in March 1977, whilst Radio Trent was allowed to cut back its hours by 115 minutes a day in 1976.

Meanwhile, unfettered by all these controls, Manx Radio has been happily going its own way, following a policy of developing its own programmes for the rather special requirements of the island's locals (plus the half million tourists in the summer). The station currently offers a middle of the road approach (a sort of zappy Radio 2) during the weekdays with a number of talk programmes at weekends. The religious organistions are not left out either. Having lost the pirates, and being specifically refused permission to advertise on the ILR stations, Manx is the last refuge, and between them they take 7pm to 9pm each weekday. Perhaps most interestingly, Manx Radio has proved that it is possible to find advertisers willing to buy time during serious Radio 4 type discussion and talk programmes. Banks and insurance companies for example, not noted for their willingness to pop in and say 'hi' between a stream of top 40 hits, can be induced to take spot adverts during such programmes.

Although Manx Radio has had rough times of it financially for some years it is now starting to make a profit, and plans for the future are big. Later this year they will move from the current 232m

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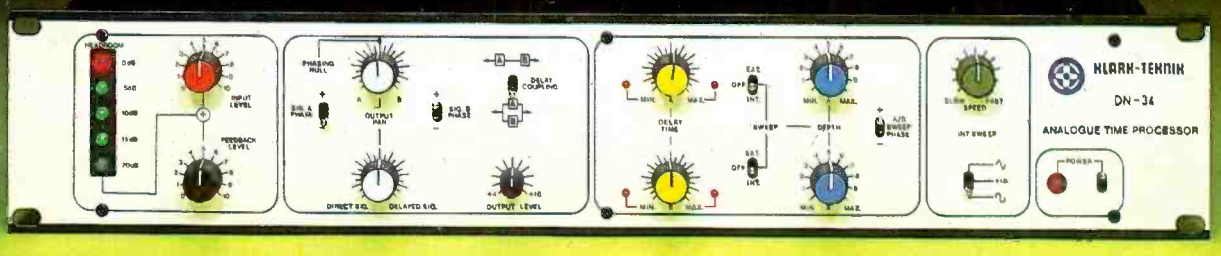
The new DN34 analogue time processor.



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Designing consoles for radio and tv music production

Consoles built for multitrack recording and mixdown are not always suitable for use by broadcasters. **Dan Popescu** *of Denmark Radio examines the shortcomings of currently-available desks and goes on to discuss the automation of certain facilities.*

THE DEVELOPMENT of multitrack techniques has led to a simultaneous explosive increase in the sophistication of recording consoles. This is especially the case with facilities such as monitoring, filters, foldback and the automation of level control. Radio and television organisations are also in the process of introducing multitrack techniques, for both studio and outside broadcast productions. Such productions are characterised by the desks being used for not only on-air broadcasting, but also for on-air broadcasting and multitrack music recording.

In this article I intend to discuss such broadcast applications with special reference to anthropometric parameters, one or two-man operation, positioning of controls in relation to the stereo/quad axis, and simplification of the console's layout through the introduction of centrally-controlled functions. Furthermore, the solutions available for automating certain static functions—of special interest for sound in television studios—will be examined.

A Cadac L-shaped console at Roundhouse Studios, London.

Ergonomics

Human factors or ergonomics (from the Greek word ergon, meaning work) make up a class of problems that have increasing interest for people engaged in planning and constructing equipment operated by people. One of the reasons why various ergonomic aspects have become so deserving of attention is the effort that goes into developing systems with high reliability. The absolute reliability of a piece of equipment is a function of its basic reliability under operation—as characterised by the 'hardware'—but is, at the same time, a function of the manner in which the human operator uses the equipment. Such systems should not be constructed, therefore, without consultation with the operator, the person who is going to be using it.

One cannot demand a high degree of operator effectiveness if the equipment is not characterised by a layout designed for human operation. In analysing unsatisfactory operation we must investigate whether or not faults are caused by unsuitable equipment design.

These rather general statements about the ergonomic criteria in designing equipment are particularly appropriate for equipment which is found within the audio field (tape machines, audio consoles etc).

In their studies ergonomists often refer to the so-called 'man-machine' system. This can be defined as a working combination of one or more persons with one or more items of equipment—which, acting together, influence some data input to produce a result—without underestimating the effect of the environment. One simple form of the man-machine is the sound engineer and console or tape machine. In this same area concerned with the description of man-machine systems we can mention the classic box diagrams for the so-called 'closed-loop' systems—both manual and semi-automatic—which in a similar manner can be adapted to the situation found in a control room; ie a 'sound engineer-console' system. The manual system corresponds to the traditional console, while the semi-automatic system analogues with, for instance, a console where the dynamic functions (ie faders) have been automated; the automation assists the operator but does not make the decisions.

A decisive role in the process of designing and constructing equipment to be operated by people, is concerned with the so-called anthropometric parameters. Tables and drawings of dimensions of, for instance, a 'standard person', a 'standard hand' and 'minimum standard between operating elements' (dependent on the size of fingers) are important factors in the design of consoles. We should also take note of, among other things, the Barne's diagram, which shows the maximum working region for a sitting person (**fig. 1**).

Apart from these more or less physical limitations we must take into account such questions as: pace of work; number of simultaneous or nearly simultaneous activities; and number of control instruments that have to be accessed simultaneously, etc.

Consoles for music production

Radio and television sound personnel have to accept a situation where the development of recording techniques is decided by the gramophone industry—at least as far as popular music is concerned. Developments in this area, including the number of tracks, facilities available on the console, construction of studios etc, is determined only to a limited degree by technicians working in radio and television studios.

Multitrack productions in recording studios involve at least two phases:

1 Recording on a multitrack tape machine

The operations required at the input channels are more or less static. Tracks are filled up without the use of equalisation or reverb, with main activities taking place at the monitor console. It is also possible to store information from the monitor faders in a memory system. Additionally, this information can be used during the mixdown phase.

2 Mixdown

The input channels are coupled to the outputs of the multitrack and all the desk's facilities (eq, panning and so on) are now used in the final treatment of the 16/24/32 tracks to a stereo or quad mix.

In the last few years it has become more and more usual for manufacturers to automate the dynamic functions of a console, such as channel, group and sum faders, as is the case with Neve, Harrison, MCI, Cadac and Helios consoles.

Consoles for radio and tv music productions

Two working methods are typical in making music productions for radio and television:

Direct productions

Direct productions, for example broadcasting today's or yesterday's concert, is not known in the gramophone industry, and will remain the broadcaster's strong point. If we examine the future development of radio within a ten or 20-year perspective, we are led to the conclusion that activities within radio-producing organisations will be more and more restricted to radio's typical activities—such as: news, radio plays and montage, as well as the playing of 'library' recordings made in conventional studios. These recordings can be made to a higher quality, at a more reasonable price than those produced at the radio organisation's own studios.

This will result in a great development in outside broadcast facilities (because the recording of yesterday's concert will never be on gramophone records today!) especially of ob units equipped with multitrack facilities. The mixdown of these multitrack productions will take place, of course, in modern and complex mixdown facilities.

Direct stereo productions with simultaneous recording on a multitrack (fig. 2)

Here, we require that the control of levels, which is carried out during the direct stereo production/transmission, should not influence the recording on the multitrack tape machine. Among other things it should be noted that the multitrack outputs are taken after the patch point in order to be able to matrix an M/S programme from a stereo microphone into an X-Y form.

Solutions

Numerous different products, which solve the described tasks in quite different manners, are presently available from a variety of manufacturers. In looking at these from an ergonomic viewpoint we can detect three separate lines of development:

Linear or L-shaped consoles (Neve and Cadac)

These consoles are divided up into an input subconsole and a monitor subconsole. With their breadth of between 3.5 and 4m they are really only suitable for two-man operation; during the recording the producer usually sits at the monitor subconsole, while the engineer is placed at the input subconsole (look again at the Barne's diagram, **fig. 1**).

U-shaped consoles (BBC concept)

This is a characteristic solution for manufacturers such as Helios and Neve, in situations where there are a large number of input channels and one-man operation is desirable.

'Compact' consoles (Harrison, MCI and Cadac)

Here the monitor facilities are built into the actual input channels. The console can be operated by a single engineer who is faced with a very complex layout. We can mention some of the standard facilities included in an input channel—filters that can be switched into the monitor circuit and channel faders that can be swapped with the monitor faders. The total number of operating items and indication elements is absolutely enormous. For example, in one Harrison or MCI console which has 40 input channels, there are as many as 4000 operating and indicating elements in an area of less than $2m^2$.

Let us now examine the way in which these approaches to console layout can be used in radio and television productions. Since, even in the future, direct production will be a feature of radio and television, one of the first requirements is that the input channels are located symmetrically in relation to the

FIG. 1 BARNES DIAGRAM OF NORMAL AND MAXIMUM WORKING AREAS IN THE HORIZONTAL PLANE (DIMENSIONS IN CM)

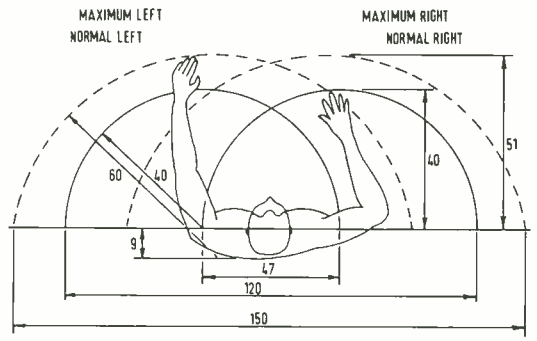
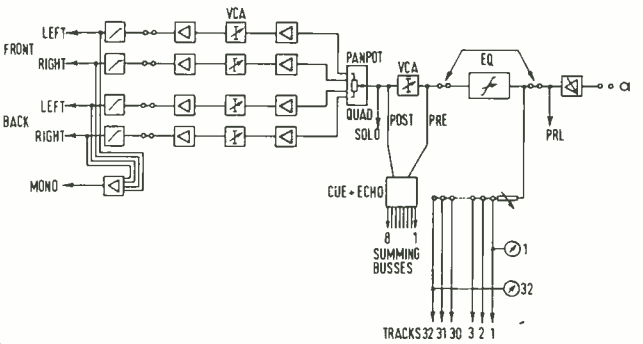


FIG. 2 CONSOLE LAYOUT FOR BROADCASTING AND MULTITRACK RECORDING



stereo/quad listening axis. This will mean that the monitor section of both the linear and U-shaped consoles will be positioned asymmetrically to the listening axis. In spite of this, an interesting solution can be seen on the Helios console installed at Maison Rouge Studios, London. This desk has the monitor section compactly positioned on the righthand side of the central area. However, this monitor section is limited to 24 channels with channels 1 to 12 nearly out of reach (from a sitting position). In addition, the dimensions of this console make it unsuitable for installation in an ob vehicle.

The compact or 'in-line' console is seen by Danish Radio as being the best possible type of console construction, since the axis of symmetry of the monitor section is identical to the axis of symmetry of the input channels. The dimensions of a compact-formed 40-input channel console (without a patch bay) are such that it is possible to install them in larger ob vehicles.

Problems to be solved

We have noted that the total number of operational elements 38 ▶

and indicators in the compact console is enormous. Ergonomists are unable to believe that this type of console can be operated by engineers who, now and again, have to work in other production rooms with equipment of quite different construction. Specialists in medical optics have warned about possible eye strain as a result of the enormous quantity of information contained within a restricted area. This means that the ergonomically-correct solution found in the design of the compact console creates a new ergonomic drawback: the amount of operating and indicating items related to each channel.

Central operation

This situation recalls some of the ideas that have been raised by numerous ergonomists, concerning the utilisation of central items for the selection of tracks, grouping and degree of equalisation.

Which functions should be included in a centrally-operated system? Peter Leuning at the 'Tonmeistertagung' held in Cologne in 1975 presented, in a very interesting resumé, the design of future consoles. This had only a very few controls in the operating area, the electronics being contained within a 'blackbox' somewhere within the console's innards or in a rack.

It is impossible to argue against the proposition that someday electronic circuitry will disappear altogether from the console. Likewise the great number of operating items will be reduced considerably through the introduction of central operation. However, Leuning's further vision of a situation where the total number of faders is as low as two—and where the desired channel can be coupled through the use of a keyboard—cannot be accepted.

Channel and group faders, in my view, can never be operated centrally like the rest of the elements (equalisers, cue, foldback, track selection plus possibly panpot, solo and mute). This kind of solution is on the market already in the form of the Allison *Memory Plus*, the Cadac compact routing system, the NTP central-remoted equaliser.

The question of display becomes even more problematic to answer when we consider the central control of channel equalisation. Should a frequency curve be used, or should there be a digital display on a central screen? One idea is based on indicating the selected filter function through the use of leds placed around the operating knob—which can be rotated without limitation, but only gives the direction of plus or minus.

Such a system of central operation will finally solve the problem of static memory in a console. It will be of use in both resetting a previous mix during a mixdown session and, perhaps most useful of all, in a television studio or in a direct broadcasting of a concert, with several orchestras on the stage.

A well-known problem in both television and radio is the demand for consoles with large numbers of input channels. Although they are not always needed to be in use simultaneously, they may be 'prepared' or 'held-in-ready' to cover three or four successive scenes, orchestra changes etc. The use of a static memory system would reduce the dimensions of this type of console, because of its ability to memorise optimum settings for faders, equalisers, panpots etc. (Similar techniques are used in lighting equipment for theatres and television studios.)

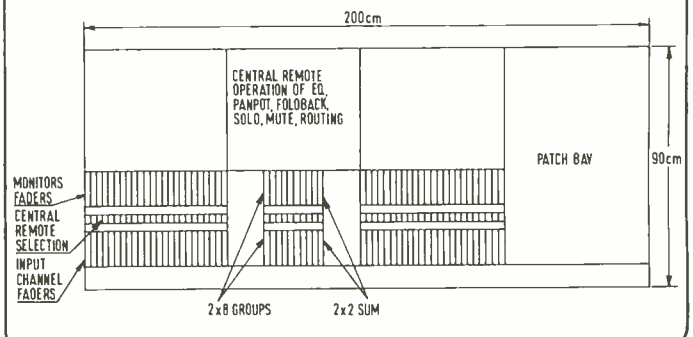
Positioning of group/sum faders

Taking Barnes diagrams into consideration, it was felt that consoles with 40 or more input channels should have their group/sum faders and the central operating units placed such that there is an equal number of input channels on each side. Without doubt, this solution will prove to be better than placing the group faders and central operating units on the right-hand side of the bank of input channels. (Which results in there being over 2m between channel 40 and the console's most used working area, the group faders.)

We can suppose that the forthcoming generation of consoles will have a considerably reduced total width (even compact consoles with 40 input channels have a width approaching 2.5m).

A Neve in-line console at Utopia Studios.

FIG. 3 CONSOLE WITH CENTRAL CONTROL SECTION



This can be achieved by reducing the width of the input module (at present standard 40 mm) to perhaps 20 mm (as is the case in the Allison *Memory Plus* system). However, this reduction in channel width is inconceivable at present because of the already very large numbers of operating and indication elements involved (**fig. 3**).

Another unanswered question that can expect to be put by most console users, is the choice of discrete instruments—for example, led and bar graph or multichannel monitors, connected with a $\frac{1}{3}$-octave filter for frequency analysis of channels or group outputs.

Conclusion

One thing at least is quite certain, both for design and operating staff: really imaginative console designs are on their way. Perhaps the design staff should make even greater efforts to really get to know the engineer's working environment and to solve those problems that develop as a result of the new production methods. We can quite definitely say that the traditionally-built consoles have reached their limits; limits that can no longer be extended due to certain ergonomic aspects that have already been raised. Operating staff must begin to learn the new language which is tied-up, among others, with the central operation of most functions. Perhaps some time in the future this will include all functions, with the exception of channel and group/sum faders. It is only a matter of a few years before these new concepts of operation will be introduced. ■

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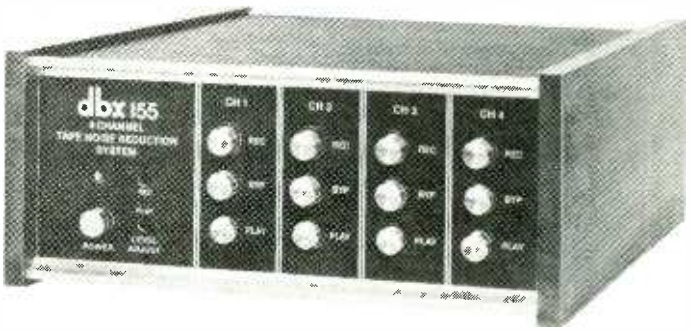

The dbx 158 and 155 noise reduction units are semi-professional versions of the well established dbx professional series of noise reduction units. Recordings made on either unit may be decoded by any studio using professional dbx equipment—and vice versa.
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Making the most of a Rock Festival

Bill Aitken

Knebworth Park with Sound Tower right, Lighting Tower left.

Although the BBC has over 50 years experience of recording outside broadcasts, even today, there are still many pitfalls awaiting the intrepid engineers when they arrive on site to make a live recording of a rock concert. Here, Bill Aitken describes the events leading up to the Quadraphonic transmission of Genesis from the Knebworth festival.

KNEBWORTH House on Wednesday morning was the rendezvous for representatives from the rock festival site management and the BBC sound crew, including myself, who were covering the Genesis performance on the following Saturday. It was intended that this 'live' recording would be transmitted the week afterwards on the *Alan Freeman Show*.

Whether the programme was to be multitracked or not was the subject of discussion between Tony Wilson (the producer) and Genesis' management, and so consequently it had not even been decided whether to use a BBC Outside Broadcast van or hire a commercial mobile recording truck. The alternative to multitracking and remixing was simply to record the mix direct from the PA mixer (right in the middle of the park) and to mix this with audience effect mics in order to pick up audience reaction and ambience (if any) generated as a result of the estimated 100kW of PA exploding across the park. It had been relayed to us via several intermediaries that this more simple approach to the recording was the one favoured by the band, however, like any other sensible engineer, I had doubts about the possible results of such a method, compared with the obvious advantages afforded by multitracking and remixing.

As this programme was also contributing to the BBC Matrix-HJ 'quadraphonic equipment experiment', we had to think about 4-channel aspects of the production, and live reaction was to be picked up by the Calrec prototype *Soundfield* microphone and reproduced all around the sound stage.

The first priority was to rig enough lines for the stereo PA mix and/or separate multitrack feeds, from the PA sound mixing board in the tower, through the audience area to the front of the stage, and from there to the back stage area for connection to whichever technical vehicle ultimately used for the job.

It was for this specific purpose that Tony Wilson, Bob Harrison (assistant to the chief engineer, Radio Broadcasting) and myself were standing there with our shoes and socks soaking in the sodden turf of dear old England, gazing up at the scaffold framework, which at this unfinished stage was more reminiscent of an overgrown Brontosaurus specimen from the Natural History Museum, than a concert platform.

Unfortunately there was no sign of anyone who could give us definite information about how things were going to happen. I had already approached several 'beefy' gentlemen who were occupying themselves by battering some unfortunate looking nails into the wooden parts of the platform with crowbars, spanners, bits of scaffolding—in fact with just about anything except a hammer.

Eventually a rather large gentleman who, with hindsight, was probably the 'under-assistant site sub-contractor supervisor', asked us: "Are you guys signing on as stage-crew?".

"Er, no actually we're from the BBC—you don't know where Steve Hall is, do you?"

"Nope!"

Inactivity resumed and the moisture in my trouser legs was approaching my knee, when up rolled a dark red *Range Rover*, and out jumped Steve Hall who was, in fact, a very helpful and pleasant chap, and who, despite the aggravation of being chased by almost everyone on the site with every conceivable kind of problem, started giving us some definite answers to important questions.

Steve introduced us to the American in charge of the PA sound crew so that we could sort out how to derive signal feeds. He was rather tall and busy and we found it quite difficult trying to keep up with him as he walked around, but we did manage to strain a few meaningful phrases from his thick Texan drawl.

"Ah'm jest trahyin' t' get this rig together . . . An don' wanna talk 'bout it raght naeow!"

Tony then made to my mind a faultless production decision with which Bob and I heartily concurred, and that was to retire to the nearest pub for food, drink, and to let our trousers dry out.

After lunch a somewhat agitated, balding chap arrived to explain to Steve Hall why the sound towers had not been erected.

"Well, you see, the tower that should have been here is on the Continent doing another Festival—but we'll find all the bits necessary to make another one!"

Questioned further about the estimated time of completion, we were told that there would be no opportunity to rig lines until the following day. Bob and I then decided to depart having spent a full day confirming that the lines would be flown, not dug in, and having arranged to be there early the following day when we were assured that all our requirements as regards rigging the lines would be satisfactorily met. This factor was of prime importance, as the prospect of paying out and hoisting cables across a jam-packed festival site on Saturday was one which we intended to avoid at all costs.

Returning on the Thursday, we saw the beginnings of the sound-tower. Almost all of the floor had been constructed, and there were even one or two poles sticking up, but no sign of a catenary cable! As on the previous day we hung around waiting to collar representatives of the various contractors on the rare occasions when they ventured within earshot.

Eventually we spoke to the PA crew, who were hauling out multiway cables between tower and stage in anticipation, we thought, of hoisting them with the overhead cable. The tall American was bending down, taping plastic bags around the multiway connectors in the middle of the cable run, so we seized the opportunity to have a stationary conversation with him.

"Hi, when's the catenary cable going up?"

"It ain't."

"Oh, er, what's going to happen to the cables?"

"They're gonna lay on the graeound!"

As he now seemed more conversational than the previous day, we discussed the matter of sound feeds. He made it quite clear that, as far as he was concerned, he would supply us with a buffered feed of the stereo PA mix, and that there was no way that he would be supplying separate feeds for a multitrack mix. Meanwhile we rigged enough lines to allow for a change of mind, although rumours were spreading that we wouldn't even be allowed to get the truck into the backstage area, and so the recording might not even be possible. So whilst Bob and I rigged four 50 metre 7-way multiway cables, Tony Wilson was frantically trying to sort things out with the various factions involved in London.

We breathed a sigh of relief, and reflected that, although it had taken a day and a half to put the cables in position, the time had been well spent in avoiding having to perform the same operation through a densely populated festival site.

Before we left, we thought that we'd just inform the PA crew of our departure, and remind them about looking after our cables. On doing so, we were advised that it would be risky to leave the cables on the ground as there would be a number of heavy vehicles—tractors and the like—zooming around the site, and that as the crew wouldn't be there all the time to ensure safe keeping, they intended pulling theirs in again after the sound check had been completed.

Bob and I were bitterly disappointed. For a few minutes we talked about leaving the cables where they were, and debating as to whether the multiway connectors would stand up to the battering or not, but the risk involved really wasn't on. With heavy hearts we withdrew the cables and after making the exposed multiway connectors watertight in plastic bags, returned to London having achieved next to nothing.

That afternoon, Tony went up to Knebworth to talk to the band and manager and reported that there was now no problem about the truck and also that the band were happy for us to multitrack the concert on the understanding that we simultaneously recorded the stereo PA mix which, if ultimately more satisfactory, would be transmitted instead.

The multitracking, however, would not entail the more conventional approach of splitting mic signals on stage, but instead recording eight separate premixed mono subgroups. This was the last stage in audio processing on the PA board before these eight signals were panned and mixed across the main output busses. Feeds of these signals were available on eight post submaster fader jack sockets, each busbar being associated with the total performance of a particular member of the band on various instruments (as mixed by the PA engineer).

The recording truck problem was also resolved because *Nationwide*, who were producing a special feature on Genesis, were hiring the RAK mobile recording truck to cover the event, and instead of the BBC appearing with two trucks, Bob had sensibly arranged that we should split the cost, and share facilities.

There would be only stereo loudspeaker monitoring in the truck, but by recording the B-format signals from the Calrec *Soundfield* microphone we would, with the appropriate decoder, have full control off tape of the 4-channel audience reaction balance.

On Saturday, Bob and I were joined on site by Anthony Pugh, bringing the strength of the BBC radio crew to four. Miraculously, the platform looked complete, the sound tower and two lighting towers were clearly finished, and the huge 'Hush Power' generators were busily humming back stage.

The crowd was much more enormous than I had dared to think, but once we got stuck into the job of hauling out cables, it wasn't as traumatic as we had anticipated. The crowd was most co-operative, and hardly a voice was raised as we trampled over heads, hands, feet, the occasional nose, lots of sandwiches, and other various unmentionables. We connected OB boxes to either end of the two, now continuous 100 metre runs and checked the lines individually using a battery-powered Shure line level microphone and a pair of headphones at the other end. We then decided to rig the Calrec audience effects mic. The ideal spot would have been on the tip of one of the scaffold uprights of the sound tower, but because of the density of crowd, there was no way of getting a ladder in, so we lashed the mic to the right-hand side of the scaffolding as high up as we could safely manage.

By this time Roy Harper had appeared on stage and started the festival off. His strident guitar and inimitable voice sallied forth across the arena, and the PA sounded very good.

It took about 20 minutes to battle our way from the sound tower and when we got back, we could see that the RAK truck had arrived but we were not allowed backstage because, instead of having 'Technical Passes', we had incorrectly been supplied with 'Guest Passes'. Although these magic sticky labels entitled us to go into the guests enclosure where, if we were lucky we might get to rub shoulders with the stars in the beer tent, at this point, however, we wanted to do some work, and by producing a BBC identity card, and getting corroborative support from several officials who provided sworn-statements and suitable hostages, we were eventually allowed past Checkpoint Charlie.

Tim and Vince from the RAK truck were already pulling out their multiway cable. Mains was very quickly provided by a co-operative electrician in a green Southern Electricity Board boiler suit. The outlet we were given was one of a selection of regular 13-amp sockets serving the back stage area. We checked that this source was common to the PA sound mixing equipment in order to minimise the possibility of earthing problems.

At this stage Tony and I thought we'd better liaise with the PA crew about finding appropriate outputs of our feeds. We made our way armed with a collection of connectors, adaptors and cables, and made reasonably good time out to the sound tower. Brand X were now on stage, and the crowd was beginning to get more dense around the tower.

When the band had finished their set, we enquired about the various outputs. The main stereo mix was no problem, and all we needed were two standard mic cables with XLR plugs and sockets to interface with our OB box. The Calrec *Soundfield* mic was similarly no problem, and that too was soon connected.

However, when asked about multitrack feeds, the tall American said that he hadn't been told anything about multitracking. We assured him that the band and the manager had given the go-ahead, and he grudgingly pointed to a row of jack sockets.

The journey back now took about 40 minutes, and we were disappointed to find that only the main stereo PA feeds were giving us anything like sensible sounding signals, although noticeably lacking in bass. We were not sure whether this was due to a mis-match or (as I now with hindsight know) there was considerable modification of the main signals via crossovers and graphic equalisers before the sound reached the audience. This factor presented

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MAKING THE MOST OF A ROCK FESTIVAL

another good argument for remixing the concert for radio presentation.

Lastly, and worst of all, some of the eight submaster feeds didn't appear to work at all, and those that did were one-legged.

We had confirmed that the lines were OK from the OB boxes to the truck, so we now suspected that the eight feeds were not, as we had anticipated, balanced line outputs, but unbalanced. This seemed likely since we were floating all the lines on the multiway cables and the end result was a selection of one-legged signals. As we didn't want to common our earth with theirs, Tim and Bob started making up a set of leads with a PO jack plug at one end, and XLR connectors at the other, but with the wiring arranged so that the sleeve circuits on the PO plugs were now connected to the pin 3 in the XLR connectors, insuring that, despite the earth circuits being discontinuous between truck and PA mixer, we now would be able to receive their unbalanced outputs on pin 3 (now PA mixer earth) and pin 2 (hot wire as normal). As their circuits would now be connected to our balanced lines, any signals from them would have to go via balancing transformers. We hoped that this arrangement would give us good audio signals, and obviate common earth problems.

We found, to our intense relief, that most of these new leads worked and that our reconnection had not interfered with the PA system in any way. After a few minutes we deduced that three submaster PA mixer outputs didn't have anything routed to them or were faulty. However, before we could check, an agitated back stage technician (yet another tall American) approached and asked where our mains supply lead was plugged in. Tim from the RAK truck described the location of the outlet and the American then asked if we had 'official authorisation' to take mains from this source. We explained that a co-operative electrician had plugged us in. The American then decided that as this electrician was clearly not, from the description we gave, a fellow American, he couldn't have had the 'authority' to connect us. In addition, since there was a tripper being blown on stage, and ours was the only plug in the area which he didn't recognised, he was going to pull it out! A few minutes later the power to the truck failed.

Our friendly electrician from the Southern Electricity Board found us another outlet, but instead of being connected to one of the two 100kW generators supplying the PA sound equipment, local lighting and emergency supplies, we were now on the same 250kW generator as the stage lighting system. We switched the truck on and waited apprehensively to hear if there were any earthing problems. To our relief both the PA system and the truck were clean. That only left thyristor problems, but we would have to wait until the evening to find out about that.

Although I didn't relish the thought, I now had to face the journey to the sound tower once more in order to rationalise the situation as regards the multitrack feeds, and to try and engage the tall American in conversation to see if there were any alternative sources for any of the sub-master busses.

It became more obvious as I drew nearer the tower, that I wasn't going to get around the side of it nearest the entrance, but I managed to get as far as the front wall and one of the security guards in the tower, seeing my predicament, together with one of his mates, lifted me up over the fence, and lowered me into the area below the tower floor.

I called Tony on the intercom, to see if anything had changed since I left the truck. It had. As one band had gone off and the other one had come on, two of the submasters previously not functioning were now 'live' and others were now 'dead'.

The only output which hadn't given anything at all was output 2, and they seemed to be getting everything in the truck except the vocals. I then went up to the sound mixing area and had a good look at the operational state of the mixer. Tony was right about submaster 2, which was now feeding the PA with vocals, but not sending anything to the truck via its associated auxiliary output. Whilst I was on the bridge, I looked for possible alternative outputs such as unused echo/foldback sends and alternative sockets on the jack field. Tom Petty and the Heartbreakers were still on stage, so conversation with the tall American was out of the question (not that it was much more likely between acts), but from what I could make out, both auxiliary send chains on the board were being used for echo and harmoniser effects.

I waited until Tom Petty and Co had finished and saw that the PA board was being set up for Genesis. There was another act scheduled to appear before Genesis, but that was being handled by the second PA mixer which belonged to a different company altogether. This was a stroke of luck, as it meant that we would have plenty of time to sort out problems on the main PA mixing board. However, when approaching the tall American I learnt that he still hadn't been told by the management to go ahead with the multitrack operation, and on mentioning an alternative source of submaster 2 via an insertion point, he became most heated and said that if we broke any of his signals from the PA mix he might just pull our plugs out. Then, having second thoughts on the matter, he said he might just pull all our plugs out anyway! I retired gracefully under the floor, and relayed all this information back to the truck. Tony immediately went off once more in search of Genesis management while we waited.

During the next few minutes I became very irritable and depressed. Just then the tall American shouted at me. To my amazement he alleviated our problems by rearranging the mixing board layout so that submaster 2 would now carry the relatively unimportant percussion mics, rather than the second drum kit (on which Phil Collins occasionally performed a drum duet with the regular drummer Chester Thompson) originally routed to it. In addition, and again to my amazement, the American almost apologised for the faulty output and the fact that he had neither the time nor the resources available to repair it, and added that he was interested to note that we had managed to get any feeds at all as he had never tried using the submaster auxiliary outputs before. I thanked him for his concern (as he had clearly taken the initiative himself, there not having been enough time for anyone to get a message to him).

As I mentioned earlier, a second PA company were servicing Jefferson Starship who had apparently not had the benefit of a sound check. Predictably, the sound at the beginning of the set was horrendous but as time wore on the sound started improving.

Back at the truck, Tony explained that there were too many technical and administrative problems to attempt deriving feeds of the percussion mics from the back stage area and fortunately Tony knew the material and the percussion was not frequently used in the act, so the end result would still be musically satisfactory without it.

We now had the Calrec *Soundfield* microphone powered, and having listened to it, Tony wasn't certain about its position so he had taken the additional precaution of asking Tim and Vince to rig a cluster of Neumann *KM84* mics on a boom stand placed a few metres away from the truck, poking out over the corrugated iron fence into the arena.

After spending 2½ days rigging and checking 18 lines, we could start thinking about recording them. Tim already had this well in hand, as did Lauri Choate and his other two crew members, Stewart and Dave, who had come along as the *Nationwide* film sound recording team. The film crew wanted to take away with them an audio reference tape for cutting the film, so we had to derive sensible reductions of the basic sound elements of the show. Luckily the RAK truck had a convenient audio submastering system, so by pressing a few buttons, it was possible to arrange suitable submixes

46 ▶

Tom Petty on stage at Knebworth

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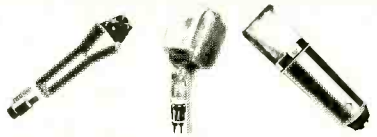

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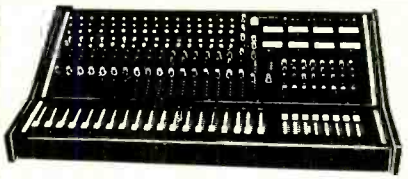

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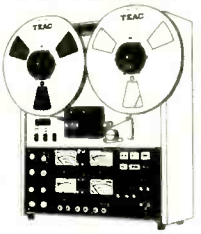

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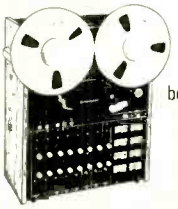

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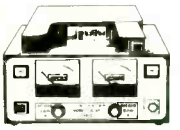

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MAKING THE MOST OF A ROCK FESTIVAL

from the multitrack feeds which were recorded on a stereo Nagra with pilot tone.

Suddenly, all the lights in the van went off! Bob and Tim raced out and up the ramp to the back stage area. We bit our nails for about ten minutes when, just as suddenly, the lights in the truck came on again. Bob and Tim returned looking happy. Apparently, the second PA company servicing Jefferson Starship were in a hurry to get away and were derigging everything in sight.

We were seeing the tail-end of a glorious sunset, and the evening chill was just setting in as Bob Harris introduced the headline act to a tumultuous reception.

In the van things were going well. Tim kept an eye on levels to the multitrack, constantly applying smooth control to compensate for the fact that we were getting post-fader submaster feeds from the mixing board.

The only technical hitch was caused by a dirty PO socket associated with one of the audience mics. During the brief period in which that problem was causing a panic, Bob Harrison, who was trying to get some well earned sleep in his car, was dragged into the truck to see if he could help. Afterwards, he told us that the meters associated with the truck's power supply had shown the mains frequency momentarily dipping as low as 30Hz apparently due to fluctuations in the operational state of the lighting board (which incidentally had not presented us with any thyristor problems). We were blissfully unaware of this fact, and were in general very happy about the results of the recording (which says a lot for servo controlled capstan tape machines). The bass sounds, guitar and keyboard feeds were all excellent (most of them being derived from DI sources).

The vocal feed was of the sort of quality which we expect from the types of microphones used in these situations. The frequency response was somewhat restricted, but was to some extent compensated by the excellent acoustic separation that was achieved, allowing as much EQ as we wanted later. The vocal submaster feed included vocal effects as mixed by the PA engineer, saving us a lot of note-taking and mixing complications. We weren't happy about the drum sounds—the snare drums and tom-toms were in general 'thin' and 'boxy' and the bass drums tended to be over balanced in the drum mixes and somewhat woolly in quality, but in the circumstances we thought ourselves lucky to get a recording at all, and we had no doubt that, within the context of a live recording, the overall result would be good after remixing.

In comparison to the gargantuan amount of time spent wheeling and dealing our way past administrative, technical and physical problems, the performance was over in a flash, and soon it was time to start derigging. Considering the huge number of people who attended the concert, the arena was cleared very quickly. It didn't take us long to collect the OB boxes and connectors and to haul in the cables, although these were coated in much muck, the possible sources of which I didn't care to think about.

After recuperating on the Sunday, I was in bright and early on Monday morning to BBC Maida Vale, Studio Six. This particular studio has a 24/8 Neve with 16-track quadraphonic monitoring facilities, making it ideal for quad mixing sessions. We managed to rustle up every piece of peripheral electronic processing equipment that was available in the shape of digital delay line, harmonisers, graphic equalisers, a BBC designed magnetic disc (with movable replay head to alter echo delay time), and as well as having two stereo plates for 4-channel reverb, we managed to get hold of an EMT *250* 4-channel digital reverb unit.

Bob Harrison had arranged for us to have the loan of a Lyrec 24-track machine for the remix, as we don't have 24-track facilities in the BBC. Finally we plugged in and lined up the BBC Matrix-HJ 4-2-4 quadraphonic encoder/decoder, and associated monitoring circuits.

The first mix was the 2-channel Matrix-HJ version using the PA engineers mix and distributing audience reaction all around the sound stage. The B-format signals of the Calrec *Soundfield* microphone were put through their decoder and rotated to the optimum position. As Tony had feared, we had not really had the chance to put it in the ideal place and it picked up too much close perspective information (chat from security guards and technicians) from inside the tower. Also, our immediate reaction to the musical

BBC Maida Vale Studio 6 'arranged' for the Genesis mixdown. Note Lyrec 24-track with remote controller by Neve console, BBC racked Dolby A units, and central equipment 'stack' comprising (top to bottom) Calrec Soundfield decoder, Eventide Harmonizer, Technics equaliser and BBC Matrix-HJ encoder.

ambience arriving at the Calrec mic from the PA was that it was unusable. Being in the open air, the PA sound received at the sound tower was not modified by multiple reflections as in an indoor situation, and except for changes in the frequency response, sounded much the same as it would have done had the mic been much closer to the stage, but with a time delay. However, replaying the relevant tracks off the record heads had the effect of bringing the ambience relatively ahead of the rest in time and allowed us to pull up the ambience mic just enough to colour the sound picture slightly. Listening and panning the *KM84*s appropriately, provided an ideal mixture and gave us the best chance of creating the effect that Tony Wilson wanted.

The various audience/ambience recordings were premixed on the resident 16/4 Neve submixer which appeared as a 4-channel sub-group on the main mixer, so that once I had a satisfactory audience/ambience balance, I didn't have to touch individual channels related to these sounds any more.

Consequently, the only variables in this first mix were the main PA stereo music mix (placed across the front of the quadraphonic picture), and the audience/ambience 4-channel subgroup. We zoomed through this part of the section, and by late afternoon both we, and the film sound recordist, had complete Matrix-HJ 2-channel versions on our respective machines. This part of the operation also gave Tony Wilson another valuable opportunity to listen to the material once more before the multitrack mix.

Before breaking for the evening meal, we set up the 'mix' proper on the first number with the appropriate panning, EQ, compression and effects. We decided on a judicious use of various effects because, although the ambience mics gave us an impression of being at the event, the band's sound panned across the front of the sound stage did not have a lot of what I can only describe as 'depth' again owing to the fact that we had recorded in the open air. As Genesis material is somewhat 'symphonic' in style, and as they frequently made use of various 'cosmic' effects at certain points in the performance, we took the liberty of adding echo and reverb—just enough to give the impression that there was some kind of ambience being reflected on the stage, as well as across the arena. This approach was particularly beneficial to the drum sound.

The second mix went well but as it was now a multitrack music mix, progress was predictably much slower. By the early hours of the next morning, this final version of the whole show had been completed.

All that remained now was to play the results of the band, and to edit the relevant version ready for transmission. On the Wednesday, the band heard a decoded 4-channel playback, and okayed the multitrack remix. They requested removing a few numbers from the programme owing to tuning problems earlier in the set when things hadn't warmed up properly, and by the following Saturday, Tony and Anthony had edited the master tape ready for it to be included as a 1½ hour special within the *Alan Freeman Show*.

Despite the 'negative vibes' about the concert that appeared in much of the press, I witnessed thousands of Genesis fans going off home after what was for them an exhilarating concert and I would hope that a few of those who couldn't make it, shared some of the excitement a week later by turning on their radios. ■

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ADRIAN HOPE

Long waves?

JUDGING FROM the recent welter of published correspondence and comment it seems only those making and selling radio sets and Howard Newby (managing director of BBC Radio) welcome the wavelength changes to be adopted by the BBC on November 23. Added to that perhaps EMI, who are getting £438,000 to install new tuners at three mf transmitters and whatever firms have landed any other necessary conversion contracts. As a nation, we inevitably resist any change, but the BBC changes which centre around the transfer of Radio 4 from the medium to the long wave, do seem guaranteed to create even more than the normal quota of resistance—and not just from Jimmy Saville who was recently reported to have taken delivery of a £40,000 Rolls with a number plate tuned to a now obsolete Radio 1 wavelength.

For a kick off, anyone with a portable or car radio which receives only medium wave will no longer be able to listen to Radio 4. This will doubtless make LBC in London very happy indeed, as the station thereby overnight receives a massive free gift of news seeking mw listeners on a plate. Listeners with their medium wave sets tuned to Radio 1 will suddenly find themselves hearing Radio 3, but after the initial shock will doubtless curse and simply learn to cope with the situation. After all, both Capital and LBC had to kick off in London on temporary medium wavelengths and switched to spots right at the other end of the dial at a crucial time when both were still fighting for listeners. As proved by the Capital-LBC switch, very few listeners are so stupid that they cannot cope with a wavelength change—provided of course that they can receive the new wavelength being used. Listeners with mw only won't be able to cope with the Radio 4 change without buying a new set. Sorry about that granny, blame Auntie. Probably even more significant but much less well recognised and less argued in the popular press; is the question of *quality* of reception, especially resistance to interference. Assuming the non-vhf Radio 4 listeners already have or are prepared to go out and buy a set with long wave capability they may well find themselves encountering reception problems with Radio 4 that they never knew existed. At the root of the problem is our old friends thyristors and triacs, mentioned in passing in a previous column.

A final thought–while the BBC juggles medium wavelengths, BBC local Radio stations continue to notch up their tenth birthdays (Radio Leicester was the first local radio station to go on the air on November 8 1967). Isn't it about time that the BBC allocated funds for all its local stations to go *stereo* on vhf, and so have a reasonable chance of competing with the all-stereo commercial stations already existing and the new batch due soon, subject to Home Office approval . . .

More razor blades

THE SAD TALE of the disappearing single-sided razor blade produced some useful reactions. Although you are unlikely ever again to find single-edged blades at Woolworths or your local chemist, there are now several sources in the UK. Space doesn't permit me to thank all correspondents individually but here is a collation of the nitty gritty. Industrial Blades Ltd, Hawksley Avenue, Sheffield, has apparently just *started* manufacturing single-edged blades and one university department found they could buy a thousand at £22.85. Feldon Audio Ltd has been importing blades from the States for a while and sells then at £5 per 100. Stanley Productions at 147 Wardour Street, London W1, will sell you single-edged blades over the counter at 7p each with discounts for quantity and Sounds Interesting at 37 Hillfield Road, London NW6, sells blades imported from the States at around the same price. There is also another alternative. Some chemists (although I've never found any) are reputed still to have Valet auto-strop blades which are made in the UK by Gillette. These are single-edged but don't have the solid rib backing along the blunt edge and are thus less easy to use than the good old type to which most tape editors have been accustomed. Thanks again to all those who wrote or phoned in and with whose help the great razor blade famine has been narrowly averted.

Hill and dale video disc

THE EUROPEAN record pressing industry has a hard time ahead. The new Japanese video disc system, *Visc*, has as its main advantage the fact that the video disc can be pressed on conventional audio disc presses using a conventional vinyl plastics mix. The recorded signal is full colour video, plus two discrete channels of sound (either for stereo music or bi-lingual dialogue) and is cut as frequency modulation on carriers in a hill and dale groove.

As Edison repeatedly argued a hundred years ago, and on into the early 20th Century, with a hill and dale cut there is no lateral movement of the groove and stylus. As a result the groove pitch can be kept constant and very fine. So far it has proved possible with *Visc* to cut up to an hour of colour video and 20 kHz bandwidth audio using a rotational speed of 450 rpm and a track pitch of 2.3 microns.

Now for the bad news. Although the audio and video signals, being recorded as frequency modulation, are remarkably resistant to the effect of dust and finger marks on the disc surface (they can be handled and cleaned in the manner of ordinary audio discs) the system is intolerant of groove wall damage and imperfections. If the stylus, which is a super-fine diamond tracked tangentially by an arm not unlike that found on a cutting lathe, breaks through the groove wall, the result is repetitious picture break up and that portion of the disc is unplayable.

Clearly it will take only the slightest inconsistency in the *Visc* pressing mix to produce groove wall faults and make the pressing unacceptable. Perhaps most sobering for the record-pressing plants is the absolute requirement for pressed *Visc* to be flat to within 300 microns. The stylus will just not track a *Visc* if it is warped by more than that amount. Although Japanese pressing plants have proved themselves well capable of pressing blemish-free discs which are truly flat, the same can most definitely not be said of many European plants, to whom a flat record must seem like the eighth wonder of the world.

Wake up the neighbours

IN 1977 the annual French hifi exhibition, the Festival du Son, was held almost co-incidentally with the Spring AES Convention, thereby allowing audio engineers and the like with a foot in both the pro and domestic camps to kill two exhibitions with one visit to Paris. This year the Festival du Son (the 20th actually) was on its own at the Palais des Congrès but was typified by a studio and disco approach to domestic sound. Quite simply the French audio market place has gone overboard for loudspeakers and blockbuster amplification capable of generating control room or disco levels of sound in the living room.

Unfortunately, the quality of the systems on show was most often of disco rather than studio standard. Even more unfortunately all concerned seem to have lost sight of the fact that even fewer French than English apartments have thick enough walls and ceilings to cope with anything approaching the levels of sound for which the equipment on show is intended.

Presumably most of the Festival visitors were just living for thrills, vicariously viewing and listening to equipment they have no intention whatsoever of even trying to afford. If so the French audio industry is faced with a serious problem. Just as soon as everyone planning to open a disco has done so and bought their equipment, there won't be any more customers. ■

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Survey: studio ancillaries

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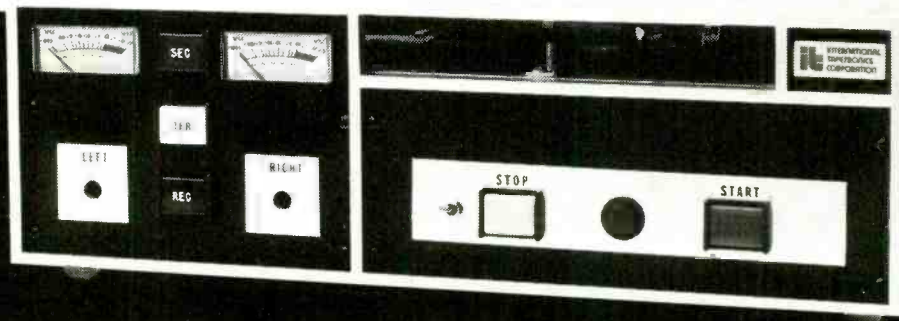
The ADO55 Compressor is a dual channel compressor/limiter with a comprehensive range of useful facilities. The two identical systems may be linked for stereo operation.

Specification

RATIOS 2 : 1 3 : 1 5 : 1 Limit (20 : 1)
RELEASE TIME Adjustable — 75mS 150mS 300mS 600mS 1·2 sec 2·4 sec
ATTACK TIME Adjustable — 0·25mS 0·5mS 1mS 2mS 4mS 8mS
FREQUENCY RESPONSE 1dB 20 Hz to 30 kHz NO COMPRESSION
DISTORTION 0·1% at 1kHz to 10kHz NO COMPRESSION + 8dB input
MAX. COMPRESSION 25dB
MAX. OUTPUT + 19dB at 1kHz + 12dB at 20Hz
MAX. INPUT Dependent on the MAX OUTPUT and MAX COMPRESSION
NOISE Wideband — 68dB Band Limited — 71dB

Audio Developments
Hall Lane, Walsall Wood
WALSALL, W. Midlands, WS9 9AU
Telephone: Brownhills 5351/2/3 (STD Code 05433)
Telex: 338212 Audio



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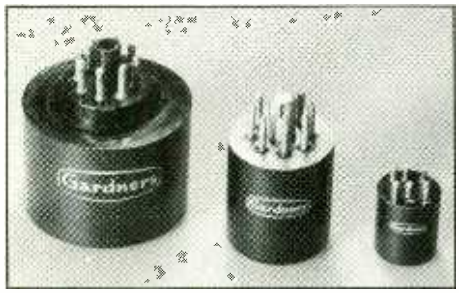

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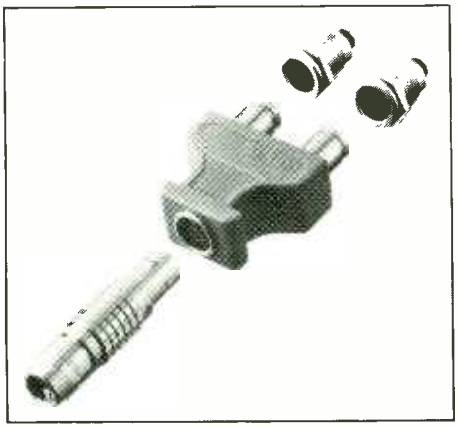

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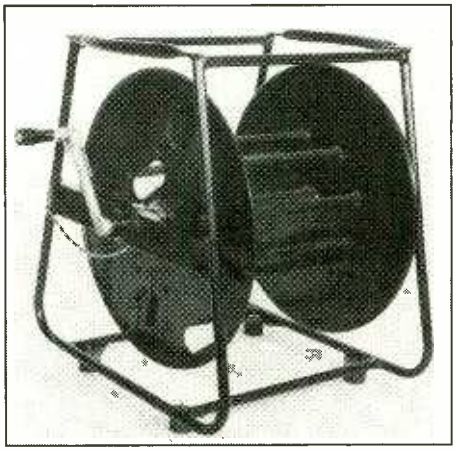

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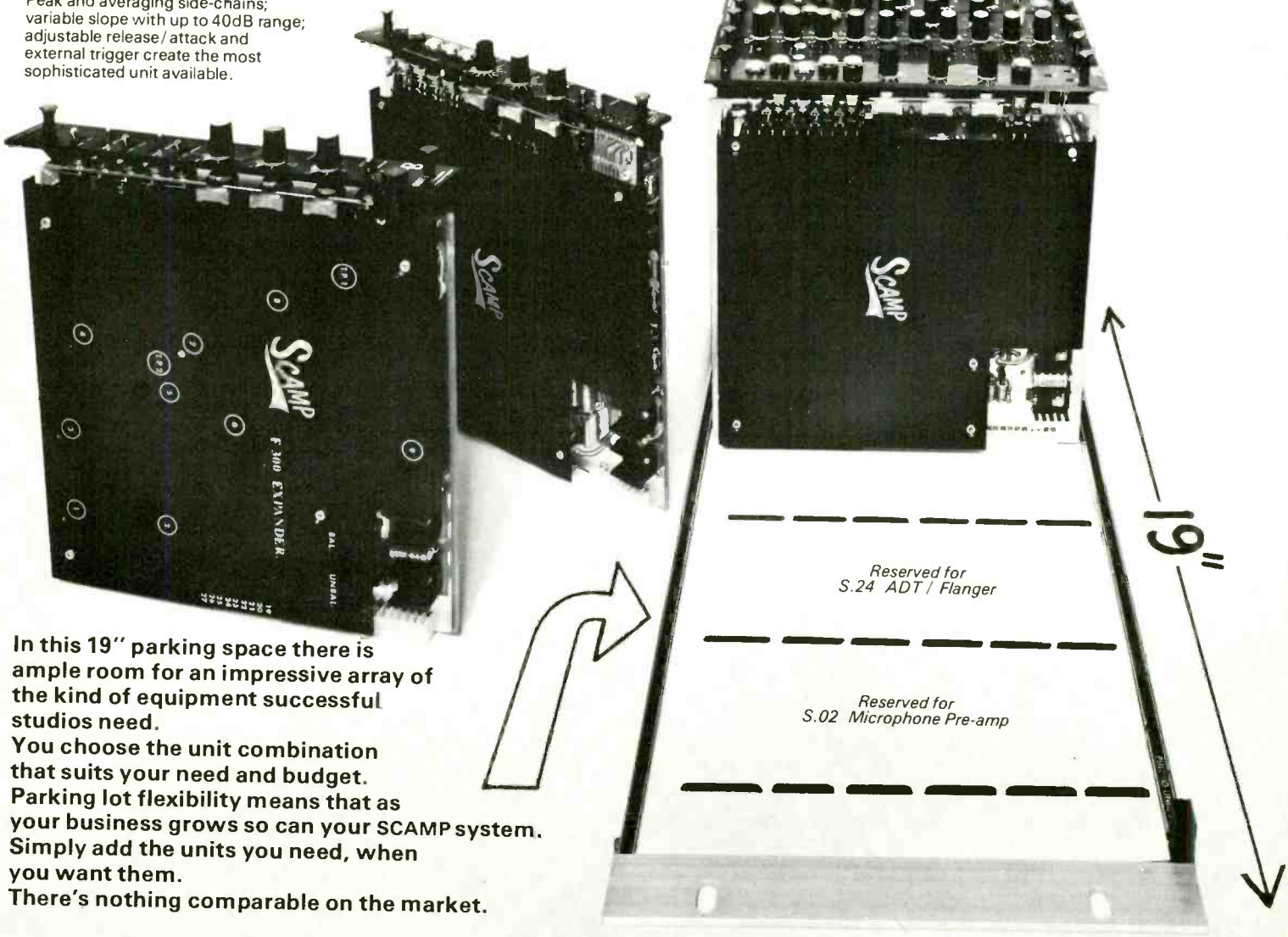

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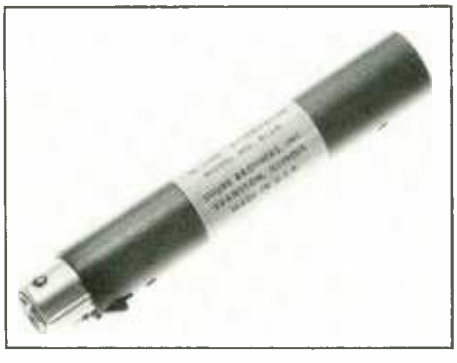

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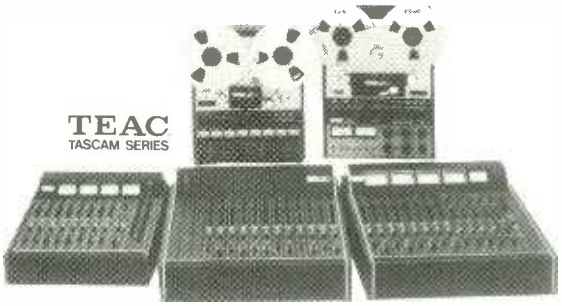

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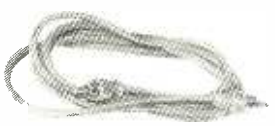

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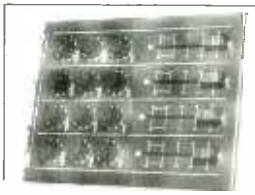

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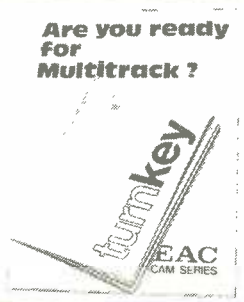

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work

Home from home at Eden

Chiswick may not be the hub of the throbbing metropolis but it has much to commend it—a nice stretch of river, non-trendy real ale pubs and a compact music centre called Eden.

Down a quiet residential road near Chiswick Park Eden stands, externally unimpressive until you pass under its arched entrance and then things are different. On a blazing summer day you're plunged (well almost) into a continental courtyard with Russian vines, garden chairs, sun shades and ice-cream. A small door hides a very calm and relaxed 24-track recording studio that belies some of the more frenetic music generated there by people like Elvis Costello, Graham Parker and the Rumour, and Nick Lowe.

The calm and collected Piers Ford-Crush, one of the trio who started and still run Eden, introduced himself. Mike Gardner appeared a fraction later but the third, Philip Love had completely vanished from the face of the earth in a frenzy of moving house.

Piers and Mike worked together as technicians in the Beeb. Philip, then a budding song writer, was introduced and the demo studio developed from there. These were the heady days when demos were mostly on acetates and you could still charge £8 an hour for 4-track. After five years of successful part-time operation the studio, then in Eden Street, Kingston, was compulsorily purchased which prompted the decision to go full-time, big-time.

The studio was built inside an existing store building and Piers is convinced that starting as near from scratch as possible yielded the best results. "It took us over three years to find these premises, the main requirements being a large open space—very hard to find without building from nothing". They brought in Ken Shearer for the basic design because the trio felt in sympathy with his attitudes about sound treatment. It is very much a room-within-a-room design with a respectable sized studio and a moderately low ceiling. "It works out very well in fact, just as Ken Shearer said it would. We can get, without a word of a lie, a 35 piece line up in here, brass strings and timps."

The studio, control room and vocal booth are in fact built completely separate from each other with small air gaps between all the internal walls. A 60cm airspace separates the inner complex from outer wall. As there was no external LF vibration, the deeply concreted floor didn't have to be floated but a lot of energy was expended in making the control room as massive, in weight, as possible. Piers explained, "the control room has been heavily concreted on top. If you are going to drive it at the kind of sound levels you need, it's got to be a really massive structure. I'm sure that the ideal control room would be built like the Tower of London." Working from scratch has really paid off here, the bass in the control room is very firm even with the recently installed JBL *4350s* driven flat out.

The Shearer treatment was executed by Graham Anthony and Peter Wadley, two 'real' architects who have contributed enormously to the atmosphere of Eden. The walls are finished with panels that are multi-diaphragms that selectively remove the room fundamentals. Slipped in between the irregular ceiling panels is light tracking, a new innovation at the time the studio was built three years ago. The lighting is in various colours and can be used up full when the studio is packed or turned down to make the studio more comfortable for vocals and solos.

In the far corner is a semi-permanent drum booth sectioned off with four of Eden's rather smart screens. These were done by Anthony and Wadley around Ken Shearers basic principles—they're bright blue with large windows and notches in the top and bottom giving the impression of a giant N. To complement these, the half screens are waist height E's and D's just to remind you where you are. The idea of a permanent booth had been kicked around but its present form has a lot of advantages. First it works as a booth should with no spillage, but at the same time the drummer still feels part of the studio with no sense of claustrophobia. On the back walls of the booth is another simple and effective touch, again on Ken Shearer's suggestion—two fairly short curtains that can be drawn across for a dead 'disco' sound, or left open, as they were now, for a much more live effect.

Everything was ready for an album session with the Rumour who had booked Eden (again) for four weeks. Among the usual complement of AKG *451*s and Neumann *87*s were one or two unusual beasts. The team were initially appalled at Roger Bechirian's (resident engineer) choice of *Soundstars* for the booth and especially toms. But now they defend them totally. "Sometimes you find a mic that has exactly the right sound without any EQ and that happens to be one of them." So there.

"Phones are an eternal problem with studios," Mike Gardner said picking up one of the well used and taped up Beyer *DT100*s, "so with a regular turnover of cables being pulled out or otherwise destroyed, something easily replaceable from our own stock of spares is important."

Eden's aim seems to be towards allowing groups to feel at home with people and a place that is easy and comfortable to work in rather than go hell for leather into every new device available. Everything about the control room reflects this attitude.

Again, it is a comfortable size, seating about eight. In a perfect world Piers might have considered something a little larger but in fact it has turned out to be ideal. "You don't always want people in the control room and if it's crowded then that's a good reason for people to get out. If somebody hasn't got a seat they probably shouldn't be there anyway." A lot of what Piers and Mike said related to the long chain of human problems, the way people use things and react to equipment. It was no surprise to find that communications between the control room, studio and the overdub booth down the side of the control room, were excellent. Large windows, so that everyone can see everyone else, and a comprehensive talkback system that includes microphones in the roof of the studio and booths to avoid mimed gesticulations when overdubbing instrumentals.

The mixer was built and designed in-house whilst the rest of the building work was going on. It is a basic 20 input design, with a centrally placed 24-track monitoring section

58 ▶

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

Angus McKenzie (March 1978)

REVOX

F.W.O. Bauch Ltd. 49 Theobald St. Boreham Wood, Herts. WD6 4RZ

all very compact. At the time it was built, none of the big manufacturers could produce a desk with the same facilities in the same space so everyone was happy with the end result.

Over the years minor things have been added or removed. For example, at the time of installation 'quad' was all the rage so originally the mixer was built completely quadraphonic with quad pots that have since vanished. Only one quad recording was ever made and that was cut in Japan, never to be heard of again. Although the studio started life as 16 tracks, all the design work had to take into account early upgrading to 24 so when after 18 months of operation, the Ampex *1200* was installed, everything was already prepared.

For speed, when changing the desk to mixdown mode, one knob switches all the input channels from mic to the Ampex output. Individual overrides are on each channel if needed. The output routing to the two stereo machines, a Studer *A80* and *B67*, is also instantly switchable.

Mike went over the effects side in detail. A separate console contained a *DN22* graphic, an Orban three input de-esser which was considered excellent and simplicity itself to use, Eventide *Flanger* and *Harmonizer* and Audio & Design parametrics. Echo is provided by a stereo EMT plate, two *A77s*, one at 76cm/s, the other 38cms which can be vari-speeded and are operated by the same switch on the desk, and also occasionally a heavily modified H&H multi-echo in addition to the delay facilities on the *Flanger* and *Harmonizer*.

The control room is positioned side-on to the studio—this was done to avoid musicians being confronted with gawping faces peering out over the mixer at them but it also means that the monitors don't have to be set in the ceiling. In fact Eden have recently changed from Tannoys to the enormous *JBL4350*. There were some problems in the initial installation trying to get the pair set as a mirror image, but now everyone is knocked out with them. Between Elvis Costello tapes Piers told me, "the room was here, we just needed the right speakers. With these it's not fatigueing. You can work at that kind of level and not come away concussed. I just can't understand why more studios don't use monitors of that standard". They are driven by a *DC300* at low frequencies and a Quad *405* for the HF section, and the end result of control room design and monitors is obviously good enough for the Rumour bass player, who was spotted later happily playing in the control room with everyone else coming over the monitors.

Eden do not favour a tape-op in the control room so an autolocate is essential for the Ampex. Their present one does most of what is required without getting too complex to handle quickly and easily. Later developments have been tried but the present unit looks as though its going to stay for a while.

About this time the Rumour started arriving, so we moved off to the rest of the building where expansion work had started. The studio is now pretty well booked up five months in advance with afternoon and night album bookings including Elvis Costello and Dr Feelgood. The mornings are often reserved for remixing and other work.

The new building work represents a new phase in the development of Eden. The finishing touches are being put to a tape copying room with Leevers Rich and Ampex machines for basic copies and a pair of Mkl *A77*s for low speed work. The copying room has taken a lot of pressure off the control room and will be linked to the adjoining offices, one of which will be used as a songwriting room, the rest as normal offices. On the other side of the courtyard, the large exstore room is about to be turned into a games room for everyone to relax in after long sweaty sessions.

The whole of Eden is geared to this approach, trying to get a sense of involvement with the people recording, getting the best out of them by easing things along and trying to foresee problems before they happen. So now they are expanding. Philip and Piers are hoping to develop production and publishing and hence the new offices. In the nearer future, an 8-channel extension unit is due to be installed on the mixer in July and plans are afoot for a completely new mixer although this may wait on further developments in digital technology. As there are no criticisms of the general layout that haven't already been resolved, that will remain much as it is.

Piers is happy about the way things are going and wants to keep it that way. Just to prove the point Bob Andrews (yes the Rumour again) was smiling all day. Something had to be wrong, the topic was broached by the concerned engineer. Still smiling Bob replied, "No, nothing, I just like being here. Every time I come back I still feel at home."

Tim Frost

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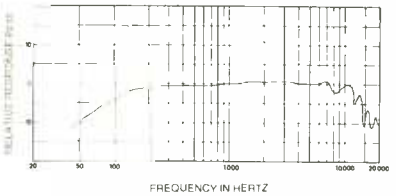

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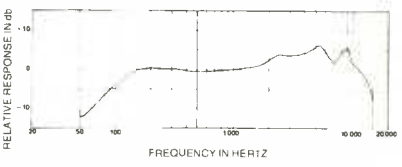
...some like a "presence" peak.



professional microphones...by SHURE®

Shure Electronics Limited, Eccleston Road, Maidstone ME 15 6AU—Telephone: Maidstone (0622) 59881

International Broadcasting Convention, a preview

THE 7th International Broadcasting Convention is this year being held at the Wembley Conference Centre, having outgrown the Grosvenor House. Demand for space has been such that exhibitors will be found tucked into the most unusual corners around the complex. The first IBC was held in London in 1967 with some 30 exhibitors attracting 550 delegates, while this year there are some 88 with over 3,000 delegates expected. The International Broadcasting Convention is second only to the Montreux Symposium as Europe's broadcasting exhibition. This is quite simply because Montreux regularly offers 7,200 square metres of exhibition space while IBC is limited, even at Wembley, to 2,062 square metres. In contrast, Photokina in Cologne which is held the week before, is this year using about 100,000 square metres of exhibition space.

Dates for IBC are September 25 to 29 with the exhibition opening from 09.00 to 18.00 each day except 10.00 opening on Monday, and 16.00 closing on Friday. Of course a major part of the Convention is the Technical Programme which for the most part runs in two parallel sessions. Principal headings are:

- Microprocessors and Minicomputers in Broadcasting
- Point-to-Point Transmission
- Video Signal Origination and Processing
- Transmitters and Transposers
- Video and Audio Recording and Storage
- Transmitting Antennae
- Satellites in Broadcasting
- Teletext Broadcasting Systems
- Stereo and Quadraphonic Sound Systems (Sept 28, morning)
- Teletext Subtitling Systems
- New Broadcasting Systems (including Carfax and digital sound broadcasting, Sept 28, afternoon)
- Future Possibilities in Radio Receiver Design (Sept 28, afternoon)

Despite numerous comments from exhibitors at the IBC, the only concession made for the majority of delegates who only want to attend the exhibition is a £3 ticket valid only for Friday Sept 29. Otherwise the charge for a full-time convention delegate is £62.64, for one day only £15.66, and for research students £31.32 for the week. Enquiries concerning registration should be made to IBC Secretariat, IEE, Savoy Place, London WC2R 0BL. Phone: 01-240 1871 ext 261, telex: 261176. During the convention call 01-902 8833 ext 286/7/8.

This preview is only concerned with sound and broadcasting aspects of IBC and is not intended to be complete.

Agfa Gevaert will be showing studio quality mastering tapes *PEM468* and *PEM525*, and *PEM526* master tape low noise with black antistatic coating and improved surface quality of magnetic layer for minimum shedding and headwear.

Sound mixing equipment designed for broadcasting will be exhibited by **Audix** including the *3500 series* of 35mm wide modules designed and built for ITN which offer comprehensive equalisation and routing facilities for up to eight groups and six aux outputs. Also a BBC Radio stereo desk built to a BBC specification. Other items of interest will include a new intercommunications system providing intercoms for both technical and office areas produced in co-operation with Barkway Electronics.

FWO Bauch Ltd handles a wide range of studio and broadcasting equipment including: Studer *A800* multitrack linked via *TLS2000 TapeLock* system to a VTR, *A80* and *B67* tape recorders, Revox *B-series*, Neumann FET condenser microphones including new shotgun mic *KMR82i* and handheld *KMS84i*, EMT direct-drive turntable *EMT-950*, Albrecht magnetic film recorders, ITC cart machines, Ivie portable spectrum analysis systems, Lexicon digital delay lines, Urie sound processors, Switchcraft connectors, Klein & Hummel monitor speakers and MRL test tapes.

Agfa Gevaert PEM 468 tape

Brabury Electronics provides a systems design and manufacture service and supply custom-made parts to many companies including racking, mains distribution units, automatic voltage stabilisers, tally light panels, on-air/rehearsal lights and a range of video jack fields. The new Soundfield microphone which provides unprecedented operational flexibility will be shown by **Calrec Audio.**

In addition to promoting A and B **Dolby** systems, a paper will be presented by David Robinson concerning automatic switching of FM tuners for Dolby-B decoding. Basically, a 15kHz tone at –70dB relative to Dolby tone is used and detected by hetrodyning with 15.2kHz derived from the stereo decoder providing an easily detectable 200Hz signal.

Philip Drake Electronics will be exhibiting a full range of studio and OB talkback equipment as well as audio switching matrices and related equipment for broadcasting. The new *Mini-Mobile* package catering for two areas, two externals and three cameras, will be introduced.

EMI Sound & Vision Equipment will be introducing the *8200 series Transicom III* intercommunication system designed to satisfy all requirements for communications talkback and cueing in broadcasting and studios. Modular construction allows specific requirements to be met.

Granet Communications will be showing a complete Cuerac automation system with a basic capacity of 500 cartridges with complete random selection manufactured by Consolidated Electronic Industries. From Cetec Broadcast group, the Schafer *Model 7000* automation system and Spectra solid state transmitters, and Fidelipac wow and flutter meter and cartridges.

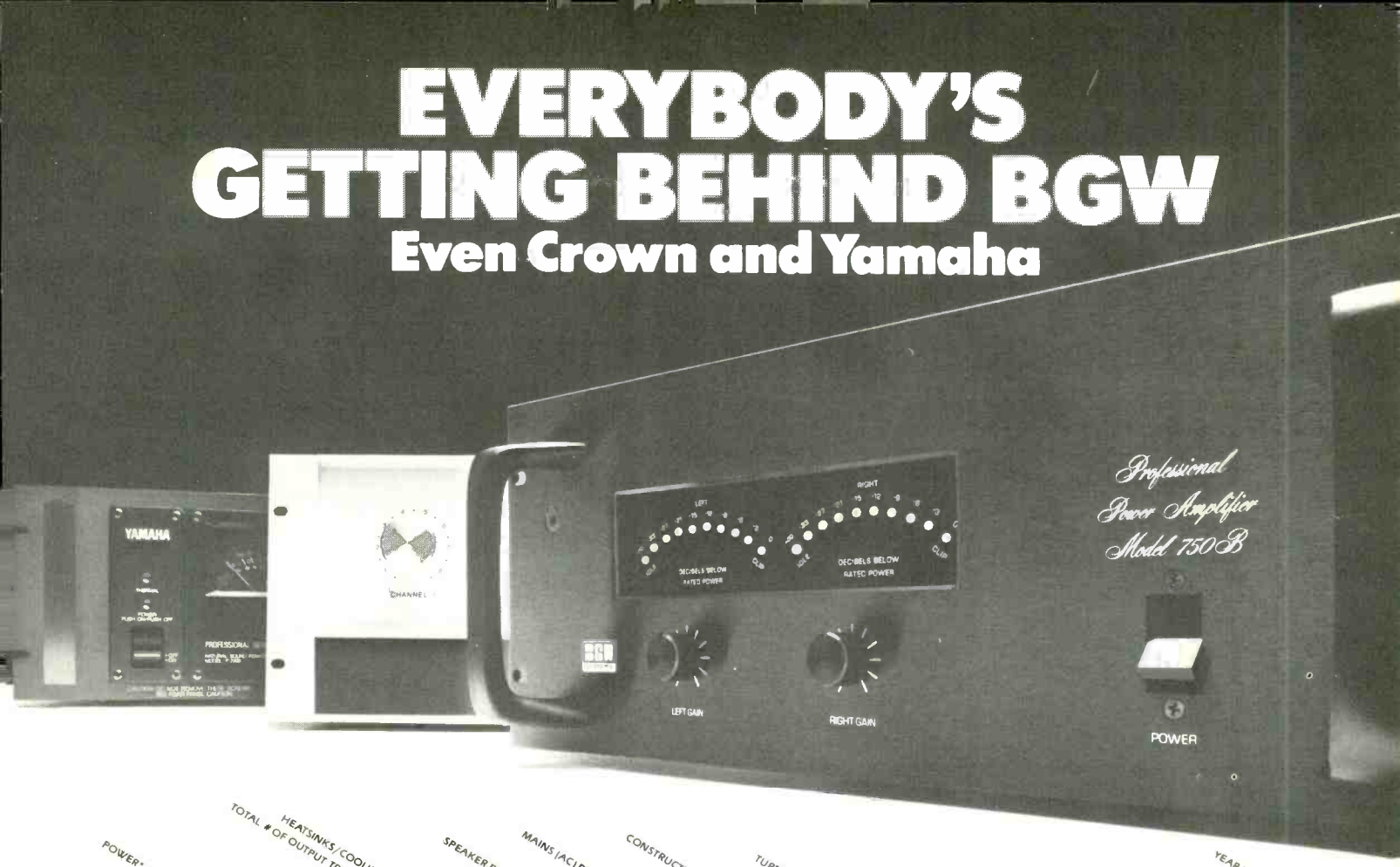
Although **3M** will not be showing the new digital audio recorder developed jointly with the BBC, the system will be discussed during a BBC paper 'Microcomputer mixing and processing of digital audio signals'. The well established *M79* 24-track will be featured with *Scotch 256* studio mastering tape and *Scotch 262* broadcast stereo tape.

NEAL-Ferrograph will be exhibiting the *Studio 8* professional tape recorder in a broadcast console and with synchroniser and pulse rate converter. The *Logic 7* semi-professional tape

62 ▶

EVERYBODY'S GETTING BEHIND BGW

Even Crown and Yamaha



	POWER* @8 OHMS	@4 OHMS	TOTAL # OF OUTPUT TRANSISTORS	HEATSINKS/COOLING SYSTEM	SPEAKER PROTECTION	MAINS (AC) PROTECTION	CONSTRUCTION DESIGN	TURN-ON DELAY	CIRCUITRY	T.I.M.	PRICE**	YEAR INTRODUCED
BGW 750 B/C	225 Watts/ch.	360 Watts/ch	20	Forced air cooling for 2 massive removable modules	Active arc-interrupting circuitry	Front panel magnetic circuit breaker	Modular all Teflon wiring	Relay operated transient delay circuitry	Full complimentary	0.02%	$ 999 — Model 750C $1099 — Model 750B	1978
CROWN DC300A	155 Watts/ch.	NO FTC RATING	16	Passive airflow only	None provided	Rear panel fuse only	Hard-wired, non-modular	None	Quasi-complimentary	Not specified*	$ 919	1974
YAMAHA P2200	200 Watts/ch.	NO FTC RATING	12	Passive airflow only	None provided	Rear panel fuse only	Hard-wired, non-modular	None	Full complimentary	Not specified*	$1095	1976

Here they are — The big guns of professional amplification: The respected Crown DC300A, The cosmetically impressive Yamaha P2200, And BGW's new, no-nonsense 750B/C.

Top-of-the-line professional power amplifiers from the industry's most respected manufacturers. All boasting impressive reputations. All costing about $1,000.

The table reveals the specifications.* You decide which one is best.

THE RELIABILITY FACTOR

Above all else, professional musicians and audio engineers want to know two things about their power amplifiers: How dependably they function under extreme conditions, and how well they interface with other components.

BGW's new 750 Series amplifiers have taken the lead in both areas. Twenty (20) output transistors as opposed to Crown's 16 and Yamaha's 12 provide a Safe Operating Area unmatched by either the DC300A or the P2200. While both Crown and Yamaha rely on passive "convection" cooling, the extensive heat sinks on BGW's pro amps are cooled by forced air for reliable, continuous performance even on the hottest outdoor concert stages. Unique new arc-interrupting circuitry protects speakers — not just the amplifiers themselves — from catastrophic DC offset.

Like all BGW amplifiers, the 750B and C feature modular construction and front-panel circuit-breakers rather than hard wiring and cumbersome rear-panel fuses. The result: Maintenance is easier both onstage and in the studio — when time and tempers can be very short.

CLARITY AND PRESENCE

Now that audible Harmonic and Intermodulation Distortion have been all but eliminated from professional power amplifiers, Transient Intermodulation Distortion (TIM) has become important. Neither Crown nor Yamaha specifies TIM levels whereas TIM specs for BGW's 750's Series are published with the greatest of pride. The 750B and C consequently produce clearer, warmer, and more open sound.

Pros will also appreciate another BGW exclusive: A delay circuit that eliminates all transient "thumps" when the 750B and C are activated. Neither Crown nor Yamaha has anything like it.

POWER

This is where BGW really leaves the competition behind. While the Crown DC300A and the Yamaha P2200 are rated at 155 and 200 watts, respectively, BGW's 750B/C delivers a full 225 watts per channel into 8 ohms,** leaving the competition behind entirely at 4 ohms, with a whopping 360 watts. Only BGW has FTC rated 4 ohm power specifications.

Both the DC300A and the P2200 are good power amplifiers by conventional standards. But real recording pros don't deal with convention.

They get behind BGW.

Because the competition already is.

*Based on manufacturers' published specifications and prices available 7/1/78.

**BGW 750B/C FTC Specification: 225 watts minimum sine wave continuous average power output per channel with both channels driving 8 ohm loads over a power band from 20Hz to 20kHz. The maximum Total Harmonic Distortion at any power level from 250 milliwatts to 225 watts shall be no more than 0.1%.

BGW SYSTEMS **Get Behind Us!**

BGW Systems, INC.
13130 S. Yukon Avenue
Hawthorne, California 90250
In Canada: Omnimedia Corp., 9653 Cote de Liesse
Dorval, Quebec H9P 1A3

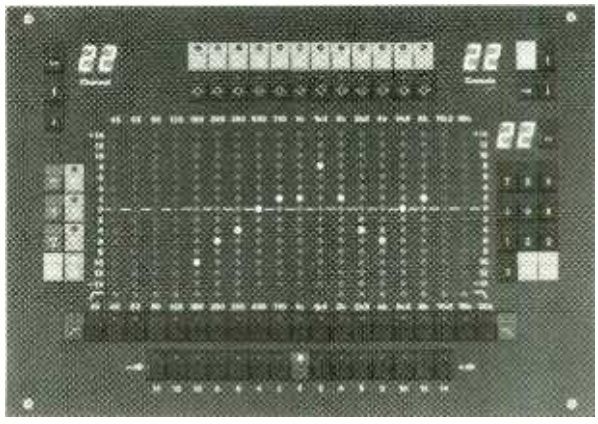
IBC, A PREVIEW

recorder, NEAL *302* three motor logic controlled cassette recorder, and audio test equipment will also be seen.

Neve Electronics International Ltd are showing one of a pair of 30 channel sound mixing desks ordered by Harlech TV in Bristol which features 16-track recording capability especially adapted for television production work. Also on show the *5315* general purpose console designed for music recording, broadcast production or OB use, and the *Necam D* computer aided mixdown system especially developed for post production dubbing work.

NTP Elektronik A/S will be exhibiting a range of peak programme meters, compressors, limiters, equalisers and introducing an EBU meter with gas discharge tube, LED display PPM, tone burst generator for PPM alignment, stereo compatibility meter using LEDs, and a programmable equaliser facilitating central controlling and display.

Shure will be displaying the new *SM81* unidirectional condenser microphone especially suitable for applications requiring extremely wide frequency response, low noise and distortion characteristics, very low RF susceptibility and highly reliable operation. ■



Exhibitors list

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AEG-Telefunken
Agfa-Gevaert AG
Allotrope Ltd
Ampex International
Aston Electronic Developments Ltd
Audix Ltd
Autocue Products Ltd
Avcom Systems Ltd
Aveley Electric Ltd (Rohde & Schwarz)
Barco-Cobar Electronic NV
FWO Bauch Ltd
Bell & Howell AV Ltd
BM/E's World Broadcast News
Bosch Fernseh (Robert Bosch Ltd)
Boston Insulated Wire (UK) Ltd
Brabury Electronics Ltd
British Broadcasting Corporation
Calrec Audio Ltd
Canda Television Equipment Ltd
CCA Electronics Corporation
CMC Technology Corporation
Alexander Cole Ltd
Consolidated Video Systems Inc
Continental Microwave Ltd
Michael Cox Electronics Ltd
Crow of Reading Ltd
Datatron Inc International
Digivision Ltd
Dixons Technical Ltd (Ikegami)
Dolby Laboratories Inc
Philip Drake Electronics Ltd
Dynamic Technology Ltd
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EMI Sound and Vision Equipment
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Independent Broadcasting Authority
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Keeline Productions
Key Electronics
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LGT—Laboratoire General des Telecommunications
Link Electronics Ltd
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Spin Physics Inc
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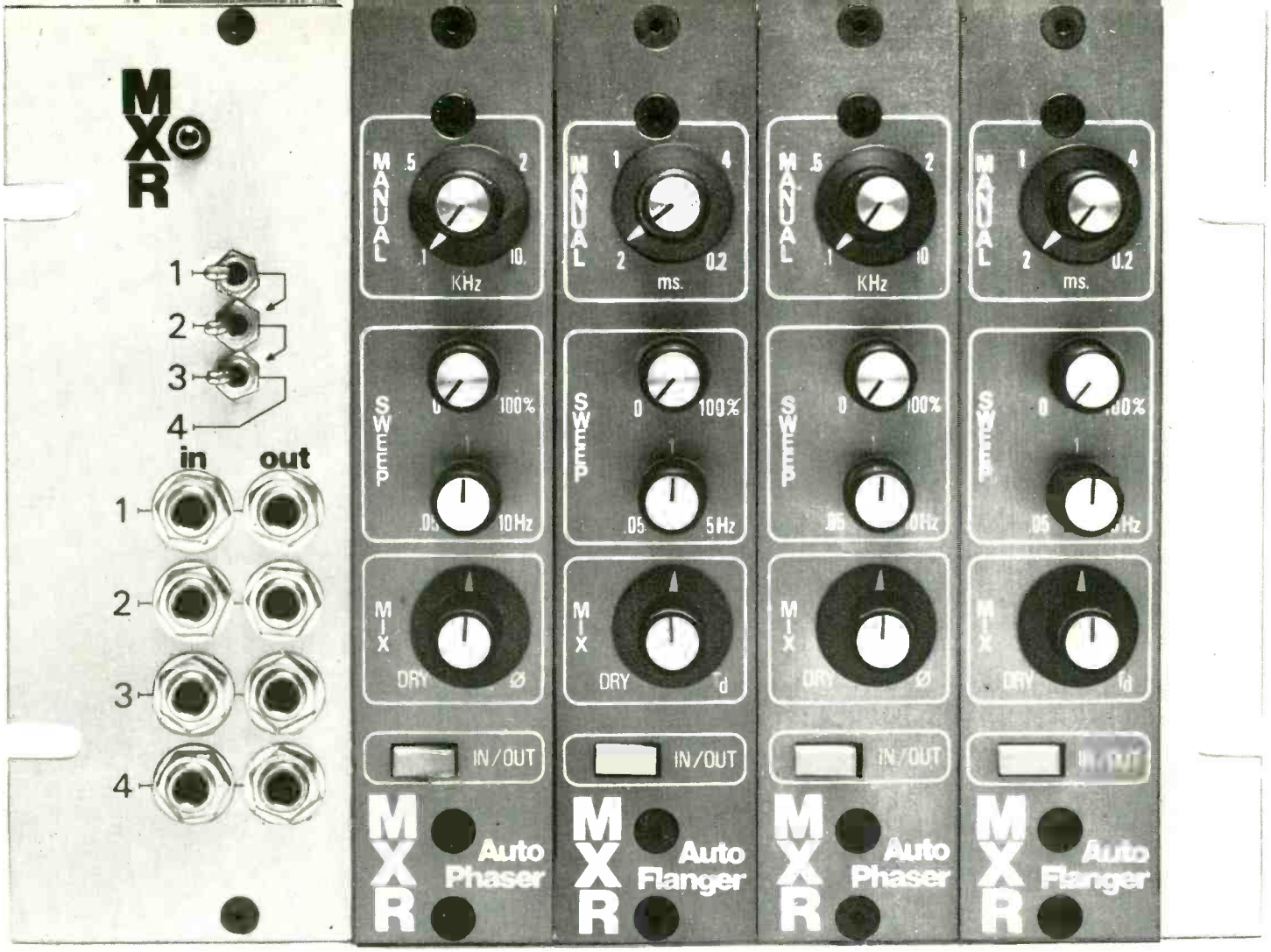

Superiority Complex!

MXR is the world's leading manufacturer of high quality electronic signal processing equipment.
Our Auto Phaser is designed to be the finest available for professional applications. The wide range of effects, low distortion, and low noise enable it to fill every studio, portable mixing or P.A. phasing need.
The MXR Auto Flanger is the first professional audio delay line capable of producing true flanging, repeatably and economically, designed for both portable use and custom installation. The Auto Flanger reliably meets the most demanding of professional audio uses.
Shown above is the MXR Professional Products Rack. A compact, self-contained enclosure for mounting, powering, and interfacing up to four Auto Phasers or Auto Flangers in any combination.
MXR is constantly designing new products.
In the past, a quality digital delay was just too expensive. So a studio or musician had to turn to the cheaper, mechanical units, which were noisy and unreliable.
Now MXR bridges the gap.

The MXR Digital Delay system combines the capabilities of short variable delay with long echo delay and also has the capability of double voicing, short slap-back echoes, hard reverberation, flanging, and true vibrato. The Digital Delay system has a dynamic range exceeding 80 decibels and a delay capability between 0.08m.sec and 320m.sec. If required, you can add plug-in memory boards to increase the delay to 1.28 secs.
The MXR Mini Limiter's low noise, low distortion and quick response enable it to effectively control signal peaks. Attack time is fast (approx. 1ms), and release time is both variable via rear trim pot and dependent upon the amount of gain reduction. Four instantly responsive L.E.D.s continuously indicate gain reduction. The Mini Limiter has quick recovery from heavy gain reduction, but approaches maximum gain slowly, a most useful recovery characteristic in application.

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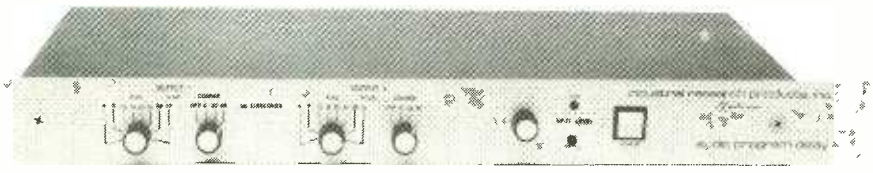
reviews

Industrial Research Products audio program delay

Hugh Ford



MANUFACTURER'S SPECIFICATION

Frequency response: 20 Hz to 15 kHz ±2 dB (at —2 dBm output). 30 Hz to 12 kHz ±2 dB (at +4 dBm output).
Dynamic range: greater than 90 dB.
Pre-emphasis: equivalent to 50 μs.
Distortion (thd): less than 0.25% at 1 kHz at +12 dBm output.
Input impedance: 15k ohm transformer-isolated.
Input level: adjustable; 10V rms maximum, 250 mV rms minimum.
Output impedance: 150 ohm effective (40 ohm optional) transformer-isolated, for 600 ohm (150 ohm optional) or larger impedance terminations.
Output level: 6V rms maximum (+18 dBm, 600 ohm load).
Gain: Adjustable; 28 dB maximum.
Noise: 90 dB below maximum output level (20 Hz to 20 kHz noise bandwidth).
Time delay: 96 ms in 4 ms steps.
Power: 115/230V, 50/60 Hz, 10W maximum.
Weight: 3.2 kg.
Number of inputs: 1.
Number of outputs: 2.
Size: 483 mm wide x 44.5 mm high x 216 mm behind panel.
Controls: coarse and fine delay selection for each output. Coarse settings of 0, 32 and 64 ms. Fine settings in 4 ms increments from 0 to 32 ms and are additive to coarse setting. Input level adjust with two led indicators: red on peak clipping level, green on at 14 dB below clipping level. Terminal block connectors on rear for input and output connections. (*XLR*-3 type connectors optional.)
Price: $1200.
Manufacturers: Industrial Research Products Inc, 321 North Bond Street, Elk Grove Village, Ill 60007, USA.
UK: Knowles Electronics Limited, Victoria Road, Burgess Hill, Sussex.

THIS audio delay unit is a slim standard rack mount unit intended as a signal delay in public address systems and similar applications. The audio input and the twin outputs fed from the single input are to the rear of the unit in the form of terminal connections (with the option of *XLR* connectors: and are fully floating, transformer-coupled connections. Also to the rear of the unit are the fixed mains power lead and its associated Imperial-size fuse, which is not identified in type or value; but, while the audio input and outputs were identified, the polarity of the connections was not indicated.

To the front of the unit is an illuminated power on/off switch, next to which are a red and a green led indicator for indicating signal. The green led indicates a working level and the red one overload conditions. Adjacent to these indicators is a potentiometer input level control—these being the only controls common to both outputs. The remaining front-panel controls comprise four delay time controls—two for each output channel. A coarse delay time control provides for zero, 32 ms or 64 ms delay plus an 'off' position. The adjustment of the fine delay time control is added to the setting of the coarse control, the fine settings being between 4 ms and 32 ms in 4 ms increments. The overall available delay therefore being 0 to 96 ms in 4 ms increments for each output independent of the other.

Within the chassis all the electronics, including the power supplies, are mounted on a single glass-fibre printed circuit board, the layout of which was not particularly tidy and without component identifications to aid servicing—no service manual being supplied with the review sample anyway. Unfortunately, there are several complaints about the electrical safety of this unit in terms of British Standard requirements (BS 415 or BS 4743). Firstly, the fuseholder was connected the wrong way round such that the incoming mains supply was connected to the outer connection of the fuseholder, such that the fuse could be live when being withdrawn. Secondly, printed circuit tracks which are connected directly to the incoming mains do not have sufficient clearance from tracks connected to the chassis of the unit. Thirdly, the metal base of the unit is very close to mains-carrying tracks on the printed board, a thin loose piece of insulating material being rested in the base of the unit as a gesture towards safety.

Other than the statement that the unit uses digital charge-coupled technology, no information was provided about the method of operation. But I have yet to see a ccd delay line without severe restrictions, and as will become clear this device is no exception.

Frequency response

The overall frequency response of both outputs was found to be identical and independent of the time delay setting or output loading with 600 ohm terminations. The use of the specified 50 μs pre-emphasis leads to a loss of signal-handling capability of approximately 10 dB at 10 kHz. This is apparent in **fig. 1**, which shows the frequency response at +18 dBm output at 1 kHz and also at the lower levels of +10 dBm, 0 dBm and —10 dBm. As can be seen the results at 0 dBm and —10 dBm are virtually identical up to 20 kHz, and the unit is in agreement with the manufacturer's specification.

Distortion

Checking the second and third harmonic distortion at a level of +12 dBm output produced **fig. 2**. This shows that while the unit is

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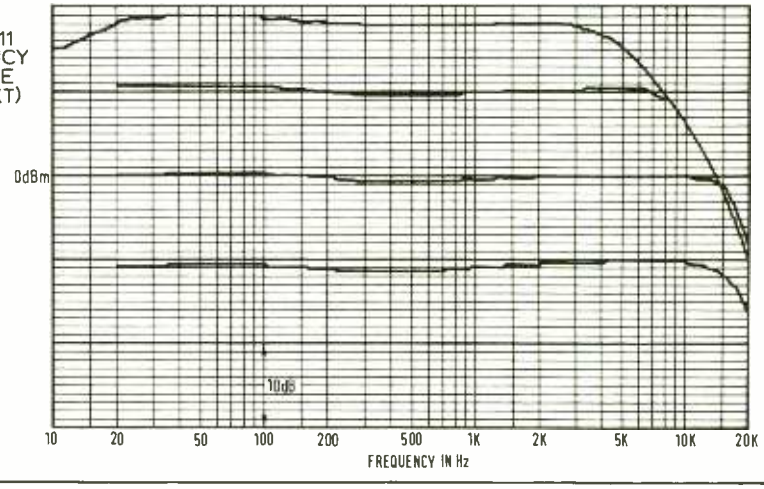
FIG. 1
IRP DC4011
FREQUENCY
RESPONSE
(SEE TEXT)



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professional quality delay plus special effects

Lexicon's new Model 93 "Prime Time" digital delay processor gives recording studios and entertainers an easy-to-use professional quality time delay with special effects and convenient mixing all at a price you can afford. It combines a degree of flexibility and versatility never before offered in equipment of full professional quality.

- Two delay outputs independently adjustable from 0 to 256 ms
- Complete mixing for delay and reverb processing, freeing up main console channels and tape tracks
- Integral VCO for special effects like vibrato, doppler pitch shift, flanging and automatic double and triple tracking
- Long delay special effects — up to 2 seconds
- All dynamic functions can be footswitch controlled
- 90 dB dynamic range, total distortion below 0.08% at all delay settings

Lexicon

Lexicon, Inc., Waltham, Massachusetts 02154, USA

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IRP AUDIO PROGRAM DELAY

within the manufacturer's specification at 1 kHz this is the lowest distortion point, both at this output level and at —10 dBm output—the lower frequency distortion products remained constant and not very good as is shown in **fig. 2.** As is to be expected, the higher frequency distortion rises at this +12 dBm output level, but at —10 dBm output the second and third harmonic dropped above 1 kHz to rise again to 0.1% at 10 kHz and 0.3% at 15 kHz.

Intermodulation distortion to the CCIF method using two equal amplitude tones separated by a constant 70 Hz and looking at the difference frequency component produced **fig. 3.** It can be seen that the intermodulation performance is not particularly good at the —10 dBm output level used for the measurement; in particular, the performance at high frequencies is poor.

The performance of the unit when transmitting pulses or tonebursts is shown in **figs. 4 and 5,** the former showing what happens to a 1 ms pulse of 1V peak-to-peak amplitude at any delay setting, and the latter the transmission of a 1 kHz toneburst leading to +18 dBm output level. In the case of the latter the 'damage' to the leading edge was found to depend to a large extent on the repetition rate of the burst, which I consider rather suspicious.

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FIG. 2
IRP DC4011
HARMONIC
DISTORTION AT
+12dBm OUTPUT

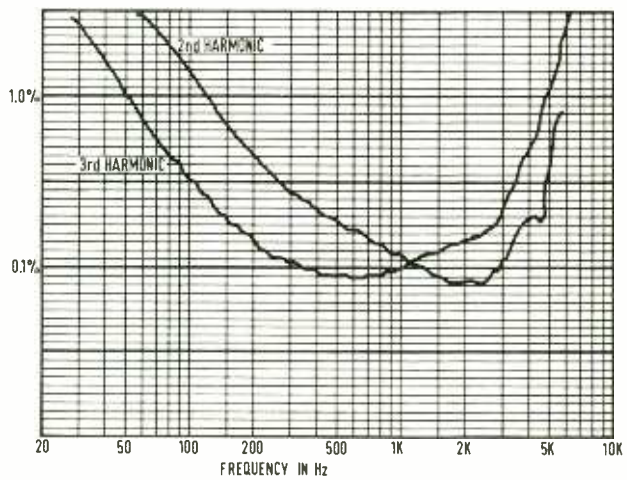


FIG. 3
IRP DC4011
INTERMODULATION
DISTORTION

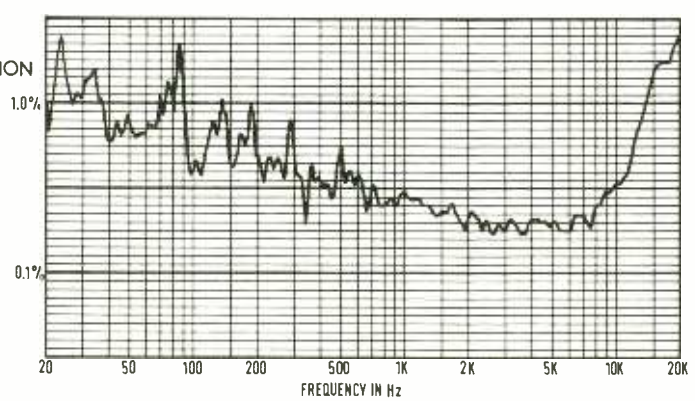


Fig. 4 IRPI 1ms pulse with delay IV peak/peak

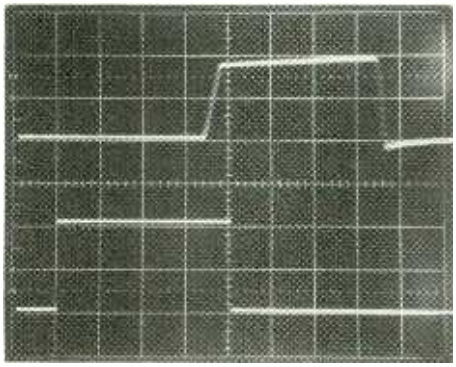
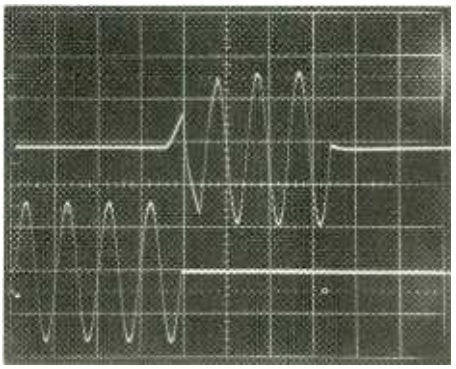


Fig. 5 IRPI 1 kHz burst to + 18 dBm O/C



HEAR FROM US BEFORE YOU HEAR FROM THEM.

Today's broadcasting equipment and standards let you transmit things you never could before.

Like tape hiss, cue tone leakage and turntable rumble, to name a few.

And that's precisely why you need the JBL 4301 Broadcast Monitor.

It lets you hear everything you're transmitting. All the good stuff. And, all the bad. So you can detect the flaws before your listeners do.

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JBL

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Noise

During the measurement of the output noise for both channels one channel was found to be faulty, and indeed it was subjectively very poor, so that channel has been ignored in the following measurements. While the manufacturer specifies noise as 90 dB below maximum output level in a 20 to 20k Hz noise bandwidth, this particular parameter was not measured, but the A-weighted noise suggests that the specification was met. However, this is only part of the noise story, the no-signal noise measurements being shown in **table 1** follows:

Table 1 noise performance

Condition	Noise (dBm output)*
Band-limited 20 to 20k Hz rms	—62 dBm
A-Weighted rms	—73.5 dBm
CCIR-weighted ref 1 kHz rms	—65 dB
CCIR-weighted ref 1 kHz quasi-peak	—60 dB

*Adding the maximum output of +18 dBm gives the dynamic range.

Unfortunately, although the performance in **table 1** looks good, subjectively there was very severe modulation noise, or noise breathing, in the presence of signals of any output level. This was investigated by undertaking a spectrum analysis of the unit's output both with no input signal and with a 1 kHz tone leading to +10 dBm output. The results are shown on the same scale in **fig. 6**, from which it can be observed that the noise rises by between 30 and 35 dB in the presence of a +10 dBm output signal. If we consider this condition in relation to the A-Weighted noise, the effective dynamic range is not the apparent 91.5 dB(A)—73.5 plus 18—but something like 50 dB—a rather sad story, and that's just what the unit sounds like! In kindness it should be noted that the noise performance is independent of the delay setting or the input gain setting.

Input and outputs

The input-level handling capability was such that well in excess of +22 dBm could be applied to the input, the maximum sensitivity being such that an input of 0.25V rms gave the rated output of +18 dBm—an overall gain of 28 dB. The floating input was found to have an impedance which varied only slightly with the input gain setting, being 15.3k ohm at most gain settings but decreasing to 13.7k ohm at maximum gain—all satisfactory in this department.

On the output end both channels could deliver +19 dBm before the onset of severe distortion, with the red overload warning led indicator coming on at the appropriate point. This indicator was found to be satisfactorily fast in action, but it could do with a hold circuit to make it more visible. The green operating light came into action at, on average, +6.5 dBm output which is a sensible choice of signal level.

The outputs, which are transformer-coupled and floating, offered a satisfactorily low output impedance of 110 ohm and took kindly to being loaded into the standard 600 ohm terminations.

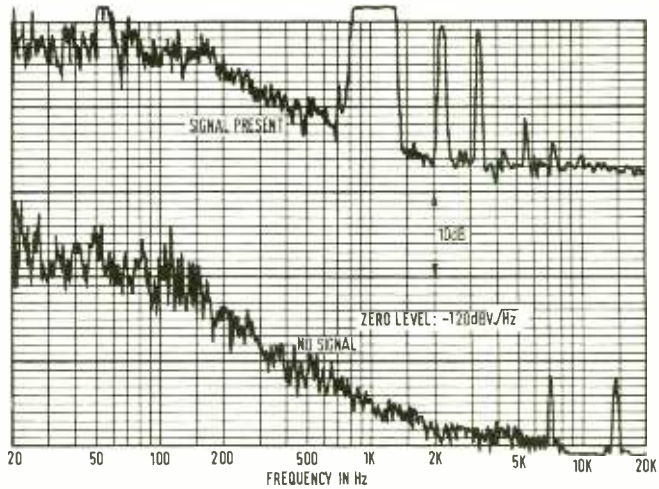
Delay time setting

Checking the time delaying capacity of both channels showed that the setting of the delay time switches was generally within 1% of the nominal delay time, so there is no cause for complaint in this direction.

Summary

While in many ways the measured performance of this delay unit does not appear bad for sound reinforcement work, I found that the noise modulation performance produced objectionable results. Furthermore the electrical safety of the unit leaves much to be desired. In short, I cannot recommend this unit in its existing form. ■

FIG. 6
IRP DC4011
NOISE BREATHING
(SEE TEXT)

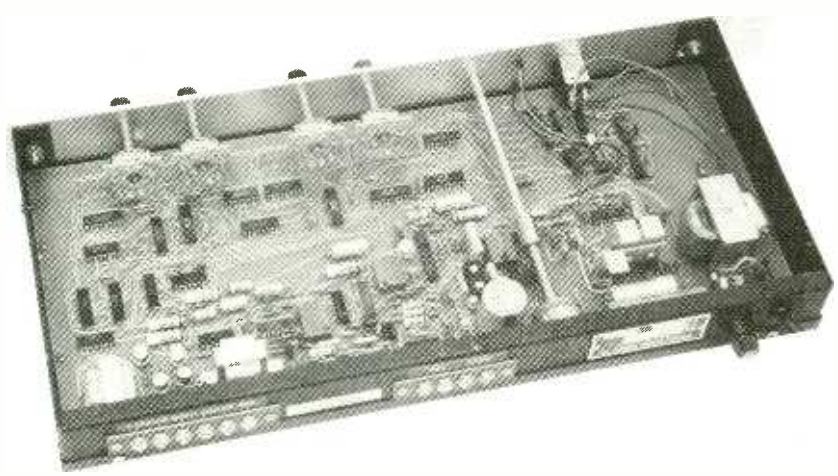


Manufacturer's comment

Mr Ford's concluding remark expresses his concern for safety relative to BS 415 or BS 4743. In this regard, models manufactured subsequent to that supplied to Mr Ford include construction changes which render the comments no longer applicable.

There have been significant advances in charge-coupled device (ccd) technology for digital storage. The model DC 4011 *takes advantage of these advances and uses only four lsi memory elements of 16 384 bits each, whereas our previous models using mos shift registers would have required 64 dual-in-line packages for the same delay configuration. The observations that distortion and noise do not change with delay (or gain) setting is evidence that digital processing is being used in the* DC 4011.

Studio Sound *articles and Mr Ford have discussed at length the nature of noise reduction schemes and how their use has made digital delay economically viable. The curves in figure 6 show the result of a compression/expansion process (cf Studio Sound, September 1976, page 38). Such systems, whether analogue-proportional (for example, dbx) or digitally-coded range selection, as in competitive delay, and applied in a single broadband or to individual narrow bands, have a noise modulation that follows the signal level. The tolerability of the attendant noise modulation must be related to the application in terms of the psycho-acoustic and cost factors. The* DC 4011 *and other digital delay models manufactured and sold world-wide for more than seven years by Industrial Research Products Inc, for a wide variety including the most critical of applications, are accepted as providing exceptional value and reliability for sound reinforcement system use. The* DC 4011 *has met its design objective and represents a bold new step in digital delay by providing exceedingly useful sound delay quality at a price heretofore impossible. We are pleased to note that Mr Ford also finds the* DC 4011 *satisfactory for this application. May we respectfully remind Studio Sound readers of the statement by Lord Rayleigh: 'The sensation of sound is a thing* sui generis, *directly or indirectly all questions connected with this subject must come from the ear . . . from which there can be no appeal'.*

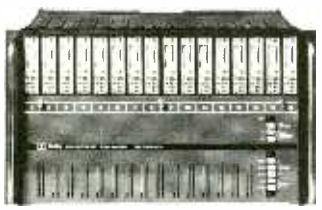


There is a Dolby noise reduction unit for every professional application

Professional recording and transmission applications

360
The Dolby 360 is a basic single-channel A-type noise reduction unit for encoding or decoding This unit is normally used in a fixed mode such as in disc cutting or landline sending or receiving; the operating mode is manually selected

361
The Dolby 361 is similar to the 360, providing a single channel of A-type noise reduction, but with relay switching of operating mode and tape recorder connections. The changeover can be controlled automatically by the recorder



M-Series
The Dolby M16H A-type unit is designed specifically for professional multi-track recording, and incorporates 16 channels of noise reduction in a compact chassis only 10 . inches high. The similar M8H is an 8-track version, and the M8XH allows simple extension of the M16H for 24-track use

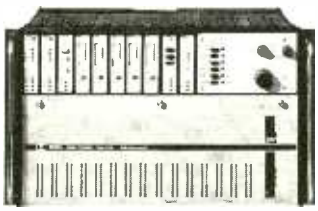
Noise reduction module

Cat no. 22
The Dolby noise reduction module, Cat no. 22, is the basic functional unit employed in all A-type equipment The Cat no. 22 is available as a spare or in quantity to OEM users for factory installation A half-speed version of the module (Cat no 40) is also available

Motion picture industry

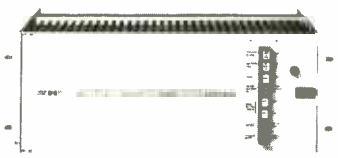
364
The Dolby 364 Cinema Noise Reduction Unit is intended primarily for use with Dolby A-type encoded optical sound-tracks The 364 also includes a standard 'academy' filter for conventional tracks, and provision for playback of magnetic sound tracks with or without Dolby system encoding

E2
The Dolby E2 Cinema Equalizer is a companion unit to the 364, and has been specifically designed to solve the response equalization problems of cinemas Used with the 364 and Dolbyized optical sound-tracks the E2 enables most cinemas to achieve modern sound reproduction standards without replacement of existing equipment



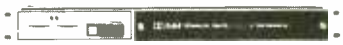
CP100
The Dolby CP100 Cinema Processor is designed for the reproduction of all current and presently foreseeable film sound-track formats including conventional optical and magnetic tracks, Dolby encoded monaural optical tracks, Dolby encoded magnetic sound-tracks and the new stereo optical release prints Up to three noise reduction modules can be incorporated Typically, three channels of theatre equalization, as in the E2, will be incorporated, but facilities exist for five channels of equalization and the connection of an external quadraphonic decoder

CP50



The new Model CP50 is intended for the reproduction of all optical soundtrack formats, Dolby encoded and conventional, mono and stereo. The unit is designed to interface with an existing fader and magnetic stereo installation A wide range of accessories is available

Professional encoders for consumer media



330
The Dolby 330 Tape Duplication Unit is a professional quality unit with B-type (consumer) noise reduction characteristics The unit is used for encoding duplicating master tapes in the high-speed duplication of Dolbyized cassettes, cartridges, and open-reel tapes The 330 is a two-channel unit

334
The 334 FM Broadcast Unit allows broadcast stations to encode stereo FM broadcasts with the Dolby B-type characteristic The unit also provides for a reduction of high frequency pre-emphasis to 25 microseconds; this reduces the need for high frequency limiting, thus allowing a significant additional improvement in reception quality.

Test set (A-type)

Cat no. 35
The Dolby NRM Test set, Cat no 35, permits rapid verification of performance of Cat no 22 noise reduction modules without their removal or the need for additional test equipment

Noise weighting filter

Cat. Nr. 98A
Noise weighting filter to CCIR/ARM characteristic (recommended by Dolby Laboratories) Filter is used with average responding meter (ordinary millivoltmeter) allowing noise measurements to be made on tape recorders, tapes, FM tuners, etc, with results which correlate closely with the subjective effect of the noise Filter can be used for the testing of professional and consumer equipment

Dolby

Dolby Laboratories Inc.

731 Sansome Street, San Francisco CA 94111
Telephone (415) 392-0300 Telex 34409
Cable Dolbylabs

346 Clapham Road, London SW9 9AP
Telephone 01-720 1111 Telex 919109
Cable Dolbylabs London

AKG BX10 reverberation unit

Hugh Ford

MANUFACTURER'S SPECIFICATION

A) Both reverberation intensity controls in position 1 (fully dry signal)
Nominal input level: −22, −6, +6, and +12 dBm (selectable on printed circuit board).
Maximum permissible level: 18 dB above selected input level.
Input impedance: ≧2k ohm per channel, electronically balanced.
Nominal output level: +3 dBm (±3 dB).
Output impedance: ≦100 ohm, transformer balanced.
Maximum output level: +8 dBm.
Recommended output load: ≧200 ohm.
Frequency range: 20 Hz to 20 kHz.
Crosstalk between channels: ≧70 dB.
Weighted s/n ratio at nominal output level: ≧75 dB rms (DIN 45405).
Unweighted s/n ratio at nominal output level: ≧75 dB rms (DIN 45405).
B) Both reverberation intensity controls in position 7 (full reverberation)
Frequency range: 20 Hz to 12 kHz.
Frequency response: 50 Hz to 8 kHz within a strip of ±6 dB from the standard curve.
Bass control range: ±8 dB at 150 Hz.
Treble control range: ±4 dB at 5 kHz.
Reverberation decay time (measured with ⅓-octave pink noise with mid-frequency at 500 Hz): 1.5, 2.5, and 3.5s—can be set independently for each channel.
Crosstalk between channels: ≧35 dB (valued according to DIN 45405).
Level difference between channels: adjustable compensation.
Weighted s/n ratio at nominal output level: ≧65 dB rms (DIN 45405).
Unweighted s/n ratio at nominal output level: ≧60 dB rms (DIN 45405).
Acoustic feedback safety: ≧100 dB ie the sound level in close proximity of the device may be up to 100 dB spl before any acoustic feedback occurs.
Hum sensitivity: ≦1 mV/50 mG field.
Maximum output level: to encounter for the peaks of the reverb frequency response, headroom up to +24 dBm becomes necessary.
C) General
Line voltage: 220 or 110V ac +15/−10% (internally selectable) 40 to 60 Hz.
Power consumption: 12W.
External dimensions (whd): 430 X 300 X 490 mm.
Weight: approx 21 kg.
Price: £1225.
Manufacturer: AKG Akustiche und Kinogerate GmbH, Brunhildengasse 1, A-1150 Vienna, Austria.
UK: AKG Equipment Ltd, 191 The Vale, London W3 7QS.

THE AKG type *BX10* is a twin-channel portable reverberation unit operating on the torsional transmission line principle. The two channels can be operated either in the mono mode, where both channels are driven by a single input signal, or as a twin-channel unit that can be operated in the stereo mode, or as two separate channels with reasonable isolation between the two channels.

In the form of a sombre looking rectangular box with a single carrying handle the unit is completely portable, the plug-in chassis which contains the controls and all the electronics being secured within the box with two captive screws. Sensibly the controls are recessed to minimise the likelihood of damage during transit.

On the control panel, the common controls to both channels are the power on/off switch with its associated indicator, the mono/twin-channel switch and an unidentified main fuse. (I do wish manufacturer's would identify fuse values, it is a dangerous practice not to do so!)

Each channel has a three-position rotary reverberation time control with settings for nominal times of 1.5 seconds, 2.5 seconds or 3.5 seconds. In addition there are separate treble and bass shelving controls which affect the reverberation signal, and also potentiometers for mixing the direct and reverberation signals at the unit's output—a function usually performed on the desk, but a feature that should be very useful in mobile use.

At the other end of the electronics chassis, which is recessed at the other side of the black box, there are *XLR* input and output connectors in the form of floating connections and the fiendish flat-pin-type mains power connector—a standard IEC type would be much preferred.

Within the electronics chassis the power supply is housed on a bolted-in printed wiring board, with the mains transformer being well shielded and equipped with a mains voltage selection switch for either 110V or 220V operation. The signal electronics are mounted on two separate (one for each channel) plug-in printed wiring boards which each have four preset potentiometers, the purpose of which is unknown, and a slide switch for setting the nominal signal input level to −22, −6, +6 or +12 dBm.

While there are not any component identifications on the boards to ease servicing problems, and no servicing data is supplied, the boards are not too crowded and are clearly laid-out with reasonable quality components.

As far as the performance is concerned there are two distinct conditions of interest in view of the facility for mixing the direct and the reverberation signals. This control allows a full range such that in the extreme positions the unit's output is either the direct input signal, or the reverberation signal alone—thus the unit can be permanently in the signal path and its performance is of interest in this role as a line amplifier.

Direct condition

The overall frequency response from the line input to the line output in this condition is shown in **fig. 1.** From this it can be seen that even though the high frequency response is satisfactorily flat, the bass end rolls off to a −3 dB point at 30 Hz; it is felt that this should be bettered in the direct mode.

With the +6 dBm nominal input level selected (as was the case with all tests) the overall gain in the direct mode was found to be −2.5 dB, the output level being limited within the unit to +11 dBm by 'built-in limiter

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FIG.1
AKG BX10
FREQUENCY
RESPONSE
(DIRECT)

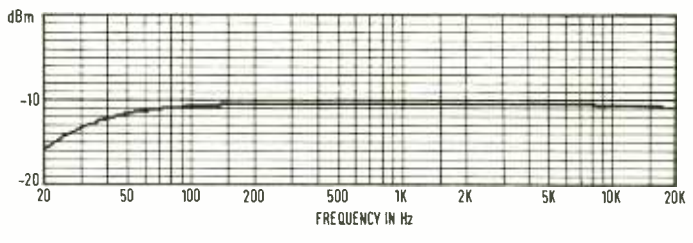

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TABLE 1 NOISE AT OUTPUT

Measurement method	Channel 1	Channel 2
Unweighted rms 20 Hz to 20 kHz	−77.2 dBm	−72.5 dBm
'A' Weighted rms	−82.0 dBm	−77.0 dBm
CCIR Weighted rms ref 1 kHz	−75.0 dBm	−69.0 dBm
CCIR Weighted quasi-peak ref 1 kHz	−69.0 dBm	−64.0 dBm
DIN Weighted rms	−75.0 dBm	−71.5 dBm
DIN Unweighted	−66.0 dBm	−63.5 dBm

TABLE 2 REVERB ACCURACY

Frequency	Time
125 Hz	4s
500 Hz	3.6s
4 kHz	3s
8 kHz	2.4s

FIG. 2
AKG BX10 HARMONIC DISTORTION AT 0dBm OUTPUT

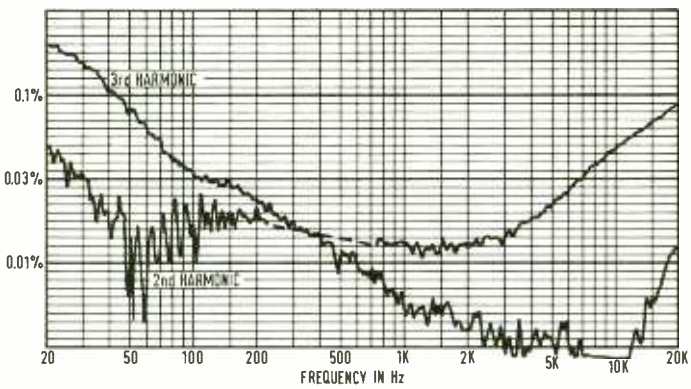


FIG. 3
AKG BX10 INTERMODULATION DISTORTION AT 0dBm OUTPUT

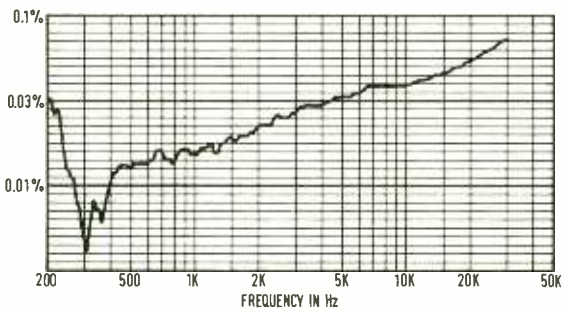
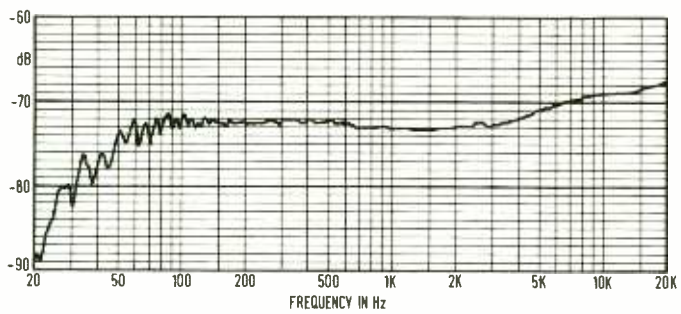


FIG. 4
AKG BX10 CROSSTALK AT 0dBm OUTPUT



circuitry'. This is understandably useful when reverberation is in use, but a doubtful asset in the direct mode.

As can be seen from **fig. 2** the second and third harmonic distortions at 0 dBm output (loaded into 600 ohms) are generally satisfactory but not outstandingly good as a line amplifier. However, the intermodulation distortion to the twin-tone CCIF method using two equal amplitude tones separated by 70 Hz, as shown in **fig. 3**, is to a high standard.

Similarly the crosstalk as measured with one channel driven at 0 dBm output and the other channel with its input terminated in 600 ohms is very good, as can be seen from **fig. 4**. The noise in the output was measured using the common weighting networks and unweighted as shown in **table 1.**

While the noise performance and dynamic range of both channels is good, the large difference between channels is surprising and very clearly audible as a noise difference (as opposed to tones such as mains hum).

Reverberation channels

Measurement of the reverberation time using bursts of one-third octave pink noise centred on 500 Hz showed that the nominal 3.5s time measured as 3.6s, nominal 2.5s as 2.2s and nominal 1.5s as 1.4s—these accuracies are within the limits of measurement errors and completely satisfactory. Checking the reverberation time at other frequencies using the nominal 3.5s time gave the results as in **table 2.**

Such a consistent reverberation time with change in frequency is not common to normal rooms, with of course the exception of a purpose-built reverberation chamber.

The reverberation characteristic when exciting the unit with a single cycle of 1 kHz sinewave is shown in **fig. 5,** which suggests a clean exponential decay with multiple diffusion as is desirable.

Using white noise as an input and undertaking a spectrum analysis of the output signal was the technique used to determine the overall frequency response of the reverberation channels and the effects of their treble and bass shelving controls. The results of this are given in **fig. 6,** which shows the frequency response with the shelving controls in their mechanical flat position, and also with either control at its extreme positions.

It is to be seen that the shelving controls meet their specification and provide a very useful degree of correction for circumstances where such correction is not available on the desk. Also the overall frequency response is quite adequately flat for a device of this type.

As is to be seen from **table 3,** the noise performance of the two channels was not identical, but exhibited less difference than the 'direct' channel, the overall performance being good for a reverberation unit.

Crosstalk between the two channels in the reverberation mode is shown in **fig. 7** for one channel driven with pink noise and the output of the other channel subjected to spectrum analysis, the upper trace showing the output from the driven channel and the lower trace the crosstalk. It can be seen that having regard for the type of unit the crosstalk performance is good. It was also noteworthy that the

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PICO mixer
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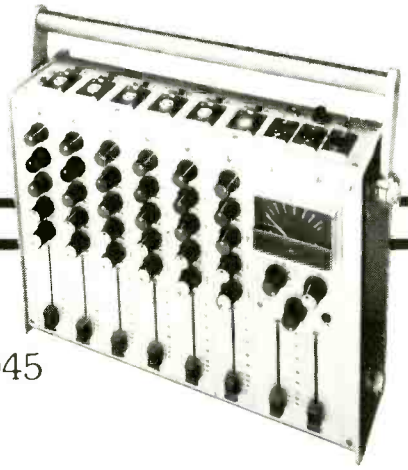

AD 045

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acoustic isolation of the reverberators was excellent, in that using the unit only 1m from monitor loudspeakers did not introduce any acoustic feedback.

Similarly, the isolation of the reverberators to external vibration was unusually good. However, tapping the case with a finger produced a significant electrical output—it is suggested that the unit should not be used in locations where it is likely to be knocked, or as a table for the usual collection of coffee cups and beer mugs!

Fig. 5

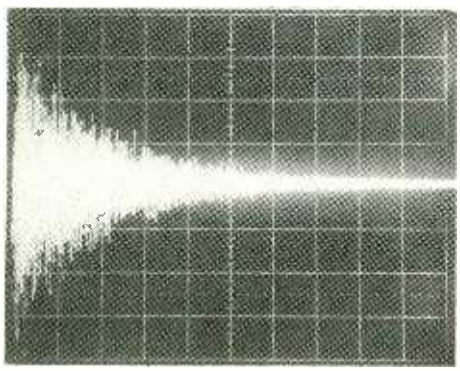


TABLE 3 NOISE AT OUTPUT (see text)

Measurement method	Channel 1	Channel 2
Unweighted rms 20 Hz to 20 kHz	−65.0 dBm	−67.0 dBm
'A' Weighted rms	−73.0 dBm	−70.5 dBm
CCIR Weighted rms ref 1 kHz	−65.5 dBm	−63.5 dBm
CCIR Weighted quasi-peak ref 1 kHz	−60.5 dBm	−59.0 dBm
DIN Weighted rms	−67.5 dBm	−65.5 dBm
DIN Unweighted	−62.5 dBm	−63.0 dBm

Inputs and outputs

With the nominal input level set to the previously mentioned +6 dBm it was found that the input clipping point was at a meritable +29 dBm into an input impedance of 6500 ohms—which is on the low side for comfort.

As with all reverberation units, the effect of reverberation can build up a large signal as a result of the reflections adding in amplitude and phase, but the *BX10* is capable of delivering +24 dBm into 600 ohms at the output clipping point. As a result of this high drive capability, care must of course be taken to ascertain that the following equipment can handle such levels from the low output impedance of the *BX10* —which was found to be approximately 80 ohms.

Operation

In operation the *BX10* was found to be a versatile device highly suited to mobile use and small studios, particularly in view of the inbuilt mixing and equalisation facilities which were most effective.

The subjective quality of the reverberation was generally good, but it was felt that the sound was slightly 'tinny' and not as 'open' as some reverberation devices. However this is not in any way to suggest that the sound has any similarity to earlier spring-type units.

A factor which I do find rather surprising is the use of the inbuilt output level limiter in the direct channel, with only the reverberation channel being capable of clipping the output amplifier. But no doubt AKG have some good reason for this arrangement.

Summary

The measured performance of the AKG type *BX10* was generally to a high standard, the only 'peculiarity' being the difference in the noise performance of the two channels. But other than the unweighted noise in the direct mode, where I suspect a specification error, the unit met its specifications.

As a portable reverberation unit the *BX10* has a good performance. It is versatile and, very important, it can operate without special location or protection. ■

FIG. 6
AKG BX10
OVERALL
REVERBERATION
FREQUENCY
RESPONSE AT
0dBm OUTPUT

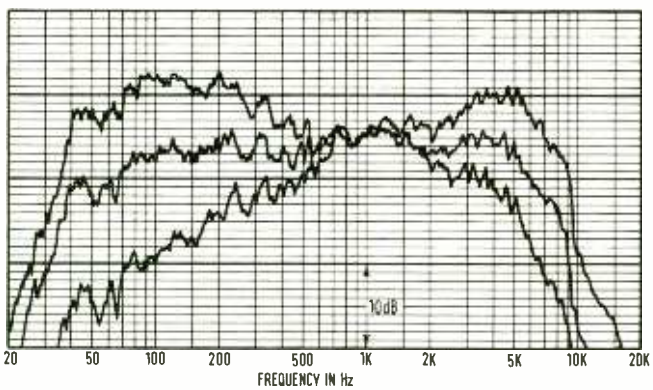
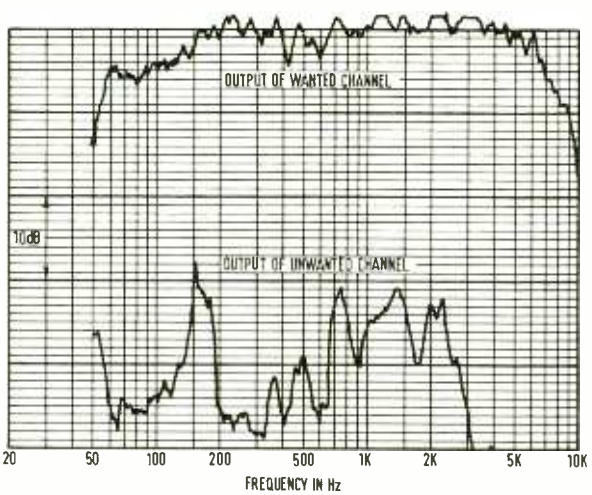


FIG. 7
AKG BX10
CROSSTALK IN
REVERBERATION MODE



agony

Now it can be told . . . Around ten years ago Marlene Dietrich was still on the road, singing, with Burt Bacharach as her md. BB was suddenly getting famous in his own right and quit the Dietrich job. At the time one of our regular correspondents was sharing a flat with some musicians, one of whom was then a very young, very talented keyboards player and arranger. Now he's ten years older and a well established md.

One morning the phone in the flat rang and a husky German voice asked for the young keyboards player by name. 'He's out', the husky voice was told, 'who shall we say called?'. 'Marlene Dietrich', said the voice. 'Piss off Liz', the voice was told. 'we'd recognise your cod German accent anywhere'. She phoned back, twice more, and each time was told to piss off. It wasn't until an agent casually enquired 'whether Miss D had ever phoned', that the awful truth finally dawned. But by then someone else had got the job of md to the great lady.

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MANUFACTURER'S SPECIFICATION

Voltage ranges: 0 . . . 30/100/300μV 1/3/10/30/100/300mV 1/3/10/30/100/300V.

Frequency range for peak rectification: ranges 1mV to 100V 10Hz-1MHz ranges 30μV to 300μV and 300V 10Hz-100kHz.

Frequency range for rms rectification: all ranges 10Hz to 100kHz.

Tolerance for sinusoidal voltages and measurements without filters: amplifier (mV and V ranges) 20Hz-200kHz ±3%, 10-20Hz and 200kHz . . . 1MHz ±5%. Amplifier (μV ranges) 20Hz-50kHz ±3%, 10-20Hz and 50kHz-100kHz ±5%. Input divider ±5%.

Dynamic properties: for peak rectification according to DIN 45405 for rms rectification according to DIN 45402 and DIN 45500.

Input impedance: 1MΩ/50pF.

Maximum tolerable voltage at input: DC400V, AC in the mV and V ranges 500V peak, in the μV ranges = 10V rms.

Noise voltage: referred to unterminated screened input without filters 20μV eff, unterminated screened input with 1000Hz filter 3μV eff, terminated with 10kΩ without filters 10μV eff, with 1000Hz filter 2μV eff.

Outputs: monitor output 100mV at fsd, source impedance 60Ω ±3%. Headphone output 1V at fsd Source impedance 600Ω ±3%. Filter output approx 20mV at fsd. Source impedance 600Ω ±3%.

Input Impedance of external filter input: 600Ω ±20%.

Sensitivity of external filter input: 2.5 to 12.5mV adjustable on rear panel.

Standard integrated filters: 1000Hz filter attenuation at 1000Hz 0dB ±0.2dB, 50dB attenuation at 500Hz and 2kHz. Weighting filter to CCIR 468, attenuation at 1000Hz 0dB ±0.5dB. Weighting filter to DIN 45405 and DIN 45500, attenuation at 1000Hz: 0dB ±0.2dB. dB (A) weighting filter to DIN 45500, attenuation at 1000Hz 0dB ±0.2dB.

Optional plug-in filters: two on plug-in board.

Frequency of built-in calibration generator: 1000Hz.

Power requirements: 45-60Hz, 180-265V for 220V operation. 90-130V for 110V operation. Approximately 15VA.

Dimensions: 294x195x156mm.

Weight: approximately 6kg.

Price: £480.

Manufacturer: Sennheiser Electronic, D-3002 Wedemark 2, West Germany.

UK agent: Hayden Laboratories Ltd, Churchfield Road, Chalfont St Peter, Bucks.

THIS Sennheiser *Universal Level Meter UPM 550* is the long awaited replacement for the Sennheiser *RV 55* meter which has for many years been the common instrument for measuring quasi-peak noise to the DIN standard or, more correctly nowadays, the CCIR Recommendation 468 which is rapidly becoming adopted in the audio industry.

Time and again I meet confusion about this type of quasi-peak meter so before proceeding further, I will explain a little about the quasi-peak noise measuring meter. Firstly it is *not* a peak reading instrument in the strict sense. That is, it does not have a very fast attack time like for instance the Bruel & Kjaer *2426* which has a rise time constant of less than 50μs. In fact it is a slugged peak detecting meter which bears some similarity to a peak programme meter, but here again it is *not* a peak programme meter and is not interchangeable with any standard type of peak programme meter.

Anyhow, turning to the Sennheiser *UPM 550*, this is a neat and smallish instrument housed in a grey crackle finish metal cabinet, the front and rear panels being silver finish with exceptionally clear markings in black. The large meter on the front is clearly scaled in millivolts, dBm and dBV. The voltage range in use is selected by a rotary switch which, in addition to selecting the range, also illuminates a red LED indicator adjacent to the markings in volts and dB located above the switch. In all, there are 15 ranges covering a maximum input of 300V (+50dBV) to a most sensitive range of 30μV (−90dBV) full scale deflection.

Beneath the range switch there are two further LED indicators which show the usable bandwidth as either 10Hz to 1MHz associated with a red indicator, or 10Hz to 100kHz associated with a yellow indicator. When weighting functions are selected both these indicators are sensibly extinguished.

At the bottom of the front panel there is a row of 11 pushbutton switches each having an adjacent LED indicator illuminated when a particular function is selected thus giving very good readability of the current range and function of the instrument. The two left hand switches are interlocked and select either the quasi-peak rectifier function or true rms rectification with the standard 'fast' meter ballistics associated with sound level meters.

Eight further interlocked switches select the weighting from the following possibilities: off, DIN unweighted, 'A' weighted, CCIS Recommendation 468 weighting, a 1kHz notch (bandpass) filter, a possibility of two further internal weighting networks, an external weighting network. Out of this selection, the two further internal weightings are mounted on a single plug-in printed circuit board, but at the time of writing no standard additional weighting networks exist. In this context, it is in some ways surprising that the DIN unweighted curve is built-in, while the DIN weighted curve is not included and is not available; but, on the other hand this weighting is no longer of particular interest.

The final and eighth pushbutton disconnects the input to the instrument and applies a 1kHz test tone at a level of −70dBV which is not only useful for checking the instrument, but also for calibrating external weighting networks.

Further front panel features include the BNC input connector adjacent to which the maximum safe input level for various ranges has been very sensibly marked, the mains on/off switch and its associated power on indicator, and finally two output connections. These comprise a BNC connector giving 100mV output at full scale deflection from a source impedance of 60Ω for feeding further instrumentation using the Sennheiser as a preamplifier and a standard 6.3mm jack connector giving 1V for full scale deflection from a source impedance of 600Ω, this being useful for feeding headphones.

To the rear of the instrument there is the IEC standard power line connector, the fuses and mains voltage selection being within the cabinet. BNC connectors provide the external filter input and output connections, there being a screwdriver operated external filter input sensitivity control for calibration purposes. In addition to the very clear markings associated with these features the rear panel includes frequency response graphs of the inbuilt weighting and filter characteristics.

The cabinet includes two good carrying handles which also protect the front panel controls from damage if the instrument is laid on its front, large rubber feet and a tilting bracket for tilting the instrument when it is used on a flat bench.

Internally the form of construction is a mother board into which other boards are plugged by means of pin type connectors thus easing servicing. All printed circuit boards are of good quality and include good quality components, the only exception being the external filter sensitivity control which is in the form of a domestic looking carbon skeleton potentiometer.

Voltage Reading Accuracy

Initially, the accuracy of the internal 1kHz reference was investigated as this effects the overall calibration of the instrument. The voltage of the reference was found to be stable and to be accurately −70dBV within the readability of the instrument, the frequency which is critical for adjusting some filters, being 988Hz which is clearly adequately close to 1kHz for practical purposes.

Using a 1kHz signal in conjuction with a very accurate digital voltmeter and suitable attenuators, the accuracy of the instrument at full scale deflection on all ranges was found to be within a creditable 1%. As is only to be expected, the accuracy at one third full scale deflection was not as good but all points using rms rectification on all ranges were within 3% with peak rectification giving equally good results except on the two most sensitive ranges where noise adds to the signal giving 4.6% error with 30μV input on the 100μV range and

78 ▶

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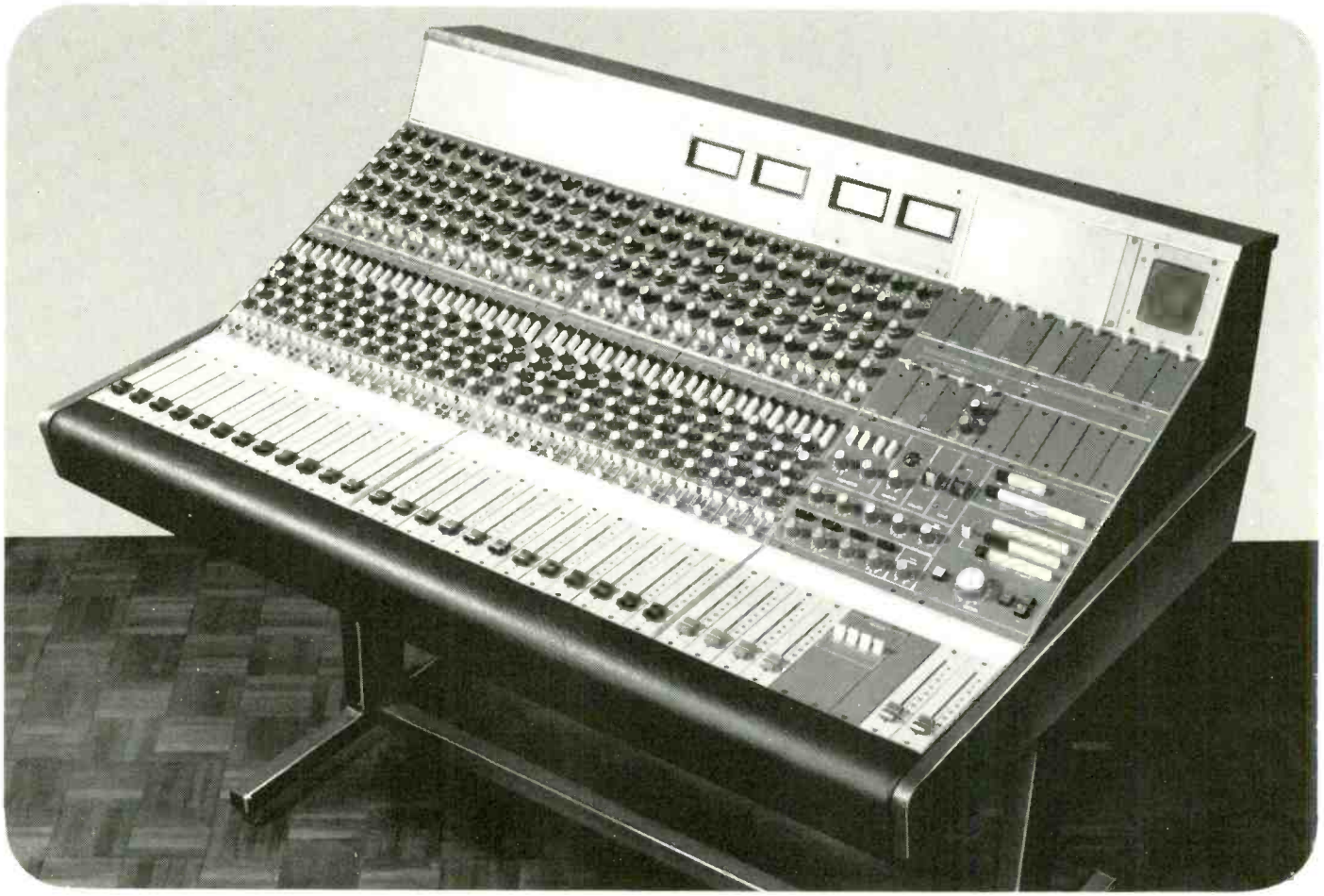

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SENNHEISER UPM 550

11% error with 10μV input on the 30μV range.

In addition to this accuracy being good, the accuracy with which the filters and weighting curves had been aligned at 1kHz was beyond reproach.

Frequency Response

As is to be anticipated, the effective frequency response of the instrument without any weighting or filters in circuit depends to a certain extent upon the sensitivity range in use and also upon whether quasi-peak or rms rectification is being used.

Fig. 1 shows these effects up to a frequency of 200kHz and shows that the instrument is well within its specification with rms rectification, the frequency response in fact rising with rms rectification on the V and mV ranges above 200kHz before falling off.

The characteristics of the weightings and filters are shown in **fig. 2** from which it can be seen that the CCIR Recommendation 468 weighting and the 'A' weighting correspond in overall detail to the standard curves. Careful checking of these weightings in relation to the CCIR Recommendation 468 and the IEC. Standard 179 (Precision Sound Level Meters) in the case of the 'A' weighting showed that both curves were very well within the permitted tolerances at all frequencies.

The DIN Unweighted curve provides a useful defined bandwidth for noise measurements with the −3dB points at 20.5Hz and 23.96kHz with the attenuation reaching −18dB at 15.66 Hz and 31.09kHz. Furthermore, the characteristic was found to be flat within ±0.1dB from 29Hz to 8kHz rising to +0.3dB at 14.3kHz to fall to 0dB at 18kHz.

80 ▶

FIG. 1 SENNHEISER UPM 550 METER FREQUENCY RESPONSE AT 200 KHz

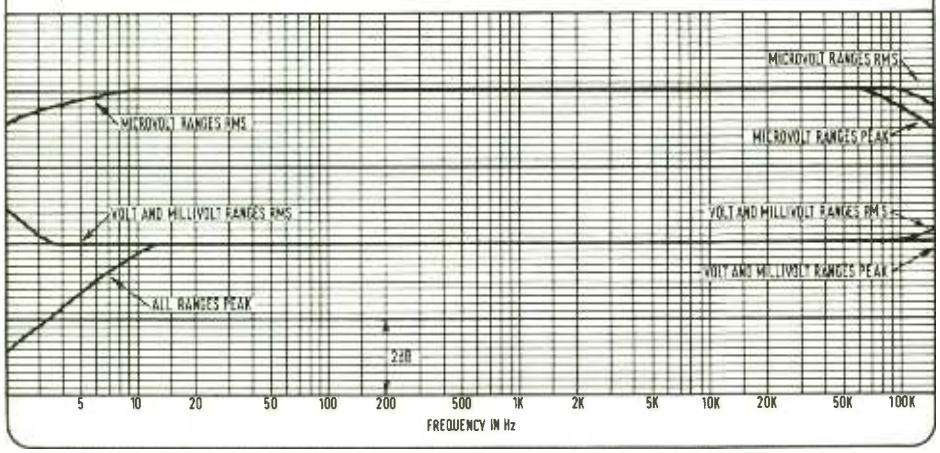
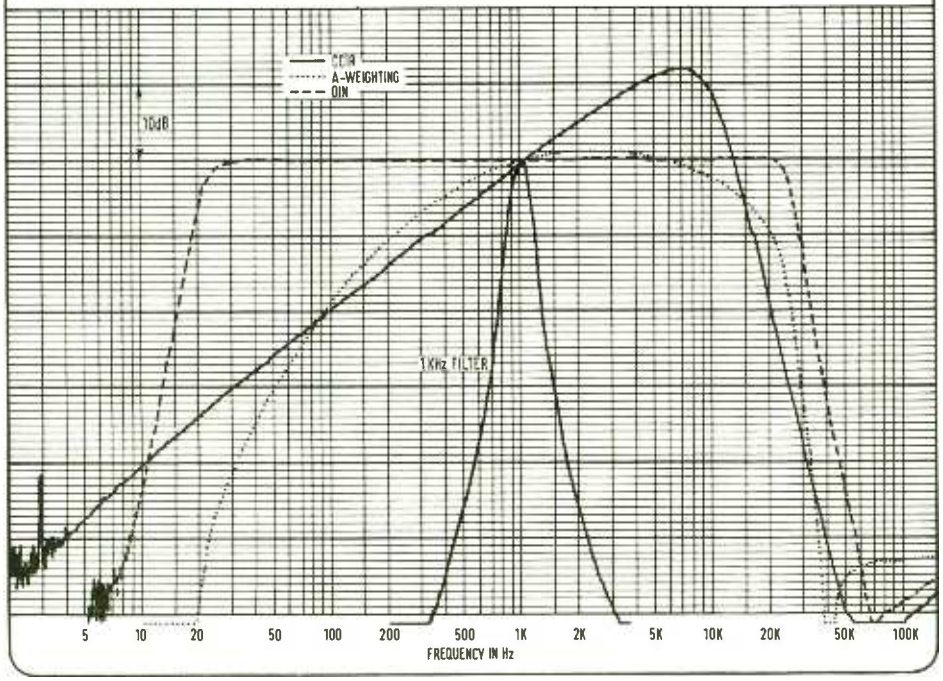


FIG. 2 SENNHEISER UPM 550 METER WEIGHTING AND FILTER CHARACTERISTICS



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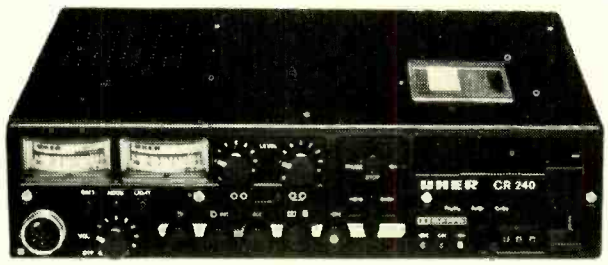

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SENNHEISER UPM 550

As can be seen, the 1kHz selective filter provides a useful feature for such measurements as tape erasure and crosstalk, but being a sharp filter with 45dB attenuation at 500Hz and at 2kHz, it can be readily used for measuring the third harmonic distortion of a 333Hz tone such as that used for measuring the performance of cassette tapes.

Noise

The residual noise indicated by the instrument naturally depends not only upon the filters or weighting in use, but also on whether the quasi-peak or the rms rectifier characteristic is in use. The residual noise was measured with the input short circuited and also open circuit and screened as **Table 1**.

As can be seen, the noise performance is very good and furthermore the dynamic range at the 0.1V output was good, see **Table 2**.

The Meter Ballistics

The effective ballistics of the meter in the rms rectification mode were measured as required by the IEC Standard 179 (Precision Sound Level Meters) and found to precisely correspond to the requirements for the 'fast' sound level meter characteristic which, among other things, means that the instrument may be used as a precision sound level meter in conjunction with a suitable microphone. Not forgetting of course that it has the standard 'A' weighting inbuilt.

So far as the quasi-peak mode is concerned the instrument was measured in terms of the CCIR Recommendation 468 and DIN 45405 and found to be well within the requirements of the recommendation whilst not always being on the centre line specification.

A further matter which is important for this type of instrument if the overload capability and here again the instrument passed with flying colours with in excess of 20 dB margin above full scale meter deflection.

TABLE 1

Filters and weighting	Input open circuit		Input short circuit	
	rms	quasi-peak	rms	quasi-peak
Off	11.5μV	19.0μV	6.5μV	7.5μV
DIN unweighted	9.0μV	14.5μV	1.8μV	2.0μV
'A' weighted	8.0μV	13.0μV	1.2μV	1.1μV
CCIR weighted	21.0μV	34.0μV	2.6μV	3.8μV
1kHz filter	2.0μV	2.0μV	<1μV	<1μV

TABLE 2

Voltage range	Dynamic range ref 0.1V (22Hz to 22kHz bandwidth)
Above 100mV	54dB
30mV	48dB
10mV & 3mV	54dB
1mV	50.5dB
0.3mV	47dB
0.1mV	37.7dB
0.03mV	28dB

TABLE 3

Output	Voltage at full scale	Impedance
0.1V BNC	99.6mV	60Ω
1V jack	974mV	585Ω
Filter	20mV	588Ω

Inputs and Outputs

Although the input impedance of the input varied slightly with the meter range setting, it was for practical purposes constant being 975.6kΩ in parallel with 53.5pF for the ranges of 1V and above. With the ranges between 0.3mV and 30mV, the impedance of the input was found to be 1.02MΩ in parallel with 60pF —all adequately high impedances.

The two front panel outputs were also very close to specification as was the filter output on the rear panel as **Table 3**.

The rear panel filter input was found to have an input impedance of 545Ω with an input sensitivity for full scale meter deflection which could be varied from 1.95mV to 9.13mV by the rear panel potentiometer, these sensitivities not corresponding to the specification. However this is of little consequence and easily modified.

Summary

This Sennheiser meter is one of the very few available for making measurements with the CCIR Recommendation 468 weighting plus a proper standard quasi-peak reading meter and passed all tests with a more than adequate margin.

It is a versatile instrument made to good professional standards, ergonomically well designed and versatile in its applications. Finally it is far from expensive for an instrument of its class. ■

COMMERCIAL RADIO IN BRITAIN

slot on medium wave to the much better 219m and at the same time the output will be upped from 1kW to 4kW, thus bringing the station into the range of many more people on the mainland. The VHF transmissions are due to go into stereo in 1979 and this event should be followed swiftly by a move to 24 hour broadcasting. And all this with just three engineers and a chief engineer who between them cover both the studio and transmitter operations.

There can be no doubt that had the Labour Government not stepped in in 1974 and called a halt to the proceedings we would now have around 60 commercial stations beaming programmes to around 90% of the population. However they did step in and the : Annan committee was set up, reporting back in March 1977. Annan's job was to look at all of the broadcasting scene in the UK—TV as well as radio, and much of its time was taken up considering the fourth TV channel.

Nevertheless, despite being crowded out by the problems of the box, Annan's comments on ILR do make interesting reading. 'Too many stations,' it says, 'are trying to find the cheapest form of programming which would attract the maximum audience.' And later: 'There are therefore among us those who think that these stations give an unsatisfactory service to the public . . .'

All the stations, according to Annan, felt that the IBA interfered too much, charged 'punitive' rentals for the transmitters, and required excessively high engineering standards. From Canada, where local radio is very advanced, came the comment that local stations were overstaffed, transmitters were too elaborate, and operating costs unnecessarily high. (The IBAs lowest estimate for setting up a station is £250,000, compared with an estimate of £2,000 to set up a simple loop-induction station on a university campus).

Annan's local radio recommendations section begins with the now famous phrase, 'At present local radio is in a mess.' Annan's answer was to suggest the setting up of a new body which would handle all local radio—both BBC and IBA, and responses to this, and other questions of radio usage were wide and varied.

On the old question of frequencies Annan seemed satisfied to take some rather over-cautious statements offered to the committee without seeking to find out the whole truth and without pushing the Ministry of Defence to reveal more of what it is doing with its frequency allocation. Although it is true, as John Whitney, managing director of Capital Radio recently pointed out, that there are currently over 80 countries involved in frequency disputes, there are still many solutions to the problem, but by and large Annan gave the impression of not wanting to know.

The proposal that one authority should take over all the ILR stations was rejected by the BBC, but accepted by the IBA, naturally with the proviso that it should be that authority. Great play was made by the IBA of its interest in such developments as twinned stations (as with the one they propose to serve Cheltenham and Gloucester) small scale experiments in neighbourhood radio in the conurbations, and cable radio (which Annan felt would be too expensive).

Clearly we are now approaching a time when these ideas will all have to be sorted out in one way or another—although the history of radio in this country shows that no-one should expect any rapid developments (unless there be moves to actually shut down stations.) With the coming of satellite radio and TV in the 1980s, there is a chance that the government is going to be embarrassed once again if TV Luxembourg decide to throw a couple of stations our way, as they are planning to. That might be a good sign for the development of radio, for if the availability of overseas TV shows on British screens becomes a big issue, the government might be distracted into letting commercial radio look after itself for a few years.

Meanwhile the 19 ILR stations carry on, doing their own thing as best they can. Next month I shall be taking a look at what three of them have been getting up to. ■

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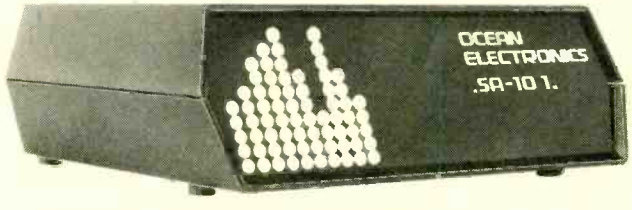

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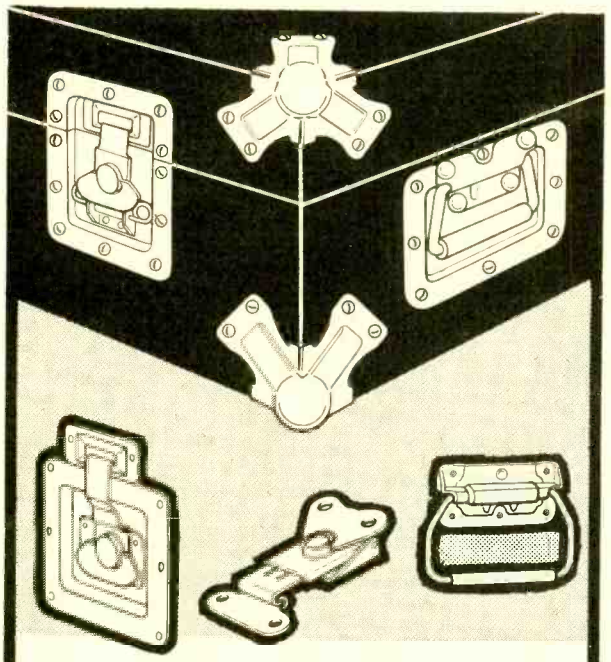

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Ampex MM1000 16tr. spare 8tr. H/B	7,250
Scully 8tr. Portable	3,000
Brennel 8tr.	1,500
Otari 8tr. MX7308. In console immaculate. 1" tape.	5,000
Otari 8tr. MX5050. ½ " tape.	3,000
Otari 4tr. MX7000. ¼" tape. In console.	1,200
Ampex AG440. 4tr. In console.	1,500
Stereos	
Scully 280 series.	P.O.A.
3M M79	P.O.A.
Revox A700. 1 year old.	850
Revox A77 Mk. 4. As new.	400
Otari MX7000. In console.	1,000
Otari MX5050.	800
Consoles.	
Trident B. 30x16x16	16,500
Amek. 20x16. 18 months old	6,500
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Sound Techniques. 20x16. Excellent order.	6,000
Audio Applications. 10x4. 3 band EQ.	750
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3M M79 24tr. Head block. new.	2,500
Neumann. U87, U47, U67, M49, M50, KM56, KM54, KM254.	When available.
AKG C451. Used with CK1 caps.	65
AKG C414	180
JBL 4320. Walnut as new.	750 pr
DBX 154.	350
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Eventide. Flanger.	300
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Note: Advertisement copy must be clearly printed in block capitals or typewritten.
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★**Cathedral Sound manufacture** a professional standard compressor/limiter module for under £25, mixer modules, and complete mixer channels. Professional discounts available on Revox, N.E.A.L., Sennheiser, also MM mixers. S.A.E. details. Cathedral Sound, Fourways, Morris Lane, Halsall, Lancs L39 8SX. Tel. Halsall (0704) 840328. X

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★**Revox, Teac,** Otari, Brenell, Tascam, Nakamichi, Tannoy sales and service. The Music Laboratory. 01-349 1975. X

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ANY TYPE OF AUDIO TRANSFORMER AT THE RIGHT PRICE

Whilst we specialise in every kind of transformer for audio control decks and mixers, demands are increasing for **LOUDSPEAKER TRANSFORMERS** and **100 VOLT LINE AUDIO OUTPUT TRANSFORMERS** for most kinds of amplifier from 30 watts to 500 watts output. We have standard designs for AMCRON and BOSE amplifiers and can also supply **Multi-output transformers for COLUMN LOUDSPEAKERS** in a wide variety of powers.

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(Continued)

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

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Automatic double tracking.
Varispeed/varipitch.
MUSIC LABORATORY 01-349 1975

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★**Tape copying service.** Open reel and cassette available. The Music Laboratory, 01-349 1975. X

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★**A note for tape slashers** that don't wish to go go to the chemist: single-sided blades are available from Stanley Prod., 151-153 Wardour Street, London, W1. Tel. 439 0311. J

★**Current MCI Console**—JH 528 stereo Quad, 28 in and 24 out, operated only a few weeks, debugged and latest factory mods. Cherokee Recording Studios, phone (213) 653 3412, U.S.A. J

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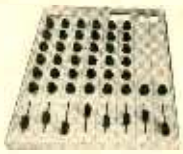
Quantity discounts.
Prices on application.
Mail Order service.
MUSIC LABORATORY 01-349 1975

★**Spectra Sonics 1024-24 Recording Console,** 24 in-out, producer's desk, 18 months old, excellent condition, $25.000. Phone (805) 966 6630, 966 1271, U.S.A. K

make it!



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Can be made in 8 hours.
Kit price; £99.95. incl vat
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★**8 track 1 inch Brenell** £1,750. Tel. 0252 850359. J

★**Audio tape, matt black,** 2,400ft. hubs, £2 per roll + VAT. Tel. Ed or Chris on 01-734 3325. J

★**Have gone 16 track.** All in excellent condition: 8 track Leevers Rich £4,500 ovno. 4 track Scully £2,500 ovno. 1 Allen Heath mixer with mods 14-8-8 £1,800 ovno. Hopkins Grand Piano, as new, £1,700 ovno. 16 track 3M M56 poa. Tel. The Old Smithy Recording Studio, Worcester (0905) 820659. K

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★**Nagra III** Recorder, Xtal sync, £1,000 o.n.o. Nagra BM2 mixer—offers. Two AKG D109 neck mics, £12 each. All plus VAT. Tel. 01-998 0318. J

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★**16 track Scully** tape machine, Amek 16-16-16 desk, 4 track Scully tape machine, 1 pair of Lockwoods LE1-S. £6,500 complete: may split. Tel. 0924 405681. J

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★**Major New York City** recording studio seeking top notch creative maintenance engineer. Excellent opportunity. All enquiries confidential. c/o Studio, P.O. Box 275, Old Chelsea Station, New York (New York 10011), U.S.A. L

SITUATIONS WANTED

★**Experienced 16 track** engineer (25) requires move to a new studio to progress and work in. Box No. 794, c/o STUDIO SOUND. J

★**Qualified Audio engineers:** three young enthusiastic, BBC-trained maintenance engineers, each with over three years' experience, require interesting jobs in recording studios. Box No. 793, c/o STUDIO SOUND. J

★**Experience needed in sound engineering:** three years electronic background, very interested in sound recording. Anything considered. Box 792, c/o STUDIO SOUND. J

WANTED

★**Private buyer seeks** 16 track tape machine. Tel. 0252 850359. J

★**Secondhand Soundcraft 12/4** Series II Mixer wanted, Penny & Giles faders and sweepable equaliser necessary. Please mention price and your address in your letter. Charisma Musik Productions, Box 3055, 300 03 Halmstad, Sweden. J

★**Revox's urgently wanted.** The Music Laboratory. 01-349 1975. X

★**Tannoy GRF** corner horns, good price offered for one pair in good condition, damaged ones considered. Tel. Mike 0473 49541. X

★**Tannoy Speakers Wanted.** The Music Laboratory. 01-349 1975. X

★**Wanted. Revox and Teac** Tape Recorders. Best prices paid. R.E.W. Professional Audio. 01-836 2372. X

★**Teac 3340 (S) urgently wanted.** The Music Laboratory. 01-349 1975. X

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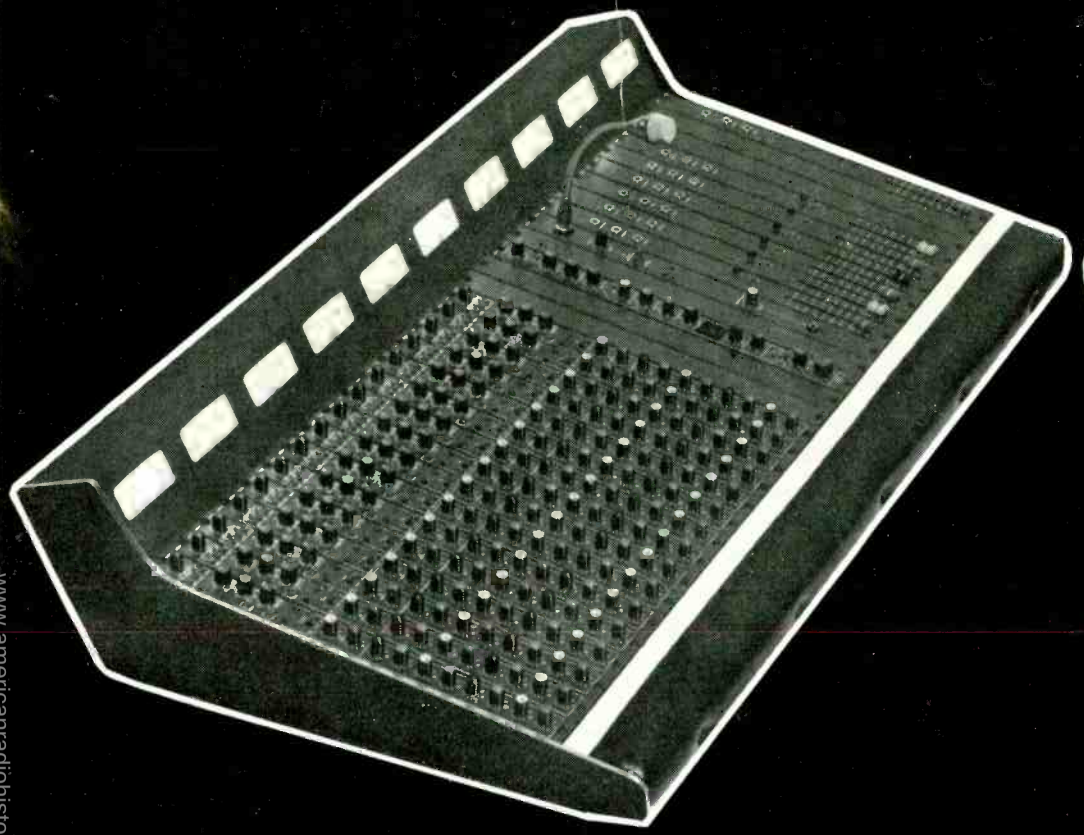

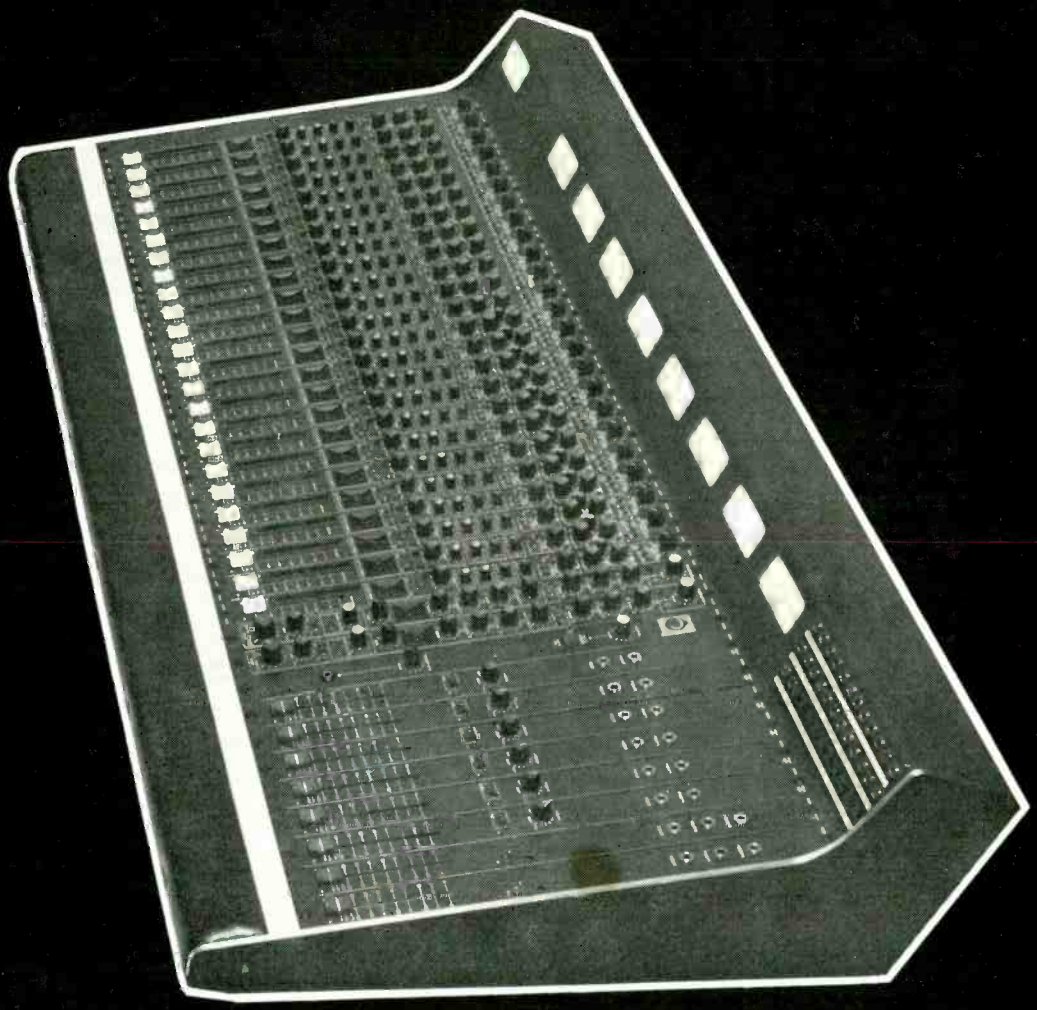

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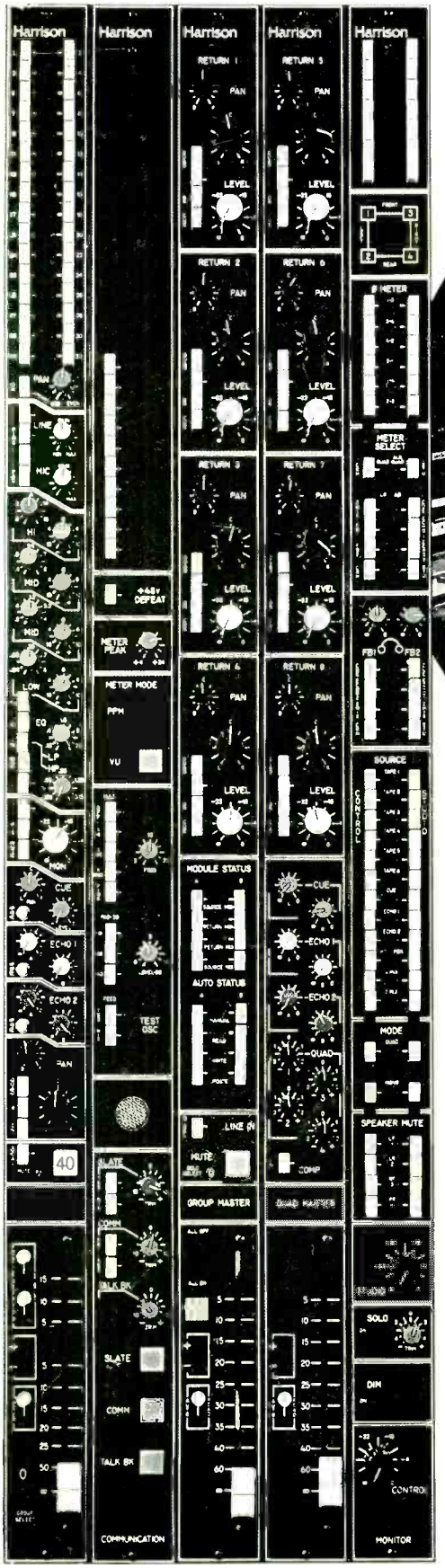

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