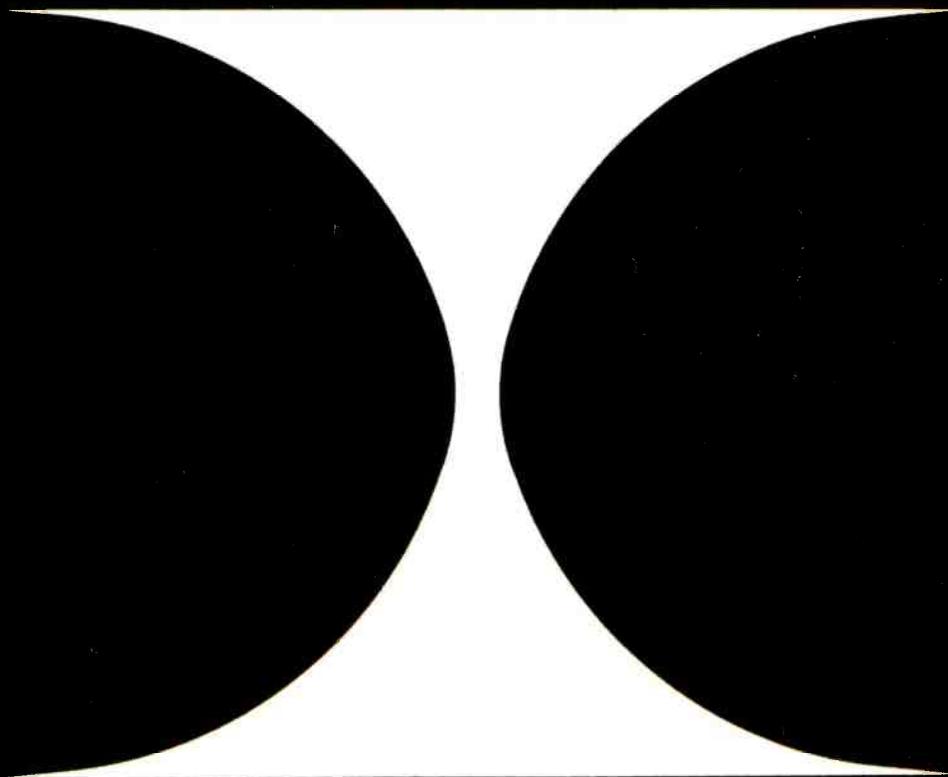


studio sound

October 1977 50p

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studio sound

AND BROADCAST ENGINEERING

Overspecialisation

These offices recently received a phone call from a chap who wanted to record an Indian folkgroup, and did we know of a studio who, while not actually specialising in this sort of music ('No matc, don't get a lot of call for 16-track sitar overdubbing'), had some experience of the exotic instrumentation involved. Much head scratching and a thumb through *Kemps* resulted in a 'Sorry, can't come up with anybody specific, but any self-respecting studio *should* be able to accommodate you'. 'Ta, squire,' says he, and rings off.

Well, advice—informative or otherwise—is free, but on reflection were we right? In very arbitrary terms studios seem to either specialise in rock or classical recordings, and not just because of floor space or the number of *U87*s they can muster at the drop of a baton. And within the loose classification of rock, certain studios will be better-known for their 'West Coast' or 'NY Heavy' sound, and others more *sympatico* with the needs of an 'ethnic folk' group.

Commercially, it makes sense for a studio to associate itself with a particular sound. And once you have a successful group pass through your portals, bandwagon jumping assures your future—in the short term at least.

But are studios doing themselves a disservice? It still must be true that a competent engineer can correctly mic up anything that vibrates or oscillates. So perhaps it would make sense to promote your services occasionally on a 'We may be known for our *Tamla* feel, but we also know what brass bands are about'. You may have to turn away the occasional Supergroup, but at least you keep in touch with more kinds of music that way.

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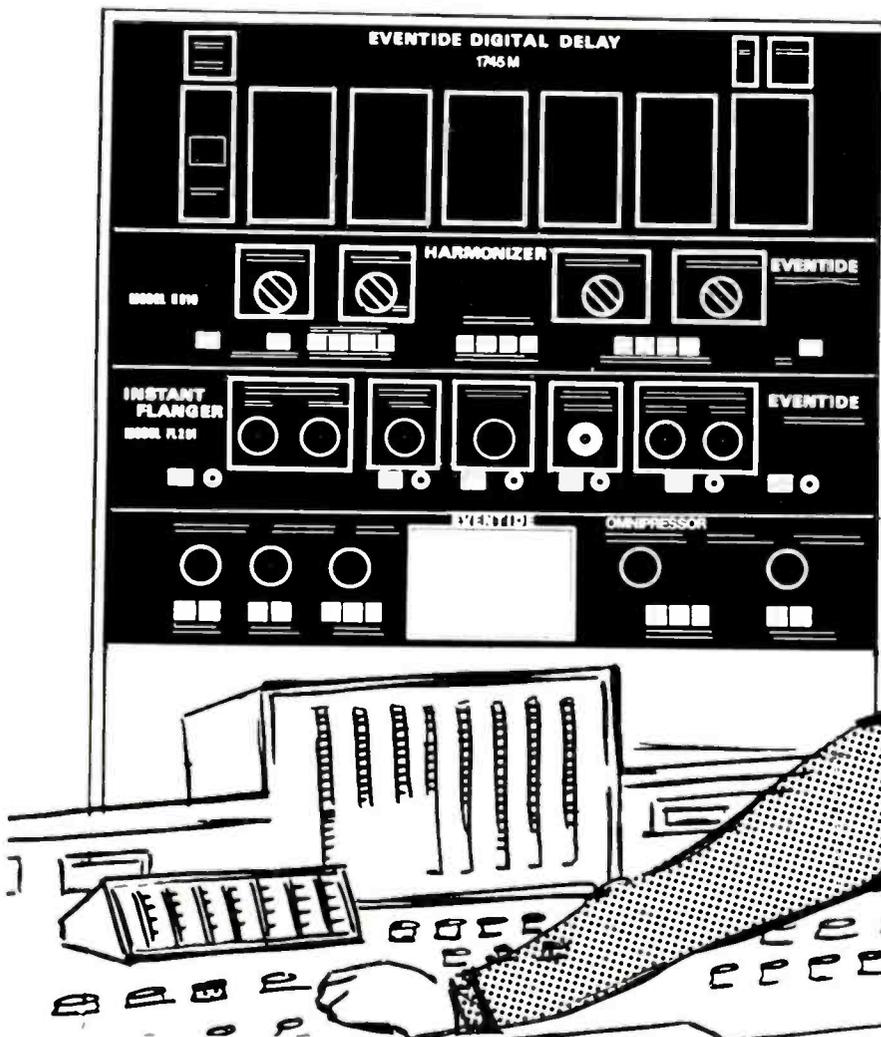
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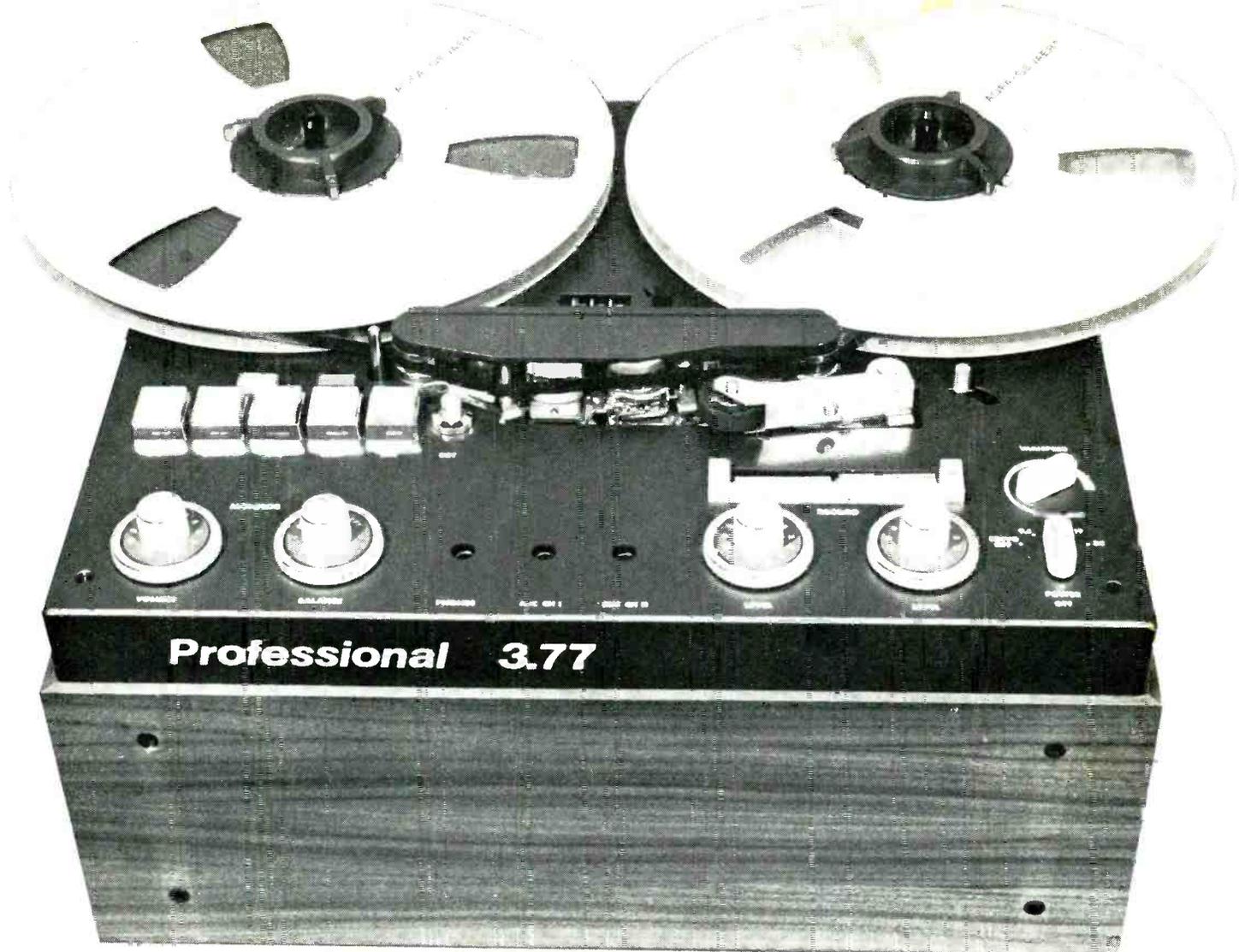
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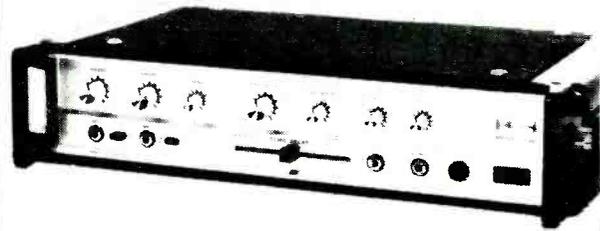
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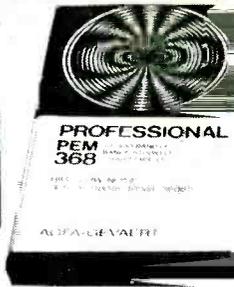
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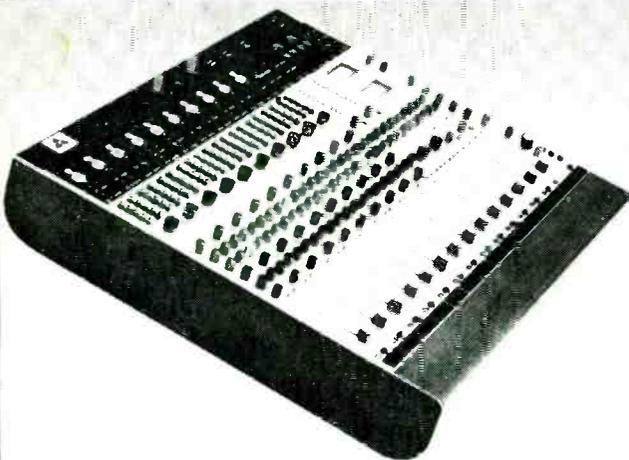
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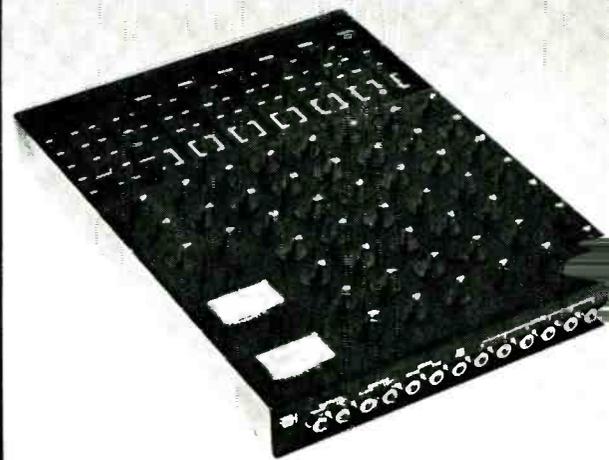
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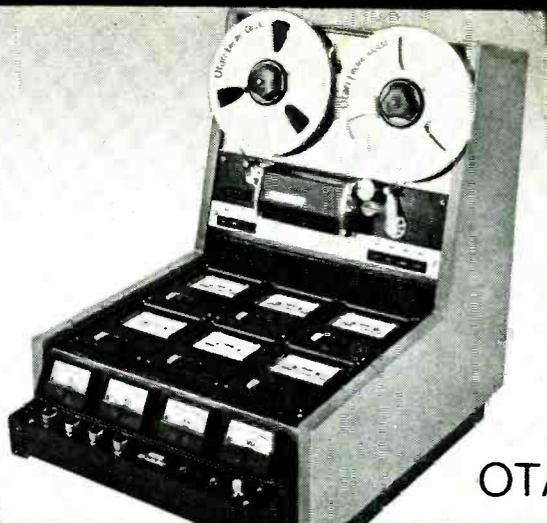
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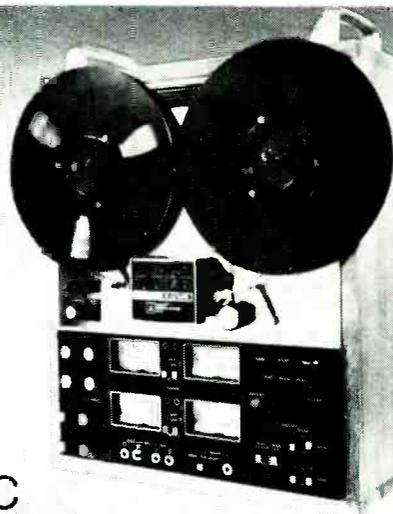
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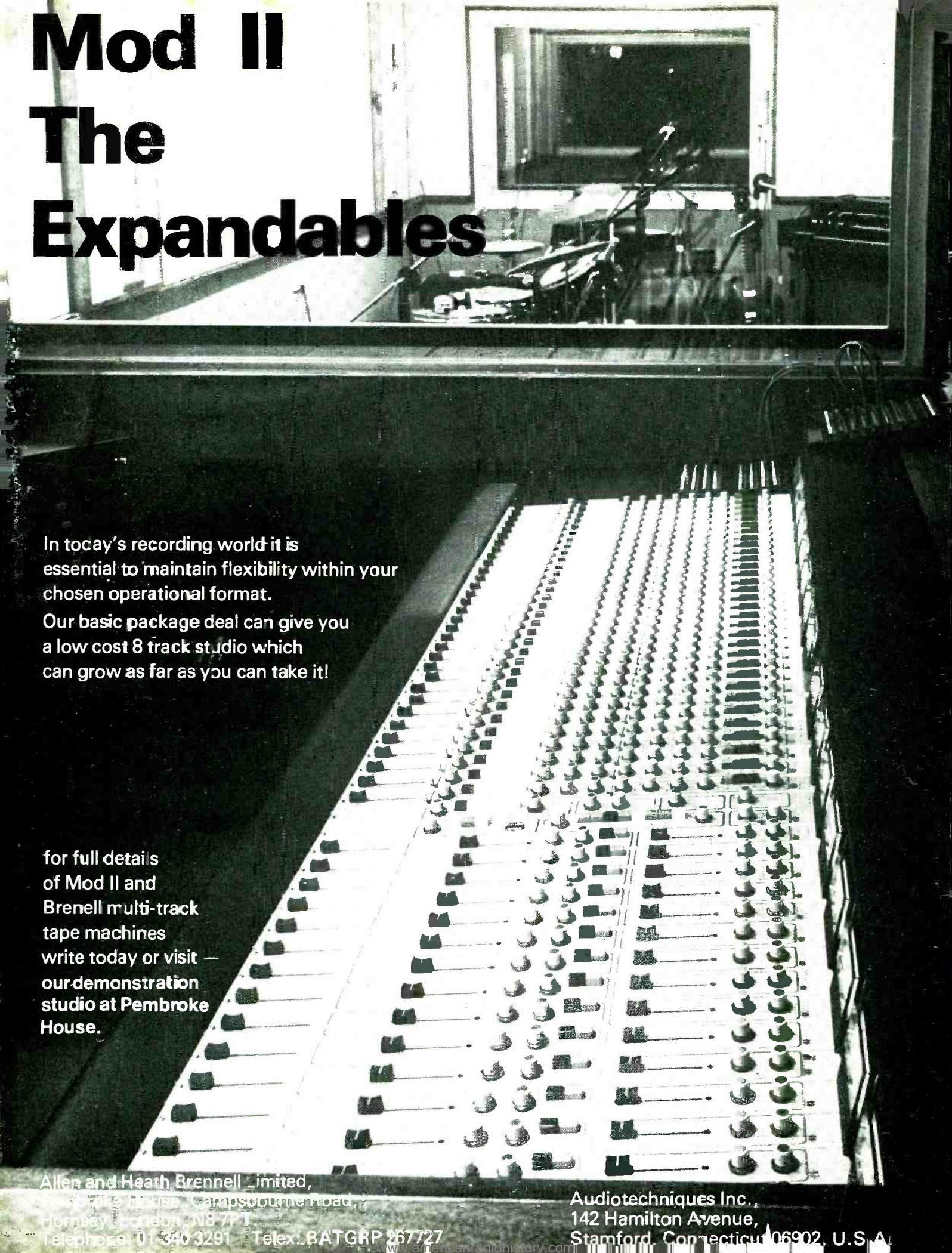
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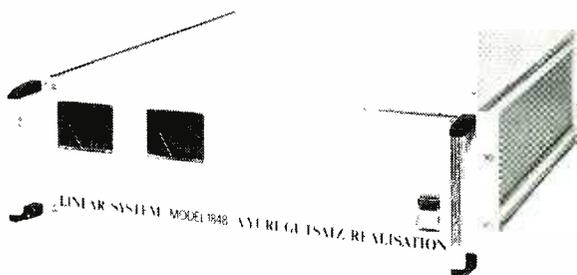
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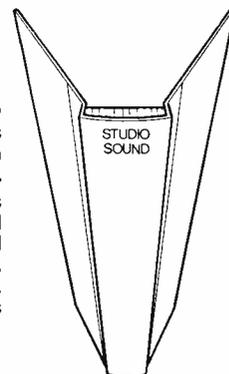
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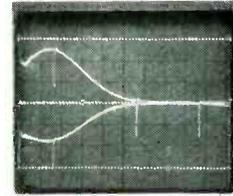
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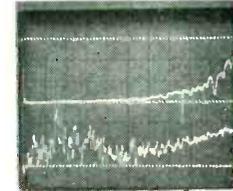
Oscilloscope photographs of some typical examples of plots made using the 4400 and an oscilloscope



Swept sine wave frequency response plot of the reciprocal action of a low frequency equalizer. The small negative spikes are markers at 62Hz, 1kHz and 8kHz. The amplitude window between the top and bottom reference lines is 30dB, the horizontal axis is log 20Hz to 20kHz



Frequency response of the speaker and room in a monitor system. The top trace, with 40dB window between reference lines, is before equalization, the bottom trace after equalization. The source was pink noise and the plots were made using the spectrum analysis mode with a 1/3-octave bandwidth



Spectral analysis of the noise floor of a tape recorder playing back erased tape. A 2% filter bandwidth was used. Bottom reference line is -90dBm, top -30dBm. Second trace is phase shift versus frequency between two reproduced tracks. Top reference line is +180°, middle 0° and bottom -180°. The marker is at 4kHz in the 20Hz to 20kHz sweep



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The TEAC TASCAM Centre at REW



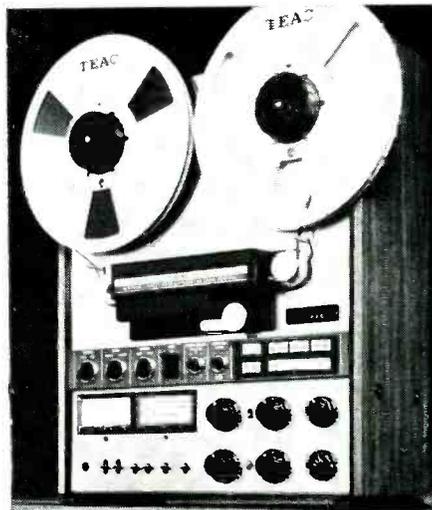
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8/4 mic/line inputs, 2 Band EQ, direct O/P, full monitoring built-in Test Tone Talk Back (optional) with slate tone. Professionally built for easy servicing. Designed to interface with 80-8 1/2" 8 Track.



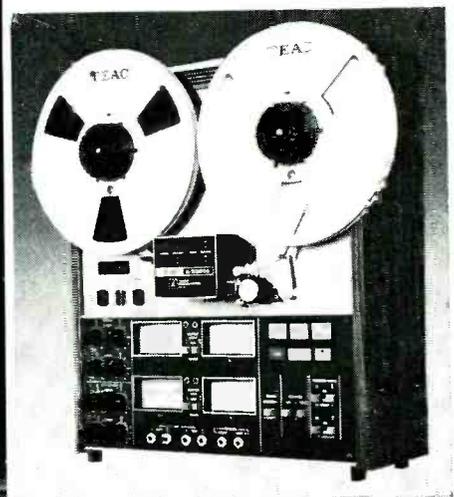
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2 Track machine of mastering quality. Suitable for most high quality applications, with reliable logic controlled transport. Running at 7 1/2/15 ips, it also has Varipitch. 4 inputs for mic or line, and large Vu's.



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REW Professional Audio, 126 Charing Cross Road, and 17 Denmark St., London WC2. Tel: 01-836 2372/7851

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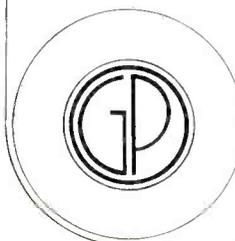
SS10

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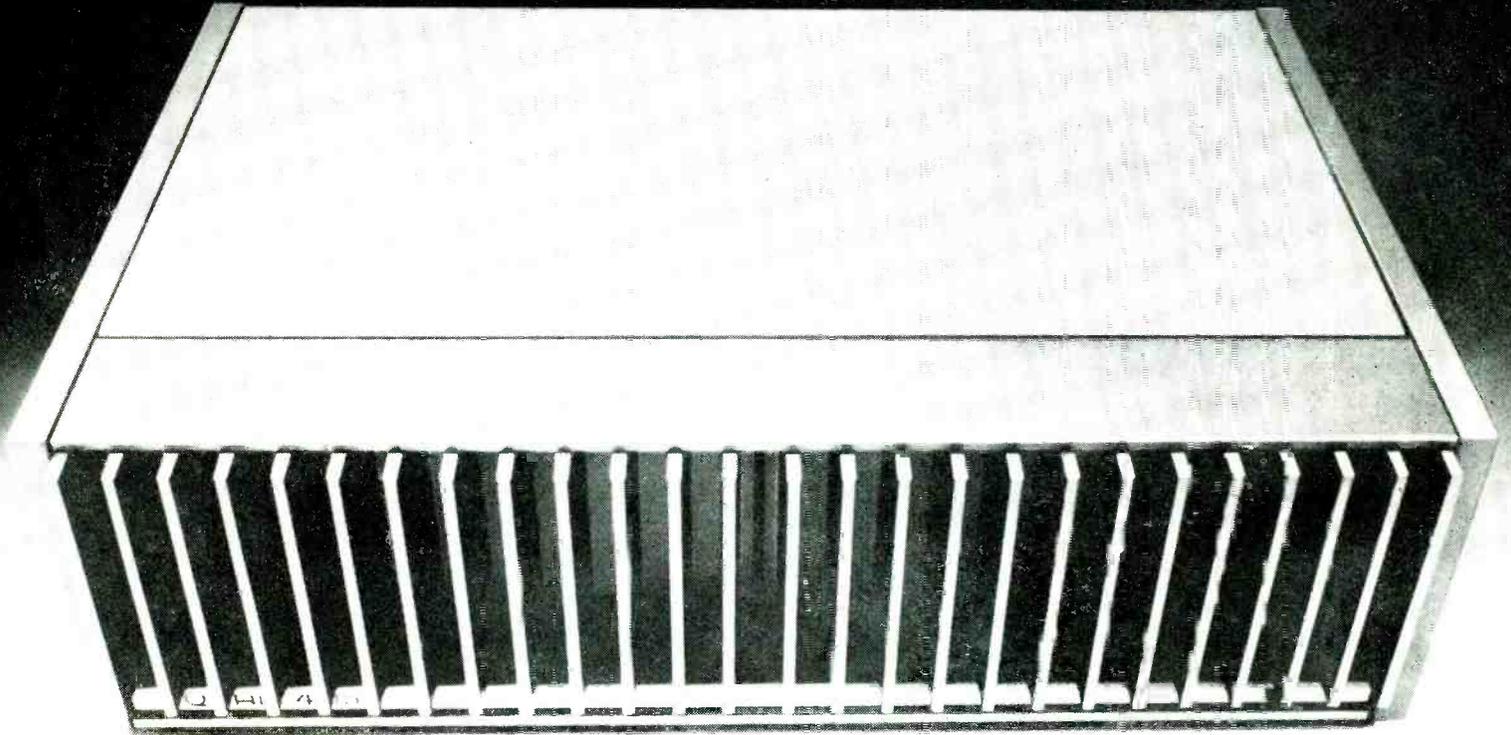
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8 track
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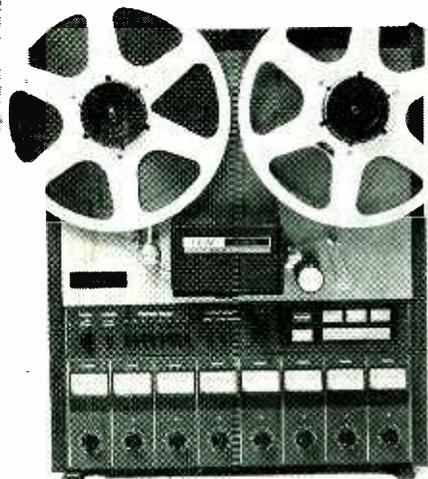
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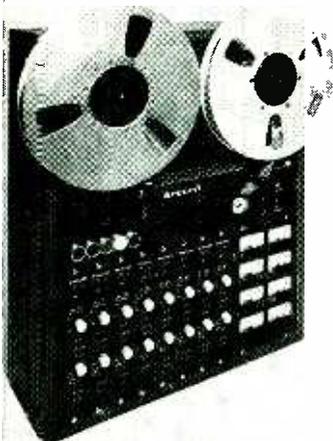
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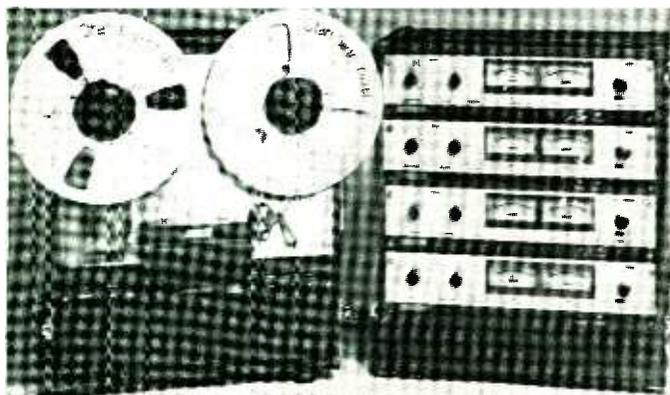
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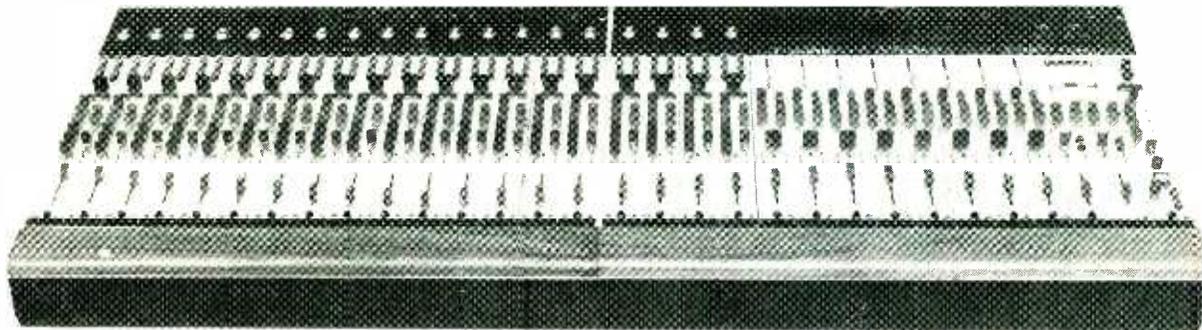
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Recording studio equipment specialists. Main distributors for Revox, Teac, Nakamichi Tannoy, AKG, Brenell, Tascam, DBX, Amcron, JBL, Otari, Gauss, Allen & Heath, Write or phone for information.

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THE WORLD**

Fleximix upsets many people



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So we concern ourselves with the reaction from our customers who are unanimous in their praise of the Fleximix System portable sound mixer. The comprehensive facilities and the unique expandability of Fleximix continues to appeal to discriminating professionals and promotes enthusiasm in the many existing users.

A basic 10 input-2 output configuration, costing a little over £2,000, can easily be built up—by any increment—to a maximum of 40 input channels, 10 mixed outputs and 24 track monitoring. Expansion is simply a matter of slotting additional modules into the mainframes. When existing slots are filled, another mainframe is added. Modules may be placed in any sequence desired. No rewiring is necessary and no factory rework is required. Additional mainframes may be rigidly or flexibly coupled to the original system and flight-cases are available to accommodate any arrangement.

New modules recently added to the system include a dual compressor/limiter and input/output line-balancing units. A meter overbridge is also available to provide additional VU metering on group outputs. Floor stands can be built to special order.

Send for details to:

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United States Agent:

**Studio Maintenance Service,
12438 Magnolia Blvd.,
N. Hollywood,
California 91607.**

Tel: (213) 877 3311.

Contact: David Michaels.

Canadian Agent:

**Audio Analysts Inc.,
2401-A St. Catherine St. East.,
Montreal H2K 2J7, Quebec.**

Tel: (514) 525 2666.

Contact: Pierre Pare.



news

AES British section

Following the forthcoming agm on October 11 there will be a talk on audio reminiscences, entitled 'A funny thing happened on the way to the anechoic chamber', by James Moir. This will be followed (it says here) by a general exodus to the *Old Caledonian* for refreshments.

Two other meetings later in the year should also prove interesting. On November 15 a talk entitled 'The broadcaster's approach to quadrophony', will be given by R Harrison of BBC Radio. The second part of 'A century of sound recording and reproduction', covering the period 1927-77, is to be delivered by Rex Baldock and 'supporters' on December 13.

Full details from: AES British Section, 32 Knoll Rise, Orpington, Kent BR6 0EL.

Monitor loudspeaker

The new *Sentry V* monitor from Electro-Voice features a Thiele/Small vented speaker design, and is capable, so we're told, of delivering 111 dB from 300W peak and 96 dB spl at 1m from 1W.

Frequency response is a claimed ± 3 dB 45-18k Hz (or 32-18k Hz with an optional equaliser set to a 'step-down' mode), and dispersion angle $126 \pm 31^\circ$ horizontal from 400-16k Hz, $66 \pm 16^\circ$ vertical from 4-16k Hz.

Electro-Voice Division of Gulton Europe Limited, The Hyde, Brighton, Sussex BN2 4JU. Phone: Brighton (0273) 66271. Telex: 87172.

Sorry, John

The telephone and telex numbers for John Page Ltd, UK distributors for Stellavox, is as follows: (01) 578 0372/2641, and 24224 (Reference 568); and not as they appeared in the August issue (p18). It appears that the company shares a telex number with several other users, and messages have to be suffixed with a reference number to avoid confusion.

Distortion analyser

The *IE-15A* accessory from Ivie Electronics allows measurements of total harmonic distortion to be carried out *in situ* with their model *IE10A* spectrum analyser. Measurements are made at a fixed frequency of 1 kHz in the range 0.02-100%, the results being displayed on the analyser with an accuracy of 1 dB.

The unit measures only $69 \times 92 \times 39$ mm (w \times h \times d), weighs 285g and operates from line-voltage or nickel-cadmium rechargeable batteries.

Ivie Electronics Inc, 500 West 1200 South, Orem, Utah 84057, USA. Phone: (801) 224 1800.

MCI news and views

If you want to catch up with what those guys at MCI are up to, why not send for a copy of their 'News and Views' newsletter. The latest issue (number 2) will tell you how they checkout a *JH-110A* tape machine before it reaches a studio (a complex process involving at least 16 hours in their 'burn in' room), and how Jeep Harned almost didn't make it to the recent LA AES Convention.

Of more immediate use may be a series of service tips for improving the *JH-100* transport and auto-locator.

Copies of the newsletter can be obtained from: MCI News and Views, 4007 NE 6th Avenue, Fort Lauderdale, Florida 33334, USA.

Talkback for Italy

Brabury Electronics has received an order from Castellanza Italy, for the design and manufacture of a communications and talkback system to be installed in a new studio

complex near Milan.

The order will be the most complex yet undertaken by the company, who have many smaller systems in operation throughout Africa and the Middle East.

Brabury Electronics Ltd, 109a Loverock Road, Reading, Berks RG3 1NS.

Phone: Reading (0734) 52434.

Eagle microphones

Five new models are now available in the UK and Europe:

PRO M10 is a lightweight, hyperdirectional rifle mic with a front-to-back ratio in excess of 18 dB, and an impedance of 600 ohm. A phase-cancellation barrel can be removed to allow normal use of the mic when necessary. The mic comes complete with cable, stand and detachable windshields, and costs £29.75.

PRO M60 is a miniature 'studio' tieclip mic with a 17×17 mm capsule, 600 ohm impedance and 65 mV sensitivity. Frequency response is compensated for lack of top frequencies in the normal wearing position. Price: £32.30.

PRO M70 capacitor and *M80* dynamic mics are based on the *PRO M90* model and use the same body and windshield design. Both are fitted with an integral *XLR* connector. Their cardioid front-to-back ratio is said to be better than 10 dB. The *M70* has an impedance of 600 ohm and costs £34.20, while the *M80* has a 200 ohm impedance and costs £37.60.

PRO M90 is a studio-quality dynamic cardioid mic, and features a heavy diecast body with integral *XLR* and a rugged mesh windshield. Impedance is 600 ohm, sensitivity 72 dBV/Pa and front-to-back ratio better than 10 dB. The mic weighs 325g and costs £43.90. Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU.

Phone: (01) 902 8832. Telex: 922131.



Guitar synthesiser

The new ARP *Avatar* utilises a specially designed 'hexaphonic' pickup that can be mounted on any solid-body guitar, and which provides an output signal for each string. Internal circuitry of the synthesiser proper is similar to that found in the *Odyssey* keyboard synthesiser. Two vcOs are tunable over a 10-octave range and can be phase-synchronised. Other functions include vcf, vca, sample and hold, pink and white noise generator, adsr and ar envelope generators, highpass filters, ring modulator and lfo.

The *Avatar* is also touch sensitive. An envelope follower translates the strength of the pickup signals into a voltage that controls the dynamics of the synthesiser. An adjustable trigger sensitivity allows the musician to set the minimum picking force necessary to 'start' synthesising effect.

A patented-design pitch extractor—or pitch-to-voltage converter—follows every nuance of the pickup signals, including bends, finger vibrato, hammer-downs and glissando. The extractor continues to follow the pitch of the guitar string until its vibration has become too weak to analyse.

Other synthesisers can also be connected to the *Avatar* via rear-panel control voltage, gate and trigger input and output jacks.

The *Avatar* costs about \$2500 (£1,300).

ARP Instruments Inc, 320 Needham Street, Newton, Mass 02164, USA. Phone: (617) 965 9700. Telex: 922544.

UK: Stateside Electronics Ltd, 49 The Broadway, Haywards Heath, Sussex RH16 3AS. Phone: Haywards Heath (0444) 58301; and FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Phone: (01) 953 0091. Telex: 27502.

Electro-Voice in UK

The company are currently engaged in establishing a network of dealers and have recently appointed the following franchised dealer for the London West End area:

REW Professional Audio, Charing Cross Road, London. WC2. Phone: (01) 836 2372.

Details of other retail and wholesale arrangements can be obtained from: Electro-Voice Division of Gulton Europe Limited, The Hyde, Brighton, Sussex. BN2 4JU.

Phone: Brighton (0273) 66271.

Orban 418A

Stereo Compressor/Limiter

The Subtle One

Specifically designed to provide smooth, subtle and distortionless control of stereo programme.

The Orban 418A is equally at home in the multi-track studio, broadcast production studio and cassette master preparation area or optical film transfer suite.

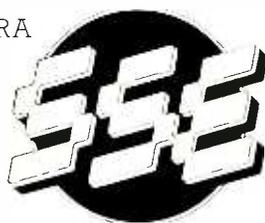
- Variable time-constant H.F. limiter section
- Accurately ganged stereo controls
- 'Programme controlled' attack and release times.
- Simple and sensible front-panel controls



The Orban 418A is a high quality stereo limiting system consisting of a pair of ganged broadband compressor-limiters followed by a variable time-constant H.F. limiter.

For further information on the Orban 418A Compressor Limiter, the new Orban 622B Parametric Equaliser, the Orban 516EC Dynamic Sibilance Controller or the Orban 245E Stereo Synthesiser contact:-

Scenic Sounds Equipment
97-99 Dean Street, London W1V 5RA
Telephone : 01-734 2812/3/4/5
Telex : 27939 Scenic G



In Sweden :
Tal and Ton Musik and Elektronik
Kungscatan 5, S411-19 Gothenberg 5
Sweden

NEWS

IBA 4-channel demo

The Independent Broadcasting Authority's laboratories at Winchester recently opened its doors to the technical press for a day, and generally impressed all present with goodies in the audio and video field. Realistically, the visit was far too rushed; through shortage of time many burning questions were never asked, let alone answered, and many demonstrable points left undemonstrated. It emerged without doubt, however, that the IBA is firmly behind the Ambisonics 45J system, albeit with the reserva-

tion that some 'fine tuning' is needed before final recommendations are made to the EBU for international standardisation.

The surround sound demonstrations were rather disappointing. But this was mainly due both to the rush and shortage of time which devalued the day and the IBA's gallant attempt to demonstrate surround sound to a dozen people at a time; an ambitious but fanciful notion. More important than the indeterminate results of the demonstration ('Does it sound phasy at the side because I am sitting too near the side? Is that where the solo voice is supposed to be? Was the original sound in Winchester

Cathedral a mush?' and so on) is the undoubted conclusion that the IBA has looked very seriously at all available surround sound systems.

While other organisations, including the BBC, have been developing their own systems, the IBA has been quietly evaluating the relative merits and demerits of what already exists. The authority has also been able to carry out useful tests on the feasibility of transmitting an extra, third channel of information in phase quadrature with the 38 kHz difference signal in a conventional fm stereo broadcast.

Arriving at quite different results from the BBC, and IBA believes that such extra channels of information can be transmitted without causing breakthrough problems for the majority of listeners unequipped to decode the extra information. This discovery follows from another revelation, namely that the extra channel of information need only have a very narrow band width (as little as 2 kHz) and can be transmitted at -7 dB relative to the programme material.

The reminder cannot be made too often that, with the Ambisonics 45J system, this extra channel (or half-channel) of information is *not* an extra loudspeaker channel, but more an information control channel. The signals it carries help reduce the 'phasiness' of the decoded two-channel matrix signals, and enables the listener to use linear, rather than logic, decoders.

While the IBA 'fine tune' the Ambisonics 45J system, and the BBC negotiate with the Ambisonics team, a final agreed standard that is in the narrow ground between 45J and Matrix H seems inevitable. If this is then put to the EBU, all parties will be on the final straight to a unified European standard.

But in the USA CBS has now petitioned the FCC 'for rule making which would require any broadcasts over present stereo transmitters that are claimed to be quadraphonic to follow the SQ system specifications'. CBS has already criticised the BBC's Matrix H in no uncertain terms: 'In short, the H matrix would hardly entice any self-respecting record manufacturer—it is unsuitable for high fidelity broadcasting or recording,' are the words most recently used.

As yet no attack has been launched by CBS on the 45J system, but with the BBC and Ambisonics formats basically so similar it seems inevitable that this will come next. Equally inevitable, therefore, seems a confrontation between CBS and SQ on the one hand and Europe and any H/45J compromise on the other.

Let's hear it for the Mayor

The College for Recording Art, which claims to be one of the largest and most respected institutions of its type on America's West Coast, was recently honored by San Francisco Mayor George Moscone, who issued a special proclamation 'saluting' the college for its many contributions to both the recording industry as well as to the city itself.

In his speech, Mayor Moscone reiterated the long acknowledged interest the college has enjoyed with the industry.

'The college has long been considered a true leader in the recording industry, whose graduates have brought high honour to their profession and to their college', he said. 'The college has received the highest praise for the excellence of its training and the variety of the courses it provides.'

Acoustic measurement

Nortronic has introduced a new dual-channel unit with a white, pink or bandpass-filtered noise generator, two filters with a frequency range from 2.5 to 31.5k Hz, and A, C, D and linear weighting networks. The instrument will operate in $\frac{1}{3}$ and $\frac{1}{2}$ -octave bands, or stepped in $\frac{1}{3}$ -octave intervals by remote control.

Outputs can be in either digital form containing frequency and bandwidth information, or in an analogue form to drive, for example, an xy recorder for automatic frequency/level plotting.

The model 719 filter costs £2900 in the UK, and can also be supplied as a single-channel unit for £2400. A version without the noise generator section is also available.

Nortronics A/S, N-1380 Heggedal, Norway. Phone: 79 7721.

UK: Gracey and Associates, Three-ways, Chelveston, Northants NN9 6AJ. Phone: Raunds (09335) 2016.

Scampering at APRS

Audio & Design tell us that their stand at the recent exhibition was 'briskly attended'. Visitors included the famed Pete Townshend chatting about his recent acquisition of SCAMP units and E560-R selective limiter for Eel Pie Studios, and Laurent Thibault from the Honky Chateau who purchased SO1 compressor-limiters and SO4 parametric equalisers off their stand.

Adrian Hope

24 ►

Minimixer for Nagra SN

The model SNM-3 minimixer developed by Noriyuki features:

- record; test; stop and play functions for the SN transferred to front-panel switches;
- choice between two a/b powered condenser or dynamic mics (input sensitivities are switched internally);
- before and after-tape monitoring with separate headphone level control;
- 10 Hz quartz-controlled pilot tone in record mode;
- audible check on recorded pilot tone by pushing 'pilot' button—a

1 kHz beep every second is heard in the cans;

- built-in 1 kHz reference oscillator.

The unit is self-powered, measures 200 × 160 × 50 mm (w x d x h) and complete with a Nagra SN weighs just 1.75 kg. Noriyuki Electronics, PO Box 242, Amsterdam 1000AE, Holland. UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW. Phone: Gerrards Cross 88447. Telex: 847469.



The Noriyuki SNM-3 minimixer and its raison d'etre, the Nagra SN. Front-panel controls include headphone gain; dynamic or a/b powered capacitor mic switch; 'flat' or low-frequency cut switch; battery check; 1k Hz tone button; 'direct' or 'off-tape' switch; gain controls for the two mic inputs; and a function switch. Price in the UK is about £650. A 'multiplier' unit will be available shortly to convert the 10 Hz pilot tone to 50 Hz (plus separating it from the audio signal). This will allow taped material to be transferred to a Nagra 4 machine, or facilitate direct dubbing in a 50 Hz transfer bay.

"ON AIR"



From the beginning the Technics SP 10 Mark II was designed as a 'no-compromise' broadcast-standard turntable.

It is already installed in many broadcasting stations both here and abroad.

The reasons are many and varied.

In 1969, Technics were the first to introduce the DC electronically controlled direct drive principle to the world with the SP 10.

With the experience gained we've never looked back, and the SP 10 Mark II represents a considerable advance in turntable technology.

Take speed accuracy. Wow and flutter are an insignificant 0.025% WRMS. And speed drift + or - 0.002%. Rumble is also very low at -70 dB.

Through the use of a quartz locked drive system a very high torque is developed by the motor. This results in an instant start facility which takes the record from 'stop' to 33 $\frac{1}{3}$ in 0.25 secs.

And in addition you can change from one speed to another very quickly. 33 $\frac{1}{3}$ to 45 in 0.1 sec.

Another benefit is that a record can be easily cleaned 'on air' with no audible speed variation.

The three speeds (33, 45, 78) are selected by illuminated microswitches and the start/stop function can also be remotely operated. Extremely useful if you are operating a bank of turntables.

The power supply is separate and the mains supply is not directly linked to the turntable, thus avoiding any possible hum problems.

For more information about these and other benefits just write to Technics, 107/109 Whitby Road, Slough, Berkshire SL1 3DR. Tel: Slough 27516.

 **Technics**

The SP 10 Mark II Quartz-controlled Direct Drive Turntable.

NEWS

Philips desks

A new range of desks for radio and multitrack studios, known as the *LDC 35*, was introduced at the recent Montreux exhibition. The range uses a selection of standard 30-mm wide modules also found in the *LDC 15* and *25* range, combined in a new and larger stock frame size.

In addition to the standard modules, the new frame allows longer channel modules to be fitted. These have three instead of two auxiliary sections, an extended choice of channel amp sensitivity settings, a channel mute and post-fade listen.

Use of 30-mm modules enables a mixer with 40 input channels, 24 output groups and 24-track monitoring facilities to be housed in a console just 1.6m wide.

NV Philips Gloeilampenfabrieken, Electro-acoustics Division, Eindhoven, The Netherlands.
Phone: 040 784616.

UK: Pye TVT Ltd, PO Box 41, Coldhams Lane, Cambridge CB1 3JU. Phone: Cambridge (0223) 45115.

US: Philips Audio Video Systems Corp, Audio Division, 91 McKee Drive, Mahwah, NJ 07430.
Phone: (201) 529 3800.

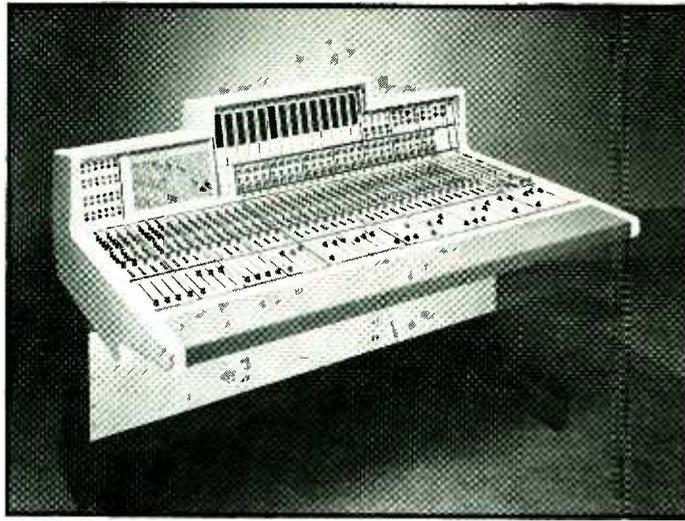
Trendy IFPI boss

A 'Trendsetter' award, the citation to which reads: 'For waging a battle to get records regarded around the world as cultural commodities', has been awarded to Gillian Davies, assistant director general of the International Federation of Producers of Phonograms and Videograms (IFPI). The awards are made annually by Billboard Publications to those who, in the opinion of their editorial board, have made an outstanding contribution to the record business during the previous year.

FRAP it

The forthcoming Emerson, Lake and Palmer extravaganza/tour of the USA this Autumn should prove interesting in more ways than one. Not only are ELP scheduled to play some 40-odd dates from San Francisco to Toronto complete with a 50-piece orchestra, but most of the orchestra's wind and string instruments, plus the group's acoustic guitars, pianos and gongs, will be fitted with electronic pick-ups.

A FRAP (it stands for 'flat



40-input desk from the Philips LDC 35 range.

response audio pickup') *FS200* stereo system will be used to amplify Greg Lake's acoustic guitar, Keith Emerson's acoustic piano and Carl Palmer's gongs, plus various violas, violins, cellos and bass violins. A collection of battery-powered *W5-200s* will amplify the orchestra's flutes, oboes, bassoons, contra-bassoons, piccolo, English horn and soprano sax.

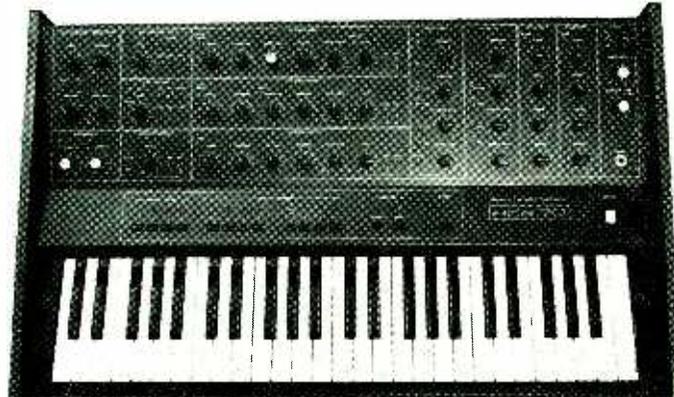
It is claimed to be the first time that an entire symphony orchestra has been amplified with electronic pickups 'to achieve a natural sound at extremely high volumes' (sic).

A last word from the system's inventor, Arnie Lazarus, for whom amplifying an entire symphony orchestra was the culmination of an 8-year-old dream:

'I got a real emotional charge out of the whole shebang . . . and the added pleasure of working with a bunch of pros whose first priority was to hire the very best people for any given job and pay them for their work. I didn't see any prima donna trips go down; no screaming tantrums. It was a pleasure to work under these conditions'.

Details of how to FRAP a Strad

Audio Systems Electronics' programmable synthesiser.



can be obtained from: Box 40097, San Francisco 94140, USA. Phone: (415) 543 5458.

Memory-controlled synthesiser

Audio Systems Electronics, a recently formed Italian company, has developed what they claim to be the first completely programmable electronic music synthesiser. Programs, in the form of front-panel knob and switch settings, are stored in digital form on four cassettes in the rear of the instrument. Up to 16 different programmes can be memorised on each cassette, allowing a library of pre-recorded sequences to be stored for later use.

An optional interface can be provided to allow the synthesiser to store several hundred programmes on floppy disc. The *MCS70* can also be interfaced with a computer, or used in conjunction with an automated mixing console.

The following basic units are provided:

Oscillators: three 6-waveform vcocs, range 0.1-30k Hz, plus a 4-waveform lfo for control, range 0.03-

300 Hz.

Noise generator: white or pink, plus random voltage for control applications.

Filters: two vcfs, one high or lowpass filter and a lowpass only.

Envelope generators: two 4-stage units with adsr parameters variable from 1ms to 50s.

Amplifiers: two vcocs with parallel controls, switchable linear or exponential.

Keyboard: 4-octave with opto-electronic keys.

The synthesiser is expected to cost about \$7-8k.

Audio Systems Electronics, Via Colatina 76, 00171 Roma, Italy.

US: Tom Gamache, 26150 Veve Way, Calabasas, Ca 91302

16-track for September

September Sound Studios, which was set up by Look Records to provide recording facilities for its custom-pressing clients and contracted artists, has now gone 16-track and is offering rates of £10 per hour—plus block-booking discounts.

The studios have been in their present premises for two years and were previously operating 4-track. A new 16-track (prewired for 24) Lyrec *TR53* has now been installed, and is linked to their existing Sound Techniques 18/4/18 desk. Other control room equipment includes several Ampex *AG440* stereo machines, Revox *A77s*, Dolby *A* noise reduction units, Neve stereo compressor-limiters, an EMT *240* echo plate, an Eventide *Instant Flanger*, Astronic equalisers and a H/H loop echo.

Up to 45 musicians can be accommodated in the 14 x 8 x 6 m studio. As well as an upright and electric piano, prospective clients can use a pipe organ in the church next door. But not, we are told, on a Sunday.

More information can be obtained from the studio manager, Dave Whiteley, at: September Sound Studios, 38 Knowle Road, Golcar, Huddersfield. Phone: Huddersfield (0484) 658895.

IBC 78

Next year's International Broadcasting Convention will be held from September 25 to 29 at the new Wembley Conference Centre, London.

Enquiries should be addressed to: The Secretariate, International Broadcasting Convention, IEE, Savoy Place, London, WC2R 0BL.

Are you really serious about a new console?



Model Pacifica 28 Input/16 output

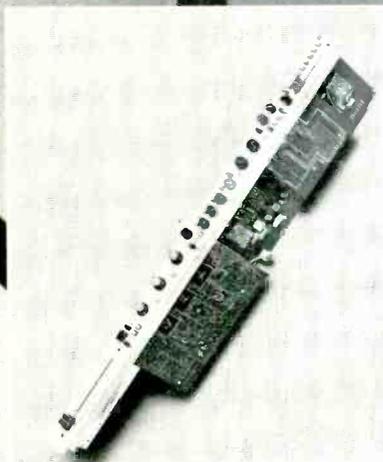
We know that buying a large multi-track console is no small decision. For most professionals, it's one of the largest investments you'll make — a decision that you'll have to live with for years.

There are a lot of companies making consoles. Many perform adequately. Others are compromises. Few have all of the features and performance at a reasonable price. So, what are we leading up to? A simple statement of fact that you should consider seriously if you're really interested in an outstanding console system: Quad/Eight has an enviable reputation for quality and reliability. It's something we've worked at for over 10 years. We've also had a reputation for building the industry's most expensive systems too. Now, relax. Our new modular series consoles look expensive. Truth is, they're priced right in the same category as our best competition. In addition to having the best human engineering for operational ease, they're loaded with more features and performance:

- 3 band, 33 overlapping frequency equalization
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If you're really serious about a new console and the quality of your work, then do yourself a favor and contact us for full information on a new outstanding line of modular consoles.

*The Coronado, 40 Input/24 Output equipped with Compumix III available in October, 1977.



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NEWS

Ccd digital delay

Industrial Research Products has introduced two new digital delay units that incorporate ccd technology. Both the *DC-1011* and *DD-1012* offer 96 ms of delay in 4 ms increments at two independent outputs. The only difference between the two units is a tamper-proof front panel fitted to the *DD-1012*, behind which the controls are recessed.

Dynamic range is said to be greater than 90 dB, pre-emphasis equivalent to 50 μ s, and distortion less than 0.25% at 1 kHz. Input and outputs are transformer isolated. A red led indicates peak clipping level, while a green led lights at 14 dB below clipping to warn you to back off a shade.

Both units are rack-mountable and measure 483 x 44 x 216 mm (w x h x d). Nominal weight is 4.1 kg.

Industrial Research Products Inc, 321 Bond Street, Elk Grove Village, Ill 60007, USA.
Phone: (312) 439 3600.

UK: Knowles Electronics Ltd, Victoria Road, Burgess Hill, Sussex RH15 9LP.
Phone: Burgess Hill (04446) 5432.
Telex: 87460.

Circuit 77

Is the title of a touring exhibition of sound and communications equipment organised by the Association of Sound and Communications Engineers. On display will be amplifiers, loudspeakers, cartridge players, communications systems, intercoms, microphones and stands, mixers, radio paging equipment, and studio gear.

The three exhibition venues are as follows: Grand Hotel, Broad Street, Bristol (October 31); Midland Hotel, Peter Street, Manchester (November 2); and Windmill Hotel, Mill Green View, Seacroft, Leeds (November 3 and 4). Admission is free.

Further information from: ASCE Ltd, 47 Windsor Road, Slough, Berks. Phone: Slough 39445.

Eagle pa equipment

Their new rack-mounting series of amplifiers comprises: *TPR 300* rated at 30W rms with a frequency response ± 1 dB 45-20k Hz; *TPR 600* rated at 60W rms with a frequency response ± 1 dB 45-20k Hz; and *TDR 900* rated at 120W rms with a frequency response

± 1 dB 45-20k Hz.

All three amps have low impedance and 100V-line outputs, plus open-circuit and short-circuit protection. Inputs comprise two low-impedance mic (200-600 ohm, balanced) and one high-impedance mic (50 kohm, unbalanced). Separate bass and treble controls provide 14 dB cut/boost at 100 and 10k Hz.

A slave amp, *TPR 800*, with similar specifications to the *900* but without tone controls, is also available.

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU.

Phone: (01) 902 8832. Telex: 922131.

Cheaper Delta-T

Lexicon has announced price reductions of up to 23% on its *Delta-T 102* range of digital delay systems. This latest cut is in addition to the 10-15% reductions introduced earlier in the year (see February '77 issue, p22).

The actual percentage price reductions will be dependent on the system's configuration. As an example, a 'typical' stereo system with two independent input channels, 240 ms of delay, three outputs, and a vco special effects module will now cost \$4700, against a previous price of \$5894. FWO Bauch, UK distributor of Lexicon gear, tells us that the UK price of such a system will now be reduced to £3330.

Lexicon Inc, 60 Turner Street, Waltham, Mass 02154, USA.

Phone: (617) 891 6790.

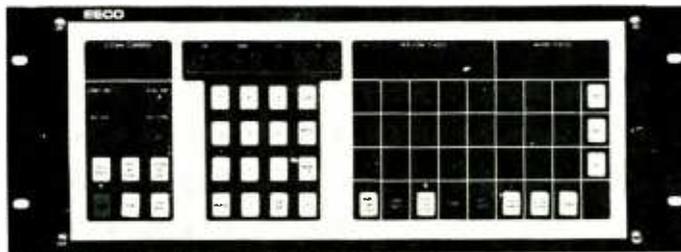
UK: FWO Bauch, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.

Phone: (01) 953 0091. Telex: 25703.

IBA technical review

The third edition of the IBA Technical Review number 2 is mainly devoted to tv equipment, but also contains two interesting articles relating to independent local radio stations. Of equal interest to broadcasters should be an article describing the IBA procedure for making distortion measurements of tape machines, mixers, line networks and transmitters.

Subject to availability, copies of the review can be obtained from the Engineering Information Service, IBA, Crawley Court, Winchester, Hampshire SO21 2QA. No charge is made for small quantities.



Audio/video tape synchroniser

Three tape transports can be synchronised simultaneously by the latest EECO microprocessor-based *MGS-100*. The transports can be mixed to include audio, video or magnetic film units.

SMPTE/EBU time code, which consists of an 80-bit digital code generated 25 times per second (30 in the USA), is recorded on an audio track and provides unique identification based on real time. During replay, codes from different tapes are compared and the transports electronically controlled to provide synchronous operation.

A & D in SF

Audio and Design has appointed the following direct sales representative for its products in the San Francisco Bay Area:

Nigel Bramwell, 737 Eardley Ave.ue, Pacific Grove, Ca 93950, USA.

Phone: (408) 372 4312.

Audio engineering courses

The next part-time day course on 'Sound Studios and Recording', organised by the Polytechnic of North London, commences on October 27, and runs for one year. Lectures and seminars are held every Thursday, from 2.30-4.30 pm, and cover studio principles and techniques including electronics, transducers, room acoustics and recording methods.

Further details can be obtained from: Roger Driscoll, Department of Electronic and Communications Engineering, The Polytechnic of North London, Holloway, London N7 8DB.

Phone: (01) 607 6767.

Re-organised Altec

The company has created two separate divisions within its Sound Products Division to meet the growing need for their products. Professional sound products will

▲ The *MGS-100* can also cope with code offset, allowing tapes with different indexing to be synchronised.

System modes include high-speed search and cue, 'follow the leader' or 'chase', synchronised playback, fast and slow synchronisation and roll back with automatic resynchronisation (the code can only be read while moving). One button actuates all transports to roll back, start forward and synchronise automatically.

EECO, 1441 East Chestnut, Santa Ana, Ca 92701, USA.

Phone: (714) 835 6000.

Or Ampex sales offices.

now be marketed through the new Altec Lansing Sound Products Division. The other new division, Altec Lansing International, will assume responsibility for both consumer products and foreign marketing of all Altec lines.

Further details from: Altec Corporation, 1515 S Manchester, Anaheim, Ca 92803, USA.

Phone: (714) 774 2900.

Wrong BASF address

Apologies to BASF for printing their wrong address and phone number on p67 of the August issue. It should have read: Haddon House, 2-4 Fitzroy Street, London W1P 5AD. Phone: (01) 637 8971.

Broadcast consoles

Two new 12-page booklets are available from Cetec describing its range of consoles and studio equipment. One booklet is devoted to the *Centurion Series* and *3000-series* consoles, while the other contains details of other consoles, studio and remote broadcast 'furniture', and monitor loudspeakers. Copies can be obtained from: Cetec Broadcast Group, 75 Castilian Drive, Goleta, Ca 93017, USA. Phone: (805) 968 1561.

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Compressors and limiters: their uses and abuses

Mike Beville *

*Audio and Design Recording

The compressor-limiter is an extremely valuable tool in the field of creative music recording. Like any device, however, the greater the understanding an engineer has of its operation, the better will be the results obtained from its application.

TYPICAL PURPOSES of limiting and compression are to provide system overload protection, so avoiding distortion or even damage; reduce dynamics to make a more acceptable or comfortable range of sound level; and increase loudness or create impact.

Function

The compressor-limiter is primarily a linear audio amplifier with a voltage-controlled attenuating element. The control voltage is derived from the signal being processed in what is known as the 'side-chain'. The characteristics of the side-chain will determine the dynamic performance of the system: its sensitivity will establish the threshold level (the point at which gain reduction commences); its loop gain above threshold will control the slope or ratio (the relationship of input to output level); the way in which it integrates and derives the control signal will establish its attack characteristics, whether it be peak sensing, averaging or rms. The speed of operation, or attack-time, will depend on the integration time and any additional CR network. The recovery or release-time is normally controlled by CR networks, either singly or in a multiple arrangement. It is primarily the range of attack, release and slope characteristics which will determine performance possibilities and application.

Limiting

Limiting implies the use of a level control system to give overload protection; its purpose is to 'limit' the signal at a specified level. The amount of overshoot (the amplitude of a transient allowed to exceed the steady-state limit threshold) will be determined by the attack time. The effect of stopping every transient, no matter how fast, is likely to result in a lower average level, with audible side-effects such as a 'gritty' sound and switching spikes. Delay-line techniques, of course, can have a zero overshoot without these side-effects, but will still result in a lower than average modulation level.

There is a growing consensus of opinion which suggests that it is better to have limiter attack-times of some 250 μ s to 1 ms, allowing the very fastest transients (which will not be visible on a ppm) to overshoot and in the extreme instance saturate the tape. Such an

approach preserves the wave-front information that essentially gives the transient its characteristic, reduces side-effects within the system, and increases mean level for a given amount of gain change.

Where ultra-sensitive systems are involved—as in the case of am transmitters or pcm links—a diode-clipper is usually incorporated. Extensive tests conducted by the BBC several years ago demonstrated that a limiter with a medium attack time followed by a diode-clipper some 2dB above the limiter threshold, sounded more satisfactory than using a super-fast attack time.

The compression ratio in a limiter will need to be greater than 10:1, and will typically be of the order of 20 or 30:1 (see fig. 1). Although units are available with even higher ratios (100:1), it will be appreciated that in normal use the difference between 20 and 100:1 will be microscopic in terms of increased output, and the tighter slope will be certainly more audible.

The action of limiting must involve a peak-sensing side chain as it is peak level that is being controlled. When limiting, programme dynamics are not greatly modified since gain reduction—when it does occur—is usually momentary, of small magnitude and relatively short duration (a fast release-time being usual so that the action of recovery is inaudible).

However, 6 dB of limiting can make all the difference between background noise being audible or inaudible. The action of limiting thus allows an engineer to reduce his 'headroom' or overload margin, and thereby extend the dynamic range of his recording or transmission medium without fear of overload. In the limit mode, the compression ratio is said to be 'tight' because whatever the increase at the input, the signal level at the output cannot rise significantly.

Compression

Compression is used to describe conditions of gain reduction that are more or less continuous; the original dynamics are compressed or reduced. Compression ratios may be anything from the softest slopes (typically 1.5 or 2:1) to the tightest 'limit' slope, dependent on the effect required. The ratio simply specifies the relationship between the input and the output levels. The normal relationship in an amplifier is 1:1; in a compressor or limiter this relationship changes above the threshold point and the output level rises at a slower rate compared to the input. For example, if a 2:1 slope is selected, for every 10 dB rise above threshold at the input the output increases by only 5 dB (see fig. 1).

When it is desirable to compress, yet retain the maximum dynamics within the signal content, it is preferable to use a soft slope with a slowish or multiple release time. For a given amount of compression or gain reduction, the threshold on a soft slope will be lower than for a tight limit ratio. The same compression effected on the two slopes will sound different: on the 2:1 slope it will be hardly detectable, while at 20:1 it will be more noticeably stopped or limited.

Attack time

Attack time will determine the characteristic and size of peaks

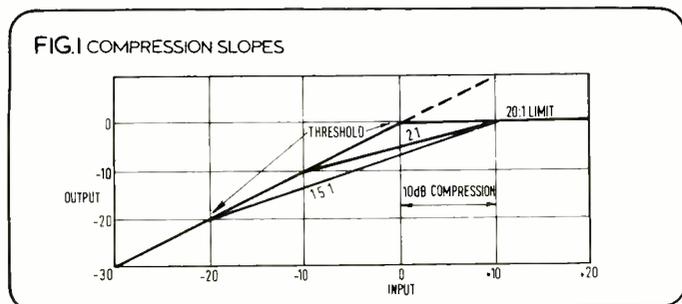
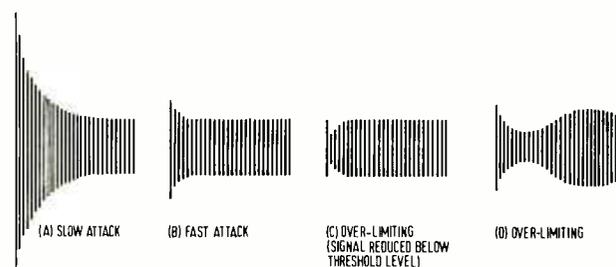


FIG. 2 ATTACK CHARACTERISTICS



allowed to pass through the system prior to attenuation; in effect it will dynamically modify the static sinewave response of the compression ratio. Slow attack can be observed on a ppm as overshoot, and is apparent aurally as a softening or easing on a tight limit ratio. As attack time lengthens, a subtle change takes place in the spectral energy balance as increasingly high frequency content passes unattenuated and, in extreme cases, can lead to sibilant accentuation. Slower attack times are useful especially when considerable compression is required with a tight ratio for maximum impact on an instrumental track (eg bass or drums).

Fig. 2 shows various attack characteristics on a pulsed sinewave; 2a and 2b show good waveform envelopes as the signal is smoothly attenuated to the threshold level; 2c and 2d are examples of over-limiting and poor design, and will sound constricted.

Release time

Release time is very important since it determines the moment-to-moment gain change in the system, which in turn controls loudness. Under conditions of considerable compression, very fast release time and tight ratio, the medium and low level signal content is raised to peak level (see fig. 3), thus increasing *subjective* loudness. (The definition of subjective loudness: sounds louder, but is at the same peak level). In the extreme, fast gain change becomes noticeable as 'pumping' or 'breathing'—the effect of background ambience and reverberation rising and falling in level. Pumping and breathing can be used for effect, but when unwanted can be minimised by either increasing the release time (or using a programme-controlled release network), reducing the amount of compression, or softening the ratio.

A programme-controlled release is obtained by means of a multiple network that gives two or more release times, dependent on signal level. It is intended to provide maximum gain change without pumping effect. Usually this means a fast release over 4–6 dB gain reduction before turning into a medium or long recovery time. The effect is sometimes described as a gain riding platform, and is ideal when considerable overall long-term compression is required (eg am broadcasting).

Where a fast rate of compression is essential, side-effects can be greatly reduced by recording in a dead acoustic with good separation and compressing prior to tape. By reducing reverberation, ambience and any cross-mic pickup there is little to indicate that gain change

is occurring, and the engineer may be surprised at how much compression is possible. It should be noted that as the release time becomes shorter, low frequencies are increasingly flattened by the attacking action on each cycle. Fortunately the ear is very tolerant of lf distortion. In practice, therefore, this is not a major problem and can be used for effect (slowing the attack 'rounds' the distortion), and in any case is completely under the control of the operator. For bass instruments a release time of greater than 0.4s will give a totally clean sound.

Noise and modulation effects

Self-generated noise in compressors is rarely a problem in professional units. However, source noise can be raised through the action of compression on acoustic noise such as ambience, rumble and spill-over from other instruments. If you compress off-tape, a 15dB gain reduction means an increase of 15 dB in tape noise (unless you use an expander). Even so, one should remember there is little or no masking of hf noise with a bass instrument, and it will be best to obtain the required sound before going onto tape.

Modulation of the signal by specific instruments can best be avoided by compressing individual or groups of similar instruments. There is then no dominant line to modulate another. It is impossible to limit a high-level lf signal without a most obvious and objectionable modulation of high-frequency signal and ambience (unless bandsplitting techniques are used). Such sounds must be treated as a separate track—get it tight and well controlled on or before the final mix-down.

There is often the need to compress a balanced programme where the dynamic range of the new medium may be more restricted. Modulation effects can be minimised by using a soft slope, a programme controlled release or an averaging side-chain. Some units incorporate or make provision for the insertion of equalisers into the side-chain to modify system response. Cutting the lf content will reduce any modulation effects caused by bass instruments, so that compression is controlled from the mid-band signal. This can only apply to compression, since limiting may produce sudden surprises as lf signals exceed the established limit threshold.

Boosting frequencies in the side-chain can also be used to advantage. An hf lift can predispose the compressor to operate on sibilants—with a variable frequency equaliser the engineer can find and boost the sibilant frequencies. Normally a tight slope would be used, along with a fast release and attack time. Compressor gain would be adjusted so that attenuation only occurred in the presence of sibilant signal. This is best done on a separate vocal track to avoid modulation of the whole programme.

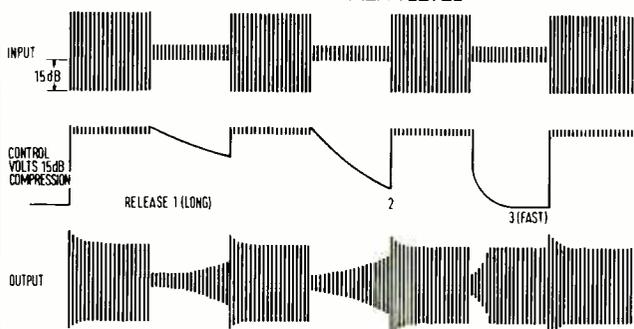
Compressors need to incorporate some system gain (typically 20–30 dB), which means that normal line levels can be compressed by the amount of gain available, yet still appear at the output at the standard operating level in the chain. This allows comparison between the direct and processed signal.

A conventional compressor-limiter usually offers a range of ratios (eg 2, 3, 5, 10 and 25:1), but while the operator might prefer to use the softest slope (2:1) this can only be done on a well controlled signal. On a more unpredictable signal (for example, vocals), one might feel the need for overload protection as well as compression. On such a system a compromise must be struck by selecting a 5 or 10:1 ratio, which may not be quite so good artistically. In the more exotic units, it is often possible to compress at any ratio yet retain a limiter slope over the compressor. It is usually possible to vary the relationship between the compressor and limiter thresholds, so determining the amount of compression before the onset of limiting. Simpler systems may adopt fixed thresholds which, after say 10 dB compression, tighten to the slope of a limiter. Both approaches would allow the use of the softest slopes without fear of overload.

Expansion

The addition of an expander or gate greatly adds to the effectiveness of a unit. Besides reducing the increased source noise due to compression, the expander section can clean up tracks and dramatically reduce cross-mic pickup from other instruments. Gates are rather like limiters in reverse: typically, for a change of 1 dB at the input, the output falls by 20 dB, the rate being dependent on release setting. They can work well on punchy, well-defined dry sounds, but due to the switching type characteristic are usually critical to set up.

FIG. 3 EFFECT OF RELEASE TIME ON MEAN LEVEL



COMPRESSORS AND LIMITERS: THEIR USES AND ABUSES

The expander may be likened to the compressor, except that it is operating on a low-level instead of a high-level signal. The softer the slope, the easier it is to use without modulation side-effects; but the softer the slope the less useful it is in attenuating noise effectively. In most recording applications, the purpose of an expander gate is not to expand the music, but to get in below the low-level signal and attenuate the channel gain in the presence of noise only.

Imagine that on a particular programme the noise lies 10 dB below the wanted signal. By setting the expander threshold just under the music, it will be possible to lower the noise by a further 10 dB with a 2:1 expand slope. At this point it will be held on the noise itself. A tighter slope, of say 4:1, would increase the separation to 40 dB but the more susceptible to modulation effects.

For general track attenuation, a combination of peak sensing and averaging appears to be the correct side-chain characteristic, so that it opens quickly when necessary yet modulation effects are reduced on decaying signal. For creative work the peak sensing side-chain may offer greater options.

Matching

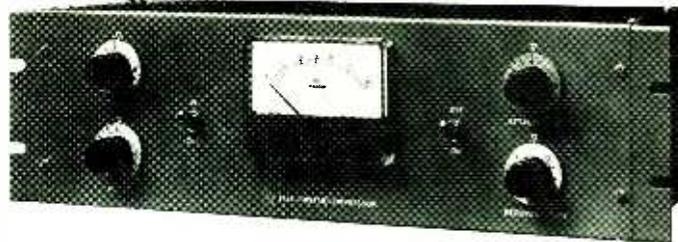
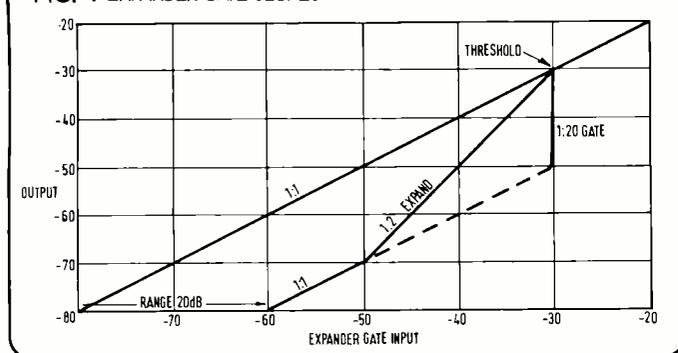
Stereo matching is a very important aspect since gain reduction must track very closely if there is to be no image shift during compression. Although mono units are sold with coupling possibilities, the potential user should establish the manufacturers stereo matching tolerances, since this is rarely stated. Purpose-built stereo units are likely to be more predictable in performance.

Metering

Gain reduction or compression is normally indicated on a meter or light system. Whatever the quiescent gain established in the device, this shows the moment-to-moment gain reduction occurring in the channel. In a combination unit, it could be limiting, compression or even expansion (although in the latter case there is usually some other indication of what section is functioning). In addition to showing gain reduction, it is customary for the meter or light column to give a visual indication of release-time. Clearly in the case of the meter, accuracy depends a lot on the ballistics, but it is normally a good guide to the rate of gain-change going on in the system. One should remember that although there may be a high compression reading, this does not necessarily mean that there is a lot of gain change operating—an indication of increased loudness will be the *rate* at which the meter moves. For little movement there will be little increase in loudness (other than the long term increase in lower level signal); where the change in dynamics within the music is faster than the release time, the music will hardly be affected whatever the amount of compression shown. It may be said that *the rate of gain change determines loudness*.

Vu metering is widely used in studios. However, since it doesn't indicate peak level a variation in setup procedure may be considered advantageous when using a peak-sensing compressor-limiter. If it is set up on tone, the vu will probably under-read by 6 dB when operational on a compressed or limited dynamic signal, and only approach zero vu under conditions of fast gain change. Bearing in mind that any system that uses vu monitoring must have good headroom (peaks in excess of 10 dB being not uncommon), it makes

FIG. 4 EXPANDER GATE SLOPES



Control facilities have come a long way from this: see survey p 34.

sense to set up under dynamic conditions so that the vu meter reads zero vu at least. Using fast attack in this circumstance the engineer can be confident that peak level is being well controlled some 6 dB higher without fear of sudden overload—well within the normal operating range. This may not apply to an rms or averaging device where peak levels may be less predictable.

Application notes

In any recording work, whether classical or pop, it will be best to apply compression to the sections needing it, rather than overall. Where this is not possible, gain reduction will probably be restricted to some 6–10 dB, if its effect is to be inaudible. Up to about 6 dB can be accomplished as limiting with a fast release (fast enough so that recovery is inaudible); over this it may be best to use an automatic release network, where possible, with a soft slope and the limiter coming in on top. In this way maximum dynamics are retained.

Studio

The effect of compression on signals containing plenty of presence frequencies, especially with ambience (ie choral work), is for the signal to recede as gain reduction takes place. Using the soft slopes will allow the sound to really get louder and reduce the impression of a receding image.

Using a tight slope on bass or bass drum, with fast release and medium or even slow attack, will give a bigger sound as the decaying signal is lifted to the level of the initial peak, creating a sustain. The acoustic will considerably affect the character of the sound, and is worth experimenting with.

Piano will come through well using a tight slope, medium/slow attack and fast release. The same goes for vocals in a rock group where high mean levels must be maintained to retain intelligibility. Some presence can be added after compression to help. More normally, the use of the softer slopes on vocals will retain expression and dynamic range. Compression with fast release will compensate for movement around the microphone.

Where direct injection is possible (for example, on bass, rhythm, lead and keyboard instruments), it can be worthwhile compressing the direct signal (to avoid spurious pickup) and mixing this with acoustic pickup.

Weaker instruments (like violins) can be given more body by compression; care must be taken, however, to watch out for pickup from foldback headphones. If this happens a good expander will maintain a clean track. With vocal or handclap overdubs, pickup from cans will be a problem; in this case impressive cleanup can be achieved with a gating action.

Gating or expanding the bass drum (depending on separation) can also be effective. A fast attack filter will give a sharp edge (like a stick), while slow attack will create a mellow, rounded 'leather pedal' sound. With fast release, the threshold should be adjusted until maximum cleanup is obtained.

When there is a lot of splash from cymbals (the mic was probably wrongly placed) it may be best to use a slower attack, so as to respond to the drum rather than the cymbal. A gate with a frequency conscious side-chain could be helpful.

Selective expanders or dynamic filters have proved to be useful. A highpass version can be used to attenuate low-level acoustic rumble or electronic hum, until sufficient wanted lf is present to mask it. At this point the system would be adjusted to give a flat response.

Similarly, a lowpass dynamic filter can attenuate electronic hiss or high-frequency splash around a bass instrument, or be used with guitar and keyboards—opening to give a flat response in the presence of wanted hf transients and signal.

The Studer A68 Amplifier — a powerful break with tradition

The Studer A68 is a unique breakthrough in high power amplification for professional use. Its 100 watt per channel (into 8 ohms) power capability is achieved through completely new design concepts which have eliminated transient intermodulation distortion while keeping harmonic distortion below 0.1% at all power levels. The result is a fully professional low distortion amplifier ideally suited to continuous high power operation under arduous studio conditions.

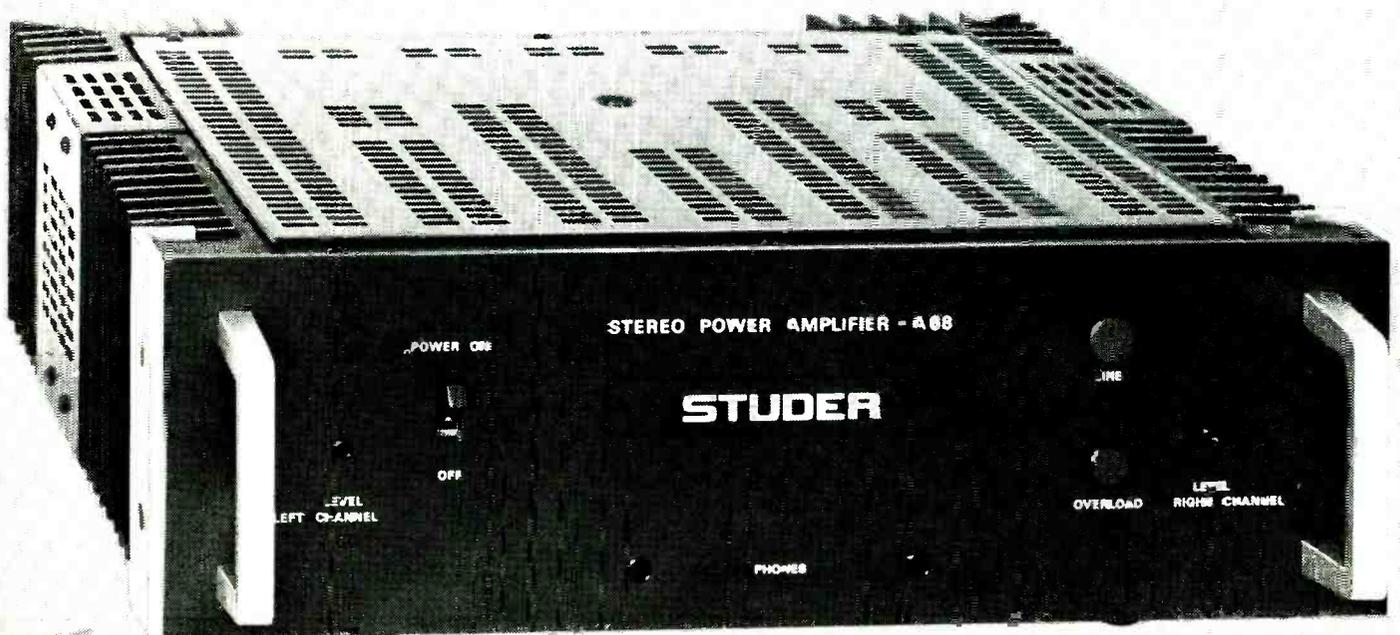
Other features of the Studer A68 include:

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COMPRESSORS AND LIMITERS: THEIR USES AND ABUSES

Stage

Expanders can make a useful contribution to stage work on vocal mics and direct injection keyboards since often more are kept live than are being used at any one time.

In sound reinforcement situations, compression can considerably add to the effective power output of the system. This can either be achieved by a limiter alone, or a compressor-limiter combination. Overall limiting would be essential to protect amps and speakers. Care must be taken to allow for increasing gain on recovery, which will affect feedback levels.

Expanders with variable range control can be useful in recording speech against a high ambient noise level. In such cases it is probably best to accept some noise, rather than try to eliminate it all. This can be done by adjusting the range for approximately 10 dB attenuation with medium attack and fast release, and then setting the threshold to open on voice. Background noise will be masked by the voice and attenuated during pauses by 10 dB.

Classics

In classical recording where high-level compression causes a reduction in upper-level dynamic contrast, an alternative form of compression can be arranged.

When a limiter-compressor is placed in parallel with the direct signal, it is possible to obtain low level compression; the advantage being that the slope gets progressively softer as level rises, until finally returning to a 1:1 condition. In order to retain a correctly related internal dynamic balance between the original and compressed signal, it is essential to have a very soft slope with low threshold level. Compression commences just above the lowest signal level; this way the compressed signal can be a true reduction of the original.

Happily one of the effects of arranging the compressor in parallel is to soften even further the slope selected: for example, the 2:1 ratio

is reduced to >1.5:1, while a 1.5:1 slope becomes 1.25:1 with a threshold of 60 dB down on peak level.

The procedure is as follows: adjust the direct signal for required peak output (if live signal it may be preferable to use a limiter on the final output); connect a compressor in parallel and select the lowest ratio available that will give 20 dB reduction; adjust the compressor to give 20 dB compression at peak input level; then set the peak output level of the compressor to be 10 dB below the peak level of the direct signal. The two signals are mixed and the effect will be approximately 12 dB overall compression.*

Although this is similar to the Dolby arrangement, it would be unwise to use Dolby units as single-ended compressors since there will be considerable spectral energy distortion due to the action of the band processors. Plus the drawback that since Dolby units use a limiter slope the ratio will be too tight.

Conclusion

A wide range of limiters and compressors are currently available to meet the many applications to which they are now put. Simpler devices, although in general easier to operate, must compromise on the range of options available, which in turn restrict their application in creative engineering.

By their very nature, units that offer greater flexibility require a higher degree of operational competence and discipline on the part of the engineer. It is essential that he understands what he is trying to achieve, and know what needs to be done to get the effect he is after. It is inevitable though, that in inexperienced hands combinations of such widely varying parameters could produce disappointing results.

It is a sad fact that, due to occupational pressures, many engineers just don't get time to fully explore the possibilities of their auxiliary equipment: for those who do, the rewards can be high. It is so often the ability to produce that little extra something that brings recognition by an artist and earns an engineer the accolade: *master of his art*.

**Detailed application notes are available from the author. A large sae would be appreciated.*



HHB
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NEW LOCATION
Unit F. New Crescent Works
Nicoll Road London NW10 9AX

IAN JONES
01-961 3295

The Professional's Choice



The Adaptable A77

The industry's workhorse. Over 400 versions ensure that an A77 is suited to your particular application. Make your choice from five tape speeds, three track configurations, Dolby noise reduction, varispeed, three enclosure styles, power amplifiers, remote controls, voice-operated auto-start, balanced input/output, NAB or IEC equalisations, built-in loudspeakers... etc., etc. The standard echo and track-to-track facilities of the A77 are as well known as its proven track record over the past decade. The machine by which all others are judged.

The Versatile A700

The deck that closes the gap between top ranking amateur tape recorders and full grown professional studio machines. Full logic control and motion sensing, 3 tape speeds, real-time counter, open head format, built-in mixer with balanced mic. inputs and RIAA pre-amplifier make the A700 a self-contained and versatile recording system.

The Modular B77

Latest addition to the Revox range, the B77 with its logic control, self-sharpening tape cutter, easy access to heads, remote and varispeed controls and modern styling make it the natural choice of the semi-professional and the true Hi-Fi enthusiast.

Sole U.K. distributors, F.W.O. Bauch Limited, 49 Theobald Street,
Boreham Wood, Hertfordshire WD6 4RZ.

STUDER REVOX

Survey: compressors and limiters

Forthcoming surveys include 2 and 4-track tape machines (December), multitracks (January) and equalisers (February). Information for inclusion should reach the editorial office (address p 3) not later than six weeks before the issue publication date.

ALICE

Stancoil Ltd, 38 Alexandra Road, Windsor, UK.
Phone: Windsor 51056. Telex: 849323.

The company will only supply limiters and compressors as part of a small mixer or as modules in their larger desks. Their 62/3 6 and 8-channel mixers can be fitted with limiters in each output group, but are not accessible for external use.

ACM Module

Contains two compressor-limiter units with switched stereo ganging. A gate/expander system will be incorporated at a later date.

Noise: 68 dB (no conditions).

Total harmonic distortion: $\leq 0.2\%$ (no conditions).

Attack time: 1-20 ms.

Release time: 250 ms to 2s.

Ratio: 2-30:1 in six steps.

Threshold: variable.

Price: approx £140.

ALLEN & HEATH

Allen and Heath Brenell Ltd, Pembroke House, Campsbourne Road, Hornsey, London N8, UK.
Phone: (01) 340 3291. Telex: 267727.

US: Audiotekniks Inc, 142 Hamilton Avenue, Stamford, Conn 06902.

Phone: (203) 359 2312. Telex: 230996519.

Agents in Canada, Belgium, France, Germany, Austria, Greece, Italy and Portugal

FEED FORWARD DELAY LIMITER

See review p70.

The unit employs an analogue delay circuit in the main signal path that activates a side-chain limiter circuit in advance of an incoming transient peak. This is claimed to eliminate normal limiting-related problems such as transient distortion and overshoot. Variable threshold, release time and output level are featured, plus an overload indicator, stereo linkage and a 3-position led ppm.

ALLISON

Allison Research Inc, 2817 Erica Place, Nashville, Tenn 37204, USA.

Phone: (615) 385 1760.

Export: Gotham Audio Corporation, 741 Washington St, New York, NY 10014, USA.

Phone: (212) 741 7411.

UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts, WD6 4RZ.

Phone: (01) 953 0091. Telex: 27502.

GAIN BRAIN Model 700

A unit containing the 'unique' combination of peak and rms limiters plus high-speed led readout.

Altec 1612A limiter amplifier.



Several units can be connected for tandem limiting.

Noise: ≤ 83 dB below threshold of peak limiting.

Total harmonic distortion: $< 0.3\%$ < 40 -15k Hz.

Gain: 0-30 dB reduction.

Attack time: peak section: < 1.5 dB overshoot 1 μ s after application of 50 kHz tone burst exceeding the threshold of limiting by 15 dB; rms section: 7-40 ms for 90% ultimate gain reduction, dependent on complexity of waveform, amount of limiting and control positions.

Release time: peak section: < 1 μ s for transients of 50 μ s duration, variable between 50 ms and 5s for other peak signals; rms section: 0.25-5s.

Limiting ratio: peak section: approx 50:1; rms section: approx 40:1.

Threshold: -20 to +30 dBm in peak mode; rms mode raises peak threshold by 6 dB while lowering rms threshold 6 dB. This allows a separation of thresholds that is continuously variable from 0 dB (peak mode) to 12 dB (rms mode).

Power: 24-28V dc, 70 mA.

Price: £191.

ALTEC

Altec Sound Products, 1515 South Manchester, PO Box 3113, Anaheim, Ca 92803, USA.

Phone: (714) 774 2000. Telex: 655415.

Europe: Altec Sound Products Ltd, 17 Park Place, Stevenage, Herts SG1 1DU, UK.
Phone: Stevenage (0438) 3241.

1612A LIMITER

A 2-input device that functions either as a line amp or a limiter amp.

Audio & Design F760X Complex limiter.



Equivalent input noise: -130 dBm with 1588C mic preamp; maximum output noise -55 dBm, 20 kHz bandwidth.

Total harmonic distortion: as a limiter amp: 1% typical, 50-20k Hz at +8 dBm output, threshold to 25 dB compression.

Attack time: typically 10 μ s in 'fast' mode; 33 μ s in 'slow'.

Release time: typically 800 ms in 'fast' mode; 2.8s in 'slow'.

Threshold: variable from -74 dBm input with 1588C mic preamp; from -40 dBm direct input.

Slope: nominally 20:1 from threshold to 25 dB compression.

Limit/line balance: 0-20 dB of compression.

AUDIO & DESIGN

Audio and Design (Recording) Ltd, St Michaels, Shinfield Road, Shinfield Green, Reading, Berks, UK.

Phone: Reading (0734) 84487. Telex: 847605.

US: Audio and Design Recording Inc, 1019 N Winchester, Chicago, Ill 60622.

Phone: (312) 252 8144.

Agents in Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Greece, Holland, Italy, Japan, New Zealand, Norway, South Africa, South East Asia, Sweden, Switzerland and West Germany.

F600 BROADCAST LIMITER

A 'straight forward' 2-channel limiter for use in systems that have critical overload conditions, such as optical film recording, disc cutting, and broadcast transmitters.

Signal to noise: > 80 dB ref limiter threshold.

Total harmonic distortion: <0.2% at 1 kHz.
Gain: 34 dB max; unity in bypass mode.
Attack time: 10, 25, 500 μ s, 1, 2.5 and 25 ms.
Release time: 25, 50, 100, 200, 400, 800 ms, 1.6 and 3.2s, plus 'automatic'.
Threshold: input: -19 dBm max for limiting; output: up to +15 dBm.
Price: \$956.

F690 MUSIC-VOICE RATIO LIMITER

Consists of a standard F600 stereo broadcast limiter fitted with a voice-operated threshold switching circuit. Spec virtually identical. Price: \$1021.

F760X COMPLEX LIMITER

A unit that combines a variable ratio compressor with an overall peak limiter and a low-level, noise-reducing expander/gate. Available as a mono or stereo rack-mounting system, and as a mono module. Three limit pre-emphasis values—50, 75, or 100 μ s—can be supplied.

Signal to noise: better than -80 dB ref threshold level as set by output attenuator; better than -87 dB with expander operational.

Total harmonic distortion: compressor: <0.1% at +10 dBm threshold (typically 0.04%); limiter: <0.3% at +14 dBm.

Attack time: limiter: <250 μ s for 100% control of overshoot without over-limiting; compressor: 250 μ s, 2.5, and 25 ms; expander: 20 μ s, 2 and 40 ms.

Release time: limiter: 250 ms; compressor: 25, 50, 100, 200, 400, 800 ms, 1.6 and 3.2s, plus 'automatic'; expander/gate: variable between 25 ms and 5s.

Threshold: limiter: +14 dBm max ref unattenuated output; compressor: calibrated wrt peak limiter threshold and marked 0-20 dBm in 2 dB steps; expander/gate: -40 to +14 dBm wrt input.

Price: \$1470 (stereo system).

F769X VOCAL STRESSOR

Basically, comprises a F760X Complex limiter and an E900 sweep equaliser. A routing switch changes the relationship between the two units: the equaliser can be positioned before or after the limiter, or inserted into the limiter's control side chain, thus modifying its response to frequency content. Not only de-essing, but 'de-rumbling' and 'de-bass end modulating' are among the useful applications said to be possible. Price: \$1305.

E500/E560 BAND PROCESSOR/LIMITER

Specifically designed for band-split limiting, the E500 features the following: high and lowpass sweep filters for dynamic and static shelf-type eq; parametric notch filter of variable 'Q' for dynamic or static peaking/limiting; monitoring of selected area for adjustment and use as effect; switched threshold control that converts variable input/output limiters or expanders to unity gain; electronic crossover with zero phase-shift; simulated 'stereo' from mono tracks; and phasing effects by altering sweep notch control. The model E560 combines the selective notch section of the E500 with an F600 limiter. Price: E500: \$1250; E560: \$1350 (stereo models).

SO1 COMPRESSOR-LIMITER MODULE

A member of the SCAMP family of 25 mm modules.
Noise: less than -80 dB (no conditions).
Total harmonic distortion: <0.1% (no conditions).
Attack time: limiter: 500 μ s; compressor: 500 μ s, 2 and 25 ms.

Release time: limiter: 250ms; compressor: variable between 25 ms and 3s, with an 'automatic multiple network' position that gives a fast recovery time over 5 dB gain reduction range on a slowly changing release platform.

Threshold: limiter: -4 to +16 dBm max output level; compressor: linked to ratio selection so that for 10 dB compression on any slope the output level remains constant, and above that level of compression the slope tightens to 30:1 as the peak level limiter becomes operational.

Compression ratio: 1, 1.5, 2, 3, 5 and 10:1.
Price: \$325.

GEMINI COMPACT

Marketed in the USA only under this name, and in Europe by Industrial Tape Applications as the Compliment (see review, p 66).

Noise: <78 dB ref limit threshold at -3 dB and

25 kHz.

Total harmonic distortion: <0.2% at 1 kHz for 10 dB compression.

Attack time: 500 μ s and 5 ms.

Release time: variable between 25 ms and 3s, plus 'automatic'.

Threshold: -10 to +10 dBm at output (-20 dBm at input).

Ratio: limiter: 20:1; compressor: 1.5 and 3:1.

Stereo matching: \pm 1 dB on control voltage tracking over 10 dB range.

AUDIO DEVELOPMENTS

Audio Developments, Hall Lane, Walsall Wood, Brownhills, West Midlands, WS9 9AU, UK.

Phone: Brownhills (05433) 5351. Telex: 338212.

Agents in Australia, Austria, Canada, Denmark, France, Germany, Holland, India, Italy, Japan, Norway, South Africa, USA, and Venezuela.

AD055

A rack-mounting unit, the two channels of which are completely independent but can be linked for stereo operation. DIN, XLR and audio jack connectors are fitted for ease of connection.

Attack time: 250, 500 μ s, 1, 2, 4, and 8 ms, switchable.

Release time: 75, 150, 300, 600 ms, 1.2 and 2.4s, switchable.

Threshold: two ranges; 'low ratios' adjustable from -10 to +10 dBm in 2 dB steps; 'limit' adjustable from 0-20 dB in 2dB steps.

Ratio: 1, 2, 3 and 5:1, plus 'limit' (20:1).

AUDIO DESIGNS

Audio Designs and Manufacturing Inc, 16005 Sturgeon Roseville, Michigan 48066, USA.

Phone: (313) 778 8400.

Other countries: Ampex International Operations, including:

UK: Ampex GB Ltd, Acre Road, Reading, Berks.

Phone: Reading (0734) 85200. Telex: 848345.

302 LIMITER MODULE

Noise: -73 dBm max below threshold; -85 dBm max at 20 dB limiting.

Total harmonic distortion: 0.15%, typical.

Gain: 0 dB below threshold; up to 30 dB of gain reduction.

Attack time: 1 ms.

Release time: 50 ms to 2.5s.

Threshold: -16 to +24 dBm.

Power: \pm 20V, 50mA.

AUDIO/TEK

Audio/Tek Inc, PO Box 5012, San Jose, Ca 95150, USA.

Phone: (408) 378 5586.

MODEL 400 FREQUENCY SELECTIVE LIMITER

Primary designed to control hf energy in tape duplication masters and fm broadcasts, but has applications in disc mastering and slow-speed tape recordings.

Noise: 65 dB below +40 dBm output, 20-20k Hz.

Attack time: 'full limiting within first half-cycle of input signal'.

Release time: 10 ms max.

Limiting characteristics: dependent on input level and frequency.

AUDIX

Audix Limited, Station Road, Wendon, Saffron Walden, Essex CB11 4L9, UK.

Phone: Saffron Walden (0799) 40888. Telex: 817444.

4B02 MODULE

A compressor-limiter in a 178 x 40 x 255 mm module also equipped with a noise gate.

Noise: less than -94 dBm.

Total harmonic distortion: <0.1%, typically <0.03% at 1 kHz for 10 dB limiting.

Attack time: 1, 2, 5, 10, 20 and 50 ms.

Release time: 100, 200, 500 ms, 1 and 2s, plus 'auto' which gives a time related to depth of compression.

Threshold: -10 to +12 dBm in 2 dB steps.

Ratio: 1.5, 2, 3, 4 and 6:1, plus 'limit'.

Noise gate: sets gate to cut off input signal below -50, -40, -30, -20 and -10 dBm, and 'off'.

Price: £165.

SP704 LIMITER AMPLIFIER

Designed for insertion into programme lines operating at 0 dBm. Facilities for slave (tandem) and voice-over applications are incorporated.

Noise: -80 dBm (no conditions).

Total harmonic distortion: 0.03% residual; <0.1% operating (at 500 Hz).

Attack time: 'auto' (nominally 5 ms for 12 dB of control).

Release time: 100, 200, 500 ms, 1 and 2s, plus 'auto'.

Threshold: -12 to +4 dBm in 2 dB steps, and 'off'.

Ratio: 8:1 internal drive and 2:1 external drive.

Price: £145.

CADAC

Cadac (London) Ltd, 141 Lower Luton Road, Harpenden, Herts, UK.

Phone: Harpenden (05827) 64351. Telex 826323.

USA: Joel Associates, 528 River Road, Teaneck, NJ 07666.

Phone: (201) 836 8741.

Also agents in Australia, Belgium, Eastern Europe, Finland, France, Holland, Israel, Italy, Norway, Japan, Portugal, South Africa and Spain. (For addresses and phone numbers see May '77 issue, p 50).

A505

Utilises the Cadac V-cat voltage control attenuator, the control circuits of which can be coupled together for stereo or quadraphonic operation.

Noise: better than -85 dBV normal; better than -95 dBV with noise gate operating.

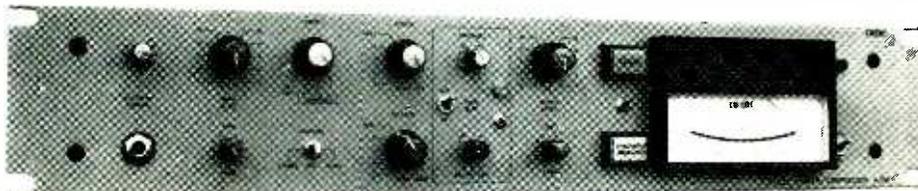
Attack time: 'fast' (600 μ s for 60% gain reduction from a step increase of 20 dB above threshold, using 20:1 ratio) to 'slow' (100 ms) in six switched and calibrated steps; plus 'off'.

Release time: 'fast' (800 μ s for 60% recover from 20 dB gain reduction, using 20:1 ratio) to 2s in six-switched and calibrated steps; plus 'auto'.

Threshold: +4.5 dBV with controls in zero position; maintained \pm 0.5 dBV for all ratios.

Ratios: 20, 8, 4 and 2:1, automatically compensated for each ratio.

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A505 from Cadac with V-cat voltage-control attenuator.

SURVEY: COMPRESSORS AND LIMITERS

External control: main compressor circuit may be controlled from the external input and is designed for 'ducking' and 'voice-over' applications.

dbx

dbx Inc, 71 Chapel Street, Newton, Mass 02195, USA.

Phone: (617) 964 3210. Telex: 922522.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

Phone: (01) 734 2812. Telex: 27938.

Agents in Belgium, Denmark, France, Netherlands, Norway and Sweden.

Model 160/161

Both units are single-channel and use true rms sensing and feed-forward circuitry. The latter is claimed to eliminate noticeable distortion even at high compression ratios. The *Model 161* is a lower-priced version of the *160*, which features balanced high-impedance differential input stage and balanced 25 ohm output, plus turn-on and turn-off transient protection. Two units may be ganged for rack-mounting.

Equivalent input noise: -78 dBm, typical unweighted.

Distortion: 0.075% 2nd harmonic at infinite compression and +40 dBm output; 0.5% 3rd harmonic typical at infinite compression ratio.



dbx

Model 162.

Attack time: 15 ms for 10 dB level change above threshold; 5 ms for 20 dB change; 3ms for 30 dB change.

Release rate: 120 dB/s.

Compression ratio: 1:1 to infinity.

Threshold: -38 to +12 dBm.

Price: Model 160: £221, \$315.

Model 162

A 'true-stereo' unit utilising true rms sensing, feed-forward circuitry and ganged threshold, compression and output gain controls. Two or more units can be linked for quadraphonic operation. Specification virtually identical to Models 160/161.

Price: £425, \$600.

DUKANE

Dukane Corp, International Division, 2900 Dukane Drive, St Charles, Ill 60174, USA.

Phone: (312) 584 2300. Telex: 720426.

Model 2A80B COMPRESSOR/NOISE GATE

Described as a 2-input line amp combining a compression amplifier with an 'instantly operating' noise gate that reduces the no signal noise by 15 dB.

Noise: -70dB at threshold of compression; -80dB dynamic noise level with amp on.

Total harmonic distortion: 0.5% with 40 dB of compression.

Gain: channel 1: 51.5 ± 2 dB at threshold of compression; channel 2: 39 ± 2 dB with 600 ohm matching transformer.

Attack time: <30 μs.

Release time: 1.5s.

Compression ratio: 10 and 5:1.

Model 2A103 COMPRESSOR MODULE

Noise: -65 dBm from threshold.

Total harmonic distortion: 1% max.

Gain: 34 dB at threshold.

Attack time: <1 ms.

Release time: 1.5s.

Compression ratio: 10:1.

Power: ±24V, 20 ma, via octal plug.

Model 2A165 COMPRESSOR AMPLIFIER

A pcb module designed to plug into standard 483 mm rack-mounting chassis.

Noise: 80 dB below output, 5 dB into compression 20 kHz bandwidth.

Total harmonic distortion: <5%, 5 dB into compression.

Gain: 20 ± 2 dB below threshold.

Attack time: 500 ms.

Release time: 3-5s.

Compression ratio: 20:1.

Power: ± 22.5V, 20 mA.

DYMA

Dyma Engineering, Route 1, Box 51, Taos, New Mexico 87571, USA.

Phone: (505) 758 2686.

LDA-31 LIMITER/DUCKER

A 'ducking' feature, independent of limiting section, uses the same gain reduction circuitry to reduce the amp output by an amount proportional to a control voltage. About 5 ms of attack time is available, and release time is factory set to between 250 ms and 3s. Threshold of limiting is adjustable from 0-30 dBm.

Nominal gain is 10 dB, but may be factory set to any specified value. The unit is available as a pcb in a variety of formats. Price: \$69.

EMT-FRANZ Vertriebsgesellschaft mbH, Postfach 1520, D-7630 Lahr, West Germany.

Phone: 78025/512. Telex: 754319.

UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.

Phone: (01) 953 0091. Telex: 27502.

US: Gotham Audio Corp, 741 Washington Street, New York, NY 10014.

Phone: (212) 741 7411.

EMT 156

Two-channel unit with identical controls of dynamic compression and limiting to avoid any displacement of stereo image. Limiting or compression, or both, are pushbutton controlled.

Limiter threshold: -2 to +7.5 dB (referred to internal reference level of 0 dB).

attack time: 0.1 ms max.

release time: 250 ms to 2.5s, adjustable, for 10 dB gain variation.

Compressor gain: 0-18 dB, adjustable.

ratio: 1.5 to 4:1.

rotation point: -6 to -1.5 dB (0 dB internal reference).

attack time: 1-4 ms, internally adjustable.

release time: 500 ms to 3.5s, adjustable, for 10 dB

gain variation.

Expansion ratio: 1.5 or 2.5:1.

rotation point: -35 to -55 dB (0 dB internal reference).

attack time: coupled with compressor release time.

release time: 1.5-7.5s, adjustable, for 10 dB gain variation; about 4.5s in automatic mode.

Total harmonic distortion: ≤ 0.6% at 1 kHz, 0 dB gain.

Crosstalk: >35 dB between channels at 1 kHz and nominal level.

Other: internal gain can be varied over 40 dB range by means of a 6V dc signal applied to a rear-panel socket.

EMT 256 COMPRESSOR

Noise: 67 dB rms with 0 dB compression gain.

Total harmonic distortion: <0.5% at 1 kHz and 0 dB internal level.

Gain: 0-18 dB.

Attack time: approx 2.5 ms.

Release time: 0.25-10s/10 dB.

Ratio: 2-20:1.

Other: automatic expander attack and recovery time, with a 2.5:1 ratio and threshold version between -55 and -35 dB.

Power: 24V dc (either polarity), 160 mA.

EMT 258 NOISE FILTER

Comprises a bandpass, highpass and lowpass filter, all three set for the same frequency between 1 and 20 kHz, linked to an expander circuit. The latter is automatically switched in and out as necessary, and functions in the range below 1kHz to supplement the effects of the lowpass filter. Thus the unit adjusts itself in such a way as to leave the signal modulation unchanged, while attenuating the hf noise components.

Noise: ≥ 80 dB rms (unweighted) at 0 dB internal level.

Total harmonic distortion: ≤ 0.5% at 0 dB internal level.

Expander release time: ≤ 50 ms for 10 dB.

Filter release time: 50 ms to 2s, adjustable.

Turnover frequency: 1-20 kHz, dependent on signal amplitude; threshold of signal that determines turnover frequency is adjustable between -25 to -65 dB.

Power: 24V dc (either polarity).

EMT 257 LIMITER

In 'equalisation' mode an amp with a frequency-weighting network is inserted into the control loop. Components for the pre-emphasis are fabricated on a plug-in unit, and can be changed for any desired frequency weighting of the limiting threshold.

Attack time: 50-500 μs.

Release time: 250 ms to 20s/10 dB.

Threshold: -2 to +10 dB relative to internal zero.

Range: 20 dB max.

Other: can be switched between linear or pre-emphasised mode.

Power: 24V dc (either polarity).

EMT 260 FILTER-LIMITER

Comprises an amplifier and limiter linked by means of a frequency crossover network. Below the limiting threshold, lf components are fed via the amp branch and hf via the limiter. If the threshold is exceeded, gain is reduced in the hf branch.

Attack time: 50-500 μs/10 dB.

Release time: 0.25-10s/10 dB.

Range: 15 dB at 20 kHz.

Control: responsive to average value below threshold; peak value above threshold.

Turnover frequency: 4.5 kHz.

Weighting: 60 or 180 μs.

Power: 24V dc (either polarity), approx 130 mA.

EVENTIDE

Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA.

Phone: (212) 581 9290.



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Exclusive export agent: Gotham Export Corporation, New York

SURVEY: COMPRESSORS AND LIMITERS

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.
Phone: (01) 580 4314. Telex: 286668.

OMNIPRESSOR

Combines the characteristics of a compressor, expander, noise gate and limiter in a rack-mounting unit. Also capable of dynamic reversal: +10 dBm input produces -10 dBm output and vice versa.
Noise: -90 dBm below output at unity gain.
Total harmonic distortion: 0.05% 20-20k Hz, and typically 0.02% at 1 kHz with agc disabled.
Attack time: 100 ms to 100s, continuously variable.
Release time: 1 ms to 1s, continuously variable.
Compression ratio: 1:1 through infinity to -10:1, continuously variable. (Infinite compression setting gives constant output ± 1 dB for 60 dB change in input level.)
Expansion ratio: 1-10:1, continuously variable.

HARRIS

Harris Corporation, Broadcast Products Division, PO Box 290, Quincy, Ill 62301, USA.
Phone: (217) 222 8200.

MSP-100 AUDIO PROCESSOR

A stereo broadcast unit incorporating a tri-band agc and broadband peak limiter with pre-emphasis compensation. Changing a single module (protection section) converts the unit from fm to am operation. Asymmetrical limiting allows 125% positive peak modulation in the latter mode.

Noise: 70 dB below +10 dBm output, 30-15k Hz.
Total harmonic distortion: $\leq 0.25\%$, 30-50k Hz, +10 dB output.
Gain: 23 or 43 ± 2 dB, switched.
Intermodulation distortion: $\leq 0.25\%$, 60 and 7k Hz mixed 4:1 at +10 dBm output.

Three-band AGC section

Crossover frequencies: low: 73-316 Hz; high 1.7-7.2 kHz; both in seven switched positions.

Attack time: 250, 800 μ s, 2.5, 8 and 25 ms, compression or expansion.

Release time: 800ms to 12s, compression or expansion; a dual recovery mode dynamically increases period recovery time up to 10x value selected.

Compression ratio: 12:4, 12:2, 12:1, 12:0.5 dB/dB at centre of range.

Expansion ratio: 12:24 dB/dB, fixed.

Compression threshold: adjustable over 12 dB range.

Expansion threshold: -30 dB relative, adjustable ± 12 dB.

Compression range: 24 dB.

Expansion range: 12 dB.

Limiter section

Attack time: 10 μ s to 3.6 ms in preset automatic mode; 40 μ s to 3.6 ms in manual mode.

Release time: 10 μ s to 3.6 ms in preset automatic mode; 0.8-12s in manual. Dual recovery mode functions in same way as agc section.

Ratio: 12:0.5 dB/dB min.

Range: 12 dB.

FM and AM protection section

Fm module features flat, 25, 50 and 75 μ s compensation curves, 100 μ s attack and recovery time, and parallel split-band (450 Hz crossover) operation. Am module utilises 100-130% asymmetrical limiting, 40 ms attack time and 30 ms to 1s recovery time.

ITAM

Industrial Tape Applications Ltd, 1-7 Harewood Avenue, Marylebone Road, London NW1, UK.
Phone: (01) 724 2497. Telex: 21879.
France: Son Professionnel, 29-31 avenue André

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Morizet, 92100 Boulogne, Paris.
Phone: 605 3363.

COMPLIMENT

See review p 66.
Only available in Europe. For specifications see Audio & Design's entry for *Gemini Compact* stereo compressor limiter. Price: £247.

MOSELEY ASSOCIATES

Moseley Associates Inc, Santa Barbara Research Park, 111 Castilian Drive, Goleta, Ca 93017, USA.
Phone: (805) 968 9621. Telex: 658448.

TFL-280 AUDIO LIMITER

A single-channel broadcast limiter for fm mono, stereo, quadrasonic and sca applications, plus tv sound. The unit is supplied with 75 μ s pre-emphasis, but can be converted for other time constants. An output de-emphasis network can be switched in when flat response operation is required.

Noise: <70 dB (de-emphasised).
Total harmonic distortion: <0.7% 50-15k Hz at any degree of limiting.

Attack time: hf controller: <20 μ s; wideband controller: 20 μ s to 2 ms (factory set to 100 μ s).

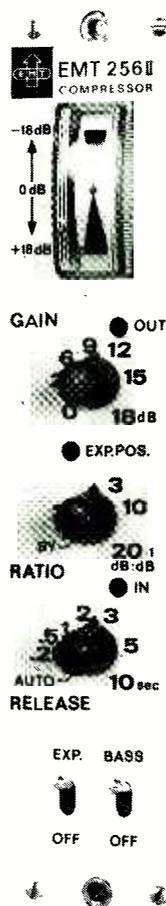
Release time: hf controller: 50-500 ms, programmable; wideband controller: 200 ms to 5s, program-operated triple-timing.

Filtering: plug-in lowpass filter located prior to hf agc.

Control range: >35 dB.



Left: Neve 32264 from 22 series.
Right: EMT 256 compressor.



MXR

MXR Innovations Inc, 277 N Goodman Street, Rochester, NY 14607, USA.
Phone: (716) 442 5320.
UK: Rose-Morris and Co Ltd, 32-34 Gordon House Road, London NW5 1NE.
Phone: (01) 267 5151. Telex: 23170.

MINI LIMITER

Noise: 73 dB below threshold.
Threshold level: -30 to +10 dBm.
Attack time: approx 1 ms.
Release time: variable via rear-panel trim pot, and dependent upon amount of gain reduction.
Other: four leds indicating gain reduction.
Power: +15 to +30V, 22 ma.

NEVE

Rupert Neve and Co Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU, UK.
Phone: Royston (0763) 60776. Telex: 81381.
Canada: Rupert Neve of Canada Ltd, 2721 Rena Road, Malton, Ontario.
Phone: (416) 677 6611.
US: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Conn 06801.
Phone: (203) 774 6230. Telex: 969638.
West Germany: Rupert Neve GmbH, 6100 Darmstadt, Bismarckstrasse 114.
Phone: 06151 81764.

22 SERIES

Available in a variety of formats: 2254JE standard version with 133 x 137 mm panel dimensions; 2264, repackaged version with 222 x 46 mm panel; 3314, another repackaged version with 222 x 35 mm panel; 2254S, a variant of the 2254JE with pre-emphasis in the compression side chain to reduce sibilance; 2264IX, a variant of the 2264 for use in 150 ohm systems; and LCR2P, a 133 mm, rack-mounted package of two 2254JEs with power supply and stereo link option. All models can be linked for stereo or multichannel operation. Independent limit and compress functions are also featured. The compression section samples ahead of the output amp, thus enabling mean programme level to be raised after compression.

Noise: better than -75 dBu, rms unweighted, unity gain.

Total harmonic distortion: <0.08% in linear condition, up to 0.5 dB under limit ceiling; <0.2% with compression 6:1, 800 ms release, +80 dBu output, +20 dBu input, -14 dBu threshold.

Compression threshold: -20 to +10 dBu in 2 dB steps.

ratio: 1.5, 2, 3, 4 and 6:1.

attack time: 5 ms (nominal)

release time: 400, 800 ms and 1.5s, plus 'auto' (50 ms/5s).

gain: 0-20 dB in 2 dB steps.

Limit ceiling: +4 to +12 dBu in 0.5 dB steps.

attack time: 'fast': 100 μ s to 5 ms, programmable.

release time: 100, 200 and 800 ms, plus 'auto' (50 ms/5s).

slope: 'at least' 100:1.

NTP

NTP Elektronik A/S, 44 Theklavej, DK-2400 Copenhagen NV, Denmark.
Phone: (01) 101222. Telex: 16278.

179-120 COMPRESSOR

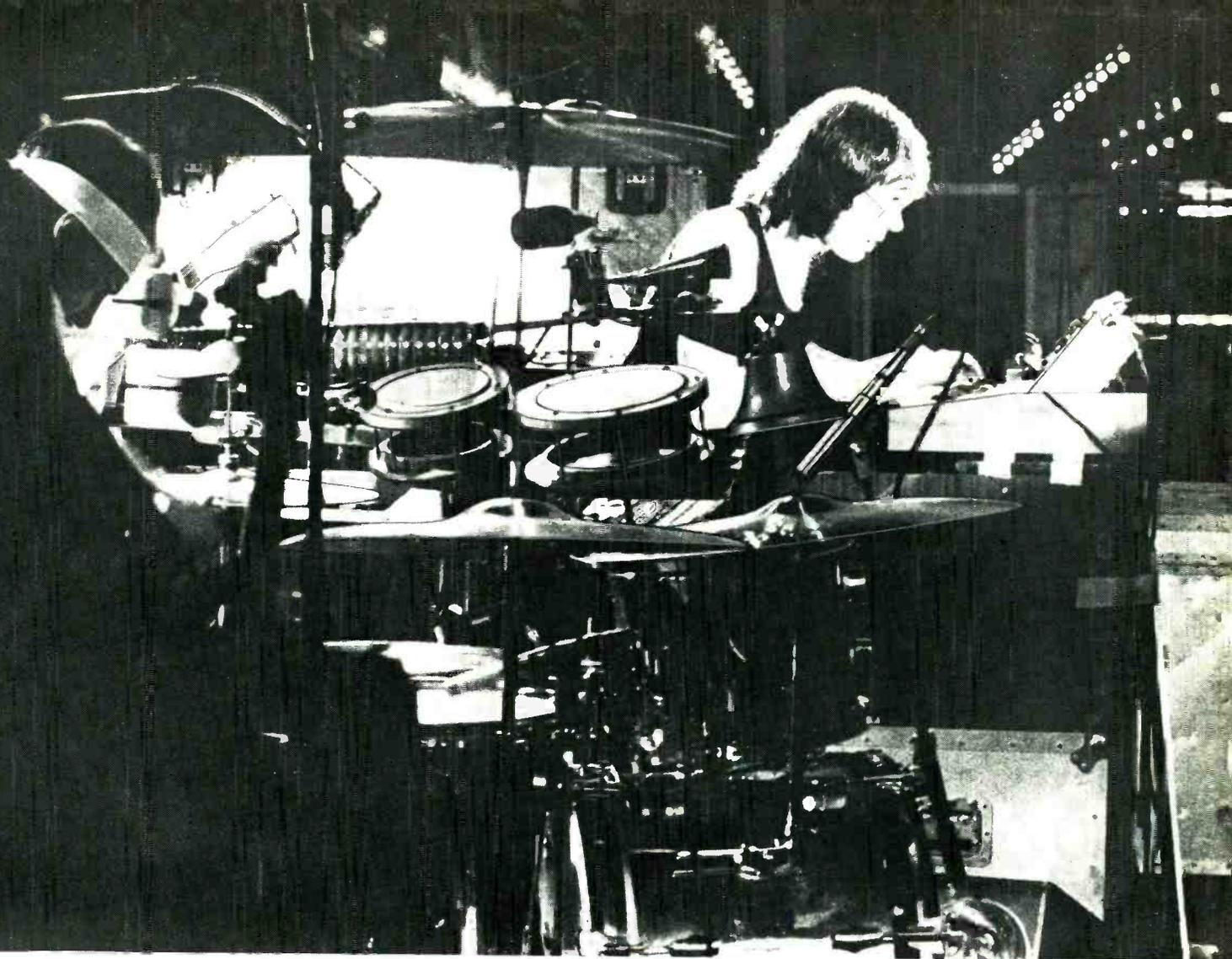
In order to operate with long attack times, a fast symmetrical limiter is provided. Control voltages of two units can be linked for equal gain stereo operation.

Noise: 80 dB(A) at compression threshold.

Total harmonic distortion: <0.5% up to 20 dB gain reduction.

Gain: up to 15 dB.

40 ▶



MANFRED MANN

and his Earthband

"Achieving my Sound"

During my long experience I have used different sound equipment. Mick Williams, my sound-engineer, and I have found AKG products to be the most suitable for our purpose.

This is why:

For all vocals: AKG D 2000 E

A rugged hardwearing microphone.
Good integral popshield.

For guitar stacks: AKG D 1200 E

The switchable e. q. on this mike is very useful.

For bass stacks: AKG D 202 E

In addition to the direct inject the microphone on the bin gives the depth.

For kick drum: AKG D 12

This mike gives a good fat sound and takes plenty of stick.



For lo floor tom, hi floor tom, rack tom and snare: AKG D 224 E

The lack of the proximity-effect on these two-way cardioid microphones suit Chris Slade's drum tuning, giving a hard solid sound.

For hi hat: AKG C 451/CK 1

This condenser microphone provides super clear definition of the super highs.

The A 51 swivel joint between the capsule and the preamplifier makes for easy positioning.

For keyboards: AKG 100 K

My Moog, the Hammond C 3, the Rhodes and the omni-string synth run through the new AKG 100 K keyboard mixer which is very flexible and has great e. q. for those instruments.

182/4 Campden Hill Road Kensington

AKG Equipment Ltd.

London W8 7AS Tel. 01-229-3695, 01-727-0788

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- ★ Modular construction
- ★ Serviceability.
- ★ Spares readily available.



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Communications Ltd.

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Weybridge (0932) 47785

At the service of the Broadcast and Recording Industries.

Technical Translations.

SURVEY: COMPRESSORS AND LIMITERS

Attack time: 100 μ s to 200 ms/20 dB, adjustable in 11 steps.

Release time: 60 ms to 4s/20 dB, plus 'auto' (200 ms upon 15s), in 11 steps.

Release delay: 0 or 50 ms, switched.

Compression ratio: 1, 2, 3, 5 and 20:1.

Threshold: +6 dBu (normal); +19 dBu ('normal').

Power: 24V dc, either polarity, approx 100 mA.

179-230 LIMITER

Incorporates a combination of a relatively long attack time with a symmetric log clipping curve to eliminate transient noise during striking. Recovery circuit is programme dependent based on a dual-time constant principle, said to eliminate pumping and similar effects. Control voltages of two units can be linked for stereo operation.

Noise: 80 dB(A) at limiting threshold.

Total harmonic distortion: 0-20 dB limiting, 0.3%; 20-30 dB limiting, 0.5%. 20-20k Hz, steady conditions.

Attack time: 1.5 ms.

Release time: T1: 100, 200, 400 ms, 1, 2, and 4s; T2: 1, 2, 4, 10 and 20s, and 'off'.

Threshold: +6 \pm 0.5 dBu, referenced to output.

Range: >30dB.

Pre-emphasis: 50 μ s (normally not connected).

Power: 24V dc, either polarity, approx 75 mA.

179-300 LIMITER CARD

Based on same circuitry found in 179-230 limiter.

Noise: 82 dB(A) at limiting threshold.

Total harmonic distortion: <0.2% up to 20 dB limiting, 40-20k Hz.

Attack time: 1.5 ms.

Release time: dual time constants, 200 ms upon 15s.

Control voltage: 1V/5 dB; may be linked for stereo operation.

Power: \pm 15V dc, 60 mA.

ORANGE COUNTY

Orange County Electronics Corporation Ltd, 1125 Empress Street, Winnipeg, Manitoba R3E 3H1, Canada.

Phone: (204) 775 8151.

PO Box 369, Pembina, North Dakota 58271, USA.

Phone: (204) 775 8151.

Australia: JNS Electronics Industries, PO Box 85, Rosanna, Victoria 3084.

Phone: 439 1430.

Brazil: Larex Electronica Ltda, Avenida Princesa Isabel, 7 Grupos 915 e 916, Rio de Janeiro.

Phone: 275 1695. Telex: 2121616.

South Africa: Tru-fi Electronics, PO Box 31801, Braamfontein, Tvl 2017

Phone: 838 4930.

Sweden: Elfa Radio and Television ab, S-171 17, Solna.

Phone: (08) 730 0700. Telex: 10479.

OCAVS-1 STRESSOR

A combined single-channel equaliser, limiter, compressor, expander and gate. The equaliser can be routed 'pre' or 'post' compressor-limiter, or inserted into the latter's control side chain.

Noise: -84 dB below limit threshold; -91 dB with expander.

Total harmonic distortion: 0.1% for 15 dB gain reduction at +18 dBm output.

Attack time: compressor: 250 μ s, 2.5 and 25 ms; limiter: 10 μ s; expander: 20 μ s, 2.5 and 40ms.

Release time: compressor: 25, 50, 100, 200, 300, 400 800 ms, 1.6 and 3.2s, plus 'automatic'; limiter: 20 ms; expander: 25 ms to 8s, continuously variable.

Threshold: compressor: 0 to -20 dB ref peak limiter in 2 dB steps, or frequency sensitive; limiter: +18 dBm output unattenuated; expander: -40 to +30 dBm input, continuously variable.

Compression ratio: 1, 2, 3, 5, 10 and 20:1.

Price: \$1492; £776.

OCACLX-S-FM STEREO PROCESSOR

A combined limiter, compressor, expander, gate and high-frequency limiter. The two channels may be used independently, or coupled for stereo operation.

Noise: -84 dB below limit threshold; -91 dB with expander.

Total harmonic distortion: 0.1% for 15 dB gain reduction at +18 dBm output.

Attack time: compressor: 250 μ s, 2.5 and 25 ms; limiter: 10 μ s; expander: 20 μ s, 2.5 and 40 ms; hf limiter: 10 μ s.

Release time: compressor: 25, 50, 100, 200, 300, 400, 800 ms, 1.6 and 3.2s, plus 'automatic'; limiter: 20 ms; expander: 25 ms to 8s, continuously variable; hf limiter: 20 ms.

Threshold: compressor: 0 to -20 dB ref peak limiter in 2 dB steps; limiter: +18 dB output unattenuated; expander: -40 to +30 dBm input, continuously variable; hf limiter: varies dynamically with frequency, follows 25, 50 or 75 μ s characteristic.

Ratio: compressor: 1, 2, 3, 5, 10 and 20:1; limiter: 250:1; expander: 1:2 and 1:20; hf limiter: 250:1.

Price: \$1976; £1028.

OCACLX MODULE

A combined single-channel compressor, limiter, expander and gate.

Noise: -84 dB below limit threshold; -91 dB with expander.

Total harmonic distortion: 0.1% for 15 dB gain reduction at +18 dBm output.

Attack time: compressor: 250 μ s, 2.5 and 25 ms; limiter: 10 μ s; expander: 20 μ s, 2.5 and 40 ms.

Release time: compressor: 25, 50, 100, 200, 300, 400, 800 ms, 1.6 and 3.2s, plus 'automatic'; limiter: 20 ms; expander: 25 ms to 8s, continuously variable.

Threshold: compressor: 0 to -20 dB ref peak limiter in 2 dB steps; limiter: +18 dBm output unattenuated; expander: -40 to +30 dBm, continuously variable.

Ratio: compressor: 1, 2, 3, 5, 10 and 20:1; limiter: 250:1; expander: 1:2 and 1:20.

Price: \$846; £440.

ORBAN/PARASOUND

Orban/Parasound, 680 Beach Street, San Francisco, Ca 94109, USA.

Phone: (415) 776 2808.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

Phone: (01) 734 2812. Telex: 27939.

418A STEREO LIMITER

Noise: -80 dB, typical.

Total harmonic distortion: <0.05% at 1 kHz.

Attack time: hf limiter: 3 ms; broadband limiter: 1-2 ms.

Release time: hf limiter: varies around 15 ms according to programme history; broadband limiter: continuously variable.

Compression/limiting ratio: >200:1.

Hf time constant: 75, 50, 37.5 and 25 μ s, and 'flat'.

Price: £685, \$990.

PACIFIC RECORDERS

Pacific Recorders and Engineering Corporation, 11100 Roselle Street, San Diego, Ca 92121, USA.

Phone: (714) 453 3255. Telex: 695008.

MULTIMAX

A tri-band audio processor and agc amplifier. Four meters display low-band, mid-band and high-band compression plus output level. Two units can be coupled for stereo operation.

Noise: > 72dB below +4dBm, ref 6 dB compression at 1kHz.

Total harmonic distortions: <0.2% 30-15k Hz at +24 dBm (0.2% im, 4:1 ratio).

Attack time: fast section: 100 ms; slow section: 500 ms.

RAC

LIMITER/COMPRESSORS RACLIM 2

New unit in VERO module.

Mains powered, XLR connectors

Controls:—

- Compression ratio
- Threshold
- Gain make up
- Release time

Indicators:—

- LED Threshold reached
- LED Output +10dB

Size:—

180mm high, 50mm wide, 275mm deep approx.

Price:—

£69.00. Balanced inputs and outputs plus £20.00

RACLIM 1.

Pair of printed circuit cards for building into existing equipment price £14.25

contact Martin Bennett,

Rugby Automation Consultants

19 Freemantle Road, RUGBY Tel. 0788 810877

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Or, for more information, call Andrew Stirling at 01-340 3291.



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Steyning, Sussex, BN4 3GY

SME

SURVEY: COMPRESSORS AND LIMITERS

Release time: fast section: 200 ms; slow section: 1s; 'retired': 5s.

Band filters: 18 dB/octave, Butterworth type; division frequencies at 309 and 6k Hz.

MULTILIMITER

A broadcast compressor-limiter available in two versions for fm or am application. The fm version is designed to operate with tv, fm or fm-Dolby transmissions, and has facilities for 25 and 75 μ s pre-emphasis plus special circuitry to compensate for the 2 dB possible modulation loss due to lowpass filters in the stereo modulator. The am version automatically selects the polarity of the signal so that the majority of the peak material is positive-going, thus allowing positive modulation in excess of 100%; an 'automatic polarity correlator' ensures that the switching takes place inaudibly during momentary pauses in the programme.

Noise: <72 dB for -20 dB input.

Total harmonic distortion: <0.25% below threshold of limiting, 50-15k Hz at +24 dBm output; <0.5% with 6 dB rms compression and 3 dB fast limiting 50-15k Hz (1 kHz ref).

Attack time: rms fast section: 100 ms; rms slow section: 500 ms; fast limiter: 5 ms; peak limiter: 5 μ s; hf limiter (fm version): 50 μ s.

Release time: rms fast section: 200 ms; rms slow section: 1s; fast limiter: 50 ms.

Asymmetric operation (am): positive voltage peaks 100-150%, continuously variable.

Pre-emphasis operation (fm): flat, 25 and 75 μ s, switchable.

PHILIPS

NV Philips Gloeilampenfabrieken, Electroacoustics Division, Eindhoven, The Netherlands.

Phone: 040 78616.

UK: Pye TVT Ltd, PO Box 41, Coldhams Lane, Cambridge CB1 3JU.

Phone: Cambridge (0223) 45115. Telex: 811103.

US: Philips Audio Video Systems Corp, Audio Division, 91 McKee Drive, Mahwah, NJ 07430.

Phone: (201) 529 3800.

LDM0090 COMPRESSION AMPLIFIER

Available as a stereo (2-channel) or mono unit.

Noise: better than -60 dB at 0 dB threshold setting; typically -78 dB at -24 dB threshold setting. (Values weighed to CCIR 468.)

Total harmonic distortion: <1% at 30, 1k and 8k with 600 ohm load.

Attack time: compression: <0.5 ms; limiting: 1 \pm 0.5 ms.

Release time: 100 ms to 3.2s in six switched steps.

Compression ratio: 1, 2, 3, 5:1 (switched), plus linear for line-up.

Threshold level: compression: -24 to +16 dBm; limiting: -16 to 24 dBm; both controls calibrated in 2 dB steps.

RAC

Rugby Automation Consultants, 19 Freemantle Road, Rugby, Warwickshire CV22 7HZ, UK.

Phone: Rugby (0788) 810877.

Eire: Music City Industries, 28 Gardiner Place,

Dublin 1.

Phone: 745545.

Holland: Sound Techniques Nederland bv, Groenelaantje 11, Alkmaar.

Phone: 072 112944.

LIM1 BOARD

A pair of pcbs for incorporating a limiter into existing equipment.

Noise: -80 dB (no conditions).

Total harmonic distortion: generally less than 0.5%.

Gain: 13 dB unlimited.

Attack time: 20 μ s.

Release time: 33 ms/700 ms combination.

Compression ratio: 4:1 at -10 dB threshold, to 25:1 at +13 dB threshold.

Power: 24V dc.

Price: £14.25 (\$26).

RACLIM 2 MODULE

A mains powered unit for rack-mounting.

Noise: -80 dB (no conditions).

Total harmonic distortion: generally less than 0.5%.

Gain: 20 dB.

Attack time: 20 μ s.

Release time: switchable, four positions.

Compression ratio: 1-25:1.

Threshold: -20 to +10 dB in six switched positions.

Price: £69 (\$130).

RACLIM 3 LIMITER

A double mono/stereo limiter with full metering that should be available early 1978. Price: approx £400.

REBIS

Rebis Audio, 127 Soho Hill, Handsworth, Birmingham, UK.

Phone: (021) 523 3509

Belgium: Sound Equipment Distributors, Rue Bara Straat, 146, 1070 Brussels.

Phone: 522 7064.

Denmark: Lake Audio, Artillerivej 40, DK-2300 Copenhagen 5.

Phone: 570 600. Telex: 19010.

France: 3M France, Mincom Division, Boulevard de L'Oise, Cergy 95000.

Phone: 031 6420. Telex: 695185.

Netherlands: Pieter Bollen Geludstechniek BV, Hastelweg 6, Eindhoven.

Phone: 512 777. Telex: 59281.

Norway: Kvam Audio, Tollbugt 7, Oslo 1.

Phone: 412 992.

Sweden: Tal & Ton Musik & Elektronik, Kungsgatan 5, S411-19 Gothenberg.

Phone: 139 216.

UK: Scenic Sounas Equipment, 97-99 Dean Street, London W1V 5RA.

Phone: (01) 734 2812. Telex: 27939.

RA 301

See review p 62.

A two-channel unit for independent compression and limiting, or ganged for stereo operation.

Noise: -80 dBm at threshold/unity gain.

Total harmonic distortion: 0.5% at 5 dB compression; 0.1% at 25 dB compression.

Attack time: 20 μ s to 1.5 ms.

Release time: 50 ms to 3s.

Compression/limiting ratio: 1-50:1.

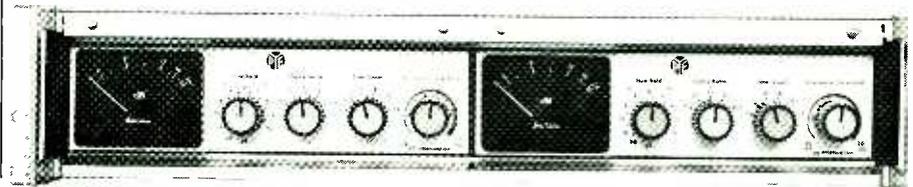
Minimum threshold: -20 dBm.

Compression gain: 40 dB.

Price: £400.

44 ▶

Philips/Pye LDM 0090 compression amplifier.



Some of our products need no introduction

Up to date thinking is the key to ITAM's design philosophy. The 805 Master Recorder brought 8 channel recording within the reach of the smaller studios, and is still the most advanced 8 channel 1/2" recorder available, featuring modular electronics and variable tape speed. ITAM Mixers offer an unbeatable combination of performance and sensible price. 4 and 8 output group versions available.



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- ★ Variable attack and release times.
- ★ Less than -78dB signal/noise.
- ★ Low distortion.
- ★ Accurate stereo matching.

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SURVEY: COMPRESSORS AND LIMITERS

SESCOM

Sescom Inc, PO Box 590, Gardena, Ca 90247, USA.

Phone: (213) 770 3510.

Australia: Klarion Enterprises Pty Ltd, Regent House 63, South Melbourne 3205. Phone: 61 3801.

Canada: Chas L Thompson Ltd, 1121 W 15th Street, North Vancouver, BC. Phone: (604) 987 9388.

Holland: Iembe Roos Import, Hogeweg 33 and 52, Amsterdam Oost. Phone: 020 353555.

Italy: Laboacustica, Via Lulgi Settembrini 9, Roma 00195. Phone: 381965-355506.

UK: Macinnes Labs Ltd, Macinnes House, Calton Park Industrial Estate, Saxmundham, Suffolk IP17 2NL.

Phone: Saxmundham (0728) 2262/2615.

C-1 COMPRESSOR MODULE

A plug-in, octal-based unit with adjustable agc time constant between 0.1 and 1s by means of an external resistor.

Noise: -90 dB below rated output.

Total harmonic distortion: <0.5%, 20-20k Hz.

Compression range: approx 30 dB (two or more modules can be connected in series for greater range).

Power: +12 to +24V dc.

Price: £30.72.

SPECTRA SONICS

Spectra Sonics, 770 Wall Avenue, Ogden, Utah 84404, USA.

Phone: (801) 392 7531.

Model 610 COMPLIMETER

The unit can be used for peak-limiting and volume-compression, either independently or simultaneously.

Noise: <80 dB below +4 dBm output with -40 dBm input (threshold), 20-20k Hz, unweighted.

Total harmonic distortion: <0.1%, 30-20k Hz, at +16 dBm and up to 30 dB compression.

Compression/limiting ratio: 1:1-100:1, continuously variable.

Attack time: limiter: 0.1-2 μ s; compressor: 0.1 μ s to 1.2 ms; both automatically variable.

Release time: limiter: <0.09 μ s; compressor: 50 ms to >10s, continuously variable; both for 90% recovery.

Threshold attack level: -40 dBm.

SHURE

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Ill 60204, USA.

Phone: (312) 328 9000.

UK: Shure Electronics Ltd, Eccleston Road, Maidstone ME15 6AU.

Phone: Maidstone (0622) 59881. Telex: 96121.

Agents in most countries.

SE30-2E GATED COMPRESSOR/MIXER

Combines a 3-input mono mixer and a gated memory compressor in one unit. A 40 dB compression range is featured, with a ratio of approx 10:1 in the normal operating range. The response rate (averaging time constant) is adjustable to compensate for various types of programme material. Attack and recovery are variable between 100 ms and 8s, and in the 'hold' condition the gated memory holds the gain recovery to less than 20 dB after 60s to prevent pumping. A stereo parallel jack allows two units to be synchronised.

THOMSON-CSF

Thomson-CSF Laboratories Inc, 37 Brownhouse Road, Stamford, Conn 06902, USA.

Phone: (203) 327 7700. Telex: 4743346.

France: Thomson-CSF, DRT, 94 Rue du Fosé Blanc, 92231 Gennevilliers.

Phone: 790 6549. Telex: 620573.

VOLUMAX Model 4101/4111 LIMITER

A limiter for monaural (model 4101) and stereo (model 4111) fm broadcasting.

Noise: \leq 70 dB below maximum output level.

Total harmonic distortion: <1% with normal gain-reduction levels, 50-15k Hz.

Attack time: between 1 μ s and 3 ms, depending on program waveform and rise time.

Release time: 200 ms (low frequencies); 10 ms (mid frequencies); 2 ms (high frequencies); all field changeable.

Compression ratio: 10:1/infinite.

Control range: 15 dB.

Price: model 4101: \$1115; model 4111: \$1950.

VOLUMAX Model 4300 LIMITER

A limiter for am broadcasting.

Noise: \leq 70 dB wrt max output level.

Total harmonic distortion: <1%, 50-15k Hz.

Attack time: between 1 μ s and 2 ms, depending on program waveform.

Release time: 200 ms.

Compression ratio: 10:1/infinite.

Maximum gain: 50 dB.

Control range: 15 dB.

Threshold level: selectable; 100, 115 or 125% of negative peaks.

Price: \$975.00.

AUDIMAX Model 4440A/4450A COMPRESSOR

A compressor for monaural (model 4440A) or stereo (model 4450A) broadcasting.

Noise: \leq 70 dB with normal gain.

Total harmonic distortion: <0.5%, 50-15k Hz at +16 dBm output.

Attack time: 10-150 ms, depending upon programme.

Release time: 0.9, 1.5, 3s, gated and adjustable.

Compression ratio: 10:1.

Control: \pm 12 dB of gain.

Gating threshold levels: adjustable from -20 dB to normal input.

Price: model 4440A: \$925; model 4450A: \$1650.

TRIDENT

Trident Audio Developments Ltd, Shepperton Studios, Squires Bridge Road, Middlesex, UK.

Phone: 09328 40201. Telex: 27782.

Canada: Audio Analysts Inc, 2401A St Catherine's Street East, Montreal H2K 2J7, Quebec.

Phone: (514) 525 2666.

USA: Studio Maintenance Service, 2444 Wiltshire Boulevard, Suite 214, Santa Monica, Ca 90403.

Phone: (213) 990 5855.

CB9119

A single-channel compressor-limiter that can be coupled for stereo operation.

Total harmonic distortion: <0.3% at 20 dB limiting.

Attack time: 20 μ s to 250 ms.

Release time: 25 ms to 2.5s, variable.

Ratio: 1:1 (not limit) to 20:1, variable.

Price: single-channel unit in 483 mm rack-mounting case: £140; additional single-channel unit (for stereo): £110; complete stereo system: £250.

TWEED

Tweed Audio, Pinnaclehill Industrial Estate, Kelso, Roxburghshire, Scotland.

Phone: Kelso (05732) 2983. Telex: 727633.

Australia

Opollo Imports, Holden Hill, S.A.

Tel: 261 1383

Austria

Soundmill Vienna, Peter J. Müller.

Tel: 222 944 4233. Telex: 75922.

Brazil

Serion Ltd, Sao Paulo. Tel: 34 8725.

Canada

Noresco (Mfg) Co. Ltd., Ontario.

Tel: (416) 249 7316.

Telex: 06-217 876, a/b Norescomfg.

Caribbean

Professional Sound Equipment

Kingston, Jamaica.

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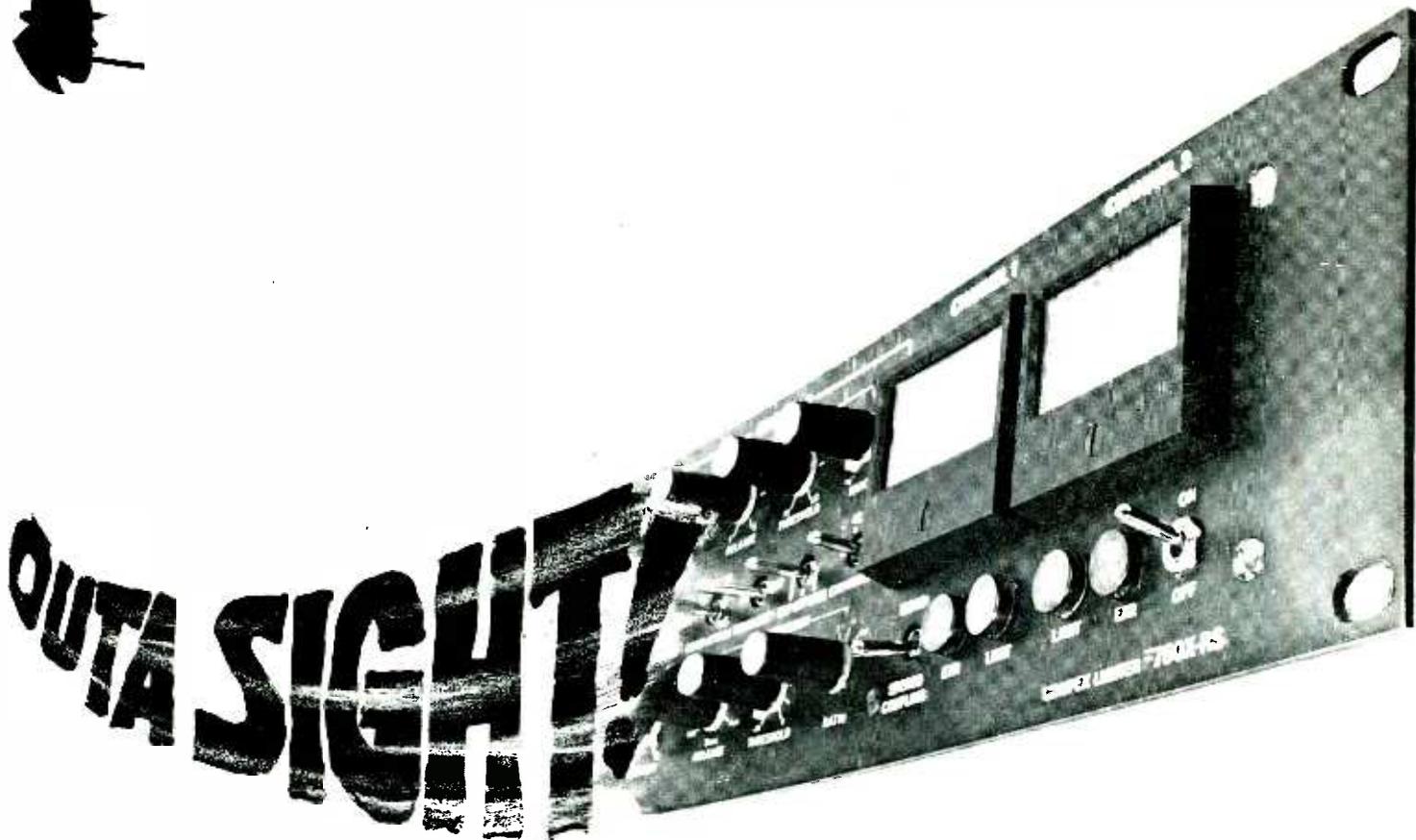
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SURVEY: COMPRESSORS AND LIMITERS

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Noise: -78 dB, 20-20k Hz.
Total harmonic distortion: <0.3% at 20 dBm limiting into 600 ohm load; residual typical 0.05%.
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Threshold: 0-12 dB above reference level in 2 dB steps.
Ratio: >100:1.

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Two or more units may be linked to track for stereo or quadrasonic applications.
Noise: -87 dBm (or better) at 0 dBm gain.
Total harmonic distortion: 0.1% operating; residual <0.03%.
Attack time: 5 ms (CCITT method) but self-adjusting on programmes.
Release time: 100 ms to 3s variable, or automatic self-adjusting.
Threshold: -20 to +10 dBm in 5 dB steps.
Ratio: 1.5, 2, 3, 4, 6 and 9:1, plus 'limit' (20:1).
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Utilises an electro-optical attenuator for independent gain reduction and control. Limiting frequency response is adjustable to allow up to 10 dB gain reduction at 15k Hz compared to those below 1k Hz—said to be advantageous in fm transmission where pre-emphasis is used. Characteristics of unit can be changed from those of a compressor to those of a limiter by throwing a rear-panel switch. Two units may be linked via attenuators for stereo operation.
Noise: >80 dB at threshold of limiting, 30-15k Hz.
Total harmonic distortion: <0.5%, 30-20k Hz.
Threshold of limiting: -10 or -30dBm; dependent on gain setting.
Attack time: <250 μ s to 0.5 ms.
Release time: 0.5-5s.
Price: £280.

LA-4

Like the LA-3A, utilises an electro-optical attenuator for 'smooth, predictable performance coupled with ease of operation'. Because the unit's gain reduction circuitry is rms-responding, it is not recommended for overmodulation protection of transmitters, disc or optical recorders, unless followed by a peak limiter, such as their model 1176LN. Two units can be linked for stereo application.

Equivalent input noise: 90 dBm, 15.7 kHz bandwidth.

Total harmonic distortion: <0.25%, 30-15k Hz.
Attack time: 1-10 ms for 63% correction, depending on waveform.

Release time: 100 ms to 1s for 63% return, depending on duration of limiting.

Compression ratio: 2, 4, 8, 12 and 20:1, front-panel switched.

Threshold of limiting: -30 to +20 dBm.
Price: £298.

LA-5 AUDIO LEVELER

The unit has a fixed compression and is designed for sound reinforcement applications. Like the LA-4, this unit is not recommended for protection of transmitters, disc or optical recorders.

Equivalent input noise: 90 dBm, 15.7 kHz bandwidth.

Total harmonic distortion: <0.25%, 30-15k Hz.

Attack time: 1-10 ms for 63% correction; depending on waveform.

Release time: 100 ms to 1s for 63% correction; depending on duration of limiting.

Compression ratio: 20:1.

Threshold of limiting: -30 to +20 dBm.

Price: £253.

BL-40 MODULIMITER

Designed specifically for am broadcasting, but with tv and signal processing applications. A 'phase optimizer' circuit automatically maintains most favourable signal polarity, reversing phase whenever negative peaks exceed positive ones by a preset amount. Independent controls (plus meters) for rms and peak limiting, and variable positive modulation up to 125%.

Noise: <70 dB at the threshold of rms limiting; equivalent input noise less than -100 dBm.

Total harmonic distortion: <0.5%, 30-15k Hz, +24 dBm output.

Attack time: rms section: 1-50 ms for 63% correction, dependent on signal; peak section: 5 μ s for 10 dBm limiting.

Release time: rms section: 50 ms to 2s for 63% return, dependent on duration of compression; peak section: 100 ms.

Price: £492.

1176LN PEAK LIMITER

Utilises an fet as a voltage-variable resistor ahead of the first stage of amplification. Two units can be coupled for stereo applications.

Noise: <81 dB at threshold of limiting, 30-18k Hz.

Total harmonic distortion: <0.5%, 50-15k Hz with limiting at 1.1s release and +24 dBm output.

Attack time: 20-800 μ s for 100% recovery.

Release time: 50 ms to 1.1s for 63% recovery.

Threshold level: dependent on input and output levels and compression ratio setting.

Price: £346 (stereo adaptor £23). ■

Rebis RA 301 Two Channel Compressor/Limiter

- Programme related variable attack and release controls
- Low 'worst case' distortion figure
- Compression continuously variable to 30db

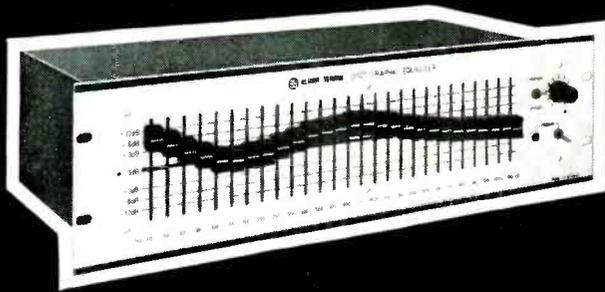


For full specifications of the Rebis RA301 Compressor Limiter and the RA402 Parametric Equaliser, contact: -Scenic Sounds Equipment 97-99 Dean Street, London W1V 5RA Telephone: 01-734 2812/3/4/5



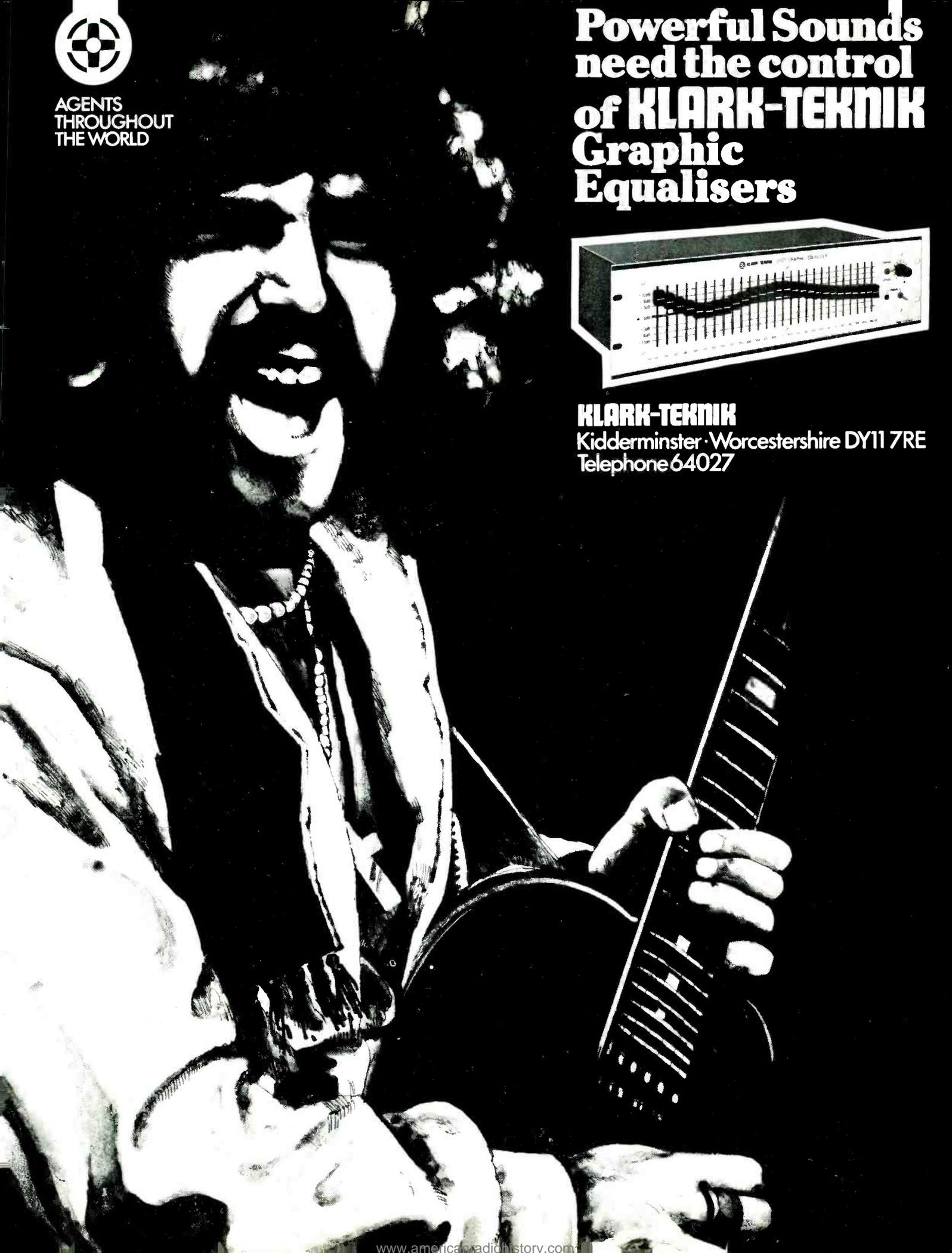
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Phasync out?

ONE ASPECT of the EECO *MQS-100* series synchronisers shown by Ampex at the last APRS has perhaps been overlooked in some quarters. This machine, you may recall, can synchronise any three audio or video tape machines for ganged use. Usually the synchroniser is used to link an audio multitrack machine to a video machine, to enable multitrack sound recordings to be made in sync with video. An SMPTE or EBU code is recorded on both tapes to lock the machines together in perfect sync. By locking two 24-track machines together, you can build up a 46-track recording facility (with one track of each tape sacrificed for sync pulses), and sooner or later someone is bound to gang three machines to produce a 69-track facility.

It'll be a pretty expensive pastime, of course, because in addition to the cost of three 24-track machines (around £20k each) and the synchroniser (around £10k), it'll surely be essential to use a computer-assisted mixing console—costing at least £100k—if it is to cope with 69 tracks. But has anybody looked seriously at the problems of phase discrepancies arising between the tracks of synchronised machines? It's something that ought to be looked at because, as Ampex say in their literature, some studios are already locking pairs of 24-track machines together to provide around three dozen tracks.

Although, to be euphemistic, not everyone on the Ampex stand knew too much about the finer points of the EECO synchronising details, a knowledgeable and helpful ITV engineer who happened to be visiting the stand told me about the SMPTE time code used with equipment. Now however accurate this system may be, surely it cannot preserve phase accurately between tapes—where, for instance, the same instrument is spread over tracks of the two tapes being synchronised, it seems inevitable that there will be phase drift between them.

Sync phase error isn't new. For the Festival of Britain, 25 years ago, some stereoscopic, stereophonic films were shown at the Telekinema. Two projectors were used for the stereoscopic process, with the left channel sound recorded on one film and the right on the other. By all accounts it was less than successful, with sound image drift. When the films were reshowed recently at the National Film Theatre, the sound track was in mono. (Left or right only I wonder?)

Another example of 'mechanical' phasing drift was heard when the film *Fantasia* was first released in the USA. The sound was recorded using a gang of eight mono optical recorders; in 1941 surely the first multitrack round recording ever. A stereo print was then made for limited distribution by printing

first the left channel, then mechanically racking over the optical printing head and laying down the right channel on a second run through the printer. Those who heard the decidedly phassey results still wince at the memory. No one is suggesting that synchronising two multitrack recorders to SMPTE will produce problems anywhere near as significant, but it's an area that calls for a little thought.

What's on ILR tonite?

IN MANY RESPECTS the success of the UK commercial radio stations is a triumph against adversity. Whereas BBC radio and tv has the *Radio Times* and ITV has the *TV Times*, commercial radio kicked off with no real means of keeping the public informed over what programmes were going out on which station and when. The schedules carried by local and national papers are as brief as property adverts and, for the most part, the stations have had to rely on regular slot programming to hook audiences on regular listening.

Radio Guide, from the *TV Times* stable, was one attempt at an answer. But the June issue warned of an hiatus due to 'holidays', and the July and August issues were dropped. The latest news is that a new *Radio Guide* issue will be published on September 23, covering the whole of England. It remains to be seen whether this issue is monthly, or—as some of the stations fear—quarterly.

Even for the monthly radio guide, stations had to put their copy in at the beginning of the month preceding the issue, which meant that some of the information supplied to the *Radio Guide* publishers amounted to predictions almost two months ahead. As the local stations see spontaneity and topicality as one of their main selling points, the idea of a 2-month ILR programme prediction is a contradiction in terms. And if *Radio Guide* were to become quarterly, it would presumably involve 4-month predictions, which would surely make it a nonsense.

Small wonder, then, that behind the scenes some very positive negotiations are in progress, whereby some of the local stations will be able to publicise up-to-the-minute programme details through an entirely new channel of wide circulation print. No one is yet saying anything more specific, but it seems likely that before the year is out a deal will have gone through.

Trial and error

ALTHOUGH it's probably too late now for a visit to the British Genius Exhibition in London's Battersea Gardens, the *London Experience* launched by EMI in the basement

of the old Piccadilly Circus Lyons Corner House restaurant provides a similar audio-visual experience to that which formed the featured centre point of the *Genius* show.

EMI did a deal on the old Correr House and spent a million pounds on converting the basement into a 300-seater auditorium. The plan was to stage a multi-media spectacular intended to introduce tourists to London, by giving them a brief run-down on the city's history peppered with interesting and appetite-whetting facts.

Leslie Buckland was brought in to create the show, Buckland having created other *Experiences* round the world. A 50-minute show was put together for EMI with an opening date set for early May 1977 to catch the Jubilee tourist traffic. A Royal premiere was laid on, with a preview for Bernard Delfont and his colleagues. He didn't like what he saw or heard, and pulled the plug on the show.

It finally opened nearly three months later, after heavy re-editing of the sound and special effects. The final result vindicates Delfont's decision, because it is a worthwhile spectacle and deserves a visit, even for Londoners. Engineers will be even more interested if they know a little more of what is going on behind the scenes.

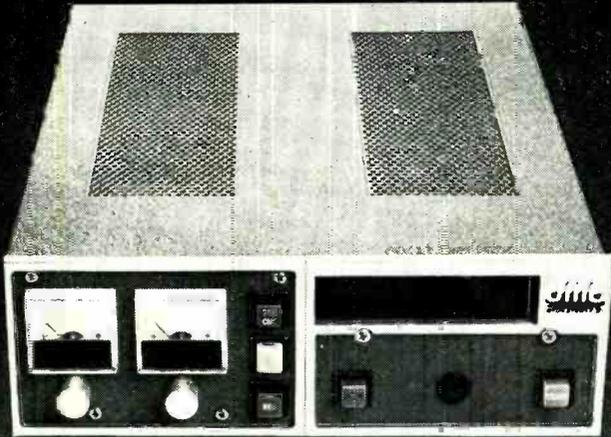
A spread of sound is recorded over five tracks of a Studer *ANO*. The channels feed rear left, front left, centre, front right and rear right banks of speakers hidden round the auditorium and behind the 7-section, 20m wide screen. Ten JBL studio monitors are used, along with a pair of Electro-Voice 75-cm bass units. The bass units are Amcron-driven, while the JBLs are powered by four stereo Quad *J05* current dumpers. All tracks are Dolbyed, as is the optical track of the 35 mm anamorphic movie projector ganged in with the 42 Kodak *Carousel* slide projectors. The projectors are controlled via Electrosonic microprocessors by three data tracks making up the rest of the 8-track format.

The data coming off tape is in the form of a 10 kHz tone chopped into a 120-bit code, the chopped signal being converted into a digital 126-bit code by an Electrosonic demodulator. The extra six bits are for signalling projector faults, eight bits being used for projector command (such as fade, switch on, switch off, and so on), and the remaining 112 bits used for enabling each of the slide projectors (up to 56 can be handled) to recognise their own, individual commands.

Sound levels are high, by tourist auntie standards, but clean. At the press show there was some upper mid-band peakiness, but this should by now have been pulled down with $\frac{1}{3}$ -octave equalisation. Also hopefully cured are a few unsuppressed switch clicks and a few bass rattles.

On the whole, the London Experience lives up to its title and carries a moral: If you are putting on a spectacular and it isn't up to scratch . . . scratch it. By sending the producers away for three months to improve on the package, Delfont saved EMI from embarrassment. How many other impresarios would have crossed their fingers and hoped the public didn't notice the deficiencies? But then it's the ability to take decisions like that that has put Delfont where he is—not running a flea pit in the sticks. ■

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--- oOo ---

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Compressor~limiter a cutter's best friend

George Peckham *

*Master Room

The cutting engineer's magic phrase 'if in doubt cut flat' doesn't always apply these days. Years ago tapes leaving the studio en route to the cutting room had been vetted by the engineer, the producer and mostly the producer's associates. The actual mention of a bit of equalisation, let alone a limiter or compressor, would have lifted the very best toupee to amazing heights. But, sad as it may be, eq, limiting and compression are standard functions in today's cutting room.

THE HARD FACTS are that the latest breed of 'super engineer' has never done his 'gig' in the cutting room—consider the importance: he records, mixes and treats the sound, but doesn't actually know what he can get onto disc. All too common are phrases such as, 'Hey man, dig that dynamic range', and, 'Yeah that bass, baby, will lift the stylus right out of the groove'.

Very true, it will. Enter the limiter—the lifesaver, the dynamic range masher, the peaky bass end basher . . . the cutting engineer's face saver.

I must admit that if I didn't have a pair of limiters, I just

wouldn't be able to get any level on disc most of the time. My first introduction to valve limiters was in Apple studios; the famed Fairchild limiter, in fact. (A smoother function you just can't get.) I've made comparisons with transistor limiters, but I find the function more like that of a compressor—the secret of a good limiter is that you don't hear it working.

We all know the 'response' from transistor equipment leaves valves standing, but the valve does something really nice and natural sounding to our ears: it rolls off high frequency and very low frequency, and boosts itself in the higher bass region and mid as well.

At one point in my career I worked in a studio (no name mentioned) as chief engineer for a couple of months but, would you believe it, no limiter in a place where a limiter is so necessary. The studio had blown the budget, and so it was down to hand limiting on the faders. As can be readily imagined, I used to get home with brain damage every night—hence my appreciation of the limiter.

One particular occasion springs to mind when an engineer from a well known studio brought in some tapes of an album he had engineered and produced. He was feeling rather proud of himself, as I think it was his very first session. I played the tapes for a few minutes and stopped the tape machine. 'Sorry mate, but these tapes are uncuttable'.

The problem was that he'd been monitoring at such a colossal level that he had completely ignored the meters, and had got what he thought was the most gutsy sound ever. True, if everyone could have listened to the music in a studio with massive monitors it would have sounded great. But he had added so much very low bass to the tapes that as soon as you tried to remove the 'dangerous area', around 30 to 40 Hz, all the bass vanished.

I tried boosting the higher bass area, around 100 to 150 Hz, but there just wasn't anything there. I even tried the magic limiter, but no; absolutely nothing could be done with his tape. He had to go back and ask his boss nicely, 'Can I please mix the album again, sir'. Get technical; offer advice to engineers.

Moving on to the compressor, it's as different again as the valve is to the transistor. The limiter has quite a fast reaction, while the compressor is much slower and much more aggressive—this little beauty says 'Nothing shall pass me', and means it. The compressor is a great piece of gear. For things like the bass drum, it literally sucks and blows. Have you ever heard one of those bass drums that shifts your diaphragm in and out? You can be sure that a sneaky compressor has had its hands on it. And snare drums too can be given that good old Fifties' sound by the compressor. But a compressor is not very good for voice or very 'dynamic' instruments, because then you will hear it sucking and blowing far too much, even with noise reduction.

So when using compressors remember: 'Nothing shall pass me', and, 'When I'm grafting all shall know'. It's a real workhorse and has saved lots of engineers many a hassle in the studio when the producer isn't happy with the drum sound (as usual). A 'quick'



engineer drives his compressor harder and hears the magic words, 'Now why didn't I think of that before a little more noise reduction'.

I remember the occasion, while working at Apple, going to cut a Doris Troy album, but yet again the dynamics were well over the top and the limiter just couldn't handle it. I booked in at EMI with Peter Bown to make a copy with his Altec valve compressors; they certainly did the job and made the album a lot more punchy. If I'd tried any other way I just wouldn't have got the kind of cut from the tape I wanted.

For those who are not sure why dynamic range is such a problem for the cutting engineer, peaks are the reason to limit. A transient peak 10 dB over a stable level, for example, would require the tape to be cut 10 dB down; but put a limiter in circuit, and if you can control the transient by say 5 dB, you can immediately come up in level 5 dB. The bigger the transient the larger the groove excursion, so if you're not careful you end up with a record that jumps.

Obviously we try to put as much level on a disc as possible. You will all have noticed that these days the quality of pressing is very close to nil. Therefore, the higher the level on disc the less you notice the crackle, plops and rumble.

But, above all, everyone who comes into the cutting room wants his record to be louder than anyone else's. It's a pity that the new breed of engineer hasn't had his turn at cutting a record. In that way, by the time the tape reaches the cutting room, level would be the only thing left to check.

It would be really nice to be able to take the engineer by his hand and give him a general trip through the everyday problems that arise in the cutting room. Even better if the studios could afford to have their engineers spend a whole day sitting with the cutting engineer—it would certainly help to eliminate any future problems with their tapes.

Again I refer to conversations with studio engineers: one guy once told me, 'I didn't limit anything on the recording or the mixing. I really want that punchy loose American sound. Oh, and by the way I want you to cut it flat so it will be just like direct to disc'.

'Yeah. Sure. But you don't mind me using the main fader to drop the level down to normal level on disc do you?'

'Normal level,' he replied. 'I don't give a f... if it jumps so long as everyone says what a fantastic sound. Let's face it, you'll get the blame if it jumps, ho ho'.

So, ho ho I thought—'limit', that magic word—I'll fix the sod. And I did, making the limiter work much harder than I like to use it. He commented how much better than everybody else's tapes it was; I was standing there ready to own-up that I was playing games. But no he hadn't even noticed, he was so into the sound—finger popping, shuffling his feet with the occasional, 'Fantastic, too much man'. I thought, 'Bugger you', and carried on. As you can imagine, by now he'd knocked my enthusiasm for six. And if he hadn't noticed the limiters squeezing the sound I certainly hadn't, as he'd just proved how concerned he was.

Two chaps from a certain band came in one evening at 6 pm to cut an lp. I aligned my machine to their tones and proceeded to play the tape. Comment: 'It doesn't sound right, let me check you lining up the tape machine'. So back to the top, check the tones. 'Ok, the tones are right, check your azimuth'. Double check. 'Still sounds wrong'. My comment was that perhaps the speakers they'd monitored on sounded different to mine. No, they wouldn't have it. 'I'll look around to find something to lay on the floor to change the sound'. Finding some old carpet underlay, he tries it out, lays flat on his back on the floor but it still sounds wrong. He then decides to call an engineer to bring his scope over and make sure the tones are going through my system correctly.

The engineer arrives and I insert said scope. When it comes to checking the azimuth I put my hand over my phase meter. 'Ok', say I, 'you align the azimuth to his satisfaction'. This he does, and I take my hand off the phase meter commenting: 'Well, well, would you believe it. My meter says it's in phase too.'

The session carried on in this vein until I was feeling tired and told them they'd have to leave as I had a client in at 9.30; I had to get washed up and grab a fast breakfast before then. So they left and I carried on through my normal day, until a call came through in the afternoon. They wanted to recut one of the sides. Well, I thought, considering that I know that album inside out, this won't take long. They arrived again at 6 pm and, would you believe, at 9 am I had to tell them I had gone as far as I could—if they weren't satisfied they would be better trying another cutting room. But they



said they would like to try just one more cut of the album.

This was the last straw. I had to order them out; I had been more than patient and they left. Of course, 9.30 again, time to start working—I was so tired. But as I thought how I'd ordered them out, and they wouldn't come back again, I suddenly had a great surge of energy and became very perky. I got through that day so easily knowing that there was a bed in the sunset tonight waving me on. And getting into that bed was a better feeling than the moment I lifted my hand off the phase meter. ■

agony

A British conductor, paying a visit to New York in order to do an opera at the Kennedy Centre, had a quick look into a record shop and was astonished to find that all the records, brazenly on show, were bootleg. There was even an 'alternative' *Gramophone* catalogue (not published by *Gramophone*, of course) available to help the record buyer through the maze of competing pirated recordings. An assistant, recognising our hero, rushed out and insisted on having an autograph and then, seeing as how the pirates don't pay artists a penny in royalties, generously let him have a bootleg of one of his own performances (with his picture on the front) for 10% off list!

A local dignitary was being shown around a 24-track recording studio in the West of England, and was looking in fascination at the desk as the engineer, doing a mix, controlled the various instrument levels with the faders. The leds flashed, the meters moved and the studio monitors delivered a high level of sound, impressing the dignitary no end. Just as he was leaving, he was suddenly struck by a thought. 'If the sliding knobs on that thing there—points at desk—control the volume of all the sounds it makes, what do you need real musicians for?' Collapse of assembled company.

work

Clyde revisited

The Trust House Forte hotel at Glasgow Airport is the first hotel I've ever found that has a local commercial radio station—Clyde—plumbed into the room service sound system. I'm not saying that there aren't other hotels in the UK that provide bedside ilr for their guests at the push of a button, (the IBA mention Liverpool in this respect), but I am saying that usually there's only a choice of Radio 3, 4, perhaps 2, and sometimes musical drive from a Muzak-style cartridge. I've even run across hotels where there's been a spare, unused switch position which no one has thought, or bothered, or wanted, to use for the local commercial station. But in many respects Glasgow and ilr Radio Clyde have always been different.

Right from the start, Clyde was a success story. In *STUDIO SOUND*, Feb '75, Jeff Barron reported on Clyde, and how over 70% of the 1.8 M Glasgow population were listening to Radio Clyde at some time each week. And McListenerwise, Clyde has gone from strength

to strength. According to recent reports, although Capital Radio hardly surprisingly holds the biggest share at 3.6M of the 13.5 total British weekly audience for independent local stations, Clyde comes top of the poll outside London with a pretty staggering listening audience of nearly 1.28M. And in its vhf area, Clyde pulls in more than all the BBC Radio stations and Luxembourg taken together. Although I find all listener rating figures inherently suspect (well, have you ever been asked which stations you listen to?), the message is inescapable—Clyde is a highly successful radio station. Having heard Clyde in action, courtesy of Trust House Forte's audio plumbing, I can understand why.

Just one example. Switching on at random, I caught that fine guitarist, Ken Sykora, who used to broadcast regularly on BBC, playing records of swing music from the big band era with occasional recourse to trivia furnished by Ken's 'College of Useless Knowledge'. Actually what Ken was doing was playing good music and mention-

ing contemporary happenings, to put the feel and style of that music into historical perspective with a high degree of intelligence. There is nothing quite like listening to a programme, on whatever topic, broadcast by a professional who knows something about the subject on which he is talking.

I well remember in the early days of Capital, dj Tommy Vance talking with painfully obvious ignorance about jazz in a regular weekly programme devoted to that specialist topic. With disarming honesty, Vance (who clearly knows other areas of music well) openly admitted he had never heard of the names he was reading off the record sleeves (and frequently mis-pronouncing them). During one interview he clean forgot the unfortunate guest's name. Then, with no knowledge of the poor chap's musical background, Tommy Vance was reduced to regaling the listening audience with a run-down of what they'd had for dinner together before the show went on the air. Mercifully, Capital axed the weekly display of Vance's ignorance on jazz.

Having listened to Clyde for a few more hours off-air, I went into Glasgow later that night to try and get a brief look-see and talk. For purely Glaswegian reasons I wouldn't recommend it to anyone else with the same idea. Although the Clyde studios are in the centre of Glasgow, at the new Anderston Complex shopping precinct, they are the very devil for a non-local to find—and Glasgow's streets in the early hours of the morning are about as relaxing to stroll through as uptown New York.

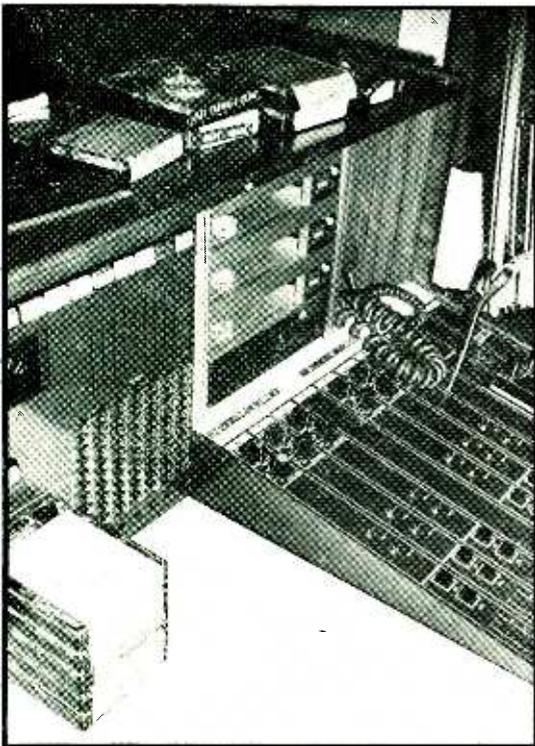
The offices and studios are surprisingly large; but then there's a staff of 70 of which, unusually, 18 are employed on news. For Clyde, although equipped with a London link, does not officially take IRN. This makes sense and is probably inevitable. One reason why Clyde has succeeded is the high content of local Scottish news, as opposed to the high content of non-local news to which the locals were obliged to listen, courtesy of the BBC. 'Well, you'd get pretty sick of listening to hot news about punctures in Argyll Street,' said a Clyde broadcaster on late-night duty.

It is interesting to see that Clyde is still using the British-made Bias tape recorders which, as Jeff Barron reported, were installed at the beginning as a budget alternative to Studers. It's nice to see people buying British and still not regretting it three years later. The Pye desk in the master control room has, however, now been replaced by a custom-built Alice to the design of Clyde Chief Engineer, John Lumsden. A fascinating feature of

this desk is a matrix of push-button switches, enabling the dj or engineer on the desk to cross-patch a wide variety of incoming feeds, including phone lines, radio car, IRN, pocket phones, and so on. This kind of multi-feed system is particularly valuable for complicated ob coverage; for instance at election time. The engineer can switch to and between ob sources, take two at a time, and listen on pre-fade to an incoming phone call, all at the push of a button. It's a classic example of a control desk tailor-made for local broadcasting, and such a desk couldn't have existed until a few years of practical experience with local broadcasting in the UK had taught engineers what it was they really wanted and needed.

The original turntables have now been replaced by Technics 'instant-starts' ganged to desk faders. As the fader comes up from zero, so does the turntable speed. The rise in speed is at least as fast as the normal fader lift, obviating the need for slip-mats and the like. Previously Clyde had used Russco quick start rim-drive decks, well thought of but inevitably a less elegant solution to the problem of fast-start cueing, once the Technics electronic system had become available.

What really matters to the Glasgow listening audience is not technology but programming, the responsibility of programme coordinator, John MacCalman. Clyde is now a 24-hour station, whereas originally it was on the air 24 hours a day. Particularly noticeable is a marked absence of phone-ins, chat shows, other than quizzes, an hour's *talk-in* on Sunday and a political direct-dial on Friday. Ken Sykora broadcasts several times a week, and there is a weekly *Hear me talkin* programme with musical notables like Harry Edison, Ian Whitcomb, Harry Chapin, Oscar Peterson, McCoy Tyner, Joe Pass, and the likes, interviewed by MacCalman, Jim Waugh, and others. Waugh also hosts a two-hour *World of Jazz* programme. This, along with *Hear me talkin* and Ken Sykora's various offerings, must make Clyde one of the most jazz-orientated local stations in the UK. And as a memo for other stations, an interesting personality doesn't necessarily have to pass through Glasgow to be interviewed for Clyde. Tapes are made in London or abroad, if the personality warrants it. Like Capital, Clyde also records live music, either with the ob truck or in the small music studio using a Scully 4-track. More tracks are scheduled for the future.



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WORK

Reading between the lines, there is only one area of mild discontent at successful stations like Clyde. This is that Big Brother Independent Broadcasting Authority would ideally like to see all the IIR stations running in financial step, with an equal measure of success like a pack of phantom white horses. Anyone up front and winning stands out of the pack, and is inviting an especially close watch from the IBA. The more struggling local stations (struggling, it must be said, to pay the extremely high and ever-increasing transmitter rentals payable to the IBA) can hope to get away with more naughtiness on and off the air than a station, like Clyde or Capital, making money without bending the rules. You won't, for instance, get away with a Workers' Playtime-style outside broadcast, with top names performing from a 'biscuit factory somewhere in Scotland—or London'; but you might just get away with something similar in the sticks. Likewise you could only hope to get away with joint promotion deals run, perhaps, with a local record shop where the station is otherwise having difficulty making ends meet.

It would seem fair that if there is a set of rules it should be one set of rules for all, and that the price of success should not be a tighter rein from the IBA. **Adrian Hope**

Getting into narrow gauge

'We costed out hire rates, based on 24-tracks of Neve, Studer and the like, and quite frankly we couldn't see how the kind of returns we could expect would even pay the interest on the loan . . . Perhaps if we were very popular we would be able to pay the interest; but there was no way that we could be paying back capital at the same time. So we asked ourselves why we needed Neve and Studer, and came up with two answers: continuous rating reliability and signal-to-noise ratio. But with a nine-to-five studio you don't need continuous rating reliability, and with dbx and the Tascam 8-track 12.5 mm format, you can get a 100 dB dynamic range. Someone once worked out that it cost around £1000 per dB with modern studio equipment—well, at that rating, by going Tascam and dbx, we've £100k worth of dB for around 10% of the price'.

Ivan Berg was speaking at his new studio in Broadhurst Gardens, Hampstead, London; just behind John Barnes's emporium on the Finchley Road. One of the first new

studios to go wholly Tascam-Teac-dbx from the start, and actively discourage demo work, Ivan Berg Associates makes an interesting case study.

The crucial decision was to spend the lion's share of the money available (from ATV) on the recording environment, rather than the recording equipment. In the event, this departure from normal professional studio practice meant the allocation of some 75% of the total building and equipment budget on the control room and studio environment. And the only way that this was possible was to find equipment that could live up to the environment but cost what, by present multitrack standards, comes out at absurdly little.

In many respects it's frightening that the answer has had to come from Japan. Berg would clearly have welcomed the opportunity of buying British, but couldn't find anyone or anything home-grown to touch the Teac-Tascam recorders and desk for price, performance and facilities.

'The answer is that the Japanese have decided to bulk produce studio equipment,' said Berg, 'and in this way they are able to offer high performance at low cost. There's no shortage of facilities on Tascam, and with dbx the ½-track format, which of course is far more economical on tape costs, is perfectly adequate.'

Berg's enthusiasm for the Teac-Tascam wares started with his work with Teac 3310 4-track 6.35 mm machines in a studio just round the corner from Broadhurst Gardens. Recordings made on the 3310 were mastered onto a Revox HS477 using Dolby A, for cassette duplication by Phonodisc.

'Now Phonodisc are fairly pernickety,' says Berg, 'but they were happy with the masters we were sending them. In fact, they complimented us on their quality. Finally they came round to have a look at the studio, and disbelieved that what we were putting out came from what we were using. Of course you need more care in setting up and using ¼-track equipment; but there's no reason why the results shouldn't be every bit as good as from wide format originals.'

An interesting point made by an arranger with whom I subsequently spoke, is that 'narrow-gauge' recordings with numerous overdubs only become a menace when they have been produced by an over-enthusiastic composer to demo a new song. The listening arranger, or group, who will perhaps be giving the song a new feel, will then find difficulty in cutting through the jungle of overdubs. They would



Tascam-Teac gear in abundance.

often prefer to be working with more raw material, such as a voice plus piano or guitar accompaniment only. But 4 and 8-track comes into its own as a budget medium when used by a small studio, such as Berg's, or as a means of making budget masters for commercial release.

The question of track compatibility requires consideration. Problems can arise, for instance, if attempts are made to replay 6.35 mm tapes recorded in the Teac ¼-track format on Studer and other ½-track stereo machines. 'Ganging' track pairs (for instance, recording a mono signal across two tracks of a 4-track format for replay on one track of a stereo Studer) will only work if virgin or bulk erased tape is used. Otherwise there may be a risk of the Studer heads reading off unwanted material that had previously been safely lost in a guard band. Anyone who has ever tried mixing full-track mono, ½-track and ¼-track domestic stereo formats, without first bulk-erasing, will be only too well aware of how easy it is to get bleed-through of unwanted sound—as often as not running backwards. But, of course, where multitrack narrow tapes are made and played in-house and then

mastered for cutting or duplication on ½-track machines (as at Berg's studio), there will be no compatibility problems.

Broadhurst Gardens has an interesting history, in that it's a residential area where you wouldn't expect to find planning permission for a recording studio. But 25 years ago Walt Disney took a lease on the premises to build a dubbing studio for putting foreign-language tracks onto Disney films. After Disney moved out, Broadhurst Gardens became Pan Sound, and then Weir Sound, for musician Frank Weir. In January 1976 Weir Sound became Ivan Berg Associates; but it took almost a year, until the beginning of 1977, before the rebuilding programme was finished.

A studio in a residential block, of course, has advantages. Like, for instance, no lift machinery, no rf interference, and so on. But acoustic isolation can be a problem, especially as Broadhurst Gardens is only 50m from Finchley Road Underground and the busy main Finchley Road. The studio and control room were designed to background noise level NR15 spec by

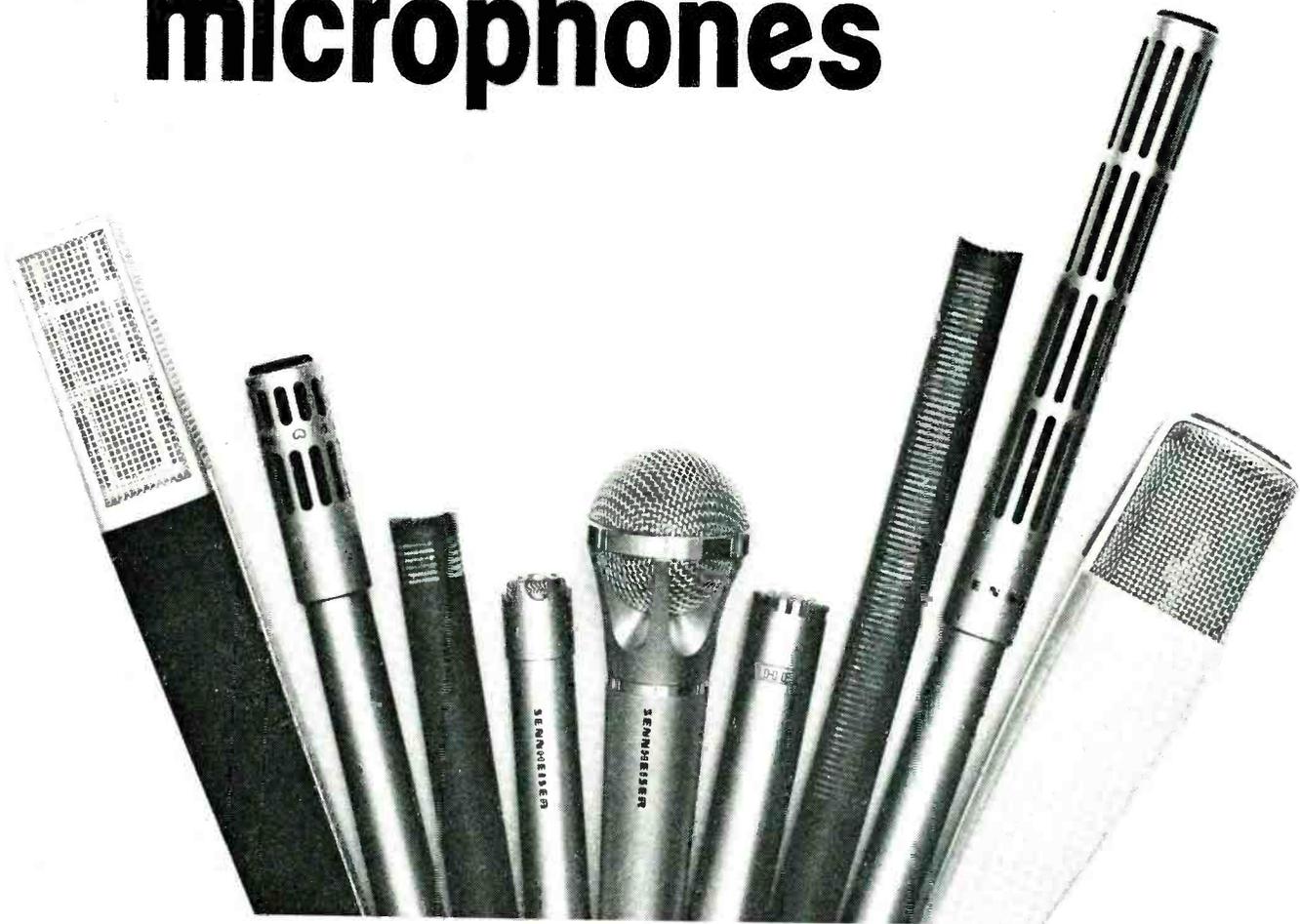
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Strawberry aren't that busy

In the recent piece on Manchester (August issue, p58) I went out on a limb suggesting that the busy state of business at Strawberry might be leaving the studio with no time left for good pr. I waited for the inevitable phone call, and it came. But, all credit to Strawberry, not so much peeved as concerned at how what the studio regard as a false impression could have been created. It raises an interesting question: how does a studio enjoy solidly full bookings for six months ahead, and not create the impression of being too busy to be worth approaching. After all, a studio that isn't busy may not be worth approaching either (albeit for different reasons). We'll look at this cleft stick in a future issue, timed to tie in with Strawberry's 10th birthday, their construction of a new cutting room, and the recent launch of Strawberry South. Sounds interesting material . . .

AH.

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letters

Two Soundcrafts

Dear Sir, I read with interest your report on Swiss recording studios in the August issue of *STUDIO SOUND*. I feel that I should correct the impression which the report gave that the Aquarius recording desk is a 'much customised Soundcraft desk'.

This desk was designed and built by myself on a 'one-off' basis while I was working for a Swiss firm which was then known as Soundcraft.

Neither this firm nor the desk have any connection with Soundcraft Electronics Ltd of London.

I hope this clears up any confusion which may have existed about this name.

Yours faithfully, D L Norman, Kestral Electronics, Seestrasse 15, 2563 Ipsach, Switzerland.

Synthesiser temperature drift

Dear Sir, I read with interest your combined operational/technical review of the Roland 700 synthesiser in the July '77 issue, but I feel that Hugh Ford has underestimated the importance

of oscillator stability. Synthesisers are used over wide temperature ranges, and it is not uncommon in a live performance to unload equipment from a van on a frosty day and go straight on stage to a performance ending at, say, 30°C ambient. However unreasonably, users do expect their synthesisers to stay on tune right through a performance in these conditions.

To understand the problems one has to appreciate the internal workings of the particular oscillators. All good-class synthesisers use logarithmic scaling, and this is invariably achieved using the exponential characteristic of a transistor. This relationship is usually written:

$$I = I_0 \exp(V_{be}/kT)$$

and contains a temperature (in °K) within the logarithmic scaling factor.

Temperature compensation can be achieved at one value of current (ie frequency) by using a dual transistor, and this is usually set to be around mid-scale, say 250 Hz. The scaling (ie volts/octave) has to be compensated, either by running the transistor pair in an oven, or modifying the frequency control input sensitivity with temperature sensitive resistors of the correct

temperature coefficient.

If this is not compensated, chords will drift out of tune in a manner both offensive and incorrectable by alteration of the keyboard span controls. A valid test of synthesiser oscillators, in my opinion, would be to tune two together to zero beat on a 2-octave interval, and see if they will stay that way over the whole keyboard range. They should then be cycled over 0—30°C to check frequency and scaling stability. The results of this test on some earlier designs are quite horrifyingly bad, and some designs have appeared on the market with no scaling temperature compensation at all.

This is not intended as a criticism of the Roland synthesiser, but merely an indication of the high levels of performance (by industrial and commercial standards) now required by modern-day musicians of even the humblest electronic synthesiser.

Yours faithfully, Ken Gale, K Gale Electronics, 28 Grove Road, Parkstone, Poole, Dorset BH12 3LG.

APRS again

Dear Sir, I would like to thank Mr John Dwyer (letter in July issue) for displaying such keen interest in the APRS: I am sorry that he is not eligible for membership of our Executive Committee.

Yours faithfully, Jacques Levy, Chairman APRS, 6 Carlisle Mansions, SW1P 1HX.

John Dwyer replies:

Oh well; but Jacques Levy has still not answered my question.

WORK

Peter Sarony and Associates, with Keith Rose as Acoustic Consultant. Doubtless thanks to Rose's BBC connections, the surprisingly large (42 m²) studio and control room has a decidedly BBC feel. The acoustic box absorbers, soft and hard side screens, and curtained walls are all indebted to Sandy Brown and Keith Rose. The air conditioning is totally silent, designed to run during recording, and the control room is a 90-tonne box of solid concrete that is floated on a matrix of rubber jacks. In fact, the control room was built as a solid box, then jacked up with a gang of manual screw-jacks, and then allowed to sit back down on the rubber mounts. The manual jacking alone took two days.

A Teac 80-8 (8-track, 12.5 mm), a 3340S (4-track, 6.35 mm) and a 7300 (2-track master with variable speed) all have dbx on all channels: 'It's automatically plumbed in,' says Berg. 'It doesn't even appear on the patch bays.'

Although the studio is available for hire at £20 an hour (it can hold up to 25 musicians), around 50% of the work done is in-house originated. And the majority of the in-house work is voice recordings

for release mainly on cassette; for instance, as part of the *Times* cassette series, or as one of the 60 titles in the *IB Cassette* series.

The studio mostly uses Agfa PEM 368 long-play tape. This is not only in the interests of economy, but also reduced head-wear in comparison with standard-play tape. Berg is well aware of the risk of increased print-through from lp tape, but again reckons that using dbx cures this problem. There is, of course, the added consideration that lp tape feels less solid to the touch for manual editing; but this is not a major consideration where, as in the case of Berg's catalogue titles, the mixes are done live.

Audio publishing is a relatively new idea, and with 60 titles *IB* are in the lead. Examples include a cassette on Shakespeare; one on Marconi; another on Edison; another on the Hindenburg disaster; and an Edgar Lustgarten 'Justice' series. Some *World's Greatest Scandals* such as 'Fatty Arbuckle' are planned for the future. In most cases an event or situation or life is enacted in play form, using professional actors and a narrator, plus music and effects. The majority of cassette sales are by mail order, and the market is mainly specialist.

The actors come from a regular,

nucleus team of around 60. The scripts are sent out to the actors two weeks before recording date, and when they come in there is no rehearsal. This is possible because everyone knows and has worked with everyone else before; hence the regular team. Mistakes are corrected using drop-ins with no subsequent editing, the voice recordings going straight down into 4-track. The actors then go home, and Berg does a live mix of voices plus effects and music straight down into stereo. The whole thing runs so tightly now that the actors can produce two 1-hour programmes in a day.

Where does the need for multi-track come in? Apart from contract work and in-house original music recordings as featured on some of the cassettes, the 8-track Tascam is used to build up sound effects. For 'The Battle of Mid-Way', Berg could only get hold of two different gun effects on disc, and one aeroplane. With judicious overdubbing and multitracking he recreated the sound of the US Marines and Air Force in action. To 'avoid driving the tape duplicators mad', Berg uses a dbx 160 to compress such effects.

Studio monitoring is via Tannoy 27-cm units in Lockwoods. Gerry

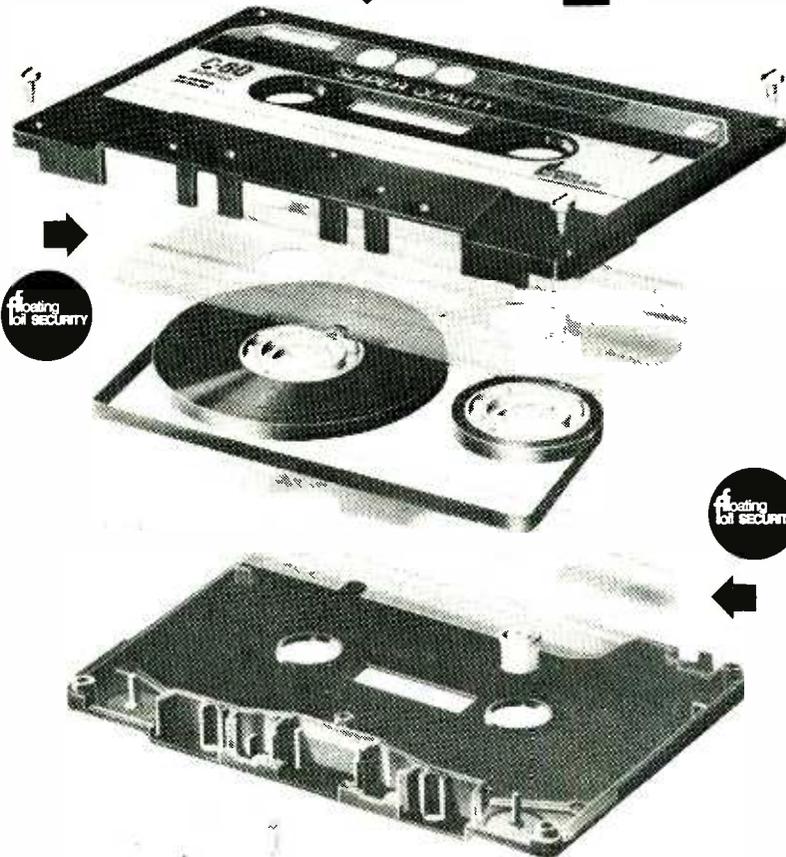
Taylor has built some unusual gadgetry into the control room to aid live mix-down. There are, for instance, electronic timers on all three tape machines. However, the auto-cue and remote facility used for effects is particularly interesting. Although most of these come initially off disc (or multitrack tape after overdubbing), they are transferred onto standard cassettes prior to mixing. Three Teac A660 'domestic' cassette machines are all remote-operated from the desk. This is possible because the Teacs have solenoid operation, and Berg reckons that by standardising on BASF *Ferrochrome* cassette tape he can get virtually disc quality.

A 2-frequency tone (60 plus 11k Hz) is recorded on the cassette tape between each effect, as a cue. The machine reads the tone and stops in the pause position, ready to be instantly restarted by the push of a series of buttons. These are built into the 16/8 desk formed from a pair of standard Teac *Model 5* modules. It's an impressive sight to see the three cassette machines coming automatically up to cue during mixing, and the system is obviously far easier to handle than disc.



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WORK

Berg prefers to use only dynamic mics, mainly AKG 190 and 202, because of their 'freedom from sibilant' problems. He also uses dynamics for outside music recordings, often made in nearby Rosslyn Hill Chapel. Berg obviously favours this chapel, because it costs only £50 a day to hire and has superb acoustics. The main body of the church hall is fully carpeted, and has a soft, but fairly long, reverb time. The altar area is stone-floored, and has much harder acoustics. As a bonus, there is a room just off the hall that is ideal for monitoring on speakers at fairly high level. The main disadvantage of Rosslyn Hill, however, is its proneness to aircraft noise, when wind direction has London Airport routing traffic over Hampstead Heath.

With an eye to the future, Ivan Berg writes video as well as audio rights into all his contracts. Thus all the cassettes currently available in sound may one day be available in pictures. This may be nearer than you think, because already Matsushita in Japan has developed a working prototype of a cassette playback machine which digitally encodes colour picture information in the guard bands between the stereo tracks of an ordinary Philips cassette. When the cassette is played on a mono cassette machine it produces mono sound. When the cassette is played on a stereo cassette deck it produces stereo sound. When the cassette is played on a Matsushita stereo sound and picture machine, it produces stereo sound plus still pictures on a colour TV monitor every few seconds. Around a thousand pictures can be encoded on a C-60 cassette.

Adrian Hope

Around sound . . . again

In the past we have criticised the Ambisonics team (Professor Peter Fellgett, Michael Gerzon and John Wright) for their reluctance to produce nuts-and-bolts information and demonstrate hardware for their surround-sound system, despite NRDC cash backing. We are thus pleased to report that something positive now seems to be happening. At a recent AES meeting in London, it was announced that an agreement has been reached between the NRDC (for Ambisonics) and Nippon Columbia in Japan with American Duane Cooper, (originators of the UD-4 system). The two, previously rival teams, should now combine forces, pool patents and exchange knowhow, to develop and push a single

rationalised system. In many respects the alliance is technically logical and commercially sensible. But it is nevertheless welcome—because in the surround-sound field what is technically logical and commercially sensible seldom seems to happen. UD-4, which has over recent years become virtually defunct, was always regarded by engineers as one of the most elegant of the surround-sound systems. It was also clear that the mathematics behind UD-4 (from Duane Cooper) and the mathematics behind Ambisonics (from Michael Gerzon) had much in common. There was also a clear conflict between the similar patent rights owned by NRDC, Nippon and Cooper.

Out of the projected alliance now comes a clear plan of campaign for the future. The joint system, to be called 45J, is rational in that it offers a hierarchical approach to the transmission and recording of surround-sound. In its simplest form, basic horizontal surround-sound information is matrixed into two channels for stereo radio transmission, and stereo tape and disc recording. If a third channel of even limited bandwidth is available (for instance an extra multiplex radio or disc channel) then additional information is carried there. The extra channel helps the reproduction equipment produce better results from the information decoded from the base band stereo pair; one advantage being less 'phasiness' of the loudspeakers signals. Where a fourth information channel is available, either by further multiplexing or the use of multitrack tape, this is used to carry height information—that is to say information that will enable the reproduction setup to reproduce an image with vertical perspective, as well as the horizontal perspective derived from the other two or three channels. Engineers familiar with the UD-4 system will now readily understand why the alliance was so logical. The UD-4 system adopted a comparable hierarchical approach, with two, three or four channels providing additional surround-sound information, albeit only in the horizontal plane. This approach differs from that of the JVC CD-4 system, where the four channels on the disc (stereo base band plus multiplexed additional pair) are used to carry four discrete signals, each intended for a separate loudspeaker.

The distinction between, on the one hand, the CD-4 discrete approach and, on the other, the current 45J and now extinct UD-4 approach, highlights another important aspect of the Ambisonics work. This concerns the manner in which the received channels of

information are handled. Ambisonics reproduction equipment does not feed each channel of decoded or demodulated information direct to an amplifier for loudspeaker reproduction. Instead, the content of all the available channels of information is processed, and from this processing there are derived loudspeaker signals which are by no means the same in content as the signals carried in the various channels. In other words, according to Ambisonics philosophy, the transmission channels (be they on disc, tape or radio) never carry loudspeaker signals. Indeed, according to Michael Gerzon, there is a positive disadvantage in using more than three channels to convey the horizontal surround-sound information. Inevitably, this highly contentious point will be the subject of much argument in the future because it undermines the whole philosophy behind the CD-4 discrete system, which has already achieved reasonable commercial success. An equally entertaining argument (for spectators at least) is to be expected on several other fronts as well.

It is claimed that although the Ambisonics signal processing circuitry only produces optimal surround-sound results when used with 45J encoded material, the system will also handle material encoded according to most existing quadrasonic formats (including CD-4). So far, however, the Ambisonics team have indicated that their system will have most difficulty in handling SQ material. A lively response from CBS and Ben Bauer is clearly inevitable.

Likewise there will be squabbles on the broadcasting front. Every surround-sound and quadrasonic system must balance the ability to provide good surround-sound reproduction for those with the necessary equipment, against good stereo and mono capability for those who couldn't care less about such new-fangled things. Every rival system to date has claimed that its particular compromise is the ideal. Needless to say, the 45J compromise is the latest to be claimed as ideal. According to the hierarchical approach, a mono or stereo listener will achieve good reproduction from 45J base band material, regardless of whether or not it contains an additional one or two information channels.

A listener with equipment to decode the base band information achieves good surround-sound in the horizontal plane; a listener with better equipment capable of decoding the third channel achieves better horizontal surround-sound; and a listener with equipment capable of decoding the fourth channel (as

and when it is used) will be able to reproduce height information. As no demonstrations of 45J recording or reproduction equipment have yet been given, such claims must be regarded as unsubstantiated (although doubtless backed up by the mathematics which only Michael Gerzon and a handful of others are capable of understanding). Crunch time for Ambisonics and 45J is, however, not far off. Studio equipment for recording and reproduction equipment for surrounding the listener with sound is now available and under test by the BBC and IBA.* Test discs are being pressed, and it is likely that demonstrations for other interested parties in the studio and broadcasting fields will follow thereafter. We shall report on these as and when they occur. And there may be much of significance to engineers to report. For instance, Michael Gerzon remarked at the AES that: 'Someone, somewhere, guessed at a quad panpot law, nearly ten years ago. This subsequently turned out to be wrong, but studio engineers and broadcasters have been stuck with it ever since, even though the ideal panpot law is simpler to engineer.' (Sorry, chaps, but all those expensive new quad panpots you put in last year but have never used because nobody ever booked your quad-capable studio for a quad session, will have to go.)

Particularly important will be the effect which 45J demonstrations and tests have on the IBA and BBC. Although the IBA is believed to be interested in 45J, at least some of the individual independent local radio stations round the country have been using the Sansui QS system. The BBC has now started broadcasting scheduled programmes encoded in its own Matrix H format. Although no Matrix H decoder is at the moment on the market, a Sansui QS decoder with *Variomatrix* can be easily converted to H-format, by incorporating a phase shift of around 60° in one channel. Thus most people listening to the BBC broadcasts in surround-sound will be doing so on Sansui equipment. It has been assumed until recently that the BBC decision on Matrix H was final. But with Ben Bauer attacking the decision on the grounds that the 48° front-centre image phase discrepancy is unacceptable, and the influential NRDC and commercially giant Nippon Columbia joining forces to offer the BBC an alternative, it seems that the whole ridiculous business of quadrasonic and surround-sound confusion is at risk of going back a decade to square one.

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Kudelski Nagra E

OPERATIONAL ASSESSMENT

Peter Sharp

It had been intended to publish this operational assessment in last month's issue—alongside Hugh Ford's technical review. However, pressure of work, in particular his attendance at the recent TGWU Conference in the Isle of Man, prevented our reviewer completing it in time.

THE SWISS precision engineering company Kudelski have been manufacturing Nagras for more than 25 years. And the latest addition to their stable follows in the tradition of their other portable reel-to-reel machines. In other words, it is reasonably light-weight, beautifully made and produces the same outstanding fidelity that has made Nagra the 'Rolls Royce' of their genre.

Basically the Nagra E is a compact version of the tried and tested Nagra 4.2, the idea being to produce a cheaper version (the 4.2 costs a hefty £2k) and at the same time include most of the specifications that made the earlier model such a success.

But if you have hopes of owning a Nagra for less than £1k forget it. The new E costs around £1.1k—depending on the Sterling/Swiss Franc exchange rate—which is still roughly £600 more than you would pay for a stereo Uher.

So what do you get for your money? John Rudling of Hayden Labs—UK agents for Nagra—says the E has been aimed primarily at the radio reporter: 'The machine is a simplified version of the Nagra 4.2; It is some 1.5 kg lighter than the 6.8 kg 4.2; It's easier to operate, yet takes most of the 4.2's accessories. As well as its obvious suitability for broadcast use, the E is also ideal for accurate noise survey work.'

Working as a reporter for Independent Radio News I used the E for several weeks. In terms of straight sound reproduction it would be difficult, if not impossible, to match the machine's performance.

Engineers at London Broadcasting, IRN's home base, were enthusiastic about the



machine's performance, which in terms of audio quality was—as expected—far superior to that of a Uher or cassette machine.

My trial with the E got away to an embarrassing start. I had been assigned to cover the talks between the United States UN Ambassador, Andrew Young, and British Foreign Secretary, Dr David Owen. The press conference ending the day of talks took place under conditions familiar to most reporters—an impromptu news briefing on the steps of Lancaster House in London.

The instrument panel is slightly confusing if you have never handled Nagras before. To place the machine into 'record' the control dial must be twisted firmly forward through two notches. The first position is a 'test' mode to enable level checks from the well-detailed meter. Unfortunately, when the news conference began I was paying more attention to the intricacies of the Rhodesia problem, than I was to the technicalities of the Nagra E.

The machine remained firmly in the 'test' position—completely oblivious to the weighty words of Dr Owen and Ambassador Young. With the machine in its case and slung from the shoulder it was impossible to see if the reels were actually in movement. And although the meter showed excellent levels, I had missed the interview completely. I consoled myself—and my news editor—with the fact that the briefing produced little fresh news.

But the real capabilities of the machine were demonstrated a few days later. I was interviewing Richard Adams, the author of 'Watership Down', at his country home on the Isle of Man.

I wanted to conduct the interview outside in his garden, in the hope that his conversations about rabbits and country life would be backed up by its own built-in actuality . . . the sound of birds and crickets from his own garden. It worked perfectly, and this is where the real strength of the E lies. It is the ideal machine for the one-to-one interview.

Such was the quality of the interview that when Adam was talking about his feeling for nature, the machine was picking up the 101 sounds of a summer garden, completely placing the interview in context.

But the Nagra E did have its disadvantages. First of all—as with other Nagras—there is no digital counter. The argument from Kudelski is that a counter mechanism would fluctuate the load on the tape, and hence increase wow and flutter. Also, unlike the Nagra 4.2, the E has just a single speed (one of the price savings).

There were some design functions I found annoying. While monitoring speeches at a trade union conference, it was awkward having to open the whole case of the tape recorder before you could place the machine in fast playback, since the pinchwheel mechanism can only be operated by a lever inside the case. If you wanted to listen to playback with the machine slung over your shoulder you would physically have to set the machine down, unzip the carrying case, open the plastic lid, release the pinch wheel, and set the tape recorder into playback.

It could be argued this is a minor complaint. But if this machine is specifically aimed at the professional radio reporter it is a valid criticism.

For line-feeding down a telephone the Nagra is cumbersome and produces only a marginally better signal than a professional cassette recorder.

Finally, it is worth looking at the cost of the Nagra E. The machine is expensive, but Kudelski point out, with justification, that most of their recorders built 10 to 15 years ago are still in use. They claim that the machine is built to give at least 10 years service, and in that time other machines would have had to be replaced.

I would argue that the Nagra E is not the ideal machine for day-to-day 'nuts and bolts' radio reporting, but that it is still possibly the best tape recorder in the world for that sort of money. ■

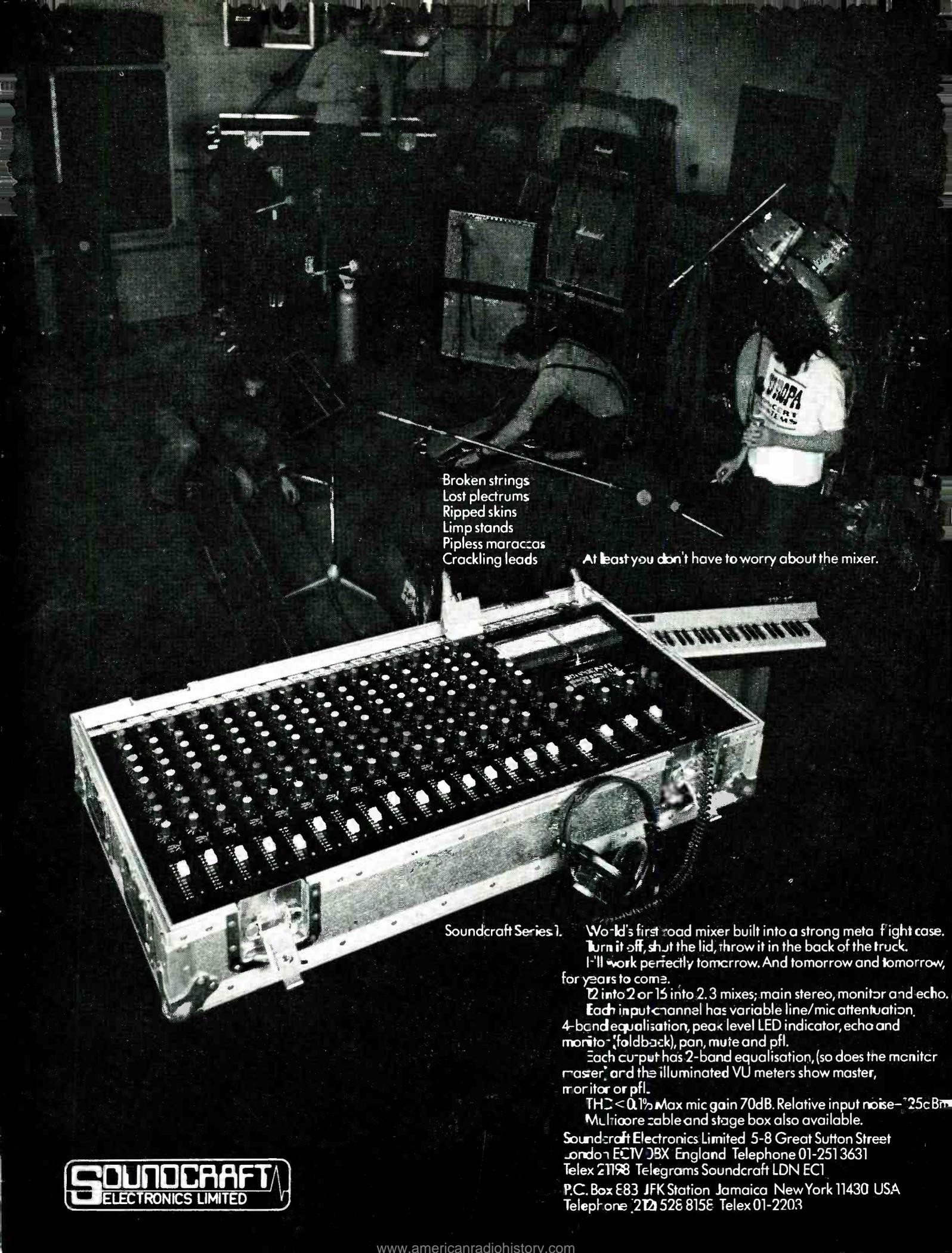
WORK

Footnote: FURTHER DEVELOPMENTS: Recently the IBA allowed the first experimental 'on-air' test of the Ambisonics system—a 45J broadcast from Radio City in Liverpool of Mahler's Eighth Symphony, *The Choir of A Thousand Voices*. This followed closed-circuit demonstrations of Ambisonics 45J to musicians in the Winchester area, and was intended to check the mono/stereo compatibility of a 2½-channel 45J transmission. Basic surround-sound information is matrixed into a base-band stereo pair transmitted in normal fm-stereo multiplex format. In addition, a limited bandwidth, reduced level, carrier in-phase quadrature carries extra surround-sound information. In practice the quadrature 'half' channel can have a bandwidth of as little as 2 kHz and still enhance the surround-sound effect quite considerably. Although it had

originally been hoped that the Liverpool broadcast would be made in 2½-channel format, in the event it went out in 2-channel 45J only; further broadcast tests should, however, be in the 2½-channel format. A closed circuit demonstration is planned for the Press, and will be reported in a future issue. This is of prime importance because one of the main BBC objections to the 45J hierarchy (and a prime mover for the corporation's independent work on 2-channel Matrix H) was a fear that the extra half-channel proposed by Ambisonics might cause interference and increased noise levels for mono and stereo listeners, as well as proving difficult to transmit along standard pcm links. It seems, however, that the BBC mind is opening in this respect because news has just been received that the BBC and NRDC/Ambisonics team have 'agreed to share their knowledge and experimental experience'. Almost certainly this sudden, but unsurprising, announcement fol-

lows from the adverse reaction that the BBC has received on the stereo compatibility of its Matrix H broadcasts. Although with short-term listening Matrix H appears to give good stereo compatibility, in the longer term its inherent 'phasiness' (phase discrepancy between channels) can cause listener fatigue; especially in those mortals blessed (or cursed) with greater than average sensitivity to phase effects. Because 2-channel matrix encoding and the base-band encoding for Ambisonics 45J are very similar (and closely related to Sansui QS), it cannot now be long before agreement is reached—at least between the BBC and NRDC. This could unify a 2-channel encoding format, which will serve as the standardised 'bottom-rung' for an agreed hierarchy of encoding formats. Together with its inbuilt 2½, 3 or 4-channel transmission options for the future, this should ensure that decisions taken now are not obsolete in the next decade.

Adrian Hope



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reviews

Rebis RA301 Compressor-Limiter

Hugh Ford

MANUFACTURER'S SPECIFICATION

Input impedance: 100 kohm.
Output impedance: <10 ohm.
Maximum input level: +24 dBm.
Maximum output level: +23 dBm into 600 ohm.
Gain: 30 dB \pm 1 dB.
Minimum limiting threshold: -21 dBm \pm 1 dB.
Maximum compression: 30 dB.
Attack time: variable from 20 μ s to 1.5 ms (for 90% capture).
Release time: programme related; variable from 50 ms to 3s. (Calibrated for 90% recovery with 200 ms input pulse.)

Frequency response: 20-20k Hz \pm 1 dB.
Noise: -80 dB referred to operating level of +4dBm, 20-20k Hz noise bandwidth; measured on mean sensing calibrated rms millivoltmeter; conditions: ratio control set 40:1; limiter at threshold with +4 dBm input and output.
Total harmonic distortion: <0.6% at 1 kHz with 5 dB compression (worst case); release time set to 3s.
Power: 120/240V; 50/60 Hz.
Price: £400.
Manufacturer: Rebis Audio, 127 Soho Hill, Handsworth, Birmingham, UK.

THE REBIS AUDIO type RA301 compressor-limiter is a 2-channel stereo device with two identical channels that may be linked by a 'stereo link' front-panel toggle switch; other than this feature the two channels are identical.

On the review sample the inputs and outputs via a rear-panel barrier strip connector were unbalanced. It is understood, however, that balancing transformers are available as an optional extra, suitable connections being available on the strip connector. Other than this, the rear panel has the IEC-type mains connector, a voltage selector and the metric mains fuseholder, which is properly identified with the fuse value.

Each channel has a front-panel vu meter, which is controlled by a toggle switch such that the meter can indicate input, output or active degree of compression. Additional miniature toggle switches are provided to switch each channel in or out of action.

The operation of each channel is controlled by five colour-coded knobs, the input and output level controls being coded yellow, the attack and release times green, and the compression ratio grey. The latter may be varied from unity to 40:1, while the attack time can be varied from 0.02 ms up to 1.5 ms, and the release time from 0.05 seconds right up to 3 seconds. Calibration points are provided adjacent to all the controls.

Within the unit all the signal electronics are

contained on a single glass-fibre pcb. It has been very cleanly laid out, but in this early unit did not have component identifications. A toroidal transformer supplies the power supply board at the rear of the unit, the interconnecting wiring between the boards and from the signal electronics board to the front-panel controls and input/output connectors being extremely tidy. In fact, the overall standard of construction and presentation was first class.

Inputs and outputs

Both pairs of inputs and outputs were unbalanced XLR connectors, with the option of balancing transformers being fitted. At maximum gain the limit of input voltage was found to be +2 dBm for the onset of waveform clipping, this limit increasing to +24 dBm at the minimum input gain setting—a more than adequate margin.

The input impedance was effectively constant with the setting of the input gain control. The value was measured as 96 kohm in parallel with 380pF; a very sensible input impedance for matching both professional and semi-professional equipment. The output impedance was extremely low, with the maximum output drive capability being +22.6 dBm when loaded into 600 ohm, or +24 dB (ref 0.7746V) into an open circuit.

The level meters were reasonably accurately calibrated for the '0' vu point to correspond with +4 dBm. The ballistics of the two meters

were such that the rise and fall times were 300 ms, which corresponds with the vu meter standards.

Frequency response and noise

The overall frequency response from 2 Hz to 200 kHz is shown in fig. 1. It can be seen that the overall frequency response is well within the claimed \pm 1 dB from 20-20kHz, with a very realistic roll off below 10 Hz and above 20 kHz which can prevent many interference problems.

Noise at the output was measured with the unit set for unity gain and also under maximum gain conditions. There was relatively little difference between the two sets of figures, or for that matter between the two channels. The following figures are for noise in dBm at the output using the standard A-weighting with a genuine rms meter; band limited noise from 22-22 kHz; and also CCIR-weighted noise with the weighting filters gain set to unity at 1 kHz (both the latter also using a genuine rms meter):

	maximum gain	unity gain
Channel 1		
A-weighted	-63.5 dBm	-65.5 dBm
22-22k Hz	-60.0 dBm	-63.0 dBm
CCIR-weighted	-55.0 dBm	-57.5 dBm
Channel 2		
A-weighted	-63.0 dBm	-64.5 dBm
22-22k Hz	-59.0 dBm	-62.5 dBm
CCIR-weighted	-55.0 dBm	-58.0 dBm

Allowing for the maximum output capability of the unit, the tabulated figures represent a reasonably practical performance. It is felt, however, that the use of vu meters for controlling the level makes it difficult to use the full output capability without running into distortion on peaks.

Distortion

As with all types of compressor-limiters, distortion is an inherent problem in one way or another, depending upon the attack and release times in use. In the straight-through mode of operation, distortion should not be a problem. This is confirmed by fig. 2, which shows the second and third harmonic products to be generally below 0.1% harmonic distortion at +4 dBm input and output, the more objectionable third harmonic being at a very low level.

A similar plot using 5 dB compression is shown in fig. 3, which shows a substantial increase in both second and third harmonic products. The amount of second harmonic becomes somewhat large at low frequencies and at very high frequencies.

Compression characteristics

The relation between the input signal amplitude and the output signal amplitude under steady state conditions is shown in fig. 4. The compression ratio control setting was used as a parameter, and it can be seen that a very wide

64 ▶

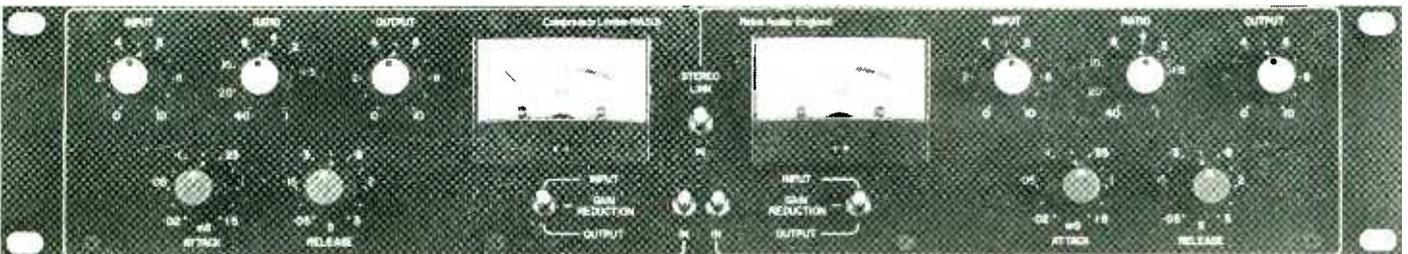
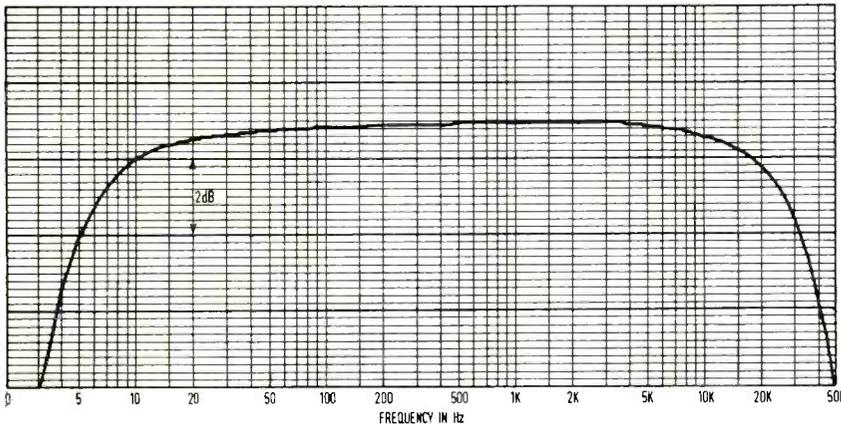


FIG. 1 REBIS RA301 FREQUENCY RESPONSE



REBIS RA301

FIG. 2 HARMONIC DISTORTION AT ZERO GAIN REDUCTION

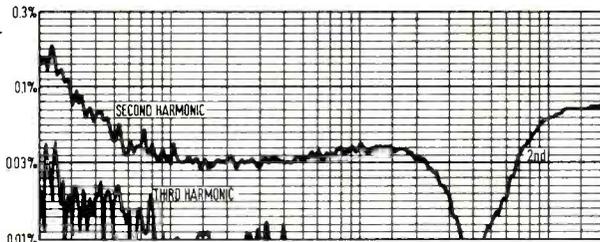


FIG. 3 HARMONIC DISTORTION AT 5dB GAIN REDUCTION

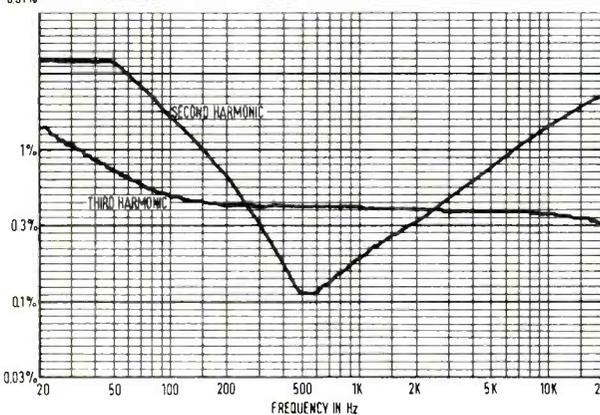
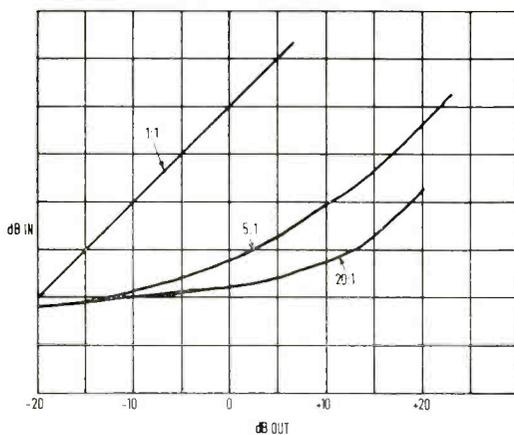


FIG. 4 REBIS RA301 COMPRESSION CHARACTERISTICS



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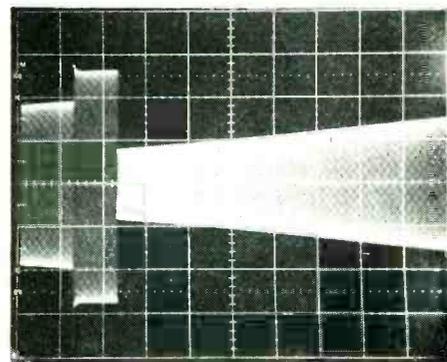
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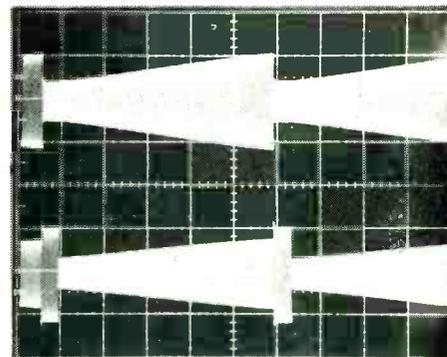
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REBIS AUDIO RA301



Above: Fig 5

Below: Fig 6



range of ratios are available, with the nominal coverage being continuously variable from 1:1 right up to 40:1.

Both the attack and release time controls also have a more than adequately wide range, with the adjustments being smooth in operation. As is to be expected, selecting too slow an attack time leads to overshoots, but if the correct time was used the overshoot was minimal. This can be seen from the oscillogram in fig. 5, which represents a 2 ms burst of sine-wave with 10 dB gain reduction in operation, and with the original sinewave being bursted above a threshold.

In the stereo tracking mode of operation, the tracking was found to be excellent between the two channels, as shown in fig. 5. The upper trace is the controlling waveform, which comprised a continuous tone bursted in amplitude for 2 ms, whilst the lower trace is the gain performance of the other stereo channel that had a continuous tone applied without compression in action. It is to be seen that the lower trace follows virtually exactly the upper trace in time and amplitude, thus showing a minimum stereo image shift when one channel is activated into compression.

Summary

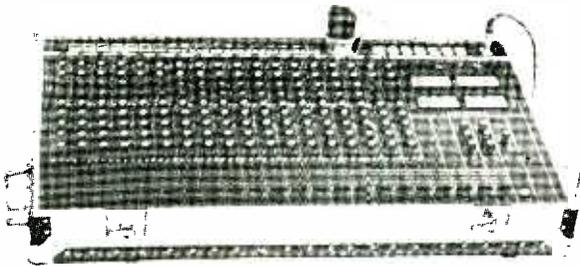
The Rebis *type RA301* is not only a very tidy and well made unit, but its facilities cover a wide range of compression ratios and both attack and release timing. In operation the unit behaved well, and its input and output interfaces are well suited to professional and semi-professional applications. It is felt, however, that the fitting of vu meters as opposed to peak reading instruments is a disadvantage. But this is a common criticism of much professional and other audio equipment. ■

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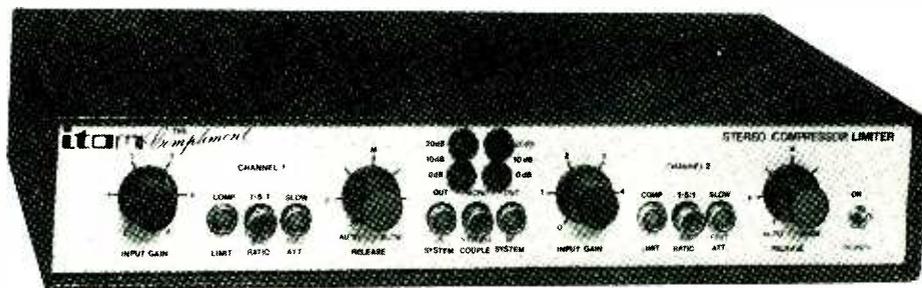
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Itam Compliment Compressor- Limiter

Hugh Ford



MANUFACTURER'S SPECIFICATION

Input: 10 kohm unbalanced; variable potentiometer.
Output: <1 ohm source; unbalanced; clip +18 dBm.

Limit threshold: at the input: -20 dBm; at the output: variable from -10 to +10 dBm.

Ratios: limiter: 20:1; compressor: 1.5 and 3:1.

Range: >30 dB compression.

Attack time: 500 μ s and 5 ms.

Release time: variable from 25 ms to 3s (plus).

Frequency response: ± 0.5 dB 30-20k Hz.

Noise: (-3 dB at 25 kHz) better than -78 dB ref limit threshold.

Distortion: <0.2% at 1 kHz for 10 dB compression >0.4s release).

Stereo matching: ± 1 dB on control voltage tracking over 20 dB range.

Power: 100-120V and 220-240V ac; 50 or 60 Hz at 250 mA.

Dimensions (w x h x d): 311 x 57 x 178 mm.

Price: £247.

Manufacturer: Industrial Tape Applications, 1/7 Harewood Avenue, Marylebone Road, London NW1.

Note: Marketed in the USA by Audio and Design as the *Compact Gemini*. (See compressor-limiter survey p 35.)

THE COMPLIMENT is a 2-channel compressor-limiter, the two identical channels of which may be linked for stereo operation by means of a front-panel switch. Intended for the lower end of the market, the inputs and outputs are rear-panel unbalanced jack connectors of the 2-pole variety. Further rear-panel features include two pre-set gain controls that set the output level in relation to the limiting level, and the mains fuse and fixed mains lead. While the lead was properly secured, it was noted that

the fuse holder was loose.

At the front of the unit there are two identical sets of controls, two indicator lamps for each channel and the power on/off switch. Each channel has an input gain potentiometer, which was well considered for normal input signal levels. A further potentiometer controls the release time over a wide range, and also has a switch at its extreme that initiates an automatic control of release time in accordance with the nature of the programme source.

Three self-illuminating pushbutton switches for each channel select either the limiting or compressing function; the compression ratio of either 1.5 or 3:1; and a fast or slow attack time in either the compression or limiting modes of operation. Further pushbuttons put the compressor-limiter in or out of circuit, while another single pushbutton allows linking of the control voltages for stereophonic operation. The front panel also contains two indicator lamps for each channel that indicate the degree of compression or limiting in action. A yellow lamp is illuminated when the unit reaches the onset of compression or limiting, and becomes brighter as the degree of compression or limiting increases. At 10 dB compression or limiting a red lamp is then illuminated, and this becomes brighter as the degree of compression or limiting increases up to the maximum.

Internally, the construction is based on a single pcb that includes good-quality components, and has very clear component identifications for servicing. This is aided by full information and circuits in the operator's manual. It was found, however, that the electrical safety of the unit was a cause for

concern because of the inadequate clearance between the mains voltage tags on the power on/off switch, and metal parts of the switch connected to the chassis.

Inputs and outputs

The unbalanced jack socket outputs offered a maximum output level of +18 dBm into 600 ohm with the 3:1 compression ratio in operation, or +14 dBm with the 1.5:1 ratio. The output impedance was found to be extremely low, and hence suitable for most interfaces.

The maximum input level is effectively unlimited because the input level control is a full-range potentiometer at the input terminals, the level for onset of clipping at maximum gain being +21 dBm. The input impedance varied only slightly with the setting of the input level control. At maximum gain the impedance was a rather low value of 7.2 kohm, rising to 9.5 kohm at mid-gain and maximum gain setting.

When the compressor-limiter is switched out of circuit by the front-panel pushbutton switch, the input is directly connected to the output without buffering; the resulting changes in input and output impedance could be a cause for embarrassment.

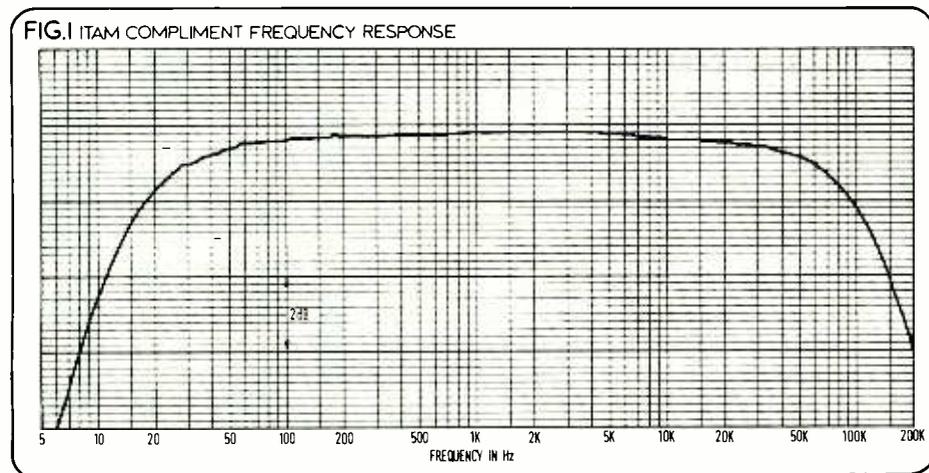
Frequency response and noise

The overall frequency response of the compressor-limiter is shown in fig. 1. This is just outside the manufacturer's specification if the latter is based on a zero point at 1 kHz, as is conventional. However, the measured performance of 1 dB error from 30 Hz to well over 20 kHz is no cause for concern, and the rapid roll off at both the treble and bass ends is a good thing.

The noise performance was measured at the output with the output gain set to maximum. Thus it can be related to the limiting output, which averaged +13 dBm and depended to a smallish extent on the compression ratio and which function (compression or limiting) was selected. For the two channels the following noise levels were measured using weighted and unweighted measurements:

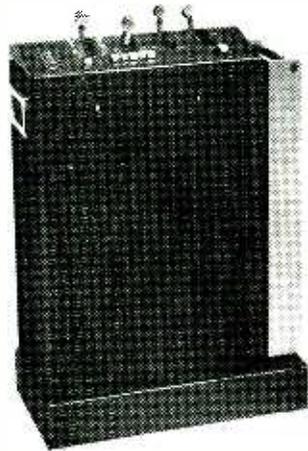
Measurement method	channel 1	channel 2
Band limited 22-22k Hz		
rms noise	-70.0 dBm	-69.5 dBm
A-weighted rms noise	-72.5 dBm	-73.5 dBm
CCIR-weighted rms noise ref 1 kHz		
unity gain	-63.5 dBm	-65.0 dBm

The above noise performance is very good in terms of dynamic range, and no troubles were





STUDIO- TECHNOLOGY



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ITAM COMPLIMENT

found with mains hum or other continuous tones in the output signals.

Distortion

The second and third harmonic distortion components of the compressor-limiter at zero dBm input and output without compression or limiting is shown in **fig. 2**. It can be seen that the more objectionable third harmonic is at an extremely low level, and that the second harmonic distortion performance is also reasonable. Similar measurements at 10 dB compression and 10 dB limiting gave effectively identical results with each other. The performance at 10 dB compression is shown in **fig. 3**, which demonstrates a good performance at mid and high frequencies but with more distortion than might be desirable below 100 Hz.

Compression characteristics

Measurements of the attack and release times confirmed that the two available attack times were indeed the specified 500 μ s and a little short of the specified 5 ms—but the error is really of no consequence. The release time is controlled by a potentiometer that was found to allow variations from 30 ms up to 1.6s, with a mid position time of 120 ms; thus providing a good control law.

It is felt, however, that the minimum attack time at 500 μ s is too long for a limiter, and that this inevitably leads to overshoot. This can be seen from **fig. 4**, which shows the effect of a 10 dB burst into limiting with the attack and release times set to minimum. A similar, but less severe, situation arises at lower frequencies. **Fig. 5** again shows the effect of a 10 dB burst into limiting, but this time with a 1 kHz tone, the release time set to 'automatic', and a fast attack time setting.

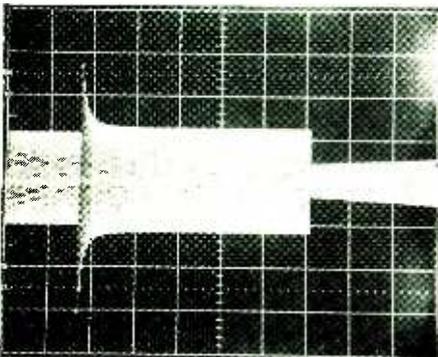
Stereo tracking was very good, as is shown in **fig. 6**. The upper trace shows the driven channel entering 10 dB of compression, while the lower trace shows the effect upon a low-level signal (well below limiting or compression) in the other channel when the stereo mode has been selected.

Other matters

In operation, it was felt that the indicator lamps were perhaps not particularly useful, but that the overall effect of the controls was good, and that the performance did not give cause for complaint in relation to the intended use of this compressor-limiter. It is not usable, however, as a strict limiter, in view of its slow available attack time that leads to overshoot.

The actual law of the three modes—1.5:1

Fig. 4



ITAM COMPLIMENT

FIG 2
HARMONIC DISTORTION AT
ZERO GAIN REDUCTION

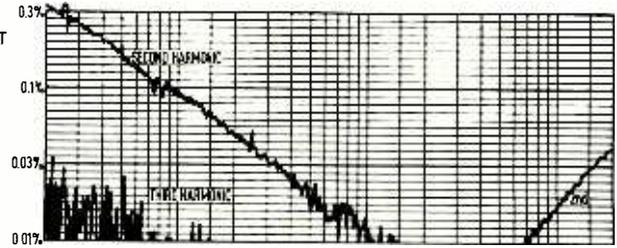


FIG 3
HARMONIC DISTORTION AT
10dB GAIN REDUCTION

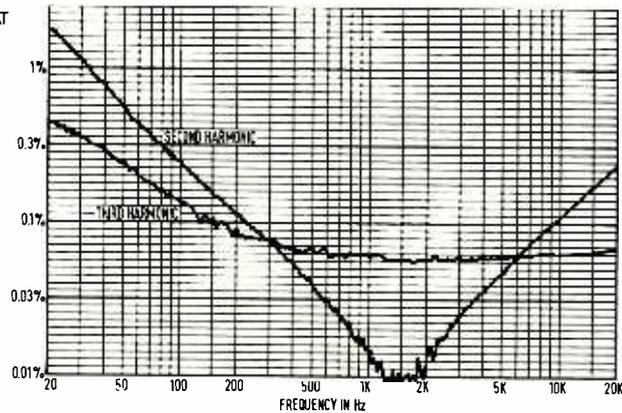


Fig. 5

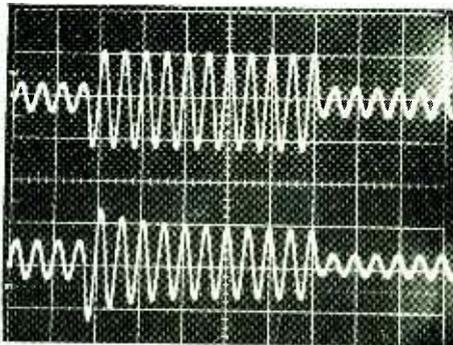
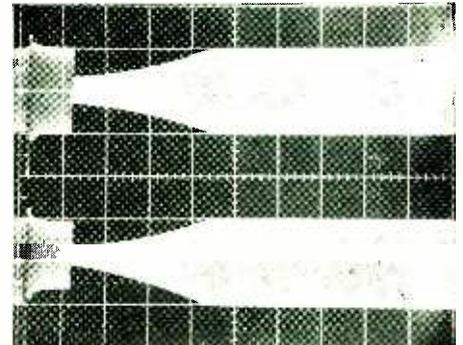


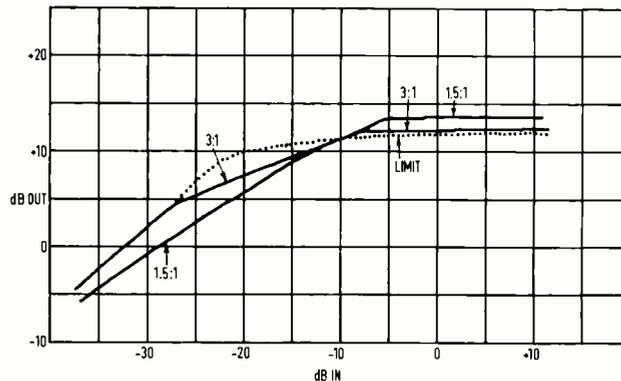
Fig. 6

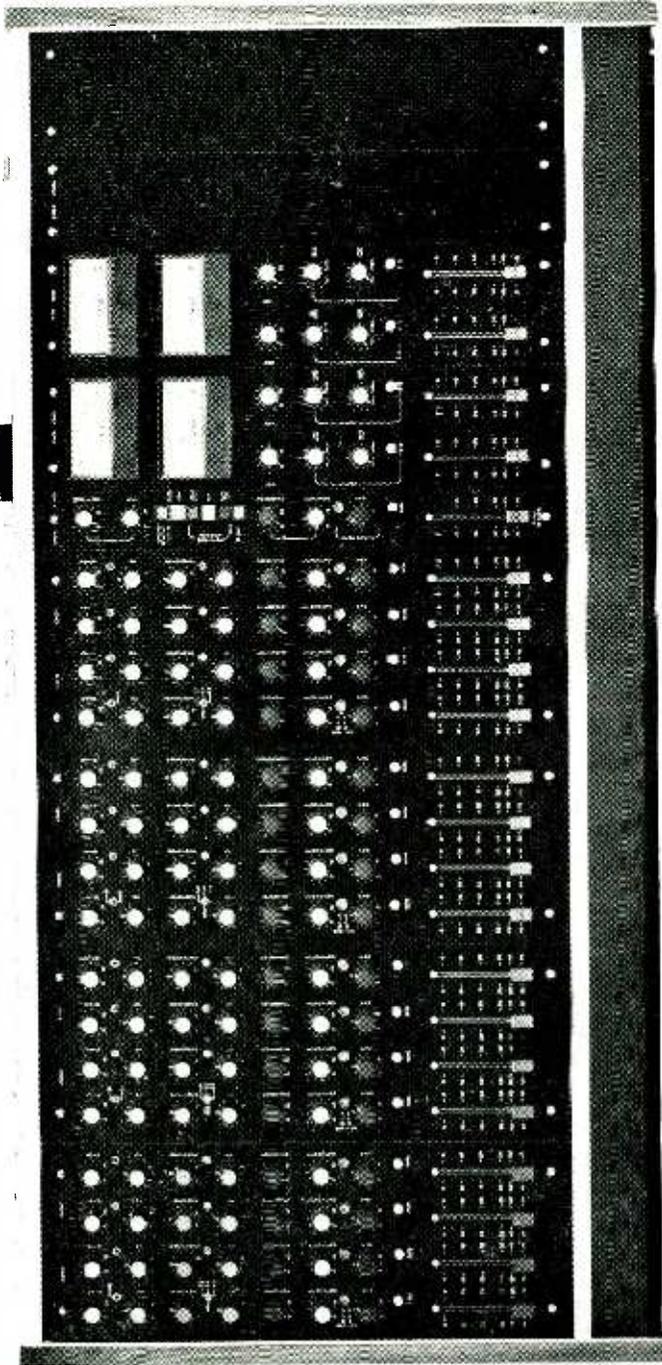


compression, 3:1 compression and limiting—is shown in **fig. 7**, which illustrates a 2.5 dB difference in the maximum output when different modes are selected. However, for most low key applications this is of little significance, and the overall curves show a useful range of effects.

All considered, this unit should find application in smaller studios where it offers practical facilities at a reasonable price. It is not fair, however, to expect it to compare directly in performance with much more expensive units that can be justified by the larger studios.

FIG. 7 ITAM COMPLIMENT COMPRESSION CHARACTERISTICS





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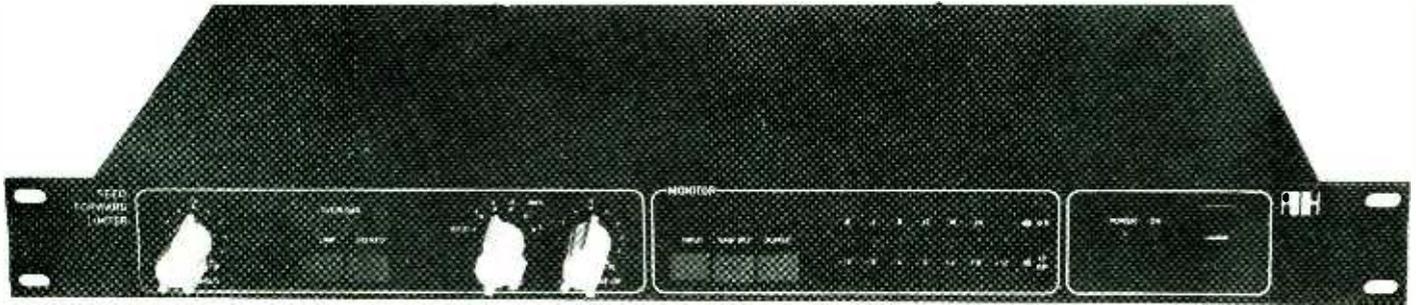
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Limiting threshold: variable; min: 1 num -10 dBm (250 mV rms), maximum +10 dBm (2.5V rms).
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Distortion: 0.1%_{rms}, ref 12 dB limiting at 1 kHz.
Noise: -68 dB with internal 50 μ s pre/de-emphasis; -61 dB without, ref limit level.
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20 Hz and 20 kHz, ref 1 kHz.
Output: for limit level variable between -10 and +10 dBm; balanced floating 600 ohms; max level 22 dBm (9.75V rms).
Monitor: switchable between input, output or gain reduction; reading: ppm characteristic 7-led display ('0' = 0 dBm).
Connections: input 10 kohm balanced on XLR connector; output 600 ohm balanced on XLR connector; ac power 220-240V on IEC connector (ac earth to case).
Price: £260.
Manufacturer: Allen & Heath Brenell Ltd, Pembroke House, Campsbourne Road, Hornsey, London N8 UK.
US Agent: Audiotechniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902.

THE ALLEN & HEATH *Feed Forward Limiter* is a single-channel limiter intended for limiting transients in disc cutting, fm broadcasting, and such applications as high-power pa systems where transients must be avoided at all costs.

Unlike most conventional limiters, this unit derives its voltage control signal from the level of the incoming audio signal. This is then delayed by 1 ms before its level is influenced by the voltage control. Thus, in combination with the extremely fast attack time of only 25 μ s, overshoot is effectively impossible in the output signal.

Physically, the limiter is of standard size for mounting in a 483-mm rack, with the floating XLR-type input and output connections at the rear. Also included are an IEC-type power connector and jack connector for linking pairs of limiters for stereo operation. A front-panel

pushbutton switch gives the option of switching out the limiting action such that the unit operates as a straight-line amplifier.

Potentiometer-type input and output level controls are fitted, the control knobs having an accurate indication of the unity gain setting. A further 6-position rotary switch has settings for release times of 3, 1, 0.5, 0.3 and 0.1s, plus an 'auto' position. In the latter position the release time is controlled according to the programme content, but the attack time remains very fast and independent of the release time.

Because the delay mechanism within the limiter is a digital device, it is very important to avoid overloads. An overload led indicator is therefore fitted, and was found to be very fast acting with a reasonable hold time. Thus the indicator could be easily seen on short transient signals.

A set of seven more led indicators provides a

meter display in 4 dB level steps. This display may be switched to indicate either the input or output signal levels, or the degree of limiting or gain reduction from 0 dB up to the maximum of 20 dB. As with the overload indicator, this is a very fast acting display with a well chosen hold time for good readability.

Within the unit, the mains transformer is located in a well screened compartment. The signal electronics are housed on a single glass-fibre pcb that includes clear component identifications to assist servicing in conjunction with the well-prepared user manual.

While the unit gives the impression of being generally well engineered, it is a shame that skeleton pre-set potentiometers are used. Furthermore, a capacitor was found to be lacking solder on one of its connections, which led to an intermittent fault.

A final internal feature of the limiter, not so far mentioned, is the inclusion of plug-type links for the insertion of a 50 μ s pre-emphasis or de-emphasis for broadcast applications. It is assumed that this can be readily modified to 75 μ s for American broadcasting, which uses this alternative time constant.

Input and output

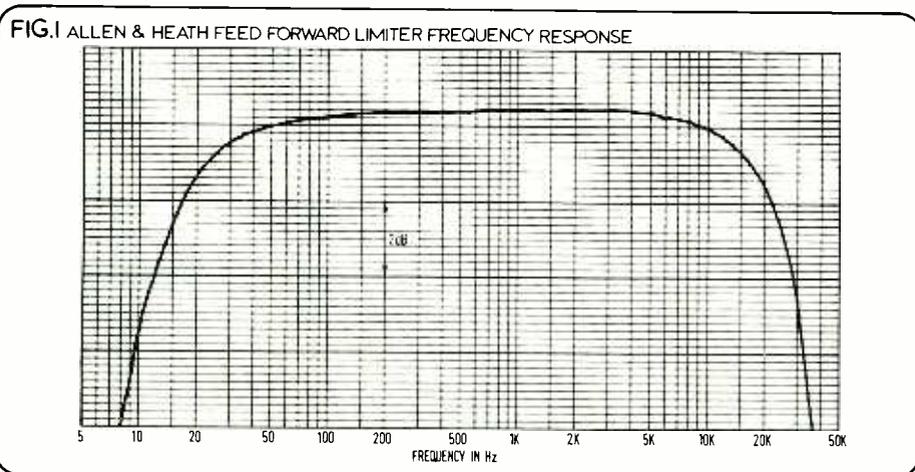
On the input end the maximum signal handling capability was found to be in excess of \pm 23 dBm at minimum input gain, or \pm 18.8 dBm at the nominal unity gain setting. The input gain control had a range from +10 dBm to -12 dBm for zero level indication on the led meter display.

Unfortunately, the input impedance varied widely with the input gain control, from 16.7 kohm at a nominal unity gain setting to 24.4 kohm at minimum gain. While these impedances are sensible for matching most audio equipment, the impedance of 6.4 kohm at maximum input was decidedly on the low side.

The output impedance was found to be very low, with a maximum output level capability of \pm 21.5 dBm into 600 ohm or the same level into an open circuit. The output gain control provided a range of \pm 8.8 to -12.5 dB about the system unity gain setting, such that when the unit is used in the limiting mode (as opposed to a line amplifier mode) the output can be set within the range \pm 8.8 to -12.5 dBm.

Frequency response and noise

As is to be seen from **fig. 1**, the overall frequency response at an operating level of 0 dBm input and output is just on the manufacturers' specification from 30-15k Hz, being -1.0 dB



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down at the point with respect to 1 kHz. These frequency limits correspond to the normal broadcast criteria, and it is pleasing to see that the response is well rolled off at both the low and high ends. The latter is vital in view of the use of the digital delay, which would otherwise produce beats.

The output noise was found to be effectively free of any high-frequency signals used in the digital delay section of the unit. The following noise levels were measured at the output with and without the 50 μ s de-emphasis network in use:

output noise in dBm	no de-emphasis	50 μ s de-emphasis
A-weighted rms noise	-63.0 dBm	-69.5 dBm
CCIR-weighted rms ref 1 kHz	-55.5 dBm	-61.8 dBm
Band limited 22-22k Hz rms	-59.0 dBm	-67.0 dBm

The above noise figures are, of course, without gain reduction in action and, as is only to be expected with wide band gain control devices, the noise can audibly 'breathe' with the input signal level.

Distortion

Measurement of the second and third harmonic distortion products at zero dBm input and output without any gain reduction in action is shown in **fig. 2**. It can be seen that the level of distortion is extremely low in the audio frequency band from 20-20k Hz.

As is to be anticipated, the distortion content rises as the amount of gain reducing increases. **Fig. 3** shows the situation with 8 dB gain reduction in action using a 3s release time. While the third harmonic distortion is satisfactorily low, it must be born in mind that the subjective effect of the second harmonic is less obtrusive and that its level at mid frequencies is also satisfactorily low.

Compression characteristics

An idea of the rapidity of the attack time can be gained from **fig. 4**. The upper trace shows the input signal level, which contains a single cycle burst of 10 kHz tone 10 dB above the visible continuous tone; the lower trace shows the output of the limiter with the release time set to 100 ms. It can be seen that limiting is effectively

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FIG. 2
HARMONIC DISTORTION AT ZERO GAIN REDUCTION

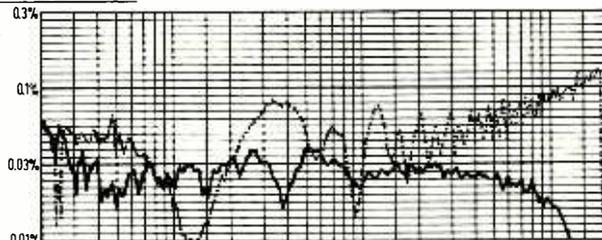


FIG. 3
HARMONIC DISTORTION AT 8dB GAIN REDUCTION

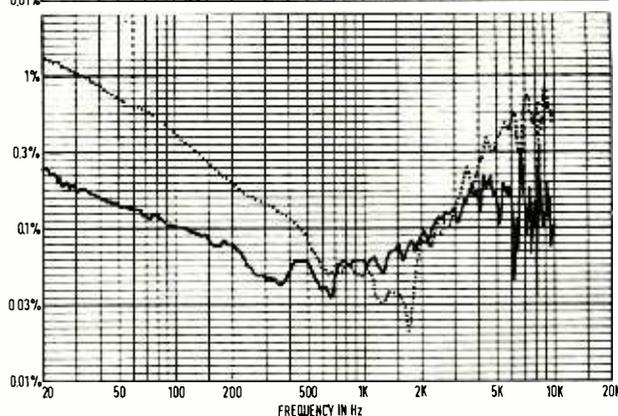


Fig. 4

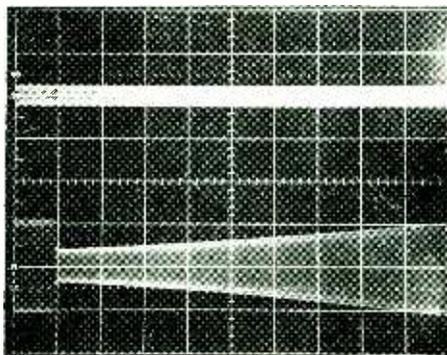
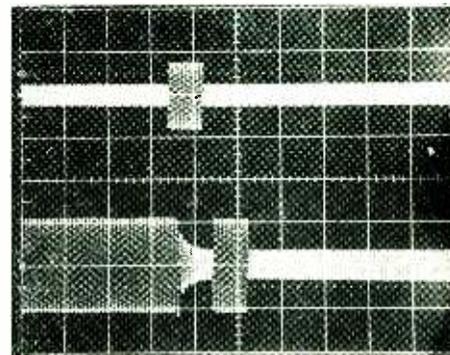


Fig. 5



instantaneous, and the release smooth.

Checking the available nominal release times showed that all but the 3s times were reasonably close to the nominal times, but that the nominal 3s was too short at about 1.7s. However, the usefulness of such a long release time is doubtful.

The effect of the limiting on the delayed audio signal is shown in **fig. 5**. The upper trace

is the input signal, comprising a 1 ms burst of 10 kHz tone superimposed on a continuous signal. In the lower trace, which represents the limiter's output signal, it can be seen that the gain is reduced shortly after the leading edge of the input tone burst. By the time the tone burst reaches the limiter's output there is no chance of any overshoot. (The time scale is 1 ms per horizontal division, which confirm the nominal 1 ms delay on the audio chain.)

Other matters

Checking the accuracy of the led meter display showed that it was generally within 0.2 dB for input signal levels, but that indicated output levels could be as much as 1 dB adrift—as could the indication of the amount of gain reduction in action. It is felt, however, that such an accuracy is quite adequate for the use for which the display is intended.

While all controls in the audio chain were quiet in operation, it was noted that the power on/off switch could produce a very nasty click in the limiter's output. It is felt that a suppressor could well be justified.

In other respects the limiter worked well and gave good subjective account of its operation, provided that appropriate release time settings were used; the automatic mode was satisfactory for many applications. ■

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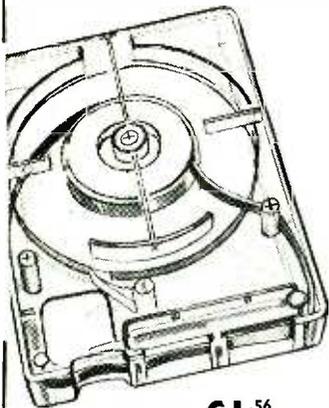
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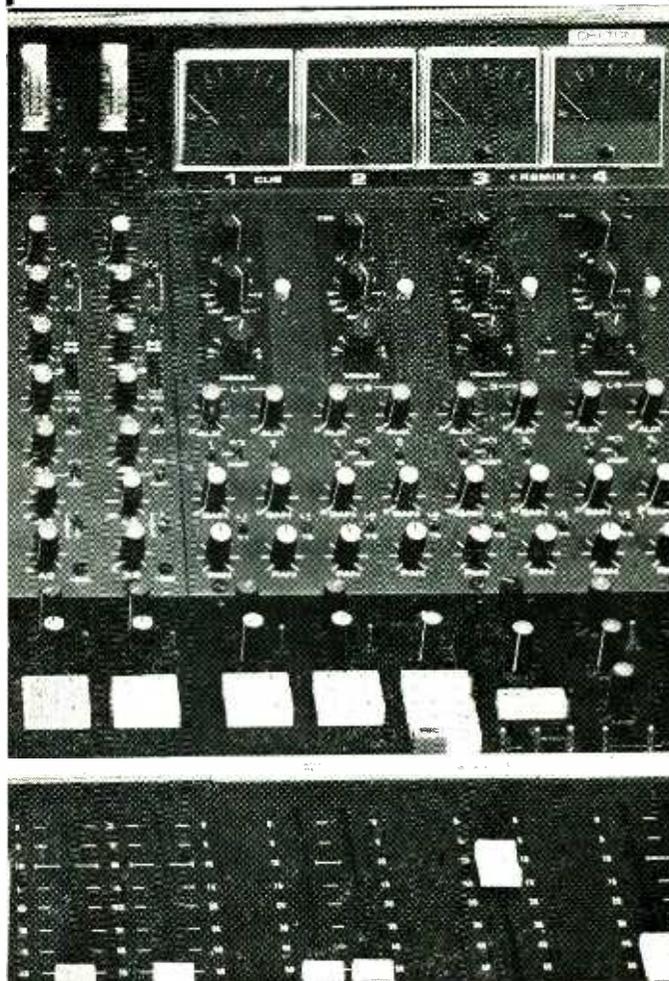
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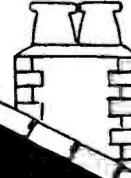
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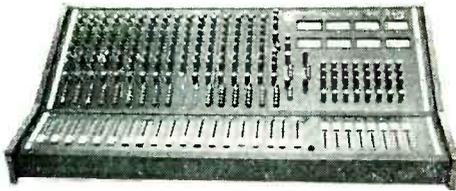


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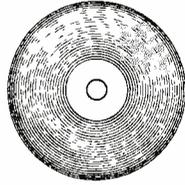
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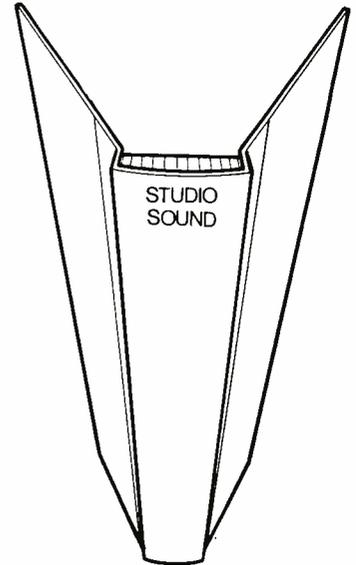


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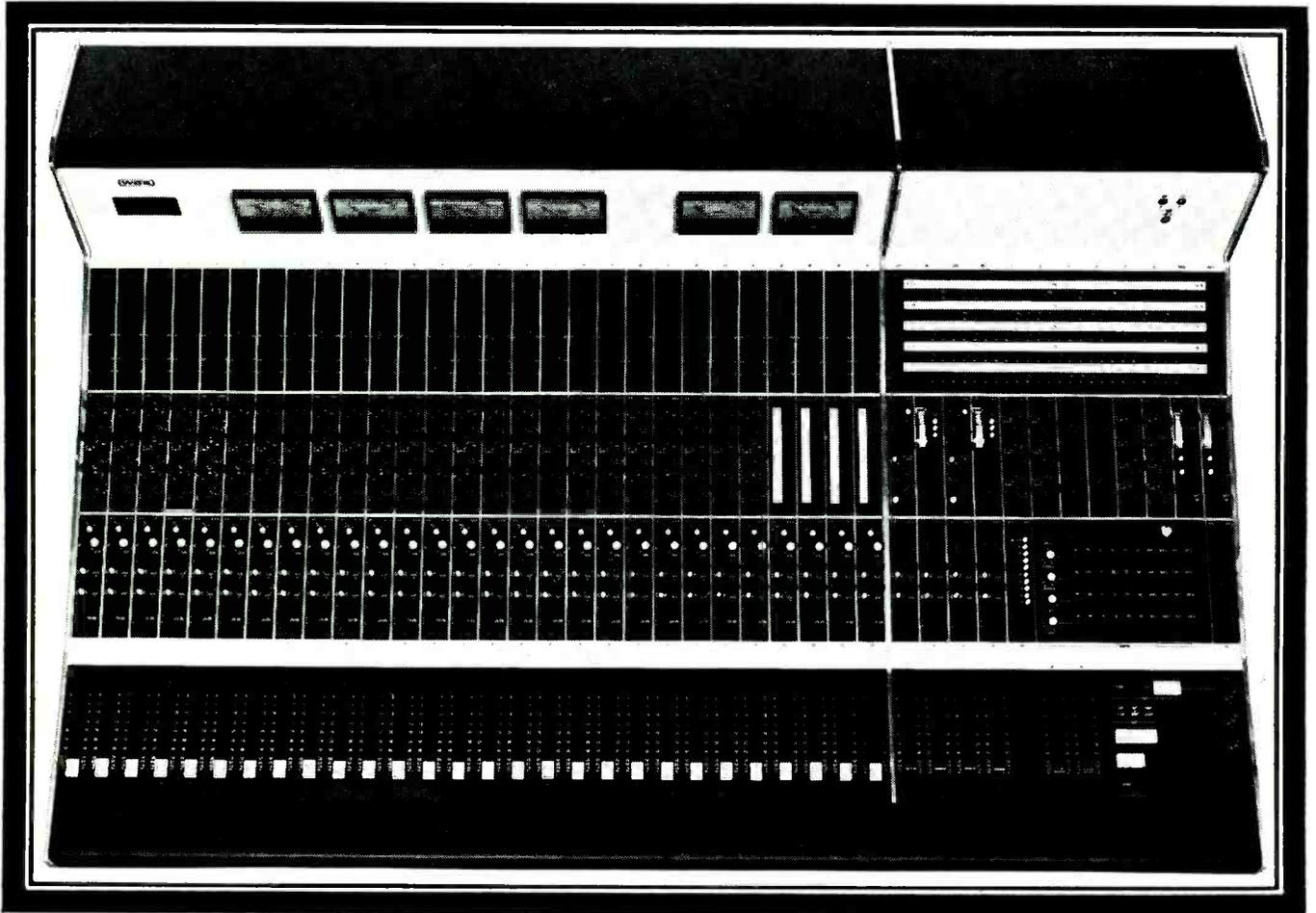
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