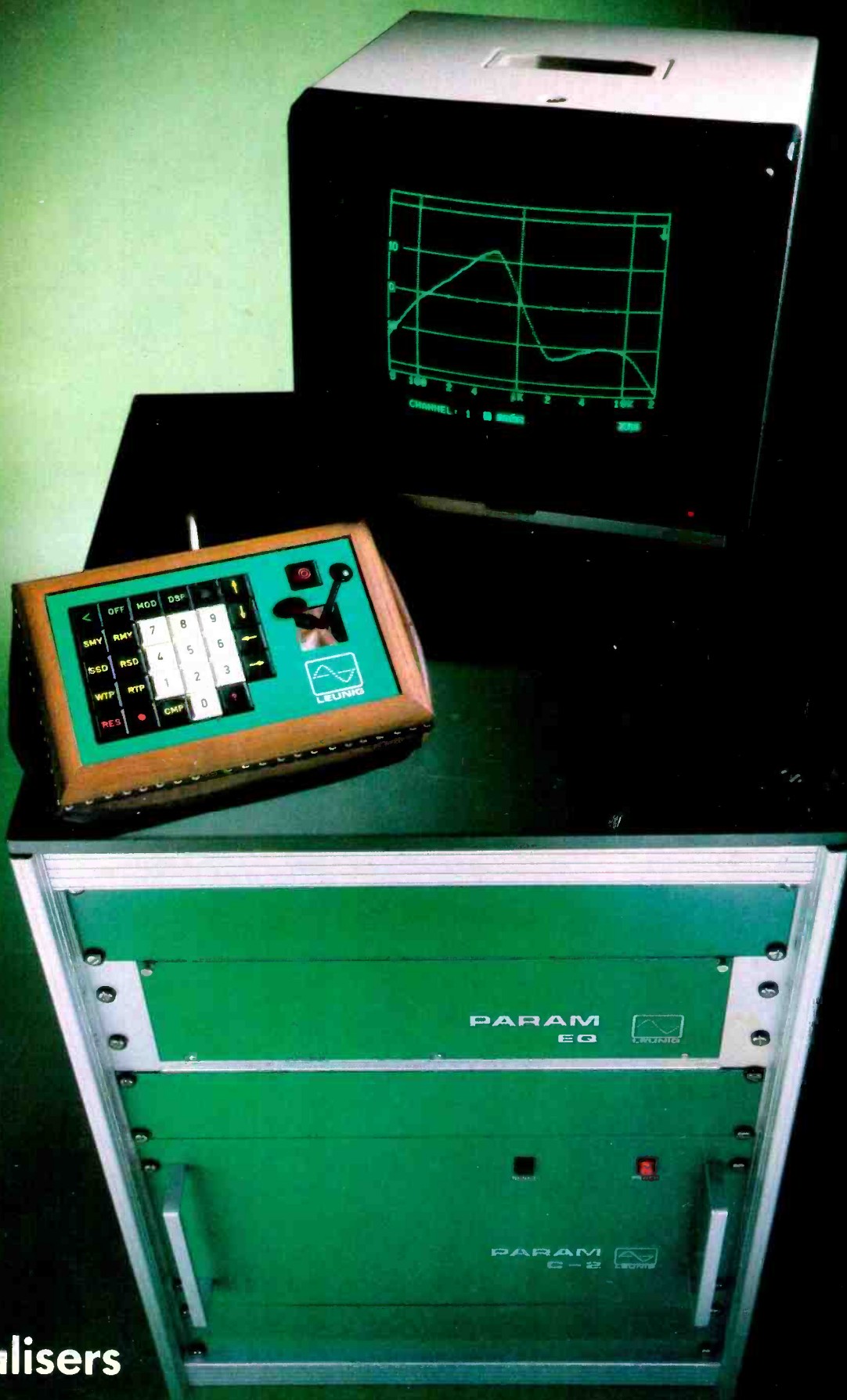


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PUBLICATION



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This month's cover photograph of the Param equalisation system was taken by Roger Phillips.

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Shrinking the console

The layman, walking into a modern studio control room, is almost always struck initially by the console, not only by its size, but by its apparent complexity. But take him or her through a typical input channel and then explain that almost every other part of the board is little more than a copy of that channel, although each channel handles a different signal, and certain aspects of the technology of today's recording process begin to become more clear. Yet there is still often the thought at the back of the layman's mind that the whole thing is really too complex to be useful. Why all the knobs doing essentially the same thing? Engineers sitting behind a state-of-the-art console may also, in these days of VCAs, dc control voltages and digital automation systems, begin to wonder the same thing. Does a console really have to be 12ft long to be effective?

Today, the answer is almost certainly no. While a console *may* require the same number of faders as discrete signals, there is no reason why other aspects of the console, particularly equalisation, should not be made assignable, if the system is carefully designed. To begin with, we can relatively easily construct a desk which has no audio passing through it at all, but merely dc control signals or digital pulse-trains signalling to processor-controlled audio elements in a rack at the back of the control room, between the tape machine and the lines into the control room from the studio. Although such a console—looking just like a conventional one—is technically possible, some may object to the presence of so many VCAs, and others may object to the overall cost. But this situation is bound to improve with time. The next step—assuming that we regard developments in digital control of *analogue* audio as being worth the effort—is to centralise equalisation control. A number of approaches to this goal already exist as add-on units. The NTP programmable graphic is

one such approach, the *Param* (reviewed operationally in this issue and technically at a later date) is another, and Calrec are also developing their own assignable system, which was previewed at this year's APRS exhibition.

But for such a system to replace the conventional desk eq, careful thought must be given by the manufacturer to exactly what the engineer *does* with an equaliser. You need to be able to assign the eq to a channel and twiddle with it audibly. If you do not have conventional calibrated knobs, some indication of what you are doing is required—for example the *Param's* video display. You need to be able to switch it in and out—and while you're at it, digital storage gives you the opportunity to switch between a number of possible equalisation settings. You need to be able to transfer eq from one channel to another, *and adjust them together* (for example, on a stereo pair) and switch them in and out together for comparison. If thought is given to criteria like these, the possibilities are endless, but it must always be borne in mind that the idea is not just to add flexibility and facilities, but to make the mixing engineer's job easier—less time-consuming and less arduous, so that he can concentrate more on the music and less on the chores.

Today's digitally-controlled equalisers are fascinating precursors of what may be coming along, and our look at the *Param*, plus our article on automated eq, will help to give an impression of the way things are going. Yet as always, with such new technology, there must be plenty of feedback between users and manufacturers. The result of such co-operation will not only help to make the next generation of consoles and equalisers more helpful to the engineer: it will also establish operational and ergonomic guidelines for the first generation of complete digital recording systems.

Richard Elen

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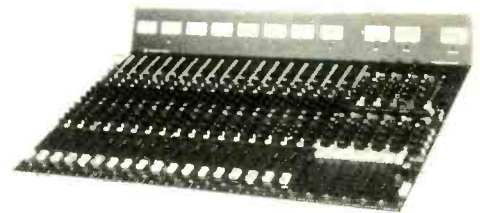
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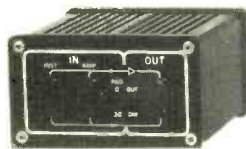
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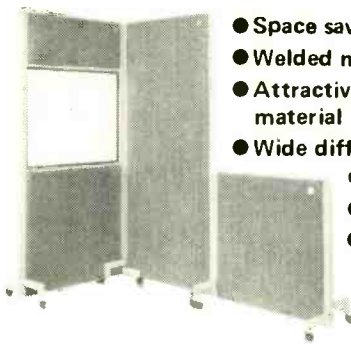
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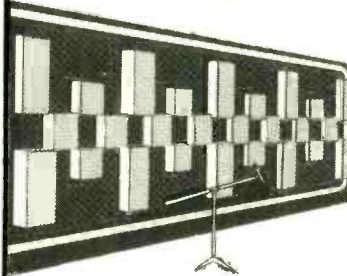
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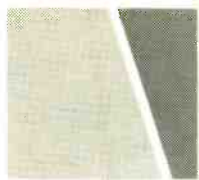
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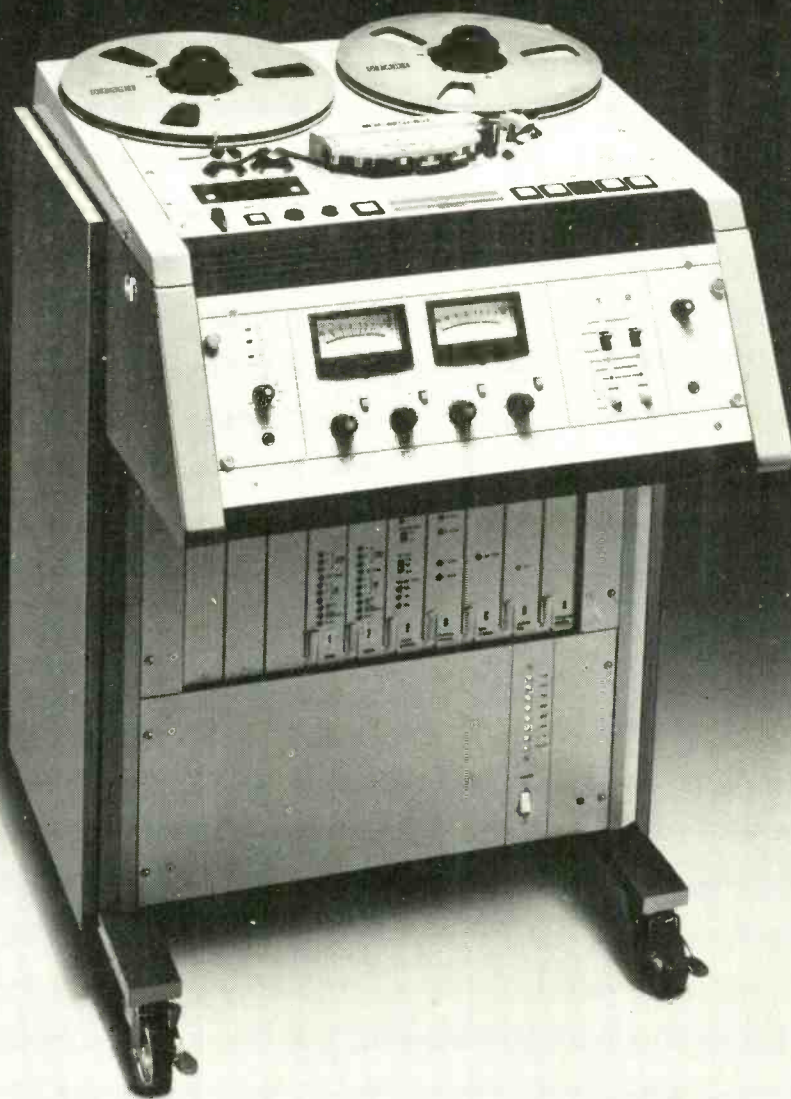


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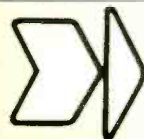
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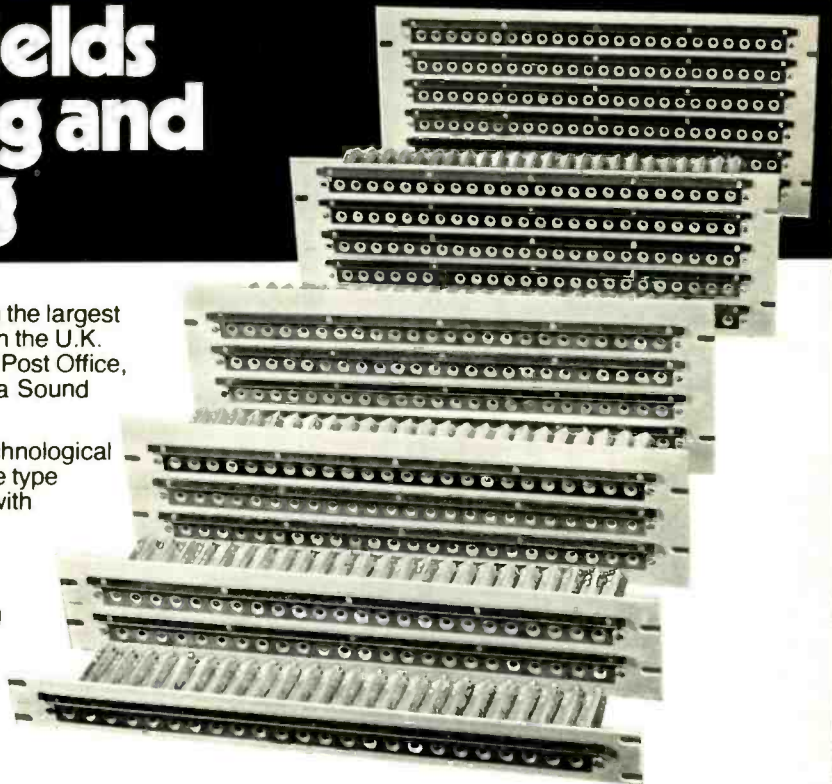


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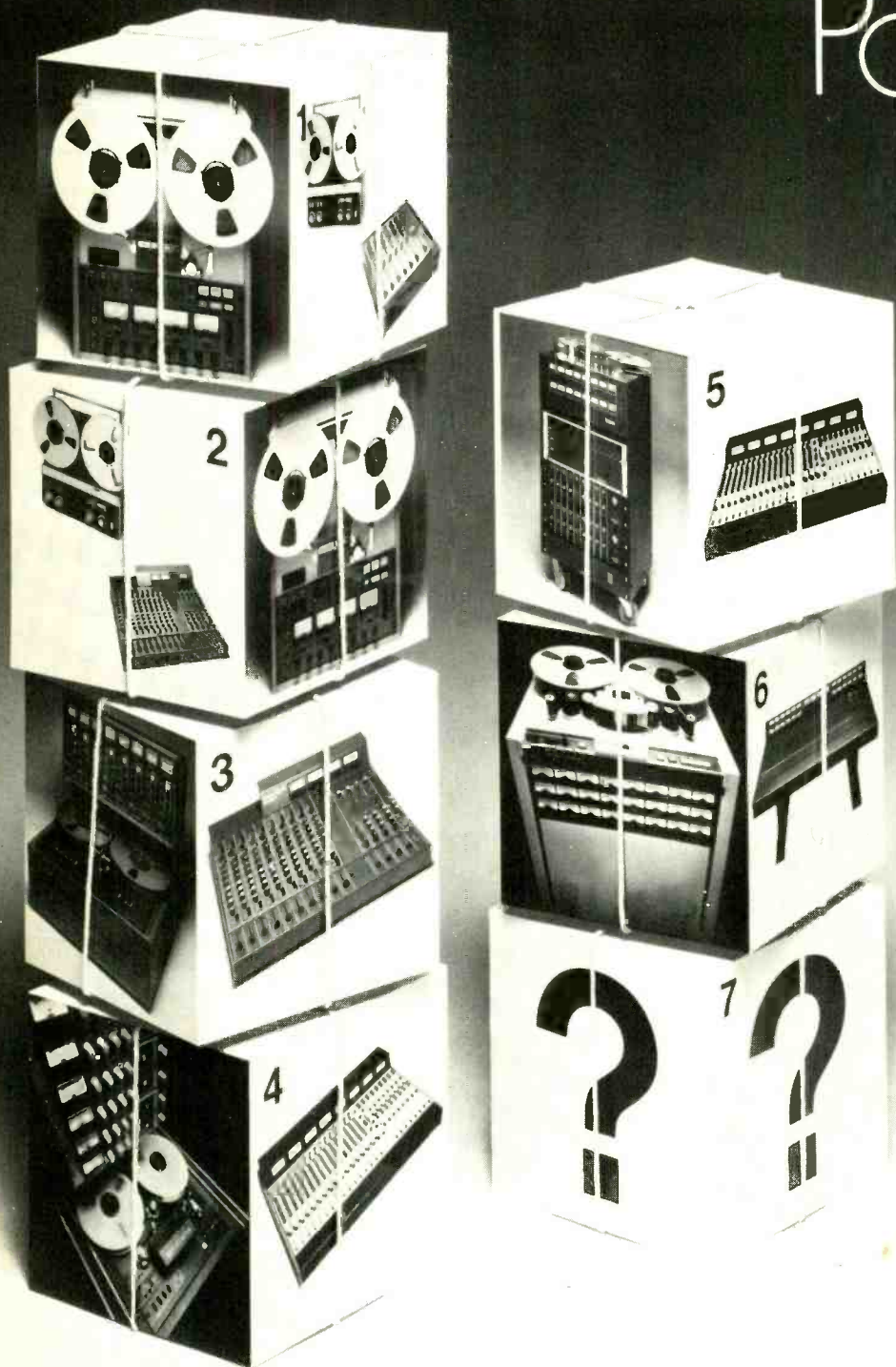
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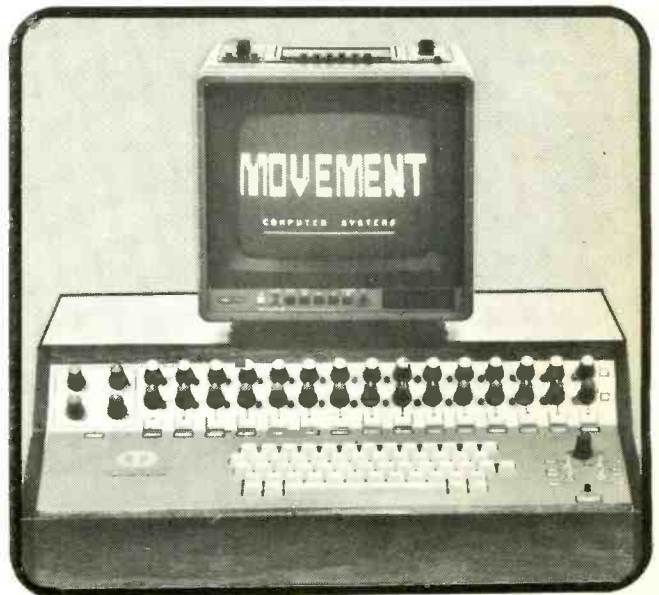
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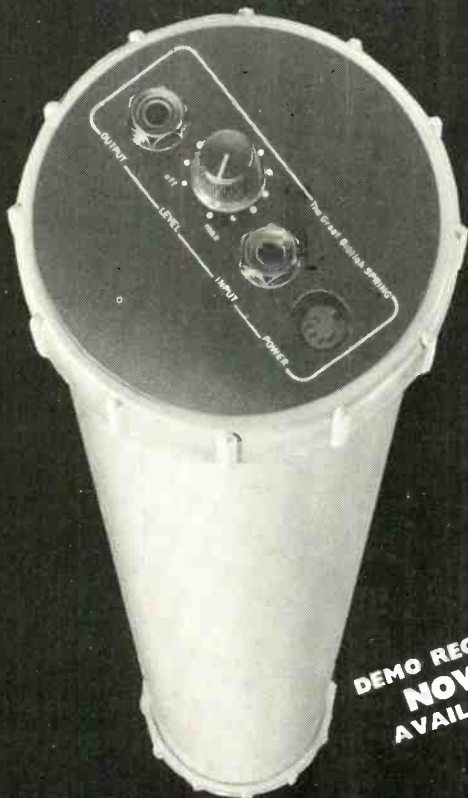
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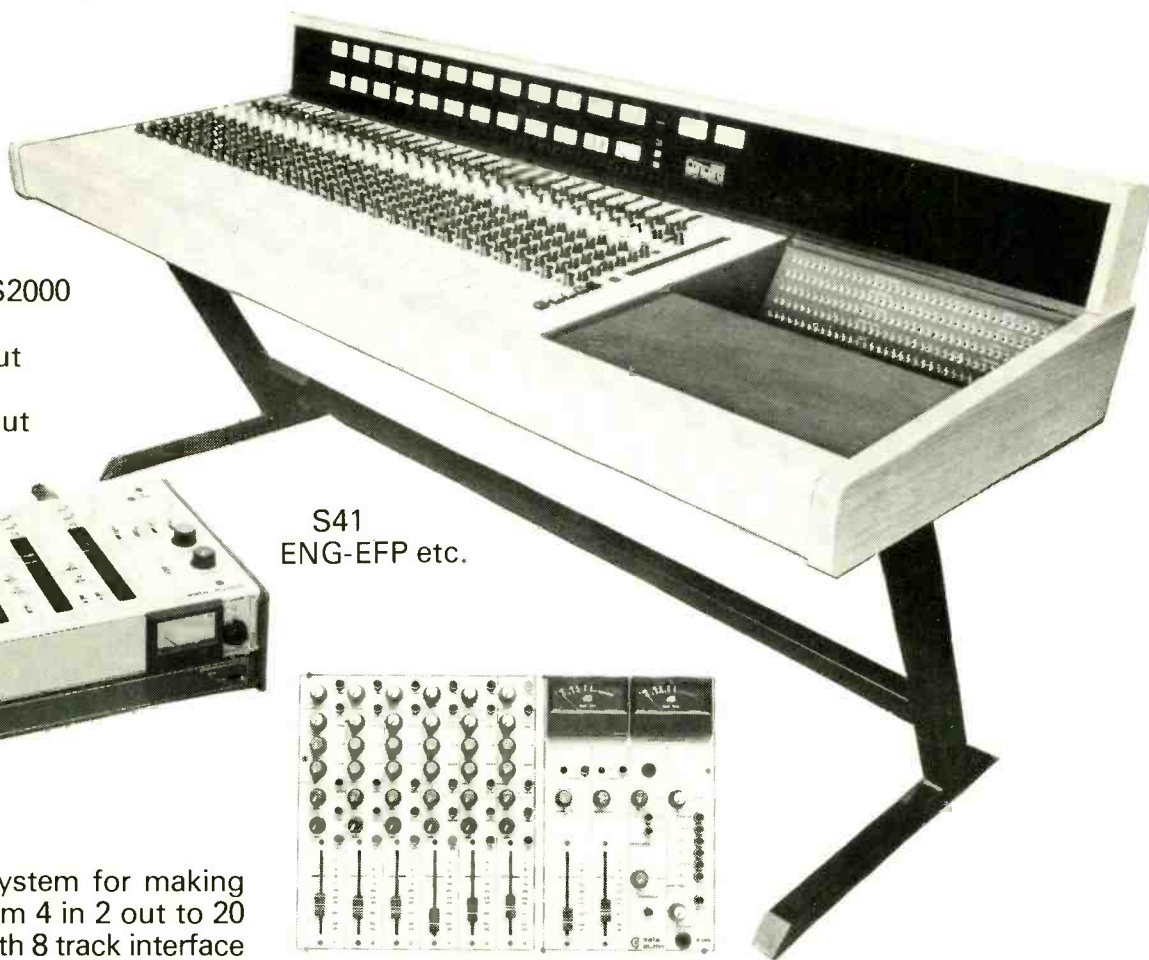
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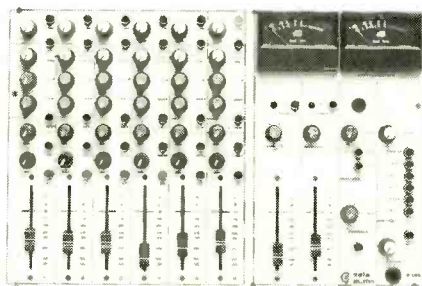
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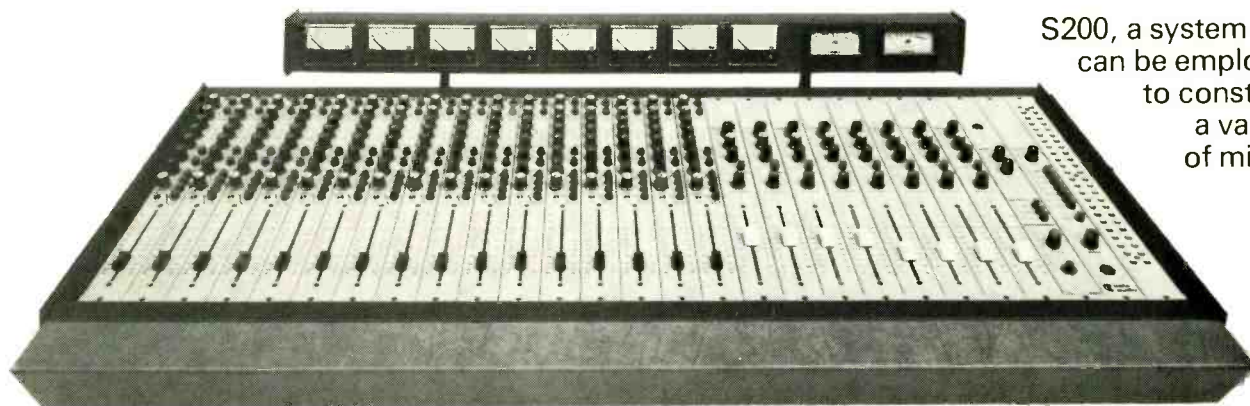
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Having talked to B67 users the world over, professionals who demand the highest quality and performance standards, Studer now introduce the Mk II version of this highly successful 1/4" machine.

An even better noise specification and a dual circuit

braking system are just two of the refinements built into the B67 Mk II. Easier access to the heads makes for swifter editing and this is further aided by automatic blocking of the tension sensors in the stop mode.

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16 plus Fact File

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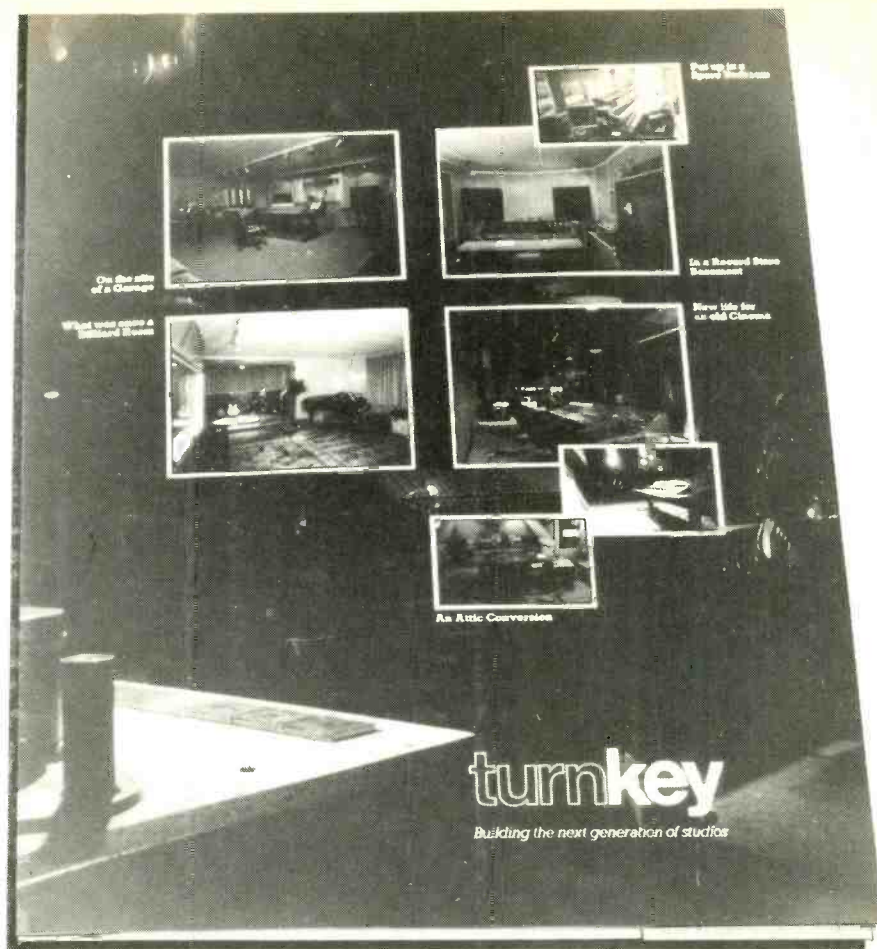
Based on our involvement with these projects and their problems, we have prepared a unique file of information. It contains vital facts and figures, covering all aspects of establishing a successful studio.

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14 STUDIO SOUND, OCTOBER 1981



In brief, this 40 page file covers;

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Studio Cashflow Planner and completed examples.

Finance and how to get it, what to tell your bank manager.

Package quotes for complete 16 & 24 track installations including wiring and installation.

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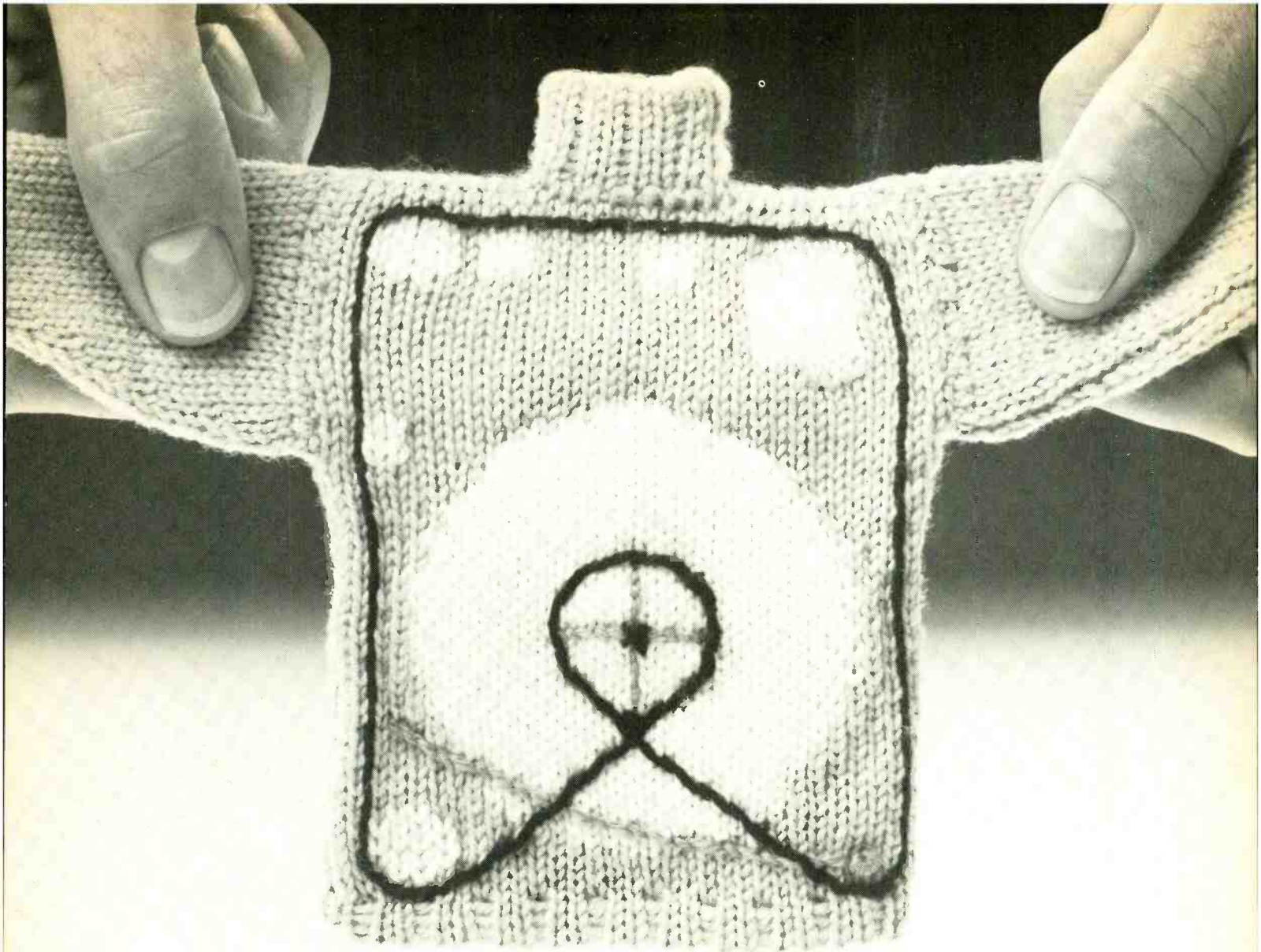
The cost of running a studio and how much you can charge.

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SOME MACHINES MAKE CARTRIDGES A LITTLE WOOLLY!

Not the ITC 99. A cleaner, crisper sound. That is what ITC cartridge machine technology is all about. And the ITC 99 delivers precisely that.

Built around a rugged deck that is not cast but milled from half-inch thick, solid aluminium

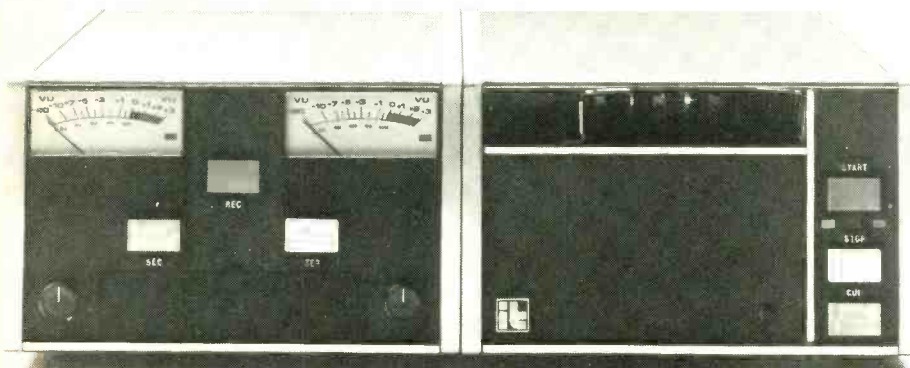
tool plate, the ITC 99 contains such advanced features as a crystal-referenced servo-motor, a positive, mechanical latching solenoid, a micro-adjust head module and a distortion-free cartridge positioning system. To the user, these features mean reduced wow and flutter,

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In short, reel-to-reel performance from a cartridge machine.

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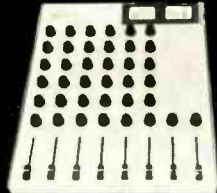
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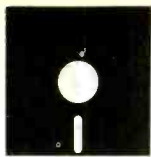
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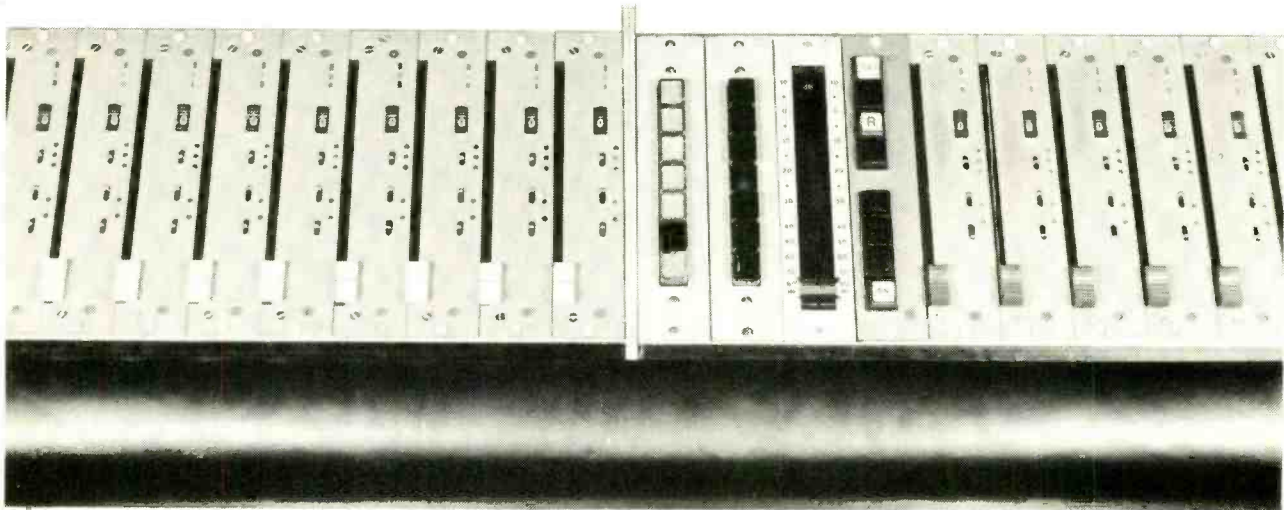
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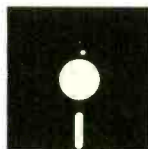
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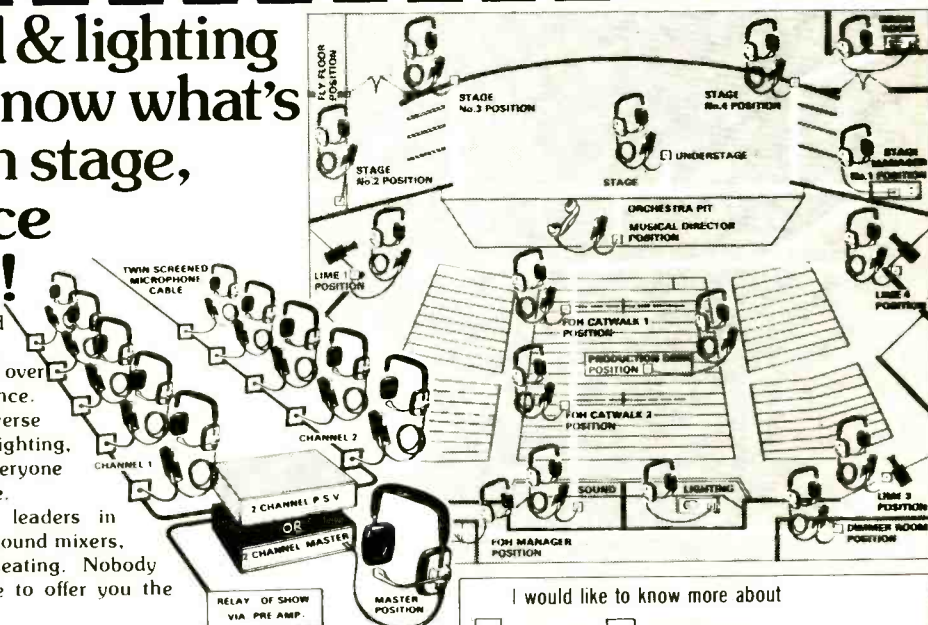
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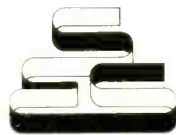
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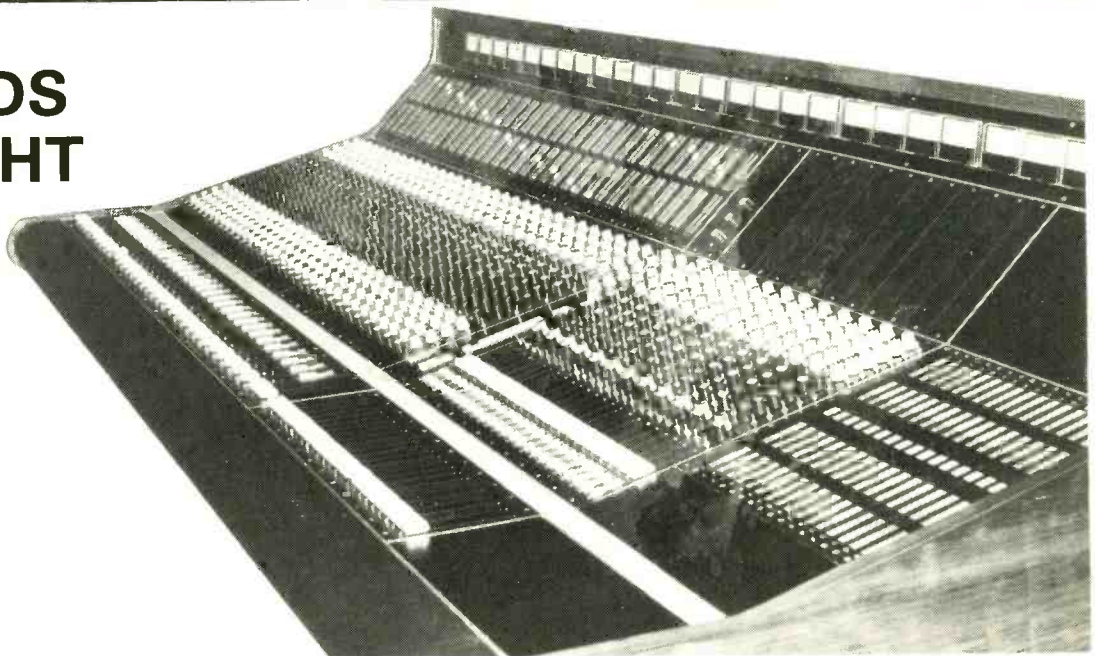
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HAVE YOU HEARD?

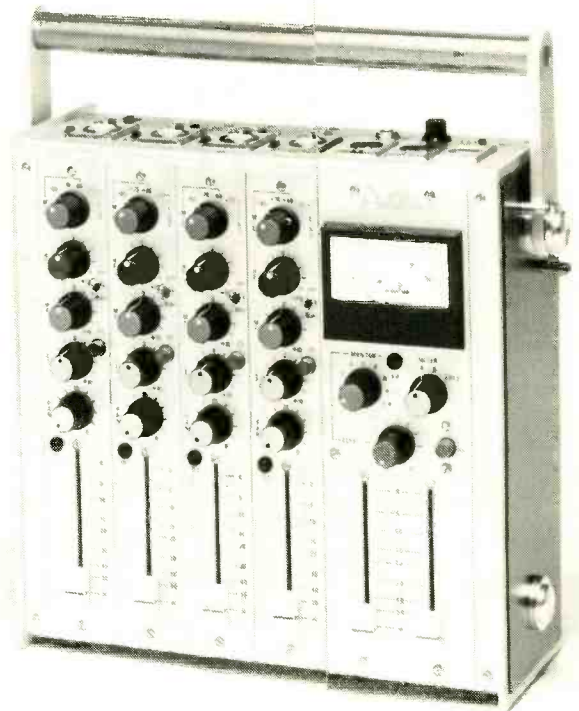
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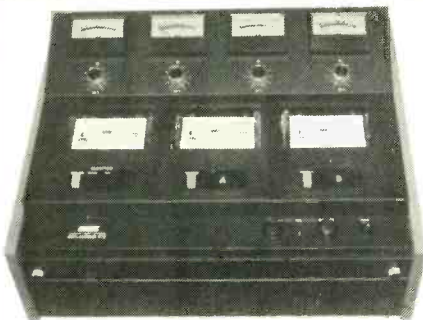
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Scotchflex brochure

3M has produced an illustrated brochure covering the company's complete range of *Scotchflex* IDC connectors and accessories. The brochure contains full information on socket connectors and headers, backplane connectors, DIP and pcb connectors, plug and edge-card connectors, delta ribbon connectors, flat and shielded ribbon cable, and jacketed and jacketed/shielded flat cable. A comprehensive range of tooling to aid the fixing of connectors to cables is also described. New additions to the *Scotchflex* range include 14, 24 and 36-way delta ribbon connectors; 20, 26 and 34-way backplane socket connectors and a 64-way *DIN 41612*-style socket connector. Copies of the new brochure are available from Lynn Walters, Marketing Supervisor, Electronic Products Group, 3M UK Ltd, 3M House, PO Box 1, Bracknell, Berks RG12 1JU, UK. Phone: 0344 26726.

Forthcoming Exhibitions

September 29

Sound Broadcasting Equipment Show, Birmingham (0734 53411).

October 30 to November 2

AES 70th Convention, New York ((212) 661-2355).

November 25 to 27

Prosound '81, London (01-340 3291).

November 25 to 28

Tonmeisterstagung Convention and Exhibition, Munich (Berlin (030) 308 2234).

December 2 to 4

CTEAP Convention and Exhibition, Paris ((1) 222. 40.73.).

March 2 to 5, 1982

AES 71st Convention, Montreaux, Switzerland ((212) 661-2355).

June 23 to 25, 1982

APRS Exhibition, London (09237 72907).

September 18 to 21, 1982

International Broadcasting Convention, Brighton (01-240 1871).

20 Years Ago

"Don't cross the channels" says the ad in October 1961's edition of *Tape Recorder* (the title of *Studio Sound* before 1970) magazine. "Stereo tape recording has come to stay. If you want first-rate stereo sound in the end, you must have a first-rate stereo microphone from the start . . . No wonder, therefore, that the new ACOStereo microphone is strictly in the champion class . . ." Another full-page ad announces that "Your Recorder deserves: The tape that speaks from space." This tape, introduced from the United States, was apparently selected for the US Space Satellites, Tyros I and II." Its name is strangely familiar: made by



SSE competition winner

Visitors to the recent APRS Exhibition will have noticed that Scenic Sounds Equipment ran a competition for the highest score on a Galaxian Video Game, with all proceeds from the competition being

donated to the DEAF charity. The tempting prize on offer from SSE was a pair of JBL monitors, and winner of the competition was Majella Bedmar from Vienna with the startling total of no less than 48,800 points.

Call for papers

The American publication *Computer Music Journal* has informed us that its Spring 1982 issue is to be devoted to the subject of digital audio. Topics to be included in this issue include: tutorials on digital audio; digital audio signal processing; digital recording, editing and mixing; intelligent sound analysis; advanced digital signal processing techniques; digital audio discs; and digital noise reduction. Papers on any of these subjects would be welcomed for consideration and possible inclusion in this issue. Interested authors are asked to contact C Roads, Editor, *Computer Music Journal*, Room 20B-229, Massachusetts Institute of Technology, Cambridge, Mass 02139, USA.

Syn-Aud-Con travels

Don and Carolyn Davis of Synergetic Audio Concepts have announced that after a two year absence from the Midwest and East Coast caused by the construction of their recently completed West Coast seminar centre, they are now again offering nationwide courses. Syn-Aud-Con courses "on the road" are scheduled for Denver (Sept 1 to 3); St Louis (Sept 16 to 18); Chicago (Sept 28 to 30); Cleveland (Oct 6 to 8); Washington DC (Oct 20 to 22); New York (Oct 27 to 29); Atlanta (Nov 9 to 11); Orlando (Nov 18 to 20); and Dallas (Dec 1 to 3). Full details are available from Don Davis, Synergetic Audio Concepts, PO Box 669, San Juan Capistrano, Cal 92693, USA. Phone: (800) 854-6201, or (714) 496-9599.

the Reeves Soundcraft Corporation, Connecticut, USA, *Soundcraft* tape was marketed in the UK by Soundcraft Magnetics Limited, Haddenham, Bucks (no relation?).

Meanwhile, down to earth, mono and stereo recordings of the same performance were being made possible by a special 17-channel console made by EMI for Levy's Sound Studios of New Bond Street, London. .at a cost of £9,000. The console included rack mounted units and special features designed by EMI to meet Levy's particular requirements.

In October, 1961, the Westrex Company Limited, London, had just installed new sound effects equip-

ment for the Ghost Train at Blackpool Pleasure Beach. The system was specially designed and built for the purpose, and consisted of a 12-way multi-tape replay system comprising 12 tape decks with associated preamps, amps, control switching and speakers, each fitted with switches and time delay circuitry to trigger the effects at the correct time. The entire system operated automatically and occupied two 10ft racks, one for the tape drives and one for a dozen identical thermionic amplifiers.

Once again on the ad pages, Emi-tape were announcing *Emi-guides*, "6 demonstration tapes that pave the way to better recording".

Revox clinic

Owners of Revox tape machines will no doubt be interested to know that Studio Equipment Services in conjunction with FWO Bauch are holding a clinic for the checking over of machines from October 6 to 8. Any Revox owner who would like his machine automatically tested, aligned, and where applicable given a list of machine faults, are welcome to avail themselves of this service. Studio Equipment Services are at The Shop, 100 Hamilton Road, London NW11 9DY. Phone: 01-458 9133.

ILR news

The development of independent local radio continues apace in the UK with NorthSound the new Aberdeen ILR station going on air in late July and with several new contracts being awarded recently. The contracts include the first ILR associate station Saxon Radio covering Bury St Edmunds, this station to operate in association with Radio Orwell (Ipswich). Other contracts which have been awarded are Swindon/West Wiltshire to Wiltshire Radio; Hereford/Worcester to Radio Wyvern; and Preston and Blackpool to Red Rose Radio. Looking to the future Northside Sound has applied for the Londonderry franchise, while the IBA has also invited applications for the Newport (Gwent) franchise.

With 27 stations now on the air and with a further eight due to begin broadcasting over the next nine months—the final 10 authorised stations are expected to be operational in 1982 or 1983—the cause of ILR in the UK has been given an additional shot in the arm with the announcement by the Home Secretary that a further 25 ILR stations (as outlined in our news item in the July issue) have been authorised. This decision opens up the prospect that virtually the whole of the UK will be covered by an ILR service during the 1980s.

Said EMI, "John Borwick, the well-known writer and broadcaster on all aspects of tape recording, has devised, written and recorded six *Emi-guides*. With these, you can *make your tape recordings as good as his*." The six tapes covered 'getting the quality right', 'mic technique', 'tape editing', 'outdoor recordings', 'trick recording and sound effects', and 'producing feature tapes'. Nearby, Gramplan Reproducers advertised their *DP4* microphone (£7.11s) and parabolic reflector. "Capture all the charm", says the ad over a picture of a singing bird. "Ideal too for broadcasting, public address, call systems, etc".

The Dream Equalizer Goes Stereo

When we introduced our 672A "dream equalizer" in 1979, it became an immediate favorite of recording studios, broadcasters, motion picture production houses, sound reinforcement contractors, and others making their living delivering pro-quality sound. The 672A's eight parametric EQ bands (with reciprocal curves) were combined with wide-range tunable 12dB/octave highpass and lowpass filters to create an amazingly powerful and useful machine. Professionals tuning monitor and reinforcement systems loved the 672A's cost-saving ability to provide a full electronic crossover function from its high and lowpass filters.

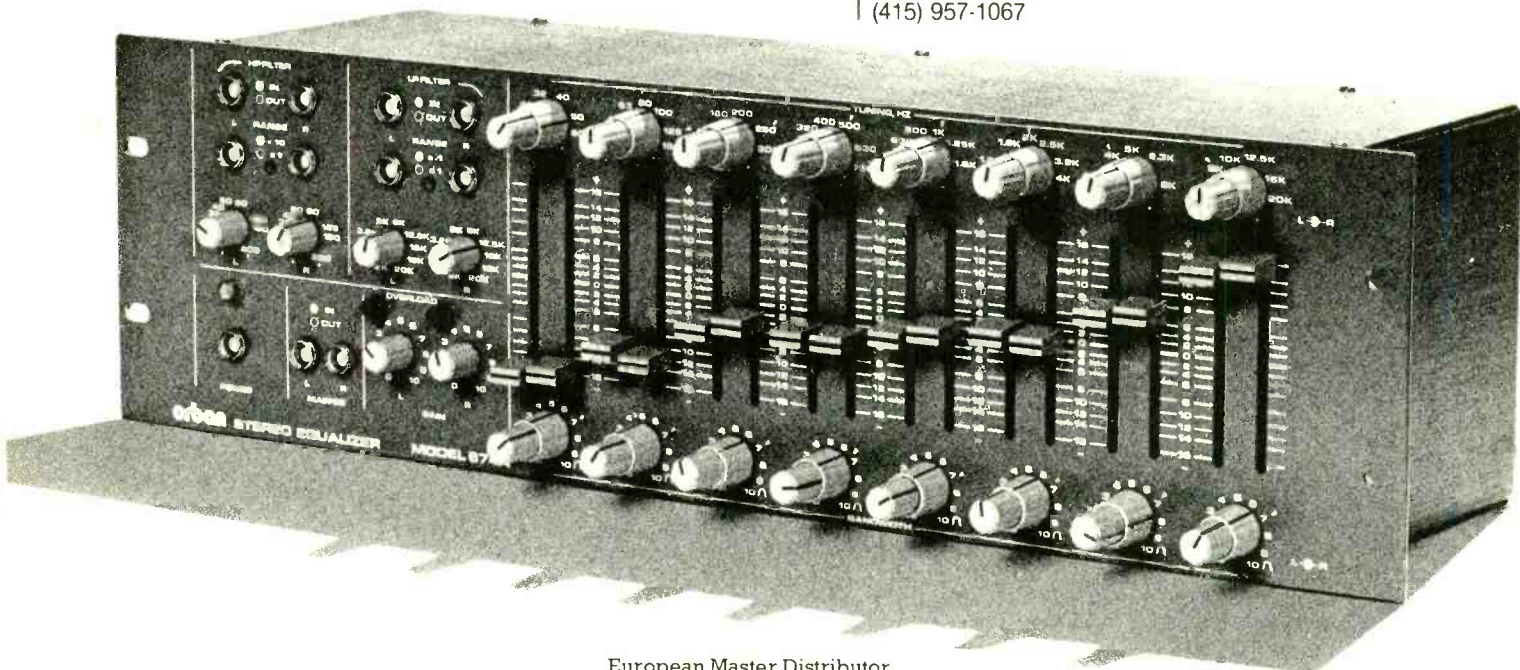
The 672A now has a stereo twin—the new 674A. The 674A packs all of the power of two 672A's in the same size 5¼" rack mount package. And controls are configured so that both stereo channels can be effortlessly adjusted together.

Naturally, the 674A is built to full Orban professional standards, with industrial-quality components RFI suppression, a heavy-duty roadworthy chassis, comprehensive back-up support, and a complete and informative manual.

For complete information on the popular mono 672A, or the up-and-coming stereo 674A, contact your nearest Orban dealer.

orban

Orban Associates Inc.
645 Bryant Street
San Francisco, CA 94107
(415) 957-1067



European Master Distributor



Scenic Sounds Equipment Limited

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

England Industrial Tape Applications Belgium Sait (Bruxelles) Finland MS-Audiotron (Helsinki)

France Schaeffer, Riesser & Cie (Paris) Germany Estemac (Hamburg) Greece Audiolab Hellas (Athens) Holland Cadac Holland (Hilversum)

Italy Audio Products International (Milano) Spain M. Llewellyn-Jones (Madrid) Sweden Tal & Ton (Gothenburg)

Tape box labelling

A seemingly small problem has been quietly tackled by the APRS, and their solution could well become an internationally accepted standard in one area of studio organisation.

After years of mounting confusion and irritation over the diverse (and often rather cryptic) way that tape boxes are labelled for storage, an APRS committee has dissected the problem and prescribed a set of precise descriptions for recorded tapes.

If generally adopted these should ensure that problems in locating stored tape which has been oddly or incorrectly labelled become a thing of the past.

Complaints about the existing lack of system have also figured in a recent SPARS technical practices survey in the USA, and the APRS has sent details of its proposed standardised label wording to SPARS. The list of definitions has also been sent to European studio organisations but, as APRS committee chairman Peter Harris concedes, language differences make it unlikely that it will be adopted on the Continent.

The approved designations are: Session Tape—a reel of original recorded material (can include both master material and out takes); Out Takes—material retained but not included in the master; Multitrack Master—multitrack session tape designated for completion and mixdown; Original Master—a fully prepared, edited session tape, or fully prepared mixdown of multitrack master tape in final format; Production Master—an equalised or otherwise modified copy of original master for production purposes; Copy Master—an unmodified copy of any master made for use as a master itself; Safety Copy of any of the above—an unmodified copy made to safeguard against loss or damage of a specific tape.

A heartfelt footnote from the committee, which spent much time trying to cover every possible eventuality, states: "If a tape or recorded material does not fall within one of the above descriptions then that tape should be marked 'not master material' and *not left unmarked* to generate later confusion."

Some tape manufacturers on the APRS committee have reacted favourably to the idea that they should print up labels carrying the approved definitions, and let purchasers of their tape have them on request. Eventually of course studios adopting the new labelling system would have them incorporated in their own printed tape box labels.

People

● Pentagon Industries Inc has appointed Harry Sheaffer as director of sales and customer service.

● Ray Updike has joined Valley People Inc as vice president and general manager. In addition Liz Clark has been appointed sales and marketing coordinator.

● Sony has appointed Martin Ryan as European accessories product manager with responsibility for the marketing of headphones, mics and general accessories.

● Colin Broad has joined Audio Kinetics with responsibility for the development of new hard and software products. In addition John Grumbridge has been appointed production manager.

Agencies

● Red Acoustics Ltd has appointed Kadek Vision Ltd as a distributor of its *Red Professional* loudspeaker system to the AV market. Kadek Vision Ltd, Shepperton Studio Centre, Squires Bridge Road, Shepperton, Middx TW17 0QD, UK.

● Tondale Electronics Ltd have been appointed dealers for the

American manufactured Trompeter range of interconnection products. Tondale Electronics Ltd, Upton Road, Tilehurst, Reading, Berks RG3 4JA, UK. Phone: 0734 29446.

● Trego Sales Co Inc has formed a new division handling professional audio products. Headed by Derek Allen, the new division is to distribute products from Beyer, Clearlight, Studer-Revox, Hafler, Klark-Teknik, Meteor Light & Sound, Audio-File, Hunley & Packard, Kimber-Kable, Integrated Sound Systems, Rebis and Statik Acoustics. Trego Sales Co Inc, 2239 Benedict Canyon Drive, Beverly Hills, Cal 90210, USA. Phone: (213) 274-8351.

● Scenic Sounds Equipment Ltd has been appointed sole UK distributor for the Publison range of effects units. Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA, UK. Phone: 01-734 2812. Telex: 27939.

Address Changes

● MBI Broadcast Systems has moved to 69 Ship Street, Brighton BN1 1AE, UK. Phone: 0273 24928.

● Uher Sales & Service Ltd has

moved to 30/31 Lyme Street, London NW1, UK. Phone: 01-485 0943/4.

● C-Tape Developments Ltd, manufacturer of the *C-ducer* contact mic has moved to 18a Bridge Street, Godalming, Surrey GU7 1HY, UK. Phone: 04868 7356. Telex: 858623.

Contracts

● Trident has supplied Record Plant, New York with a 56 input *TSM Series* console for its refurbished remix room.

● The IBA has ordered a further 12 Rediffusion *BT1000* MF transmitters to extend its ILR coverage. This order brings the number of Rediffusion transmitters ordered by the IBA to a total of 37.

● Sony has supplied the University of Surrey with a *PCM 100* based digital recording system which also includes Sony *Betamax* recorders.

● Canford Audio has supplied a new PA system for St Marys Cathedral in Newcastle.

● Calrec Audio is to supply the South African Broadcasting Corporation with 85 condenser mics plus a full range of accessories.

Copyright

The long awaited Green Paper on copyright was published on July 15, a 61-page Consultative Document putting forward various proposals for the revision of the law relating to this hugely complicated subject. The Paper has its origins in the Report of the Whitford Committee published in March 1977 and in the intervening period the Dept of Trade has been engaged on an elaborate programme of review and consultation with the many organisations involved. This has resulted in a number of recommendations for changes in the law which the Government has been able to accept, but in some areas the Committee was unable to reach unanimous views, and these and other areas of wide divergence of opinion are put forward in the Paper. What the Government hopes to encourage now is a wide public debate which will enable it to finalise its views.

One area of the copyright situation which all of us involved in audio and video are particularly concerned about is home taping of course, and in many respects this is the most difficult question dealt with in the Paper. 'On the one hand there is no doubt the record industry loses sales as a result. On the other hand, the true extent of these lost sales is unknown; in fact it is probably unquantifiable. If a levy on blank tapes or equipment were to be introduced therefore, how much should

this be? To charge a levy sufficient even to raise the Green Paper estimate of £50m per year would require a very large increase in the price of tapes or equipment. The Government would hesitate at imposing this on the public, especially since imposition of a levy would involve rough justice, with many tape users who never record copyright music having to pay . . . Further, a levy on blank tapes could be circumvented by selling tapes with trivia recorded on them, or by obtaining them by mail order from abroad. The Government has not received convincing evidence that a levy would be an acceptable solution'—a situation welcomed, of course, by the Tape Manufacturers Group (BASF, 3M, Maxell, Memorex, Sony and TDK). 'If a practical spoiler system to prevent re-recording is developed the Government will consider ways of supporting it by legislation against anti-spoiler devices' but ' . . . it may be that the industry will have to reconcile itself to a situation where its revenue comes mainly from broadcasting and other public performances (such as discos) of its recordings.'

Regarding piracy the Government is concerned that the present criminal remedies for infringement of copyright are too light and it proposes to increase the penalties and to make a new offence of 'possession of an infringing copy in the course of trade. The present import restrictions

on books which infringe copyright should be extended to pirate records and films'.

Other particularly contentious areas regarding the copyright situation are industrial design and photocopying. On the former, the Government considers that it is in the national interest for protection to be withdrawn on what the Paper describes as 'purely functional designs', citing as an example an exhaust pipe. The UK is at present almost alone in protecting items such as these and this arguably puts our spare parts manufacturers at an almost unique disadvantage. Of course, how you decide what is purely functional design and what has an element of creative design (which would remain protected) is another matter.

On the knotty question of photocopying, the Government argues that some form of blanket licensing is probably the most practical way of controlling the copying of copyright works. It does not agree with the suggestion that the latitude extended to students and to Libraries should be removed but it does propose to introduce tighter controls on the making of multiple copies.

The Green Paper, *Reform of the Law relating to Copyright, Designs and Performers' Protection*, Cmnd. 8302, is available from HM Stationery Office at £3.90.

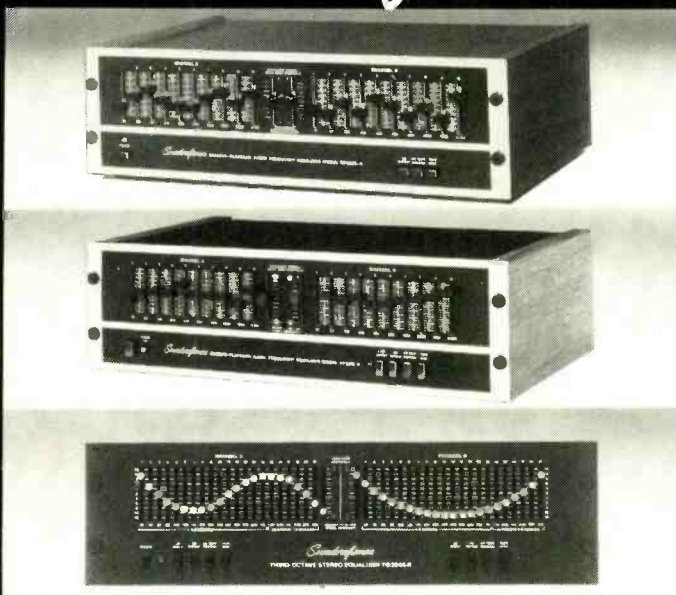
Ivor Humphries

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One third octave equalization has always been acclaimed by professional sound engineers as being the absolute method of achieving balanced frequency conditions in problem listening areas. Up until now, the one third octave units were either too expensive and/or overly complicated. The TG 3044 is divided into one third and alternate one third segments. The advantage of this frequency division is two fold, firstly, by eliminating the less often used controls in the high end the unit becomes less complicated to use yet precise and quick set up is possible. Second and most important, this equalizer offers facilities and specifications not available from other manufacturers at any price.
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REW PROFESSIONAL AUDIO

Sole UK Distributor:

REW Professional Audio, 114-116 Charing Cross Road, London WC2. Tel: 01-836 2372/7851.

Agents: Buzz Music, Widemarsh Street, Hereford. Tel: Hereford (0432) 51831.

At last, a machine that really gets to grips with the cassette.

The GRAFF cassette machine is a completely new departure in cassette handling. Because

it is built to uncompromisingly high standards, several variants can fulfil a number of different highly demanding roles with equal success.

It can record the Minute Waltz in 3.75 seconds.

GRAFF HSCD High Speed Cassette Duplicator

The most highly developed precision machine on the market. Copies cassettes at **16 times normal speed** - both sides at the same time. (It takes under 2 minutes to copy a C60). Extra slave modules can be added one at a time.

For Jingles that don't Jangle.

GRAFF JM Cassette Jingle machine

Now a viable low cost alternative to the cartridge jingle machine. Runs at double the normal speed (**3 $\frac{3}{4}$ ips**), with a double-sided head for superior reproduction. Auto cue at **500 ips**, and optional auto link system for slave machines.

Modular construction, no belts, no pulleys: 4 motor drive per cassette. Precision electronic motion control. All parts are machine engineered for reliability.

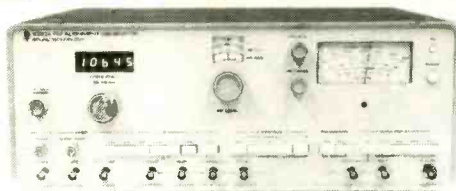
ICD Industrial Cassette Developments Limited
10 Sirhowy Estate, Tredegar, South Wales NP2 4XY Tel: (049 525) 5035

GRAFF™

new products

Sound Technology — new additions

Sound Technology has introduced a new FM alignment generator, *Model 1020A*, for use as a test instrument measuring the performance of receivers and tuners. The new unit, which includes a stereo modulator and FM/RF output, features digital RF readout with a 1kHz resolution; expanded RF level readout with three calibrated scales (μV , dBf 75 Ω , and dBf 300 Ω); internal oscillator (switchable 100Hz, 1kHz, 6kHz and 10kHz); internal IHF SCA with a 67kHz carrier (modulation frequency 2.5kHz, deviation 6kHz); selectable pre-emphasis of 25 μs , 50 μs or 75 μs (accuracy 0.1dB); internal



Sound Technology 1020A

10.7MHz marker; standard sweep or dual sweep for accurate IF and discriminator sweep alignment; and wideband aux modulation input. Price of the *1020A* is \$3,950.

The company has also announced three new optional accessories for its *Model 1500A* audio test system. These comprise the *VP-150* video printer, a thermal printer which connects directly to the video output on the rear of the *1500A* and replicates the CRT display in hard copy form; the *007* card module, a $\frac{1}{3}$ -octave spectrum analyser module which plugs into an existing card slot to provide facilities for performing spectral noise analysis and flutter measurements; and the *TR-150* test record containing 17 bands of phono cartridge tests including trackability, anti-skating, phasing, channel separation, tracking, etc. Prices of the optional accessories are: *VP-150* \$1,525 and *007* card \$1,500.

Sound Technology Inc, 1400 Dell Avenue, Campbell, Cal 95008, USA. Phone: (408) 378-6540. Telex: 357445.

UK: CE Hammond & Co Ltd, 105-109 Oyster Lane, Byfleet, Surrey KT14 7LA. Phone: 09323 41131/51051. Telex: 262525.

Audy Series 2000M

A new monitor mixing console with six separate output mixes for on-stage monitor mixing, sound reinforcement, and recording applications has been introduced by American manufacturer Audy Instruments. Termed the *Series 2000M* monitor mixing console, the new mixer provides 16 inputs (stackable to 32) with separate output mixes that permit control of up to six independent monitor sends. Features include 1C op-amps; a dual LED system indicating input attenuation switch adjustment; a claimed 25dB of headroom throughout the console; input and output channel patching; eq in/out switch for each input mix control; individual channel muting; talkback; six auxiliary inputs; headphone monitoring with solo priority system; high resolution 20-segment LED bargraph meters; phantom power; Penny and Giles faders and sealed conductive plastic rotary pots; work lamp socket; and a flight case. Price of the *Series 2000M* is \$6,995.

Audy Instruments Inc, Shetland Industrial Park, PO Box 2054, Salem, Mass 01970, USA. Phone: (617) 744-5320.

Graff cassette machines

A new company producing cassette machines for professional usage has recently been established in the UK. The new company Industrial Cassette Developments Ltd, owned by Muna Dawoodi and Ian Collins, has been set up with government backing in Wales, and is to market a series of modular cassette systems under the trade name *Graff*. Although only preliminary details of the new range are presently available, all the systems are fully modular and interchangeable and feature four motor drives with no belts or pulleys. Six machines are to be produced, these being the *HSCD* high speed cassette duplicator operating at 16 x normal speed; the *JM* cassette jingle machine operating at 3 $\frac{3}{4}$ in/s; the *BM* background music cassette system with optional multiple slaves; the *RT* professional studio quality realtime cassette machine with remote; the *DM* 'Dump' machine operating at 16 x normal speed for storage of digital information up to 14MB; and the *L* cassette logging machine operating at half speed, capable of accepting analogue or digital information up to 7kHz, and with a single cassette recording capacity of up to eight hours.

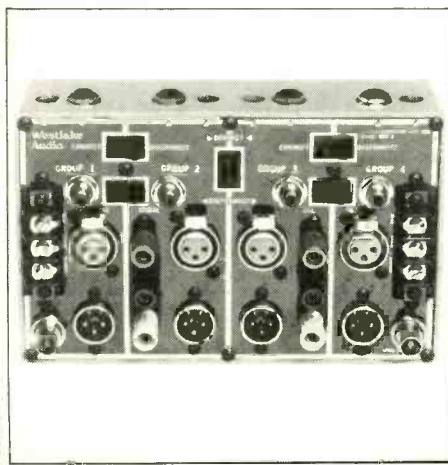
Industrial Cassette Developments Ltd, 10 Sirhowy Estate, Tredegar, Gwent NP2, UK. Phone: 049525 5035.

Westlake CMB-2

Westlake Audio has produced a useful little unit, the *CMB-2*, which is capable of functioning as an interface adaptor box, signal muting box, signal switching box, and general trouble shooting aid. Measuring only 4 $\frac{1}{2}$ x 2 $\frac{1}{2}$ x 7 $\frac{1}{2}$ in, the *CMB-2* which is completely passive in design, accommodates male and female *XLR*, phone (TRS), TT (Tiny Telephone patchcord), phono, BNC, banana and terminal strip connections. Through the use of various permutations of switch selection the connectors can be isolated into a maximum of four sections or they can function as one continuous 26-connector, 3-connector multibox.

Westlake Audio, 2696 Lavery Court, Unit 18, Newbury Park, Cal 91320, USA. Phone: (805) 499-3686.

Westlake CMB-2



Nady Pro-49 system

Nady has introduced a new wireless guitar and lavalier mic system, the *Pro-49*. Utilising the same circuitry as the *Nasty Cordless Blue* and *Nady VHF* systems and offering a S/N ratio of some 100dB, with a range of over 250ft, the system is fully portable and incorporates a single 9V battery giving some 10 hours of operation. In use as a guitar system the *Pro-49* crystal controlled fixed frequency receiver operates in conjunction with the *GT-49* transmitter, while as a lavalier mic system the receiver is used in conjunction with the *LT-49* transmitter which comes complete with an *ECM 1025* lavalier mic.

Nady Systems, 1145 65th Street, Oakland, Cal 94608, USA. Phone: (415) 652-2411.

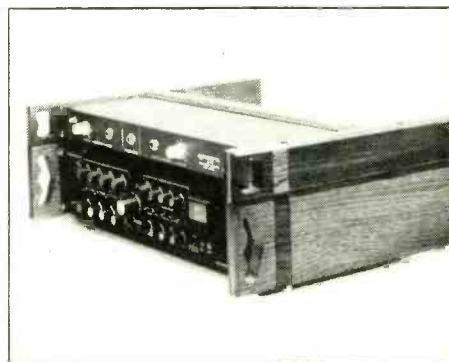
UK: Hardware House (Sound) Ltd, 34 St Philip's Road, Dalston, London E8. Phone: 01-249 0916.

ToyBox cabinet system

American manufacturer Wood Tailoring Co has introduced a new variety of modular cabinetry termed the *ToyBox* system. The system comprises a handling and stacking system for 19in EIA standard rack mount equipment. Constructed with 10-32 tapped aluminium mounting brackets and solid hardwood side panels fitted with integral handles, the modules feature adjustable 18-gauge steel bracing to secure the mounted equipment and provide rigidity. Non-marring nylon feet on the bottom of the system mate with recesses on the top of the side panels for stable stacking. Designed for quick assembly the modules are available in solid oak or walnut to fit either 1U, 2U or 3U high 19in units. *ToyBox* units permit ventilation between units and add only $\frac{1}{2}$ in height per cabinet to the height of a conventional 19in stack. Other components in the system include mating top panels to dress off a stack, angled rails for use on non-horizontal

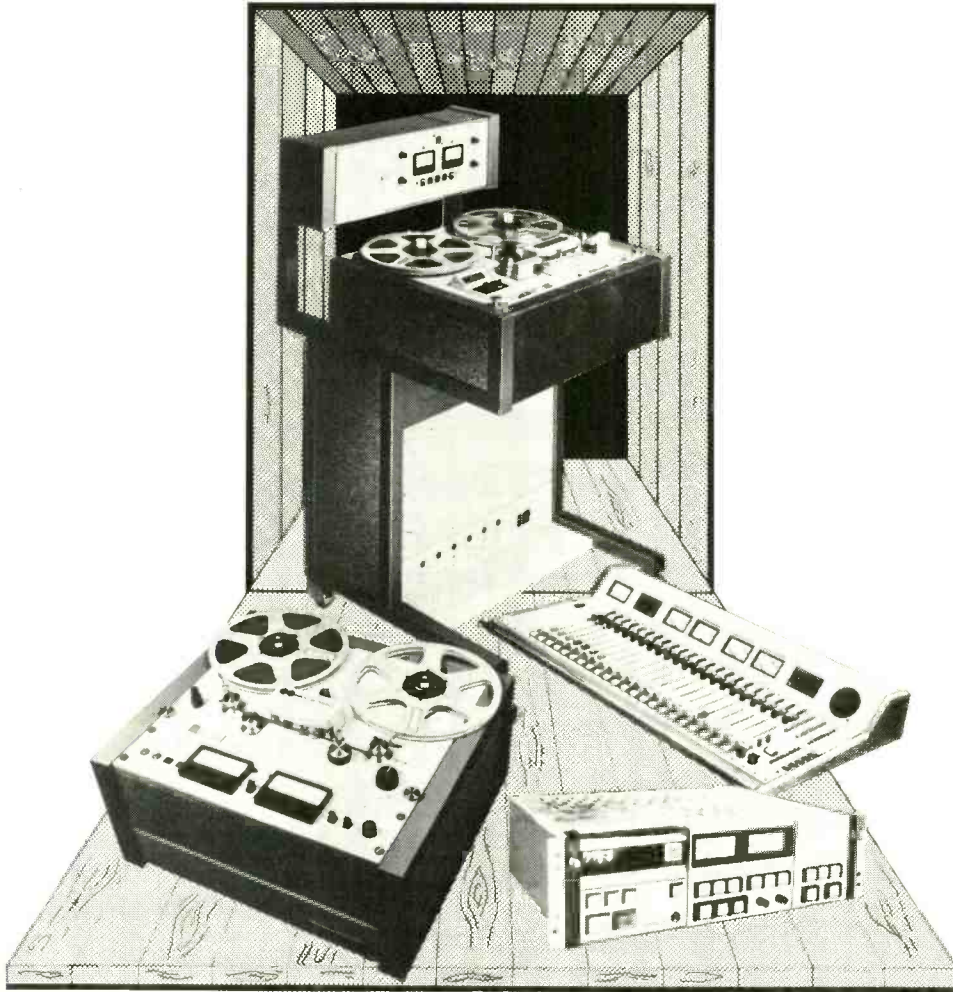
surfaces, a roll-around base, and termination options.

Wood Tailoring Co, PO Box 11314, Portland, Oregon 97211, USA. Phone: (503) 282-0588.





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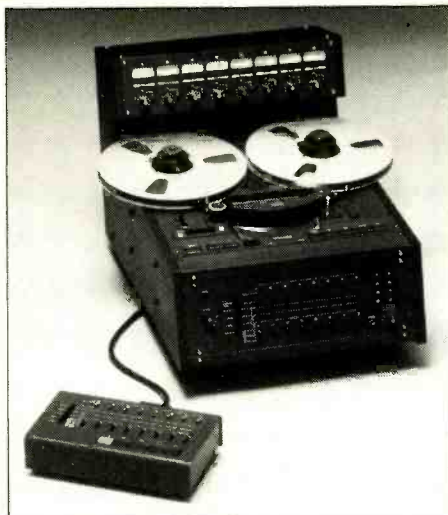
new products

ProTech new items

ProTech Audio has introduced a new compressor/limiter, plus two new units for its *Integra 3* PC card system amplifiers and related components. The new comp/limiter designated the *Model 663CL* is a general purpose unit for use in broadcast production, recording and PA systems, and is a 19in rack-mount unit with self-contained power supply and featuring plug-in pcb mother board construction. Front panel controls of the *663CL* include compression threshold, output level, screwdriver adjustable attack and release times, in/out switch, VU meter switchable to output or compression, and a power on/off switch/circuit breaker. Inputs/outputs are 600Ω transformer coupled, balanced, floating, capable of handling up to +27dBm level before clipping. Compression is 20dB max with a ratio of approximately 2.5:1. The compression control circuits are accessible externally, allowing two or more units to be interconnected for stereo or multichannel operation. Price of the *663CL* is \$495.

The two new units for the *Integra 3* card system comprise the *725BPS18* power supply and the *725RMP* rack-mount panel accessory. The *725BPS18* is a compact modular plug-in PC card bipolar power supply rated for ±18V at 250mA max, and features IC voltage regulation and a low profile power transformer which may be strapped for 120 or 240V ac 50/60Hz operation. Price of this unit is \$150. The *725RMP* rack mount panel mounts up to four *725SCH* single card holders horizontally, requiring only 1¼in of vertical 19in rack space. The panel has a removable front panel to access the plug-in cards and the unit can be used to house typically three amplifier cards or *Lumiten* remote volume controls with an associated power supply. Price of the *725RMP* is \$75.

ProTech Audio Corp, Flowerfield Building, Suite 1, St James, Long Island, NY 11780, USA. Phone: (516) 584-5855.



Otari 5050 Mark III/8

Continuing its updating and improvement of existing products, Otari has announced the introduction of a new ½in 8-channel tape recorder, the *5050 Mark III/8*. Designed as a successor to the *MX5050-8D*, the new machine retains the following features from the previous model: 15

and 7½in/s tape speeds; variable speed dc servo capstan motor; selective repro for overdubbing; built-in dual frequency test oscillator (1kHz or 10kHz); and easily accessible electronics. New features of the *5050 Mark III/8* include micro-processor control of realtime counting with LED display, dynamic braking and transport logic; automatic monitor switching; headphone monitoring for each channel (channel combinations selectable); and peak reading indicators on each channel. Other features include separate controls for record status and channel monitoring; master mode switching; memory rewind which automatically engages the stop mode when reaching zero; and transparent punch-ins and punch-outs. The new recorder is available with two optional types of remote controllers—the *CR-705A* which handles all transport functions, or the *CB-110* with facilities for the remote control of transport functions, channel switching, varispeed (±7%), and remote electronic timing.

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

USA: Otari Corp, 2 Davis Drive, Belmont, Cal 94002. Phone: (415) 592-8311.

UK: ITA, 1-7 Harewood Avenue, Marylebone Road, London NW1 6LE. Phone: 01-724 2497.

Symetrix Patch-32

American manufacturer Symetrix has introduced a new patchbay designed for economical and reliable interconnection of unbalanced audio units. Termed the *Patch-32*, the patchbay accepts up to 32 unbalanced ¼in phone jacks (or optionally RCA jacks) on the rear panel, and routes the signals to 32 front panel ¼in jacks. For user convenience the top row of front panel jacks are normalised to the bottom row so that automatic connections between two devices may be made without a patchcord between the two rows. All the jacks are isolated from the chassis to prevent ground loops; the jacks used are ADC connectors; and crossbar contacts are gold plated for reliability. Prices for the two versions are, *Patch-32A* (¼in jacks, front and rear panel) \$149, *Patch-32B* (RCA jacks rear panel, ¼in jacks front panel) \$129.

Symetrix Inc, 109 Bell Street, Seattle, Washington 98121, USA. Phone: (206) 624-5012.

Bruel & Kjaer instrumentation tape recorders

Bruel & Kjaer has introduced two new portable instrumentation tape recorders for combined field and laboratory usage. Specifically designed for multichannel instrumentation recording of sound, vibration and other analogue signals in the frequency range dc to 60kHz, the recorders operate from self contained rechargeable batteries, and differ in as much that the *7006* recorder is a simplified version of the *7005*. The *7005* features a range of interchangeable plug-in units which enable any combination of up to four IRIG wideband FM and intermediate direct record/reproduce channels to be accommodated without the need for head changes or adjustment. Tape speeds are either 1½ or 15in/s, the recorders accept 7in spools, and they have phase locked servo controlled differential capstan drives, in addition to which a post-record automatic flutter compensation mode may be selected.

Other features include a tape loop cassette for repetitive playback of short duration signals for frequency analysis, a small handheld mic and built-in loudspeaker for audio monitoring, auto stop, splice muting and a tape marking function, a 3-digit tape position indicator, and provision for remote control. While the *7005* incorporates a plug-in 2-channel compander unit with both linear and A-weighting input modes, enabling two separate signals to be recorded and reproduced in conjunction with two of the FM or direct channels—the unit may also be used to power two B&K mic preamps to facilitate recording of sound measurements without the need for a sound level meter—the *7006* excludes this feature. The channel and compander unit can, however, be added to the *7006* which has the same mainframe and drive unit as the *7005*.

Bruel & Kjaer, DK-2850 Naerum, Denmark. Phone: 02 80.05.00. Telex: 37316.

UK: Bruel & Kjaer (UK) Ltd, Cross Lances Road, Hounslow, Middx. TW3 2AE. Phone 01-570 7774. Telex: 934150.

USA: Bruel & Kjaer Instruments Inc, 185 Forest Street, Marlborough, Mass 01752. Phone: (617) 481-7000.

34 ▶



Loft Model 450

Phoenix Audio Laboratory has provided us with details of the Loft *Model 450* delay line/flanger, this unit being an updated version of the respected *Model 440*. The *Model 450* is a standard 19in rack-mount unit and utilises analogue shift register circuit technology to create effects such as flanging, chorus/doubling, slap back echo and many other time base effects. Features include calibrated input/output level controls; regeneration eq shift switch; LED headroom indicators; XLR and ¼in jacks on inputs and outputs; up to 20dB of gain for use with musical instruments; foot pedal interface for remote control of delay time; and the facility to plug in an optional *EM-450* module to double delay time. Flange and delay times are pushbutton selectable with delays increasing as bandwidth is reduced. Price of the *Model 450* is \$750, while the *EM-450*

delay extension module costs \$125.

Specifications: input impedance balanced >20kΩ, unbalanced >47kΩ; max input level +18dBm; output impedance 10Ω; max output level +18dBm; delay time 4 to 40ms (18kHz bandwidth), 8 to 80ms (9kHz bandwidth), 12 to 120ms (6kHz bandwidth), 16 to 160ms (4.5kHz bandwidth); delay time flange mode 0.5 to 5ms (18kHz), 1 to 10ms (9kHz), 1.5 to 15ms (6kHz), 2 to 20ms (4.5kHz); regeneration (feedback) variable from 0 to 100%; frequency response ±3dB of above bandwidths with delay, direct 20Hz to 20kHz +0, -1dB; THD delayed signal at 1kHz at +10dBm, typically 0.2% flange mode, typically 0.8% delay mode.

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

TEAC

UPDATE

turnkey

85-16

Now there's no excuse for buying a used machine. This precision engineered 16-track offers integral dBx, the economy of one-inch tape and, of course, TEAC reliability. Someone in Japan really worked this one out, it's TASCAM's finest hour.



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Custom Portastudio systems, road-cased or racked, with speakers, amps and effects, can be tailored to your requirements. Call for details, and remember that the 144 is available now at lower prices.

Baby 15

The other half of TEAC's 16-track package is the massive Model 15 mixer. Specs and facilities outshine anything they have made before. Our mini performance comparator is available on free loan to anyone seriously interested.



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The 80-8 is the world's best selling 8-track machine, producing hits in thousands of studios.

Working systems available at package prices.

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All the TASCAM range is covered in the new, 30 page, full colour booklet, available on request. As this ad is written two months before you read it, please call or write for the latest prices and offers.

If you would like to learn more about multitrack, we can supply copies of TEAC's "Are you ready for Multitrack?" and "Multitrack Primer" at 60p and £3.30 respectively, incl.

Free with four

We have helped many multitrackers on their way with our offer of the 1478 mixer with every 3440 that we sell. It features treble, bass pan and fader on each of four channels, ideal for bouncing or mixdown.



32-2B Immediate Release

The latest version of TEAC's remarkable, low priced, 2-track mastering machine now features separate left and right record switches extending its already versatile performance. In stock now.



turnkey

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Tel: 01-440 9221 Telex: 25769

new products



Wright condenser mics

Introduced at the AES Los Angeles Convention were two new professional electret condenser mics from a new American manufacturer Wright Microphones. The two mics are the *SR-1* with a conventional transformer coupled output stage, and the *TSR-1* with a solid state output stage. The mics feature a gold foil electret condenser element and integral phantom powered preamp housed in

Multivox digital sequencer

Multivox has introduced a new keyboard controlled digital sequencer, the *MX8100*. Designed primarily for live use, the digital sequencer is an active keyboard controller governing either synthesiser performance or recording



Highland switches

Highland Electronics has introduced a new range of both round and square bezel miniature illuminated pushbutton switches and matching indicators termed the Series 19 range. The new components have panel dimensions of 9mm diameter or 9x9mm; with the switches being single-pole with normally open contacts, although they are also available with both momentary or maintained actions; and they are suitable for low level switching. Rated at 100mA 50Vac or 72Vdc maximum, they have gold plated contacts, and a range of coloured screens are

available. Illumination is provided by miniature T1 bi-pin filament lamps in six different voltage versions from 6V to 36V. In addition LED illumination may be used in conjunction with special transparent screens in a choice of four colours. Both the switches and indicators are panel mounted in an 8mm diameter hole and secured by knurled nuts. The plastic moulded cases are available in a choice of either black or grey.

available. Both have a 100Ω output impedance and the solid state version has 12dB more gain. Both mics are supplied with a windscreens and a unique foam rubber shock mount and mic holder, while optional accessories include a switchable 6 to 12dB pad and a plug-in battery supply. Prices of the mics are \$440 for the *SR-1* and \$600 for the *TSR-1*, with the pad costing \$80.

Specifications: polar pattern, extended angle cardioid; frequency response 20Hz to 30kHz; max SPL 130dB; source impedance 150Ω; S/N ratio >80dB; noise figure 28dB; phantom power 12V to 48V dc.

Wright Microphones, 2093 Faulkner Road, N E Atlanta, Georgia 30324, USA. Phone: (404) 321-3886.

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

sequences, with provision via portamento controls for gliding effects to be incorporated into sequences.

The *MX8100* features exponential/linear and positive/negative gate input and output jacks and controls allowing compatibility with the majority of synthesisers, whilst it may also be synchronised with rhythm units or other sequencers, or triggered by optional bass pedals and guitars. Keyboard transposition may be accomplished either from the beginning of a sequence or at any other point depending upon the position of the key mode lever. LED indicators display which of four independent channels are selected or whether all four channels are being combined in series. Other LED indicators cover tempo indication and memory note consumption.

Multivox/Sorkin Music Co Inc, 370 Motor Parkway, Hauppauge, NY 11787, USA. Phone: (516) 231-7700.

available. Illumination is provided by miniature T1 bi-pin filament lamps in six different voltage versions from 6V to 36V. In addition LED illumination may be used in conjunction with special transparent screens in a choice of four colours. Both the switches and indicators are panel mounted in an 8mm diameter hole and secured by knurled nuts. The plastic moulded cases are available in a choice of either black or grey.

Highland Electronics Ltd, Highland House, 8 Old Steine, Brighton BN1 1EJ, UK. Phone: 0237 693688. Telex: 87616.

Rebis programmable pan system

Rebis Audio has introduced an automatic pan system in its *RA200 Series* of signal processing modules. The system comprises two units, the *RA215* programmable pan controller and the *RA216* stereo pan/VCA module. The *RA215* controls not only mono, stereo and multiple channel fade out or panning, but also crossfade between effects or separate tracks. Additionally, the module provides free running automatic panning with random or programmable hold and one-shot panning selectable over ¼, ½, ¾ or full cycle. Controls on the *RA215* include pan range switch; flyback switch, pan hold selectors with LED indication of stereo image status; trigger buttons with LED indication; a rate control switch which sets panning speed from 30s per sweep to 10 cycles/s; a normal image button; and an int/ext rate switch which allows the pan speed to be controlled externally. As the unit is part of the *RA200 Series*, run, hold and pan to (one-shot) functions can be controlled by external dc sources such as the *RA201* noise gate to give signal related triggering. Similarly, rate of pan can be externally controlled by an *RA208* modulator or other dc source to give Leslie or chime effects. Special effects which can be achieved with the unit include stereo field offset using the pan range switch which allows the panner to operate in either normal to centre, or reverse to centre modes instead of the usual normal, centre, reverse and return cycle. A further facility is the ability to select flyback in either direction such that a signal can pan one way and then jump back to its starting position. Prices of the units are *RA215* £97; *RA216* £89, or alternatively Rebis offer a complete stereo package comprising an *RA215* and two *RA216* modules for £275.

Specifications: *RA215:* modulation rate variable from 10 cycles/s to 1 cycle/min with front panel control or external dc (1 to 12V) input; control output waveform triangle or positive or negative sawtooth; control output voltage range 0 to 15V full sweep, or 0 to 7.5V and 7.5V to 15V with offset switch operated; programmer output can be run continuously and stopped manually anywhere in voltage range or programmed to stop at any combination of four positions in the cycle; trigger inputs, negative pulses 15 to 0V.

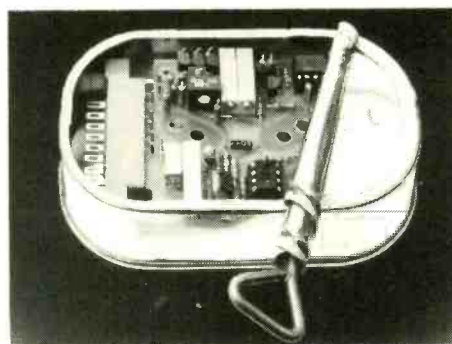
RA216: input impedance 100kΩ; max input level 20dBm; output impedance <1Ω; max output level 20dBm into 600Ω; frequency response 20Hz to 20kHz +0, -1dB; THD <0.2% at 1kHz at +10dBm; noise <85dBm; gain/attenuation +6dB to -50dB pan mode, +6dB to -80dB fade mode; dc control inputs 0 to +15V.

Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 5AB, UK. Phone: 0384 71865.

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

USA: Klark-Teknik Electronics Inc, 262A Eastern Parkway, Farmingdale, NY 11735. Phone: (516) 249-3600.

Exhibiting at Sound Broadcasting Show, Birmingham, September 29th



PPM3

drive circuit to IEC268-10A, BS4297, draft BS5428-9. Unbalanced input. May be used in equipment which will be required to pass IBA Code of Practice inspection. Aligned and soak tested 7 days, or as a kit.

PPM2 drive circuit under licence from the BBC. Balanced inputs. Approved for critical programme monitoring by IBA, EBU and BPO.

SUM AND DIFFERENCE changeover board to suit PPM2 or BBC ME12/9.

ERNEST TURNER high quality movements 640, 642, 643 and TWIN with flush-mounting adaptors and illumination kits from stock.

Broadcast Monitor Receiver 150kHz - 30MHz.

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SURREY ELECTRONICS, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG. Tel. 04866 5997

The Unlimited Limiter.



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

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

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

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

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

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

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

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

MXR Professional Products Group

MXR Innovations, (Europe)
34 Bancroft Hitchin, Herts.
SG51LA, Eng.
Phone 0462 31513, Tlx 826967

new EQUALISERS products

ADC SS-2 Mark II

Although primarily designed with hi-fi usage in mind the ADC SS-2 Mark II 2-channel 12-band graphic equaliser is also suitable for studio use. Features include individual channel level controls with seven LED display (and meter level adjustment), bypass, line/record and monitoring facilities, and meter on/off switching.

Specifications: band centres 30, 50, 90, 160, 300, 500, 900Hz, 1.6k, 3k, 5k, 9k and 16kHz; control range ± 12 dB; input impedance 75k Ω ; output impedance 10 Ω at 1kHz; max output 10V into 10k Ω ; frequency response 5Hz to 100kHz ± 1 dB; distortion 0.02% at 1V output, 20 Hz to 20kHz.

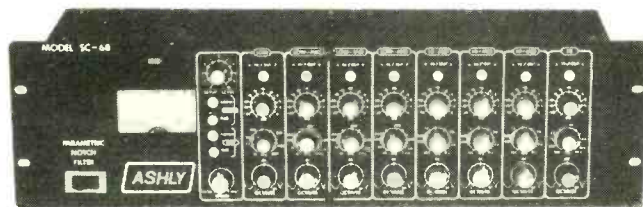
ADC SS-3

Similarly designed to the SS-2 Mark II, the ADC SS-3 is a 2-channel 12 band per channel graphic equaliser. Where it differs from the other ADC model is that the SS-3 has three selectable frequency centres for each band, hence making the unit akin to a sweep equaliser. Both channels offer 36 frequency steps (12 x 3) covering the range 26Hz to 21.5kHz. Facilities include dual signal gain LED meters, calibrated in 3dB increments (+12 to -12dB), with level adjustment; and eq and meter bypass switching.

Specifications: band centres 26/32/39, 47/56/68, 84/100/120, 150/180/215, 260/320/390, 470/560/680, 840Hz/1k/1.2k, 1.5k/1.8k/2.15k, 2.6k/3.2k/3.9k, 4.7k/5.6k/6.8k, 8.4k/10k/12k, 15k/18k/21.5kHz; control range ± 12 dB; input impedance 75k Ω ; output impedance 10 Ω at 1kHz; frequency response 5Hz to 100kHz ± 0.5 , -1dB; distortion 0.018% at 1V, 20Hz to 20kHz.

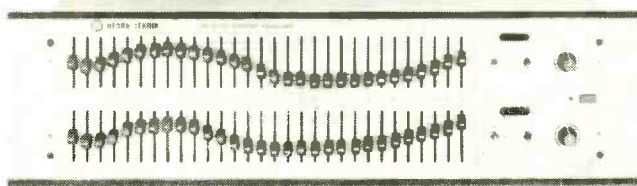
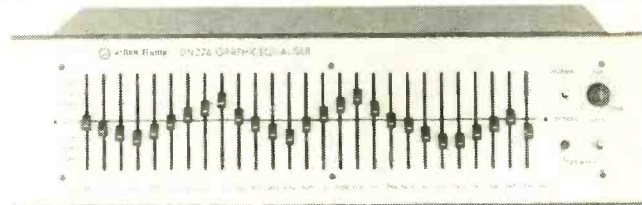
Ashly SC-68

Ashly has introduced a new parametric notch filter (a cut-only equaliser), the SC-68, which is designed to insert relatively sharp dips in the frequency spectrum. As such the unit is useful for removing problem spot frequencies such as feedback, cabinet resonances, hum or TV sync signals, and 'toning down' single 'hot' notes on musical instruments. The SC-68 comprises eight individual filter circuits applied to a common buss with each filter acting as a frequency dependent resistance with the resistance dropping to zero at the centre frequency. This enables each



Ashly SC-68

Klark-Teknik DN27A



Klark-Teknik DN30/30

band to give a minimum 30dB of attenuation. As an additional facility each band can be individually switched on/off and the entire unit can be bypassed to compare a final set up with a flat setting.

Specifications: amplitude 0 to -30dB; frequency bands 16 to 800Hz (low), 48Hz to 2.4kHz (3 low-mid bands), 160Hz to 8kHz (3 high-mid bands) and 480Hz to 24kHz (high); bandwidth 0.1 to 0.01 octave; input impedance 10k Ω active balanced bridging; output impedance 50 Ω terminal, with 600 Ω or above; max input/output level +20dBm, +5dBm at max cut; frequency response 20Hz to 20kHz ± 0.5 dB; THD < 0.05% at +10dBV, 20Hz to 20kHz.

Klark-Teknik DN27A

Successor to the widely respected DN27, the DN27A $\frac{1}{3}$ -octave 27-band graphic equaliser although basically similar to the earlier model incorporates several new features. New features include delayed turn-on to eliminate switch-on transients; total system bypass connecting the input directly to the output when power is disconnected; a rear panel mounted earth lift switch enabling signal and chassis grounds to be isolated; output drive capability increased to +23dBm into 600 Ω ; and provision of an optional plug-in transformer balanced input/output module. Other features retained from the previous model include centre detent slide potentiometers; eq bypass switch; a level control allowing input level to be set from infinite attenuation to 6dB gain; optional perspex tamper-proof cover; and XLR-type input/output connectors.

Specifications: band centres 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800Hz, 1k, 1.25k, 1.6k, 2k, 2.5k, 3.15k, 4k, 5k, 6.3k, 8k, 10k, 12.5k and 16kHz; control range ± 12 dB; calibration accuracy ± 0.5 dB; input

impedance 10k Ω nominal; equivalent input noise < -90dBm, 20Hz to 20kHz unweighted; output source impedance < 0 Ω short circuit protected; output clipping point +23dBm (9V) into 600 Ω ; frequency response ± 0.5 dB, 20Hz to 20kHz with controls flat; distortion < 0.01% at 1kHz at +4dBm into 600 Ω , < 0.05% 20Hz to 20kHz at +18dBm into 600 Ω .

Klark-Teknik DN30/30

A recent addition to the Klark-Teknik range, the DN30/30 graphic equaliser is a 2-channel, 30-band design which utilises highly stable NIC, minimum phase, combining filter networks. Features include a scale switch allowing the compact slide potentiometers to have a control range of either ± 6 dB or ± 12 dB; level controls with an input level range of infinite attenuation to +60dB gain; sub-sonic filters; system bypass on power down; and noiseless eq bypass switching. A further facility is that the rear panel mounted input/output module can be changed to accommodate many options such as 2- or 3-way crossovers; transformer balancing; and high and lowpass filters.

Specifications: band centres 25, 31, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800Hz, 1k, 1.25k, 1.6k, 2k, 2.5k, 3.15k, 4k, 5k, 6.3k, 8k, 10k, 12.5k, 16k and 20kHz; distortion 0.01% over the range 20Hz to 20kHz; noise < -90dBm.

Log EQ4A and EQ4B

French manufacturer Log Audio Equipement has produced two new parametric equalisers, the EQ4A and EQ4B, both units being technically identical and differing only in as much that the EQ4B is a 19in rack-mount unit with two channels of equalisation, whereas the EQ4A is a vertically arrayed eq module seven of which can be housed in a 19in rack frame 3U high. Both units have four bands of equalisation, plus input/output level controls, bypass switching and high and lowpass filters each with three cut-off frequencies.

Specifications: frequency bands 40Hz to 1kHz (low), 150Hz to 3.8kHz (low-mid), 320Hz to 6.8kHz (high-mid) and 1k to 20kHz (high); control range ± 15 dB; Q adjustable 0.8 to 5 octave; highpass filter 18dB/octave at 30, 70 or 100Hz; lowpass filter 18dB/octave at 7k, 10k or 15kHz; input impedance 20k Ω ; max input level



A
New
Leader

The **Rebis** Programmable Panner

Pan Range Switch

selects full, normal or reverse pan field.

Pan Hold Selectors

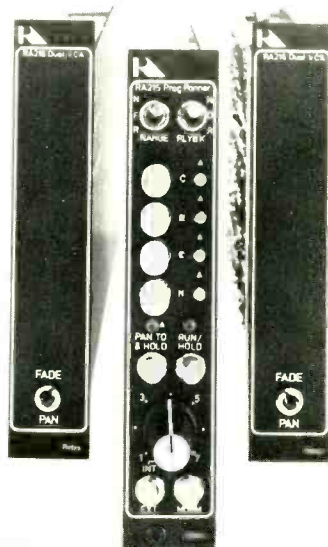
programme image hold to any combination of quarter, half, threequarters and full cycle positions to define one-shot pattern or final image after free run.

Rate Control

sets panning speed from 30 seconds per sweep to 10 cycles per second.

Rate Int/Ext Switch

allows pan speed to be controlled externally by a D.C. source for modulated or programme related pan speed.



Flyback Switch

selects symmetrical panning or flyback from either normal to reverse, or reverse to normal.

LED'S

indicate status of image throughout pan.

Pan Mode LED's

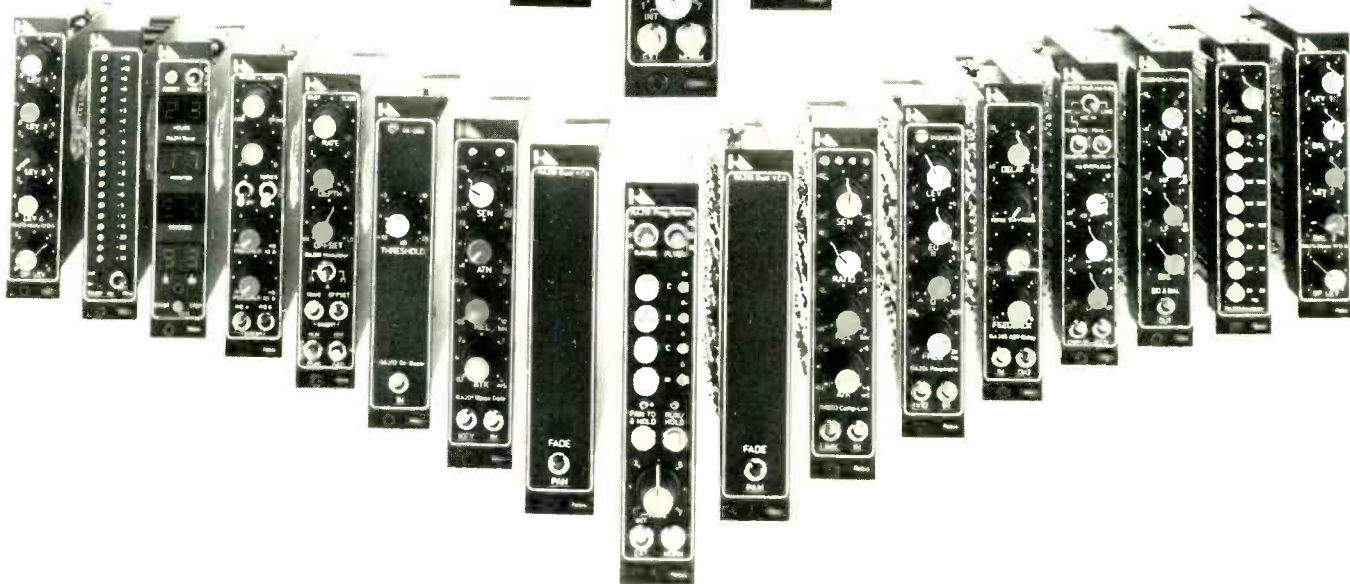
indicate programmed or free run panning action.

Trigger Buttons

for programmed one-shot, run, random hold, programmed hold, all functions can be externally controlled by D.C. or programme.

Normal Image Button

returns signals to normal positions.



The new RA215 Programmable Pan Control module uses the latest in digital technology to put you in creative control of a unique range of stereo effects.

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

Germany; Thum & Mahr Audio, Leverkusen 41600. Studitechnik Jürgen Klever, Hamburg 6901044. Hausmann Concert Electronic, Berlin 4336097. Belgium; SED, Brussels 5227064. U.S.A.; Klark-Teknik Electronics Inc., Farmingdale, N.Y. 2493660. Sweden; Tal & Ton, Gothenberg 803620. Netherlands; SAP, Amsterdam 797055. Finland; Studiotec, Espoo 5206604. France; Lazare Electronic, Paris 8786210. Spain; Mike Llewellyn Jones, Madrid 4451301. Japan; Continental Far East, Tokyo 5838451. Australia; Audio Mix Systems, Sydney 9009.

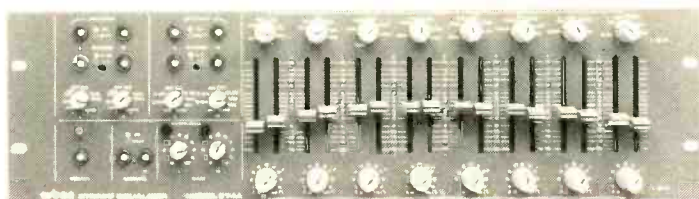
new EQUALISERS products

+22dB; output impedance 600Ω; max output level +22dB; frequency response 20Hz to 40kHz ±2dB; THD < 0.1%.

Neptune 1020 and 1021

The Neptune 1020 graphic equaliser is a 2-channel, 10-band, single-octave graphic equaliser with individual channel bypass switching, while the 1021 model is to the same configuration but designed for professional usage. Both models have similar specifications.

Specifications: band centres 31.5, 53, 125, 250, 500Hz, 1k, 2k, 4k, 8k and 16kHz; control range ±12dB; input impedance 66kΩ balanced, 33kΩ unbalanced; max input level 20dBV; output impedance 600Ω balanced, 300Ω unbalanced; max output level 24dBm; frequency response 20Hz to 20kHz ±1dB; S/N ratio 90dB at 0dBV output; THD 0.008% at 1kHz, 0dBV.



Orban 674A



Peavey Stereo Graphic

Neptune 2710 and 2711

The 2710 graphic equaliser is also partnered by a similar model designed for professional usage, the 2711. Both models are single-channel, 27-band 1/3-octave graphic equalisers at the standard ISO centre frequencies. Specifications are similar for both models.

Specifications: band centres 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800Hz, 1k, 1.25k, 1.6k, 2k, 2.5k, 3.15k, 4k, 5k, 6.3k, 8k, 10k, 12.5k and 16kHz; control range ±12dB; Q variable such that at max boost a 3dB-boost is obtained in adjacent bands; input impedance 66kΩ balanced, 33kΩ unbalanced; max input level 20dBV; output impedance 600Ω balanced, 300Ω unbalanced; max output level 24dBm; frequency response 20Hz to 20kHz ±1dB; S/N ratio > 90dB; THD 0.008% at 1kHz, 0dBV.

Orban 674A

A development of the 672A mono equaliser, the 674A is a split-stereo twin 8-band graphic equaliser with each band having a continuously variable centre frequency and bandwidth. In addition the unit has wide range high and lowpass 12dB/octave Butterworth filters following the eq section allowing the filters to be used as a 2-way electronic crossover. To aid stereo operation ganged controls are provided. Each of the eight bands tunes over a 3:1 frequency range and offers ±16dB of boost or cut with reciprocal curves. The Q is variable between 0.3 and 20 for extra narrow notches. The high and lowpass filter sections are continuously tunable over a 100:1 frequency range in two decades and each section is independently switchable. An additional facility is an eq bypass switch.

Specifications: band centres 20 to 60Hz (1), 50 to 150Hz (2), 105 to 300Hz (3), 250 to 750Hz (4), 500Hz to 1.6kHz (5), 1.25k to 4kHz (6), 3.15k to 8kHz (7), and 6.3k to 20kHz (8); control range ±16dB; inputs electronically balanced; outputs unbalanced (balanced optional); output level +4dBm nominal; max output level before clipping > +19dBm; frequency range 20Hz to 20kHz; dynamic range > 97dB; THD < 0.08% at +18dBm output.

Peavey Stereo Graphic

The new Peavey Stereo Graphic equaliser is a 2-channel 10-band single-octave graphic equaliser with a control range of ±15dB. Other features include eq bypass switching; level controls; and continuously variable 12dB/octave high and lowpass filters.

Specifications: band centres 30, 60, 120, 250, 500Hz, 1k, 2k, 4k, 8k and 16kHz; control range ±15dBm; Q average 2; highpass filter variable 5k to 30kHz; lowpass filter variable 20 to 500Hz; input impedance > 50kΩ unbalanced phone, > 2.7kΩ unbalanced XLR; max input +15dB; output impedance 470Ω unbalanced, < 200Ω balanced; max output level +20dBm into 600Ω balanced, +16dBm into 600Ω unbalanced; frequency response 20Hz to 30kHz ±1dB; THD < 0.08% 20Hz to 20kHz.

OTARI

Otari Professional Tape Recorders
are available through
the following distributors.

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Berchtesgadenerstrasse 36
A-5020 Salzburg
Phone: 06222/46164
Telex: 63186 LICHTD A

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Trans European Music N.V.
Koeijverstraat 105, 1710 Dilbeek, Belgium
Phone: (02) 569 1823
Telex: 26409 TEMBEL B

DENMARK

Studie- & Lydteknik ASP
Helgesvej 9-11, DK-2000, Copenhagen F
Phone: 01-341284 Telex: 22924 SLT DK

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Telex: 11136 INSONIC S

SWITZERLAND

Audio Bauer AG
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Haus Atlant
Phone: 01-643230 Telex: 54806 GPEL CH

UNITED KINGDOM

Industrial Tape Applications
1-7 Harewood Avenue, Marylebone Road
London NW1 6LE
Phone: 01-724 2497/8

"The performance and technology sold me. The sound of the '90 sold my clients."

Guy Costa, Vice President and Managing Director, Motown/Hitsville Studios

"When we first got our hands on the Otari MTR-90 we were impressed. The tape handling is superb. The production features are all there. The electronics and logic are to the highest standard we've come across in all the years of Motown's recording history.

But, as I've learned over the past nineteen years in this music recording business, it isn't just specs that count. The producers and artists have to like the way it sounds. A mastering multitrack machine has got to have a "musical" sound. Transparent. Clean. Performance that has to deliver everything possible — right up to the limitations of the tape.

I'd say that judging from the reactions of the creative people who record at Motown/Hitsville,



Otari's got a platinum record coming up for their New Workhorse.

And one added thing. We bought two because a lot of the music product is going 48 track. The '90 synchronizes beautifully through the AudioKinetics controller and interface. Now, all we have to do is figure out how we can juggle this year's budget to get four more!

If you use your ears for a living, use your head too. Listen to the Otari MTR-90. I did!"

OTARI

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



product EQUALISERS guide

ACCESSIT (UK)

Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9221. Telex: 25769.
USA: The Mike Shop, PO Box 366, Elmont, NY 11003. Phone: (516) 437-7925.

Parametric Equaliser: single channel, 2-band unit covering 50Hz to 300Hz and 3kHz to 14kHz at ± 12 dB.

AEC (West Germany)

Audio International Vertriebs GmbH, Box 560229, Gonzenheimstrasse 2B, D-6000 Frankfurt 56. Phone: 0611 504733. Telex: 413039.

C-41: 2-channel graphic equaliser with band centre frequencies of 31.5, 63, 125, 250, 500Hz, 1k, 2k, 4k, 8k and 16kHz.

ADC (USA)

Audio Dynamics Corp, Pickett District Road, New Milford, Connecticut 06776. Phone: (203) 355-2671.
UK: BSR Ltd, Powke Lane, Cradley Heath, Warley, West Midlands B64 5QH. Phone: 0384 65191.

SS-2 Mark II: 2-channel 12 band graphic equaliser, ± 12 dB control range.

SS-3: 2-channel 12 band graphic equaliser with three switchable centre frequencies. Bands cover centres between 26Hz and 21kHz in 36 (12 x 3) frequency steps. Control range ± 12 dB.

ALTEC (USA)

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

UK: Theatre Projects Services Ltd, ElectroSound House, 11 Marshalsea Road, London SE1. Phone: 01-407 6781. Telex: 885659.

1650: single channel graphic equaliser with 28 $\frac{1}{2}$ -octave band centre frequencies on ISO centres. 31.5Hz to 16kHz with 15dB attenuation.

APSI (USA)

Audio Processing Systems Inc, 40 Lansdown Street, Cambridge, Mass 02139. Phone: (617) 354-1144.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

Model 5590: single-channel eq module with nine $\frac{1}{3}$ -decade band centre frequencies 35, 75, 160, 350, 750Hz, 1.6k, 3.5k, 7.5k and 16kHz. Control range is ± 15 , ± 12 , ± 9 , ± 6 , ± 4 , ± 2 and 0dB switched.

Model 5620: 4-band parametric eq module.

ARAGORN (UK)

Aragorn Dynamics Ltd, 8 South Side, Clapham Common, London SW4 7AA. Phone: 01-622 4825.

S201S: 2-channel graphic equaliser with 10 single octave bands, four stereo units will fit into a 19in rack width.

ASHLY (USA)

Ashly Audio Inc, 100 Fernwood Avenue, Rochester, NY 14621. Phone: (716) 544-5191.
UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

SC63: single-channel parametric equaliser with three bands 16 to 800Hz, 160Hz to 8kHz and 480Hz to 24kHz and variable bandwidth from $3\frac{1}{2}$ to 1/2-octave. Control range is ± 15 dB.

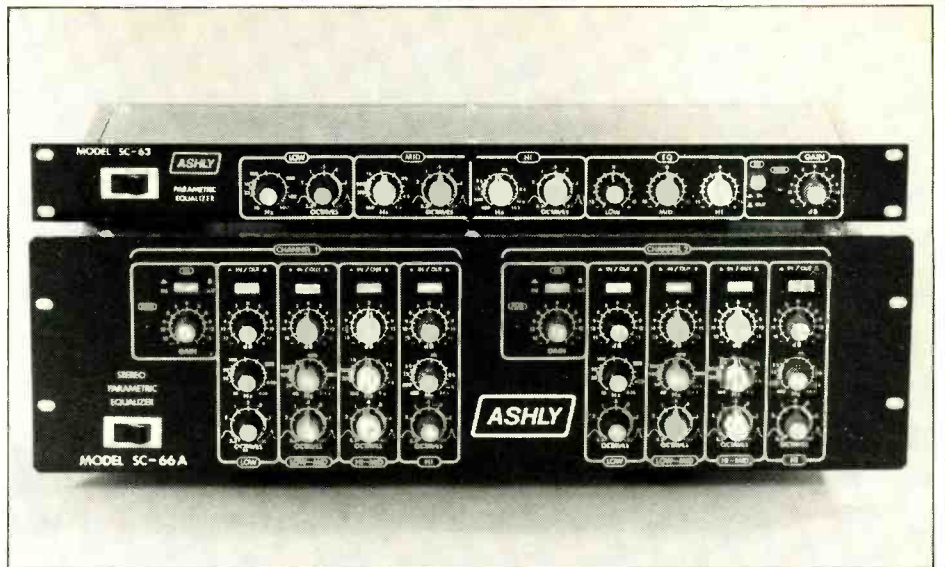
SC66A: similar to SC63 but has two channels and additional band of 48Hz to 2.4kHz.

SC-68: parametric notch filter (cut only eq) with eight individual filters offering up to -30dB attenuation. Frequencies 16 to 800Hz, 48Hz to 2.4kHz (3-bands); 160Hz to 8kHz (3 bands); and 480Hz to 24kHz. Bandwidth 1 to .01 octave.

AUDIOARTS (USA)

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

4200A: stereo parametric equaliser with four switchable bands covering 22 to 300Hz or 220Hz to



Ashly SC-63 and SC-66A

3kHz, 100Hz to 1kHz or 1kHz to 10kHz, 180Hz to 2.1kHz or 1.8 to 21kHz, control range of ± 32 dB.
4100: similar to 4200A but mono with instrument preamp.

AUDIO & DESIGN (UK)

Audio & Design (Recording) Ltd, North Street, Reading, Berks RG1 4DA. Phone: 0734 53411. Telex: 848722.

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

SO3: single-channel parametric equaliser module from *Scamp* range with three continuously variable bands covering 20Hz to 1kHz, 75Hz to 7.5kHz and 400Hz to 20kHz and control range of ± 20 dB. Q values are fixed.

SO4: single-channel parametric/shelving equaliser module from *Scamp* range with bands and control range as SO3. Continuously variable Q between 0.2 and five octaves. Mid band has symmetrical relationship between peak and dip curves whilst high and low sections have asymmetrical relationship. High and low sections can be switched to provide high and lowpass variable characteristic shelving filters with 30dB shelving.

SO7: single-channel system or room equaliser module from *Scamp* range with band frequencies over 10 octaves 31.25Hz to 16kHz and ± 12 dB continuously variable control range.

E900RS: stereo parametric equaliser with four continuously variable bands 40Hz to 1.4kHz, 80Hz to 1.6kHz, 400Hz to 14kHz and 800Hz to 16kHz and control range of ± 20 dB. Q values are fixed.

E500/560: 2-channel 'dynamic' equaliser, offering zero phase shift eq above or below a specified threshold by the use of compression or expansion. At normal levels the system is flat. High and lowpass sweep filters, 100Hz to 10kHz at 24dB/octave; parametric notch filter, variable Q, of 0.3 to 10, range 20Hz to 20kHz.

E950: single (ganged 12-band) or 2-channel (6-band) 'Paragrophic' equaliser with six bands/channels 31.25 to 500Hz, 62.5Hz to 1kHz, 125Hz to 2kHz, 250Hz to 4kHz, 500Hz to 8kHz and 1 to 16kHz and continuously variable control range of ± 28 dB. Variable Q on each band between 0.6 and 8.

AUDIO DEVELOPMENTS (UK)

Audio Developments, Hall Lane, Walsall Wood, West Midlands WS9 9AU. Phone: 05433 5351. Telex: 338212.

AD070 Prographic: programmable graphic equaliser with 15 $\frac{1}{2}$ -octave bands and 16 stores. Provides ± 14 dB range.

AUDIX (UK)

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

Model 902: single-channel graphic equaliser with band centre frequencies of 45, 80, 140, 250, 450, 800Hz, 1.4k, 2.5k, 4.5k, 8k and 14kHz and ± 12 dB continuously variable control range.

Model 908: single-channel graphic equaliser with 27 $\frac{1}{3}$ -octave band centre frequencies on ISO centres, 45Hz to 16kHz. Continuously variable control range of ± 12 dB.

B & B (USA)

Apex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046. Phone: (213) 655-1411. Telex: 910-321 5762.

UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Phone: 01-749 2042. Telex: 28938.

EQF-2: single-channel parametric equaliser/filter module with band frequency ranges of highpass 20Hz to 500Hz, lowpass 1Hz to 20kHz, lf eq 25Hz to 500Hz, mf eq 250Hz to 5kHz, hf eq 1Hz to 20kHz and ± 12 dB control range continuously variable. Features tunable peak/shelf eq, constant Q $1\frac{1}{2}$ -octave, unit fits the Apex auxiliary rack.

BANDRIDGE (UK)

Bandridge Ltd, 1 York Road, London SW19. Phone: 01-543 3633.

FE5: 2-channel 5 band graphic equaliser with centre frequencies of 60, 240Hz, 1k, 3.5k and 10kHz. Control range ± 12 dB.

BARTH (West Germany)

R. Barth KG, Grillparzerstrasse 6a, D-2000, Hamburg 76. Phone: 040 229 8883. Telex: 0212095.

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

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

W308: single-channel parametric equaliser with band frequencies of 620Hz to 16kHz, 290Hz to 7.3kHz and 40Hz to 1kHz all with switchable setting, Q switchable to 18 to 12dB/octave. Control range is ± 22 dB.

BIAMP (USA)

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

EQ/110R: 10-band single-channel graphic equaliser with centre frequencies of 32, 64, 125, 250, 500Hz, 1k, 2k, 4k, 8k, and 16kHz and control range of ± 15 dB.

EQ/210: Stereo version of EQ/110R but with separate controls for each channel.

EQ/270A: 27-band single-channel graphic equaliser $\frac{1}{3}$ -octave/band with centre frequencies from 40Hz to 16kHz inclusive at standard ISO frequencies. Control range is ± 12 dB.

CANARY (UK)

Canary Mixing Desks Ltd, 17 West Hill, Wandsworth, London SW18 1RP. Phone: 01-870 7722.

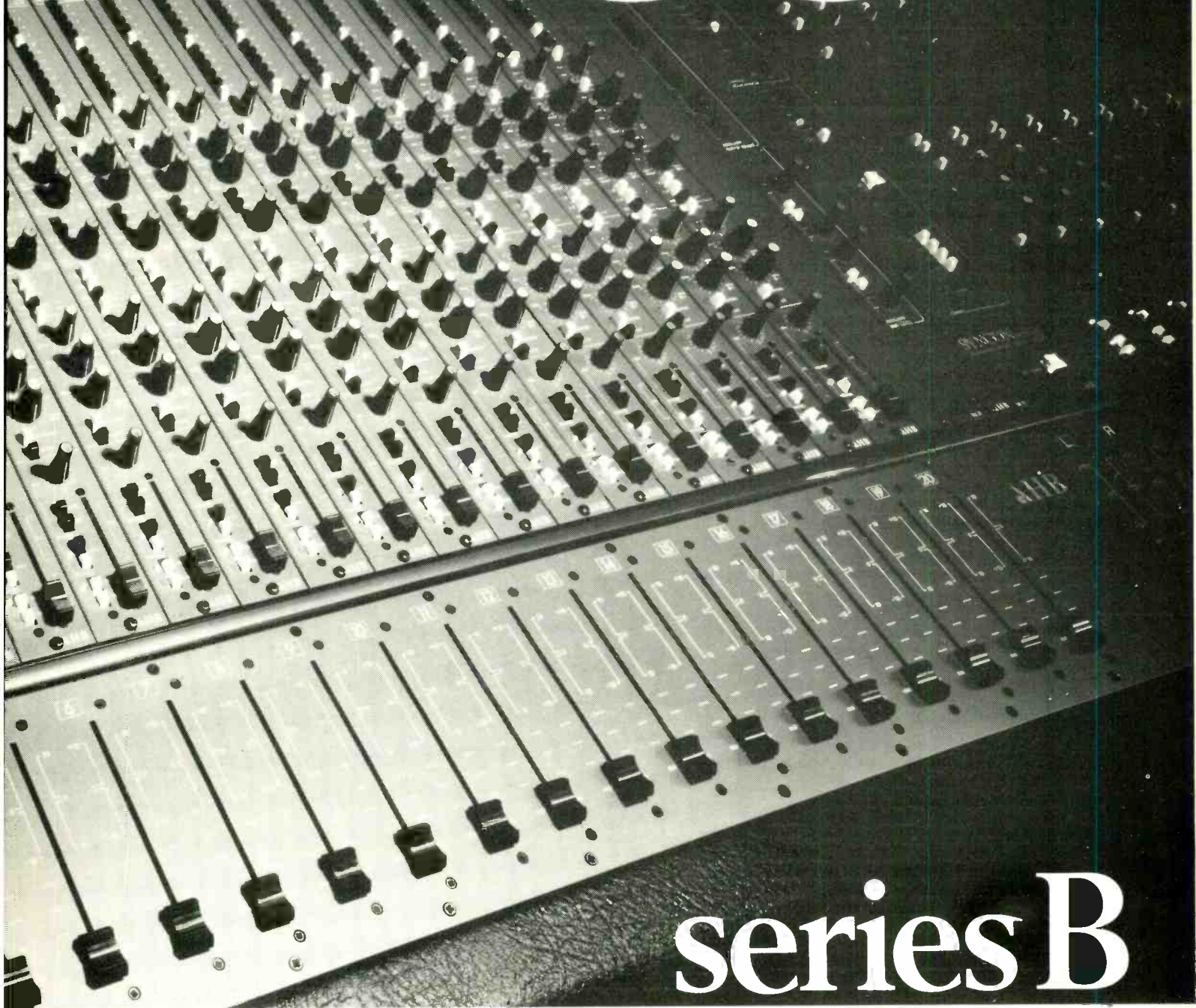
USA: GBA Inc, PO Box C1004, Wykagyl Station, New Rochelle, NY 10804. Phone: (914) 636-8006.

CARLSBRO (UK)

Carlsbro Sales Ltd, Cross Drive, Low Moor Road Ind Est, Kirkby-in-Ashfield, Notts NG17 7LD. Phone: 0623 753902.

D10: 2-channel 10 band graphic equaliser with single octave centres. Control range ± 15 dB. 42 ▶

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www.americanradiohistory.com

product EQUALISERS guide



dbx Model 905

CATHEDRAL (UK)

Cathedral Sounds Ltd, Fourways, Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Phone: 0704 840328.

SGE20: 2-channel graphic equaliser with band centre frequencies from 30Hz to 16kHz over 10 octaves and continuously variable range of ± 12 dB.

CERWIN-VEGA (USA)

Cerwin-Vega Inc, 12250 Montague Street, Arleta, Cal 91331. Phone: (213) 896-0777. Telex: 910-496 1589.
UK: Cambridge Audio Ltd, 111 Chertsey Road, Byfleet, Surrey KT14 7LA. Phone: 09323 41131. Telex: 262525.

GE-2: 2-channel graphic equaliser with 13 bands $\frac{1}{2}$ -octave below middle C to 1-octave above, 31.5Hz to 16kHz. Control range ± 12 dB continuously variable. The level sliders for each channel are frequency-adjacent rather than separated.

COURT (UK)

Court Acoustics Ltd, 35/39 Britannia Row, London N1 8QH. Phone: 01-359 0956/5275. Telex: 268279.
USA: Quintek Inc, 4721 Laurel Canyon Blvd, Suite 209, North Hollywood, Cal 91607. Phone: (213) 980-5717. Telex: 194781.

GE-60: 2-channel graphic equaliser with 30 $\frac{1}{3}$ -octave bands on ISO centres from 25Hz to 20kHz, ± 20 dB - 10dB control range.

GE-27: single-channel 27 band $\frac{1}{3}$ -octave graphic equaliser with centre frequencies between 40Hz and 16kHz, ± 12 dB boost or cut.

CROWN/AMCRON (USA)

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

Model EQ-2: 2-channel graphic equaliser covering 11 octaves 20Hz to 20kHz with centre frequencies adjustable up to $\pm \frac{1}{2}$ -octave, continuously variable control range ± 15 dB.

dbx (USA)

dbx Inc, 71 Chapel Street, Newton, Mass 02195. Phone: (617) 964-3210. Telex: 922522.
UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

Model 905: 3-band single-channel modular parametric equaliser, variable bandwidth 20 to 500Hz, 200Hz to 5kHz, 800Hz to 20kHz, ± 15 dB control range.

DYNACORD (West Germany)

Dynacord Electronic GmbH, Siemenstrasse 41-43, D-8440 Strubing. Phone: 09421 3103.
UK: Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Phone: 0444 51003.
USA: Dynacord Electronics Inc, PO Box 26038, Philadelphia, Penn 19128. Phone: (215) 482-4992.

EQ 270: single-channel 27 band graphic equaliser at ISO centre frequencies. Control range ± 12 dB. Facilities include bypass, LED display of modulation, plus level control.

EQ 210: 2-channel 10 band graphic equaliser at single octave centres, with similar facilities to the EQ 270.

EQ 1400: 2-channel 10 band graphic equaliser for PA use.

FORMULA SOUND (UK)

Formula Sound Ltd, 3 Waterloo Road, Stockport SK1 3DB. Phone: 061-480 3681.

S19G: 2-channel graphic equaliser with 19 $\frac{1}{2}$ -octave bands 31Hz to 16kHz, ± 12 dB control with equal Q in cut and boost.

S19GA: similar to S19G but with added analyser section comprising 19-band $\frac{1}{2}$ -octave filters with dual LED display.

FURMAN (USA)

Furman Sound Inc, 616 Canal Street, San Rafael, Cal 94901. Phone: (415) 456-6766.
UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

Model PQ-3: 3-band single-channel parametric equaliser, 25 to 500Hz, 150Hz to 2.5kHz, 600Hz to 10kHz continuously variable. Range 20dB boost to infinite attenuation continuously variable, Q adjustment continuously variable.

Model PQ-6: 2-channel version of Model PQ-3.

IEM (USA)

International Electro-Magnetics Inc, Eric Drive and Cornell Avenue, Palatine, Illinois 60067. Phone: (312) 358-4622.

Model 213: single-channel graphic equaliser covering 10 octaves 32Hz to 16kHz with continuously variable control range ± 15 dB.

Model 231: single-channel graphic equaliser with 31 $\frac{1}{3}$ -octaves bands 20Hz to 20kHz, ± 12 dB control range.

IVIE (USA)

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

Model 5303: modular 27-band equaliser with 27 $\frac{1}{3}$ -octave bands on standard ISO centres 40Hz to 16kHz, and ± 10 dB control range. Features audio test point, provision for optional crossover, 4-position highpass filter, gain control.

Model 5306: notch filter with six tunable $\frac{1}{10}$ -octave filters, 0 to 12dB notch depth, 50Hz to 3.2kHz range.

K + H (West Germany)

Klein + Hummel, Zeppelinstrasse 12, D-7302 Ostfildern/Kemnat. Phone: 0711 455026. Telex: 723398.

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

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

UE400: 2-channel parametric equaliser with three continuously variable bands 15Hz to 20kHz and control range ± 12 dB. Features continuously variable Q on each band 5 to 22dB/octave, highpass (60Hz) and lowpass (10kHz) filters with 6dB/octave slopes.

UE200: mono version of UE400.

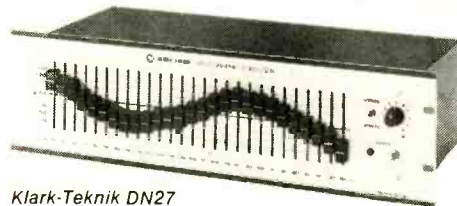
KLARK-TEKNIK (UK)

Klark-Teknik Research Ltd, Walter Nash Road West, Coppice Trading Estate, Kidderminster, Worcs DY11 7HS. Phone: 0562 741515. Telex: 339821.
USA: Klark-Teknik Electronics Inc, 262A Eastern

Parkway, Farmingdale, NY 11735. Phone: (516) 249-3600.

DN15: 2-channel 11 band graphic equaliser/pre-amp with a control range of ± 12 dB.

DN27: single-channel graphic equaliser with 27 $\frac{1}{3}$ -octave bands on ISO centres 40Hz to 16kHz and continuously variable control range of ± 12 dB.



Klark-Teknik DN27

DN27A: improved version of the DN27.

DN22: 2-channel graphic equaliser with band centre frequencies of 50, 90, 160, 200, 500, 900Hz, 1.6k, 3k, 5k, 9k and 16kHz. Control range is ± 12 dB continuously variable. Features two filters with 12dB/octave turnovers at 100Hz and 10kHz.

DN30/30: 2-channel 30 band graphic equaliser with a control range of ± 12 dB.

LEUNIG (West Germany)

Europe: R Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76. Phone: 040 229 8883. Telex: 0212095.

UK: Eela Audio Industries Ltd, 13 Molesworth, Hoddesdon, Herts EN11 9PT. Phone: 09924 68674.
USA: Audicon Inc, 1200 Beechwood Avenue, Nashville, Tenn 37212. Phone: (615) 256-6900. Telex: 554494.

PARAM: computer assisted parametric eq system capable of 128-channel operation with 6-band parametric equaliser. Response curve can be a composite of the six bands each with a range of ± 16 dB. Video display allows design of the curve required which will then be programmed.

LINDSAY (UK)

Lindsay Electronics Ltd, Unit 5, Salome Works, Prospect Place, Trowbridge, Wilts BA14 8QA. Phone: 02214 64282.

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

Model 7607: single-channel graphic equaliser with 27 $\frac{1}{3}$ -octave bands on ISO centres, 40Hz to 16kHz and control range ± 12 dB.

LOFT (USA)

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

Model 401: single-channel parametric equaliser with four overlapping frequency bands covering the range 30Hz to 20kHz. Symmetrical control range ± 18 dB, Q adjustable 0.16 to 3-octaves.

LOG (France)

Log Audio Equipment, 44 sente aux ânes, Le Boulay, F-78950, Gambais. Phone: 16(3) 487.10.97.

EQ4A: single-channel parametric equaliser with four bands covering the range 40Hz to 1kHz, 150Hz to 3.8kHz, 320Hz to 6.8kHz, and 1k to 20kHz. Centre frequencies continuously variable with a control range of ± 15 dB and Q variable between 0.8 and 5 octaves. Forms part of a modular 19in rack frame accepting up to seven units.

EQ4B: 2-channel unit with similar specifications and facilities to the EQ4A.

METEOR (USA)

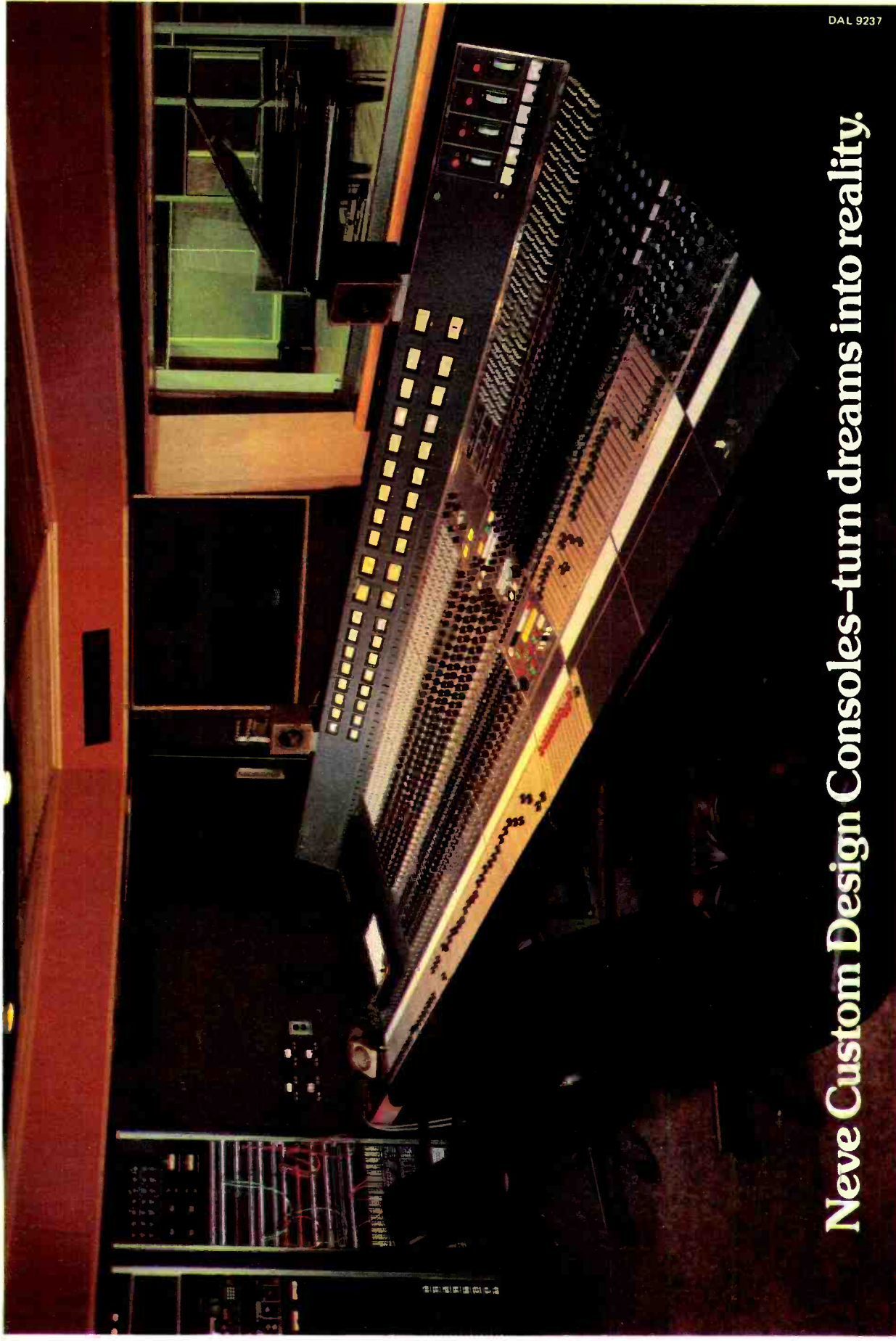
Meteor Light & Sound Co, 155 Michael Drive, Syosset, NY 11791. Phone: (516) 364-1900. Telex: 961396.

UK: C E Hammond & Co Ltd, 105-109 Oyster Lane, Byfleet, Surrey KT14 7LA. Phone: 09323 41131/51051. Telex: 262525.

Graphic Equaliser: 10-band 2-channel graphic equaliser with centre frequencies of 31, 62, 125, 250, 500Hz, 1k, 2k, 4k, 8k, 16kHz and ± 12 dB control range.

M-JAY (UK)

M-Jay Electronics Ltd, 90 Kingsdale Gardens, Drighlington, Bradford BD11 1EZ. Phone: 0532 852075.



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Rupert Neve Incorporated, Berkshire Industrial Park, Bethel, Connecticut 06801. Tel: (203) 744-6230. Telex: 969638
Rupert Neve Incorporated, 7533 Sunset Boulevard, Hollywood, California 90046. Tel: (213) 874-8124. Telex: 194942.
Rupert Neve of Canada Limited, 2721 Rena Road, Malton, Ontario L4T 3K1, Canada. Tel: (416) 677-6611. Telex: 983502.



The sound of Neve is worldwide.

product EQUALISERS guide

GE9-2: 2-channel graphic equaliser covering nine octaves 50Hz to 12.8kHz with continuously variable control range ± 12 dB.

EF2 Electronic filter: 2-channel high and lowpass filter, switchable slope 12dB or 24dB/octave.

MM (UK)

MM Electronics, Kneesworth Street, Royston, Herts SG8 5AQ. Phone: 0763 45214/46511.

EP127: 2-channel graphic equaliser from *EP Series*. Band centre frequencies at 60, 150, 400Hz, 1k, 2.5k, 6k and 15kHz and continuously variable ± 12 dB control range.

MOOG (USA)

Moog Music Inc, 2500 Walden Avenue, Buffalo, NY 14225.

UK: Norlin, 114 Charing Cross Road, London WC1. Phone: 01-379 6400.

USA: Norlin Co, 7373 North Cicero Avenue, Lincoln Wood, Illinois 60646. Phone: (312) 675-2000.

Graphic Equaliser: single-channel graphic equaliser with nine octave bands from 31Hz to 8kHz and shelf type filter at 16kHz. Control range ± 15 dB.

Parametric Equaliser: 3-band single-channel parametric equaliser 31Hz to 4kHz, 62Hz to 8kHz, 125Hz to 16kHz, range adjustable from four octaves to $\frac{1}{4}$ -octave. Control range ± 12 dB to ± 20 dB.

MXR (USA)

MXR Innovations Inc, 740 Driving Park Avenue, Rochester, NY 14613. Phone: (716) 254-2910. Telex: 978451.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

Dual 15-band Equaliser: 2-channel graphic equaliser with 15 $\frac{2}{3}$ -octave bands from 25Hz to 16kHz on ISO alternative $\frac{1}{3}$ -octave centres and control range of ± 12 dB.

31-band Equaliser: single-channel graphic equaliser with 31 $\frac{1}{3}$ -octave bands on ISO centres from 20Hz to 20kHz, control range ± 12 dB.

NEPTUNE (USA)

Neptune Electronics Inc, 934 NE 25th Avenue, Portland, Oregon 97232. Phone: (503) 232-4445.

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

Model 910: single channel graphic equaliser with nine single octave bands and control range of ± 12 dB.

Model 1020: 2-channel 10 band single octave graphic equaliser, ± 12 dB control range.

Model 1021: updated version of the *Model 1020*.

Model 2710: 12-band single-channel graphic equaliser with $\frac{1}{3}$ -octave centre frequencies from 40Hz to 16kHz and ± 12 dB control range.

Model 2711: $\frac{1}{3}$ -octave graphic equaliser at standard ISO centre frequencies, range ± 12 dB.

Model 342: 2-channel parametric equaliser with 4 bands/channel 16 to 800Hz, 48Hz to 2.4kHz, 160Hz to 8kHz and 480Hz to 24kHz. Control range ± 15 dB and bandwidth 0.1 to 3.5 octaves.

NTP (Denmark)

NTP (Elektronik A/S, 44 Theklavej, DK-2400 Copenhagen NV. Phone: 01 10.12.22. Telex: 16378.

Type 182-100: 3-band modular equaliser: high 10kHz; mid 700Hz, 1k, 1.4k, 2.8k, 4k and 5.6kHz; low 60Hz. High and low control range ± 12 dB in 3dB steps, mid range ± 10 dB in 2dB steps.

Type 182-200: modular high and lowpass filter with high cut at 1k, 1.4k, 2k, 2.8k, 4k, 5.6k, 8k, 11.2k and 16kHz; low cut at 40, 60, 80, 113, 160, 226, 320, 452 and 640Hz; 18dB/octave slope.

Type 582-100: programmable graphic equaliser with 14 $\frac{1}{3}$ -octave bands all switchable to shelving curves, ± 14 dB control in 2dB steps. Associated microcomputer controls all functions, up to 64 channel operation, eq may be copied across channels. One unit is capable of storing up to 16 console settings but floppy disk storage can enlarge this to 200.

ORANGE COUNTY (Canada)

Orange County Electronics Corp, 534 Berry Street, Winnipeg, Manitoba R3H045. Phone: (204) 774-3413.

USA: Parasound Inc, 680 Beach Street, San Francisco, Cal 94109. Phone: (415) 673-4544.

DEQ: single-channel parametric equaliser module, externally powered, with four bands 20 to 640Hz, 64Hz to 20kHz, 200Hz to 6.4kHz, 640Hz to 20kHz all adjustable 0.15 to three octaves, constant Q 10 to 0.33. Control range 20dB gain, 60dB notch/band.

PEQ: single-channel parametric equaliser similar to DEQ but ± 20 dB gain range.

SEQ: single-channel parametric equaliser, externally powered, with four bands 35Hz to 1.4kHz (Q=3), 80Hz to 1.8kHz (Q=1.5), 350Hz to 14kHz (Q=1.5), 800Hz to 18kHz (Q=3). Control range ± 20 dB.

ORBAN (USA)

Orban Associates Inc, 645 Bryant Street, San Francisco, Cal 94107. Phone: (415) 957-1063. Telex: 171480.

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

Model 622B: 2-channel parametric equaliser with four bands continuously variable, 20Hz to 500Hz, 68Hz to 1.7kHz, 240Hz to 5.85kHz and 800Hz to 20kHz. Control range ± 16 dB to infinite attenuation. Q variable between 0.29 and 3.2.

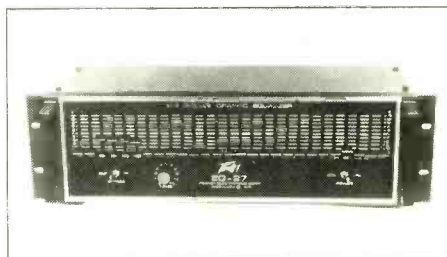
672A Paragraphic: 8-band parametric equaliser with 3:1 tuning range, 20 to 60Hz, 40 to 150Hz, 110 to 310Hz, 230 to 750Hz, 480Hz to 1.9kHz, 1.1k to 4.5kHz, 2.8k to 9kHz, 5.9k to 21kHz, additional 12dB/octave high and lowpass filters over 100:1 frequency range, ± 16 dB control range.

Model 674A: stereo version of 672A.

PEAVEY (USA)

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

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



Peavey EQ-27

EQ-27: 27-band, single-channel graphic equaliser, ± 12 dB control range.

Stereo Graphic: 2-channel graphic equaliser with band centre frequencies at 30, 60, 120, 250, 500Hz, 1k, 2k, 4k, 8k and 16kHz; Q average 2; ± 15 dB control range.

PRO AUDIO (UK)

Pro Audio Ltd, 30 Wolsey Drive, Walton-on-Thames, Surrey KT12 3AZ. Phone: 09322 21078.

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

PA20: 2-channel graphic equaliser with 10 1-octave bands with centre frequencies at 50, 100, 200, 320, 500, 800Hz, 1.5k, 3k, 6k and 12kHz. Continuously variable control range of ± 12 dB.

PA27: single-channel graphic equaliser with 27 $\frac{1}{3}$ -octave bands 40Hz to 16kHz and continuously variable control range of 12dB.

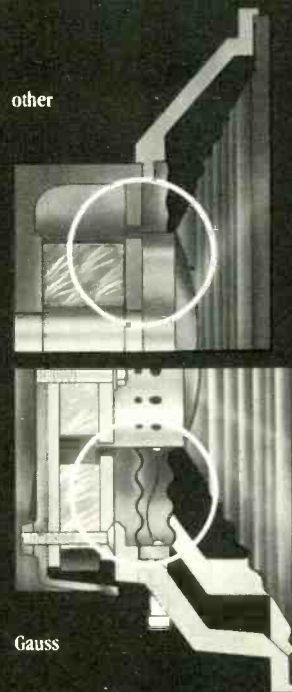
PULTEC (USA)

Pulse Techniques Inc, 1411 Palisade Avenue, Teaneck, New Jersey 07666. Phone: (201) 837-2575.

EQP-1A3: single-channel equaliser with variable band frequencies, control range and Q.

MEQ-5: 3-band single-channel equaliser, 'band 1' covers 200, 300, 500, 700Hz, 1kHz; 'band 2' 1.5k, 2k, 3k, 4k, 5kHz; 'band 3' covers both ranges. Control range up to 10dB boost on 'band 1', 8dB on 'band 2', up to 10dB attenuation on 'band 3'.

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Single spider loudspeakers are what those other manufacturers make. Gauss makes only double spiders.

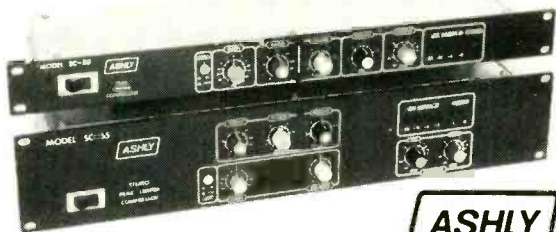
We direct wind voice coil wire onto a center former to prevent separation from the tube. Then we attach the tube to the frame with two spiders and route the voice coil leads from the terminal to the tube between the two spiders. This provides continual "active centering" of the voice coil and prevents "hang up" and lead break off. Even when driven out of the voice coil gap by some sonic accident, the double spider assembly maintains voice coil alignment. This process costs more but provides greater cost effectiveness.

With two spiders, you can drive a Gauss to its limit—with your sound, at any level, all night long—and still be in the music business.

gauss

Your reputation's worth it.

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Sun Valley, CA 91352



ASHLY

From the Ashly range of rack-mounting studio effects units, the SC-50 (mono) and SC-55 (stereo) Peak Limiter/Compressors give you positive control of all limiting characteristics. The extra low noise and distortion spec is compatible with your best mixing console. The Ashly SC series units are designed and constructed for efficiency and reliability.



FURMAN SOUND

The neat RV-1 triple-spring reverb gives you the advantage of natural reverb with a built-in peak limiter to eliminate overdrive noises, with midrange and treble equalisation controls. Wet and dry output controls, noiseless footswitch output, and its own power supply makes the RV-1 just as much at home on the stage as in the studio.

Session

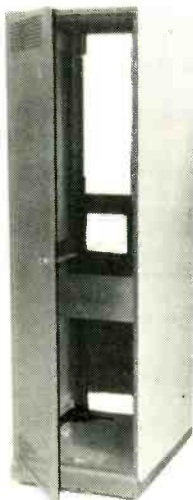


The popular Session D.I. boxes for guitar or keyboard are constructed to professional standards and housed in a strong die-cast case. The guitar splitter includes a filter switch and a choice of inputs from the instrument or your own amplifier.

The Rack

We are offering a few slight seconds of these steel, lockable, 19" rack cabinets at only **£90 + VAT**

Hurry — not many left!



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Telephone: 0462 31511
Telex: 826967

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**C414
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AKG C414 series microphones are the ultimate in condenser microphone design, for use in the widest range of recording & broadcast studio applications, where optimum efficiency and performance are the primary requirements.

C414EB (Illustrated) Four polar patterns selectable, extreme sensitivity, wide frequency range and smooth response, virtually distortion free. For phantom powering from 9–52V. Probably specified more often than any other studio condenser worldwide.

C414EB P48 Developed from the 414EB with improved electronics to give a greater dynamic range. For use only with 48V phantom powering.

C414EI Based on the specification of the 414EB but features remote control facilities for the polar patterns.

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18 9 81

product EQUALISERS guide



Spectra Sound Model 1000B

2800: 4-band version of above covering 10 to 320Hz, 40Hz to 1.2kHz, 240Hz to 1.6kHz, and 1.2 to 20kHz.

SHURE (USA)

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

SR107-2E: single channel, 10-octave equaliser 32Hz to 16kHz, can be used with M615AS eq analyser system.

SOLIDYNE (Argentina)

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

9180: modular single-channel parametric equaliser comprising: 9181 single-band graphic; 9182 2-band graphic (ISO full octave frequencies); 9182 2-band graphic (ISO full octave frequencies); 9182M 2-band graphic (1/2-octave ISO frequencies); 9183 3-band parametric, single band variable from 32Hz to 16kHz, bandwidth variable between 2- and 1/6 octave; 9186 cut-off filter 6 and 12dB/octave, continuously variable 32Hz to 1.6kHz and 320Hz to 16kHz.

SONTEC (USA)

Sontec Electronics, 10120 Marble Court, Cockeysville, Maryland 21030. Phone: (301) 628-2283.

MEP-250A: 2-channel 5 band parametric equaliser with three parametric sections in overlapping ranges covering 8Hz to 25kHz with ± 12 dB control range. Q variable from 4 to 14dB/octave.

MES-430B: 4-channel parametric disc mastering equaliser with preview and programme channels. Three band shelving parametric equalisation with overlapping ranges.

SOUNDCRAFTSMEN (USA)

Soundcraftsmen, 2200 S Ritchey, Santa Ana, Cal 92705. Phone: (714) 556-6191.

UK: REW Professional Audio, 114 Charing Cross Road, London WC2. Phone: 01-836 7851. Telex: 8814193.

AE2420-R: 10-band analyser/equaliser, 30, 60, 120, 240, 480, 960Hz, 1.92k, 3.84k, 7.68k, 15.36kHz. Control range +22dB, -28dB, all controls at maximum. Features mic preamp, pink noise source, band select switch, LED indicating comparator.

RF2215-R: 2-channel graphic equaliser, 10 bands 30Hz to 15.36kHz as AE2420-R, control range ± 22 dB (max) ± 15 dB (zero).

TG3044-R: 2-channel graphic equaliser, 21 bands, ISO 1/3 octave below 1kHz, alternate 1/3 above. Control range ± 22 dB (max), ± 15 dB (zero).

SOUND WORKSHOP (USA)

Sound Workshop Inc, 1324 Motor Parkway, Hauppauge, NY 11787. Phone: (516) 582-6210. Telex: 649230.

UK: Trad Electronic Sales Ltd, 149b St Albans Road, Watford, Herts WD2 5BB. Phone: 0923 47988. Telex: 262741.

Parametric Equaliser: modular, single-channel parametric eq with three bands 30 to 600Hz, 300Hz to 6kHz, 900Hz to 18kHz and 4-position Q switches. Control range ± 14 dB and features 18dB/octave highpass filter and rack-mount adapter to hold 8-channels.

SPECTRA SONICS (USA)

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

Model 500: single-channel 'mic/program' equaliser with two switched bands, lf 50, 100, 200 or 300Hz and hf 2.5k, 5k, 10k or 15kHz, control range ± 12 dB in 2dB steps. Features a passive network utilised as an active feedback element in conjunction with Model 701 and 701 amps.

Model 501: single-channel 'mic/program' equaliser with two bands 100Hz and 7kHz. Control range continuously variable lf ± 10 dB and ± 8 dB. Features as Model 500.

Model 502: single-channel 'mic/program' equaliser with three switched bands lf 50, 100, 200, 300, 400Hz, mf 500, 800Hz, 1.2k, 1.6k, 2kHz, hf 2.5k, 3.5k, 5k, 7.5k, 10kHz. Control range ± 12 dB in 2dB steps. Features as Model 500, also shelving curves at 50Hz and 10kHz in selectable increments.

Spectra Sound 1000B: 2-channel graphic equaliser with 10 bands between 31Hz and 16kHz. Control range ± 8 or 16dB.

STATIK ACOUSTICS (UK)

Statik Acoustics, Walter Nash Road West, Coppice Trading Estate, Kidderminster, Worcs DY11 7HS. Phone: 0652 741515. Telex: 339821.

USA: Klark-Teknik Electronics Inc, 262A Eastern Parkway, Farmingdale, NY 11735. Phone: (516) 249-3600.

SA10: 2-channel octave equaliser with band centres at 31, 62, 125, 250, 500Hz, 1k, 2k, 4k, 8k, 16kHz. Filter bandwidth 1-octave at -3dB points with 7dB boost or cut.

SYNTON (Netherlands)

Synton Electronics BV, Zandpad 46, Postbus 83, NL-3620 Breukelen. Phone: 034 62.34.99.

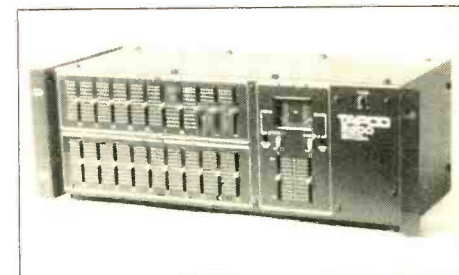
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-5804314. Telex: 28668.

299: single-channel parametric equaliser with four bands each sweepable over a 4-octave range, bandwidth variable from 2-octave to 1/4-octave. Control range ± 16 dB.

TAPCO (USA)

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

UK: Electro-Voice (Gulton Europe) Ltd, Maple Works, Old Shoreham Road, Hove, Sussex BN3 7EY. Phone: 0273 23329/778401. Telex: 87680.



Tapco 2200

C-201: stereo graphic equaliser with 10 bands at ISO octave centres and control range of ± 12 dB.

2200: stereo graphic equaliser as C-201.

2202: as 2200 with jack inputs.

TEAC (Japan)

USA: Teac Corp of America, 7733 Telegraph Road, Montebello, Cal 90640. Phone: (213) 726-0303. Telex: 677014.

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

GE-20: 2-channel graphic equaliser with 10 bands centred at 31.5, 63, 125, 250, 500Hz, 1k, 2k, 4k, 8k, 16kHz and lowpass 16kHz and highpass 31.5kHz filters. Control range ± 12 dB.

PE-20: 4-channel parametric eq unit for the company's System 20. Three bands 60Hz to 1.5kHz, 1.5k to 8kHz, and 10kHz with ± 12 dB control range.

TECNICOBEL (France)

Tecnicobel, 8 rue de la Croix-Matre, BP26, F-91122 Palaiseau Cedex. Phone: (1) 920.80.39. Telex: 692543.

CF 50: single-channel modular parametric equaliser with four continuously adjustable bands with variable slope 80 to 300Hz, 100Hz to 4kHz, 500Hz to 11kHz. 8.5k to 15kHz. Control range ± 15 dB.

CFD 60: 2-channel rack-mountable parametric equaliser with four continuously adjustable bands with variable slope 30 to 370Hz, 100Hz to 3.6kHz, 430Hz to 9.6kHz, 5.4 to 16kHz. Control range ± 15 dB.

360 SYSTEMS (USA)

360 Systems, 18730 Oxnard Street, No 215, Tarzana, Cal 91356. Phone: (213) 342-3127. 48

HLF-3C: high and lowpass programme filters with high cut-off frequencies between 1.5k and 15kHz and low cut-off 50Hz to 2kHz. Simpler versions available HLF-26, LC-6, HC-6.

HLF-23C: stereo version of HLF-3C.

QUAD-EIGHT (USA)

Quad-Eight Electronics, 11929 Vose Street, North Hollywood, Cal 91605. Phone: (213) 764-1516. Telex: 662446.

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

EQ-333: 3-band, single-channel parametric equaliser, choice of 11 frequencies on each band 50 to 500Hz, 300 to 3kHz, 1.5 to 15kHz with high and low bands switch selectable between peaking and shelving. Control range ± 12 dB in 2dB steps.

EQ-444: 4-band single-channel parametric equaliser, choice of 11 frequencies on each band 50 to 500Hz, 180Hz to 1.8kHz, 500Hz to 5kHz, 1.8 to 18kHz, high and low bands are switch selectable between narrow, wide and shelving, mid bands between narrow and wide. Control range ± 12 dB in 2dB steps.

REBIS (UK)

Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 6A. Phone: 0384 71865.

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

USA: Klark-Teknik Electronics Inc, 262A Eastern Parkway, Farmingdale, NY 11735. Phone: (516) 249-3600.

RA402: 2-channel parametric equaliser with four continuously variable bands 20 to 450Hz, 70Hz to 1.6kHz, 250Hz to 5.6kHz, 800Hz to 18kHz, and continuously variable control range ± 21 dB, Q for each section variable between 0.89 and 12 (5.5 to 36dB/octave).

RA204: modular parametric equaliser, externally powered, with one switchable band 20Hz to 2kHz, 200Hz to 20kHz (Q = 0.89 to 13), ± 21 dB control range. Up to 20dB of gain available, overload LED. Fits Rebis RA200 rack.

ROLAND (Japan)

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

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

SEQ-315: 2-channel 15 band 2/3-octave graphic equaliser with ± 12 dB control range.

SEQ-331: single-channel 31-band 1/3-octave graphic equaliser at standard ISO centre frequencies. Control range ± 12 dB.

SAE (USA)

Scientific Audio Electronics Inc, 701 East Macy Street, Los Angeles, Cal 90012. Phone: (213) 489-7600.

UK: C E Hammond & Co Ltd, 105-109 Oyster Lane, Byfleet, Surrey KT14 7LA. Phone: 09323 41131/51051. Telex: 262525.



SAE 2800

1800: 2-channel parametric equaliser with two bands 40Hz to 1.2kHz and 1.2 to 20kHz continuously variable, and ± 16 dB continuously variable control range. On both bands Q is continuously variable between 0.3 and 3.6 octaves.

In the hands of a professional, an equalizer can work wonders. For the person who owns a UREI equalizer, miracles are often made.

The UREI Equalizers

In the studio, in sound reinforcement systems, in broadcast radio and television production, a good engineer relies upon his talent and expertise. And, the UREI reputation for unparalleled professional performance and quality.

Whether to correct or create, UREI offers a complete line of the most effective audio frequency shaping instruments available:

The Model 535 Dual Graphic Equalizer

Two channels of ten calibrated, step less, vertical adjustment controls with ± 12 dB boost or attenuation. Also available in a single channel version-Model 533

The Model 537 One-Third Octave Graphic Equalizer

A single channel device, it provides ± 12 dB of boost or cut in 27 ISO 1/3 octave increments from 40Hz to 16kHz.

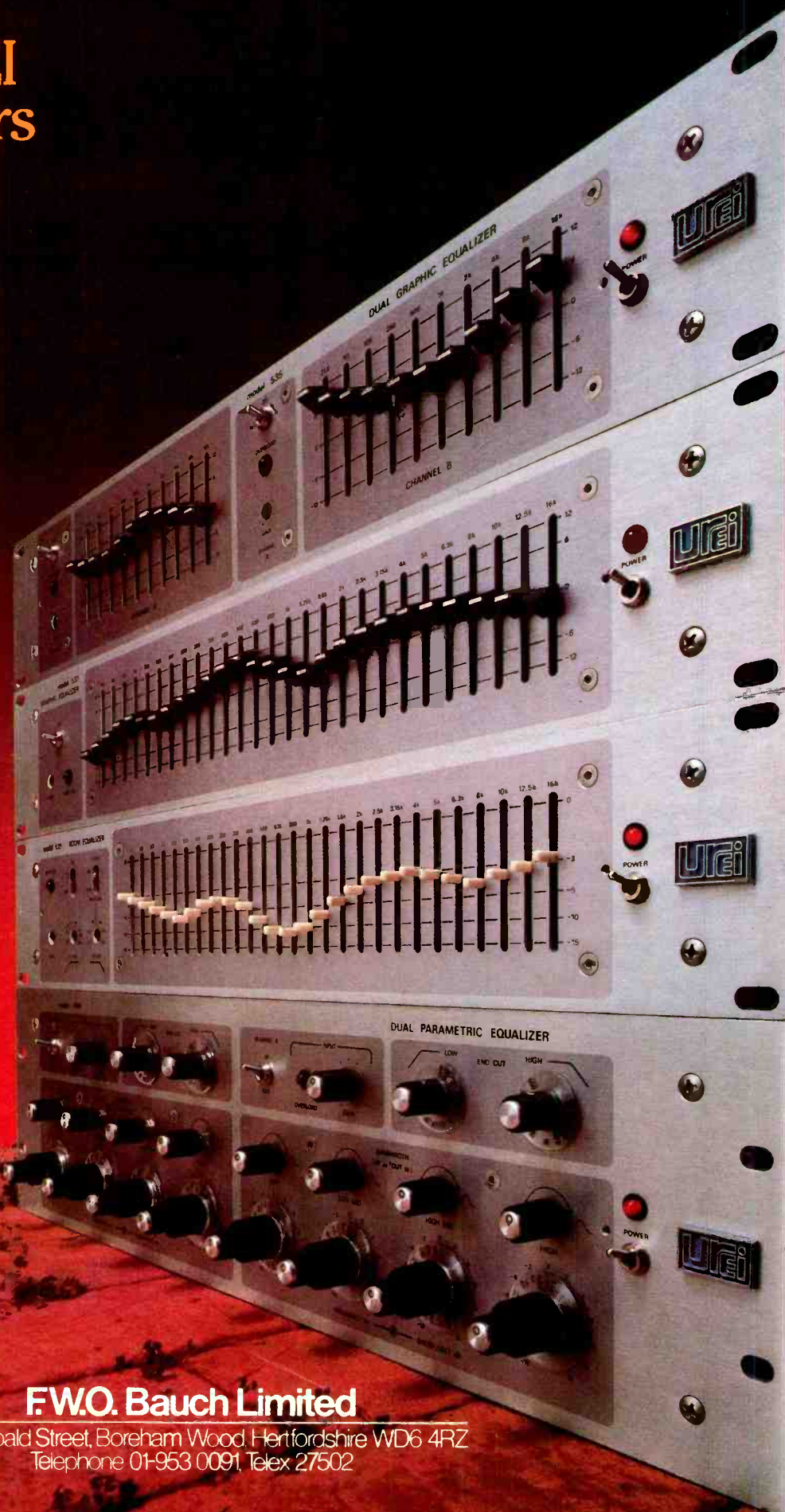
The Model 539 Room Equalization Filter Set

Specifically designed for room equalization, it offers 27 ISO 1/3 octave calibrated adjustments from 0 to -15 dB attenuation plus band-end tunable high and low-pass filters.

The Model 546 Dual Parametric Equalizer

Two independent channels. Each has four sections of continuously variable bandwidth, frequency, boost or cut; bypass for each filter section and channel; tunable end-cut filters; and 30dB gain. Also available in a single channel version-Model 545.

From One Pro To Another-trust all your toughest signal processing needs to UREI.



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Worldwide: Gotham Expert Corporation, New York

See your professional audio products dealer for full technical information.

product EQUALISERS guide

UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V5RA. Phone: 01-734 2812. Telex: 27939.

Model 2800: programmable parametric equaliser with four bands 20 to 500Hz, 68Hz to 1.7kHz, 240Hz to 5kHz, 800Hz to 20kHz, each bandwidth is variable from 1/6 to 5 octaves. Control range $\pm 12\text{dB}$ to $-\infty$. Incorporates Z-80 microcomputer system with CMOS memory for storage of 28 complete settings. A 2-channel version is also available.

TRESHAM AUDIO (UK)

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

SR271: single-channel graphic equaliser with 27 bands 1/3-octave, centres from 40Hz to 16kHz, continuously variable control range $\pm 12\text{dB}$.

SR112: 2-channel graphic equaliser, 11 bands with centres at 50, 90, 160, 300, 500Hz, 1.6k, 3k, 5k, 9k, 16kHz, and control range $\pm 12\text{dB}$.

TRIDENT (UK)

Trident Audio Developments Ltd, PO Box 38, Studios Road, Shepperton, Middx TW17 0QD. Phone: 09328 60241. Telex: 88139832.

USA: Trident (USA) Inc, 652 Greenbrook Road, Stamford, Connecticut 06906. Phone: (203) 357-8337.

CB 9066: single-channel parametric equaliser with three continuously variable bands 60 to 700Hz, 600Hz to 7kHz, 3.5 to 14kHz and control range $\pm 16\text{dB}$. Features variable Q 2dB to 18dB/octave for each range, continuously variable filters highpass 100 to 400Hz lowpass 4 to 15kHz both with 0 to 22dB/octave slopes.

UREI (USA)

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

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

Model 501: 2-channel highpass filter, 'flat' position -3dB at 30Hz and $> -50\text{dB}$ at 5Hz, 'boost' position adds 5dB peak at 40Hz, -3dB at 27Hz and 140dB at 5Hz, 18dB/octave slope.

Model 535: 2-channel graphic equaliser with 10 bands on ISO octave centres from 31.5Hz to 16kHz. Range $\pm 12\text{dB}$, overall gain -10dB to $+20\text{dB}$.

Model 533: single-channel version of Model 535.

Model 537: single-channel graphic equaliser, 27 1/3-octave bands on ISO centres from 40Hz to 16kHz. Control range $\pm 12\text{dB}$.

Model 539A: single-channel room eq filter set, 27 1/3-octave bands on ISO centres from 40Hz to 16kHz, screwdriver-adjustable highpass 20 to 250Hz, lowpass 3.5 to 20kHz (6 or 12dB slope). Control range 0 to -15dB .

Model 545: single-channel parametric equaliser, four bands 24 to 310Hz, 190Hz to 2.24kHz, 960Hz to 12.5kHz, multi-band 15Hz to 20Hz/150Hz to 2kHz/1.5 to 20kHz, bandwidth adjustable 1/4 to 2 octaves, low cut 16 to 800Hz, high cut 500Hz to 25kHz. Control range $\pm 15\text{dB}$.

Model 546: 2-channel parametric equaliser as Model 545. For mono operation all eight parametric filters may be cascaded.

Model 555: single-channel high and lowpass filters. Highpass filters adjustable 20 to 200Hz with lowpass filters 2 to 20kHz. 18dB/octave slope.

Model 556: 2-channel version of Model 555.

Model 565T: filter set with four separate cascaded continuously tunable filters. Low cut 20 to 200Hz, high cut 2 to 20kHz (18dB/octave). Two notch (or bandpass) filters 20Hz to 20kHz, 50dB minimum rejection in notch mode, width switchable 5%, 10%, 50%.

WESTREX (USA)

Westrex Co, 2629 West Olive Avenue, Burbank, Cal 91505. Phone: (213) 846-3394. Telex: 698254.

UK: Westrex Co Ltd, Bilton Fairway Estate, Long Drive, Greenford, Middx. Phone: 01-578 0957. Telex: 923003.

ST3015: single-channel equaliser with centre frequencies at 50, 75, 110, 160, 240, 360, 540, 760Hz, 1.2k, 1.7k, 2.5k, 3.8k, 5.5k, 8k, 12kHz, control range $\pm 14\text{dB}$ continuously variable.

WHITE (USA)

White Instruments Inc, PO Box 598, Austin, Texas. Phone: (512) 892-0752.

UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V5RA. Phone: 01-734 2812. Telex: 27939.

Series 4000: single-channel active equalisers, 27 1/3-octave bands on ISO centres 40Hz to 16kHz, control range $\pm 10\text{dB}$ continuously variable. Feature 12dB/octave highpass filters continuously variable 20 to 160Hz. Available in three options: Model 4001 for sound reinforcement; applications; Model 4002 for music reproduction; Model 4003 as Model 4001 but has transformer-coupled outputs.

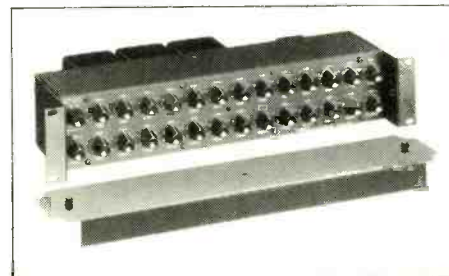
Model 4004: single-channel passive 'cut only' equaliser/filter, 24 1/3-octave filters on ISO centres 63Hz to 12.5kHz. Control range 0 to 15dB attenuation continuously variable. Features up to 15dB/octave highpass filter continuously variable from 'flat' to 40Hz through 160Hz and up to 18dB/octave lowpass filter continuously variable from 'flat' to 16kHz through 10kHz.

Model 4100: 2-channel active equaliser, 10 octaves on ISO centres 31.5Hz to 16kHz. $\pm 10\text{dB}$ continuously variable control range. Features 12dB/octave highpass filter continuously variable 20 to 160Hz.

Series 4300: single-channel active monitor equaliser, 41 bands comprising 28 1/6-octave bands between 40 and 894Hz on and between ISO centres, 13 1/3-octave bands from 1 to 16kHz on ISO centres. Equal Q in boost and cut, control range $\pm 10\text{dB}$. Features accessory socket for 12dB or 18dB/octave crossover networks.

Models 4310 and 4311: single-channel active equalisers, 41 bands comprising seven 1/3-octave bands 40Hz to 160Hz, 29 1/6-octave bands 180Hz to 4.5kHz, four 1/3-octave bands 5 to 10kHz and one octave band 12.5kHz, all bands on ISO centres. Control range $\pm 10\text{dB}$. Model 4311 transformer balanced, Model 4310 single-ended socket for crossover network.

Model 4320: single-channel passive 27 band 1/3-octave graphic equaliser at ISO centre frequencies, control range $\pm 10\text{dB}$.



White Model 4240

Model 4240: single-channel active equaliser with specific applications for voice programme equalisation. Two octave bands 63 to 125Hz, one 2/3-octave band 200Hz, 19 1/6-octave bands 250Hz to 2kHz. Two 1/3-octave bands 2.5 to 3.15kHz, three 2/3-octave bands 4 to 10kHz, all on ISO centres. Features socket for crossover network and control range is $\pm 10\text{dB}$.

WES (UK)

Windsor Electronic Systems Ltd, 58-60 Grove Road, Windsor, Berks. Phone: 07535 53779.

UK: Alice (Stancoil) Ltd, 38 Alexandra Road, Windsor, Berks. Phone: 07535 51056.

Dual 4 Band: 2-channel equaliser with four bands 30 to 300Hz, 150Hz to 1.5kHz, 400Hz to 3kHz, 1.5 to 15kHz, and control range $\pm 14\text{dB}$. Designed as line correction amp for high quality broadcast use.

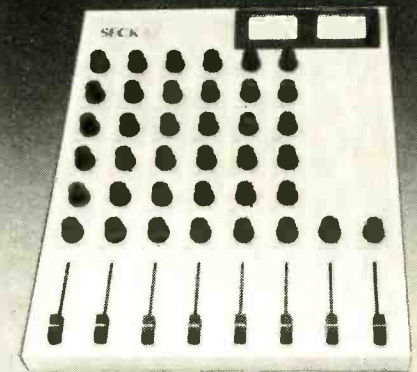
YAMAHA (Japan)

USA: Yamaha International Corp, PO Box 6600, Buena Park, Cal 90620. Phone: (714) 522-9105.

UK: Ban Electronic Music, 89/97 St. John Street, London EC1M 4AB. Phone: 01-253 9410.

Q1027: single-channel graphic equaliser with 27 bands at ISO frequencies and control range of $\pm 12\text{dB}$. Features 40/80Hz highpass filter with 18dB/octave slope, all active circuitry.

THE 8 HOUR 6 IN 2 OUT



Faster IC's, lower noise and a new meter pod are featured in the latest version of our classic mixer. Each input has wide range gain, treble, bass, foldback, echo and pan controls, with echo return and VU type meters on the outputs.

SECK 62 comes built and tested or in kit form. Construction takes about eight hours with the minimum of tools, following the comprehensive 32 page assembly and fault finding manual. (You can purchase the manual separately at £3.00, refundable against purchase of the mixer). A ten in, four out version, SECK 104, featuring pre-wired mixdown and monitor mix is also available. SECK mixers are used extensively for recording, PA, radio, AV and keyboards.

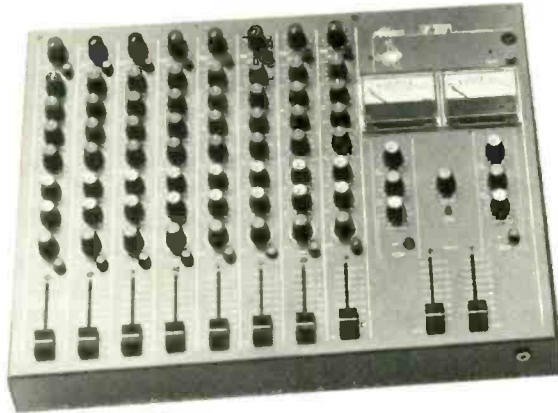
SECK 104 Ass'd £325.00
62 Ass'd £130.89
62 Kit £92.60
All prices +VAT

For full information on specs. and accessories contact:

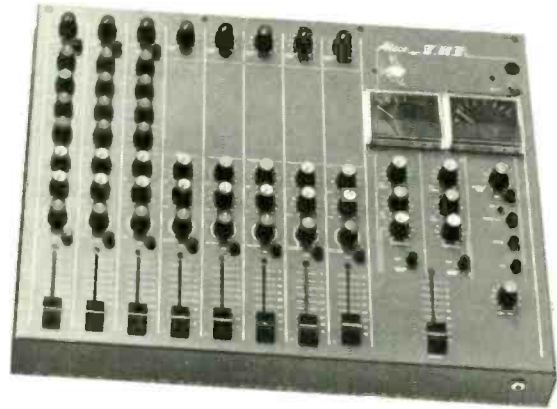
BANDIVE Ltd, 8 East Barnet Road, NEW BARNET, Herts., EN4 8RW
Phone 01-440 9221

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COMPLEMENTARY PAIR



The 828, a high quality stereo output mixer with 8 or 12 mono mic/line inputs, HF, MF & LF equalisation, echo and foldback sends, PFL on headphones, limiters on outputs. PPMs & phantom power optional.



The 828-S, a broadcast quality stereo output mixer with 3 mono mic/line inputs and 5 stereo RIAA (phono) or line inputs. Comprehensive monitoring facilities include stereo 'B' check input with gain control, phase reverse, mono and dim, PFL on meters, VU's or PPMs to order. 48v phantom power standard. LS mute by fader micro-switch available.

Alice (Stancoil Ltd.)

Alexandra Road, Windsor, England. Tel: (075-35) 51056/7 Telex: 849323 Aegis G.

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Rumfordstr. 10, 8000 München 5
West Germany
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Telex: 05 285 92 gfc fld.

THE CHALLENGER: MORE FOR LESS

MCI, the best selling "mid-range" console maker in the United States issued the challenge: "If you can find professional recording equipment that does more for less, buy it." Soundcraft, the best selling midrange console maker in Europe wants you to accept the challenge.

A lot of people would like you to believe their console will give you all the performance and features of a Neve or SSL for less money. We don't expect you to buy that. But, a Soundcraft console will give you more of the features you want... more quality

...more transparent sound...and more reliability than other consoles in our price class. And, in less room and frequently for less money.

The "top" of the Soundcraft line is the Series 2400 with full automation. The same design philosophy that went into the 2400 goes into every Soundcraft console. In fact, the same components go in, too. Best of all, every Soundcraft console sounds great because they don't sound at all.

Take the challenge. Work with a Soundcraft. Listen to a Soundcraft. Price a Soundcraft.

Soundcraft Electronics Limited
5-8 Great Sutton Street
London EC1V 0BX England
01-251-3631
Telex: 21198

Soundcraft, Inc.
20610 Manhattan Place, Suite 120
Torrance, CA 90501
(213) 328-2595

Soundcraft

THE CHALLENGER

Phil Dudderidge • Graham Blyth



Soundcraft
Series 2400

letters

A question of depth

Dear Sir, Barry Fox discussed the question of depth in your July issue. Based on the researches of Dr Peter Craven, he offered an erudite theoretical explanation of why some recordings give an aural sense of depth, or perspective, while others do not: a significant bit being that recordings which do give a sense of perspective were almost all made in the '50s and '60s while recent and current recordings never, or hardly ever, do. Dr Craven and Barry Fox have the physical reasons correct, if I may say so, but it might be useful to recall how we did it, and to ponder on why we don't do it now.

In the early days of stereo, when we were still releasing a mono version and a stereo version of the same performance, (and stereo was nearly killed at birth because of the necessity for "double inventory") the usual technique was to employ a coincident pair of mics, a C24 or an SM2 for example, hung on a boom about 8ft up. The exact position was fixed by a combination of instinct, rehearsal and experience. In addition there might be spot mic(s) for the soloist(s) panned to get the right position in the stereo picture, and to aid balance with the band. Given a reasonably lively acoustic, like Studio Hamburg for instance where all the early James Last's were done (and probably still are), a beautiful 3-dimensional perspective would be the result. Three-dimensional because what works in depth will also work in height, if you do it right.

And another thing. In Europe, at the time we are talking about, the MS method of generating a stereo signal was preferred. It gave, I think, a superior result compared with the A/B method favoured by our American colleagues, although if you want to hear an outstanding single A/B pair recording of sparkling clarity and perspective listen to the original Mercury release of Copeland's El Salon Mexico. It was a favourite test piece for monitor set-up, and whoever nicked my copy, can I have it back, please.

Times and methods change, not always for the better, and not always from choice. Equipment became available which, in effect, has enabled us to get big line-ups into small studios, section by section. More channels and more tracks making balances more complicated, and closer miking needed to get enough separation to make a final balance possible. Whatever we may have gained from all this (and I need some convincing we've gained anything but an overdraft) we have certainly lost replay quality, and the punters have not been slow to tell us so.

Yours faithfully, Denis Comper, 5 Bedford House, The Avenue, London W4 1UG, UK.

Glyn Johns

Dear Sir, No doubt Glyn Johns (and Studio Sound) will be roasted for his straightforward comments on the Tom Hidley Syndrome, but it's refreshing to see some dissent in print for a change. Studio control room monitors have traditionally been designed for exaggeration; it seems to be general knowledge that, for highest quality reproduction, you can do better in most hi-fi shops. And, good-sounding rooms are simply no longer in vogue; sadly, New York City has but a handful of large rooms left. Of course, having a small 'live area' inside a dead room does not substitute for a room characteristic.

While many console specs have improved over

the years (Johns doesn't like transformers, but mixers without them are all quite recent), there's been an emphasis on visual impressiveness—the space-ship look—even to the detriment of simple operation. The patchbay, once the very heart of a professional board, has often been deemed an eyesore, to be reduced in size and relegated to some far-off corner. Do most engineers really prefer those Bantam patchbays and cords?

As for dialogue, manufacturers don't care what engineers think: they only see what studio owners can be sold. (You can't have six good equalisers; you're getting 24 poor ones.) They'd have you firmly believe good recordings can't be made without eq, de-ess, limit/compress, reverb and noise reduction. Similarly, your local dealer may be expected to urge that, for the phasing effect, you buy one of the outboard black-box devices, with no mention of the 2-recorder method, which sounds better. And, can it be said that automated mixdown was introduced in response to the expressed needs of working engineers?

More is less? Certainly, the proliferation of equipment seems to be reciprocated by a lowering of the level of craftsmanship generally. The worst sound one hears in New York clubs, for instance, seems due to gross overuse of equalisation: as though having eq on every input demands it be used at every opportunity. (Johns rightly warns against heavy application of eq while 'soloing'.)

Anyway, having twelve mics on the drums is not 'insane' if the object is an unnatural drum sound; natural sounds are not better than any others, as Johns must know. Of course, there are producers who are so insecure, they use twelve tracks as well!

Yours faithfully, Doug Pomeroy, New York.

Engineer expertise

Dear Sir, I'm writing in response to your editorial regarding engineering training programmes and in response to the recently published interview with Glyn Johns.

I applaud your magazine and Mr Johns for promoting such radically different views than those commonly found in the industry. I found his views refreshing and akin to my own.

It is unfortunate that the accent in recording has shifted from the capturing of an inspired performance to the recording of simply 'clean tracks'. One would think that the best of both worlds, high technology and high artistic achievement, would be the norm, one enhancing

the other. Often, that is the case. However, the tendency is to rely on technology as a substitute for inspiration, that special quality in music called Magic. Technology (technique) has long interfered with art and has long clouded the creative process. This in part explains the current slump in the studio and recording industries. The public wants to be moved by a performance. They want more than just 'a great drum sound'.

Producers and engineers, especially the newer ones to the trade, have further harmed the final product—the record—by recording for the tape exclusively, without regard to the considerations of disc. The result is commonly a bass-light, compressed, low level record; this relative to the results that could be gained by following a few guidelines, ie avoiding overly close-miking, not programming record sides with too much material, and making sure material is in phase, etc. It is ironic that, in the name of technology, many achieve results which are technically inferior to those of 25 years ago.

This relates directly to your editorial regarding training programmes for future engineers. In my opinion programmes should include the recording/production techniques and philosophies of 'yester-year' as well as those currently in vogue, and should also include introductions (at the very least) to the many different aspects of the industry as well. This promotes a broad point of view and greater flexibility during one's career.

One avenue for students to explore is that of the 'recording school'. Care, however, must be taken in selecting the proper one, as many schools are not qualified. A school which deserves favourable attention is the College for Recording Arts located in San Francisco. This, in my opinion, is one of the finest schools of its type in the US.

Another approach is for students to receive their training at a large studio or record company. This, as you know, has been the traditional approach for many years.

I believe the ideal curriculum is a combination of both. Students should receive their early training at a school (to learn the basics, and what questions to ask in the field) and then move on to an apprenticeship programme under the personal guidance of a very well-seasoned professional.

Thank you for the opportunity to speak out on these subjects. I invite comments.

Yours faithfully, Steve Richardson, Skylight Exchange, PO Box 3173, Granada Hills, Cal 91344, USA.

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Elite Recordings

Marc Aubort and Joanna Nickrenz comprise Elite Recordings, an independent recording company traveling the US and Europe. Recording a wide variety of classical music they have garnered several Grammy nominations for engineering and producing. Recently they were in St Louis to finish the Saint Louis Symphony's recording of the complete orchestral works of Rachmaninoff. It was after an arduous session at Powell Symphony Hall that they were kind enough to take some time to talk about their work.

How did both of you become interested in recording and get started in it as a career?

Marc: This all started for me in Switzerland where I was born. Mr Wettler, a friend of mine who taught me the ropes, and I, recorded for a company based in New York during the time the first *Magne Corder* came out. We got it in the mail and looked at it, figured out how it worked and then started recording. We subsequently developed a way of editing. Up until this time we had been using wire recorders and editing meant literally knotting the wires together. We transferred this technique which was much easier on tape and built from there. This was 1949 or '50.

When did you move to the United States?

Marc: The first time I came to the United States was for six months in '55 for that same company, Concert Hall. The second time was for Vanguard. I started working for them first in Vienna, waiting for my papers. After coming over here I worked for them for eight years and then began Elite Recordings. Joanna joined me—when was that?

Joanna: 1969.

Marc: 69, right, four years later and ever since we've been doing recordings in various places like St Louis, Minneapolis, Baltimore, Atlanta, Cincinnati as well as Europe. Chamber music we do most often in New York, in a church actually.

Joanna: Though we have done quite a bit of chamber music in St Louis.

Joanna, what was your background before joining

Marc?

Joanna: I was a professional pianist. I am originally from Seattle and had migrated to Pittsburgh where I was the orchestra pianist for three years with William Steinberg. I played a lot of chamber music and was involved in a great deal of new music . . . and at one point . . . it was a coincidence: I had made a recording for Nonesuch where Marc was the producer-engineer, the Schoenberg *Ode to Napoleon*, and I had known him from the Marlboro Festival. In 1969 I was in the middle of a 'hairy' divorce and went to a surprise birthday party of Marc's in New York. I was certainly not thinking of going into recording at that time but I jokingly asked him about a job. He said: "You'd be a fantastic editor!" I said: "What's an editor?" I thought about it and took it quite seriously. I thought this would be a very exciting new life using my background, etc. We started that summer. Everything worked out very well and we're still together after 11 years.

When recording, what roles do you assume? Is one of you the recording engineer and the other the producer or do you pretty much share those roles?

Joanna: I am not an engineer and I don't pretend to be—although sometimes I am labelled as one. For orchestral recordings, Marc does the engineering and we co-produce. We can do it different ways

where either of us produces alone but always with orchestral recordings we do it together because of the time limitations. During union sessions where you have very little time, Marc tends at times to engineer things while I'm watching the score and vice versa.

And then after the recording session who does the compilation of all the takes and the editing?

Marc: Usually Joanna does that. I used to but more and more things kept coming up. You have to have hours where you can concentrate without interruption and that is very difficult if you are running a business as well. The non-orchestral sessions are usually produced by Joanna for that reason. She's editing it and she has a better idea of what she needs, what she wants.

What is your basic approach to recording something like the St Louis Symphony? How do you approach it as far as where you set your microphones?

Marc: Well that depends on the score in the first place and on the acoustics of the hall wherever we go . . . which may be different from any other one.

OK. Let's take the works being recorded this weekend, the Rachmaninoff pieces. Is it the same orchestral setup in this hall as other recordings?

Marc: Basically yes, with minor differences. But it had to be the same basic setup used in 1976 when we started the Rachmaninoff project because all of the music will be on four records and it has to have a continuity from the first session in '76 to what we're doing now. So we can't stray too much from what we're doing. Fortunately it started out well and the approach has worked with all the pieces recorded so far.

How far along are you in recording the complete Rachmaninoff orchestral pieces?

Joanna: Tomorrow is the last recording. It will have taken over four years to finish.

Marc: We've done all sorts of other works as well. We recorded, for example, Prokofieff's film music *Alexander Nevsky*, *Lieutenant Kije* and *Ivan the Terrible*.

Joanna: The recording sessions had to be scheduled in co-ordination with the concerts of these works here in St Louis because for us to come without the orchestra being prepared makes no sense.

What kind of preparation do you have to do for the recording?

Marc: First we have to know the score that's coming up. We have to know which instruments are being used and have an idea of what we want to do with them—where we want to place them because basically we have a two microphone approach. Although you see something like a dozen mics on stage right now, we essentially work with two main mics which give us the overall picture of the recording. *And those are omnidirectional mics.*

Marc: Yes. The other mics are used just for accents, for more definition on the soloist, or tympani, or something like that—but not very much for loudness. The two main mics are 89%, or whatever, of the total information that goes on the tape.

Do you listen to recordings made by other artists and engineers in addition to studying the score?

Joanna: Very seldom.

Marc: That depends. The *Ivan the Terrible* we did, we prepared quite extensively because of the problems involved. There were different sections in the score where voice had to be mixed with orchestra and these parts were not recorded in real time. They were recorded



an interview by Barry Hufker

separately so we had to know exactly what the cues were to know where these parts fitted in. That took quite a bit of preparation.

What kind of discussion goes on with the conductor during a recording? For instance with Leonard Slatkin in this project, do you talk to him to understand what he wants out of the recording?

Joanna: Absolutely. Before we go into the session he will point out certain problems that may come up that we could watch for. We can help him as far as balances where there's an obscure scoring so we try to do whatever we can to help that way. He knows exactly what he wants . . . precisely what he wants and we try to get it for him.

Is it that easy with other conductors?

Marc: No. He's probably the fastest conductor we have worked with as far as always being ahead of the situation. Sometimes I hardly have time to look in the score to see where he's going to start again.

Joanna: He doesn't waste a second.

Talking about seconds—the first time I came down to Powell Hall to watch you record the St Louis Symphony I was amazed at the way the session was run. The musicians' breaks and the session itself were timed down to the split second. I saw three different people with stop watches that day and you had said they were all timed to the same source which is . . . ?

Marc: To the official, exact atomic clock that is broadcast on WWV on shortwave so everybody has exactly the same beginning and end and there's no question about it. . . . you're a minute fast . . . , you're ten seconds slow . . . or something like that. That is actually *the* big problem in orchestral recordings due to the union situation. We have exactly two hours to use for recording out of a three-hour session. It's not two hours and five seconds. It's two hours on the dot and if we don't get in what we have to get in then we're in trouble because overtime is a very expensive proposition. If you haven't finished a piece, the minimum amount of overtime you can get is half an hour. The so-called three-hour session runs about \$15-17,000 for the orchestra so half an hour of overtime goes into thousands of dollars and if you have one bar of what you need missing you don't have a record.

That's the whole trick when we do these sessions, to bring in everything in the allotted time. When we get close to the end of the session, as we did today, we start skipping in the score to where we know we need something that comes later but what's in between is good. So we have to skip in the score to get that in order to finish exactly on time. But we've had situations where musicians complained because they had to sit two seconds into overtime in order to let the sound die out in the hall. These kinds of things sometimes make it a bit hard to make music.

Is such a strictly timed session the norm?

Joanna: In this country any union session is like that.

Marc: Also, a break has to be called within the first hour. Even if you are only four bars from the end you have to call a break if the time is up. That's why you have to gear yourself to what you are doing. Find a movement or segment you want to bring in before you either have to call a break or the session's over.

Joanna: We have to evaluate what is most important and at times compromise because of the time pressure, which does not make us very happy.

Marc: You always have to sort out the priorities . . . what is most important, second, third and go down the line so that at the end you

have everything you need.

Joanna: There have been occasions when we could not bring it in on time and have had to go overtime because of various musical or technical problems.

The second thing I noticed during that session was the friendliness that exists between you and the members of the St Louis Symphony. Your greeting was very warm with exchanges of hugs and handshakes.

Marc: Well, we have had many happy moments in St Louis. This is one of our favourite assignments. I think we've made nearly 40 records so far.

Joanna: They know us very well and we know many of them personally. It's a comfortable working situation. It usually takes a while to have confidence between orchestra and producers but we feel very comfortable here. We love them all. They're marvellous. It's an unusual orchestra. It's a happy orchestra, much happier than many we've observed. I think it's a healthy one.

Do you feel this relationship has been contributory to your Grammy nominations?

Marc: Absolutely.

Joanna: We also very much like working in Powell Symphony Hall. The orchestra has a problem hearing themselves but for us it works very, very well. We've found everywhere we go that if the musicians do not like to play in a hall then it's very good for us and vice versa.

Marc: There are very few where both aspects work well. One is Boston Symphony Hall. One is in Vienna, the Grosse Musik Vereinssaal; which is extremely good for anything. One of the beloved halls in this country, Carnegie Hall in New York, is one of the worst to record in, totally dead and choked. But everybody loves to play in it because they can hear each other. (Laughter)

I get the impression that the subject of your equipment comes up quite a lot. By that I mean visitors seem to expect more when they walk in. Somehow they expect to see a room full of exotic machinery. When we were talking about it the other night you said you chose it because of durability. Is that the basic reason behind it? Not only does it sound good but it has to be durable because of the remote recording you do?

Marc: Well that equipment gets bounced around something fierce at times going from plane to car or whatever so it has to be reliable and/or fixable. There are machines today that are so complicated for a small improvement in quality. If you're out on a session with a hundred people on stage and the machine just sits there dead, and you can't fix it because you either don't have the instruments or the time to go through the whole logic circuitry, that small improvement is not helping you in any way. That's why we use a machine that's relatively simple but gets good results. The machine is flat. It has very low distortion, wow and flutter. So the specifications we need are there. We don't have the last, extreme 0.01% of improvement that new equipment offers but this, to my thinking, is less important than a reliable, solid machine that delivers good results at all times and is fixable immediately if something goes wrong.

Joanna: It doesn't look pretty but it works.

Marc: It used to look pretty but it has been battered up. (Laughter) *You do all your monitoring through headphones and it would appear the same philosophy applies to them.*

Marc: Actually they're the kind used for audio measurements to

Elite Recordings

measure people's hearing response. They're sort of calibration headphones. What's missing on them today is the very last octave all the way down and the very top. I have been using these since 1953, I think, to set balances, for the specific reason that we go to so many different 'control rooms'.

Joanna: Since we are doing remote recording our control room is any room we can make do with—kitchens, bathrooms, dressing rooms, etc.

Marc: Which are not totally conducive to listening. We eliminate that variable by using not only earphones but the same earphones. We know, before we hear anything, exactly what we want to hear. If it doesn't sound like that then we go and do something about it, but we don't have to take into account the acoustics of the control room.

Joanna: It can throw the musician as well. For instance, if the control room is very live and you're recording in a live hall, it can sound pretty washed out and can be very confusing.

Marc: It's also much faster to set a balance when you have earphones. If you are using nine or ten mics, when listening with earphones, the slightest change on a fader will show up. With loudspeakers you need a correspondingly larger fader movement until you hear a difference. On the earphones it's immediate.

When you are recording, what sound are you trying to capture? Are you creating something specifically for record or are you trying to give the listener the sound of the orchestra as he might hear it at Powell?

Marc: That's a question that has been discussed and will be discussed among producers for years to come. I tend to believe that the main thing in the balance setting is the score and I don't believe in gimmicks like boosting instruments that are not normally 'heard' just because they are in the score. The composer may not have even wanted them to be heard, they are possibly just contributing to colour. There's no need to boost everything in the score. The important thing is a good overall picture. What I'm trying to do is give the listener a seat slightly above and well behind the conductor. Something like ten feet above so that there's a picture of the whole orchestra but one that doesn't use 'spotlighting' or gimmicks.

Joanna: Yet it's a picture that maintains a sense of depth.

Marc: The more you bring up the gain of mics at the back of the stage, the more you flatten out the picture.

I know you are on the road a lot. Have you had a chance to listen to many of the new digital recordings?

Joanna: We've been making some!

Marc: With different systems.

Joanna: We've used the Sony system, the 3M and the Soundstream so far.

How has digital impressed you?

Marc: Yes, I'm impressed by digital but not exactly for the same reasons that everyone else is impressed. It is a very clean system with very wide dynamic range, which is wasted on the records manufactured today since you can't put it on them. Digital is the way of the future for various reasons. You can clone your tapes—go

The Technique

MARC Aubort's microphone setup for recording the orchestral works of Serge Rachmaninoff at Powell Symphony Hall employed basically a two mic approach, omnidirectional mics placed to either side of the conductor. These two mics provided the vast majority of the sound heard with cardioid spot mics on such instruments as piano and tympani mixed in as required for presence. The sound of the

hall itself was captured with two spaced cardioids. The mics used were Schoeps valve types.

A total of ten mics were fed into two specially modified Gately mixers, two different types of Dolby units (A301 for music and 360 for ambience) and stored on a Scully 280 4-track running at 15in/s. Two of the tracks were used for music and two for hall ambience. Monitoring was done by earphone, Beyer DT48s.



Pictured at a Nonesuch Records' recording of C. P. E. Bach's Harpsichord Concerto, Jo Nickrenz (centre) and Marc Aubort (far right)

through many generations without deterioration. In that respect digital is very interesting.

Editing, however, is much slower; although some systems claim it can be as fast as analogue. We haven't seen it. So far it has taken three to four times longer to edit digitally *after* the analogue tape was edited. The analogue has to be edited first in order for the artist to approve the results and also because it is too expensive to sit there at \$250 an hour to listen to tapes. So you record the analogue in parallel, do all your listening and editing, get the finished product and then go into the studio and do the digital editing, which for a record could take three or four days.

Do you foresee a time in the relatively near future when you will abandon your Scully 280 and . . . ?

Marc: No, because the only change in digital recording is the addition of the digital machine. You just plug it in and that's it. It runs consecutively with the analogue machine. Mixers, mics, everything else remains the same.

Using a Scully 280 you record on four tracks, music on two and ambience on two. Because the music is confined to only two tracks has a conductor ever come in and expressed a desire to have something louder or softer after you have recorded an entire piece? Are you limited because you don't use multitrack?

Marc: That hasn't happened. If something like that should happen, it is usually caught during the session.

Joanna: There have been times when it would have been nice to have a little more of this or a little less of that, but it's not drastic.

Marc: It's just a matter of small degrees.

Joanna: At least for us.

What are some of the other projects you are working on?

Marc: The next one is finishing the second album of the St Louis Pops with Dick Hayman. We made one record which isn't out yet and we already have a few pieces for the second one.

Joanna: With St Louis we have a film project. Public television is doing an ongoing series on Mark Twain and the St Louis Symphony is recording the background music.

Marc: That's the first time a full symphony orchestra will be used for a television film score.

Joanna: At least in the US.

Is that because of the cost?

Joanna: Yes. We are also going to be quite involved in Los Angeles for the next few months with the Los Angeles Chamber Orchestra with Gerard Schwartz.

Marc: We are recording the same group for two different labels. One is Nonesuch and the other is Delos.

Joanna: They will both be digital, one Soundstream and the other 3M.

We are coming to the end. Is there anything you want to add?

Marc: I'd like to say again that we really like to work in St Louis with the Orchestra. We have got good results and several Grammy nominations. There's a special combination of colour in the Orchestra that is unique to it. Sometimes we say so on the intercom: "That's the St Louis sound!"

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Studiofile:1

CGD/Idea Recording, Milan

CGD, a division of Messaggerie Musicali Spa or Sugarmusic, must be one of the largest complexes (if not the largest) within the Italian recording industry. The founder, Mr Sugar, who originally hails from Hungary, has built the company up from very small beginnings, in true Hollywood style to the all-embracing organisation that it is today. The recently built premises include recording studios, disc cutting and pressing plant, publishing company and printing works for record jackets and sleeves, posters and all associated promotional material. As they say, CGD is one of the few places where an artist can walk in with a song and go out with tapes, cassettes, records and full publicity, not to mention the published music! In fact the operation is divided into the production company CGD, and the studio which is officially known as Idea Recording. Chief engineer and studio manager Mr Berlinghini who was also my guide for the afternoon, works in close collaboration to this end with Gianni Daldello who is in charge of CGD, artistes, etc. In this way the budget allocated to CGD is 'assigned' to Idea Recording in order to keep the studios and their facilities in complete working order and to upgrade as required by the demands of the marketplace.

The CGD buildings are on the outskirts of Milan near to one of the main approach roads making them easily accessible while being in a fairly quiet area and out of the bustle of the city centre which, in the case of Milan, is not a bad thing to be out of! CGD feel that this siting is to most artists' advantage being also convenient for the airport and main autoroutes. They also have an advantage in the wide office facilities at CGD with their in-house links to Rome and other important centres. In fact, while the group are recording in the studio the management could be organising the tour and promotion from the offices.

In terms of general layout the studios are situated in the centre of the main building with offices, etc, on the outside. All studios are isolated from the building and from each other and as a further refinement each studio is mounted on pillars and can be moved up or down should it be required.

The tour of the premises started with the large studio or Studio V. Access is via the control room where one is confronted by an enormous Telefunken 32/32 custom-built wrap round desk that looks like the command console of *Star Trek's* Enterprise. Well, it is not everyday that one meets desks with pin



Drum iso booth

matrixes for some of the routing and 10in long LED meters. I was told that the desk is extremely flexible as well as being comprehensive and, just as important, easy to use. Recording is also on Telefunken with M15 multitrack and stereo machines with additional 2-track work being done on an M10 and Studer B67. All channels are Dolbyed. EMT are to the fore with their 140, 240, 250 and 251 units for echo and reverb effects though there is also an AKG BX20. EMT are also present in the compressor/limiter section—as is nearly everyone else! In fact as far as effects units go, Idea have more or less everything with any new toys that come on the market being checked out immediately. I did notice that in common with quite a few Italian studios they have the Orban graphic parametrics in the racks. One of their latest acquisitions is the Prominence equaliser from Scenic Sounds which Mr Berlinghini describes as being like Aphex but with far more control over the ratio of effect in the final mix. Monitoring is by JBL 4350s and these are the house standard for all the studios. There are also two large Pyral spectrum analysers available that do the rounds between the various studios and cutting room when the spectral content needs to be checked out. Dimensions of the control room are a comfy 24½ × 19½ft (7.5 × 6m), with an average ceiling height of 12ft (3.7m), room enough for everyone, though the way the tape machines are placed provides a useful barrier between engineers and musicians!

The studio is large with dimensions of 56 × 42½ × 20ft (17 × 13 × 6m). The acoustics are fully variable being achieved by a system of motorised

panels and tubes, each having reflective and absorbent faces. Further control is available as each tube is tuned to an individual frequency, thus permitting many combinations. The motors are controlled by a panel in the studio with separate commands for each section. Actual reverb time can be controlled from 0.72 to 1.0s. Isolation is obtained by little houses in the studio (should I say iso booths?) and these are designated (1) guitar and vocal, (2) guitar, vocal and bass, (3) drums, with the acoustics designed to give a low reverb time without sounding too dead. The selection of microphones is as one would expect though Schoeps Collette series does seem to be popular in Italy. I also noticed Shure ribbons being used for cymbals, which was rather unusual, and was told that the results were excellent. (I must admit that I still think Reslo ribbons—I know that dates me—sound great on bass drum, perhaps we ought to investigate the use of ribbon mics more often.) Capacity of the studio is 80 musicians seated and there is a good selection of instruments available including Steinway Grand, C3, Rhodes, etc. Sugarmusic are the distributors for Hammond anyway, as well as quite a few other makes, so any new instruments get tried out straight away in the studio!

The small studio or Studio D is also equipped with Telefunken desk and 24-track recorder plus mastering but is scheduled to be updated in the very near future. Layout of Studio D is control room in the centre with studio to its left and isolation room to its right, making for maximum vision. With the exception of the iso room the whole will be rebuilt by the

Eastlake men. The new desk will be a Harrison 4848 custom-built with the unusual (for Harrison) feature of ASA-style VU meters with NTP light beam PPMs for main outputs. This feature is due to the fact that Mr Berlinghini prefers ordinary VUs as against LED columns. Automation will be the *Autosec 1* or 2 remains to be seen. Multitracks will be two Studer A800s in sync, which will probably be a European first. The JBL 4350s will be kept as monitors.

Earlier in the year Idea opened their new mixdown room, which bears more than a passing resemblance to that of Utopia in London! (Well, they liked Utopia when they visited it.) The acoustics are by Eastlake and feature an attractive blue-tinted aquarium between the monitors and underneath the large TV screen for the computer. Whether hit potential of a record is judged from the expressions on the fish's faces I have yet to find out! Mixing centres round a Solid State Logic 4000E 40-channel console linked to a Studer A800. Mastering is available on Studer A80 and B67 stereo machines. The whole range of CGDs arsenal of special effects is available and individual effects are often installed at the start of each session depending upon what may be required and thus avoiding too much clutter! Monitoring is again 4350s and though certain people may have misgivings about them in an Eastlake room, CGD have found this JBL model to be a good compromise between what the house and independent engineers like as a monitor. The room itself is quite spacious and at the time of my visit a Yamaha CS80 had been installed so that final synthesiser overdubs could be completed without taking up a studio.

The complex also has a comprehensive copy room with the nice touch of two pairs of Altec monitors being installed back to back so that clients/engineers hear the same thing during copying as the copyist. Response tweaking is available by the various Audio & Design modules installed in the copy desk. Another touch is that the room is open to daylight! Also falling into this latter category is the cutting room, at present fitted out with Neumann lathe and Klein & Hummel monitors. However, this facility is soon to be updated with the installation of the latest Neumann computer controlled lathe. No expense spared!

Last but by no means least on the list at CGD is the record plant. The complete disc production process is here with the manufacture of positives, negatives and stampers.

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Intermedia Sound becomes Syncro Sound

One of the oldest and most respected recording studios in Boston, Intermedia Sound, has closed its doors. At the beginning of March, ownership of the automated 24-track facility was transferred from Century III Inc, owners of Century III Studio and Centel, a video production house, to Studio 81 Inc, a subsidiary of The Cars Unlimited Inc. The new owner is a private company that represents the interest of, surprise, the best-selling new-wave group from Boston, the Cars.

All is not lost, however, for fans of the facility which has been located for 15 years in the Back Bay section of Boston. As you read this, the new owners are engaging in an extensive refurbishing of the studio, and, if all goes according to schedule, musicians will once again be able to record on Newbury Street, around the first of next year.

Intermedia Sound started out as a 4-track house, with equipment leased from Ampex, and bearing the name of its two owners, Petrucci and Atwell. In 1967, the studio was redesigned with the help of the famous acoustic consultants, Bolt, Beranek & Newman, a company recently in the news for overcharging the US Government for their analysis of the 18min gap in Richard Nixon's Watergate tapes. In 1969, Ampex developed their prototype 16-track tape deck from a 2in video transport, and gave the studio one of the first units, if not the first.

The studio, however, did not do well, although it was at the very forefront of the multitrack recording explosion. According to Berred Ouellette, chief engineer of the facility during most of the '70s, "the owners made a lot of restrictions

that made it hard to relax. You weren't allowed to smoke in there, for example. A lot of musicians were turned off by the atmosphere."

Petrucci and Atwell sold the studio in 1970 to Intermedia Systems, a local multimedia house. During the next few years, with the addition of lots of new equipment, Intermedia Sound became the hottest studio in town, with several gold records and a long series of very successful live broadcasts. Around 1976, however, the other multitrack studios that had sprung up began to cut into the facility's business, and things began to slow down. "The glamour clients were going to the newer studios," says Ouellette, "and because of its reputation as a rock studio, it couldn't attract the commercial clients that might have helped to save it".

Update

In October 1977, Ross Cibella, owner of Century III, whose nearby 16-track studio had a solid foothold in the local commercial market, bought Intermedia Sound. Cibella called in John Storyk to rebuild the control room, and he updated the studio with all new MCI 24-track equipment. Six months later, an automated MCI console was installed.

Even with all the improvements, Intermedia still faced stiff competition, and although, according to sources close to Cibella, the studio never lost money, it never regained its prominence.

By last spring, Cibella began talking with the Cars about building them a studio, and soon discussion turned to how Intermedia could be improved to meet the band's needs. Although it seems Cibella had no

intention, at first, of selling the studio, and was, in fact, planning on launching a major publicity campaign to attempt to revitalise it, the band finally made him "an offer he couldn't refuse", and within a matter of weeks, Intermedia Sound was sold.

John Storyk has once again been assigned to rebuild the facility, but this time, according to the band's co-manager Steve Berkowitz, "it will be completely redesigned. The control room, the studio, the rugs, the lobby, the bathrooms, everything." The studio will be on two levels, connected at the corners, with closed-circuit video linking all of the rooms. All new electrical, heating and air-conditioning systems are being installed. "The control room had no air exchange unless you opened the door," says Berkowitz. "We found a blanket stuffed in the air intake that must have been there three years. We also found that the main light dimmer circuits were about 6in from the record heads, and that the glass between the studio and the control room was held in with nails."

Roy Thomas Baker, the band's producer, is taking a major part in designing the new facility, as is Andy Topeka, who built Jan Hammer's hideaway studio in Connecticut. Equipment installation is being handled by Audio Professionals.

Topeka will be staying on staff after the work is completed, and will be serving, along with Thom Moore—the Cars' live sound mixer—as chief engineer. "The project is taking on a much larger scope than we had originally planned," says Topeka, "and we're really committed to making it a state-of-the-art studio". The MCI JH-632 console will be expanded to 40 inputs, and the JH-24

tape machine will be aided by a 'transient' deck, Baker's 40-track Stephens. New Ampex ATR-100s will be brought in for mastering duty, and a complete dbx effects rack will be installed. "We're now running comparisons between the dbx *Over-Easy*, the *Gain Brain II*, and the ApheX *CX-1* comp/limiters," Topeka explains. "We still haven't decided what we like best." Other planned acquisitions include four UREI 1176s, three each of the original *Kepekes* and *Gain Brains*, an Audio & Design *Vocal Stresser*, an AMS harmoniser, and a full complement of Eventide effects. The old owner's UREI *Time-Aligned 813s* will remain in place, although Topeka hopes to update them to *813As* "when UREI and we get it together".

Reverb

An EMT plate reverb remains, but digital reverbs, particularly from Lexicon and Ursa Major, are under consideration, and, says Topeka, "we're keeping our eyes on what Sony is doing with PCM reverb".

When the studio first reopens, which should have already happened as you read this, it will be used, if all goes well, to record the Cars' fourth album, as well as numerous projects that the various members of the group are involved with or are producing on their own, including bands like the New Models, Boys' Life, and the Peter Dayton Band. Along about January, Berkowitz estimates, the doors will be flung open once again to the local music community, which should prepare itself for quite a treat.

Paul D Lehrman

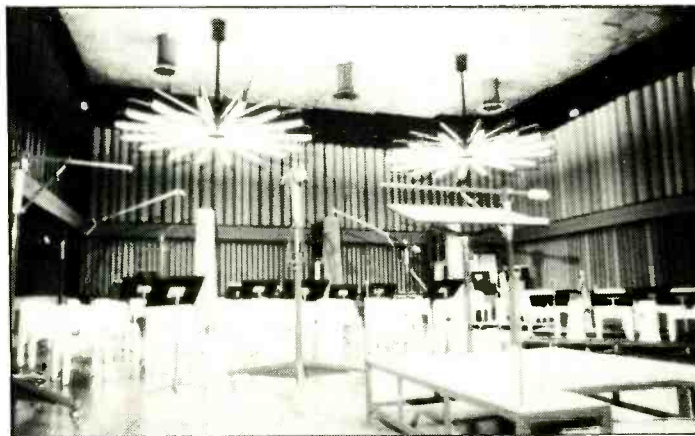
Syncro Sound Recorders, 331 Newbury Street, Boston, Massachusetts 02115, USA.

CGD cont'd

The plant features 16 fully automated presses with a large on-site maintenance room for minimum down time. Pressing is done for outside clients as well as for in-house work. With LP sales down, the plant is at about half capacity though 45s and cassettes are going strong. Considerable care over quality control is taken including the packaging which accounts for about 10 lire per disc. There is also a printing works for record sleeves and covers, posters and all associated promotional material.

The complex also has a 250-seat presentation theatre, either for live or record and mime, for press shows and similar events. It goes without saying that there are also full restaurant and bar facilities.

CGD artists can nearly always be



Spacious studio with variable acoustic panels and tubes

found occupying a good part of the hit parade in Italy with people such as Renato Zero, Ornella Vanoni, Umberto Tozzi, the New Trolls and

Gianni Bella. Newcomers to the hit parade include Viola Valentino and Ricardo Fogli. Among the clients for disc-cutting are Julio Iglesias and

The Rockets.

CGD/Idea Recording is no small affair and they aim to give every possible service to their clientele, as well as keeping abreast—if not in the forefront—of modern developments. Naturally enough, the question of digital recording came up and once again the conclusion appears to be that when digital is used from recording right through to disc reproduction then it is viable and becomes a commercial proposition.

It was time to go so thanks were in order to Gianni Daldello (Artist's CGD) and to Gualtiero Berlinghini (Idea Recording) for showing me around so thoroughly and filling me in on the many aspects of the CGD operation, as well as Italy in general.

Terry Nelson

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Automated equalisation

Allen Mornington-West

An important step towards the next generation of automated mixing consoles is centralised, assignable equalisation with memorised settings. There are several approaches to this, and this article considers current practice and possible future developments.

IT SEEMS an idea to approach the concept of automating equalisation from a design point. There are a few such products available on the market but they are markedly different. There is not the same similarity shown as there is between, say, the parametric equaliser types which most mixer manufacturers are able to offer. This approach will involve a brief consideration of such matters as the range of desirable control, the resolution of such control, the techniques available for achieving control, the manner of presenting both controls and information to the engineer, and the disposition or layout of the controls and the necessary data requirements. Imagination could be given a free rein but the reality of cost, and perhaps space, will impose useful limiting factors. There will be an underlying attempt also to consider the automation of a parametric type of equaliser. The principles and considerations involved will be most likely applicable to other types of equaliser.

Equalisers have two main roles to

play, a corrective one and a creative one. In a corrective role operating on signals which have suffered some modification of their spectral content it is most likely to be set and forgotten. However, if an equaliser is at all flexible then it will be used in a creative manner. Once started the creative requirements will grow. These days it has become quite commonplace to find controls to modify the amount of boost or cut, the bandwidth and the frequency area even on cheap non-modular mixers. These controls are essentially those of a parametric equaliser, and there is not much more that can be added: perhaps a switch to make one band change from a bell response to a shelf response, and another to remove the equalising element from signal path. Something in the order of five controls in all.

Controls

In the detailed design of an equaliser section the range of variability of each of the controls needs to be considered together with its intended use. For simple corrective uses and

use by relatively untechnical engineers, misadjustment is possible and then a restricted range of cut or boost, perhaps preset frequencies and a fixed bandwidth are likely to form design boundaries. These design boundaries are not only imposed by ergonomic considerations but also by the availability of suitable circuit design techniques and suitable components. Quite considerable time can be spent in determining the range of control, whether to arrange continuous or switched functions, and where and how to accommodate the controls on a front panel. I do not expect that this time may be reduced simply because an automated version of an ordinary equaliser is being considered. Indeed, the fact that automation implies that the front panel controls now no longer need to act directly on the signal means that some of the limitations imposed previously by components alter quite markedly.

Controls must meet criteria for ease of use and self explanatory functions. Most often a compromise will need to be reached. The mechanical and electronic implications of front panel layout and of the intended control technique will force their own brand of conflation influences. All of these, as ever, are heavily tempered by the consideration of cost. It needs to be borne in mind how large the production quantities are likely to be. A large quantity may well justify ordering a non-standard potentiometer simply because the labour content involved when a batch of equalisers are made can be usefully reduced. For the present, at least, any automated equaliser is going to be a little more expensive than a non-automated one. But the demand exists to actually place a fully automated equaliser section in every channel of a mixing desk. What is implied here is that the filters and shelving equalising elements would also be automated along with the, say, four bands of parametric equalisation, and that all of these functions are likely to be controlled from one panel. An automated

equaliser is almost certain to involve some digital control. The control settings are likely to be digitised, perhaps processed in order to derive a suitable display of position and to enable suitable driving of the automated elements. This digitisation will effectively force the controls to act in steps on the signal.

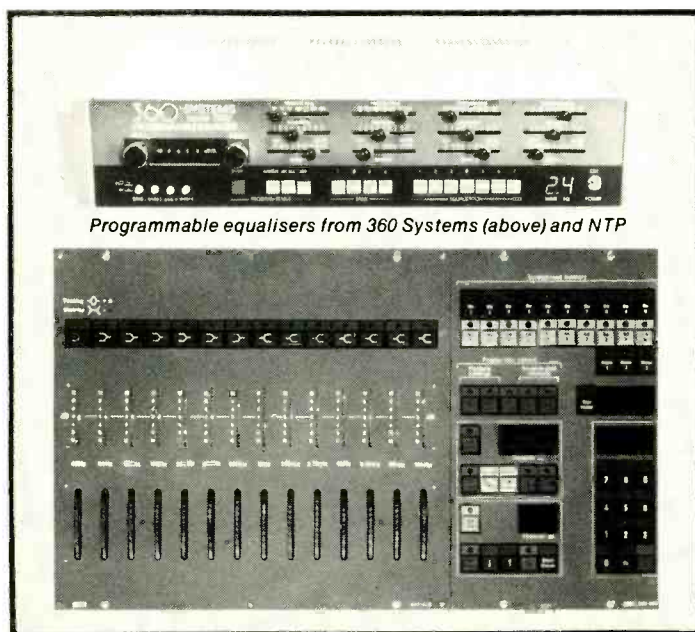
These steps are due to the digitising process coding a continuously variable signal as a number of increments of equal size. Of course it may be that instead of digitising an analogue type of controlling element such as a potentiometer, the controlling element may be rather similar to a calculator keyboard. In this case, it can be considered for the purposes of control as a digitised control in which the keyboard defines directly the steps involved.

Resolution

We are helped a little bit in a discussion of the range of control and resolution by those manufacturers brave enough to have products already in the market place. The systems which come to mind readily are the API system reviewed in *Studio Sound* in December 1974, the 360 Systems equaliser reviewed in July 1980, and the *Param* which is reviewed in this issue. Other manufacturers in the field are Audio Developments with an automated graphic equaliser, NTP, whose system was first shown in England at the February AES Convention in 1980, and Calrec who showed an interesting approach at the recent APRS show in London.

From a psychoacoustic point of view it is perhaps impossible to define limits for control resolution which will satisfy all ears. There will always be someone for whom a previously defined ideal is not acceptable. Anyway we have also to consider how this resolution is to be effected and to bear in mind the cost of doing so.

A fairly widespread limit on symmetrical cut and boost controls is $\pm 16\text{dB}$, and I cannot think of a sensible system which offers in excess of $\pm 20\text{dB}$. A system using this much



Programmable equalisers from 360 Systems (above) and NTP

boost is likely to run out of headroom quite fast. In fact, if both the headroom and the S/N ratio of the signal are to be maintained then the supply rails, normally around $\pm 20V$, would need raising to around 200V. Fairly mind-numbing if not shocking and definitely bad dream technology!

The matter of resolution remains. Your actual standard layman is said to be able to hear a 3dB change in level and should readily sense a 5dB change. I would have thought that there are perhaps a few engineers who are not able to detect a 1dB change in overall programme level. However there are perhaps hardly any who can detect a 0.3dB change—this is around the step size for automated faders—and engineers seem happy enough about it. Perhaps it also rather depends on how the control is used, for if the cut/boost control is rapidly moved then even 0.1dB steps may be objectionable. And again the control will affect only a fraction of the spectrum and so one might expect not to hear changes quite so readily. Perhaps, then, 0.1dB steps would be nice and 1dB steps may prove an acceptable compromise.

Here it is possible to insert the odd note from the engineering side of life. We are most likely to use a micro-processor somewhere in this system and most microprocessors which might recommend themselves for the job are those which handle their data and program as an 8-bit wide word, so it will seem quite sensible to allocate an 8-bit word to describe the state of each of the functions of an equaliser. Now an 8-bit word can describe 256 different states and we could use 128 of them to define boost and the other 128 of them to define the amount of cut. The step size, for a $\pm 16dB$ range would be 0.125dB. But there are other ways of using the descriptive power of an 8-bit word. For example, the most significant bit (bit 7) could be used to determine whether this particular stage of the equaliser was in or out of circuit and could thus be used also when the control was at its zero position. This reduces the resolution to 0.25dB steps, all 128 of them. To increase the resolution would then involve using two 8-bit words, but it takes longer to process two words than it does one and this is critical in a large system such as an automated mixing desk where response to any control setting has to take place within one frame (approx 40ms). But further, this larger control word has to be derived from somewhere, and if it is from the digitisation of an analogue control signal then an A/D converter with greater resolution than eight bits is called for, and that means more cost.

The resolution of the frequency control is not so easy. The musical ear is said to be able to hear a change of pitch of 1Hz at 1kHz but this is the ear's most sensitive region for pitch

detection. Although a resolution of 1Hz can easily be obtained with just two of the 8-bit words above and although there would exist a quite elegant technique for implementing this requirement in circuitry it does seem an excessive specification. Besides, the ear is more sensitive to ratios rather than absolute differences, so it would seem more sensible to divide up a frequency range in terms of fractions of an octave or even semitones—a resolution of $\frac{1}{3}$ of a semitone could cover the range from 50Hz to 8kHz in 256 easy steps—but the question is whether that width of range is desirable. If we limit the controlling word width to eight bits and further partition the word such that three bits are used to determine bandwidth and five bits determine frequency then we could set a resolution of, say, two semitones and achieve a 37:1 range of control, say, 50Hz to 1.8kHz. This would allow a 4-band parametric equaliser with a quite considerable range of overlap. Current directly-controlled types of equaliser are limited to a range somewhere between 10:1 and 20:1 partially by ergonomic considerations but also by technical limitations. The third variable control mentioned briefly above is the bandwidth, slope, or Q. The range of Q usually met with is somewhere between 0.8 (about 1.8 octaves, or a slope of 7dB/octave) and 4. There are units available which achieve Qs of around 8 (about 0.2 octaves or 36dB/octave). We could use, for example, the three bits of the control word described above to achieve eight steps of 33% each to cover a 10:1 range.

It seems that it is possible to define the state of a parametric equaliser stage by two 8-bit words. In fact, if we could tolerate the resolution of the cut and boost function being reduced to 0.5dB we could use bit 6 of that word to determine whether the stage was to have a bell or a shelving characteristic.

Control and display

Fig 1 shows an overall view of the kind of system approximately described. It is also time to consider what the controlling and display devices might be.

Controls seem to fall into two classes: self-indicating or absolute types and limitless non-indicating or relative types. Into the first category fall potentiometers, faders (even those with tame gekkos inside pushing the knob back and forth) and latching switches. Into the second category fall non-latching switches, shaft encoders, counters and continuous band devices like the Allison *Fabulous Fader*.

One of the functions of an automated item of equipment is that it can be made to set itself up to some previously defined past state. Of course it is terrifically handy for the

user to be told what that recalled state is and so a display of it is usually required. If the controls fell into the first category then there is no reason why their settings should tally with the newly defined ones, unless your tame gekko gets weaving. This causes a little bit of bother when it is required to update or modify the recalled settings. This leads into a system in which there are lining up LEDs for each control along with the necessary extra circuitry beneath the panel. This seems likely to be a major restriction on the way in which the control panel might be laid out.

Of course if the controls are not self indicating the situation is different. One of the pleasant new switch techniques to appear in recent years is the membrane switch element which is incorporated beneath the front panel. The front panel material is often 0.5mm thick polycarbonate sheet. This material is transparent and so it becomes possible to closely place switching areas and their related display areas. A parallel to this approach exists in the plasma display panels which have a touch sensitive surface. This brings the discussion round to display devices.

Most commonly used these days are LEDs. With their long life and small size and power requirement

they can be neatly fitted into tightly packed spaces and placed underneath transparent panels. Liquid crystal displays (LCDs) are attractive because if the potential number of units to be made is sufficiently large then it can become economic to have a custom-designed display. This display can be mounted on a front panel close to any controls and so helps to keep display and control topologically close and thus easier for the human operator to relate to.

An important display device has to be the television screen type. It can be made to show a large amount of information. An outstanding example of this approach in the present context is the display offered by the *Param* system in which the screen displays the frequency response of the equaliser. However, noting that the video industry seems to lead the audio industry in its use of advanced techniques, it is worth noting that Ampex, for example, have a touch-sensitive screen for their *ACE* video editing system.

Which combination of controls and displays is employed has little effect on the actual circuit techniques used to achieve the equalisation. There is a dependence on whether

FIG. 1 BASIC ARRANGEMENT OF AN AUTOMATED EQUALISER

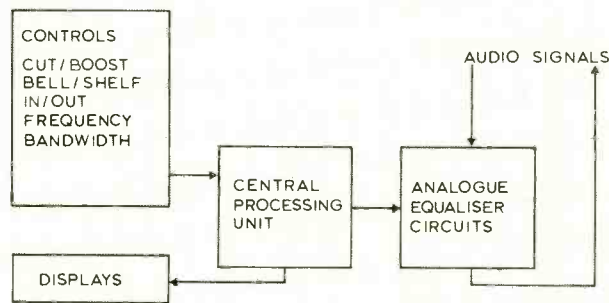
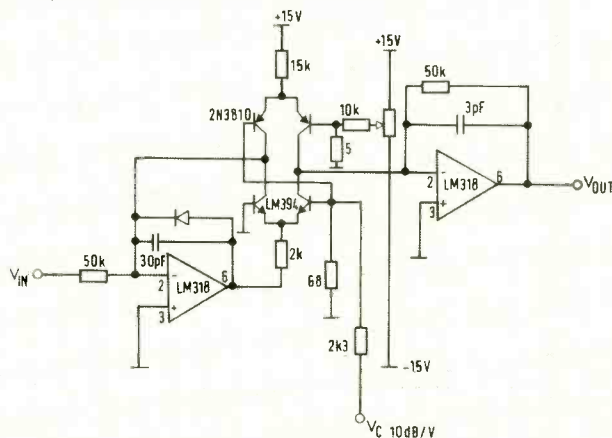


FIG. 2 THE BASIS OF A QUALITY VCA (AFTER NATIONAL SEMICONDUCTOR)



THE PRESET REPRESENTS THE MOST BASIC ATTEMPT TO REDUCE THE DISTORTION

Automated equalisation

there is intended to be one controller for many channels of equalisation, as in a mixing desk, or whether the equaliser is intended to be a stand-alone unit with perhaps a pair of channels only.

Controlling devices

Time now to think of controlling devices. What is needed is some accurate and predictable way of controlling a signal's amplitude without unnecessarily degrading it. It seems that there are two broad kinds of controlling device: continuous and switched. Within each of those a division between mechanical and solid state can be further defined. In the mechanical division there are the potentiometers with or without servo systems, and also the switches, relays, uniselectors and their like. In the solid state division there are the CMOS transmission gates, switching transistors, FETs, switched diode bridges, etc, and then there are the VCA types like the multiplier, operational transconductance amplifier, log-antilog amps, light

sensitive cells and the FET used as a linear (?) element. I suspect that at some time every one of these elements has been used in equalisers. However, viable designs are more likely to avoid the mechanical and electromechanical approach and to concentrate on high quality VCA designs and on suitable deployment of CMOS transmission gates and multiplexers—not forgetting that an entirely digital approach is likely over the next five to ten years. Fig 2 shows the basic scheme of a VCA. Here it is shown as a voltage in and voltage out circuit with a control voltage applied at V_c . The pleasant bonus is that if the second op-amp is removed then the output is a current and if a capacitor is substituted as in Fig 3 then a voltage controlled integrator will have been made. This basic block can be used in both the state variable and constant amplitude phase shift types of filters to create a filter whose centre frequency can be controlled by a voltage giving a control law of voltage versus semitones which will be a straight line. The filter can be inserted into the configuration of Fig 4. This uses yet another VCA to achieve the cut and boost function. The voltages for

these VCAs will need to be derived from the outputs of D/A converters under command of the central processing unit. Broadly the performance of the system is going to be dependent on the quality of the VCAs used. These days it is quite feasible to make VCAs with low output noise levels around -100dBu , with a signal handling ability of $+24\text{dBu}$ and a distortion of around 0.015% —all measured at 0dB gain. However the quick of mind may detect that the number of VCAs, and their presets and their D/A converters is likely to make this approach quite an expensive one. Cost reduction can be made by using cheap monolithic VCA chips but there is then a small sacrifice in performance. There is an alternative approach which avoids the need to have A/D converters for the controls and D/A converters to control the equaliser elements and a phalanx of humming VCAs.

The technique uses CMOS transmission gates and multiplexers. Transmission gates and multiplexers are quite cheap, require no presets, interface directly to the digital control word and can be employed in circuit schemes in a manner which

gives a performance indistinguishable from that obtainable from a conventional directly controlled equaliser. The basic concept behind the switching ideas was covered by Steve Dove's article in the January 1981 *Studio Sound*. The filter technique which lends itself to this approach is the state variable one. This is because all of the control nodes are situated at virtual earth points and so allowing a CMOS gate to be used in a manner in which it has no voltage across it. Fig 5 shows the kind of approach for one integrator element. A similar arrangement of gates around two further op-amps can be used to define the cut and boost rather as in Fig 6. This type of equaliser can have a number of side chains or bands of equaliser arranged around the parent equaliser element of Fig 6. There is of course some interaction between the paralleled stages which can be avoided by arranging that there is only one side chain per parent equaliser element and that further bands are added serially. Both approaches have representatives in the market place. The VCA approach is adopted by the 360 Systems equaliser and the switched approach by the *Param* equaliser. ■

FIG. 3 BASIC SCHEME OF A VOLTAGE CONTROLLED INTEGRATOR

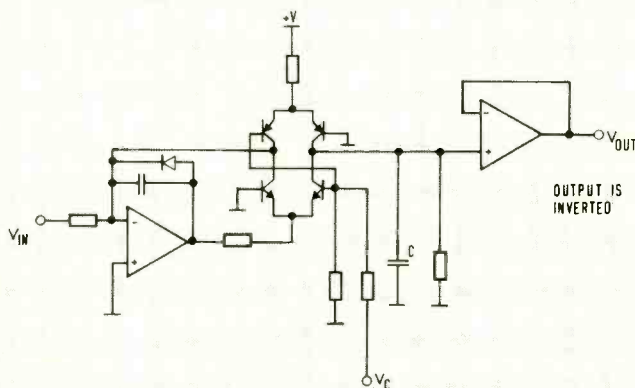


FIG. 5 THE BASIC SCHEME OF A SWITCH CONTROLLED INTEGRATOR

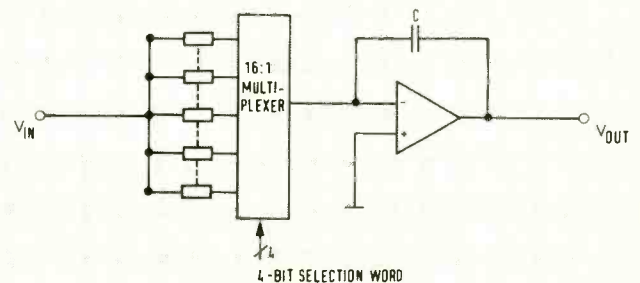


FIG. 6 THE BASIC APPROACH TO AN EQUALISER USING MULTIPLEXERS

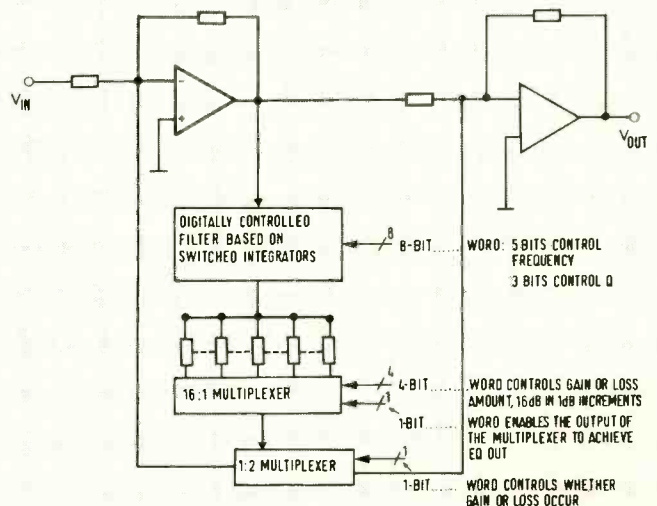
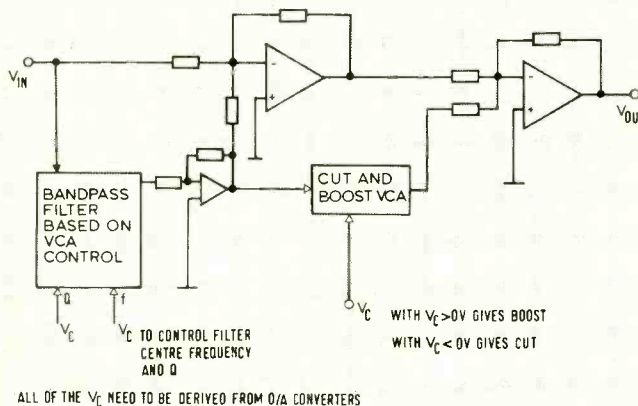


FIG. 4 A BASIC ARRANGEMENT FOR A VCA APPROACH TO AN EQUALISER



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Tape levy

Six manufacturers of blank tape have formed a trade group to fight the record industry's cry for a levy or tax of up to £3 on each blank audio cassette tape sold in the UK. The Tape Manufacturers Group is chaired by Bill Fulton, managing director of Sony UK and represents the six major suppliers of blank tape in Britain: Sony, BASF, 3M, Maxell, Memorex and TDK.

The group is a breakaway from the European Tape Industry Association which has for two years failed to agree on a policy over the vexed question of home taping. Each of the six companies has contributed £10,000 to a central fund for anti-levy publicity and market research to refute the record industry's claims.

The record companies, led by their trade body the British Phonographic Industry, blame poor record sales on home taping, and claim a loss of nearly £1m a day. The six companies now making up the TMG believe that the problem of home taping "has been grossly overstated". Two other tape companies, Thorn-EMI and Philips, also have vested interests in the record industry and resisted the ETIA's plans to lobby against a levy. Predictably, neither Thorn-EMI nor Philips has joined the TMG. BASF's representative failed to show up at the inaugural press conference.

The breakaway group admits that it has been slow to answer the BPI's claims because "never in our wildest dreams did we think anyone would be mad enough to take the idea of a levy seriously".

The TMG aims to alert the public to the anomalies which a tape levy scheme will create. Legitimate users of tape will be penalised. Authors and journalists will expect a comparable tax on all blank paper suitable for plain paper copying of their copyright books and articles. The already profitable trade in counterfeit tape (poor quality material dressed up to look like famous brand name cassettes) would effectively be granted a licence to print even more money; the counterfeiters will forge the levy stamp as well as the packaging and pocket the extra cash.

The main thrust of the TMG argument is that the BPI's figures for record industry loss have been "plucked far from the air and the public expected to foot the bill". So far the BPI has declined to explain how its figures for industry loss are arrived at, for instance by revealing the size of the samples used for its market research. But in a significant about-face the BPI has now approached the TMG and offered to accept any figures provided by the tape companies on record industry loss as conclusive, provided that the terms of reference can be agreed in advance. The BPI had previously refused even to discuss the matter of loss estimates with the tape companies unless they would agree in advance to the imposition of a voluntary levy, with proceeds made available to the record industry.

Copyright Green Paper

Well, the Green Paper on copyright is finally published. And as everyone and their dog doubtless now knows, it firmly rejects the idea of a levy on blank tape to recompense the record industry for its poor sales. The decision astonished everyone, especially the BPI who by a process bordering on a transcendental self-

hypnosis, had managed to convince themselves that everything they had said over recent years about lost sales and income through home taping *must* be true and therefore the government *must* back them with a levy. The press and public, who over recent years have been suckered into believing the BPI's propaganda, were also shocked. Those with a cooler outlook were less shocked, realising that not all governments are as stupid as the BPI seemed to be assuming. But leaks over the months preceding the Green Paper had pointed to guarded recommendation for a levy. Who knows, perhaps the leaks were accurate but the government policy-makers changed their mind at the last minute; or perhaps the leaks were all part of the industry's propaganda campaign designed to create the idea that the levy was a *fait accompli*.

Publication of the Green Paper is a watershed for the British record industry. It now has two ways to turn; either accept the government's *no-no* on a levy and concentrate on improving the industry's image to boost sales *or* fight the government. To accept defeat gracefully would involve taking up all the options previously rejected, like for instance aiming for consistency of quality, price and availability of records. (*Hear, hear! That's the real problem—Ed.*) This would encourage the public to buy recorded music again and make it easier for them to find what they want without hassles and without the suspicion that they're being gypped.

In other words the record industry would have to become competitive in the current cold climate of recession. Unfortunately, but predictably, it looks as if the record industry is again going for the easier option and campaigning for support to persuade the government to change its mind and give support for a levy. Pigs will more likely fly, so the campaign can only do yet more harm to the industry's tarnished image and poor prospects for the future.

The Green Paper contains a political master stroke. For years the BPI has been talking about a spoiler, to bury in recorded music and prevent home taping. They spent £10,000 on a report by the Wolfson Unit of Southampton University which told them what most people on the Clapham bus could have told them anyway, namely that a spoiler is possible but impractical. The BPI stubbornly refused to release the Wolfson report even though it would have stopped people dreaming of a spoiler and saved other researchers around the world wasting time and effort on re-inventing the same old dead duck ideas. Release was vetoed because the report was an embarrassment to the BPI. Why on earth did they need to spend £10,000 to be told such simple technical facts people would have asked. "There is obviously no question of us abandoning the search" the BPI told the national press.

The spoiler red herring soon surfaced again. In the Summer of 1980, the Bron Organisation claimed to have developed a spoiler which would be demonstrated in about three weeks time. Over a year later there had still been no demonstration and Bron will say only that the research is in limbo. Now there are reports in the music press of a new spoiler from the USA!

In fact by talking technical nonsense about spoilers, the BPI and the music press gave the

Government a golden opportunity for a cop-out. The Green Paper rejects the idea of a levy but still appears superficially sympathetic to the industry's plight by promising legislation to ban anti-spoiler devices if ever a spoiler system is developed. The government of course knows full well that an anti-spoiler device wouldn't be sold under that name. It would be a filter buried in the circuits of every tape recorder produced by Japan or in a black box labelled as something like an interference suppressor. The level of the industry's understanding of spoilers is probably best summed up by the recently reported comments of Monty Presky, co-Chairman of the BPI's Technical Committee. "What we want is something just outside audio range but within dubbing range" Presky told the music press after publication of the Green Paper. Has Mr Presky never heard of filters and gates?

The BPI is now in an hilarious cleft stick. If it wants to lobby further for a levy it must prove that spoilers are impractical and this will involve releasing the Wolfson Report. The next move is yours BPI. To use royal parlance "one" would hope that the BPI would now recognise its gross tactical errors over recent years and start on a more constructive tack. Support for a levy has actually been *lost* by the BPI's outrageous claims of losses due to home taping, its scientific ignorance, and its arrogance to all but the most obsequious journalist. This is clear from the Green Paper. While claiming that record sales lost due to home taping now touch £1 million a day, the BPI would never talk about the market research techniques used to produce these figures. For all we know they could have asked everyone in England, or one woman with a shopping basket outside a supermarket. But while refusing to release such information, the BPI still talked about measuring the losses. You can fool most of the people *etc, etc*, but not it seems, the British government who with remarkable frankness simply concluded that "sales lost as a direct consequence of private copying cannot be precisely quantified".

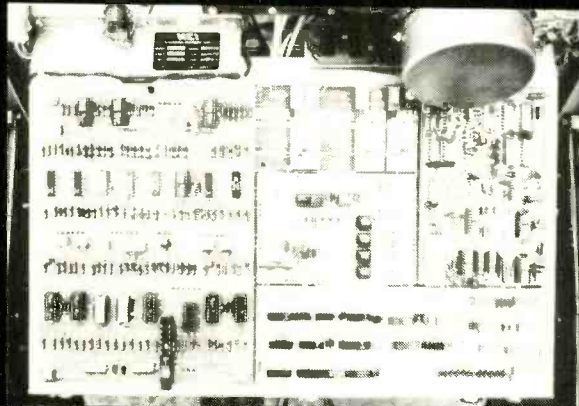
The music press recently reported on the BPI's campaign against cheap imported records. The thrust of the argument is that these are of inferior quality and thus give British pressings a bad reputation. It was said that the BPI's full time Scientific Officer (can they really have one?) found literally hundreds of defects on a rubbishy imported pressing. Fair enough, but then he turned his attention to a British pressing of the same album. This had 31 defects; 19 minor clicks, 10 clicks and two scratches. Is this really something to be proud of?

Finally a depressing pointer to the future. Shortly after the Green Paper was published, LBC ran a live Saturday night phone-in on the Green Paper and home taping. LBC phoned me on Friday lunch time with an invitation to be in the studio. I accepted. LBC also phoned the BPI offering them the opportunity to participate. The producer even gave the BPI his home telephone number. Believe it or not, even with more than 24 hours notice, the BPI couldn't find a single person prepared either to come to the LBC studio on a Saturday night or contribute by telephone. So, the record industry was once again roundly and soundly attacked on the air without a word of industry defence. ■

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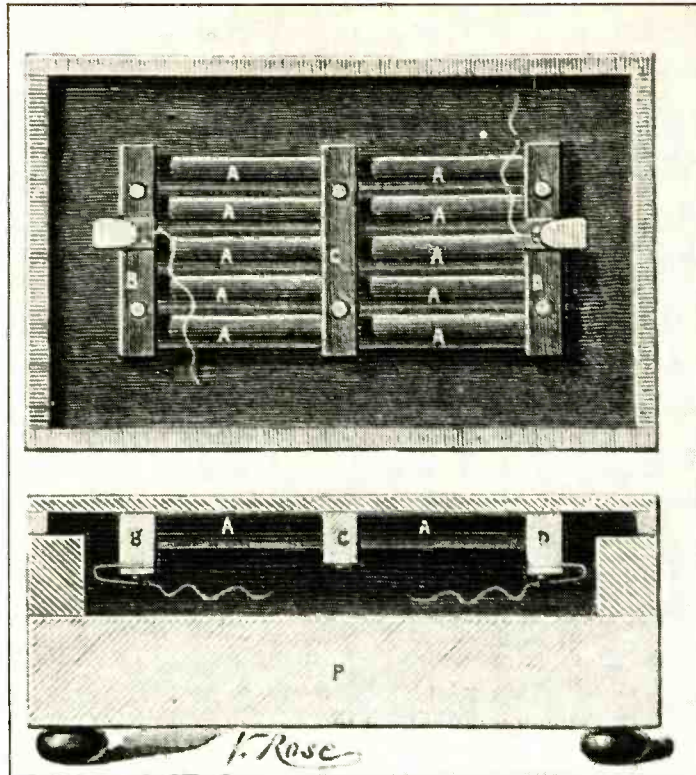
Ader

formed up of those wishing to be present and this continued until the end of the Exhibition. Though there were some unenthusiastic people who tried to throw cold water over the achievement, wishing to protest in the name of Art against musical reproduction, almost everybody with an open mind was overjoyed and professed to have heard better than had they actually been present at the Opera House which may be easily understood if you reflect that the transmitters were interposed between the singers and the orchestra and this favoured the singers whose words were heard admirably.

Transmitter

"One may see a longitudinal section through the device and the view from below shows it to be the same transmitter used throughout the General Telephone Company's network. Each is made up of 10 small carbon rods AA arranged in two groups of five and supported on three crosspieces BCD fixed to a small sheet of deal which receives the vibrations and at the same time serves as a cover for the apparatus. It is fixed to a leaden base P and supported on four rubber feet in order to prevent vibrations from the floor of the stage getting to the transmitter.

"The receivers of M. Ader are electromagnetic, the magnet being curved into a circle which serves at the same time as the handle for the instrument. Up to this point the receiver is the same as the Gower and Siemens telephones. M. Ader has added to these telephones a soft iron ring F placed in front of the



Ader's microphone design showing rods (A), crosspieces (B) and lead weight (P) sitting on four rubber feet (L'Illustration)

vibrating diaphragm, to which he has given the name *superexciter*. The presence of this superexciter has the effect of modifying the character of the magnetism to give perpendicular direction to the lines of force towards the surface of the diaphragm rather than allowing them to take a diverging direction. As a result, the variations produced in the magnetic attraction by the inductive currents which occur in the coils have a maximum effect on the diaphragm, the centre of which

is placed in the intense magnetic field perpendicular to the lines of force. The telephone is thus more powerful and more sensitive to the delicate nuances of telephone transmissions."

The opera that gains the distinction of becoming the first to be relayed in 'stereophony' is, without much doubt, Meyerbeer's *Robert le Diable*, which was, according to the Paris Opera schedules, presented on August 26th, the first night of evening opening and this is confirmed by

L'Illustration. A happy coincidence, for it was the original production of that work in 1831 that made the Opera House's fortune.

Problems

Little has been recorded about any transmissions from the Opéra Comique; this was in fact shut until September 1st. The relays from the Théâtre Français ran into technical trouble, although mention is made of hearing some speeches from *Le Monde ou l'on s'enemie* which was still running.

Up till now it has not been so successful as the relays from the Opéra, principally caused by the conditions around the footlights, where, at the Francais, they are close to flaming jets which produce loud and annoying currents of air.

L'Électricien

wrote M. Hospitalier in *L'Électricien*. That particular account ends:

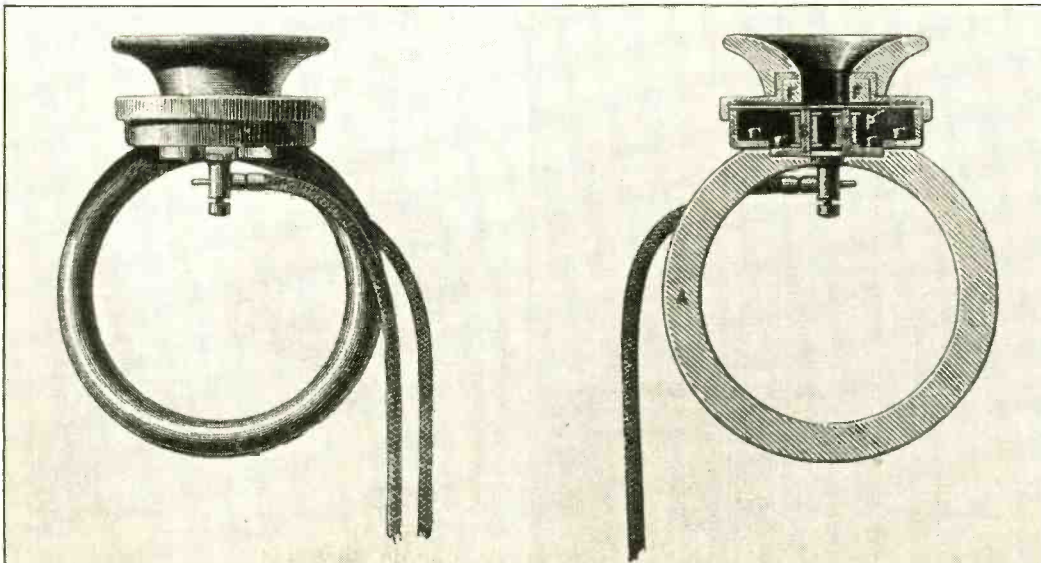
"How can one give an account of the impressions gained by the visitors to the telephone hearing sessions? One needed to have heard the indescribable effects to really have gained an idea and we sympathise with all those who were unable to take part in this demonstration, the only one of its kind in the world.

"Several people played a part in its success, but the highest praise must go to M. Ader who had developed the Hughes microphone to its practical state. The Minister of Posts and Telegraphs who had kindly allowed M. Ader the use of the lines necessary for this memorable demonstration, M. Berger and the General Telephone Company who had organised the demonstrations and M. Bréguet who had constructed the equipment also merit our thanks and commendation. Without wishing to diminish in any way the worth of the numerous marvels that were contained within the Palace of Industry, one may say that the telephone hearings constituted the greatest attraction for the public and would have alone assured the success of the Exhibition, though this was never for one instant in any doubt." (Author's italics.)

To be concluded

Antony Askew is senior music studio manager, BBC Radio and editor, Institute of Broadcast Sound.

Full view and cross section of the receiver





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This front-end design ties in with two previous articles in this series: Part Four (December 1980) where it fulfils a logical extension and practical conclusion to the design philosophies expounded there, and Part Eleven (September 1981) where it completes the entire channel system from mic in to mix out. It would seem a bit lonely without the support and context lent by the two other articles.

Origins

The mic-amp is a somewhat developed version of a basic front-end design (Fig 62) which is in grave danger of becoming an industry standard. The precise origins of this rather clever two op-amp arrangement are obscure, but it's been around a few years.

Initially most striking is the manner in which a single-track potentiometer is used to simultaneously vary the gain of two amplifying elements — the front-end, non-inverting stage and the succeeding inverting amplifier. Since the first stage is (as far as its inputs are concerned) a conventional non-inverting amplifier, transformer input coupling is not any more problematic than with simpler mic-amps (eg Fig 21, December 1980).

With maximum gain distributed between two stages, large gain is possible without any danger of running out of adequate steam at high frequencies for feedback purposes. This incidentally also makes for reasonably simple stabilisation of the amps.

Other than the obvious neatness of one-pot gain control, two nice features are inherent in the design which are delightful from the points of view of system level architecture and of operation respectively.

Console input stages largely determine the measurable performance standard for the entire system — the quoted noise, distortion, bandwidth and phase characteristics. How these relate to how the console sounds is an altogether separate affair — optimisation is not the same as maximising or minimising parameters.

Level architecture

System level architecture is largely concerned with operating all the elements of a system at the optimum levels and/or gain for noise and headroom, ie at a comfortable place somewhere between the floor and the ceiling. Where gain is involved, it's important that the resultant noise be due primarily to the gain stage that has been optimised for noise (or rather lack of it) such that it can then mask all the other hopefully minor contributions. At no point in the gain swing — particularly at minimum gain — should it be necessary to attenuate away unwanted residual gain. The amount of attenuation gets directly subtracted from overall system headroom — what good is 24dB of headroom everywhere else, if you've only got 16dB in the front-end?

In this respect circuits similar to Fig 62 score well. The graphs of Fig 63 show why. Fig 63a represents the gain in dB of a simple non-inverting amp varying with the percentage rotation of an appropriately valued linear pot

in its feedback leg. This is like the gain/rotation characteristic of the first amp of Fig 62. Similarly, Fig 63b is the gain/rotation plot for a linear pot as the series element in an inverting amp, such as the second gain stage of Fig 62.

For the first half of the rotation, the first stage provides all the gain swing and most of the gain, only about 6dB being attributable to the inverting stage at mid-point. Toward the end of the rotation, the position reverses with the front-end remaining comparatively static in gain, the extra swing and gain coming from the inverting stage.

Noise criteria are met, since the first (optimised) stage always has more than enough gain to allow its noise to swamp the second stage with the exception of at minimum gain. There it hardly matters anyway because the front-end noise contribution is going to be at a similar level to the overall system noise-floor ie *really* quiet! The impedances around the second stage largely determine that amp's noise

performance and this is such that it need not be considered in relation to input noise at any sensible gain setting.

Headroom is satisfactory as no attenuation after the first gain-stage is needed for any gain setting.

An operation goody can be gleaned from Fig 63c. This is the combined gain/rotation curve for the total two op-amp circuit. Note that for a very large percentage of rotation around the middle (where it's most often used) the dB gain change per rotation is as good as linear. It just gets a bit cramped at the top and bottom but you can't win 'em all.

For reference a little later on, it may be noted that there are two available resistors R_2 and R_3 which may be used to modify the gain structure independently of the potentiometer.

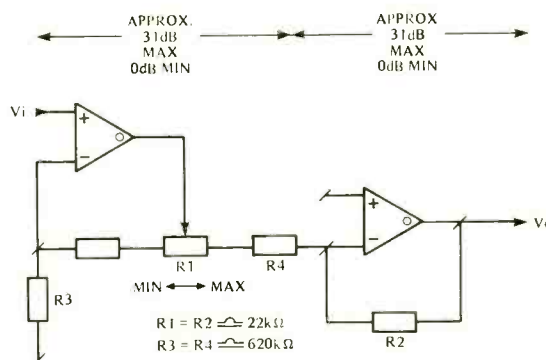
As a microphone amplifier, the fairly high optimum source impedance of the op-amp used (a Signetics NE5534 in this instance) has to be matched to the likely real source impedance of some 150 to 200 Ω . No apologies are offered for the use of transformer input coupling (Part Four, December 1980).

A Sowler type 3/95 (1:7 ratio) is used here. Many circuit values (marked with an asterisk in Fig 64) — some in some quite unexpected places — are dependent on the specific transformer type in use. Other excellent transformers, notably the Jensen JE-115-K, can be very successfully used provided the differing ratios are taken into account in level calculations. Phase and response trimming values will vary significantly — with Deane Jensen's JE-115-K it is in fact simpler than with Dr Sowler's.

Despite the circuit's apparent simplicity, a lot of effort has gone into defining the front-end bandwidth and straightening out the phase response at audible extremities. Taming the hf resonance is quite tiresome.

On the front of the transformer hangs the usual stuff to make the mic-amp useful in this world of capacitor microphones: a 20dB input attenuator and phantom power —

FIG. 62 BASIC MIC-AMP DESIGN



48V via 6.8k per leg carried common-mode along the mic line. This should see to all-comers.

A line-in option is brought in via the transformer also, featuring far stiffer input attenuation (about 36dB) whilst simultaneously disabling much of the gain swing of the first amp. The resultant gain swing of 35dB (between -25dBu and 10dBu input level) with a bridging-type input impedance of some 13kΩ should accommodate most things that the mic input or machine-return input differential amp can't or won't. A small equalisation network is used in the attenuator to bolster up the extreme LF phase response.

Common-mode rejection in the transformer is dependent mostly on the physical construction of its windings. The Sowter, in common with most other transformers, may be in need of compensation by deliberately reactively unbalancing the primary winding. Jensen transformers are uncannily good in this respect — no tweaks usually being necessary.

Less than perfect CMR shouldn't cause any ill manifestations in a typical recording environment with fairly short input leads. A high rf field of any sort, or an application with very long leads or worse yet, a multicore, is far more likely to create problems with untrimmed inputs than with those properly balanced. Vulnerability is greatly increased to all types of common-mode nasties including noise on the phantom power supply feed. Indeed this is a common compounding of faults on a desk that exhibits consistently noisy inputs.

A minor compromise is necessary in the first stage to prevent it gasping with exhaustion on extremely high input levels. Ideally, the op-amp's output has to look into an impedance of 600Ω or greater (this being the lowest impedance it can drive full output voltage swing into). Maximum gain state isn't really a problem — if the first stage was gasping out of puff into the second stage input stopper resistor, the filter output would be some 30dB into clipping and someone might notice.

No, the dodgy bit would be at minimum gain where the first stage is operating almost as a follower, its output load being some 770Ω of the remaining feedback path to ground. That's safe. Unfortunately, it would be nicer if that small resistance were a lot smaller since it is contributing unwanted thermal noise to the otherwise beautifully optimised front-end. Before you rush for the smelling salts, the degradation in calculation is only minor points of a decibel and in practicality is easily lost in the grey mist that always surrounds the marriage of calculation with practical noise measurement.

The idea of using a front-end stage that turned into a follower under operating conditions did cause trepidation at first but it has proved

stable without any obvious trace of ringing within its bandwidth. This is probably because it is only being asked to look into safe cosy unreactive loads. The most horrid and evil things that will make any incipiently unstable circuit squeal in horror have left it quite cold — amongst the instruments of torture have been pulse generators/storage scope and rf sweep generator/spectrum analyser. The 22pF compensation capacitor is more an act of conscience than a practical necessity.

Down from the nether world of Megahertz, the mic-amp is quite stable at audio even with the mic unplugged and input unterminated; the input 'zorbal' is designed to work in conjunction with the fairly low input impedance of the 5534 (150kΩ the book says).

The limiter

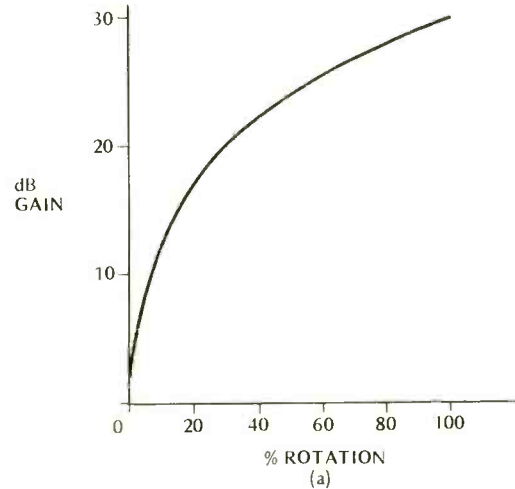
Elaboration on the simple two op-amp mic-amp element consists of arranging an automatic gain control element in the feedback loop of the second amplifier and following that with a variable turnover frequency highpass filter.

A photo-resistor device has its resistive end strapped across the normal gain determining feedback resistor. Its resistance drops in value from very high (MΩ) inverse relation to the photo-diode current to a limit of around 300Ω at about 20mA diode current. This resistance swing provides plenty of gain swing in the second amp for use in a peak limiter arrangement.

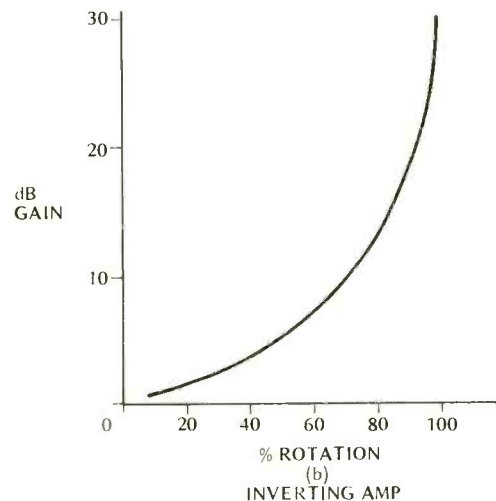
Selectable to be able to pick off from either the highpass filter output (as an input limiter) or from after the post-eq breakpoint downstream (as a channel limiter) the limiter side-chain is true symmetrical peak-detecting. A positive-going and a negative-going level detecting comparator are switchable between 'clip' detection (2 to 3dB before system headroom) or 'programme' level (nominally +8dBu but actually internally tweakable up and down).

A bi-colour LED blinks red to indicate limiting in action and when the limiter is disabled, it blinks green to signify that the selected level (clip or programme) is being reached or exceeded. In this 'indicate' mode, the limiter integration time-constant is deliberately shortened to make the green flashing similar in character to the red flashing in 'limit'. (The difference is due to the nature of servo-loops, of which a feedback limiter such as this is an example. In limit, the loop is self-regulating, the gain-control element holding back the audio level so that it's just tickling and 'topping up' the side-chain. In indicate, the loop is broken and there is no such regulation. The green light stays on whenever the threshold is exceeded and tends to hang on for a bit whilst the time-constant capacitor

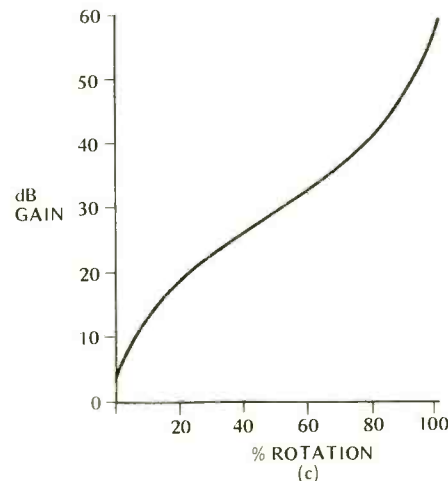
FIG 63 GAIN vs ROTATION FOR LINEAR POT



GAIN FOR NON-INVERTING AMP



INVERTING AMP



COMBINED NON-INV AND INV GAINS AS IN CCT OF FIG 62

Mixing console

discharges. With even a minor overload, this hangover can extend for quite a few finger-drumming seconds — hence the shortened time-constant.)

As an experimental aid both the attack and release time constants for the side-chain are on presets although it's suggested that once comfy settings are found, fixed value resistors of the measured value be substituted for them. Two reasons: good presets are unbelievably pricey these days; trying to get a number of channels exactly the same by ear is a mission for fools.

One thing this limiter isn't, is subtle, being designed primarily as a protection limiter. The comparators deliver a rail-sized wallop to the integrator upon threshold, softened a bit by the attack preset in conjunction with the comparators' output impedance. This rather unusual approach is to help 'wake up' the photo-resistor which has a relatively leisurely response time — the combination can be adjusted to slow enough that it doesn't clip whilst fast enough to prevent an audible *snatch*. Overshoot is generally well within 1dB on normal programme, given a

release time long enough to prevent ridiculous pumping.

As a rough guide, if it's intended to use the limiter for sporadic transient protection it's best to aim for short attack and release times, bearing in mind that such settings will behave more as a clipper to the lower frequencies. For continual effect use, longer time constants will be less grating and more buoyant. This side-chain arrangement certainly behaves differently to more conventional FET or VCA linear proportional systems and needs a slightly different approach in setting up.

From a design viewpoint, there is an awful lot of spikey current hammering about — into the integrator and through the LEDs of the indicator and photo resistor. This current is kept well away from ground, where flowing through the low level mic-amp ground path it sounds reminiscent of only slightly louder than a machine gun. Best to keep it all in the supply rails, where it belongs

Highpass filter

Constructed around the front-end's line output amplifier is a second-order highpass filter. It is a completely ordinary Sallen & Key type filter,

arranged to use a dual-gang equal value potentiometer to sweep the 3dB-down turnover frequency from between 20 and 250Hz. A click-stop switch at the lf end (anti-clockwise) negates the filter, replacing it with a very large time constant, single-order dc decoupler. The filter and the decoupler are both tied to reference in order to minimise clicks — fortunately the TL071 used in the filter uses barely any input bias current, so there is little developed offset voltage from that source to worry about.

Being an equal-value filter, the Q or turnover would be very lazy indeed if the feedback were not elevated in level to compensate for the upset resistor ratio. Here a compromise is struck. A low Q gives a very gentle roll-off and not very rapid turnover, but causes least phase disturbance. A high Q gives fastest roll-off at the expense of frequency response — pronounced bumps — and frantic phase response exhibited as ringing and smeared transients. Just like your monitors. Oops, sorry.

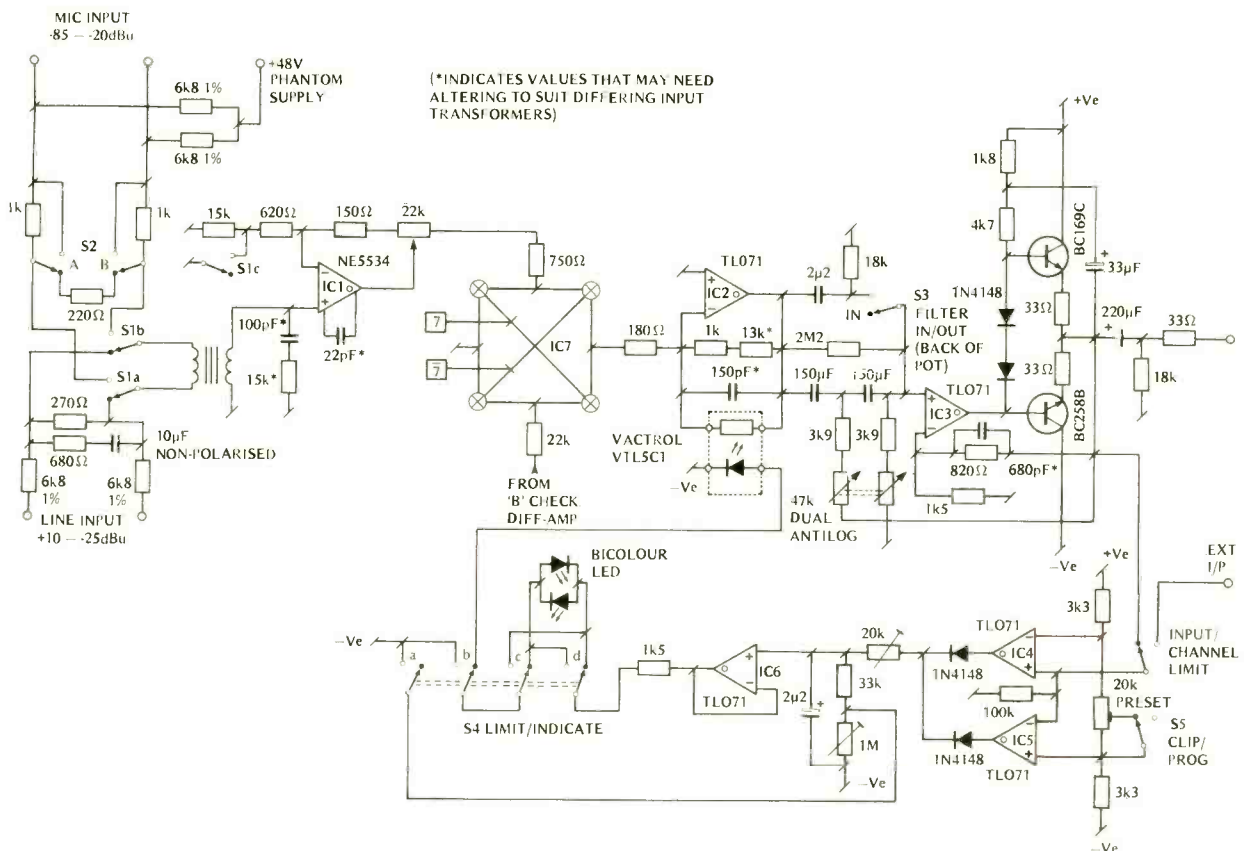
An uneasy medium lies where the in-band frequency response is maximally flat and for this a feedback hoist of around 4dB is needed. This gain is taken across the filter as a

whole, with the second stage of the mic-amp arranged to sustain a 4dB loss to compensate — it all works out in the end, with no compromise of headroom. With minimum gain set, there is still about unity electronic gain front to back. An added convenience of gain is that it provides a better chance of shoring up feedback phase margin — quite important in a line-amp that may have to drive a lot of heavily capacitive cable. Also, it provides yet another single-order lowpass pole to help iron out the mic transformer's hf resonance!

Where does it go?

Somehow or other, this fine front-end has to get glued into the channel system. That is what the analogue CMOS switcher is doing in the middle of it. It is the self-same switch that is looking lonely in the top left-hand corner of Fig 57a (September 1981). The switch's purpose is to route either the mic-amp or the machine return ('B'-check) diff-amp output into the main signal path under command of the channel-mode switcher via the PROM interpreter. Unity gain from diff-amp output to filter/line-amp output is achieved by the appropriate switch-source resistor. ■

FIG. 64 CHANNEL INPUT AMPLIFIER, HIGHPASS FILTER AND LIMITER



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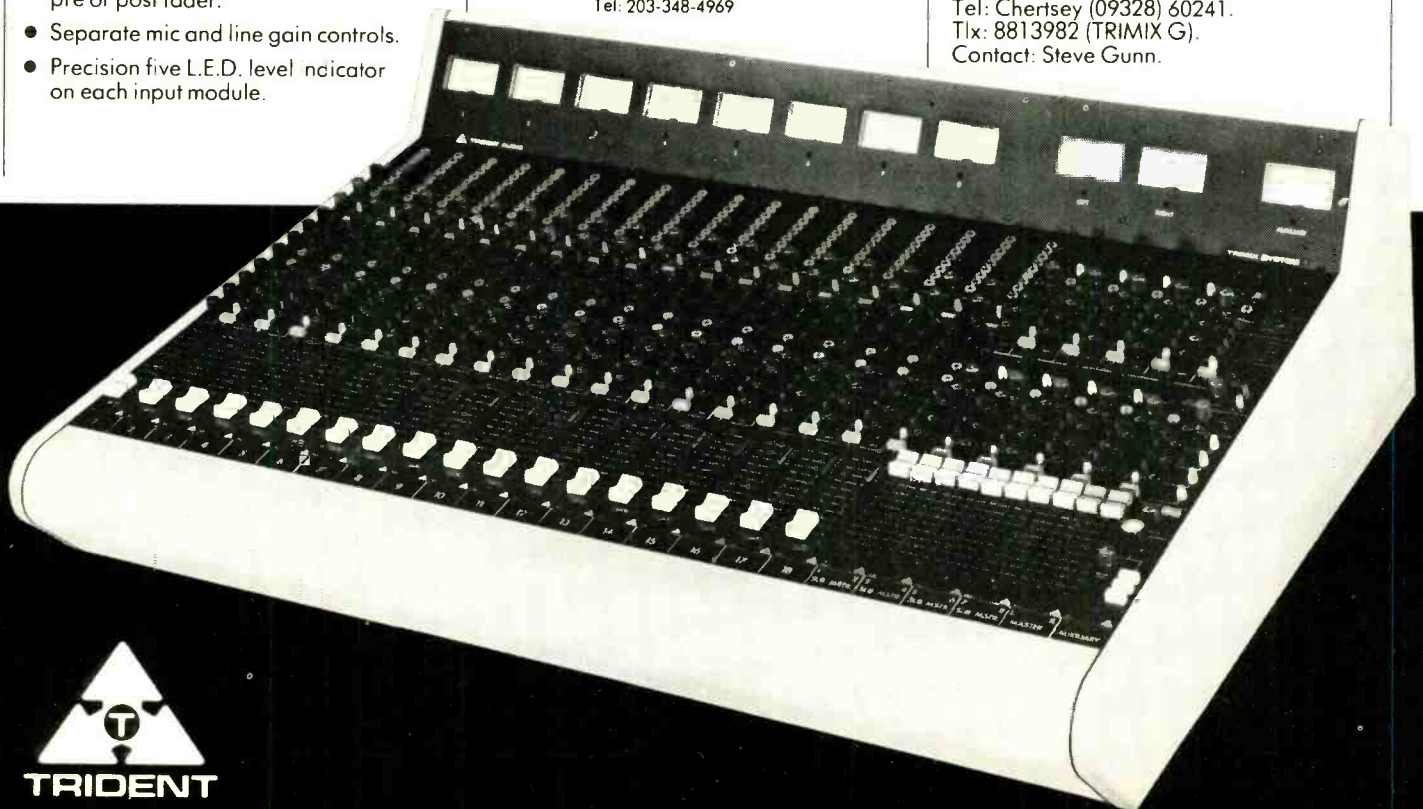
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Param equalisation system

THE *Param* equaliser system can contain up to 64 channels of 6-band (low, high, mid 1, mid 2, low cut and high cut) equaliser units which are completely controlled by a dedicated microcomputer. The system supplied for review housed the equalisers, computer and the generous power supply in a 4ft rack unit, a monitor television housed the equalisers, computer and the generous power supply in a 4ft rack unit, a monitor television and a long lead feeding the small control panel.

The computer — a dedicated *Apple II* — and the power supply are mounted in one 6U rack-mounting unit normally placed at the bottom of the rack. The power supply is of conventional design and is capable of supplying no less than 5A each at $\pm 24V$ and vast amounts of 5V. All the supplies are properly fused and crowbar protected. A conventional design was adopted despite the requirement for massive 500VA transformers, because of the danger of RF radiation had a switched mode type of supply been used. The power supply has a cooling fan which is extremely quiet in operation, with rectifiers and regulating transistors mounted in a sort of tunnel to optimise the cooling this provides.

Above the power supply, but in the same rack unit, the *Apple II* microcomputer is mounted, one slot in its backplane being occupied by a card containing the system firmware, which has been re-written specifically for the *Param*, and another containing the required interface hardware. The front panel of this unit has the main power switch and a reset switch for use in the unlikely event that the computer should 'hang'. If RESET is pushed accidentally, the system does not lose all the data stored as it would in the event of a power failure. The rear panel of the power supply has four multiway connectors to supply power to up to four equaliser racks, a socket to connect the data bus ribbon cable to the equaliser racks, 3-pin *XLR*-type connectors to and from the tape (or cassette) data storage system, a connector to the control panel, and a *BNC* connector for the video monitor. Mains is brought in via a 3-pin *IEC* mains connector above which is mounted the 5A mains fuse and the fuses for the various dc supplies. Three large terminals provide separate access for the equaliser ground, the processor ground, and the case and safety ground connection, so no problems should be experienced with ground loops when installing the unit in the already complex studio environment. The opening for the cooling fan is on the back panel,



Manufacturer: Leunig, West Germany.
Europe: R Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76, West Germany.
UK: Eela Audio Industries Ltd, 13 Molesworth, Hoddesdon, Herts EN11 9PT.
USA: Audicon Inc, 1200 Beechwood Avenue, Nashville, Tenn 37212.

and has an adequate finger guard. A reasonable airflow must exist around the power unit for all this to work effectively.

The equalisers are housed in 3U rack units, each capable of containing up to 16 channels. Each rack unit has a lid on the front of the unit allowing easy access to the channel cards, and has four multiway connectors for audio on the back. Each of these carries the inputs and outputs for four of the channels. Other connections on the back of the equaliser units are the multiway for the data bus and the (big) dc supply connection. The audio and power multiways are made by Tuchel and have locking devices to avoid accidental disconnection. There is also a large terminal for the equaliser case ground. All connections to this and the power rack are clearly marked (in English) and the standard of construction of the complete system is superb, obviously the result of extensive thought and attention to detail. For example, each panel on the unit has a unique mark on it and an adjacent panel. Thus on reassembly of the unit, aligning these marks will obviate panels being put in upside down or in the wrong position. All front panels are enamelled in an emerald green and

markings are tastefully embossed so that the complete unit exudes a quiet, efficient and professional feeling.

Equaliser boards

Each channel has a 6-band equaliser unit mounted on a long mother card providing shelving bass and treble sections, and two overlapping mid band sweep sections of constant Q. The mother card contains all the circuitry associated with address decoding and other matters digital on it (including a DIL switch which allows you to set the channel number). The audio signals are led through this card to the three main equaliser boards, one for each mid band sweep equaliser, and one for the bass and treble shelving equalisers. All the boards are double-sided, showing evidence of great care in draughtsmanship, and are well thought out and constructed. The audio circuits use very high precision resistors and capacitors and 5534 high performance op-amps and 'minimum path' circuit configurations are used throughout the system. Each channel has on-board power regulators and is specially designed to minimise the possibility of data leaking into the audio path. The data bus is also subject to careful waveshaping to minimise digital crosstalk into the audio. This seems to work well as I heard no evidence of this happening. The equaliser sub-boards plug into the channel mother board so that the component sides face each other, thus each channel appears as a rugged sandwich. This method of construction means that other configurations could be supplied if different characteristics were required. There is provision on the mother board for an extra card, which was not supplied with the review unit. This can either be used for the balanced outputs option (the system is supplied with balanced inputs and unbalanced outputs as standard) or can have a limited range VCA on it and the required switching for a 10-band spectrum analyser option.

The bass section of the equaliser is of a shelf variety with four frequency settings. Rough measurements indicated that the $-3dB$ points were at 58, 77, 94 and 120Hz with 12dB/octave slope. Extreme frequencies are rolled off from about 20Hz and (more gently) at about 27kHz. The bass cut section is roughly symmetrical with the above but does not shelf.

The treble section of the equaliser is similar in

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concept, the -3dB points occurring at 5.5, 7, 9 and 10kHz, also with a 12dB/octave slope. As with the bass section, the cut curves are similarly symmetrical although no shelf occurs.

The two mid-band equalisers have a choice of 16 peak frequencies, those of the lower section being at 150, 300, 450, 600, 700, 850Hz, 1.1k, 1.2k, 1.3k, 1.5k, 1.7k, 1.8k, 1.9k, 2.1k and 2.2kHz. The upper section covers 500Hz, 1k, 1.5k, 2k, 2.4k, 2.8k, 3.3k, 4.2k, 4.8k, 5.4k, 5.8k, 6.3k, 7.2k and 7.8kHz. The Q of the filters is not adjustable and is constant throughout their sweeps.

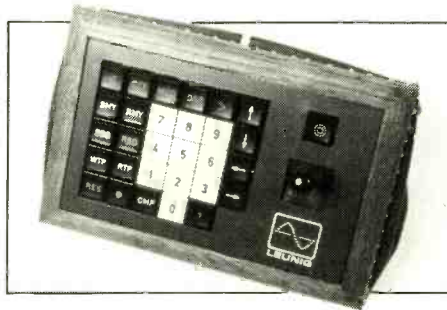
All the sections can boost or cut by a maximum of 16dB in 2dB steps. I found that the maximum boost attainable was well matched throughout the frequency range, a maximum of 1dB gain variation being apparent between sections except in the case of the lowest frequency bass boost setting where the rumble filter must have interacted. A channel overload warning is indicated on the monitor screen if the level exceeds +20dBV, the warning being given a few dB before clipping actually occurs. I found that the equalisers were pleasant to use, no harshness being apparent unless full mid gain was used — this is no doubt due to the relatively low Q chosen for the circuit. The bass and treble sections were also good to use and it is interesting to note that the 2dB steps did not actually prove as coarse to use as reading the specifications would imply. I found that subtle changes were possible and rarely wished for a setting that would have been 'in the crack'. The quality of the sound (like that of the construction) was excellent and transparent. I had no problems of clicks when switching frequencies, although if you switched level violently on signal (for example when comparing settings), you could be unlucky and hear a click. Overall I think that these equalisers would be very suitable as main desk units as they are capable of good results in the majority of situations. Obviously, sounds that need more detailed treatment could be catered for by using outboards units, as usual. These more subtle uses did have the disadvantage that the displays were not particularly dramatic — in fact the display tends to lead one to attempt to gild the lily!

Display and control

Four different 'pages' of display are available to aid the user in monitoring the systems operation. Below these pages a status line is on display at all times containing the following information:

xxany numeric input
 CHANxx...the channel number currently being controlled
 C.....if C present a comparison is possible
 CONSxx....currently active console memory number
 STDxx.....If the current response corresponds to one of the standard memories its number is displayed
 DSPor MOD — current system mode
 ?.....indicates an error. If the ? key is pressed the system jumps to display page to indicate the nature of the problem.

The most often used of these pages makes use of the *Apple II*s HiRes graphics capability fully and



'Bean-bag' control panel

is the display shown on the cover. A box is drawn enclosing a frequency response graph with vertical lines indicating the approximate area covered by each equaliser section. (Due to the overlap of the mid-band sections this indication can only be a guide.) The resultant frequency response of the channel selected is computed and shown on the screen in this mode.

The other display pages show the status of the channels and memory that are on line. The display page relating to the console configuration shows all the channel numbers in four columns. Those found on-line by the computer are indicated by a '-' sign; if equalisation is set on this channel a '+' sign is used. If an overload has occurred a flashing 'O' appears by the channel number, followed by the number of times the overload margin has been exceeded since the page was last viewed. If a channel is not present, or fails to respond correctly to the computer's scan (it checks all channels about three times a second to give warning of any breakdown that may have occurred) a '?' will be shown on the status line and no sign will appear next to the channel number which should normally have been on line.

The remaining display pages indicate the status of the 64 console and 32 'standard' memories in a column format. Memories that have not so far been used are indicated by a '-' sign, those that have been used by a '+' sign. Additionally, if a memory has been copied from another, its original location is shown with a <xx next to the new memory number, where xx is the original memory number.

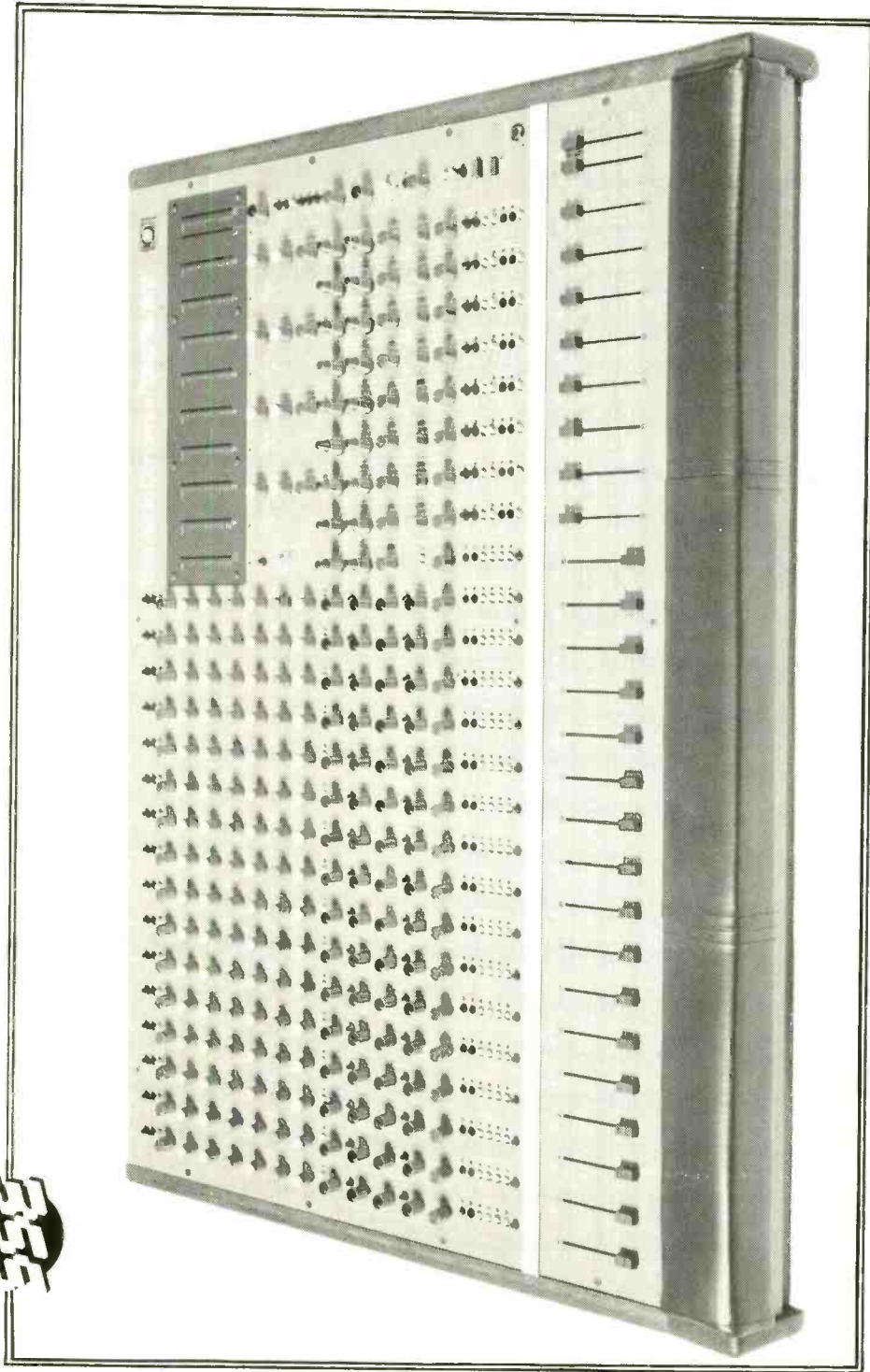
When powered up the video display shows the words "PARAM TEST" for a few seconds while the system initialises and finds out how many channels are on line. When this procedure is complete, the graphic display comes up with the status line underneath and a flashing query requesting direction. Control of the system is normally achieved through the eminently practical control panel provided although the unit may be controlled by an external device (your automation system perchance) if talked to politely through the standard RS232C interface provided. This 6x9in panel has a 'bean bag' as a base so that it can be put on any uneven surface (the top of your existing console, meter penthouse or knees) without slipping or wilfully re-adjusting controls for you. The unit houses a 6x5 key matrix and a joystick. Ten digit keys are provided (to enter a channel or memory number) the remainder being dedicated function keys. These enable the user to set and read the memories, write to and read from tape, reset all equalisers, compare equaliser or complete console settings, select mode (in the

DiSPlay mode changes are only made on the screen; the equalisers remain unaffected until the MODify key is pressed), and increment or decrement channel number. An arrow appears on the screen corresponding to the position of the joystick and, when the 'draw' key is activated, will display on the screen a simulated response curve using the chosen equaliser. Choice of the desired equaliser section is made by placing the arrow in one of the four vertical divisions on the screen, although due to the overlap in the mf sections, this is only achieved at some distance from the centre. If the equaliser section chosen is ambiguous the system attempts to use an unused section if this is possible. If not, nothing happens until you give the computer a hint as to which section you would like to alter. This is done by moving the cursor in the direction of the chosen section to 'pick up' the curve from its position. I must admit that I found this 'do nothing' mode disquieting and I can imagine that quite a lot of key bashing would result from it, although I suppose that one would get used to it in time. A response curve can thus be set up on screen while listening to the result (if the unit is in MOD mode) on the channel whose number is displayed on the status line. The response curve will only be altered when the 'draw' key is activated so that the arrow can be moved to alter a different band without upsetting anything. If the DiSPlay mode is selected (MODify and DiSPlay are selected by appropriately named keys and the status is shown on the command line) a response curve may be set up without altering the actual equaliser settings until the MOD key is pressed. At this stage direct comparison can be made with the previous setting by using the CoMPare key (which acts as a toggle between the two most recent settings) or with the flat response by pressing the OFF key in which case the 'previous setting' is lost. This very flexible system is a great help and is extremely simple to use. In a like manner, all channels can be set up as required and the total result stored in a 'console memory' which will store the setup of the complete set of equalisers. As 64 console memories are provided, detailed 'scenes' of sections of a recording may be created, put into order and then recalled during the mixdown by pressing a single key. 20ms is all the time required to reset all 64 equalisers in this mode. Moreover, if a console memory is recalled, the CoMPare key will toggle between the new and the previous console settings, allowing very useful comparisons that would be totally impractical on any standard console.

In the event that it is desired to transfer one channel setting to another (for a stereo pair, for example) a different set of memories is provided. These 'Standard' memories store only one channel, and allow more general equaliser settings to be retained or copied without having to set up each channel. The 'Standard' memory display helps the user keep track of all this by logging the channel that the memory was derived from. In order to avoid unnecessary duplication of settings in the standard memory, the command line displays STD-(memory number) if an equaliser setting happens to correspond to any already stored (you have been here before!). To save a setting, the memory number followed by the Save StandarD key must be pressed. If this



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memory has already been used, the safety key must be pressed with the save key in question, otherwise the system will flash a query on the status line. If this is followed up, the standard memory page will be displayed, showing the availability of free standard memory locations. If a quick transfer of settings is all that is required, the Save StandarD key is pressed without any preceding number. This accesses a short term intermediate memory, so that the new channel can be accessed. Pressing the Read StandarD key will complete the transfer with the minimum of key-strokes although it would be nice if this memory usage was also signalled by the status line.

Error trapping

Error trapping in the system is very simple: the '?' symbol flashing on the status line denotes the occurrence of a system failure (channel died or overload condition) or of an illegal or ill-advised command sequence. Pressing the '?' function key will cause the appropriate page to be displayed with the problem indicated. This action will normally clear the system if a lock up has occurred (it didn't happen to me). The error system is simple and quite adequate, and once more illustrates the extreme ease of operation of this system.

One facility that is not provided by the current generation of software on the *Param* is the facility to control several channels simultaneously — a sort of 'VCEQ subgroup'. As it turns out it is more than merely annoying that the nature of the system does not allow you to modify the settings on several channels at once. On a conventional console, the engineer is able to adjust the eq on say, a stereo pair, simultaneously and although the settings may not be exact, they will suffice to give a general impression of the sound. I found that with the *Param* it was quite difficult to gain an impression of how a given eq setting might sound on a stereo pair by treating one channel and copying it onto another: all the while contemplating the fact that this is precisely the kind of job that this system *could* do really well did little to diminish my frustration. According to the manual supplied, the systems configured for disc-cutting have this option so I hope that the next generation of software will have it included.

As mentioned previously, the settings of all the equalisers can be stored in any of 64 memories. Thus sections of a track can have specific eq settings stored for them, and these may easily be recalled subsequently. This facility is very well worthwhile and is extremely simple to use. As long as at least one console memory is free, the settings may be copied and shuffled to get them into the right order. Before starting the mix, all that is then needed is to key in the number of the first memory in the sequence that has been created and to press the Read MemorY key. Subsequent depressions of this key will activate the next console memory although the sequence can be altered by keying in the memory number before pressing the Read MemorY key. This facility is very interesting to use, because it is easy to return to the starting point for the next attempt at a mix, and at the same time changes are so easy to make that much more detail can be attempted than would be practical (or even sane) on a conventional mixer. All memory settings can, of course, be stored on

tape — a process that takes about 20s. Any tape recorder can be used (the manufacturers told me that they had spent a lot of time finding the worst cassette recorders to test the system on—if only I had known . . .!) although I would have thought that the most convenient place to store would be on a section of multitrack related to the music in question. It is interesting to note that, while all the standard memories are over-written on reading data from tape, only those console settings which are actually recorded on the tape are altered, and also that reading the tape does not change the equalisers. This means that (with some nifty finger work) you could load extra console settings during a track if it turned out that the 64 provided were insufficient (!). Floppy disk storage may be used to store up to 500 settings, but the manufacturers feel that, in view of the short time taken for a tape dump, there is little need to introduce the added complexity of disk storage.

An extra refinement on the control panel has been the addition of four 'direction keys' which form an alternative control in the event that setting up with a joystick proves awkward. I found these keys essential, especially when trimming a sound where the ability to return accurately to a previous setting is a real help. This was certainly partially due to the fact that the joystick provided on the review unit had been damaged in transit. I must admit to feeling that the components used in the control unit were not in keeping with the excellent standard shown by the rest of the machine — for example the selection keys did not have a pleasant feel. I found it a pity that the direction keys could only alter a section of the curve once this had been located and 'caught' using the joystick. I think it would have been much easier to 'catch' the appropriate equaliser section without totally destroying a setting that probably only needed a minor change. These keys should be made to emulate all the actions of the joystick and also should be provided with an auto-repeat function.

Software modification

One of the delights of computer-driven systems is that all sorts of changes can be implemented by changing software — for example, all the points mentioned above can easily be taken care of, as well as the provision of any extra functions that may become necessary. Although it is easy to under-estimate the time required to write and generate computer software (and therefore its expense) that is as good and as foolproof as that on the *Param*, nonetheless it does mean that a system such as the *Param* can be updated when necessary. Even then, should a fault become apparent, all that is necessary to return to the previous system is to change the relevant memory chips. Thus quite far-reaching modifications can be done with a minimum of down-time and a minimum of risk to the user.

Despite the above paragraph, I would think that only relatively minor changes to the software of this unit would be envisaged for quite some time. The system works extremely well, and certainly during the rather limited time at my disposal I never had the opportunity to observe anything at all going wrong — despite my best efforts in this direction, the machine continued to function perfectly. I think that this is in part due to the fact that the manufacturers have not got

carried away with the possibilities of the system. They have concentrated on getting the device right as it stands. The result is a system that is almost self-explanatory and thus very easy to use even by those who have not read the manual! I think that this is a very important point — after all studio clients would not take kindly to the engineer delving into an imposing tome muttering "I know that there's a way of doing this, I saw it in here somewhere . . .". I regret to say that this sort of situation is only too common in computer circles.

The users manual supplied with the *Param* is still only a preliminary version and I am glad to say that the manufacturers are adamant that this will not become a permanent feature of the system though they are waiting for comments from users before finalising it. Despite the emphasis from the manufacturers as to its preliminary nature, I found it to be surprisingly clear and concise (nine double-sided pages is not too threatening a prospect). It is divided into four sections relating to the installation of the system, a section on the equaliser, one on the video display and one on details of operation. This is followed by a troubleshooting section with a reminder to regularly clean the fan and filters, plus blueprint copies of the circuit diagrams and boards used in the unit as well as those pertaining to the *Apple II* computer. No details of the equaliser boards are given, instructions being to return defective units to the factory. Apart from some occasional curious foreign usages ("a blinking '?' indicates a problem") I found the manual very accurate and informative. This must also be due to a great extent to the excellence of the operating system evolved.

Conclusions

I found the *Param* the most interesting development in analogue audio technology. It is so different from what we have grown used to that it is difficult to describe the impact that it should eventually make. This could well be the end of the 'dinosaur-style' mixing console, messing up the acoustics of the control room, impossible to operate without extension arms and eyes, and still nowhere to put an ashtray! The operating system is, apart from a few minor points which I am sure can be altered without difficulty, an object lesson to designers seeking to use the facilities made possible by computer technology in the audio field. You do not have to be a computer expert or even remotely interested in the subject to get the best out of this unit, and I would think that even die-hard engineers would be seduced by the possibilities offered and find no real objections to this unit (unless it be to the very existence of equalisers!). Unlike the majority of 'Automation' systems the *Param* has no tendency to take over sessions or leave one feeling that the job would have been done better and quicker manually. Instead it merely does a very useful, well-defined job faultlessly and efficiently. In its present configuration it makes few changes to the 'normal' way of doing a session and therefore should meet with little engineer or client resistance. The sheer quality, of the construction and unobtrusiveness of the sound has made it a great pleasure to review this item. I am convinced that this is the basis of a sensible marriage of computer and sound technology. If you want to see the future—look this way!

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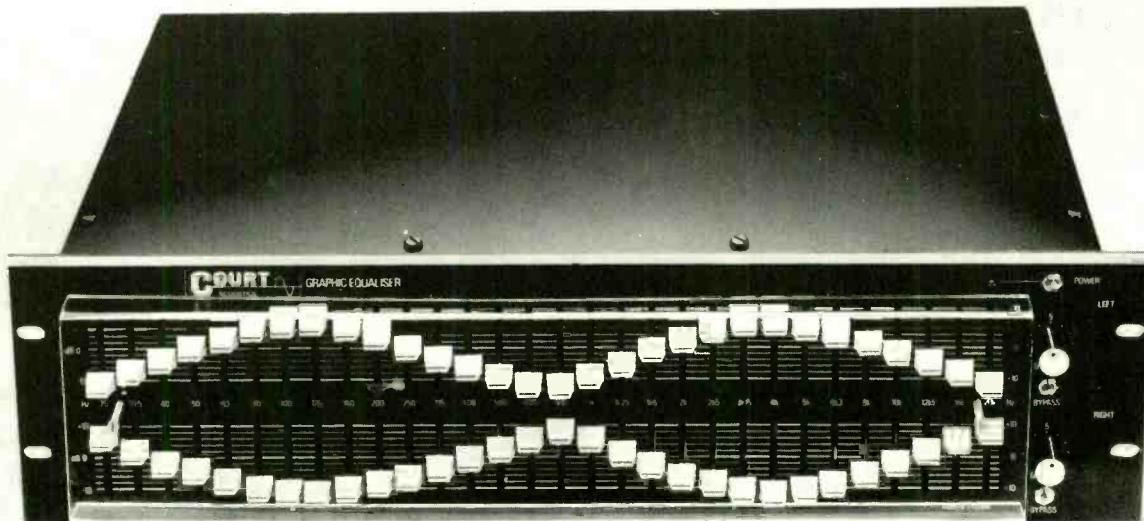


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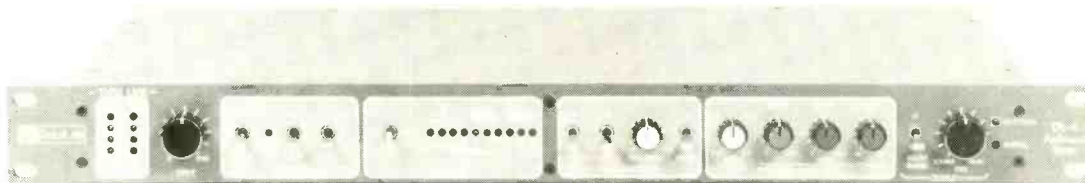
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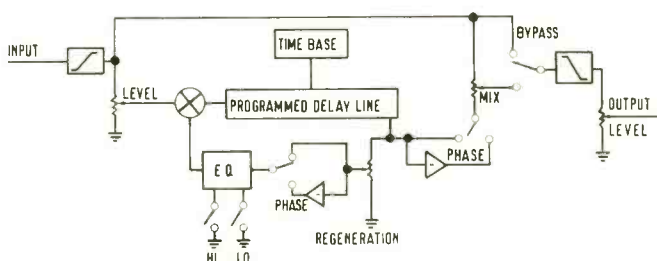
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DeltaLab DL4 Time Line

TIME LINE BLOCK DIAGRAM



MANUFACTURER'S SPECIFICATION

Delay range: X1, 1 to 128ms; X2, 2 to 256 ms; X4, 4 to 512ms.

Delay factor: 0.25 to 1.0 of setting.

Frequency response

(at -14dB) +1, -3dB: 20 to 15kHz at all delay settings

Dynamic range

A-Weighted: 90dB min, 95dB typical.

C-Weighted (broadband): 85dB min.

Headroom above 0dB: 6dB.

Equivalent pre-emphasis: 50µs.

THD (distortion plus noise):

Delay Factor

Ref 1kHz	(X.25)	(X1)
0dB	0.2% max	0.4% max
-10dB	0.2% max	0.4% max
-20dB	0.3% max	0.6% max
-30dB	0.5% max	0.8% max
-40dB	0.8% max	1.0% max

Inputs

Unbalanced (phone): 0 to 18 dBm

Impedance: 47kΩ

Outputs

Unbalanced (phone): Up to 18dBm.

Impedance: 50Ω

Time base modulator

Delay factor: Continuous from X0.25 to X1.

VCO depth: 0 to 100% of delay adjustment range (4:1).

VCO rate: From 0 to greater than 10Hz.

VCO shape: Triangular to sine to square wave —continuously variable.

Repeat: Repeats signal in memory indefinitely without degradation.

Regeneration: Recirculates delay setting to create multiple echo repeats.

Size: 1 3/4 x 19 x 10in (4.45 x 48.3 x 25.4 cm).

Shipping weight: 12lbs (5.5kg)

Manufacturer: DeltaLab Research Inc, 27 Industrial Avenue, Chelmsford, Massachusetts 01824, USA.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

PRESENTED as a standard rack-mounting unit, the DeltaLab *DL-4* should be at home in the studio or on stage, and provide a wealth of useful effects. Used in live performance, remote operation of some of its controls will attract the creative musician, whilst in the studio its technical versatility and overall good performance will make it a useful tool of the audio engineer.

The *DL-4* offers up to 512ms of high-quality digital delay with its on-board RAM, with an optional extension up to 2.5s using the matching DeltaLab 'Memory Module'.

All external connections are made on the rear panel, the majority of controls set for the most part in functional groups on the front panel. Installation and use present no problems, and once patched into the test situation, the *DL-4* required minimal familiarisation before exploration and enjoyment of the creative possibilities.

Construction

Externally and internally the *DL-4* is well constructed. Controls and sockets are directly attached to pcbs and there is a minimum of point-to-point wiring. Two main boards, screened from each other, carry the active electronics; the power supply occupies a separate board. Components are of high quality, properly dressed on the boards, with presets mechanically locked after factory adjustment. The review sample appeared to have been modified in the UK for 240V operation, the plastic shroud on the toroidal transformer sustaining some damage from a hot soldering iron

used to alter connections on the power supply pcb. It must be commented that, although the *DL-4* is well constructed, it would not meet European or British standards of electrical safety (IEC 65; BS 415:1979). The mains fuseholder allows access to live parts without using tools, clearance between live terminals and the metal cabinet is less than 6mm and an American colour-coded captive mains lead is fitted. Since the *DL-4* is not double-insulated, user safety relies on the mains earth being connected, yet there are no warnings on the cabinet to this effect, no label on the mains lead and no mention in the user instructions. A further potential hazard is the absence of an on/off switch and 'power on' indicator. The *DL-4* has to be turned on and off by pulling the mains plug.

Ins and outs

Two audio signals may be input via unbalanced tip-sleeve jack sockets, one input having a fixed sensitivity, the other having its sensitivity range set by an adjacent 2-position slide switch allowing a 20dB change. Measured sensitivity ranges were 150mV-6.5Vrms for normal level inputs, 15mV-600mV for the second input in the +20dB position. This increased sensitivity is adequate for most low-output electrical musical instruments and would match 'domestic' line levels, particularly when derived from infernal DIN sockets.

One unbalanced jack socket provides the audio output, with an adjacent rotary control to set the output level; up to 2.7Vrms was measured from a

82 ▶

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low impedance source, ample for all expected operating conditions.

Other jack sockets remote some of the functional controls and allow cross-connection of a second *DL-4* for independent or interdependent operation. A 5-pin *XLR* type socket provides for connection to the matching 'Memory Module' when delays greater than 512ms are required.

Controls, functions and delays

Audio input levels are controlled in conjunction with peak and slew rate indicator LEDs. Each display has four LEDs, two green (scaled 40 and 20dB), one amber (scaled 10dB) and one red (0dB). In most cases, setting levels such that the 10dB peak headroom LED was just illuminating gave optimum results as regards noise levels, but the slew rate indicators were most revealing and on certain material showed onset of slew-limiting although peak headroom indication appeared ample. A useful pair of indicators, which it would be nice to see on other equipment.

The analogue input stage has a 'built in' headroom factor of 6dB in hand, recognising the sometimes unpredictable dynamics of the real world, particularly working in real time. It is possible to deliberately overload the analogue input stage before overloading the A/D converter, generating rich harmonics which add tone-colour and may heighten many of the effects available with the other controls.

Fixed delay is selected in an 'up-down' fashion by toggling a switch and is indicated on a row of LEDs. Delay may also be automatically swept over a range of four steps at a rate determined by the speed set on the VCO. The fixed delays may be varied over a 4:1 range by a rotary control, which is rather confusingly grouped with the VCO controls rather than the delay controls. A tip-ring-sleeve jack at the rear allows remote 'up-down' selection of the fixed delay steps.

An 'infinite repeat' facility, using a front panel switch or remote jack, disconnects the audio input to the delay line and recirculates the contents of the digital memory for as long as the repeat facility is held enabled. Signals repeated from the RAM in this way may be further modified by other user controls and very interesting effects were obtained repeating short words or sounds, using other controls to effect pitch changes and other modulation operations. Much greater flexibility would be given by the 2.5s capability of the 'Memory Module'.

A further feedback possibility exists in the *DL-4*, regenerative feedback, whereby the analogue audio output signal is fed back to the analogue audio input. Useful in certain flanging effects, reverb and selective resonance, regeneration necessarily involves many passages through the delay line. Degradation of the signal is inevitable, as is a build-up of noise, but this was never found to be a problem or obtrusive. A rotary control sets the level of regeneration, up to a maximum just below oscillation; further modification of the signal being fed back and regenerated is possible using a phase-inversion switch and high- or lowpass filters. Roll-off of the filters commences around 175Hz and 3.5kHz respectively; both may be switched completely out of circuit in the 'flat' positions.

Three rotary controls adjust the VCO, variable from zero up to approximately 10Hz in rate, with a

sweep range of 4:1 (two octaves) and shape continuously variable from triangular through sine to squarewave. The sweep range of the VCO may be remote controlled via a tip-sleeve jack.

The output rotary control adjusts the levels of direct source and delayed signals fed to the output jack. A central setting mixes the two equally, extreme settings giving wholly source or wholly delayed signals. A phase inversion switch is provided on the delayed signal prior to output mixing.

No bypass switch is fitted to the unit, but this facility is provided for in remote operation via a tip-sleeve jack, and indicated by LEDs on the front panel adjacent to the output control.

Effective effects

The range of effects is enormous, from simple slap-back echo, reverb and flutter echo to more exotic and virtually indescribable varieties such as Haas-effect imaging and panning, talking and bouncing flanges. Reasonable simulation of the dreaded tape-phasing can be achieved, but this really requires the use of a second *DL-4* to set an actual null-point and swoosh sounds inside-out. It's also most interesting just what can be achieved by pitch-changing sounds even as short as 512ms whilst using the infinite repeat (variable Mantra?).

Everything is very easy to set up and adjust, and the user instructions provide several sheets for 'favourite patches' whereby control settings can be marked in and referred to another time.

The user instructions are generally good, perhaps a little confusing to the uninitiated in the first few pages, but continue in a good 'handheld' tour of effects and encourage experimentation and creativity.

Mumbles and grumbles

Aspects of electrical safety apart (to be fair, my comments would apply in general terms to much American-built equipment), my only real grumble concerns the slightly high level of breakthrough of the control signal in the VCO. At rates much above 3Hz, this could be heard ticking or swooshing away, depending on the waveform selected, and was painfully obvious in the absence of input signal. Perhaps a slightly better trimming operation during factory adjustment would improve matters and achieve a better 'null'. This breakthrough spoiled an otherwise excellent overall performance, and was quite intrusive on certain settings and in certain effects.

I feel that the range of effects available would have been further and usefully extended by the provision of envelope-following in the VCO such that the delay rate could be varied by signal dynamics rather than the oscillator rate as in the 'auto delay' function. Such a facility would have done amazing things for voice processing and could be quite startling on percussive sounds.

Summary

The DeltaLab *DL-4 Time Line* is a well-constructed and easy to use piece of equipment. It offers a wide variety of audio effects, which are readily set up on any subsequent occasion with the generally well laid out controls. Performance is to a high standard, and the unit has much to commend its use in studio or on stage, where its remote operation facilities will be appreciated.

Peter Carlines

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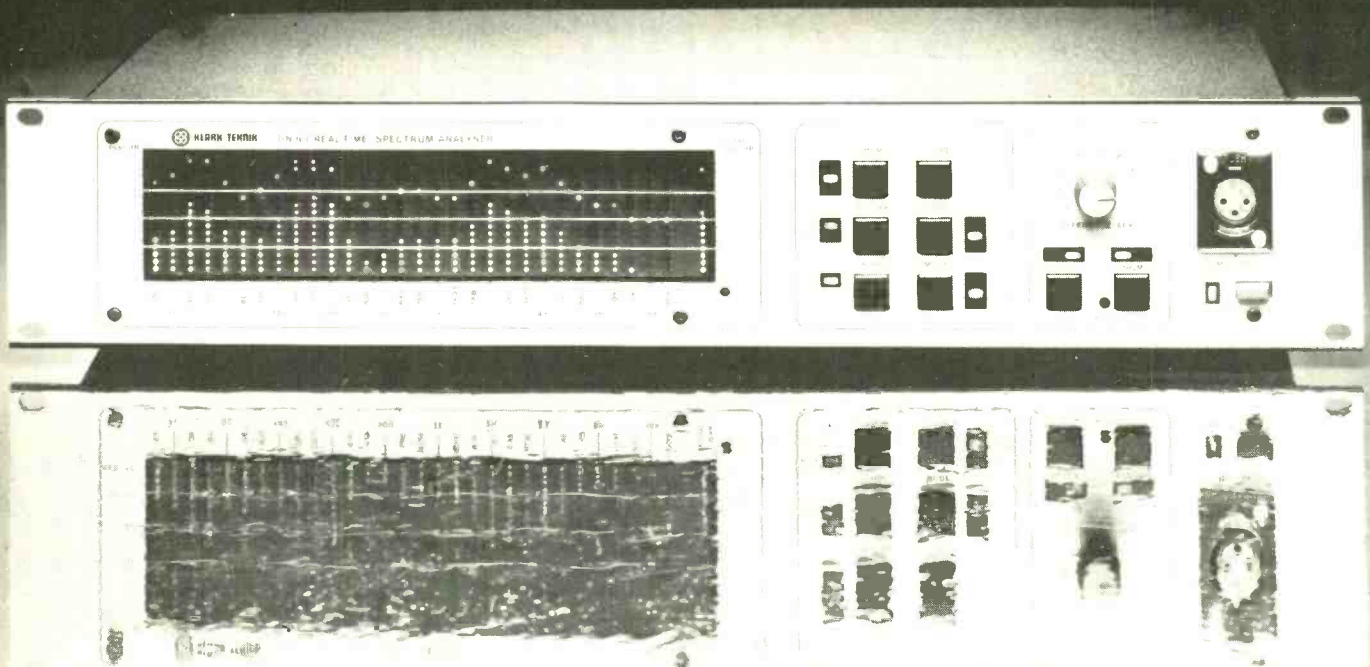
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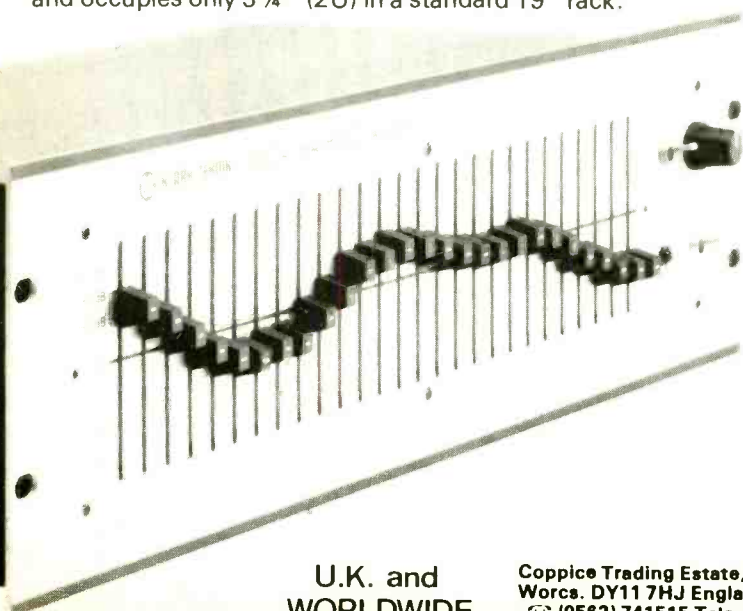
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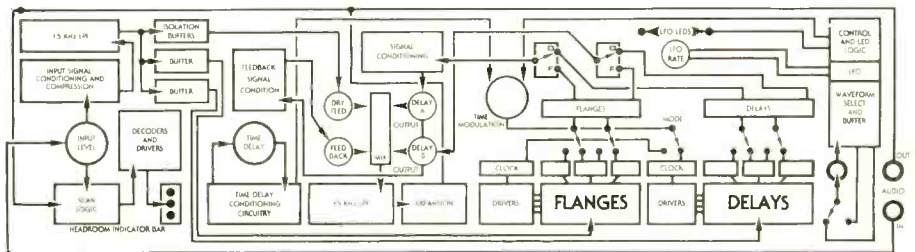
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Reviews



Marshall Time Modulator



SIMPLIFIED BLOCK DIAGRAM

MANUFACTURER'S SPECIFICATION

Time modulator offering up to 400ms delay continuously variable with a 15kHz bandwidth and 95dB dynamic range at all settings. Incorporates two delay lines each with three taps and a 72:1 sweep range. Variety of harmonic and tonal effects available via programmable locked sweep delay ratios of the internal delay lines. Unit has a separate modulation waveform selection switch, LFO high and low LED indicators, LFO rate adjustment control, and isolated flange and delay sections. Separate output level (mix) controls for each assigned delay tap. Headroom indicator bar reads input, output, and internal feedback levels. Notch depth switching logic operates to suit either the flange or delay mode.

Price: £1,400 approx.

Manufacturer: Marshall Electronic, 1205 York Road, Suite 14, Lutherville, Maryland 21093, USA.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.

THE Marshall *Time Modulator* reviewed was the model 5402, a much-improved version of the model 5002 analogue delay line which is a familiar sight in most major studios. Physically, the unit closely resembles its predecessor, a similar front panel layout being maintained to aid engineers already used to the previous model. The rack-mounting unit is 1U high.

The *Time Modulator* is an effects unit offering

flanging-type effects and automatic double tracking which require fairly short delay times, as well as 'tape echo' type effects which require much longer delays. In order to offer the best circuit performance, two separate delay lines are used, each one optimised for the desired effect. These lines are not used in tandem, so the *Time Modulator* behaves like two separate effects units in the same box.

Specially-designed analogue delay lines are used in this unit, and it is claimed that their performance and flexibility exceed those obtainable with purely digital devices, while quantising errors can not occur — which should please people who find digital sound subjectively annoying.

Connections to the unit are via three mono ¼in jack sockets on the front panel, and an edge connector at the rear of the unit. The signal input (25kΩ impedance, single ended) can be accessed either on the rear connector or on the front panel jack socket. The output of the unit, capable of driving +18dBm into 600Ω, is also routed to the front panel jack socket and the rear connector. In addition, a front panel jack socket provides an input for control voltages (these may be bipolar and the unit will accept audio through this socket).

The unit requires ±20V, which is supplied to the rear edge connector from a separate encapsulated

power unit. As the connector on the rear of the 5402 is no more than an extension of the main pcb and projects beyond the case, care should be taken when handling or servicing this unit as an accident could easily fracture the main pcb (expensive). The correct orientation of the unpolarised supply connector is indicated by a red spot stuck on to the connector and the unit. Although insertion in the incorrect sense would probably do no more than short the power supply, and therefore not damage the unit, this could lead to the failure of the power supply — once again, an accident which could easily happen in a crowded rack and prove very expensive. The mains lead on the review model was of the twin core variety; no earthing instructions are given, so safety would rely on the quality of the mains transformer. I would suggest that models for sale in Europe should be modified to correspond with the relevant safety standards.

An input level control, with associated LED indicator, is provided to optimise internal signal levels, and a mode switch selects the chosen delay line. Two delayed outputs (A and B) are provided to the signal mixer on the front panel (these are not separately accessible to the user), which also has a provision to mix in the 'dry' original signal, and a

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control for feedback around the loop. Each of the delay lines has three taps on it, so the outputs A and B can have delays as shown in Table 1.

TABLE 1	DELAY (ms)		
	1	2	3
Flange Mode			
Output A	0.2—12	0.2—12	0.4—25
Output B	0.4—25	0.8—50	0.8—50
Delay mode			
Output A	20—100	20—100	40—200
Output B	40—200	80—400	80—400

Within the ranges selected, the delay length is continuously variable. In the flange mode, it will be seen that this range exceeds 62:1 (72:1 is claimed): the control markings are nominal. This astonishing sweep range is worth comparing with other analogue or digital delay lines, where a range of 10:1 is greater than normal. The *Time Modulator* achieves this by the use of custom delay lines, which allow much shorter delays than can usually be achieved — where clocking speeds are a limitation — and are of sufficiently good quality for the frequency response/noise performance not to have fallen too drastically at the opposite end of the range.

A policy has been adopted by the manufacturer which allows the user to access the range in the delay line at which the frequency response can suffer, while pointing out the limitations of the device and remedial action which may be taken if unpleasant effects occur. This amounts to filtering at about 7 to 10kHz at both the input and the output to the device. This may prove necessary at delay lengths greater than 25ms in the flange mode, and 200ms in the delay mode. This policy allows the user maximum flexibility in using the device — an idea of which I approve: the device has been made versatile rather than foolproof.

The length of the delay line may be controlled manually by the time delay pot, or swept by the internal oscillator or by an external source of voltage control. There is no internal envelope follower provided. The internal oscillator has a range of 0.1 to 10Hz and has two LEDs to indicate the peaks of its activity. The waveforms generated are a true sine wave or a square wave. The provision of a true sine wave is definitely a good point as it allows very smooth flanging effects to be obtained. The amount of modulation by this oscillator, or the external signal source, is determined by the time modulation control, and acts about a centre point determined by the time delay control, unless the operational limits of the delay line are exceeded, in which case the control voltage is limited to keep it in range.

A major feature of this unit is that the delay lines have been dynamically biased and equalised to optimise their performance and to make their output as consistent as possible over the entire range. This ensures that the critical settings of the controls needed to achieve an effect are retained throughout the sweep range. For the same reasons, signal mixing is done before the output of the unit is expanded to normal dynamic levels, and this is done with rms sensing detectors so that the expander is not fooled by phase shifts (or worse!) introduced into the signal.

The apparent similarity of the controls to other such units is deceptive, as Marshall have optimised these in many ways, to the extent that some of the controls are almost multi-functional depending on the way the unit is set up. Thus the 'dry' feed to the internal mixer is treated in a similar manner (other than the actual delay) as the processed signal, so that any phase shifts caused by equalisation of the delay

lines are present in both signals. This, in conjunction with mixing the signals in the compressed state, allows cancellations of up to 95dB to be obtained.

Similar consideration has been given to the feedback control; its frequency response is carefully tailored to eliminate instability as far as possible, by restricting the amount of high-level high frequencies and by rolling off low frequencies. The result is that the feedback control is far less prone to 'run away' than in other devices, although this can still occur if the unit is carelessly handled. Another special feature indicative of the care lurking in the design concerns the use of the dry feed control in modes creating pitch quantisation effects. When the delay controls are fully up on the mixer and the dry feed control is 1/2 to 3/4 up, circuitry senses the level of the feedback control and acts to reduce the periodic content so that only transient content of the input is fed to the delay lines. If the delay is 'played' with a keyboard or even the manual control, pitch substitution effects are possible.

In use, the quality of the delay lines was excellent, no noise being apparent at any time (noise levels are claimed to be better than 100dB down). The sweep range in the flange mode would sweep through almost seven octaves. High frequency drop off did show when long delays were used, but this is mentioned in the manual and was found not to be offensive on the majority of instruments. I found that, in view of the many clever changes to the controls mentioned above, a thorough read of the operations manual is essential, as some of the subtle changes in the scaling of the controls (which are different in the flange and delay modes) make the unit confusing to operate if one is not fully aware of them. Unfortunately, time did not permit me to gain the familiarity necessary to appreciate the full potential of the unit.

The owners manual provided with the Marshall *Time Modulator* is, like the *Hitchhikers Guide to the Galaxy*, a "rather unevenly edited book". Many suggested setups are shown for various effects with quite whimsical names, and these worked quite well, although I must object to the attempt by Marshall to copyright terms in common usage which they have, sometimes fancifully, given to their effects. The description of the controls and their functions tends to get rather involved with an advertising campaign for the Marshall machine, which I suspect could begin to pall after a few attempts to uncover the vital secrets of some setup procedure. After all, the owner has already bought the item (presumably) and I feel that continual comparisons with other similar devices is unnecessary. A more useful feature would have been the inclusion of a full technical specification in tabular form.

In conclusion, I found the *5402 Time Modulator* an extremely powerful effects unit capable of creating many different sounds. The performance of the delay lines was exemplary and I felt that the hard work put in to make the best use of them, and to trim up the cancellation depth, was well worthwhile. I did feel that the controls provided would require some practice to get the full possibilities out of the unit, and wondered if the controls themselves could not have been somehow different, without having any clear ideas as to what I would like to have seen changed. I also wonder why the second tap of the delay lines is not made available to the user — as it is in many other units of this type — and I felt that, especially in view of the possible levels generated by the unit, having a level indicator on the input was not really helpful. If it had been reading the output, it might have been more valuable. **George Chkiantz**

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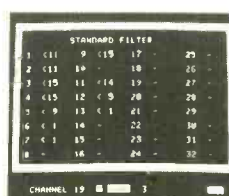
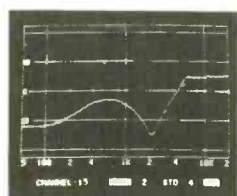
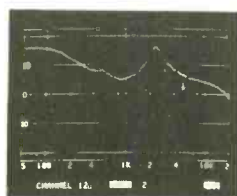
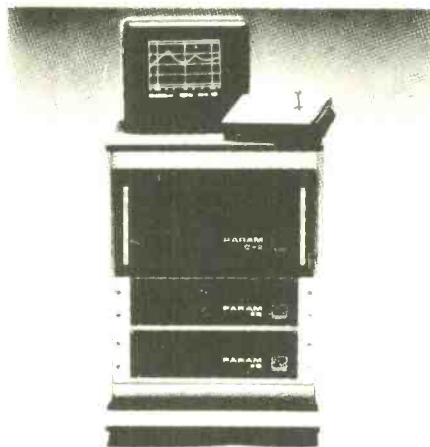


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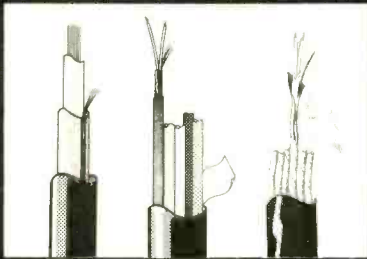
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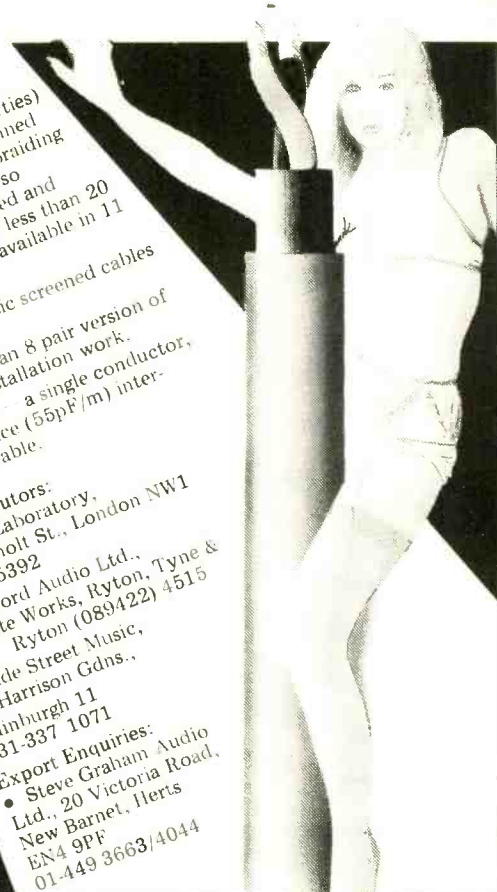
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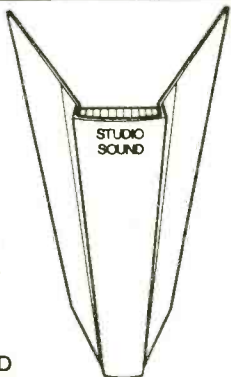
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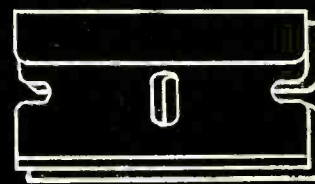
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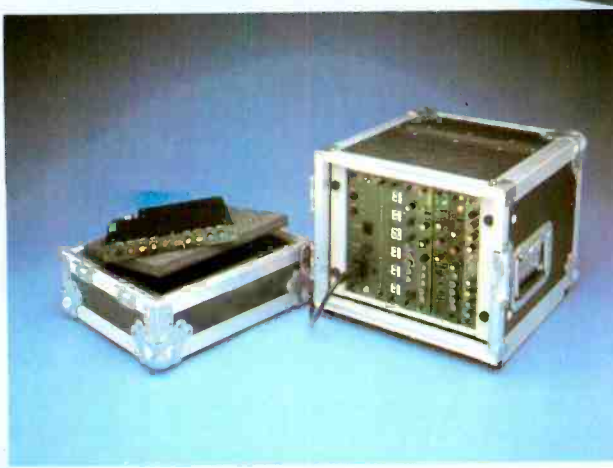
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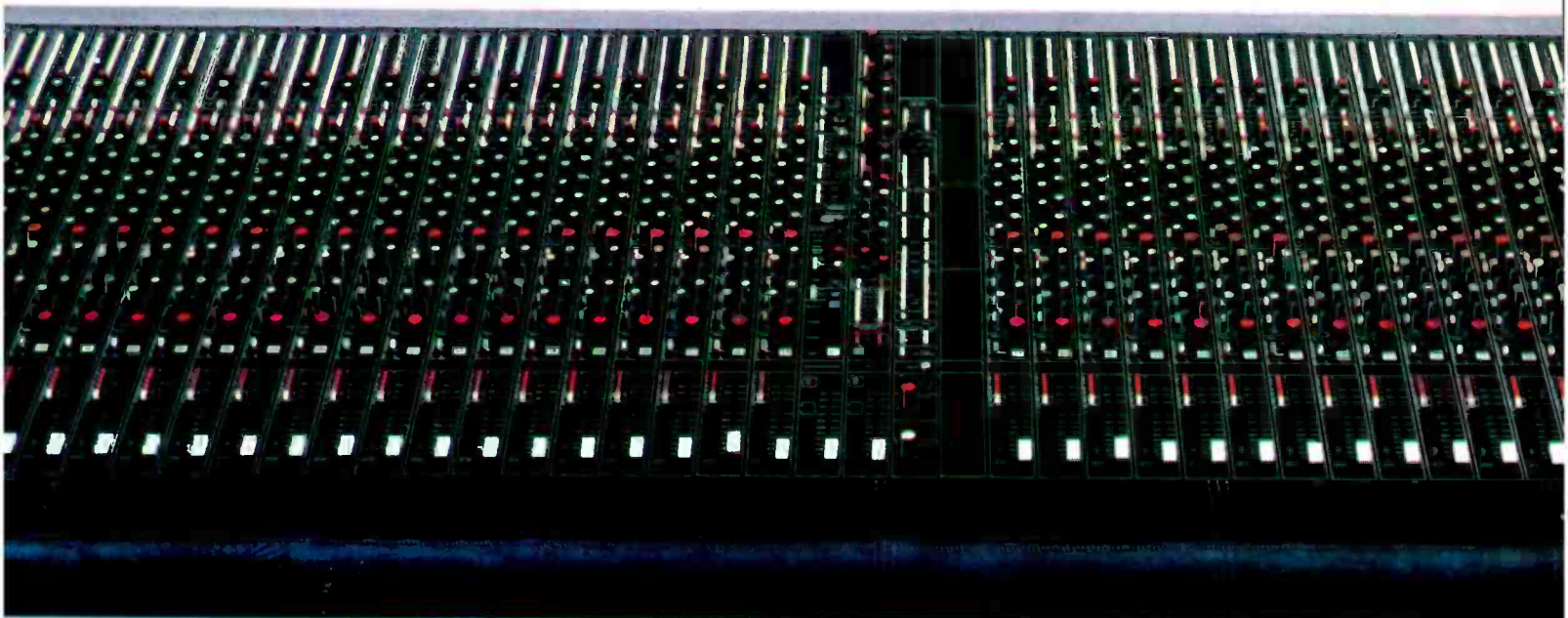
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