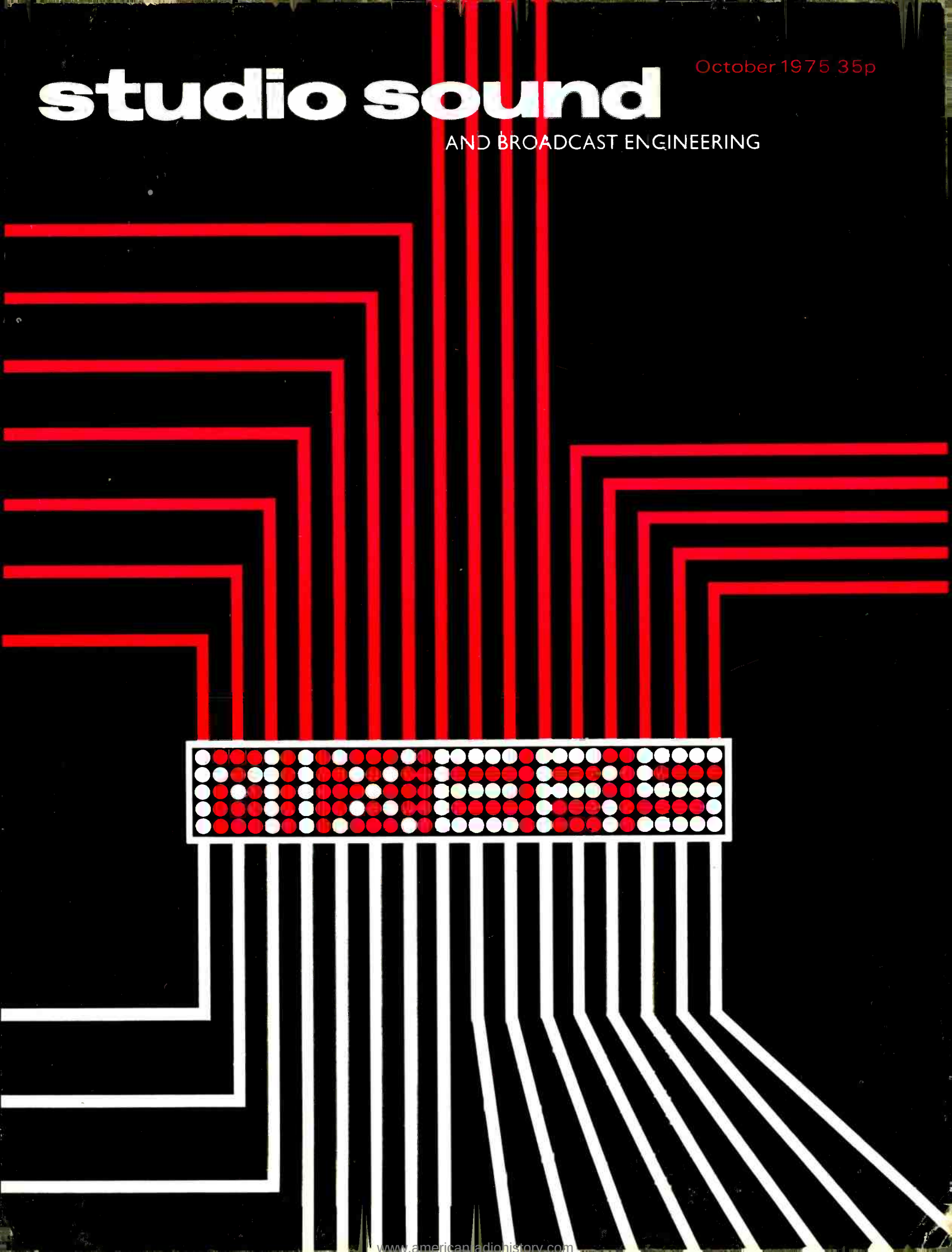
studio sound

AND BROADCAST ENGINEERING

October 1975 35p



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OCTOBER 1975 VOLUME 17 NUMBER 10

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DISTRIBUTION
STUDIO SOUND, published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. It is available without charge to qualified readers; these being directors, managers, executives and key personnel actively engaged in the sound recording, broadcasting and cinematograph industries in any part of the world. Non-qualifying readers can buy STUDIO SOUND at an annual subscription of £5.80 (UK) or £6.00 overseas.

BINDERS
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Whether you prefer your automation hot, cold or with two sugars, you'll probably agree that there is something to be gained. The remaining discussion centres on how far and, to some extent, how. But the mechanics are relevant only in a specific studio environment. Once more than one becomes involved, the compatibility problem appears, if modestly at present.

The control of the remix levels represents another insert point between the tape machine and what finally comes at you through the monitors. There are similarities with the noise reduction problem, except that we are dealing with a control function rather than the signal itself.

So what do we find? The tape code is variable, its position on tape has alternatives and likely to have more with imminent introductions, and the sampling rate is variable. The coming MCI system, with a slave data tape, and the MCI/3M combination using 76 cm tape, also represents a clear, logical way of doing things, but again is in its turn a further break with convention and a consequent weakening of compatible data links. This example is not unusual in its breaks with the past, which are justified by making appropriate use of available resources and technology, but is the most recent.

And so much for the problem. It would be unfortunate if it hindered widespread use, for automation has largely won over the initial antipathy. Perhaps compatibility is overstated: there is little need for breaking in the middle of a mix—not studios, at least. But there are strong arguments for retaining the work which went into the mix's creation in some form, so that when backing track extracts, single mono-compatible remixes and quad stereo-compatible remixes are tackled some months later there is a reference start somewhat better than the original master mix full stop. One suspects the decision has effectively been made: automated mixing is so young as not to have seen much change in its surroundings, so we cannot really evaluate those objections now.

We'll know more in a couple of years' time. Let's hope the decision was the right one.

STUDIO SOUND is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.

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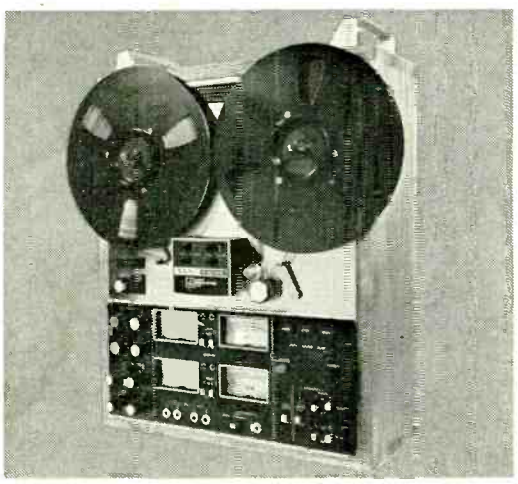

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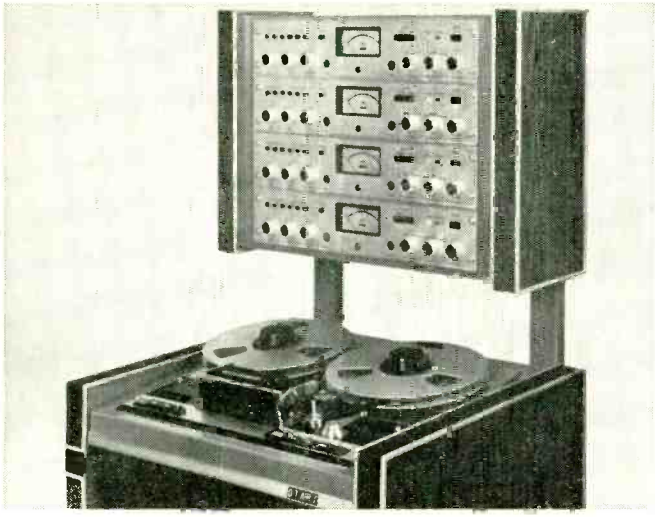

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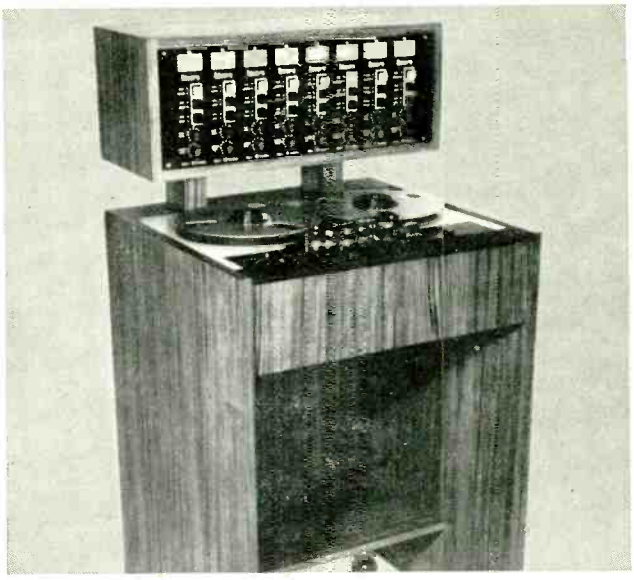

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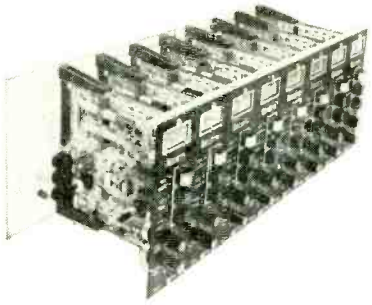

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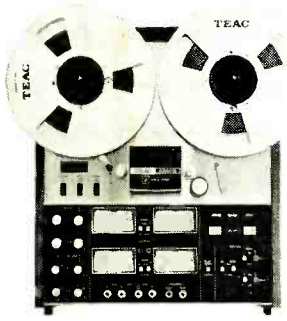

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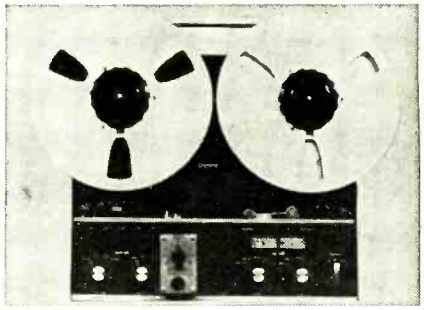

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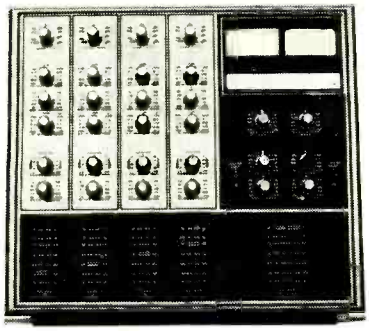

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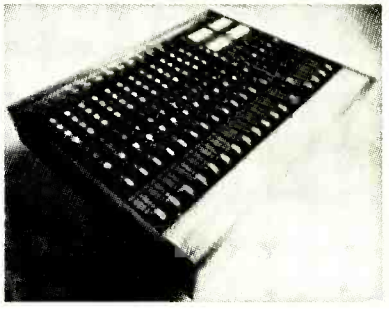

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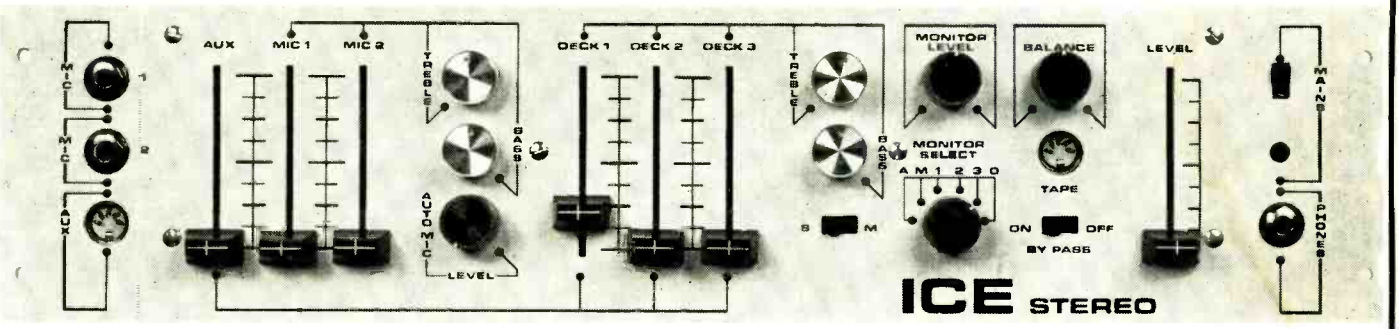

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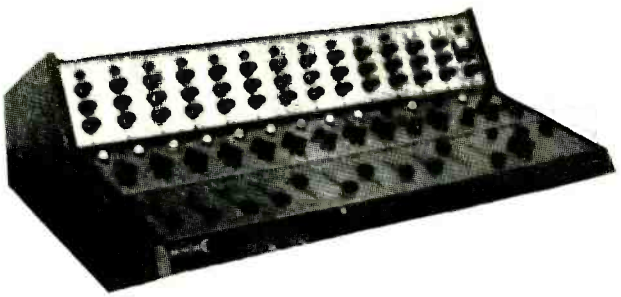

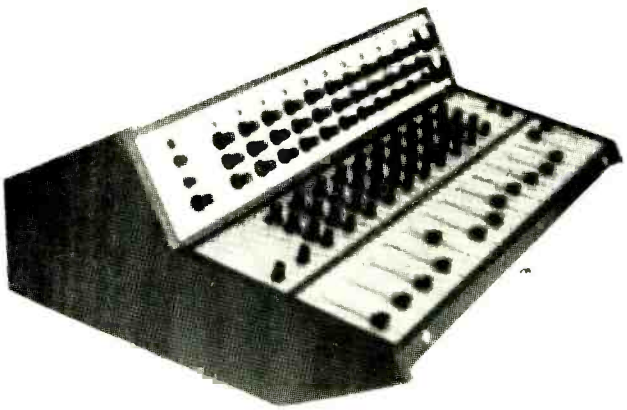

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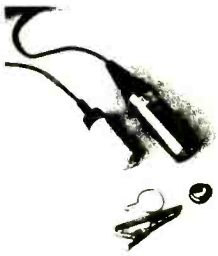

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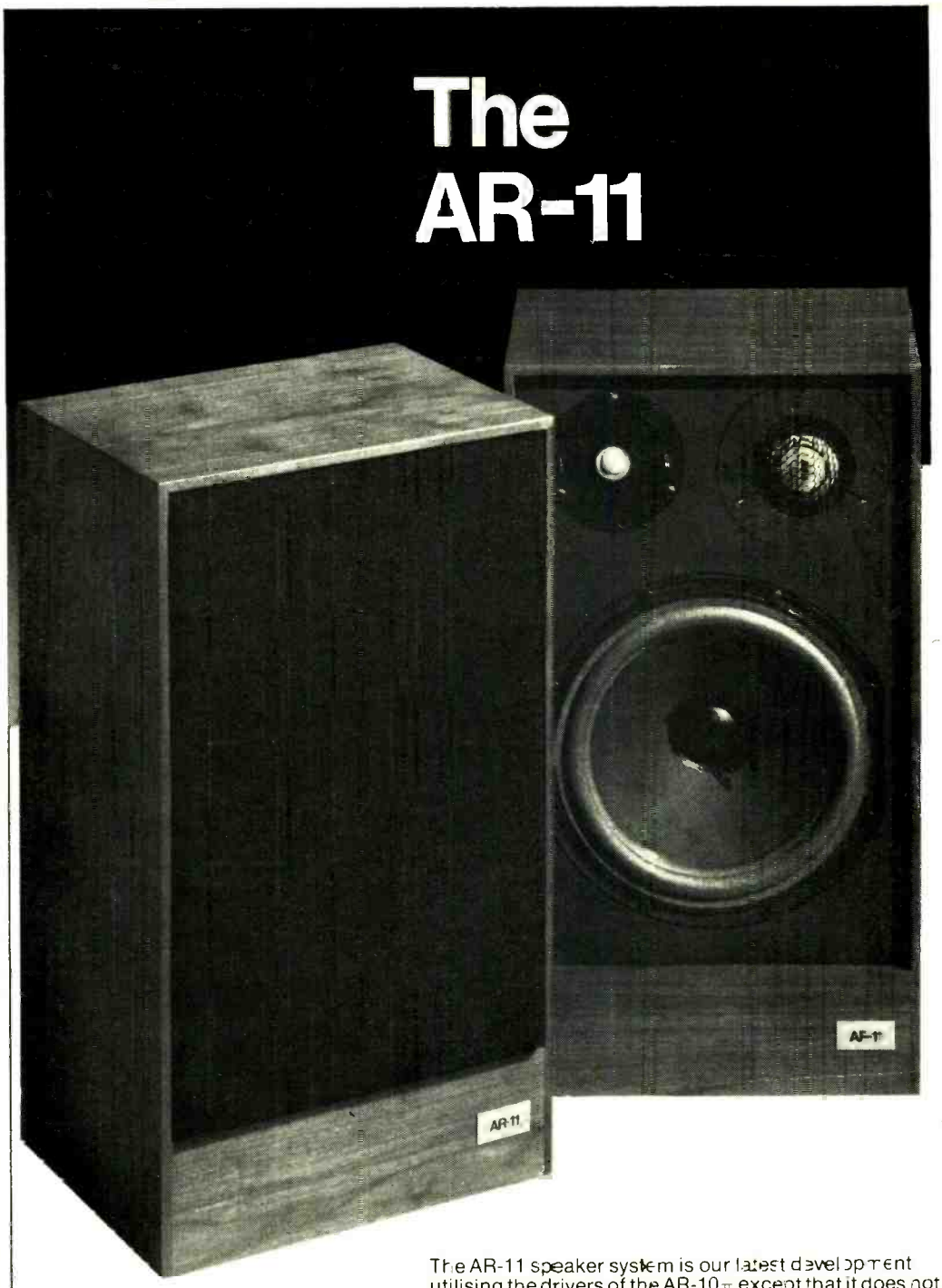

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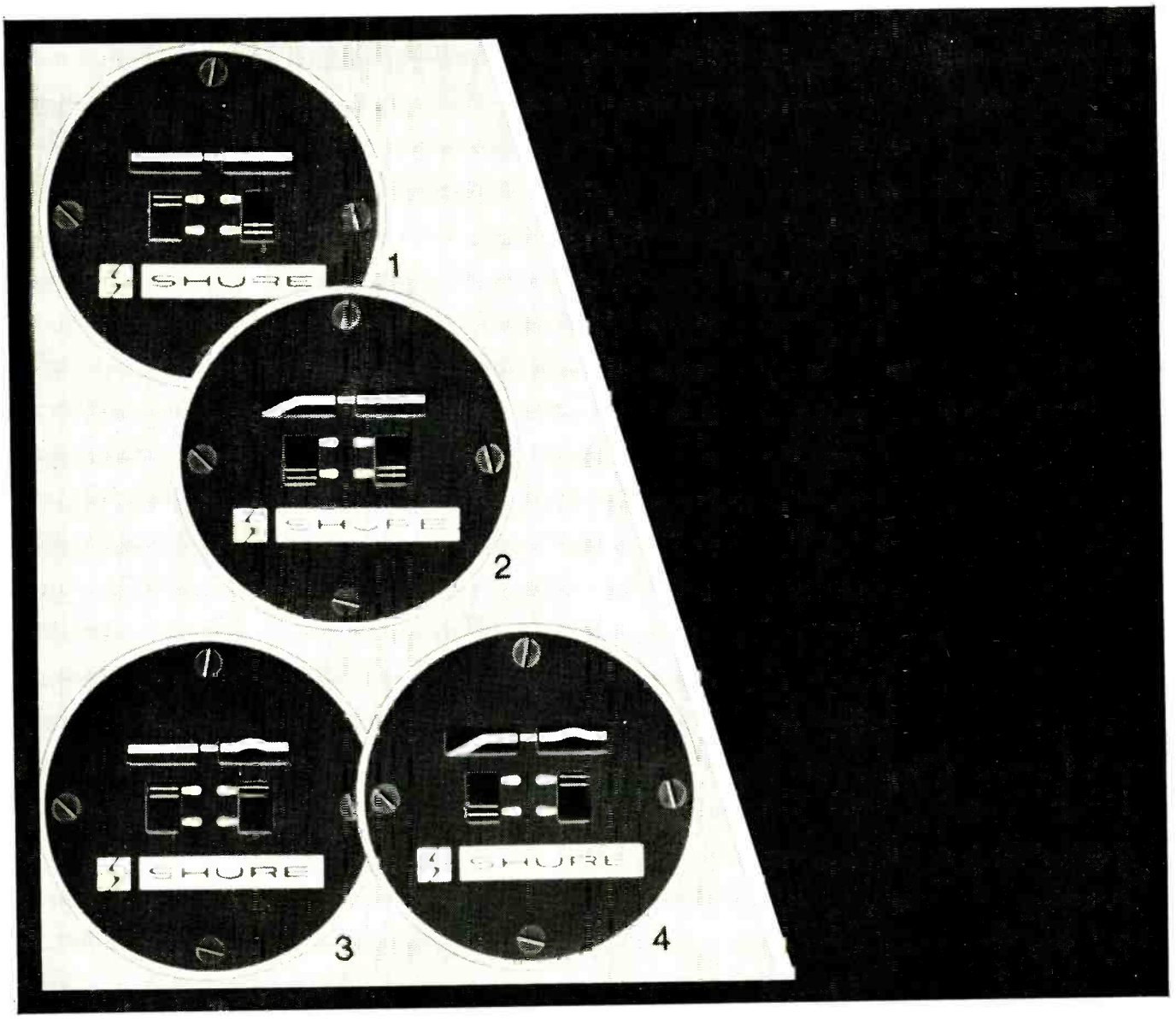

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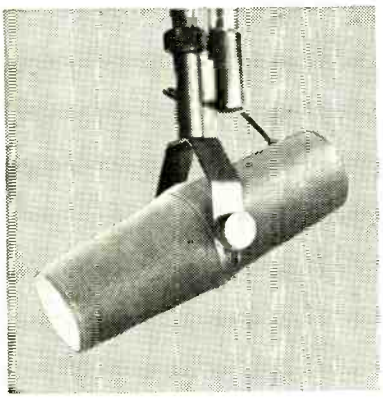

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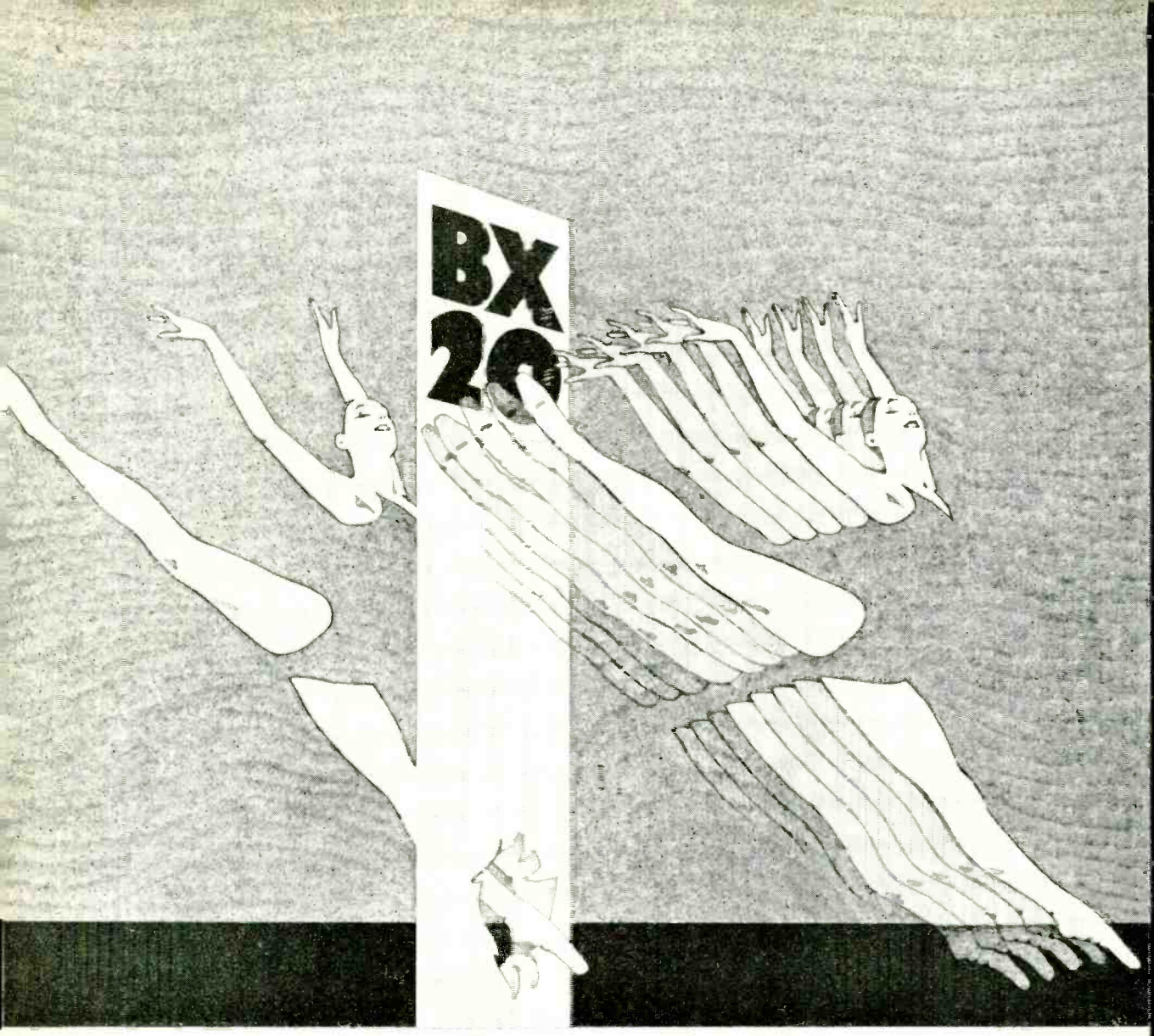

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Saarländischer Rundfunk, Saarbrücken
Süddeutscher Rundfunk, Stuttgart
Stadttheater Wiesbaden, Wiesbaden
Barbarossa-Studio, Munich
Bundeswehr-Erprobungsstelle Greding
Norddeutsches Werbe-Fernsehen, Hamburg

Great Britain
Sound Studio, London

Greece
National-Theatre, Athens

Hongkong
Recording Studio

Indonesia
Recording Studio

Iran
Broadcast, Teheran

Israel
Sound Recording

Japan
KTD-Postal Authorities, Tokyo

Luxembourg
Broadcast

Netherlands
NOS (Broadcast)
Philips-Eindhoven

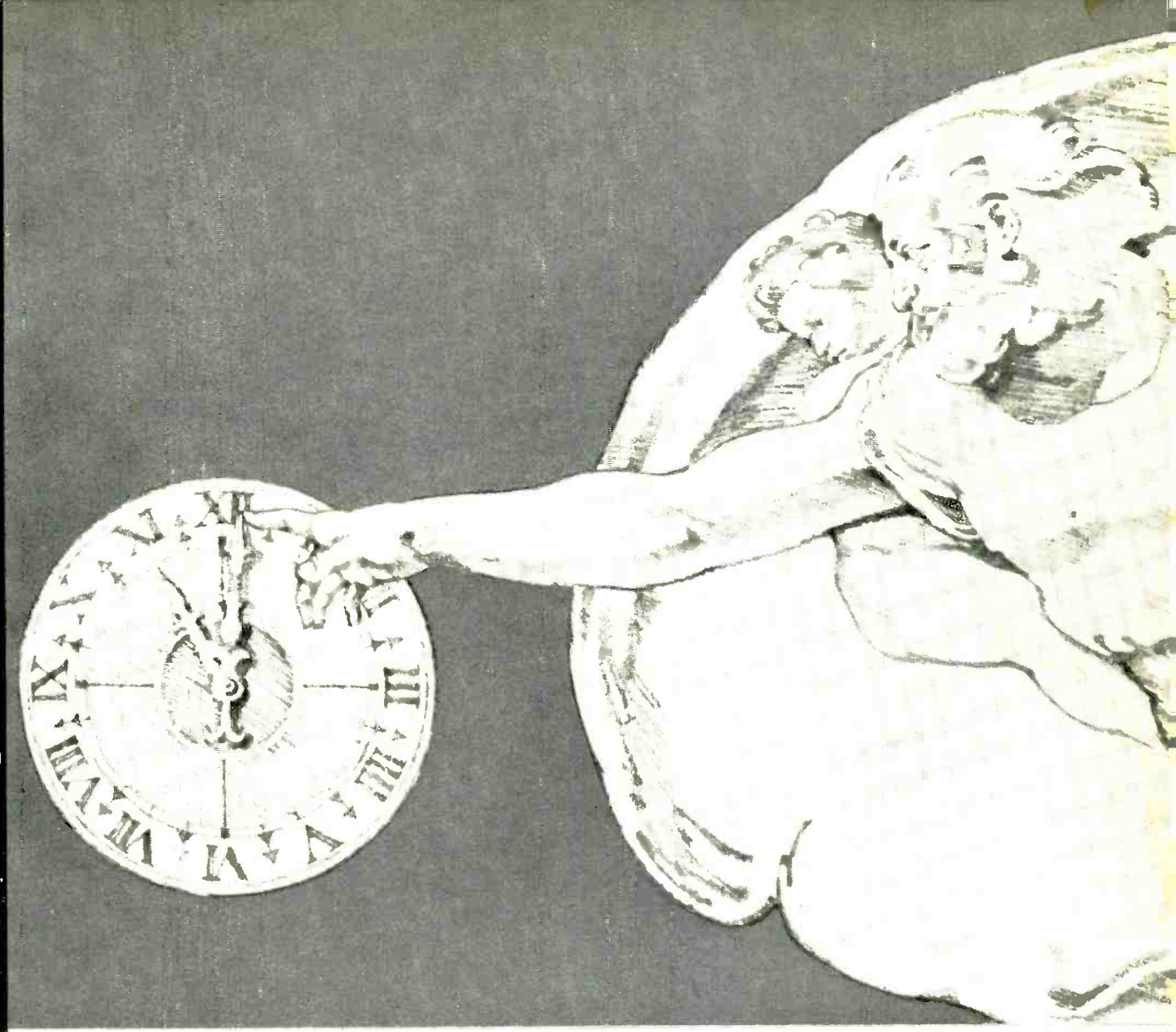
Norway
Recording Studio

Singapore
Recording Studio

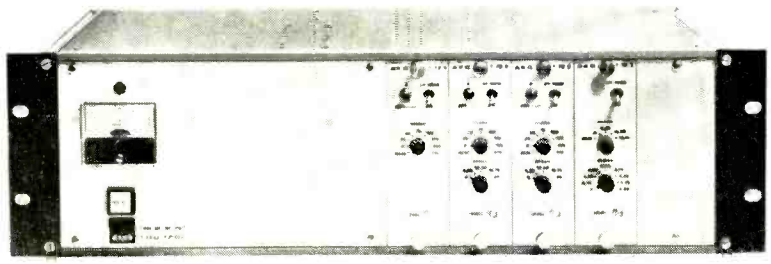
South Africa
Broadcast

Spain
Recording Studio

Tunesia
Broadcast



That professional touch...



AKG TIME DELAY UNIT TDU 7202

Whenever you require time delayed information within the sound path – this Delay Unit may solve all your demands in various applications. Delay times of 0.75 ms to 400 ms are possible. Up to 4 outputs from 1 input. Delay time is independently adjustable for each output from front panel or remotely controlled. Module technique for ease of maintenance. Continuous variation of delay time is possible within the limits of plus 0 and minus 20%. May be used free-standing or rack-mounted.
Available in 104 countries all over the world.

AKG

ADV 190/E1

Again and again and again

Given the time, the patience, and the money, one can connect* fifty 303 amplifiers nose to tail so that the programme goes through one after the other gradually deteriorating along the way.

Deteriorating? The fact is, that apart from a very slight background hiss – akin to a good tape recording – the programme will sound exactly the same at the end as when it started.

*Of course one must fit an attenuator to reduce the signal back to its original level between each amplifier.

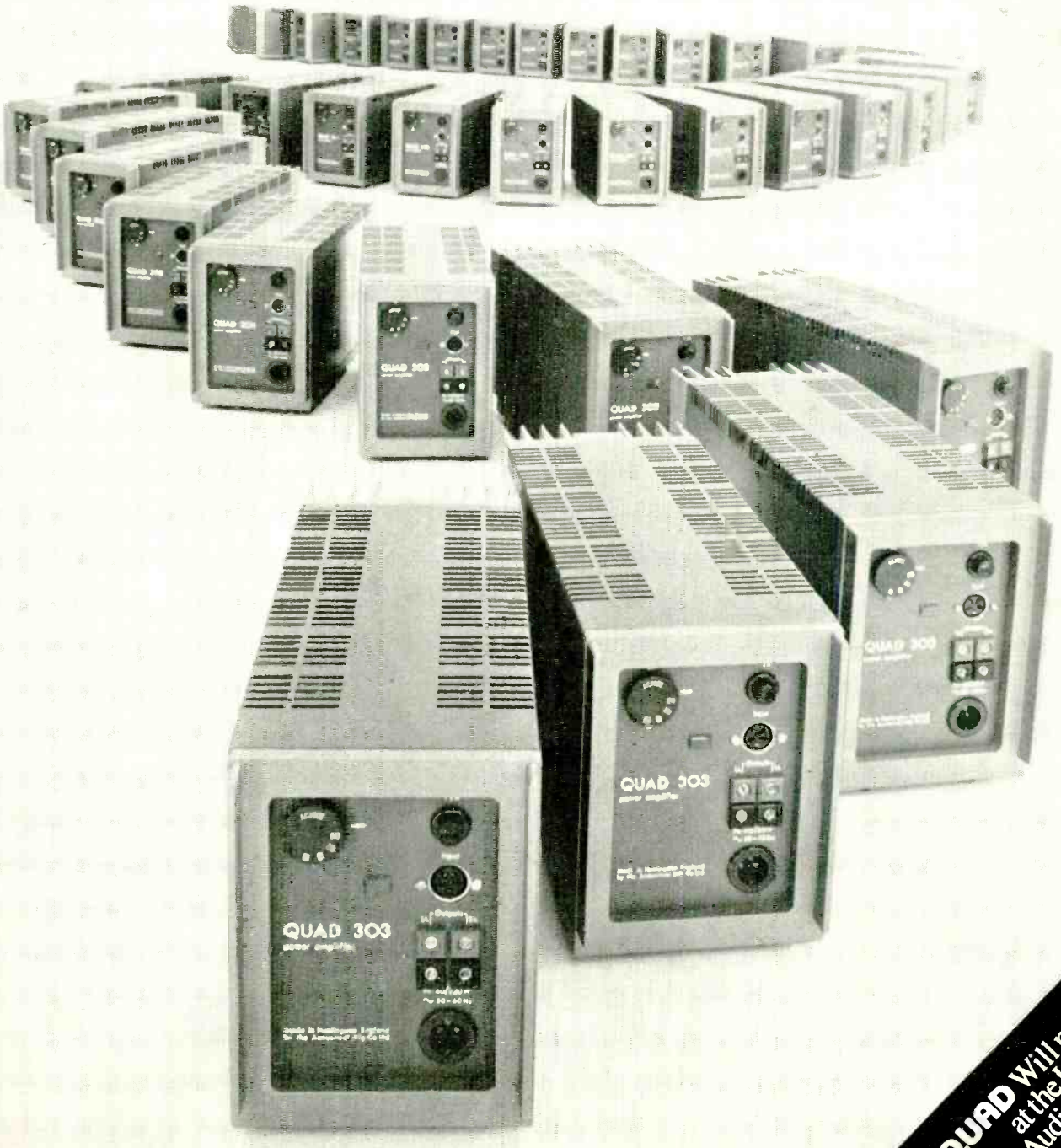
Send postcard for illustrated leaflet to Dept.SS Acoustical Manufacturing Co. Ltd., Huntingdon PE18 7DB. Telephone (0480) 52561.

QUAD

Products of The Acoustical Manufacturing Co. Ltd.

for the closest approach to the original sound

QUAD is a Registered Trade Mark



QUAD Will not be exhibiting at the International Audio Festival & Fair this year and hope that this will not disappoint prospective visitors.

COMPARE

ADM'S NRC and the "Usual" Consoles!

When you buy an Audio Designs NRC Console, you get a professionally engineered unit built to the highest quality standards. And you are assured of "no hassle" service assistance whenever you need it. But that's not all. You get extra performance and features not usually found in the ordinary console.

Look at the "unusual" extras you get in ADM Consoles

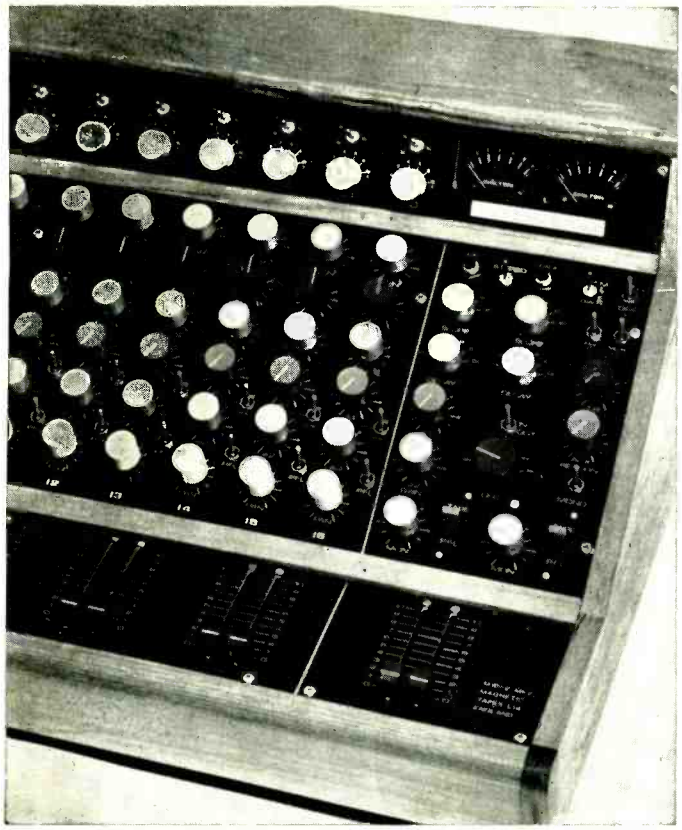
ADM FULL-FEATURED CONSOLES

• AUDEX—solid state audio reed switching system	not the "usual" troublesome push buttons.
• SLIDEX—noise-free linear attenuator with elements sealed against dirt	not the "usual" open elements (noisy).
• VUE-Scan—bar graph TV screen for monitoring up to 28 audio channels, switchable between peak and average reading	not the "usual" mess of meters.
• 4-band, 14 frequency reciprocal equalizer on all inputs	not the "usual" 3-band.
• 4 sets of Machine Remotes	not the "usual" one or none.
• Full quadraphonic capabilities with 4 joy sticks	not the "usual" one or two joy sticks.
• Simultaneous multi-track (8, 16, 24 track), quad, stereo and mono outputs	not the "usual" multi-purpose outputs.
• Complete tip, ring and sleeve patching	not the "usual" miniature size or limited patching.
• 4 cue channels	not the "usual" one or two.
• 2 solo systems	not the "usual" one.
• 5-Year Warranty on parts and labor	not the "usual" 90 days to one year.

Write or call collect for further information on the UNusual ADM Console.

AUDIO DESIGNS AND
MANUFACTURING, INC.
16005 Sturgeon
Roseville, Michigan 48066
Phone: (313) 778-8400, Cable: AUDEX

AMPEX
DISTRIBUTED OUTSIDE U.S.A.
BY AMPEX INTERNATIONAL OPERATIONS, INC.



WHY CHILTON MIXERS?

We are manufacturers in the true sense of the word; producing Teak Cabinets, Sheet Metal Work, Tooling, Front Panel and Printed Circuit Artwork etc., our products are accurate with an attention to detail that is second nature to us.

The popular M10/2 (10in 2 out) portable mixer shown is supplied as a basic unit with 10 Line inputs inc PPM, Oscillator, LF/HF Equalisers, 1 Aux and PFL. You choose the number of Microphone or Gram inputs, the channels to have Presence, Switchable HF/LF Filters or Ducking. In addition a 2nd Aux channel, Talk-Back, and/or Compressors can be fitted.

Ring or write for full information, if however our standard range is unsuitable it may be possible to modify one to suit your requirements.

M10/2 Mk4 BASIC ..... **£350.00+VAT**
16 input version ..... **£515.00+VAT**
12 in 4 out Mk2 ..... **£565.00+VAT**

MAGNETIC TAPES Ltd., Chilton Works, Garden Rd., Richmond, Surrey, TW9 4NS

Telephone 01-876 7957

Dokorder 8140

Compare the features

- 4-track, Multi-sync Recording
- Molybdenum Heads with Original Owner Lifetime Guarantee
- Three Motor Solenoid-Controlled Transport
- Adjustable Tape Equalization
- Switchable Tape/Source Monitoring
- Instantaneous Pause With Locking Feature
- Separate Input/Output Controls
- MIC/LINE Mixing
- Large, Illuminated Meters
- Electronic Echo and Sound-on-Sound

Then compare the price!

Recommended Retail Price

£312 **Excluding VAT**

That's the Dokorder 8140. Four channel or two channel, recording or playback, overdub, quadraphonic, sound-on-sound, echo . . . everything you need to help translate what you feel into what others will feel. Send for full details now.

Imported for you by:
AEL **ACOUSTICO ENTERPRISES LTD** *The Hi-Fidelity People*
Unit 7, Space Waye, North Feltham Trading Estate, Feltham, Middlesex. Tel: 01-751 0141 (4 lines)

Tandberg 10XD.

In the field of professional audio equipment, you can spend a lot of time piecing together information, comparing notes on standard and optional features, across so many different tape decks.

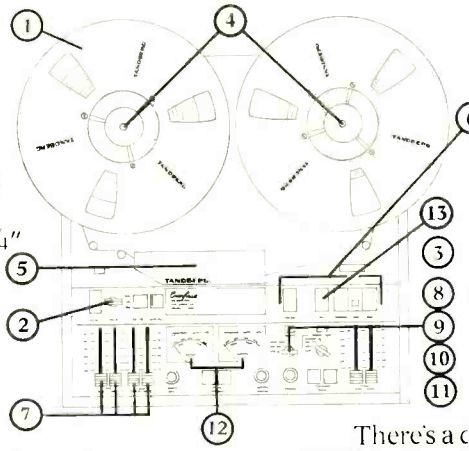
With all its refinements, the 10XD means you've hit the nail squarely on the head first go.

1. The 10XD will take any spool up to the 10½" size you see here.

2. The three speeds 15", 7½ & 3¾" all have the benefit of Tandberg's Crossfield recording technique, along with the unique Dolby B facility.

3. High speed accuracy from the electronic drive with tachometer control.

4. Behind here are 2 high powered spooling motors and over here **(5)** are four precision Tandberg heads—one more than you'll get on many units.



All the operating functions of the 10XD are electronically controlled, with the facility for remote control wherever needed **(6).**

7. Four input controls, including 2 for balanced microphone inputs that allow you to mix in stereo.

8. 9. 10. 11. Facilities for echo, sound on sound, editing, cueing and A&B tests.

12. Peak-level meters.

13. Photo electric stop.

The nice thing about the 10XD, is that you don't need to be a professional to appreciate all these qualities. Anyone with an ear for precision sound reproduction, will get a thrill out of this machine.

There's a detailed breakdown of the 10XD in Tandberg's special colour leaflet.

Use the coupon to get your free copy, and the name of your nearest Tandberg dealer.

Please send me complete details on the 10XD and other ancillary equipment.

Name _____

Address _____

SS/9/170

TANDBERG
Legendary perfection

Send coupon to **Tandberg (UK) Ltd., Farnell House, 81 Kirkstall Road, Leeds LS 1HR**

The new TEAC A-7300/2T. Technology to match your talent.

As a professional, you probably know all about TEAC. Our A-3300 Series tape decks have helped to set new standards in the recording industry.

Now we'd like to introduce you to the new A-7300/2T. A superb ½ track stereo machine with servo controlled direct capstan drive and full IC logic circuits.

It's an entirely different breed of animal with lots of new features to meet different demands and needs.

There's a built-in 4-in, 2-out mixer. You can plug up to four professional quality microphones or you can connect up to four line level sources, or combine two mic and two line sources together.

An Edit button overrides the take-up reel motor. When engaged from the play mode, this control allows portions of unwanted tape to be easily removed from the supply reel. And an elapsed time indicator shows actual minutes/seconds in all transport modes.

A pitch control provides continuously variable speeds, plus or minus approximately 8% at either of the two speeds of 15 ips and 7½ ips. This can be used to compensate for pitch variation of musical instruments or as another element in the creative recording process.

And of course there are all the other advanced features you expect from TEAC. Master input level control, dual concentric output level control, 3-position bias and equalisation settings, 10½ inch reel capacity, and much much more.

A quarter track version of the A-7300 is also available.

Write to the address below for full literature.

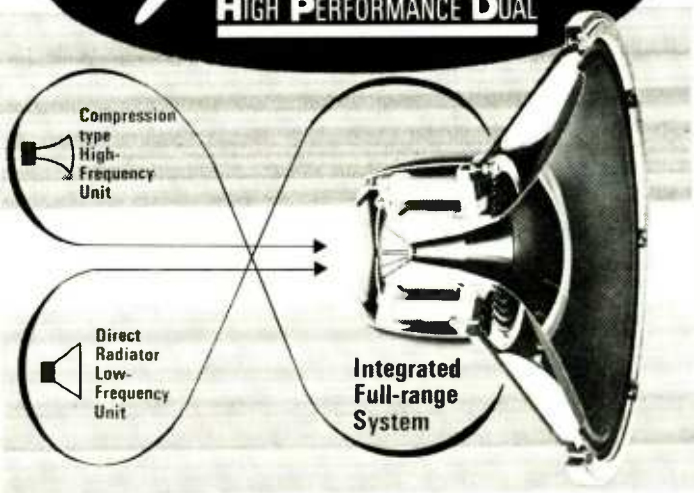
TEAC

TELEDYNE ACOUSTIC RESEARCH

High Street, Houghton Regis,
Dunstable, Bedfordshire LU5 5QJ
Telephone: Dunstable (0582) 603151

THE *New* TANNOY *Monitor*

HIGH PERFORMANCE DUAL



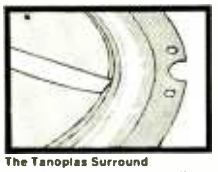
The Monitor H.P.D. represents a further outstanding improvement of a loudspeaker system which has become regarded as a quality standard over the last 25 years by Recording Studios throughout the world. There is a very good chance that your favourite records and tapes were monitored on Tannoy Dual Concentric loudspeakers, and to select these superbly engineered, individually hand-assembled speakers for *your* music system assures you of the same professional performance.

	260 mm 10"	310 mm 12"	410 mm 15"
Power Handling Capacity*	50W	60W	85W
Frequency Response	27-20,000 HZ	25-20,000 HZ	23-20,000 HZ
Intermodulation Products	less than 2%	less than 2%	less than 2%
Impedance via Crossover network	8 ohms (5 ohms min.)	8 ohms (5 ohms min.)	8 ohms (5 ohms min.)

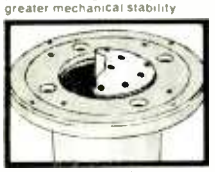
*INTEGRATED PROGRAMME MATERIAL

The Girdacoustic Cone improves frequency and transient response, gives much increased power handling capacity and greater mechanical stability

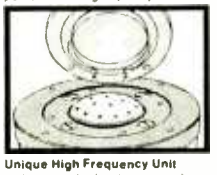
The High Temperature Voice Coil assures absolute climatic stability and great mechanical strength together with much improved power handling capacity



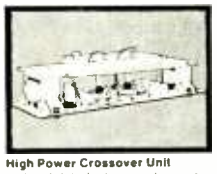
The Tanoplas Surround gives low bass resonance with excellent mechanical stability and freedom from edge reflections



Patented Magnetic Shunt combined with specially treated and selected steel gives maximum magnetic flux in the unique Tannoy twin gap system. Improves sensitivity and damping



Unique High Frequency Unit with separate diaphragm and voice coil coupled to the horn by a 19 element phase-matching system



High Power Crossover Unit with solid dielectric condensers throughout, combined with treble and roll-off controls

Designed to sound better—naturally...

TANNOY

NORWOOD RD. WEST NORWOOD SE27 9AB
Tel: 01-670 1131 Telex: 949755

AUDIO DEVELOPMENTS
PORTABLE MIXERS

AD 031 and AD 007

The Portable Mixers with the professional qualities and the professional performance.

Both have 8 inputs that drive into 4 or 2 groups.

All inputs and outputs balanced using XLR connectors throughout.

Peak Programme Meter to BS 4297/1968 specification. (V.U. meter optional.)

Auxiliary for use on either echo or foldback.

Stereo linkable compressors on the AD 007.

Extender Units that can incorporate 10 extra input modules.

Size: 540 x 480 x 225 mm AD 007
420 x 335 x 127 mm AD 031

Weight: 22.7 Kg AD 007, 10 Kg AD 031

Modular construction to promote serviceability.

Both mixers can be hired and national sound reproducers of Northolt Road, South Harrow, Middx are agents for hire in the London area.

There are agents in Belgium, Canada, France, Holland, Norway and Sweden to date.

Audio Developments

Hall Lane
Walsall Wood
Walsall
WS9 9AU
Brownhills 5351/3

NEWS

New Studer

THE LATEST MACHINE from Studer utilises the Revox *A700* tape transport, but is fitted with electronics oriented towards the broadcasting and studio recording fields. The new *A67* is available in several packages—these include portable, chassis, rack mounting and console versions.

Similarly, the machine can be supplied or changed in service to the usual track formats within the 6.25 mm tape width; also, the use of plug-in eq boards allows a ready interchange of recording standards. Basic features include full control logic interlock, vari-speed, mechanical counter indicating minutes and seconds, remote control facilities, detachable head block and tape tension monitoring in transport modes.

Synopsis of manufacturers' specification referred to operation at 38 cm/s:

Reel type: NAB, DIN and cine to 26.5 cm.
Inputs and outputs: 0 dBm nominal.
Spooling time: 120s for 700m.
Frequency response: ±2 dB 30 to 18k Hz.
Signal to noise ratio (CCIR, weighted, Agfa PER525 tape, 2.75 mm track width fluxivity 510 nW/m): 61 dB.
Wow and flutter (DIN 45507 peak weighted): 0.05% or less.

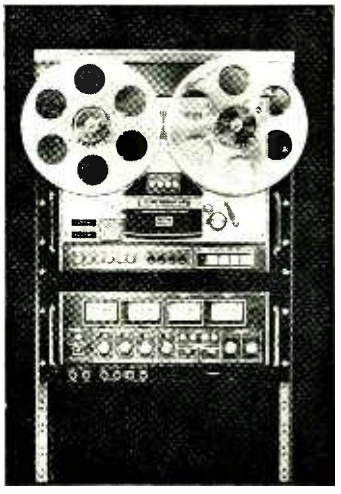
Studer International AG, CH-5430 Wettingen, Switzerland. Phone: 056 2687 35. Telex: 53682.
USA: Revox Corporation, 155 Michael Drive, Syosset, NY 11791. Revox Corporation, 3637 Cahuenga Blvd West, Hollywood, Ca 90068.
UK: F. W. O. Bauch Ltd, 49 Theobald Street, Borehamwood, Herts. Phone: 01-953 0091.

Above: *Latest machine from Studer, the A67.*
Below: *Low cost 4 channel Dokorder 1140.*

Low cost four track

THE NEWEST ADDITION to the Dokorder range of tape recorders looks possibly the most interesting development from the company. It comprises a four track tape machine on 6.25 mm tape that retails in the UK for £520. The specification includes a remote control, 26.5 cm reel capacity, high speed (19 and 38 cm/s standard), simul-sync, over dub/echo and limited memory rewind facility. The machine, type *1140*, is available in standard wooden console and rack mounting format.

Also recently available is a half track version of the *1120*. Known as the *1122*, the new model features 38 and 19 cm/s speed and an interchangeable head block facility for use with quarter track tape format. Dokorder Inc, 11264 Playa Court, Culver City, Ca 90230, USA.
UK agents: Acoustico Enterprises Ltd, Unit 7, Space Way, North Feltham, Middlesex TW14 0TZ. Phone: 01-751 0141/4.



Automated broadcasting

MELLOTRONICS LTD, the UK agents for Shafer Electronics Inc, has announced the sale of a *903* automated broadcast system to the Gibraltar station of the British Forces Broadcasting Service. The complete installation comprises the *903* memory system offering a programming capacity for up to 400 sequential events and 1440 timed events, network or studio join facilities, four *PB720* reel to reel tape reproducers, two ITC single cartridge machines and a Shafer 36-cartridge random access *Audiofile*. In addition, there is a custom-built interface allowing automation of the existing Ampex *351* recorders. The installation includes equipment to record the cue tones on the programme tapes.

The manufacturers claim that the benefits of the system include a reduction of the non-social hours working by the operating staff and a general improvement of the standard of presentation of programme output. Recent surveys suggest that up to 20% of programme output of US broadcasting stations is derived from automated cueing procedures. Within the UK there are, at present, no installations of this type. Shafer Electronics Inc, 75 Castillian Drive, Goleta, Ca 93017, USA. Phone: (805) 968 9755.
UK agents: Mellotronics Ltd, 35 Portland Place, London W1N 3AG. Phone: 01-637 0755.

Mixer hire-erratum

IN THE NEWS section of the September issue (p40), we stated that a series of Audio Design Mixers was available for hire from NSR Ltd of Northolt Road, South Harrow. The mixers in question were in fact manufactured by Audio Developments of Walsall Wood, Staffs. We apologise for any resultant misunderstanding.

Manna

A SMALL GROUP of people, based in the Portsmouth area, is setting up a trust charged with the production of religious programmes for presentation on local and hospital radio networks. However, the same secular problems face these people that also face other good causes—lack of hardware etc. They wish to appeal, through these columns, for any 'obsolete' mixers available from benevolent readers. They state that they would be more than happy to arrange transport. If such a thing as a free mixer really exists, please contact David Couchman at 51 Maylings Farm Road, Fareham, Hants PO16 7QS. Phone: 03292-5391.

AES 53 Zurich

THE 53RD CONVENTION of the Audio Engineering Society will be held from March 2 to 5 at the Hotel International, Am Marktplatz, CH-8050, Zurich, Switzerland. Following the pattern of other conventions on the international AES circuit, the Zurich venue will include a programme of technical papers, a show case for manufacturers' products and the opportunity for delegates to visit various electronic firms and recording/broadcast studios in the vicinity of the exhibition.

For those wishing to submit

30 ▶

PERFORMANCE PLUS

TECHNICAL SPECIFICATION

Mean sensitivity open circuit voltage per dyne/cm² (micro bar) 0.064 mV
Open circuit voltage level per micro bar reference 1 volt -84 dB
Power delivered into 30 ohms for 1 micro-bar reference 1 mW -76 dB.
American A.S.S. rating reference 1 mW -150 dB.
Nominal impedance 30 ohms.
Distortion less than 0.5% for a sound intensity level of 125 dB above 0.0002 dynes/cm² (20 micro-newtons per square metre) at 500 c/s.
Dimensions: length 21.3cm, mean diameter 2.54cm, weight 260gm.
Response curve is sensibly flat from 30 c/s to 12,000 c/s for sound incidence within a solid angle of 30°.

4037A Moving Coil Microphone ideal for Television Interviewing

This microphone is unobtrusive, and neat in appearance, and is therefore ideal for television and sound interviewing. It is finished in black shrivel enamel and satin chrome. There is a special locking device to prevent it becoming accidentally detached from the 4069A Jack during use. The response of the microphone to wind conditions is reasonably low, and in severe wind conditions a P.A.S. 45/39 windshield is recommended, this will permit speech clarity. A first class professional inside and outside broadcast omni-directional microphone.

Hampstead High Fidelity, 91 Heath Street, Hampstead London NW3 6SS
Telephone 01-435 0999 and 435 6377

papers for presentation at the convention, the closing date is September 25. Applications for exhibition space should be addressed to G. K. Ullman, Philips AG, Dept AVT, PO Box CH-8027, Zurich, Switzerland.

French connection

TAKEN OVER BY the French company Acousmat: Apollo Electronics, formerly of Mill Hill, London NW. The new group will manufacture the established Apollo range of modular mixer components at a production facility based in France.

Further information may be obtained from Michel Guedi of Acousmat/Apollo Electronics 22 Rue Ste Ambroise, Paris 75011, France. Phone: 357 16 97.

Low cost oscilloscope

BEING IDEAL FOR investigating phase relationships and relative signal levels, the *4D-10* dual trace Scopex 'scope should find applications in recording studios for desk and tape machine alignment. Incorporating a 6 x 8 cm display, the unit features a 10 MHz bandwidth, a trace locate facility, full speed deflection sensitivity down to 10 mV/cm (y axis) and internal time base speed to 1 μs/cm.

The unit costs £118 from Scopex Instruments Ltd, Pixmore Industrial Estate, Pixmore Avenue, Letchworth, Herts SG6 1JJ. Phone: 04626-72771.

AES 52

THE 52ND AUDIO Engineering Society Convention will be held at the Waldorf Astoria, New York, between Friday October 31 and Monday November 3. Fuller details from AES, 60 East 42nd St, New York, NY 10016. Phone: (212) 661-2355, telex: 620298 UW. Due to later availability of paper and exhibitor information, the preview may appear next month (November, published October 14).

Engineering courses

THE POLYTECHNIC OF North London is offering a range of courses on audio engineering and acoustics for the year 75/6. Starting in October, a course in electronic and communications engineering, with audio engineering as a specialisation, results in a new B.Sc (CNAA) degree. The duration is three years.

Concurrent for part-time students, a one-year course in sound studios and recording exempts students from the finals of the degree mentioned above. Continuous student assessment is by the City and Guilds of London Institute. The entrance fee is £15.

Details of these and other courses is available from the Department of Electronic and Communications Engineering (room 2/8), The Polytechnic of North London, Holloway, London N7 8DB. Phone: 01-607 6767 Ext 287.

Didn't they do well 3

FIRST OF ALL, Cadac are very happy after winning an order to supply the Vogue Studio, situated in Villetaneuse, France, with a 28/24 format desk which is also equipped to do quadraphonic mixdown work. Initially, 16 output groups are provided but these will be expanded to 24 in the foreseeable future. Other features of the desk include four echo sends and eight echo returns, four separate foldback circuits and full equalisation. Installation work is expected to start about Christmas. Cadac consider this order to

60▶

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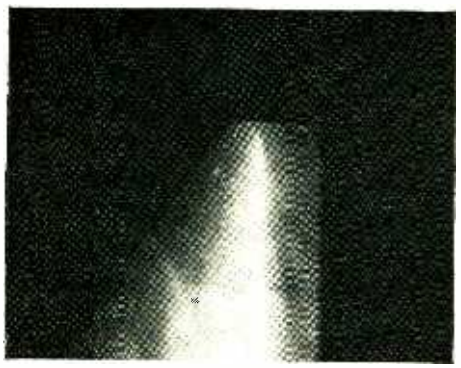

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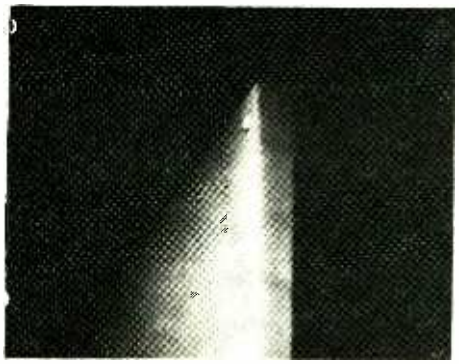

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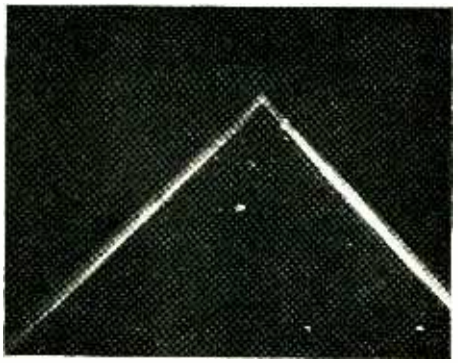

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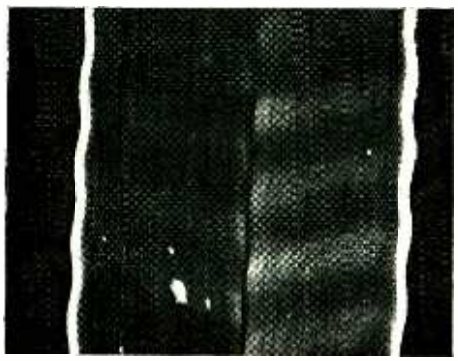

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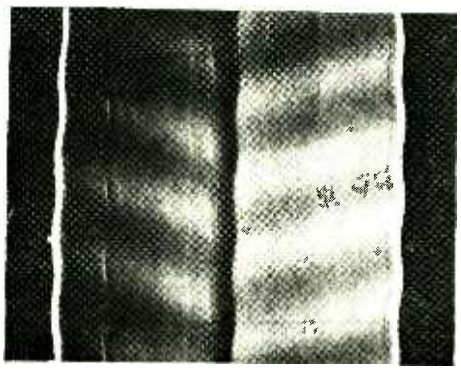

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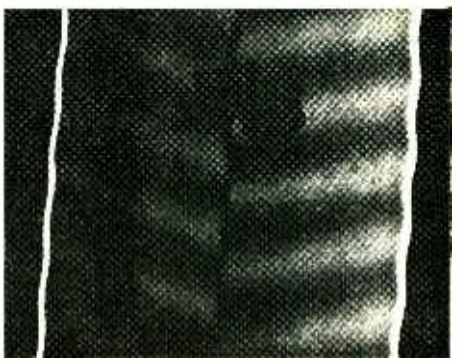

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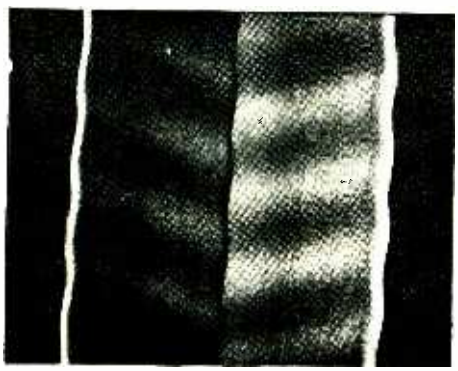


Diamond Cutting

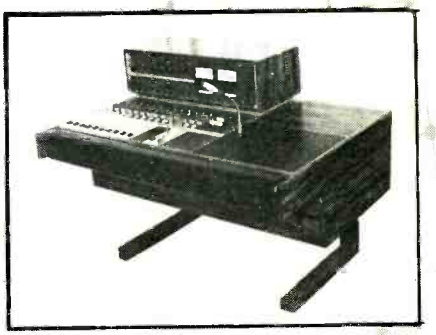
JVC's new Mark III cutting system, on which a paper was presented at the recent Los Angeles AES show, has now been in service for some time. The cutting chisel is of diamond, with a lamination of tungsten carbide on the trailing facet to prevent lacquer adhesion. Significant improvements are claimed in half-speed cutting, as indicated best by the accompanying photographs, taken by JVC using scanning electron techniques.

1. *Sapphire cutter after 40 lacquer faces operation.*
2. *Diamond cutter after 120 lacquer faces operation.*
3. *Diamond cutter, showing left and right burnishing facets.*
4. *CD-4 carrier cut with new sapphire.*
5. *CD-4 carrier cut with sapphire after 15 hours use.*
6. *CD-4 carrier cut with new diamond (black above centre is photographic print damage).*
7. *CD-4 carrier cut with diamond after 15 hours use.*

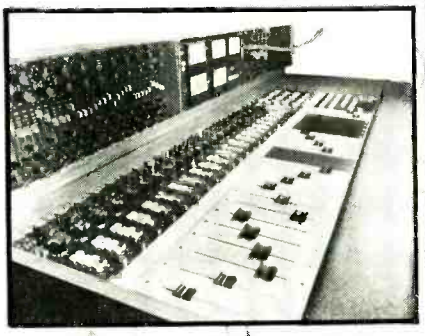
audix BROADCAST SYSTEMS

B102 14 to 32 input, 4 sub group, 2 main output control console.

Commercial radio central area control, monitoring and distribution rack equipment.



B101 10 channel, 2 group mixing console.



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LETTERS

Dear Sir, Thank you for calling to see me recently. I'm glad we were able to air our views on the studio write-up.

I thought I would just confirm the couple of points I was not happy with. The first is that I am not the founder of the company. My father, who started the company, has been involved in sound for nearly 50 years and the credit must go to him. It was probably people like him and Joe Meek who helped break the monopoly of the major studios like EMI and Decca, allowing the present-day influx of independents.

My other quote, as you agreed, was taken out of context concerning the 3M Selectake. My comments were that 'the basic machine is very good' (meaning the Selectake, not the *M79;* the *M79* is superb!) 'but you can't beat a good tape op', which I feel is fair comment, not criticism. No mention was made of the *M79* machine causing an oscillatory situation etc.

Hope you don't think I'm being 'very silly indeed' writing to you.

Yours faithfully, Robin Jones, R. G. Jones Ltd, Beulah Road, Wimbledon, London SW19.

Dear Sir, In the July issue of STUDIO SOUND, reference was made in the R. G. Jones Studio article by Frank Ogden to the 3M Selectake tape search unit used by this and many other professional studios throughout the country.

The article implies that the 3M *M79* series professional multitrack recorder affects the successful operation of the Selectake unit. This is quite incorrect. The Selectake is designed to operate with the *M79* series recorders and is available as an optional extra. In this case, the dog does not wag the tail; the tail wags the dog!

The article also implies that the Selectake is a rather cheap and nasty device which can be beaten to the gun by the recorder operator. When we were telephoned by the author and questioned about the unit, we informed him that the 3M device operates by overshooting both in forward and reverse mode until the desired preselected tape position is reached. We further informed him that there were other devices available which operate by braking in one direction only, and while these were perhaps faster, they were also more expensive than the 3M unit. Unfortunately, Frank Ogden reduced this information to: '3M comment: "At the price, we do not see this as a fault" '.

A typical use of the Selectake unit is as follows: during a recording session, the operator notes and logs take starts as indicated on the unit's readout tubes. When replays of certain takes are required, the previously recorded take starts are set on the preselector. The appropriate mode (forward or rewind) is initiated on the recorder, upon which the Selectake commands the recorder to stop at the preselected location within ±2 counts of the readout counter.

It would be appreciated if you could publish the above and so set at rest the minds of our many customers who might have been led to believe that they had purchased an inferior piece of equipment—or worse still, that their *M79* machine was in some way incompatible with the Selectake unit.

Yours faithfully, Bill Bowles, Public Relations Executive, Recording Materials Division, 3M UK Ltd, 380-384 Harrow Road, London W9.

I regret that my comments in the R. G. Jones article concerning the operation of the Selectake gave so much cause for concern. The comments, quoted verbatim, were lightly made and, as such, lightly written. It was never the intention to sit in judgement on the operation of the device. The place for such a judgement is clearly within the review columns of the magazine.

However, in context, the remarks can be defended. Bill Bowles of 3M stated that the Selectake operates by 'overshooting both in forward and reverse mode until the desired preselected tape position is reached'. Technically, this is an oscillatory situation even if damped. 'Oscillatory situation' was my description and did not originate from Robin Jones. It was never intended to criticize the operation or performance of Robin's M79 *machine. All remarks related totally to the Selectake.*—**Frank Ogden.**

Dear Sir, We would like to thank Angus McKenzie for his helpful comments in his review of our 12/4 recording console. By the time this edition of STUDIO SOUND goes to press, the new 12/4 Series 2 will be in production, superseding the model under review and embodying many improvements, certain of which are suggested by Mr McKenzie.

In particular, we have lowered the mixing point noise by a further 6 dB from that finally obtained on the review sample, and have increased the line input level capability to +35 dBm. Output of the desk is now +22 dBm into 600Ω.

For a more detailed description of the new

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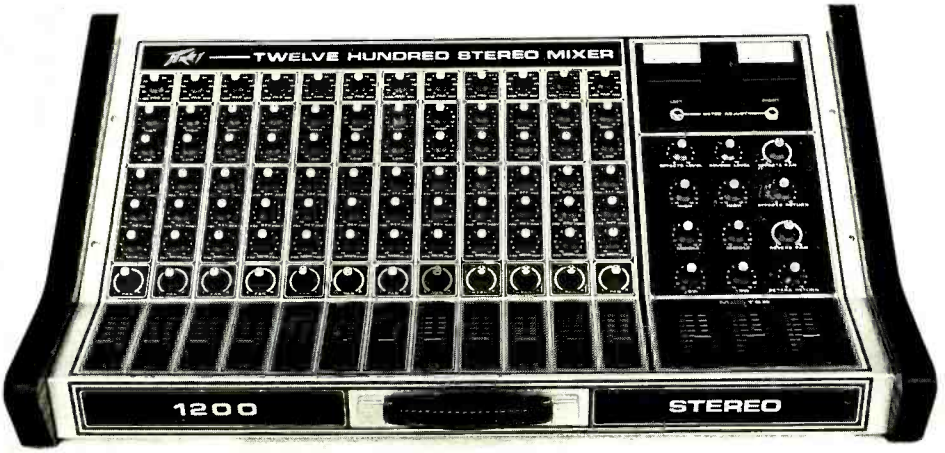

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LETTERS

desk we refer the reader to our advertisement in this issue (excuse the plug).

Yours faithfully, Graham Blyth, Technical Director, Soundcraft Electronics Ltd, 5-8 Great Sutton Street, London EC1V 0BX.

See p86—**Ed.**

Dear Sir, Permit me to write to you about the review of the Telefunken *M12* recorder in the May issue. Since we represent Telefunken in the USA we are naturally interested to see that no errors creep into such reviews. I would have written to Hugh Ford, an old friend, directly, but thought you'd like to read my comments and then pass them on to him.

He mentions two 'lethal' items to which the Hayden people replied in their letter on p. 62 but to my way of thinking did not sufficiently cover the necessary reply.

1) As for tape motion logic: I realize that the general tape recorder manufacturing industry has slipped ever more towards the lower market levels, and in these such 'baby logic' might be needed. I have yet to encounter a serious-minded engineer who doesn't bristle at the thought that such logic is necessary, and who does not object to spending money on such 'frills' to the detriment of audible quality, on which Telefunken has obviously not skimped. It is a fact that such logic is in the works at Telefunken, though.
2) The matter of the record button interlock, however, is quite another matter! We refer to section 2.3.5 on p. 2-6 of the *M12* Manual which says: 'The *M12* offers two possibilities:

   Record can be preselected using the RECORD button. The PLAY button starts the tape.

   Record is only activated when both the RECORD and PLAY buttons are pushed simultaneously.

   The second option is obtained by removing the diode between solder points 5 and 6 on the printed circuit board B-LC1.' At the head of that paragraph it further says clearly: 'To switch to record mode, both RECORD and PLAY buttons must be pushed'.

That's the good old way!

I trust this clears up what could really be an unfair comment.

It would be very nice if my comments could be included at some near future time in the letters column as well.

Yours faithfully, Stephen F. Temmer, Gotham Audio Corpn, 741 Washington Street, New York NY10014.

I would thank my friend Steve Temmer for his interest in my reviews, and for his comments upon the Telefunken M12 *review. While I appreciate Mr Temmer's remarks about 'logic' and do agree that in some instances logical interlocking can be excessive, with consequent unnecessary expense and decreased reliability, we must keep our feet on the ground.*

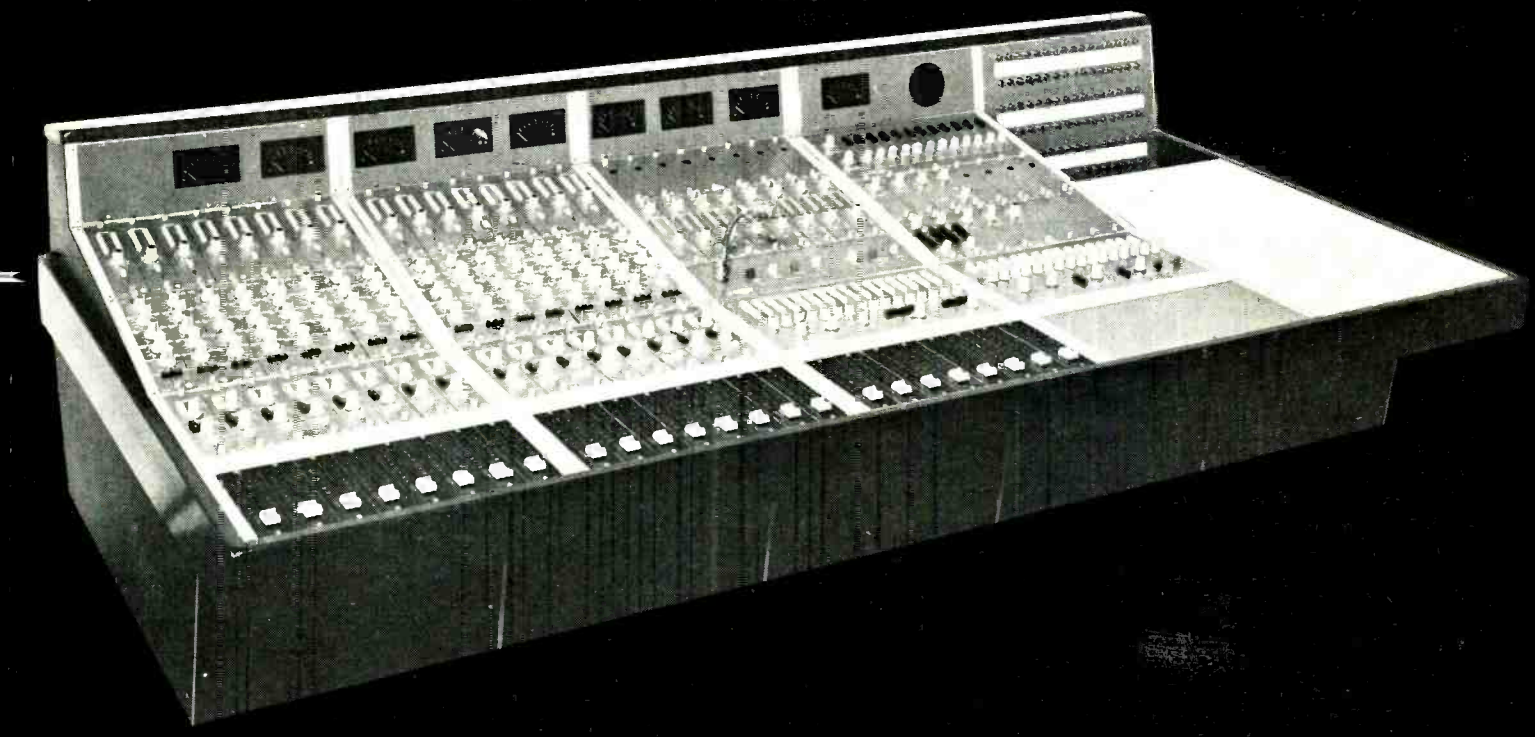
'Logic' is a word which has crept into the audio industry over the last few years, and for some reason is regarded with trepidation by audio engineers, possibly because it is associated with digits and computers, which audio people have no wish to understand! In days of old the 'logic' was achieved by multiple interlocking mechanical switches, which are expensive, unreliable bits of bent tin—these switches were used to drive mechanical relay logic. Now, what is wrong with replacing these mechanical contraptions with small, cheap, reliable integrated circuit logic?

Provided that modern logic is properly engineered, it is extremely reliable and adds little to the cost of a professional equipment and can be a valuable safety feature. The cost of a master tape bears no comparison with the small expense of logic required to protect it from mechanical or magnetic damage.

Turning to the matter of the record interlock, I reported on the machine as delivered. I assume that it could well have been delivered to a studio in the same state. Unfortunately at the time no instruction or operation manual was available, but subsequent events confirm that two interlock modes are built into the machine.—**Hugh Ford**

Dear Sir, Your long overdue articles on disc cutting are much appreciated. A comment or two on Tony Bridge's piece. Surely, some of the information given in the *Monty Python* record story was either incorrect or incomplete . . . or else George Peckham took on a much

98▶



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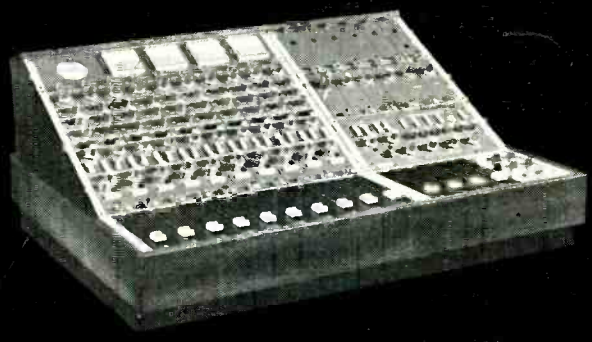

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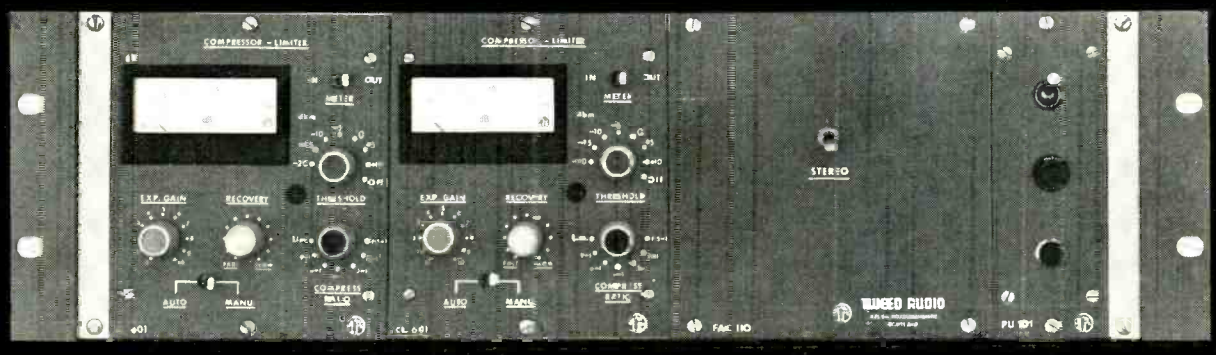

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PATENTS

THE FOLLOWING list of complete Specifications Accepted is quoted from the weekly Official Journal (Patents). Copies of specifications may be purchased (33p) from the Patent Office, Orpington, Kent BR5 3RD, UK.

July 2

1402508 ZCM Ltd.
System for conveying sound information to the brain.
1402609 Ellanin Investments Ltd.
Noise reduction system for video signals.
1402681 International Business Machines Corporation.
Tunnel erase transducer assembly.
1402695 International Business Machines Corporation.
Apparatus for unloading laminar members from a cartridge.
1402700 Osterreichische Studiengesellschaft Fur Atomenergie GMBH.
Method of and apparatus for producing a colour display of the surface of a solid body.
1402809 International Business Machines Corporation.
Semi-conductor circuit elements.
1403019 Siemens AG.
Output amplifier short-circuit protection circuits.
1403020 Hell GmbH, Dr-ing Rudolf.
Hot-point stylus writing systems.
1403097 National Research Corporation.
Earplugs.
1403110 Eaton Corporation.
Signal isolation system including a photo-transistor.

July 9

1403354 Gabr, S Z M.
Loudspeaker cabinets.
1403360 EMI Ltd.
Television camera arrangements.
1403383 Minnesota Mining & MFG Co.
Composite film structure.
1403386 Matsushita Electric Industrial Co. Ltd.
Data recorder.
1403486 Novanex Automation NV.
Transistor amplifier.
1403488 Burroughs Corporation.
Gas display panel for colour television.
1403519 EMI Ltd.
Apparatus for the automatic registration of signals.
1403695 Bosch Fernsehanlagen GmbH, Robert.
Picture signal correction system.
1403804 EMI Ltd.
Magnetic tapes.

July 16

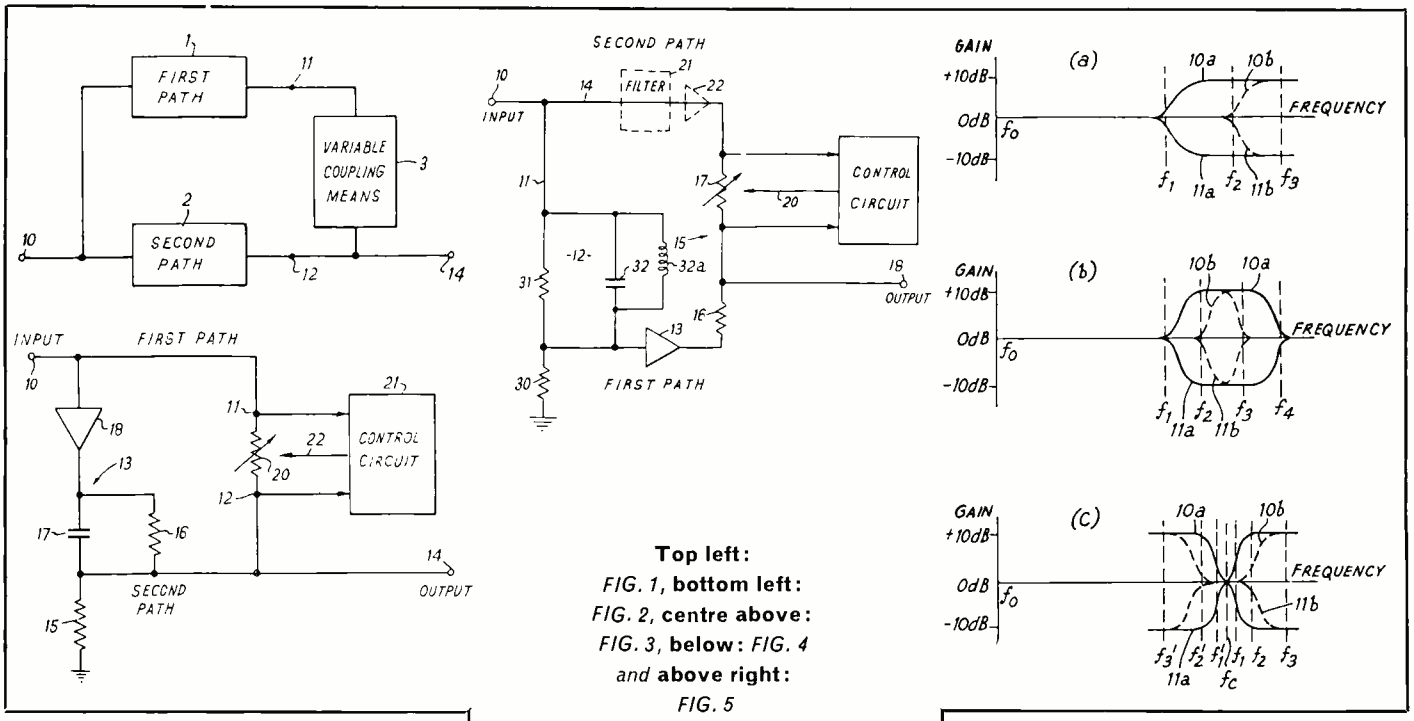
1403997 International Business Machines Corporation.
Waveform communication system.
1403998 International Business Machines Corporation.
Waveform Communication system.
1404029 International Nickel Ltd.
Magnetostrictive methods and apparatus.
1404031 International Standard Electric Corporation.
Horizontal deflection circuit for television receivers.
1404083 Matsushita Electric Industrial Co. Ltd.
Magnetic recording and reproducing apparatus.
1404093 Singer Co.
Simulator visual display system.
1404237 Matsushita Electric Industrial Co. Ltd.
Magnetic recording and/or reproducing apparatus.
1404239 Rank Organisation Ltd.
Discriminator circuits.
1404279 Ambitex Corporation and Cendev Corporation.
Acoustic feedback stabilization system particularly suited for hearing aids.
1404320 Defence, Secretary of State for
Recording tape devices.
1404460 Standard Telephones & Cables Ltd.
Device for transmitting cursive script or drawing over a telephone.
1404483 Arvin Industries Inc.
Process and apparatus for magnetic disc recording.
1404484 Arvin Industries Inc.
Magnetic record disc.

July 23

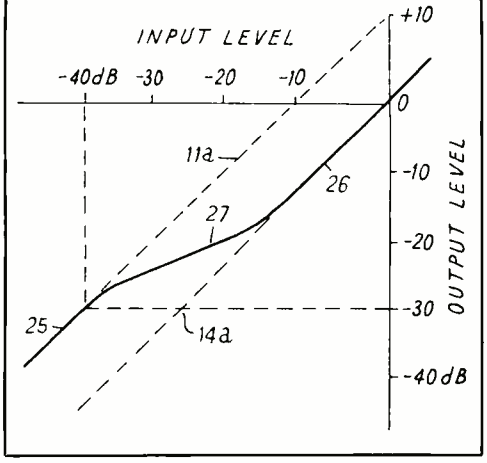
1404541 International Business Machines Corporation.
Information storage system.
1404589 Plessey Co. Ltd.
Electrical information store.
1404590 Defence, Secretary of State for
Radio signalling equipment.
1404613 Dayton Wright Associates Ltd.
Assembly comprising an electrostatic transducer in an enclosure.
1404618 International Business Machines Corporation.
Magnetic disc memory and component.
1404645 Telefonaktiebolaget L M Ericsson.
Circuit arrangements including amplifier circuits.
1404672 Hell GmbH, Dr-ing Rudolf.
Apparatus for the reproduction of pictorial images.
1404718 GTE Sylvania Inc.
Horizontal deflection circuitry for cathode ray tube system.
1404802 Fuji Shashin Film KK and Ikegami Tsushinki KK.
Colour television signal generator.
1404945 Siemens AG.
Data display systems.
1404961 Standard Telephone & Cables Ltd.
Measurement of timing jitter on PCM systems.
1404988 Perkin-Elmer Corporation.
Dynamic filter.
1405141 Matsushita Electric Industrial Co. Ltd.
Apparatus for displaying a computing function.
1405149 Chemiebau Dr a Zieren GmbH & Co. KG.
Electroacoustic transducer elements.
1405154 Siemens AG.
Telecommunications line-state monitoring circuits.

July 30

1405216 Johnson Service Co.
Microwave cavity oscillator tuning element.
1405285 Ferranti Ltd.
Semiconductor information storage devices.
1405297 Mitsumi Electric Co. Ltd.
Semiconductor impedance circuit.
1405298 Mitsumi Electric Co. Ltd.
Semiconductor impedance circuit and applications.
1405409 EMI Ltd.
Colour Television cameras.
1405445 Sony Corporation.
Transistor circuits.
1405450 Hitachi Ltd.
Pulse generating circuit.
1405542 IRD Mechanalysis Inc.
Direct reading phase meter.
1405614 Morat GmbH, Franz.
Method of and apparatus for recognising colours.
1405644 Bulova Watch Co. Inc.
Incrementally adjustable capacitor unit for tuning a crystal-controlled oscillator.
1405675 Compagnie Honeywell Bull.
Read head for an optical character-recognition system.
1405699 International Business Machines Corporation.
Optical image sensors.
1405706 ELMO Co. Ltd.
System for synchronizing motion picture apparatus with tape recorder.
1405723 Soc Italiana Telecomunicazioni Siemens Spa.
Vertical deflection circuit for a video terminal of a data transmission system.
1405781 Hewlett-Packard Co.
Electronically tunable acousto-optic filter having selected crystal orientation.
1405789 Kureha Kagaku Kogyo KK.
Electroacoustic transducer.
1405827 Mullard Ltd.
Transmission-line amplifier.
1405870 Quadracast Systems Inc.
Decoder for multiple channel FM signal.
1405881 Image Analysing Computers Ltd.
Information selection in image analysis systems employing line scanning.
1405882 Image Analysing Computers Ltd.
Information modification in image analysis systems employing line scanning.
1405903 Technicolor Inc.
System for processing signals representing colour images.
1405933 GAF Corporation.
Video reproduction system for photographic and other images.
1405996 Honeywell Information Systems Italia Spa.
Magnetic tape guiding device.



Top left: *FIG. 1*, **bottom left:** *FIG. 2*, **centre above:** *FIG. 3*, **below:** *FIG. 4* and **above right:** *FIG. 5*



THE RECENT ISSUE of a string of three new patents from Dolby Laboratories Inc. (BP 1390341, -2, -3, and the US equivalent, 3845416) is especially interesting because it provides possible pointers towards future areas of Dolby commercial development.

Both BPs 1390342 and 1390343 relate to what appears to be a new avenue of thought for Dolby Labs. The patents explain how breathing noises can be avoided by ensuring that various parts of the frequency spectrum are treated independently of each other, for instance so that noise reduction in the high frequency range is not influenced by signal levels at low and mid frequencies. It is of course also well known by now to route different signal components along different treatment paths. The new idea is to provide for separate treatment by arranging for variable coupling of separate treatment paths to control the degree of compression and expansion on a level and frequency-selective basis.

In the basic circuit of BP 1390342, the signal is split between two paths and recombined by a variable coupling means. **Fig. 1** shows the concept block schematically and **fig. 2** shows a compressor working on the basic principle. The first path is a direct connection from input 10 to variable impedance coupling device 20; for instance, an fet or photo-resistor. The input is also connected to the coupling device 20 by filter paths 15, 16, 17, 18, which provides a high frequency boost. The signal level in the circuit is sensed across coupling 20 by control circuit 21 and, as the control signal increases, the resistance value of coupling 20 is reduced.

The controlled change in the value of coupling 20 means that when the input signal level is low the output signal has a high frequency boost, and when the input signal is of high level, high frequency content, this hf boost is eliminated. Thus, the circuit operates as a signal compressor at high frequencies only and expansion by a complementary circuit can provide high frequency noise reduction at 10 dB.

In BP 1390343, a generally similar circuit (**fig. 3**) has a circuit path 14, which is completely linear, and a path 11 which is linear with respect to dynamic range but not with respect to frequency. Again there is signal sensing across variable coupling 17, and control circuit 19 operates such that when the signal in path 14 is low, coupling 17 is of high resistance value and the signal appearing at output terminal 18 is contributed almost exclusively by the path 11. On the other hand, when the signal is high, the value of 17 is low, and the signal appearing at output 18 is contributed almost exclusively by the path 14. **Fig. 4** shows the transfer characteristics of the two paths, 11 and 14, as 11*a* and 14*a*.

Below the turnover frequency of the filter, the characteristic 11*a* coincides with the characteristic 14*a*, whereby there is no compression; above the turnover frequency, there is high frequency boost. Thus compression occurs selectively in the high frequency band only, and the suggestion is that the system will be used to give noise reduction above 3 kHz. Another suggestion is that any number of paths can be used, and their characteristics altered to provide special audio or video effects, for instance in electronic music synthesis.

BP 1390341 (USA 3845416) adopts an entirely different approach. The concept of using multiple signal paths and either varying their characteristics, or fixing their characteristics and varying their combinations, is abandoned. Instead there is a proposal that only a single path be used. This will work on the narrowing band principle, to confine compression, expansion and noise reduction to frequencies where only low-level signal components are present.

Fig. 5 shows compressor characteristic 10*a* and expandor characteristic 11*a* extending over an overall frequency band between frequencies F_0 and F_3. Below frequency F_1, gain is unity, and between F_1 and F_3 there is 10 dB boost. However, in accordance with the invention, a narrowing band principle, when a high level component appears at a frequency F_2, lying between F_1 and F_3, the band of boost slides upward and narrows. As a result, unity gain extends through F_1 and up to F_2 which boost applies only between F_2 and F_3. Thus, the strong signal component at frequency F_2 has eliminated compression and expansion between F_1 and F_2 but not between F_2 and F_3. Various circuitry utilising series connected impedance networks is described, to achieve the theoretical principle described.

Aussie Festival

FESTIVAL RECORDS have what is reported to be the largest and most ambitious Australian recording studio. Commissioned in April last year, it accommodates 50 musicians within its 15 x 11.5 x 4.5m. Construction of the playing area is along 'room within a room' lines, with walls, ceiling and 10 cm-thick concrete floors floated on 'silentbloc' rubber vibration absorbers; the inner shell is then adjusted for appropriate acoustical performance and relies on the outer room and its separate 15 cm concrete walls and 30 cm concrete floor to squash air-borne sounds.

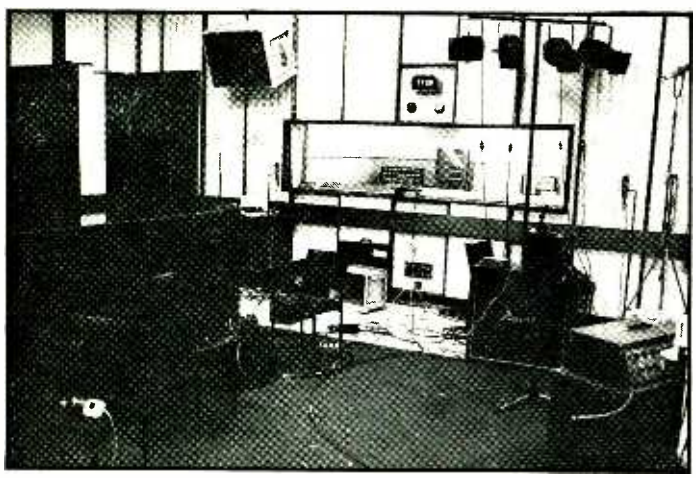
The original studio acoustics have been redesigned, with a mechanical reverberation control system based on acoustic panels suspended from a ceiling track system—this apparently allows a high degree of control over the studio reverberation time. Further, these panels can be swung round to reduce the apparent studio size by two thirds; along the same lines, and basically for the same people, is provided multicoloured dimmer lights, even in the vocal booth; thus, surroundings are even more variable to suit the clientele of the moment.

Control room is designed around a 28 input Neve console with extensive monitoring and simultaneous four, two and one track mix outputs. The 24 track MCI tape transport uses the full automated locator system, but in addition has noise gating on all channels in conjunction with the 24 *M* Series Dolby *A* noise reduction modules. Monitoring is via JBL *4320*s and Crown (Amcron) *DC300A*s. Outboard equipment includes Eventide Instant Phaser, six Kepex and two Gain Brain units from Allison Research, limiters, compressors and graphics from UREI, Cooper Time Cube, six Neve limiter/compressors and two Inovonics hf limiters.

The microphone complement reflects a policy diametrically opposed to the common one of standardisation, which is a particularly easy and attractive proposition when re-equipping or setting up. It's worth going through the list, which is an unusually wide spread across types new and old: Neumann 2 x *U47*, 2 x *U67*, 4 x *U47i*, 4 x *U87i*, 6 x *KM86i*; AKG 2 x *452E*, 2 x *D12*; Beyer 2 x *M160*, 4 x *M88*; Altec 2 x *685B*, 1 x *21C*; Electro-voice 2 x *RE15*; Sennheiser 4 x *MD411U*; Shure 2 x *SM53*, 2 x *SM57*.

In addition to the recording facilities is a cutting and pressing installation, the former with mono in an Ampex *351*-Haeco *GW120A*-Neumann *AM32*-Haeco *SC2* chain, stereo Scully *T/M*-Haeco *SD240*-Neumann *VMS*-Haeco *SC2*. Pressing starts with the spray silvering master lacquer processor, hopefully to be supplanted by a fully automatic system which is at present at design stage. Then follow 14 master matrix processors, 24 mother/stamper matrix processors and 26 Alpha semi-automatic record presses.

Michael Thorne



Above: *Festival Records' Studio.* **Below:** *Gone to tea.*

Wheeling

'WHAT DO YOU mean, why? It's because everything's got wheels, that's why. And then there was that animal, you know. So His Master's Wheels seemed right.'

It all grew out of a Neil Young tour in 1973 and Elliot Mazer's finding conventional studio hiring rather expensive; more expensive, in fact, than putting together his own mobile based in a 10.5m articulated truck. But after a winter which, on the East Coast, proved hard for mobile work in general and HMW in particular, Elliot moved out to San Francisco, into partnership with Alembic, and installed their gear. Engineering strength now includes Jerry Zatkin in what remains a small, close-knit operation, with Gary Haber, as (just departed) manager.

Shortly after, they bought out Alembic's interest in the studio operation and set about putting everything on a fully commercial footing and as independent as possible of Elliot's productions which, although plentiful, could not be expected to provide a steady basis to finance a large studio. And thus they developed through to present-day prosperity, but without losing the remote side of things. One fairly special outing was when Crosby, Stills, Nash and Young asked them to record for three days in Washington DC, 3000 miles away. So out came the entire studio in less than 24 hours, and they arrived east after three days' travelling.

Meeting back-to-the-roots engineers on the West Coast is a growing pastime. Elliot Mazer doesn't have much doubt. 'There isn't a Dolby on this session. We used to have clients coming in with Dbx and Dolby and all that stuff. I don't want it. Now: there's hardly any outboard stuff going on this session—no limiters or anything like that. Automation? No, I've been through all that. I did the first automated record.

'I want to hear what's going on and for as little as possible to get in the way. Here, for example, I'm using everything straight through except these, er, six with eq. And some of that's precaution like this 700 Hz ring on the bass drum coming up the toms. With a guitar sound like that . . . what do you do? It's coming straight out of his amp, and you've got to relate to the live sound.'

Perhaps the mobile beginnings explain Mazer's devotion to reliability. Again: 'I prefer to have two of everything. We have two *MM-1000*s with adjacent serial numbers, for example. When those were on order and going through the factory, I was down there talking to them; that's such a lot of money that you have to treat each one like a custom purchase. And since we have two 16 tracks, one can deputise for the other; but we can still run 30 track if we want to, with little problem. Even then you only need one machine most of the time, for when you get to 13 or 14 tracks full on the first two-inch then you jump the time code on to another and work with a B copy. And these transports are good for 14 in reels—and that there is a power boost for getting up speed at the start of a reel (I don't like one mil tape). When you're spooling it can take some time to get going. And those Ampexes are two years old. They've travelled 100 000 miles.

40 ▶

One time in Toronto when we arrived it was 20 below. So we switched them on; gave them half an hour's warm-up. After that they were within ± ½ dB or so.

'Other tape machines? Like I said, two of everything: three stereos, two monos and a four track in the closet.' One of the monos (an elderly Studer) is in constant use on recording sessions as a logging machine off the monitor mix, to save running the Ampex while the band is putting together a tune. Such as happened the sunny afternoon in spring I was there, with an unmentionable band of quasi-superstars taking as long as anyone does in a $115-an-hour rehearsal room to arrange their songs. So after a steady hour or so of sound getting-together, all retire to the guest suite at the back of the cavernous 7 x 8m studio, with what appears to be a horsehair sofa restoring the West Coast balance with Warner Bros facilities.

'You need a big control room for social reasons, quite apart from this one being pretty live. When the Dead come in, their entourage averages 15. And that circle is pretty busy at the moment, probably more than at any time in the last ten years.'

The studio itself is live, approximately 15 x 16 x 6 metres, with concrete floor and two and a half tons of redwood. A particular favourite among the mic complement is the Schoeps, not a common sight in North America. Although there was quite a lot of baffling that afternoon, other Mazer productions have regressed happily, like the latest Rab Noakes album which used direct stereo recording on three or four tracks. 'No, I can't remember which ones . . . the ones that sound best.' Another recent album was Andy Fairweather Low's *Spider Jiving*, which had no live two tracks but one live multitrack. 'Some were done live, but then added to—same old story.' With the live, helpful studio, Mazer reckons it's straightforward to tackle straight stereo. It's also used as an echo chamber, using a basic *C24* in the centre of the room which is driven via the monitor sends.

Monitoring is typically via two pairs of JBL *4325*s, modified into Mazer specials with a different crossover and a super tweeter, which sit politely on a pair of road boxes. These are used for quad when required, although assurance was that mono was the favourite sound of them all. Others are available as required, such as the Klipsch units often used for mobile work, or the Altec *604*s which are there for any visiting engineer who may want them. 'But with a good engineer we usually find a similar sound coming out of this studio. With only one exception I can think of. When Steve Barncard comes, he gets a different sound . . . it's a good sound, but it's different and it's difficult to say why.'

Like the speakers, the Neve console has come in for some tinkering. A standard 20/8 with 16 track monitoring, there is now provision for up to 34 inputs, 'enough for years yet'. Other changes include the splitting of channel and monitor cue pairs to give four independent circuits in place of two. Exterior to the desk, the studio has an unusual number of access points. Thus: 'If a client asks for something strange, a more standard studio might think it outlandish but we can do it, because we have that flexibility built in. One day I came in after a Dead session and thought someone had stolen all the mic cords for some reason. I'd had 47 the previous day and now there weren't any in the studio. Then I saw the control room. All the tape machines and their Moogs and stuff were all joined up, patches running from one side of the room to another, across the console. It was a wild session, but we could cope with it.'

At the moment, business is so brisk that they're turning it away. Recent work has included Michael d'Abo, Joe Cocker, Don Preston for Shelter, Lenny Williams's solo work outside Tower of Power, and a co-production is forthcoming with Merle Saunders ('he's a sort of friend of the studio'). Last autumn, the Dead recorded a mammoth film soundtrack, due for remix this summer and for eventual release in 1976 as a three- or four-record set. Remote work has included Neil Young, Frankie Miller, the Allmans, and Chicago. And in another world, the National SO of Washington and Haydn's *Mass in Time of War*. The kids who knocked on the door and made it through reception really knew who to touch for a donation to the school . . . 'oh well, so much for the profits this week'.

Michael Thorne

Moving

OUR APPLE REPORT (in July STUDIO SOUND, p44) mentioned a mysterious organisation called Aboko, which should have read Abkco, of course; and though it was our fault we think John Dwyer ought to get a new typewriter.

We've since learned that former Apple studio manager Malcolm Davies has joined Pye Studios, where manager Howard Barrow says he will be helping Pye take some of the workload off the cutting room staff. 'We want someone to cut, copy and handle clients,' he said. When asked what Davies's title would be, he said: 'We don't have titles here, he'll be part of the organisation. He'll be a cog in the wheel and we hope he'll come up with the goods.' On past form there shouldn't be much doubt about that.

Meanwhile Pye engineer Bob Harper joined Aisling Studios in Dublin on July 7. The studio is run by composer Philip Green. Harper was one of the resident engineers on the Pye mobile before it was sold to the Manor last year.

John Dwyer

Revamped Stones mobile

HAVING SET UP a mobile at a time when that meant a man with a Nagra, the Stones recently decided to give their 16 track facility a facelift. This amounted to more than just a coat of paint; the interior and apparatus has been changed to accommodate an extra eight tracks of recording capability.

This brings the total number of *3M79* machines permanently fitted within the vehicle to three—a 24, 16 and a two track. The Helios desk has been extended by six channels, bringing the total to 26. Mick McKenna, the resident engineer, says that even 26 channels aren't enough; he has now extended the desk by a further six 'mini channels'. These offer the basic requirements but no more; there's nothing fancy like equalisation etc. 'These channels are fine for things like brass or the roar of the crowd.'

That other function of recording complexity, the patch bay, has also been extended. On the subject of input channels, it is interesting to note that Mick McKenna incorporated patch space for up to 44 mic lines with only 32 inputs to the desk. He explains: 'It's useful if you are doing a gig where three bands are playing. You can set up mics for all three without having to mess about . . . all you do is re-patch.' He plans to set up even more spare mic lines.

Other things have changed. Altec *604 8G* monitors replace the previous Tannoys: 'not enough air in the truck for them to work properly'. The sound-bending devices have been tidied up. Before, the Pultec, Kepex, Audio and Design, Urei, Altec, EMT Countryman and Binson compressors/limiters/phasers/equalisers/stereo plates and drum echo were manhandled in and out of the truck as they were required. Mick: 'It was a very Micky Mouse affair'. Everything now has a place in the truck, and as a result the rear end of the truck became rather overloaded, resulting in sagging springs. These have been beefed up to cope.

Why did the updating work become necessary? It would seem to be reflecting the current trend in land-based recording studios. Mick: 'People ring up and ask if you can do a gig and then ask, almost as an afterthought: By the way, are you 24 track?'. The truck has been equipped so that it can do any type of work. If needs must, an Ampex *AG440* can be rolled on board specifically for eight track sessions, although Mick would rather 'hunt around' for an eight track head block to cut out the aggro involved in hooking in yet another machine. In any event, there's not much call for this type of recording because of the small price differential between recording rates. It's not the recording tape that costs the money, it's the hassle of setting up.

What sort of work has been done recently? Obviously, the Stones recording their new album in Holland. Some of the other people include the Who, Led Zeppelin, Paul McCartney and about three column inches of the showbiz *Who's Who*.

Frank Ogden

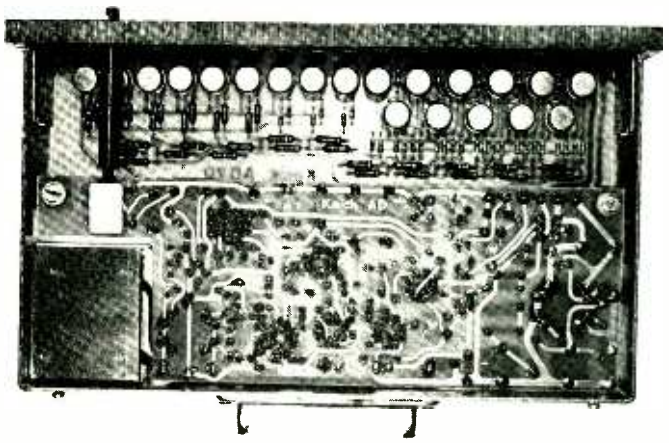
Exterior of Stones mobile

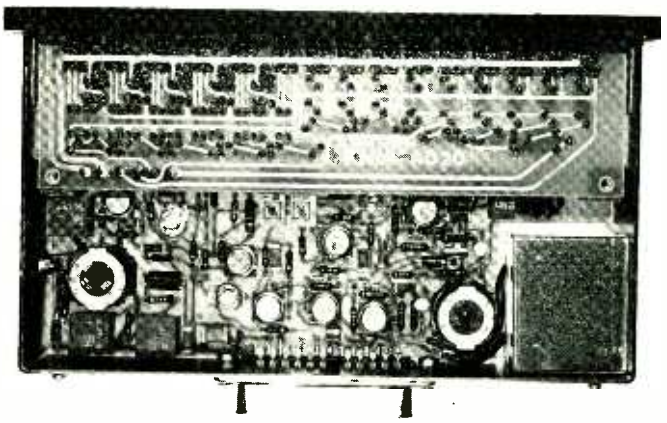
allen and heath

modular series mixing console

KNICK PEAK PROGRAMME METER AD 26V

Hugh Ford





MANUFACTURERS' SPECIFICATION
Indicator range: —50 to +5 dB and —70 to —15 dB, switching by keys.
Input reference: +6 dBm, calibrated ±1% internal adjustment within ±1 dB possible.
Frequency response: +0.1 dB. —0.5 dB. **(40 Hz to 15 kHz)**
Input impedance: ⩾ 10 kΩ symmetrical floating.
Measuring error: < ±0.1 dB in range +5 to —25 dB. <±0.5 dB in range —25 to —50 dB. < ±1.0 dB in range —50 to —70 dB.
Integration time (90%): 10 ms.
Indication delay: <1 ms.
Overshoot: <0.1 dB.
Polarity reversal error: <0.5 dB.
Working temperature range: —20 to +55°C.
Power supply: 24V, +4 —2V @ 300 mA
Connections: multipeg Tuchel *T 2700*.
Special instrument versions (on request): different measuring ranges, comparator outputs, illuminated switching key and different switched intervals, different rise and return times.
Price: £450 + VAT.
Manufacturers: Knick Elektronische Messgerate, D-1 Berlin 37, Beuckestrasse 22, Germany.
UK Agents: Dyer Audio Systems, Unit 3, 164 High Street, Barnet, Hertfordshire.

THE NAME KNICK will mean little to most readers because it is a relative newcomer to the audio business, and has specialised in the past in the general electronics instrumentation business. Knick now manufacture a range of light beam type programme meters using light emitting diode indicators in conjunction with some rather clever electronics; the active elements of these, with the exception of one transistor, are contained in integrated circuits.

The type *AD 26V* meter reviewed here is similar in design to the other meters in the Knick range which comprises meters for horizontal or vertical mounting with either 20 or 26 light emitting diode indicators and a miniature meter with only three step indicators. As its part number implies, the type *AD 26V* incorporates some 26 indication steps in a vertical array. The lamps are arranged in 1 dB steps between the maximum indication of +5 dB and –9 dB, from when the array is in 3 dB steps to –30 dB and then in 5 dB steps to the minimum indication of –50 dB. This arrangement gives maximum effective resolution where it is required about the overload point of equipment and the change between green and red indicators about the 0 dB indication gives an instant warning of potential overload conditions.

In addition to the basic scale range of + 5 dB to –50 dB, the meter sensitivity can be increased by 20 dB by means of a miniature locking pushbutton on the front panel, the range becoming –15 dB to –70 dB when this button is pressed. Adjacent to the indicator lamp array there are calibrations in terms of percentage modulation on the left, and dB on the right, both calibrations being clear and uncluttered. In practical use with speech or music, there is no need to refer to the calibrations as the length of the light emitting diode display gives a very clear indication of level, and any overload above the 0 dB point is instantly apparent when the display changes in colour from green to red. However, for line up purposes, the calibration points have been carefully chosen and include an extra marking at the commonly required 35 per cent modulation point.

The internal and external standard of construction of the Knick meter is first class, the unit using high quality components throughout. Two printed circuit boards give good accessibility to the components, one board housing the meter drive circuitry and the other all the light emitting diodes and their associated drive circuitry. The internal layout is so tidy that the only wires used in the construction of the meter are the connections to the input balancing transformer!

Five preset controls are incorporated in the meter. Two of these may be classed as operational controls, as they select the sensitivity and the release time, the latter being variable over the range 750 ms to 1.5s as standard. The remaining controls do not effect the law of the meter (as is so common) but purely provide for setting the stabilised power supply voltage, input amplifier balance and finally to compensate for the input offset of one integrated circuit.

Principle of operation

The Knick meter dispenses with the conventional logarithmic amplifier and also dispenses with the conventional methods of determining the time constants of the meter, both of which are the common sources of shortcomings with many current types of programme meter.

The input to the meter is fed to an input transformer, the secondary of which is centre tapped with each half of the secondary winding feeding a chopping amplifier, thus proving two positive half wave outputs corresponding

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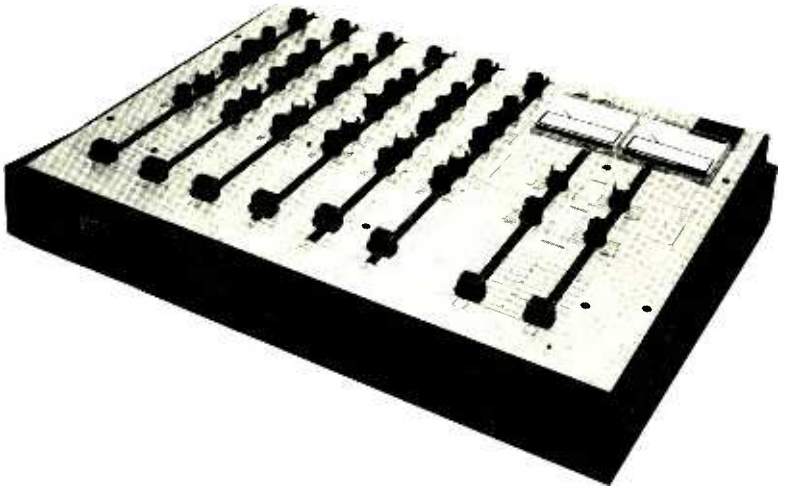

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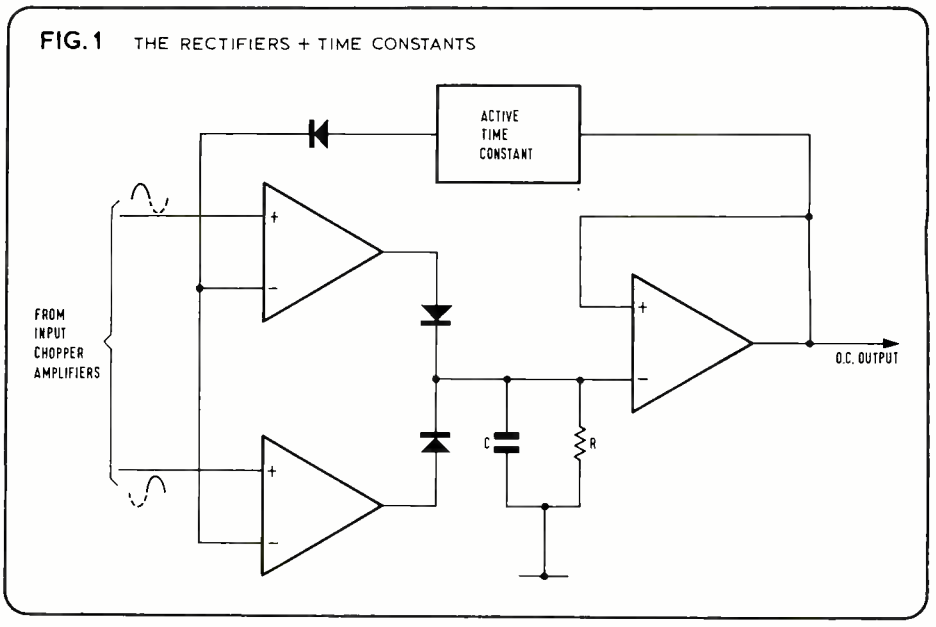
to the negative and positive halves of the input waveform. **Fig. 1** shows the clever part which follows: the output from the chopper amplifiers is fed to two amplifier/rectifier combinations which attempt to charge to storage components rc, the voltage on which is fed back to the negative inputs of the amplifier/rectifiers thus giving an extremely fast integration time. However, a further element is included in the feedback loop, which I have named the 'active time constant' and it is this element in the feedback loop which controls the integration time, with the element rc only controlling the release time. It is therefore possible to control independently the integration and release times over a large range.

Having produced a dc voltage proportional to the quasi-peak input voltage it is then necessary to manipulate this dc level to drive the logarithmic array of indicator lamps, and it is here that Knick has been clever again.

Each light emitting diode lamp is driven by a voltage comparator integrated circuit. One input of each integrated circuit is connected to the dc output from the rectifier combination, and the second input of each voltage comparator is connected to a tap on a potentiometer chain which is fed by a stabilised dc source. By careful selection of the taps on the potentiometer chain each individual indicator can be arranged to be activated at any desired input voltage—a logarithmic series of potentiometer chain taps gives a logarithmic relation between the indicators.

FIG. 1 THE RECTIFIERS + TIME CONSTANTS



	Indication	DIN	IRT
10 ms burst of 1 kHz	−1.0 dB	<1 ±0.5 dB	−1 ±0.2 dB
3ms burst of 1 kHz	−4.0 dB	<4 ±1.0 dB	−4 ±1.0 dB
Time to 99% indication	17 ms	<300 ms	< 200 ms
Release time	1563 ms	1500 ±200 ms	
0.5 ms burst of 10 kHz every 500 ms			
Maximum indication	**−7.0 dB**		−7.5 ±1.0 dB
Minimum indication	**−14.0 dB**		−14 ±1.0 dB
0.5 ms burst of 10 kHz every 1250 ms			
Maximum indication	**−9.0 dB**		−8 ±1 dB
Minimum indication	**−30 dB**		−29 ±2 dB

Measured performance

Measurements on the Knick instrument were done on the understanding that the review sample was set to the requirements of the DIN standard 45 406 Peak Programme Meter for Electroacoustic Wide Band Transmission' and also to the requirements of the Institut für Rundfunktechnik (IRT) standard which has additional requirements for light beam type meters. As has been mentioned, it is a simple matter to achieve alternative time constants, and Knick do intend to produce meters to other standards.

Initial attention was directed towards the absolute and relative accuracies of the indications. The 0 dB indicator in the display was found to just illuminate when the 1 kHz input rose to +6.03 dBm, a creditable figure where the specification is +6 dBm ±0.09 dB. Similarly, the accuracy between indicated steps was within a creditable 0.06 dB over the range of indications +5 dB to -18 dB, below which the errors progressively increased but remained within the specified limits. The additional error introduced by using the optional extra 20 dB gain was minimal at 0.1 dB.

The measured frequency response of the overall meter was within +0 -0.3 dB from 20 Hz to 10 kHz, falling to -0.5 dB at 15 kHz and -2.4 dB at 20 kHz. The response at 40 kHz was -21 dB which is perhaps rather sensitive for some applications, and only just within the DIN standard.

The next, and very important matter, is the unit's performance when tone bursts of various types are applied. In order to save me much trouble Knick was kind enough to lend me a special testgear that it has developed for measuring light beam type meters—this comprises a number of photoelectric detectors feeding a combination of gating circuits so that the time between various indications can be directly measured with timer/counters.

The above figures were obtained, which are related to the DIN and IRT requirements.

From the above it is to be seen that the 'ballistics' of the Knick instrument are generally well within the requirements of both the DIN and the IRT requirements. Furthermore, because the 'movement' is not of a mechanical nature the various requirements for overshoot and undershoot do not even apply. The final points of interest are the input impedance and the power requirements for the unit, and the dc output connection which is available at the rear panel socket.

Measurement of the input impedance showed it to be substantially constant at 15k ohms, which is ideal for normal usage. The dc output gave 6.69V corresponding to 0 dB indication from a source impedance of 495 ohms. The residual dc output with the input shorted was less than 4 mV (corresponding to -64 dB indication) even when the +20 dB gain switch was activated.

Changing the nominal 24V dc power input over the specified range 22V to 28V made little difference to the instrument's performance, but at the lower limit there was a 0.13 dB shift in the sensitivity for 0 dB indication. The steady state power requirement never exceeded 200 mA when operating on steady tones or programme material.

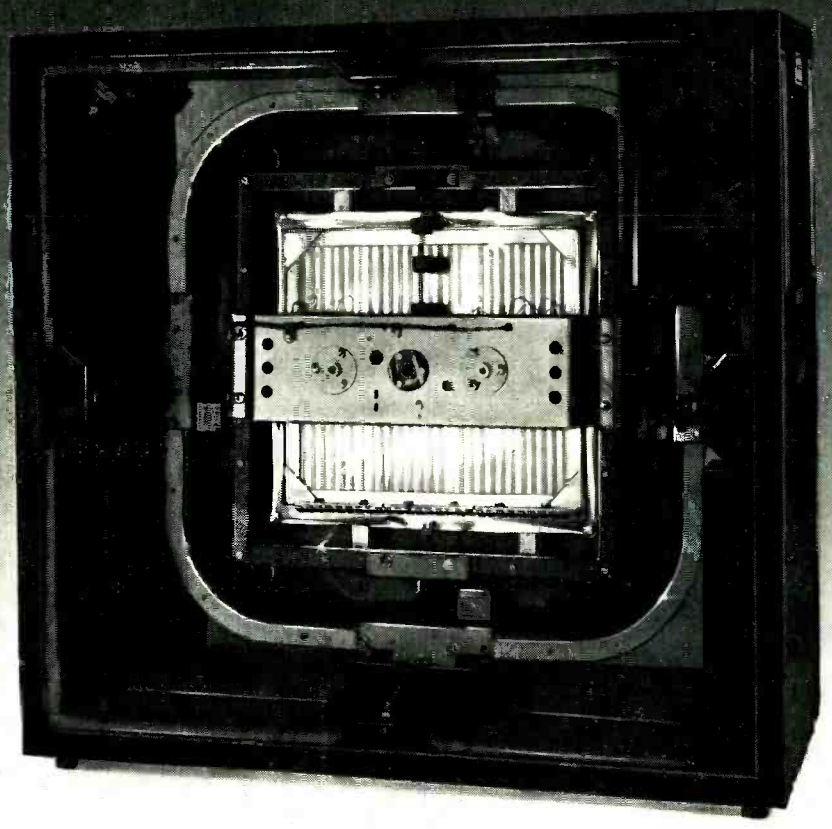
Summary

The measurements outlined in this review and also many other measurements which were done on this Knick ppm, failed to find any shortcomings in its performance, and indeed confirmed that the performance was generally far better than either the manufacturer's specification and the DIN and IRT standards for programme meters. Furthermore, the standard of construction is very good in both the electronic and the mechanical departments.

Being myself used to reading mechanical movements such as the conventional ppm and (under duress) VU meters, a light beam instrument is at first rather strange. However, after very little use I was most impressed with the readability of the Knick instrument and found it most relaxing to use. I cannot, however, vouch for the ergonomics of a multiple meter display.

Other advantages of the Knick instrument are the large dynamic ranges over which it gives useful indications, and also the instant warning by the red indicators when zero level is exceeded. Unfortunately there is a price to be paid for all this convenience and at over £450 it is no cheap instrument.

The EMT 240 Reverb Foil



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DATA:

Reverberation time at 500 Hz	min. 0.8s ± 0.2s
Variation of reverb time is effected by a damping plate which is varied in its distance from the reverb foil.	max. 5s ± 0.5s
Density of resonances	> 3/Hz
Maximum ambient noise level	30 phon
Frequency response from 40 Hz ... 15 kHz relative to standard curve	± 2 dB
Total harmonic distortion at 1 kHz and max. output	0.5%
Signal to noise ratio (unweighted)	≥ 65 dB

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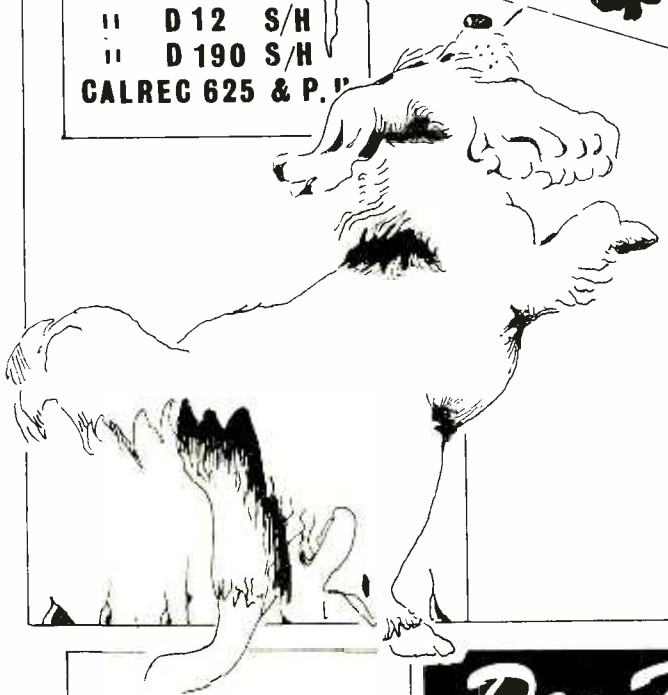

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REVOX A700

Hugh Ford

MANUFACTURER'S SPECIFICATION

All figures quoted are minimum performance values as measured with Revox *601* tape (type *LOW NOISE/HIGH OUTPUT*), normally exceeded by all units.

Tape speed: 38 cm/s, 19 cm/s, and 9·5 cm/s; maximum deviation from nominal ±0·1% (measured with 38 μm long-playing tape).

Tape slip: not exceeding 0·1%.

Weighted peak flutter:
at 38 cm/s less than 0·06%
at 19 cm/s less than 0·08%
at 9·5 cm/s less than 0·1%
measured in accordance with IEEE Std 193-1971 (consistent with ANSI S4.3 1972 and DIN 45 507).

Timer: read-out in minutes and seconds (4 digits), real-time indications for 19 cm/s tape speed. Accuracy 0·5%.

Tape-reel dimensions: up to 267 mm outside diameter with automatic tension change down to a minimum hub diameter of 38 mm.

Tape tensions: electronically regulated during all operating modes, including stop sequence.

Frequency response via tape:

38 cm/s	30 Hz to 22 kHz	+2/−3 dB
	50 Hz to 18 kHz	±1·5 dB
19 cm/s	30 Hz to 20 kHz	+2/−3 dB
	50 Hz to 15 kHz	±1·5 dB
9·5 cm/s	30 Hz to 16 kHz	+2/−3 dB
	50 Hz to 10 kHz	±1·5 dB

Equalisation: as per NAB standard.

Peak recording level: 514 nW/m (corresponds to +6 vu).

Level indication: vu-meter as per ASA plus optical peak level indication.

Overload indication: trigger level: +6 vu (514 nW/m). Response time: approximately 10 ms. Storage time: approximately 0·2s.

Distortion measured via tape at 1 kHz:

	peak level +6 vu (514 nW/m)	operating level 0 vu
38 and 19 cm/s:	less than 2%	less than 0·6%
9·5 cm/s	less than 3%	less than 1%

Signal-to-noise ratio: weighted as per ASA 'A' measured via tape and referred to peak recording level (+6 vu):
38 cm/s better than 65 dB.
19 cm/s better than 66 dB.
9·5 cm/s better than 63 dB.

Crosstalk at 1 kHz: mono better than 60 dB.
Stereo better than 45 dB.

Inputs: 2 x microphone stereo, balanced 50 . . . 600 ohm, position 'low': 0·15 mV/6k ohm, position 'high': 1·8 mV/6k ohm.
1 x phono stereo, magnetic equalisation RIAA 2·5 mV/50k ohm.
1 x Radio stereo 3 mV/33k ohm.
2 x auxiliary stereo, 40 mV/100k ohm.
All inputs have an overload margin of 40 dB.

Outputs: output level from a peak recording level at +6 vu (514 nW/m):
'line' A and B 1·55V from 5k ohm source.
1 x radio (DIN) 0·775V from 10k ohm source.
2 x headphone: max 4·9V from 100 ohm source.
1 x power amplifier: max 3·1V from 100 ohm source, including remote mains switching for *A722/A724*.

Tone control: bass ±8 dB at 80 Hz in 2 dB steps. Treble ±8 dB at 8 kHz in 2 dB steps.

Semi-conductor complement: 19 integrated circuits. 2 lsi circuits. 92 transistors. 92 diodes. 7 full-wave rectifiers.

Power requirements: voltage selector for 110 to 220V, 50 to 60 Hz operation without need for conversion. Consumption: maximum 130W.

Dimensions—cabinet without spools: 483 mm x 492 mm x 175 mm—with 267 mm spools: 539 mm x 522 mm x 206·5 mm.

Price UK: £735 + VAT (Recommended Retail).
US: $1800.

Manufacturer: Willi Studer, CH-8105 Regensdorf-Zurich, Switzerland.
UK agent: C & E Hammond & Co Ltd, Lamb House, Church Street, Chiswick, London W4.
US agent: Revox Corporation, 155 Michael Drive, Syosset, NY 11791.

FOR MANY YEARS the name 'Revox' has been associated with high quality recorders in the professional/semi-professional and better endowed domestic applications. For some reason Revox have seen little competition in the field; while others have designed recorders to compete with Revox, their end products have either been too expensive or lacking in the sound construction and good long-term performance that is associated with the Revox trademark.

While I do not know the numbers of Revox type *77*s sold, considerable confidence in the sales of the new type *A700* is confirmed by the fact that the pricing of the machine is based on 100 000 units and that the development of the specialised integrated circuits has probably cost £20 000, let alone the other development costs. With Revox working on such a large-scale production, it is of course difficult for newcomers to compete in this rather specialised market, and with a few exceptions the following review shows that the type *A700* is indeed a first-class recorder.

Tape transport

The basis of the tape transport is a flanged alloy diecasting which is machined for the attachment of the three motors and the headblock, itself a separate diecasting. The remainder of the unit is in the form of a cadmium-plated steel chassis to which is attached the electronic parts and the heavy mains transformer which is, of course, better kept off the main diecasting.

Constant tension winding is obtained by servo control of the two outer-rotor type spooling motors, with the resulting capability of handling either 267 mm NAB spools or ciné centred spools; however, NAB adaptors are not supplied with the recorder. Tension control signals are derived from tension arms adjacent to each spool, the tension arms being spring-loaded with their position sensed by a variable transformer which electrically controls the

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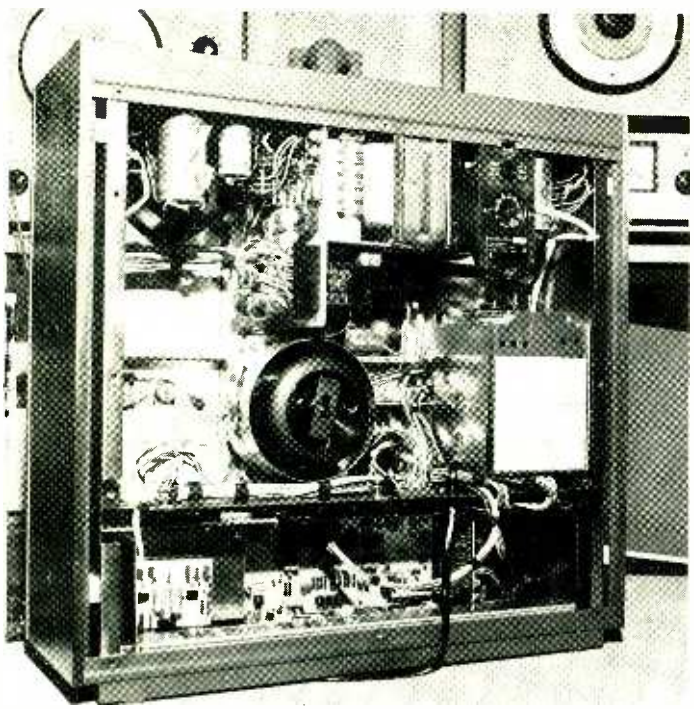

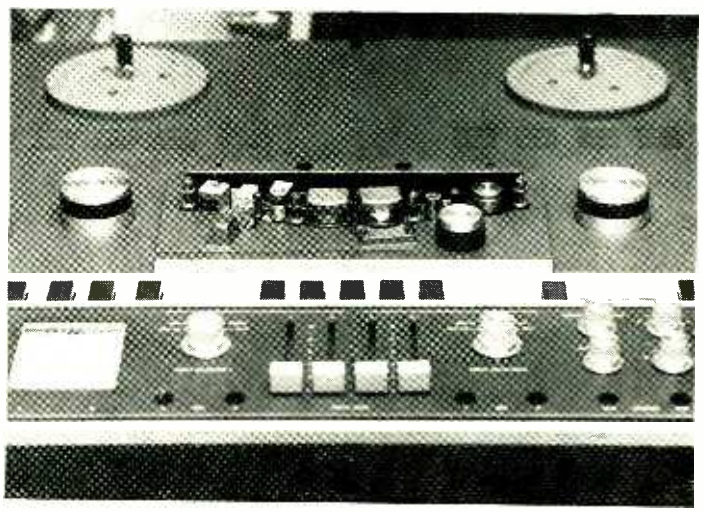

A 16 track recording console as supplied to the Vanguard Recording Society, New York.

MIDAS AMPLIFICATION

54-56 Stanhope Street, Euston, London NW1 3EX Telephone 01-387-7679

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Consoles may be supplied from 6 in 2 out, to 30 in 24 out. Other options include parametric equalisation, quad panning and solo facility. Specification of all facilities to no-compromise recording and broadcast standards.

spooling motor torque. Proceeding towards the headblock, there are two large diameter idlers, the right-hand one driving the tape timer which is calibrated in minutes and seconds at a tape speed of 19 cm/s, and is also used to detect tape motion—again using an rf variable transformer technique.

The headblock casting forms a plug-in unit with space for four heads, the normal complement being the erase, record and replay heads. Azimuth adjustment is really sound, with very positive head location. The tape guidance has been given great thought; there are four adjustable spring-loaded guides on the headblock. I am, however, a little worried about the wear properties of the guides, which appear to be unplated brass.

As with all respectable recorders, a flutter roller is included to reduce friction noise (scrape flutter), but I was surprised to find that a fixed guide is included between the flutter roller and the record and replay heads. The capstan motor is a special servo motor which is phase locked to a crystal oscillator, offering constant speed irrespective of the incoming mains frequency at the three tape speeds of 38 cm/s, 19 cm/s and 9.5 cm/s. However, when it is required to operate at different speeds an external frequency may be used as a reference. The capstan is of large diameter, thus easing mechanical tolerances. The pinch roller operates in the trailing position by a solenoid-operated arm which also manipulates the hinged replay head hum screen.

All the tape transport drive functions are electrically interlocked, and tape tension is even controlled in the start and stop modes with a resulting smooth operation without any tendency to throw loops or other untoward habits. It is quite possible to go directly from fast wind to record without disaster—the tape stops from fast wind, is lowered on to the heads and proceeds in the record mode!

However, not all is perfect; one shortcoming is that, in spite of the fact that tape motion is detected and the tape end is optically detected, when the tape comes to a finish the recorder takes a considerable time to stop the take-up spool with the result that tape can fly all over the place. This defect is caused by too much inertia and too little friction around the tape motion sensing roller. A further matter is that, in my opinion, the fast wind modes are too fast, such that even 3M type *207* with its matt back does not give a very clean wind on the take-up spool.

All function controls are illuminated push-buttons, the current function(s) showing a white light in the case of non-record functions and a red light in the case of record functions. The three tape speed selection buttons are only illuminated when the selected tape speed has been attained, providing a safety factor when changing speed. Other than the normal tape movement buttons, there is a non-locking 'pause' button which operates in any mode, including fast wind and two further control modes. One of these does a fast rewind when pressed and reverts to play when released—very useful for editing; the other button provides an 'auto' function whereby the recorder optically senses a spliced 'window' at the ends of the tape. When the end is reached, it rewinds and reverts to its original play or record mode at the beginning of the tape.

Access to the heads for editing is quite good, and certainly there is no problem in gaining proper access for cleaning and de-gaussing. However, it is not possible to listen in the fast wind modes where the tape is removed from the heads by two solenoid-operated guides. Rock and roll operation is possible in the stop mode.

Electronics

All the electronic components are mounted on printed boards, most of which are identified with component references as an ease to servicing. The general arrangement is that small boards plug into a mother board, which contains a number of components; however, access to these and other components is excellent and the many integrated circuits plug into sockets as a further aid to servicing. The overall standard of construction is excellent and the power supplies, which can be operated from all the common mains voltages and frequencies, are protected by some eight identified fuses. One small irritation is that the mains lead is not of the plug-in type; however, plenty of storage space is provided for it and its plug.

On the record side comprehensive mixing facilities are provided, selection of stereo inputs being by means of two input selector switches, each of which has two (left and right) slider-type level controls. One selector has positions for microphones of high or low sensitivity, RIAA phono, radio or auxiliary inputs, while the second selector provides for further microphones of high or low sensitivity, multiplay/echo, an auxiliary input and an off position.

The microphone inputs are balanced 6.35 mm jack sockets on the front panel and, with the exception of the radio input which is a five-pole DIN socket, the remaining rear panel inputs are phono sockets. A further slider control is provided for setting master level, recording on either or both of the half tracks which are selected by illuminated pushbuttons.

Two vu meters are provided for monitoring level in the before or after tape conditions and are also fitted with peak indicator lights which have a relatively fast response. I am, however, surprised that Revox have not gone to peak type meters.

The entire replay section is switched to before or after tape by the same switch as the level meters, and can also be switched to the four modes of operation—stereo, left, right or mono. However, of the two available line outputs, one is before the mode switch and the other after. These line output phono sockets and the DIN type record/play socket are at fixed level and occur before the tone control circuits which affect the remaining outputs.

These remaining outputs comprise a power

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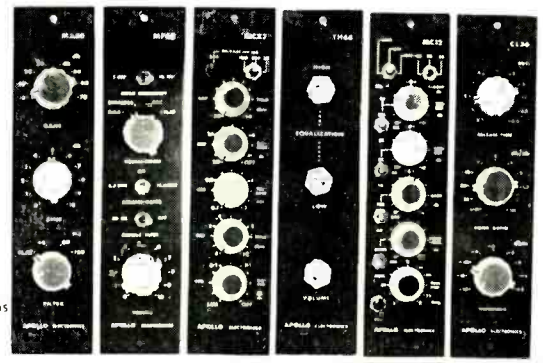

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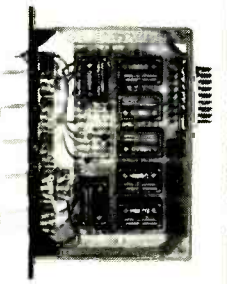

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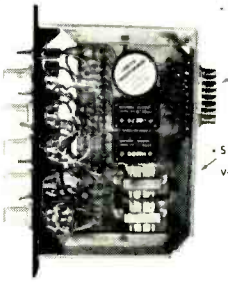

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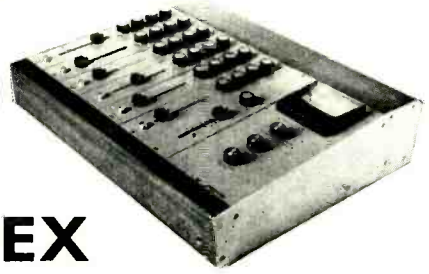

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amplifier output in the form of a DIN socket and two headphone outputs in the form of stereo jack sockets on the front panel; one of these disenables the power amplifier output when the phones are inserted. These outputs are controlled by a slider gain control and are affected by the bass and treble controls which take the form of rotary switches.

In addition to the audio facilities, the power amplifier output supplies a 20V dc line for switching the mains in the auxiliary power amplifiers made by Revox. As this socket is a standard 180° DIN socket it follows that some caution is required not to attach other equipment to the 20V dc line. Further sockets are provided for remote control, and for external speed control; a dummy socket being fitted to the review machine for the future addition of slide synchronisation.

Perhaps unfortunately, there is no provision for the addition of noise reduction systems, but such an addition should not be difficult as a customer modification.

Replay performance

Checking of the replay equalisation to the NAB standard was accomplished by means of DIN calibration tapes manufactured by BASF which are, themselves, subject to a tolerance of ±1 dB at high frequencies. It is therefore most encouraging to report that the Revox performance was within ±0.8 dB from 40 Hz to 18 kHz at a tape speed of 38 cm/s and ±1.2 dB from 40 Hz to 18 kHz at 19 cm/s or from 40 Hz to 16 kHz at 9.5 cm/s. Clearly the machine had been most carefully aligned, and this was confirmed by checking azimuth in terms of relative phase between tracks.

The signal-to-noise performance in terms of reference level to noise is also excellent as is to be seen from the following figures which show the performance of the replay amplifier system without tape but with all motors running (see **table 1**).

On the other end of the scale, it was found that amplifier clipping, at 1 kHz at a nominal tape speed of 38 cm/s, did not occur until the fluxivity at the replay head was increased to some +15 dB above 320 nW/m, which allows in the order of 5 dB margin for any current tape types.

Record replay performance

As with the replay only frequency response, the record/replay response with 3M type *207* magnetic tape was really excellent. **Fig. 1** shows that the overall response at 38 cm/s is within ±1.3 dB from 20 Hz to 20 kHz including the minor bass boost at 30 Hz which is probably due to head polepiece effects. It should also be noted that the balance between the two channels is really excellent. The general pattern of the response at 38 cm/s was followed at two lower tape speeds as shown by the following (see **table 2**).

The following table shows the reference level to noise ratio for 3M type *207* tape in its bulk erased form, and when it has been erased and recorded with bias by the machine with all inputs shut (see **table 3**).

Comparison of the above table with the replay only figures shows that there is a considerable margin between the inherent machine replay noise and the noise from a modern tape such as 3M type *207*, it is however felt that a small improvement is still possible in the noise introduced by the record process.

Distortion at the above reference levels was less than 0.8% third harmonic at the two upper tape speeds, and less than 1.0% third harmonic at a tape speed of 9.5 cm/s. Three per cent third harmonic distortion occurred at +5 dB above reference level at the two higher tape speeds and 7 dB above 250 nW/m at 9.5 cm/s.

Intermodulation distortion was measured at a tape speed of 38 cm/s by the SMPTE method using 50 Hz and 7 kHz tones in a 4:1 amplitude ratio at the following equivalent peak sinewave levels:

Record level	IM distortion
320 nWb/m	5·5%
—10 dB	1·2%
—20 dB	less than 1·0%

While the figure at reference level demonstrates the shortcoming of the bass boost in NAB equalisation, the figures at lower levels are good by tape recorder standards. Of

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FIG. 1
REVOX A700
RECORD/REPLAY
RESPONSE

38cm/s WITH 3M207
CHANNELS ALTERNATELY SWITCHED
ZERO LEVEL: -50dB/320nWb/m
PEN SPEED : 200mm/S
PAPER SPEED: 3mm/S

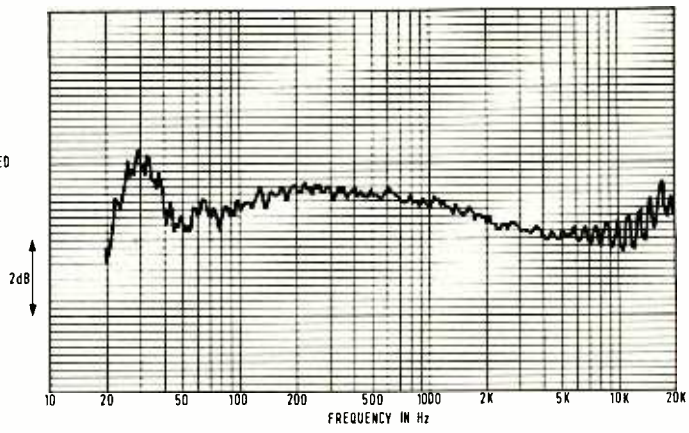


TABLE 1

Tape speed	Reference level	Reference level to noise			
		Unweighted 20 Hz/20 kHz	'A' Weighted RMS	CCIR weighted ref 1 kHz rms meter	DIN peak meter
38 cm/s	320 nW/m*	65·8 dB	74·0 dB(A)	68·6 dB	63·6 dB
19 cm/s	320 nW/m*	64·5 dB	73·4 dB(A)	68·0 dB	63·3 dB
9·5 cm/s	250 nW/m	58·8 dB	65·4 dB(A)	61·0 dB	55·5 dB

Figures are average of both channels.
*Add 4·1 dB for a reference level of 514 nW/m.

TABLE 2

Tape speed	Frequency response ref 1 kHz worst case	Channel balance worst case
38 cm/s	±1·5 dB 20 Hz to 20 kHz	±0·5 dB
19 cm/s	±2·0 dB 20 Hz to 20 kHz	±0·4 dB
9·5 cm/s	±2·0 dB 20 Hz to 18 kHz	±1·0 dB

TABLE 3

Tape speed	Reference level	Reference level to noise		
		'A' Weighted rms	CCIR Weighted ref 1 kHz rms meter	DIN peak meter
38 cm/s	320 nW/m*			
Bulk Erased		67·1 dB(A)	60·4 dB	55·4 dB
Machine Erased		63·2 dB(A)	55·9 dB	51·2 dB
19 cm/s	320 nW/m*			
Bulk Erased		67·7 dB(A)	59·7 dB	54·7 dB
Machine Erased		64·2 dB(A)	55·2 dB	50·5 dB
9·5 cm/s	250 nW/m			
Bulk Erased		61·8 dB(A)	54·7 dB	49·9 dB
Machine Erased		59·5 dB(A)	52·5 dB	46·5 dB

Figures are average of both channels, which were within close limits of each other.
*Add 4·1 dB for a reference level of 514 nW/m.

REVOX A700

similar interest to intermodulation distortion is the effect of friction noise (scrape flutter). **Fig. 2** is a narrow band analysis of a replayed 10 500 Hz tone that had been recorded at 38 cm/s. While flutter sidebands can be clearly identified at approximately ±10 Hz and multiples thereof from the carrier frequency, this performance is good in comparison to very many recorders.

Of further interest is the phase relation between the two stereo tracks; this property is shown in **fig. 3** which is an oscillogram of the phase shift when recording and replaying a 10 kHz signal at 38 cm/s. This oscillogram, which shows a maximum phase deviation of ±6°, was obtained by using a Bruel & Kjaer *2971* phasemeter which has a response time of 2400°/s at audio frequencies. It is interesting to note that the periodicity of the phase shifts may be correlated with the pinch roller diameter.

The investigation into crosstalk performance yielded very good results with the measured record/replay crosstalk between channels being below −70 dB at mid frequencies, including head contour effects which remained below −53 dB at any audio frequency, 35 Hz being the worst case.

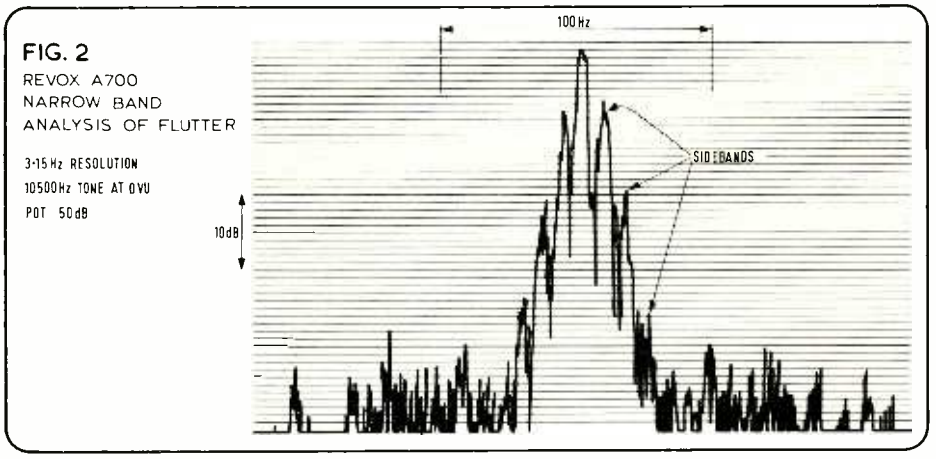
Erasure performance was measured by recording a 1 kHz tone at 38 cm/s at the reference level of 320 nW/m, and then measuring the residual signal after a further pass over the record and erase heads with the input faders shut . . . the resulting signal was reduced some 83 dB on the worst channel, the other channel offering some 87 dB erasure—no complaints in this department.

Wow, flutter and speed

Wow and flutter to the DIN weighted method (as now agreed by the IEEE and ANSI) was measured at the beginning, middle and end of both 178 mm cine type spools and 267 mm NAB spools at the three tape speeds. While there was little variation of wow and flutter within a spool, the initial measurements at the tape speed of 38 cm/s were somewhat higher than those shown in the following table, which are average values:

Tape speed	Spool type	Weighted wow and flutter to DIN
38 cm/s	NAB	0·025%
	Cine 178 mm	0·04%
19 cm/s	NAB	0·035%
	Cine 178 mm	0·05%
9·5 cm/s	NAB	0·07%
	Cine 178 mm	0·09%

These results which are well within specification are outstandingly good for this class of recorder, and the initial measurements were within specification. However, no reason was found to explain the higher initial measurements which were consistent over a period of time. The measurement of the tape speed indicated the identical error of +0.3% at all speeds which is on the tolerance limit of the calibration tape used; furthermore, the speed variation from one end of a NAB reel to the other was within ±0.01%.



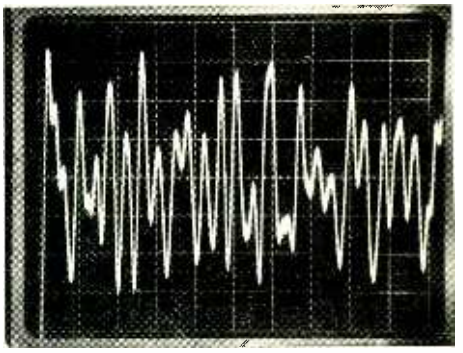
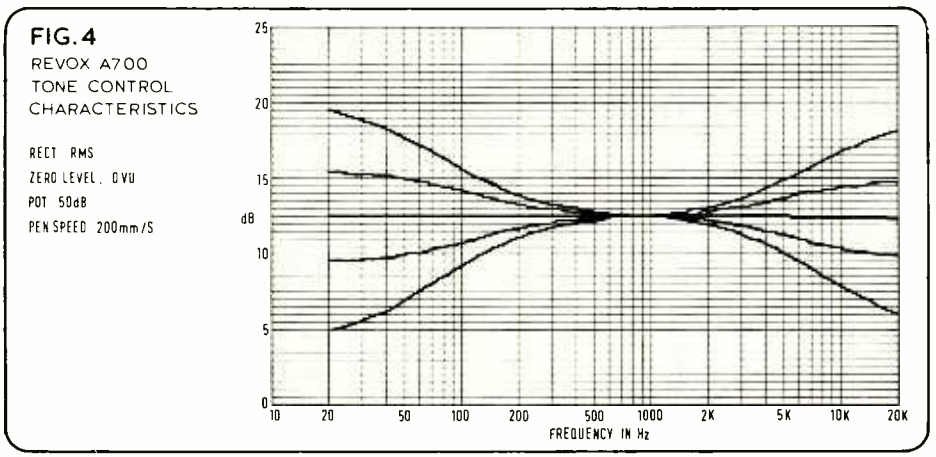


FIG. 3 *Showing phase error L-R (maximum ± 6°)*



Inputs and outputs

All the above performance figures were measured between the line inputs and the line outputs, the alternative facilities were therefore investigated. So far as frequency response is concerned, the microphone inputs to all intents and purposes were flat from 100 Hz to 20 kHz, but showed some roll-off in the bass with a −3 dB point at 35 Hz which is no bad thing. On the other hand the phono input was within ±0.5 dB of the RIAA equalisation curve from 20 Hz to 20 kHz.

While noise in the record section was generally good, the microphone inputs were rather excessively noisy, the equivalent input noise being −113 dBm when loaded into 200 ohms—this figure could be considerably improved.

The sensitivities and impedances of the inputs and outputs were all checked and found to be to specification, although some comment is appropriate. Firstly, the input impedance at the microphone input is effectively around 6k ohms which is far higher than is required for 200 ohm microphones which are probably the most common impedance. The measured noise from the microphone inputs correlates very closely with the unnecessarily high input impedance, and the provision of an impedance in the order of 1k ohms would make a very substantial reduction in the noise from this source.

Secondly, the impedance of the line outputs at 4.4k ohms (as measured) is unduly high for professional applications, and while the alternative headphones and power amplifier output are available, they are after the level control and tone controls.

On the subject of the tone controls, these are seven-position rotary switches giving 2 dB steps at 80 Hz and 10 kHz, the good characteristics of which are shown in **fig. 4,** which shows the response at alternate positions.

The level meters

While most manufacturers claim to fit vu meters, inspection often reveals that the so-called meters are nothing like the ASA standard meter—not so with Revox, the vu meters are to the proper specification with average rectifiers and the correct rise time—the return time is however measured at nearer 400 ms than the recommended time which is close to 300 ms. I am not however at all happy about the tape flux level corresponding to 0 vu which was found to be −1 dB relative to 320 nW/m which only leaves a 6 dB margin between 0 vu and 3% third harmonic distortion as opposed to the NAB recommendation of 8/10 dB.

On the other hand the peak indicator lamps operated at the 3% distortion point within 10 ms of an overload, and stayed on for 130 ms thus easing readability.

Summary

During the course of this review I have been critical of any minor shortcomings of the Revox *A700* for the simple reason that this is a very interesting machine which will, without doubt, sell in great numbers; it is a very fine machine for its price and thoroughly recommended.

I would however suggest that the microphone input impedances should be modified to reduce the rather high noise level that results from such a high input impedance and that some attention should be paid to the zero level settings of the vu meters.

On the credit side there are many excellent aspects of the machine; among which signal-to-noise in the replay department, frequency response, speed stability and wow and flutter deserve special mention. Furthermore, the standard of both mechanical and electrical construction are beyond reproach. In fact, the two latter aspects of the machine put some recorders costing very much more into disgrace.

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AGONY COLUMN

■In the olden days, the engineer used to rule his studio and the visiting producers with a rod of iron; one gentleman of our acquaintance was often known to turn out the lights of a control room full of people when he wanted to go home and they hadn't got the message when he put on his coat. Nowadays, things are very different.

The session was getting late. Too late for doing anything constructive, so the engineer thought. Suddenly, a small explosion and a cloud of smoke from behind the racks, and the faders came down. Sorry, the power supply's gone. Oh well, nothing was happening anyway. Thanks a lot, good night, nice working with you.

Only things left to do for the tired engineer were strip the studio, tidy up, and replace the disc cutter swarf in the metal box, with the fuse wire across it connected to the mains via the little switch on the console . . .

FIELD TRIAL
REVOX A700

Angus McKenzie

ALTHOUGH THE Revox *77* series, the first Revox transistorised tape machines, were domestically orientated both in design and facilities offered, many professional users have found them extremely useful, and in particular the high-speed version running at 19 and 38 cm/s. The *700* series, on the other hand, appears to be a semi-professional version of what was basically designed as a professional machine. The basic tape deck is being incorporated by Studer into a new professional tape recorder, the *A67*, and so, although the *700* electronics are clearly designed for domestic as well as professional use, they are designed down from professional, rather than upwards from domestic. The machine therefore contains many very useful professional features, while still incorporating a large number of facilities demanded by the really keen amateur. I have been using two Revox *700*s for some considerable time, both professionally and in a domestic environment, and while I find the domestic input and output sockets extremely annoying when making interconnections with professional equipment, matching can be achieved by unbalancing balanced outputs from the control desk to the machine, and connecting back in to the control desk if necessary with external 1:1 600 ohm transformers, driving these from the headphone sockets, or from the line output phono sockets rewired internally to the output of the headphone amplifier.

I definitely agree with Mr Ford's comment in his review that the microphone transformer's effective input impedance is much too high. Many users would have to use 200 ohm dynamic microphones such as the *D202* plugged straight into the microphone input jacks. To check the subjective noise of the microphone pre amplifier input circuitry, I compared this setup on track one with a *D202* microphone plugged through my Calrec control desk, whose line output was connected through the auxiliary two input to track two. The recorder was set to 38 cm/s, and a fairly high recording level was chosen, with both channels peaking identically. The hiss level on track one was noticeably higher than that on track two, but the margin did not seem quite as great as I might have expected from the measurements. For most recordings the input noise would be found satisfactory, but it would be sensible to alter the sensitivity of the microphone input by switching the primary impedance of the microphone transformers rather than, or in addition to, the gain round the integrated circuit pre amplifier. I proved this point by using an external 1:4 impedance ratio microphone transformer, thus driving the Revox from an effective 800 ohm source instead of a 200 ohm one. An improvement of about 3 or 4 dB was audible. I also used high output capacitance microphones straight into the Revox, and on the low mic gain position found that it was not possible to clip the input under all reasonable circumstances, which even included shouting fairly close to the microphone.

I also compared the basic quality between the direct microphone input and the microphone via the control desk, and I felt that there was a trace of intermodulation distortion produced in the Revox's microphone preamplifier which did not seem to be present on the auxiliary two input from the control desk signal. The difference however was fairly marginal, as was the subjective frequency response.

The input circuitry is arranged in pairs so that input channels 1 and 3 mix together to the left channel, while inputs 2 and 4 mix to the right. The controls mix with a virtual earth circuit either to stereo or mono, the mixed signal then controlled by a master record gain control. If the master gain control was used nearly flat out, with the channel gains brought down, I noticed some hiss, and so care must be taken not to use the master gain control too high, unless a lot of gain is required, with the input channel controls already flat out. I must criticise the absence of pan pots which should be provided on input channels 3 and 4; the circuit would allow for their inclusion with ease. The sliders of the channel gain controls in the circuit feed through resistors to the virtual earth point where the pan pots could be inserted with outputs to both channels. If this were done it would allow channels 3 and 4 to be panned anywhere, while channels 1 and 2 could be used for the overall stereo main input. Furthermore, it would allow flutter echo or line inputs to be mixed in at will for special effects.

The RIAA phono input worked extremely well when driven from a Shure *V15 Mk3* cartridge, and the gain provided was more than adequate to allow satisfactory dubbing from disc to tape. Although I dislike the five-pin DIN standard, the socket provided, conventionally wired, worked extremely well. This socket allows the recorder to be connected directly to tuner amplifiers also having five-pin DIN standards.

The tape monitor switch worked very well with no audible plops on the tape when the switch was changed continuously during recording. The line output sockets, however, are connected in such a way as to render many of the replay facilities of the machine almost useless to the average user. While one pair is connected directly across the amplified output of the a/b switch, the other pair follows the stereo l/r mono switch. The high output impedance of 4.7k ohms was extremely irritating when the machine was used to drive external A Dolby processing units, or alterna-

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tively, the tape monitor inputs of control desks since the return level, loaded by the input impedance of the external circuit, was lower than the levels that would normally be sent to the recorder from such equipment. The recorder is fitted with some excellently designed 2 dB per step treble and bass controls, and also replay gain slider controls for both channels. Both monitor tone and gain controls drive only the headphone sockets and a socket provided to work with a Revox power amplifier. Hugh Ford mentioned the potentially high current voltages on the normal five-pin DIN socket provided for the latter, and I actually fused the dc circuits when I attempted to use the socket after installing the machine, no manual then being available. Revox should replace this socket by a 270° one as soon as possible, so that users will realise that the socket is non standard.

The headphone sockets, driven from an output amplifier, possess a very low source impedance. 100 ohms resistors are connected in series with the jack sockets to restrict the current available into low impedance headphones. The voltage available from the headphone amplifier will allow 600 ohm line transformers to be used at this point, which can provide as high a level as is necessary to drive professional equipment, even when loaded by 600 ohms. There is also a reasonable amount of gain in hand to bring undermodulated tapes up to full studio levels at this point.

Since I frequently use the *700* to drive Dolby A deprocessing units, I checked the vu meter calibration on Ampex, MRL and DIN reference tapes, and while I agree with Mr Ford's measurements on the DIN, I found that the meters were only under-reading by 1.5 dB or so on the Ampex tape, but since the machine supplied was an NAB model the error is not so serious. I am more critical, however, of the 1 dB difference in calibration between the two replay channels, which should not have been passed by quality control. I am nevertheless puzzled by the measured differences between Ampex and DIN test tapes, not agreeing with the theoretical values; this is noticed on any machine used for comparison. Although the tone control steps are useful, I feel that it is a pity that two positions of the treble control and one position on the bass control could not have been used to obtain DIN equalisation positions for the two higher speeds. Step corrections having a shelf 3 dB cut or boost from 3.5 kHz upwards would have made a good compromise for this, and would also give a useful presence boost or cut for general purposes. A 3 dB boost at 50 Hz extending to 5 dB at 31.5 Hz would give the necessary bass correction. The existing tone controls do not give anywhere near an adequate standards conversion. A DIN version is also available to special order, having both record and replay equalisation permanently changed.

Most users will find the provision of separate equalisation and bias controls for all three speeds most useful, as I have done; I normally have my machine set up for standard play tape at 38 cm/s and lp tape at the two lower speeds, since standard play tape tends to drop out more at lower speeds. I have noticed that any such mixture of tape types allows unity gain before and after tape to be achieved only at one speed. An error of up to 2 dB can be produced, and it would therefore be an advantage to have separate record level pre-sets for the 38 cm/s speed.

On almost all the earlier models of the *700* series that I have encountered a serious design fault could cause clicks or short transient splashes of an input programme to be recorded when the record track buttons were up. This fault was rapidly brought to the attention of the importers. Studer produced some circuit boards to overcome the problem. These can be inserted in between some existing boards and their holders, and fit very easily. The specific machine reviewed by Mr Ford, however, did not exhibit the described fault, but neither did it have the extra boards, so I must assume that Revox have very recently introduced a main circuit board change. Users should check *700*s for this problem which shows up particularly badly at 9.5 cm/s when the input faders are set as if to record at a high level. If a blank tape is replayed under such circumstances, and subsequently replayed without the input programme present, the fault condition shows up very clearly with splashes appearing on the blank tape.

Some early samples of the recorder also exhibited a slight bubbly noise at 38 cm/s, especially when matt backed standard play tapes were used. This seemed to be caused by some second harmonic distortion of the bias frequency being produced in the record head circuit, and once again this seems to have been eradicated on the latest models. Clearly when a completely new model of tape recorder is first brought out, many teething problems arise; frankly the Revox *700* had quite a few. By now Revox seem to have put almost all of them right, and therefore the machine can be very highly recommended. Notwithstanding this, there is a lot of very complicated logic which can go wrong, but such logic helps produce a machine at a price which in many ways allows it to compete with professional machines costing at least twice as much. In general use, the constant forward and backward tension have proved most worthwhile, since they allow the tape to pass very cleanly and smoothly over the heads. Master tapes with many edits play back on the *700* as well as on any machine I have tried, but on the other hand I did not find this machine as easy as some for editing because the moment the tape was cut the swing arms pull the ends apart. The spooling is pretty good, although some shiny-backed tapes tend to ridge. Matt and semi matt backed tapes however spooled exceptionally well, even when running between spools of different sizes. This requires spool tension to be very accurate.

The subjective wow and flutter was completely inaudible on any programme at the two higher speeds, and only rarely noticeable at 9.5 cm/s. To check this, I tried recording piano, using an NAB reel on the left and a 100 mm reel on the right, and also vice versa; even under these conditions wow was not audible at 38 cm/s. I even tried the recorder upside down with the front of the machine resting on a table, and the back hand held. Under these conditions, only a small increase of wow was noticed. Occasionally on a recording session an engineer can accidentally touch a spool during recording, but when I did this the tension arms took up the slack so rapidly that the effect was barely noticeable. The stability of high frequency phase between tracks is particularly remarkable, especially at the lower speeds, this proving that the entire tape transport is really well made. My only severe criticism of the transport concerns the time lag at the end of spooling or when a tape runs out on the right-hand reel. Transparent leader will stop the mechanism quickly in the latter case, but not quickly enough during spooling, and often the last 6m or so of the tape gets thoroughly tangled up under the spool platform. With great care the tape can usually be extracted without damage, but it is most annoying. This tiresome reluctance of the direction sensitive roller to stop should be improved, since I am sure it causes users much aggravation.

The machine's capability of automatically rewinding and recommencing a preset function will, I suppose, be useful to a few engineers, but to allow this to happen requires the use of transparent leader tape in the appropriate places. Revox can supply this but it is difficult to obtain elsewhere. The rewind/replay button is most useful, particularly when the machine is used for copying. The facility of transferring automatically from one function to another has impressed many a client, in addition to saving a lot of time. I have not found the pause button so useful, though an action whereby one depression stops the mechanism and another restarts it could be an asset.

Although at first I found that threading up tapes was rather time consuming, I quickly became used to this, but my colleagues found the complicated tape path annoying when editing. Over a period the swing arm adjustments varied slightly, and so occasional maintenance will be necessary. Unfortunately, however, on one machine both springs associated with the swing arms broke; as Revox had a stock of these, the machine was only out of service for three days. The tape counter is usefully calibrated in minutes and seconds at 19 cm/s, and it is an easy matter to double or halve the figure for the other speeds. The counter is very accurate, and works satisfactorily in both directions. It can, of course, be reset to zero at any part of the tape. Since the speed of the recorder is very accurately set by the capstan motor control circuitry, accurate tape timing is possible.

Apart from the excellent general operational features the quality of reproduction obtained is particularly good under all circumstances. The constant tape tensioning and provision of a roller near the record head greatly reduces scrape flutter and variable modulation noise effects often produced by longitudinal vibrations of the tape.

Various head blocks can be supplied as accessories, and we have, in addition to the normal stereo half track block, a quarter track version, which works well. The output of the replay head on this is a few dB lower, and during replay, pre-set gain controls would have to be advanced to obtain a calibrated output level. The replay response, however, was virtually identical. We also have a full track

60 ▶

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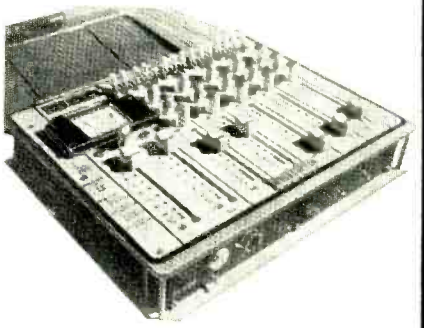
In order to fill the need for a small versatile truly professional mixer, Stellavox have designed the ultra modern Mixer type AMI 48. Using the same principles as the well known Stellavox professional tape recorder type SP7, the AMI 48 is : very rugged, with a die-cast chassis; very light and small, but with perfect operational comfort; battery operated, for use anywhere.



Being comprehensive, it offers not only the classical facilities of conventional big studio consoles, but many exclusive circuits: *powering for any condenser microphones* (parallel or phantom fed 12 V, phantom fed 48 V); very accurate *880 Hz tuning fork reference oscillator*; and the new *limiting circuits type SIL on all inputs and outputs*, allowing easy use of STELLAMASTER technology for extremely low noise recordings.

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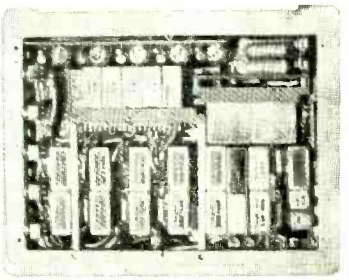

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26 Park Road, Baker Street,
London NW1 4SH.
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SS/10/75

REVOX A700

block, and in this case the replay output was some 5 dB higher than normal, but again the replay response was flat. We found that it was necessary to alter the bias considerably for the half and full track head blocks, and for the latter Revox cannot supply an erase head at the moment. FWO Bauch Ltd can however supply a *B62* Studer erase head which will probably be compatible, although some drilling of the head block will be necessary for mounting.

In general use the machine has been most reliable, although we disliked the attached mains lead which could not be adequately stored in the back of the cabinet if fitted with a heavy duty 13A mains plug. In early machines the mains lead passes over some of the circuit boards, and we found that these could be disturbed, causing certain functions to become inoperative, in particular one or both recording channels. Revox have now redesigned the internal routing of the mains lead, but surely it would be better to have a more usual type of IEC mains socket. The machine can be taken apart very easily as all the different sections of the electronics have interconnecting plugs and sockets or edge connectors, thus making it simple to withdraw and replace any faulty components.

The slide faders used do not seem to introduce any crackles, but on the other hand one of our replay faders had an intermittent contact between the bottom and chassis, making it impossible to take one of the tracks down to zero output. Some cases of instability have developed, causing inaudible oscillation to be produced which can blow the headphone amplifiers and/or external equipment. One machine produces this oscillation when all the record faders are brought down to the bottom, and it seems probable that the condition is connected with earth routing internally. Such oscillation is usually indicated by one or both vu meters going on to the end stop, and the overload light glowing. On high output tapes the overload light tends to go on rather too early, and it is a pity that it could not be replaced by a pushbutton desensitising the meter by 8 dB or so, as well as changing the indication to a peak programme type. This would not require the addition of too much electronics, but would greatly improve the ease with which peak levels could be recorded.

Although Revox importers are very unwilling to modify the *700* specification for professional requirements, many of the necessary modifications could be simply incorporated. Since the machine has virtual earth mixing, additional *XLR* input and output sockets with balancing transformers could be built-in to operate directly into a virtual earth point, and out of the headphone amplifier's main output. In such a modification it would be convenient to reduce all the recording faders to zero and set up the *XLR* balanced input with extra pre-sets to allow a predetermined flux level to be recorded for the required input level. The replay fader controls could also be bypassed with a switch allowing a standard level for the same given flux. Since the replay equalisation is switched electronically to different circuitry for all the three speeds, it would be comparatively simple to provide circuitry to play back DIN or NAB tapes. After glancing at the circuit, however, it would seem difficult to arrange this for recording. I also feel that post office type *301* balanced jack sockets would be of more use professionally than the stereo headphone type jacks provided. Much room is provided internally within the machine for additional electronics. It would appear that the manufacturers have allowed this space for alternative versions that have yet to be produced, although we understand that the professional *A67*, available towards the end of 1975, will not have identical electronics. The replay head pre-amplifier of the *700* series uses a stereo ic; performance can vary from one chip to another. One machine had very bad replay noise on one channel, but changing the ic improved the noise by 10 dB. The replay noise even at 9.5 cm/s should be well below tape

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NEWS

be very important because this will be their first installation in the Paris area which, they claim, is a very demanding and exacting market. On the home front, the same company reports a confirmed order to supply a 28/24+24 monitor quadraphonic desk, similar to the one ordered by Vogue, to Scorpio Sound Studios, London.

Ben Bauer of the CBS Technology Center reports the adoption of SQ quadraphonic broadcasting by five major New York fm stations. The five, WQIV-FM, WRVR-FM, WHLI-FM, WNYC-FM and WQXR-FM, are now equipped for 24-hour continuous SQ broadcasting with the implication that New York is now an SQ fm town.

Sorry

IN CASE YOU found that 'Ambisonics Part Two' by Michael Gerzon (August issue) didn't make a lot of sense, we can explain. Three lines that should have been on the first column of p28 were pasted on to the first column of p30, therefore making nonsense for the follow-ons from p26 and p28. Sorry about this mistake—we hope it didn't confuse too many readers.

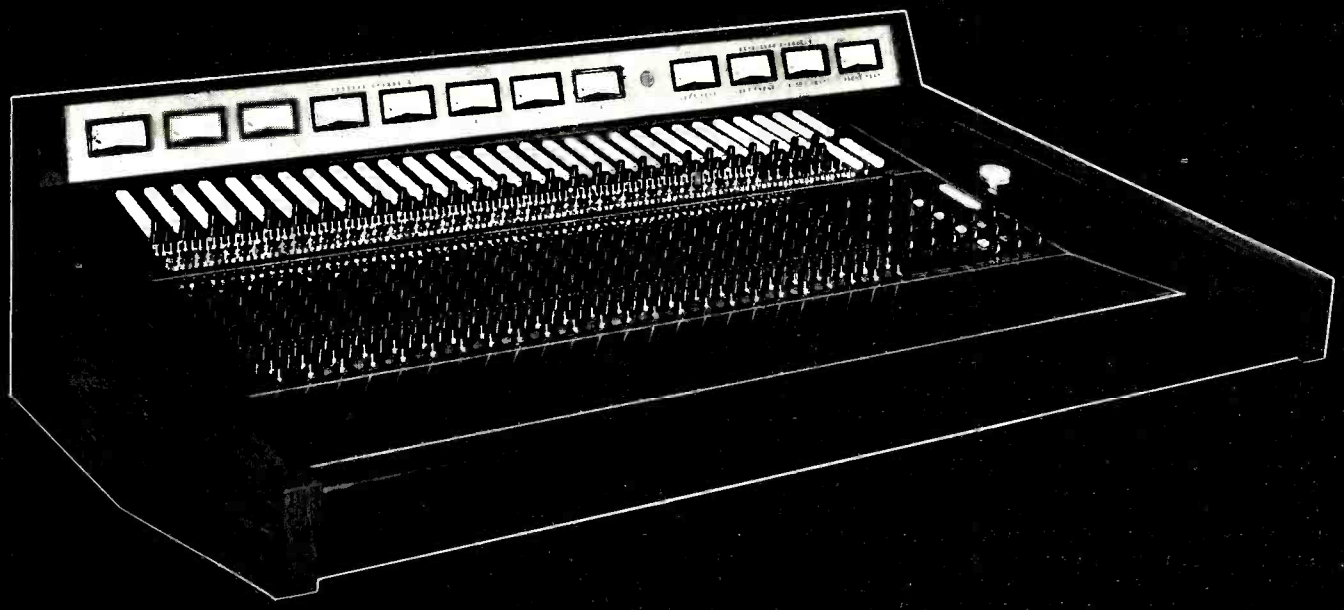
Lyrec multitrack recorder TR53-24

New cartridge

THE MANUFACTURERS CLAIM that the phasing characteristics of the *A-2SP* cartridge are better than ±90 degrees up to 12.5 kHz. The importance of coherent phasing results from the audibly unpleasant effect of cancellations that occur when stereo signals are paralleled for mono transmission.

Audio Devices, a division of Capitol Industries, state that the improved characteristics are obtained by using a one-piece housing manufacture; the guides are fixed and immobile moulded as an integral part of the cartridge housing. They also claim that the new cartridge requires no in-station adjustments; they arrive ready for use without needing screw turning or test tone erasure before use.

A-2SP is available in 12 different lengths from 20 seconds to 12 minutes. Audio Devices International Inc, 1750 North Vine Street, Hollywood, Ca 90028, USA. Phone: (213) 462 6252. Audio Devices Ltd, EM1 Elstree Studio, Borehamwood, Herts WD6 1JG. Phone: 01-953 1600.



QUALITY: **SPECTRA SONICS** audio control consoles show the care and attention to detail that are the mark of the skilled American craftsman. The internal wiring, module construction console housing and the control display reflect the precision and distinctive craftsmanship that is characteristic of SPECTRA SONICS.

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RELIABILITY: **SPECTRA SONICS** audio control consoles have an established reputation of superior reliability. Through creative design, the circuitry is developed to function well below operating limits to enhance an extended life for the components. Through empirical data on SPECTRA SONICS audio amplifiers, a reliability rate of 99.9% has been derived. These amplifiers are used in SPECTRA SONICS audio control consoles and materially contribute to system reliability.

PERFORMANCE: **SPECTRA SONICS** audio control consoles are guaranteed to outperform any other console in the world in noise, frequency response, distortion, and peak overload. All consoles are provided with documented data acquired in tests of the complete system. Guaranteed performance specifications are: Frequency Response, ± ¼dB 20Hz-20kHz; Signal/Noise Ratio (microphone input), not less than 82.5dB below + 4dBM, output for a — 50 input (50 ohms source); Signal/Noise Ratio (line input), not less than 87dB below + 4dBM output for a + 4dBM input; Harmonic Distortion, less than .01% at + 18dBM (1kHz); Intermodulation Distortion, less than .02% at + 4dBM; Crosstalk, not less than 60dB at 20kHz (typically 80dB).

Call or write for details on SPECTRA SONICS Model 1024-24:

770 Wall Avenue
Ogden, Utah 84404
(801) 392-7531

6430 Sunset Blvd., Suite 1117
Hollywood, California 90028
(213) 461-4321

SPECTRA SONICS

LEADER IN ADVANCED TECHNOLOGY

This listing and description is taken from information and material supplied by the manufacturers, mostly in response to a specific request. We have made no attempt to match sterling and dollar prices, but simply reproduce what was supplied for a particular area. In most cases, asking price fluctuates with the exchange rate. Correspondence is not direct, since adjustments occur for local handling and service needs. Owing to late information received in several instances, we will be publishing an extensive addendum next month.

Survey: audio mixers

Forthcoming Surveys

Although we automatically send out a comprehensive circular requesting information, it cannot reach everyone. Therefore, manufacturers of the following products should let us know as soon as possible, and in any case not later than the date given in brackets.

November: *delay and reverberation units (gone to press).*

December: *monitor loudspeakers (October 2).*

January: *tape machine controllers—eg synchronisers, auto-locates, remotes (November 3).*

February: *compressors and limiters (November 28).*

We need full address, phone, telex etc of manufacturer and all agents worldwide, in addition to product details.

ALICE

& Stancoil Ltd, 38 Alexandra Rd, Windsor, UK.
Phone: Windsor 51056/7.

AM Range
Fully modular system for quality multitrack recording. Options suitable stereo broadcasting. *AM 82B* is a three mono/five stereo continuity console, of which 14 are in use in UK local commercial radio. Innovations claimed are special module with in built limiter and illuminated in/out switch for self drive operation in broadcasting; comprehensive interlocked tb system available for radio station technical communications. Prices: *AM 16/8S* £8250, *AM 82B* £3700. Delivery time eight to 18 weeks.

SM 2 Range
Non-modular professional budget price mixer. For small studio and mobile applications, available in formats of 6-20/1-4. All normal studio functions provided. Approx price *SM 26/2* basic mixer £720, *SM 2 16/4* typical studio functions £1800. Delivery eight to 12 weeks.

AD 62 Series 3
Inexpensive, new, 'semi-pro' mixer with competitive noise, distortion and overload performance. 6/2 format with hi/lo switched input, eq and es. Limiters on both output groups. Phone jack connections at rear of chassis, where electronics and ps are mounted on single pcb. Price £294 excluding vat, delivery ex stock.

ALTEC

Altec Corpn, 1515 South Manchester Ave, Anaheim, California 92803, USA.
Phone: (714) 774 2900.
UK: Theatre Projects (Sound), 10 Long Acre, London WCE2 9LN.
Phone: 01-240 0955/01-540 2411.
Europe: Altec Sound Products Ltd, 17 Park Place, Stevenage, Herts SG1 1DU, UK.
Phone: 0438-3241. Telex: 825495.

1220A
Portable mixer/preamp with self-contained reverb. Ten lo Z, balanced inputs, plus one aux hi level channel for other devices. Each channel includes: level, bass, treble, es. Output may be monitored via two selectable channels. Each channel with independent vu prior to group mix buss; group vus also. Line and power polarity indicator for shock prevention, electronic crossover for biamp working and peak limiter circuit. Modular construction. 91 x 61 x 28 cm. 28 Kg weight.

AUDIO DEVELOPMENTS

Audio Developments, Hall Lane, Walsall Wood, Brownhills, Staffs, UK.
Phone: 05433-5351.
Canada: Double Diamond Electronics Ltd, 200 Consumers Rd, Suite 105, Willowdale, Ontario.
France: Studio Center, 3 Rue du Telegraphe, 75020 Paris.
Holland: Sound Techniques, Postbus 206, Alkmaar.
Norway: Siv Ing Benum, Boks 2493, Solli, Oslo 2.
Sweden: Jan Setterburg, Brevkortsgatan 11, 431 Molndal.

AD 007
8/4 portable unit with comprehensive eq, metering, osc, two switched ppms, and compressors. Standard with short travel Ruwido faders, P&G *1520* or *1820* to special order. Twelve channel extender unit available, connected via designated socket.

AD 031
8/2 'Micro Mixer'; two groups submixed to give third output; single ppm monitors all functions. Headphone monitor outlet. If compressors required, fitting is in place of one mic channel. Faders and extensions available as *AD 007*, in corresponding versions.

Super Mini
Retains most of features of *AD 007* and *AD 031*, but each module can be used as input or output, facilitating multitrack working. Led indication of module group status. Thus, a 20 module unit (between 19/1 and 16/4, for example) is less than £3000; P&G *1820* faders standard.

AUDIX

Audix Ltd, Stansted, Essex CM24 8HS, UK.
Phone: 0279-813132.
Canada: Double Diamond Electronics Ltd, 200 Consumers Rd, Suite 105, Willowdale, Ontario.

B100
Series of consoles, associated switching and programme distribution systems designed for radio and tv. Fully modular, desks purpose built to provide wide range of custom assemblies from standard production items. Complete world wide installation and commissioning service.
Studio consoles from standard *B101* 10/2 to the 24/2 *B102*, with four additional subgroups. Vu/ppm metering for mono or stereo standard; multimetering if required. *B103* portable 12/2 uses same range of modules. Range of broadcast continuity systems and self operated radio studio consoles priced between £1500 and £6000, $3300 and $13 200. Backed by complete range of rack mounting equipment (distribution amps, switching matrices etc) for radio station custom packages.
Standard modules include mic/line input channels with comprehensive eq, routing, compressor/limiter, voice-over, stereo width, distribution, line amp, osc.

MXT/800
For studio and ob use, with up to 21 channels and 2/4 groups. Rack or table top mounting. Simpler facilities and format than *B100* Series.

MXT-200
For installations requiring less stringent performance specifications, with compact arrangement, simple controls and low cost. Suitable ob.

AUTOMATED PROCESSES

Automated Processes Inc, 789 Park Ave, Huntington, New York 11743, USA.
Phone: (516) 427-6024. Telex: 950-247.
UK: 3M UK Ltd, Witley Works, Witley Gardens, Southall, Mddx.
Phone: 01-574 5929.
France: 3M France, 135 Bd Serurier, 75 940 Cedex 19e, Paris.
Phone: 331 202 8080.
Canada: Audio Acoustic Labs, 2 Thorne Cliffe Park Drive, Unit 22, Toronto, Ontario.
Phone: (416) 425-7655.
Chromacord Corp, 2343 43rd Ave Lachine, Quebec H8T 2K1.
Germany: 3M Deutschland GmbH, Carl-Schurz-Str 1, D-4040 Neuss 1.
Phone: 49 2101 141
Switzerland: 3M (East) AG, PO Box Baarerstrasse 8, 6301 Zug.
Phone: 411 355 050.

Modular systems for any requirement, based on sections including the following: *312* preamp, balanced in for 150/600 ohm, 15-65 dB gain, reverse polarity and overload protected; *544* input assign module; *840* slate/tone; *544* echo send/return; *846* fb; *325* line booster; *330* eq preamp; *440* fader, plastic track, illuminated scale, multigang within 0.5 dB; *475* fader with precision metal wiper; *480* joystick quadpot; *525* complimiter with threshold, output, two range frequency dependent release and stereo link; *550* equaliser, hf 5, 7, 10, 12.5, 15 kHz, mf 0.4, 0.8, 1.5, 3, 5 kHz, lf 50, 100, 200, 300, 400 Hz, audio band pass filter switchable, eq in/out; *553* equaliser, hf, mf, lf fixed frequency; *559* nine band graphic equaliser, approx octaves 35 to 16k Hz; *575* sine wave osc, 20 to 20k Hz in 13 steps, low distortion and output meter; *701* 10W power amp for small speaker or can systems; *705* 50W power amp; *730* 2 x 200W power

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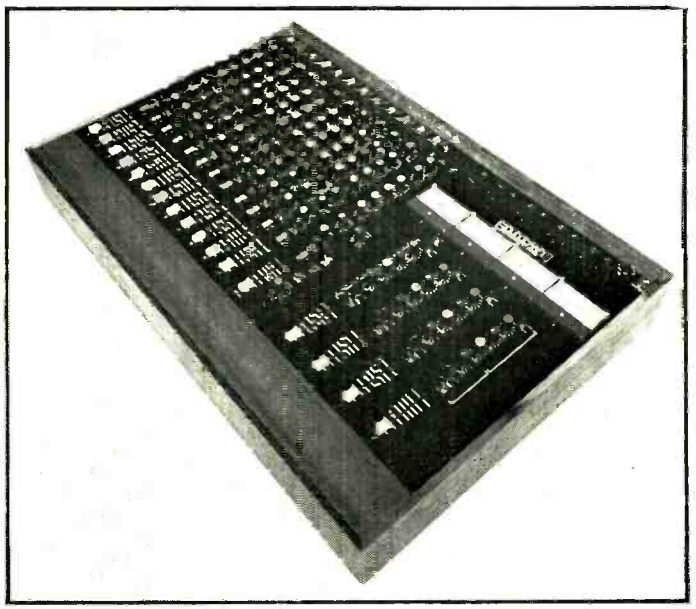
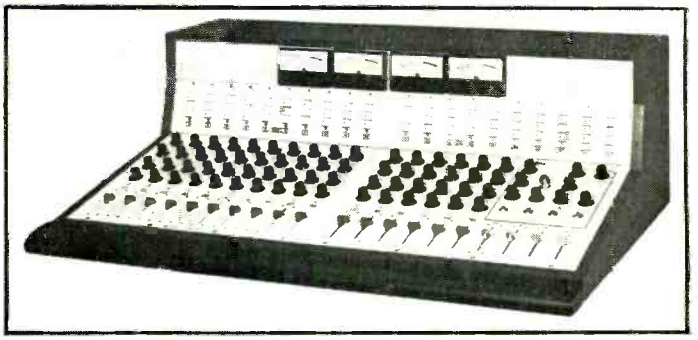
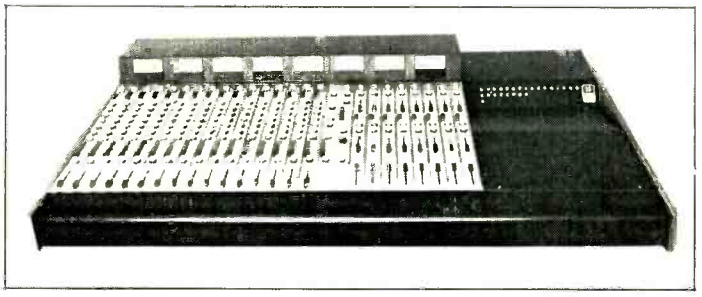
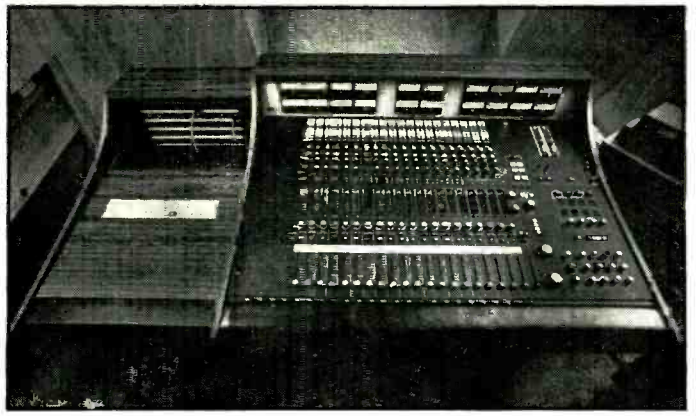
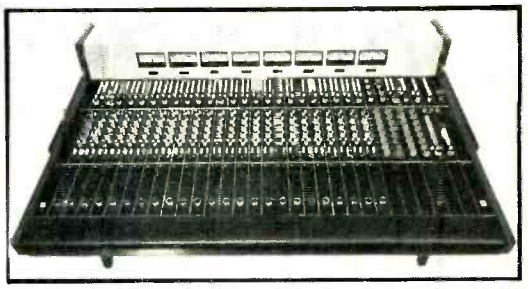


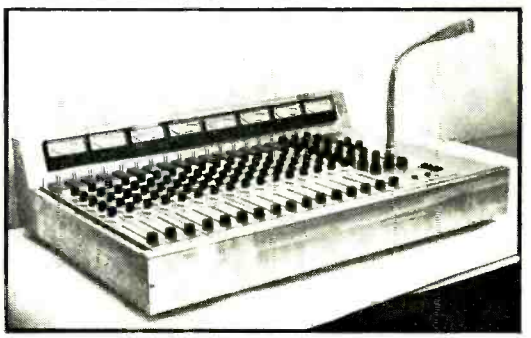




Top to bottom, left: *Soundcraft 12/4, Allen & Heath 16/8, Alice AM 82/B Sphere 'Eclipse' studio console 20 inputs/ 16 outputs.* **Above:** *Opamp model 210, Avab ME802S.* **Below (left):** *Helios parametric equaliser module.* **Below (top):** *Auditronics Grandson II model 110-8* **(bottom):** *Interface series 300, 16 channel.*







amp; *940* automated fader, with plastic track and led ± cursor indication, write/safe/update switching; *954* programmable parametric equaliser hf 800, 1.8k, 3.5k, 7k, 16k Hz, mf 200, 500, 1k, 2k, 5 kHz, lf 30, 60, 130, 260, 600 Hz, bell and notch options, with write and in switching, compatible Allison/Automated programmer.

Automix

For typical channel arrangement on Automix fully automated console mixdown system, see September *Studio Sound* p56. Console available in 24 or 32 channel options as standard, in conjunction with Allison/Automated programmer. All functions automated, including eq, subgroups and pan. Multiple led indications of status and related functions.

1604

Supplied standard as up to 16/4 console using various standard modules. Includes standard es, fb, monitor and metering options. Typical price 16 input $17 790.

2488

Supplied standard as up to 24/16/24 console with extra capacity for particular requirements as necessary. Typical price 24in with 24 monitor channels $33 000; 12 in with four monitor channels $22 930.

AVAB

Avab Elektronik AB, Kungsgatan 5, 411 19 Goteborg, Sweden.
Phone: 031-11 20 32/ 031-11 20 34.

UK: MCI (Professional Studio Equipment) Ltd, 21 Claremont Square, London N1 9IX.
Phone: 01-278 2288.

USA: Audiotechniques, 142 Hamilton Ave, Stamford, Connecticut 06902.
Phone: (203) 359-2312.
Audio Industries Corpn, 1419 Nth La Brea Ave, Hollywood, California 90028.
Phone: (213) 851-4111.

Canada: Chromacord Corpn, 2343 43rd Ave Lachine, Quebec H8T 2KI.

ME 802 S

Portable 8/2 mixer fitted in standard Antler briefcase. Channels include bass/treble control, pan, balanced mic gain, es gain, tape and echo return, subgroup pre/post. Two 10 band octave graphic equalisers patchable. Two subgroups arranged on short sliders. Peak reading led display. XLR in/out connectors.

CAMBRIDGE ELECTRONIC WORKSHOP

4 Water Lane, Oakington, Cambridge CB4 5AL, UK.
Phone: 022023-3737.

High quality desks for theatre use. Cue lights, show relay/communications facilities, Is switching, tape remote all on front panel.
Standard model provides: 10 input channels, mic/line sensitivity, treble, continuously variable presence frequency/gain between 270 Hz and 6 kHz, hi pass filter 170 Hz at 6 dB/octave; two aux send pre/post; pan; pfl; linear motion fader. Also, four direct inputs each with pan, rotary gain and pfl; two main, two aux groups with pfl; main groups with set level control. Any input or group may be metered via pfl, also stereo and off-tape output monitoring. Communications feed. Switching eight Is lines. Jack bay; connectors locking DIN. High contrast marking, colour codings. Separate ps; semi-modular construction. 63 x 63 x 28 cm, weight approx 20 Kg, price standard £1300; many options available in format and mechanics.

CADAC

Cadac (London) Ltd, 141 Lower Luton Rd, Harpenden, Herts AL5 5EL, UK.
Phone: 05827-64351. Telex: 826323, Cadac Harpden. Cables: Cadac Harpenden England.

USA: Cara Pacific Sales Co, 3050-F Via Alicante Dr, La Jolla, California 92037.
Phone: (714) 452-0813.

Spain: Singleton Prods, Via Augusta 59, Desp 805, Edifico Mercurio, Barcelona 6.
Phone: 228 3800. Telex: 54015.

Italy: Ing Oscar Roje, 20147 Milano, Via Sant'Antalone 15.
Phone: 415 4141. Telex: 39202.

Finland: Into Oy, PO Box 153, Helsinki 10.
Phone: 90-11123. Telex: 12-1836.

South Africa: Tru-Fi Electronics SA, (Pty) Ltd, PO Box 31801, Braamfontein Tvl.
Phone: 838 4930.

Japan: Kawamura Electrical Laboratory, No 34 Yarai-Cho, Shinjuku, Ku, Tokyo 162.
Phone: (03) 230-0401. Telex: J 22748.

Portable

Normally fitted 10 or 12 channels but available up to 21. Two or four group outputs. Version with full quad panning on all channels. Two es, two fb, pfl, osc, tb, standard monitoring. Both mic and line bridging inputs to channel separately gain adjustable. Five-band eq: hf shelving curves, three mid bell, and one lf shelving. Each band has frequency select/cut and booster control. Table top or stand versions. *XLR* fitted.

E Range

Multitrack recording console available in formats up to 36/32. Eight sub-mixing groups; 2/4 es, 2/4 fb; quad monitor with matrix encode/decode insertion point. Monitor up to 32 with sync/playback/record switching linked with Cadac Dolby module and multitrack tape switching. Tuchel multiway connectors.

Custom Multitrack

Two modules per channel: eq more complex than *E* or *Portable* ranges: and channel routing module. Full group reinsert and quad pan on each channel regrouping and echo return. Comprehensive monitoring. Full custom design service available.

Broadcast

Standard 20 channel broadcast console under development. Custom facilities available.
Automated mixdown (Allison) available with any console; may be fitted to existing desks.

CETEC

Cetec Audio USA, 13035 Saticoy St, North Hollywood, California 91605, USA.
Phone: (213) 875-1900. Telex: 910 499 2669.

UK: Cetec UK, Sapphire House, 16 Uxbridge Rd, London W5 2BP.
Phone: 01-579 9145. Telex: 935847.

Series 10

10/2 portable console with ten stereo input channels and ten switchable remote stereo inputs; comprehensive tb and cueing systems; stereo headphone output, remote tape controls; clock; two ps modules (remote) each of which handles requirements. Available in mono/stereo/quad forms with eq if desired.

Series 20

Live music console. Up to 30 inputs, four program outputs, mono output, stereo output, two fb, one es. Mic/line and optional switching for up to 48 additional remote inputs. Phase; solo; attenuate to 60 dB; group solo, echo return; programmable mute for four independent presets; three way eq on all inputs; led channel-on; illuminated vu for all outputs, ppm available; plug-in modular construction.

Series 2000

Available in formats of up to 32/24, based on the following modules: *712L* nine frequency graphic eq/mic amp; *711L* eight frequency eq/mic amp; *311L* mic amp; *SM-5* five channel switch push button; *SML* switch module lever, 24 channel.

Series 1204

For high quality recording, broadcasting, sound reinforcement and film work. 12 mic/line inputs, wired 16; complete eight frequency eq with es and cue on each channel; four output groups with illuminated vu; four es. Tv version available similar *1204* standard with nine frequency eq, direct feed switching bypassing main buss; four mixing busses Sub 1, Sub 2, Aud and Pgm, usable for separate simultaneous mixes. Eight monitor mute switches.

Series III

Large scale, flexible console based on the following modules, up to 40/24 configuration: input module 24 illuminated push button assign; mic preamp pad/gain; graphic or three way eq; mute, solo; extensive pan in quad and stereo groups; es send automation control, and vca. Submaster attenuation; full and extensive multitrack monitor switching. Further system options include simultaneous quad/stereo/mono mix busses; automated joystick panners; automation encoder, decoder and interface wiring; rough mix monitor and cue sends derived from input module.

AM4A

Small, modular desk, arranged as block housing and fitting plug-in modules. Standard Cetec modules are accommodated, giving wide flexibility according to specific operational requirement.
Further series of compact cabinet mixers is available varying from simple 8/2 downwards, in combinations of impedance, input type and connector.

CROSSROADS

Crossroads Audio Inc, PO Box 19371, Dallas, Texas 75219, USA.
Phone: (214) 526-1636.

Minipro

Concert sound reinforcement mixer. 16 in, three out; balanced input; simple eq; prefade monitor mix buss; post fade echo/effects subgroup, master eq on main and monitor outputs; *XLR* connectors; two large vu meters.
Pcb construction; all controls rotary. Weight 14 Kg approx, length less than 77 cm. Price $1750.

CRYSLON

Cryslon Electronics Ltd, Unit 4 Berrington Rd, Sydenham Industrial Estate, Leamington Spa, Warwickshire CV31 1PN, UK.
Phone: 0789-66282.

Complete manufacture, design, installation and after-sales service offered for theatres, film studios, local broadcast stations. Consoles manufactured range from small compact portables to multi-channel and multi-group studio facilities, as required. Stage manager systems, tb, cue, show relay and security systems. All ancillary items may be supplied. All console and rack systems built from standard range modules: mic amp, various eq, mixer, line amp, tone osc, power amp etc presented on standard front panel 177.8 x 50.8 mm; all plug-in fitting.

DUKANE

DuKane Corp, 2900 DuKane Dr, St Charles, Illinois 60174, USA.
Phone: (312) 584-2300.

13B465

Up to 16 input channels, to three output groups; overload indicator on channel and group; cue channel to monitor any combination in/out. Supplied with two large vu meters. Designed for mass audience facilities.

2A75B

Mixer-amplifier for pa and sound reinforcement purposes. Five inputs, each taking mic/line/disc, three pad positions; balanced output. *2A76B* is associated mic input expander, with five additional channels.

EAGLE

Eagle International, Precision Centre, Heather Park Dr, Wembley HA0 1SU, UK.
Phone: 01-903 0144. Telex: 922131. Cables: Eaglint Wembley.

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AUTOMIX
A Completely Programmable Mixdown Console

Automix as a manual mixdown console is incomparable. As a programmable console, it permits new standards of perfection and artistry.

You may capture every detail and nuance of a mix from up to 32 inputs and 4 echo channels. When programmed, your mix may be precisely repeated as often as desired, or each element of sound on any track may be improved individually or in combination.

The audio paths are entirely separated from the DC control circuits. Voltage control amplifiers and state variable devices in the audio paths provide for all functions: level, localization, reverberation, and equalization. Control of multiple audio paths by a single manipulator (grouping) is possible for all functions. An optional video screen displays the quad sound field, identifying each input, as a numeral, in its respective aural position.

Extraordinary performance is achieved at a very ordinary price. Automix, even with a companion Automated Processes' studio mixing console, can be obtained at substantially lower cost than a conventional console of comparable numerical capabilities.

AUTOMATED PROCESSES, INC.
789 PARK AVENUE, HUNTINGTON, NEW YORK 11743 • 516-427-6024

■ SURVEY

Range of small mixers. Self powered with two PP3 batteries.

FF 1

Four channel mono mixer and preamp. Hi/lo switched mic inputs, channel and master sliders. Switchable aux input on one channel. £28 plus vat.

FF 10

Designed for disco use: two stereo disc, one stereo tape and one mono mic input. Channel and master sliders. £34 plus vat.

FF 32

Seven channel stereo programme mixer and preamp. As *FF 10* but with additional pfl. *HA 10* headphone amp may be used in conjunction. £36 plus vat.

MP 12

Six channel stereo/mono mixer and preamp. Mic inputs switchable hi/lo impedance. £34 plus vat.

FAIRCHILD

Fairchild Sound Equipment Corpn, 75 Austin Bvd, Commack, Long Island, New York 11725, USA.
Phone: (516) 543-5200.
UK: Jacques Levy Professional Recording Services, 6 Carlisle Mansions, Carlisle Place, London SW1
Phone: 01-834 9248.

FPC

Portable, flat console available in formats between 8/2 and 16/8. Balanced mic input with gain, lf, hf boost/cut, peak selectable. Vu metering on groups, balanced out; 25 hours operation on one set 'C' batteries; solid aluminium construction. 72 x 62 x 5 cm, weight 12 to 19 Kg depending on format.

ICBM

Series of modular broadcast consoles and ic broadcast modules (ICBM) including mic input module, line and hi level input modules, remote input, output, monitor and communications modules. Metering via vu in console shell; wide format flexibility.

FIC

Flexible modular system for recording. Input module includes level, select and pad switches, input fader, es and gain pre/post, compressor, hi and lo eq, fb, vu. Output module includes slider, echo return, compressor, eq, vu meter. Monitor module includes 10 x 10 select matrix, slate, tb.

GATES

Gates Divn, Harris-Intertype Corp, 123 Hampshire St, Quincy, Illinois 62301, USA.
Phone: (217) 222-8200.
UK: Lee Engineering Ltd, Ashley House, Ashley Rd, Walton-on-Thames, Surrey KT12 1JE.
Phone: Walton-on-Thames 28783/4. Telex: 928475.
Cables: Leetech.
Dualux and Gateway 80 cabinets are simple mix and cue units for broadcast and related work. Single or dual channel vu metering. Monaural side cabinets available as extension slaves, in similar styling and layout.

HEATHKIT

Heath Co, Benton Harbour, Michigan 49022, USA.
Phone: (616) 983-3961. Telex: 729421.
UK. Heath (Gloucester) Ltd, Gloucester GL2 6EE, UK:
Phone: 0452-29451. Telex: 43216.

Mixer kits to be released October 1st 1975.

TM-1626

Simple 6/2 mixer. Four mic input channels hi/lo Z, one with pan. Two aux inputs; all inputs switchable left/right. Two illuminated vus, with adjustable led peak indicators. Rear panel jack access to mixing buss. Slider controls. £85 inc 25% vat.

TA-1620

Pa control amplifier and amp. Six balanced low Z inputs, each channel having level, bass and treble, reverb on/off. Mic pads 18 dB. Two channels high level, aux input optional. Reverb built in. Anti feedback switches on band gain. 100W power amp. Lighted output meter, switchable sensitivity. Pcb construction. Price £248 including 8% vat.

HELIOS

Helios Electronics Ltd, Browells Lane, Feltham, Mddx TW13 7ER, UK.
Phone; 01-890 0087/8/9.
USA: To be appointed shortly.
Canada: Noresco Manufacturing Co Ltd, Professional Products Divn, 100 Floral Parkway, Toronto, Ontario M6L 2C5.
Phone: (416) 249-7316. Telex: 06-217876.
Norway: Slv Ing Benum & Co, Boks 2493, Solli, Oslo 2.
Phone: (02) 56 57 53.
Germany: Elmus GmbH, D1 Berlin12, Herderstrasse 16.
Phone: Berlin 312 20 12.
Italy: Audio Consultants srl, 41100 Modena, Via Emilia Est 181.
Phone: (059) 36 79 59.
Portugal: Tecta Lda, Rua Eca de Queiros 20 3° D, Lisboa.
Phone: 56 04 05.
South Africa: General Optics Co Ltd, Film and Electronics Divn, PO Box 2409, Johannesburg 2000.
Phone: 836 4275/9851. Telex: 43-0057.

Service offered is custom design based on a wide range of modules and accessories. Areas covered are studio, multitrack mobile, broadcasting, film dubbing and high quality pa.

Alternatively, a 'semi-standard' approach uses modules for 8/16/24 track recording (*PS* Series) and 10 to 24 channel broadcast in *SB* Series. Recent introductions include a range of input modules, incorporating separate line-in control on slider, with parametric eq in three or four sections. Continuously variable frequency and Q, they can also be switched between bell and shelf curves; equalisers may be sold separately. Provision is made for automation using proprietary equipment.

Other services are: consultancy in design and equipping recording studios; provision of complete recording studio packages across design, architect and builders instruction, equipment supply, installation and commissioning; specialist design and building of mobile recording units and vehicles.

HH

HH Electronic, Industrial Site, Cambridge Rd, Milton, Cambridge CB4 4AZ, UK.
Phone: 0223-65945/6/7.
USA: Audiotechniques Inc, 142 Hamilton Ave, Stamford, Connecticut 06902.
Phone: (203) 359-2312.
Canada: Paco Electronics, 45 Stinson St, Montreal.
Phone: (514) 748-6787.
France: Techniques et Conpemporaines, 6 Rue Monsigny, Paris.
Phone: 266 36 89.
Belgium: Delba Equipment SA, 28 Rue Bu, Pabellion, Brussels 5.
Phone: 376 6034.
Holland: A. Hardes BV, Oude Gracht, Utrecht, Holland.
Phone: 31 61 44.

PM12/2

Portable 12/2 mixer for high quality pa or recording applications. Led output vus and electroluminescent lighting on controls. Channels include hi/balanced/lo, line gain, eq ±16 dB at 40 Hz, ±12 dB at 1.8 kHz, ±16 dB at 15kHz; fb and es; pan; monitor switchable pre/off/post fade; mute; sliders on channel, groups and subgroups. Additional echo return. Monitor output may drive cans, switchable between channels, groups and subgroups.

ICE

ICElectrics Ltd, 15 Albert Rd, Aldershot, Hants, UK.
Phone: 0252-28514.

Ice mono

6/1 mixer, preset for aux, mic 1/2 and disc 1/2/3. Overload capability 20 dB all inputs, output 760 mV. Bass/treble controls, headphone monitor. Tape socket. 13 x 50 x 11 cm. Price £123.66 inc 8% vat.

Ice stereo

As mono machine but with aux and disc inputs ganged stereo faders. Tape output may be used as echo send/return. 13 x 50 x 11 cm. Price £141.75 inc 8% vat.

INTERFACE

Interface Electronics, 3810 Westheimer, Houston, Texas 77027, USA.
Phone: (713) 626-1190.
Europe (Common Market): Audio Products International Viale Rimembranze di Lambrate 13, Milan 20134, Italy.

Combinations of mixer configurations for stereo, four and eight track working.

Series 100

Four group output mixers, accommodating up to 24 input channels. Four interchangeable modules provide for wide functional range as follows: *100D:* track route; pan; es (post); hi and lo frequency eq; solo; gain set; input pad; line/mic choice; slider. *100B:* as *100D* but with three band eq at frequencies 50/100/250 Hz, 500/1.2/2.4k Hz and 4/8/12k Hz *100C:* compressor input module to 40 dB, trackswitch, es, hi/lo eq solo/gain/line-mic and slider. *100AQ* and *100CQ:* various panning options, with typical channel functions. *100Q:* high level, four input module for level, cue, pan for feeding four outputs with four track signal. *100R:* combination sound-system and stage monitor module with basic monitor switching and channel-type controls of eq etc. *100J:* elaborate version of *100R*, principally with three-band eq. Output panels include vus for each of four channels, and submix options from main groups. Built-in Hammond spring reverb available on one channel only as option, as is phantom powering. *100L:* gain pots four each of four sub and main groups. *100K:* cue system controls, for each of four send busses, with associated controls, including monitor insert. Price range $2100 to $5040.

Series 200

Small, compact stereo portable mixer. Eight *XLR* inputs, vu on two output groups, echo send/return, conductive plastic faders, input pad switch. Plug-in module and ic construction. 25 x 39 x 8 cm. $1500.

Series 300

16 and 24 input eight group output desks. Modules similar *100* series except as required by eight group working. Fully modular. Module *308A* is track select push button, solo, pan, es and fb pre/post, six band eq at 100, 300, 600 1.2k, 2.5k and 5 kHz. Price range $7560 to $12 300.

Also available: *X0312* electronic crossover, three-way continuously tuneable.

ITA

Industrial Tape Applications, 5 Pratt St, London NW1 0AE, UK.
Phone: 01-485 6162. Telex: 21879.
France: Reditec, 27 ter Rue de Progress, 93107 Montreuil, Paris.
Belgium: IATA, Kerkstraat 16, 3020 Herent Wijgmaal.

10.4

Portable or studio desk for recording or pa. Modular construction in fixed format for high turnover/low cost. Facilities include: balanced mic/line input with gain; lo, mid, hi eq; es, fb; pan between groups 1/2 and 3/4; channel assign; fader; four limiters with led

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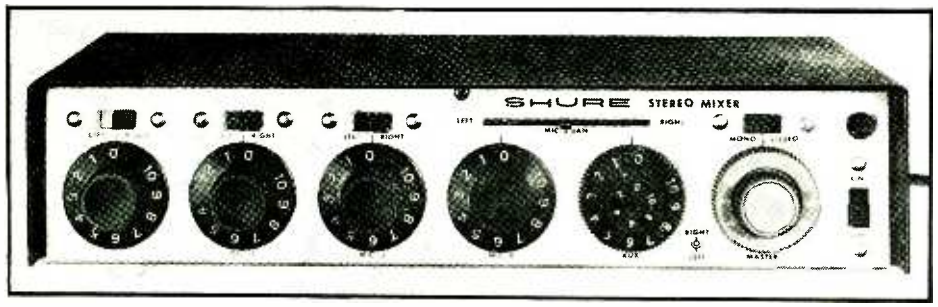
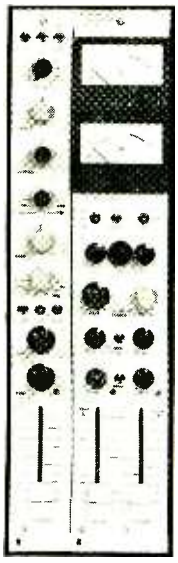
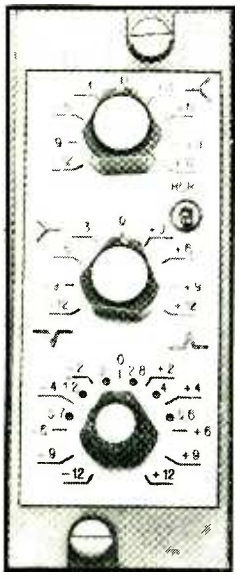
Studio Sounds

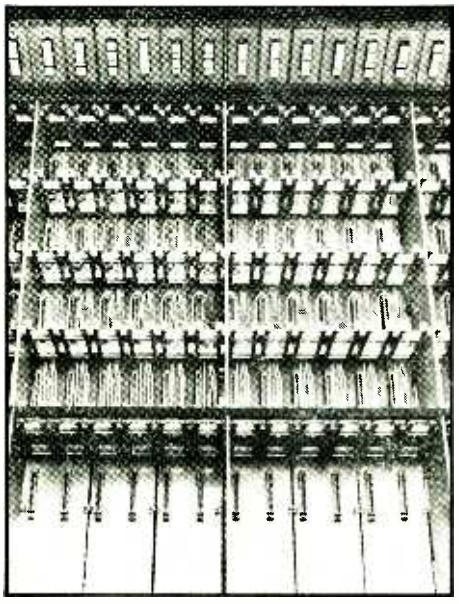
Setting the Standard of the Industry

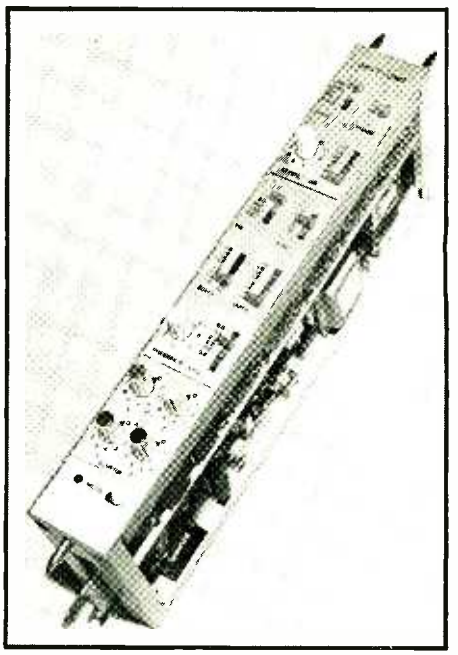
Rose-Morris 32-34 Gordon House Road, London NW5 1NE.











Top left: *Shure model M688-E stereo microphone mixer.* **Far left l-r:** *Raindirk broadcast range channel unit, Schlumberger eq module, Schlumberger main frame.* **Above:** *Studer input module.*

SURVEY

indication (variable); four monitor volume controls fed to stereo monitor output. Headphone socket; four echo returns. Connections via phone jacks. Weight approx 11 Kg. Price £647 plus vat.

20 input version £990, eight group version £1260.

LAMB

Lamb Laboratories, Lamb House, Church St, London W4 2PB, UK.
Phone: 01-995 4551.
USA: Lamb Laboratories, 155 Michael Dr, Syosset, New York 11791.
Phone: (516) 364-1900.
3637 Cahuenga Bvd, Hollywood, California 90068.
Phone: (213) 867-1200.

PML422
4/2 portable mixer. Unbalanced mic inputs 200 ohm, line greater than 20k ohm; line out +10 dBm unbalanced. Two adjustable vu meters. Input sensitivity control, treble/mid/bass lift/cut; es; pan; stereo limiters switchable; pcb construction; linear sliders.
PML424
Identical with *PML422* but configuration rearranged for dual use as four track mixer.
PML426
As others, but with six input channels only.
Delivery of all units from immediate stock. (*424* and *426* due for release shortly.) £195 plus vat.

LANG

Lang Electronics Inc, 14 E 39th St, New York, NY 10016, USA.
Phone: (212) 725-8110.

Range of mixers and associated units for recording and broadcasting.
LMX3
8/2 mixer using rotary faders. Echo send and reinsert. Input switchable mic/line. Size 13 x 50 x 18 cm. Weight approx 4 Kg. Price $750; mono version $575.
LMX4
Five input mixer with subgroup routing and return. Single vu meter. Each channel with mic or line option. With one mic amp $875.
LMX5
Similar *LMX4* but incorporating 10 slave channels only. Output to be fed through transformer coupling to mic input elsewhere. Power internal or external. With one mic amp $875.

Also available: compatible eq and reverb units and extended versions of above.

MALATCHI

Malatchi Electronic Systems Inc, 3731 E Colfax Ave, Denver, Colorado 80206, USA.
Phone: (303) 321-3520.
Range of audio mixing systems and related equipment for live sound reinforcement and for recording, along with lighting mixing and control units. Mixers use 'top grade commercial and military grade components'. Available are quad, stereo and mono configurations with any number of input channels as required. Format totally modular. Installations include Shady Grove Theatre, Washington DC and Warehouse Restaurant in Denver.

MARTIN

Martin, 320 W 46th St, New York, NY 10036, USA.
Phone: (212) 541-5900.

SLM-1020A
Compact 10/2 console. Channels switchable between line and balanced mic 200 ohm. Output 600 ohms balanced main groups, monitor 5k ohms unbalanced. Es 600 ohms unbalanced. Equalisers per channel at 50/100 or 200 Hz, and 3k/6k or 12k Hz. Separate channel pan. 27 x 39 x 19 cm overall, weight approx 11 Kg. Twin vu meters. Price fob NY $2495.
SBC 82
Stereo broadcast console, similar specifications to *SLM-1020A*. Designed for broadcast/disco, ten inputs on five dual-ganged sliders into two groups, with mono cue facility. May be used with *234* mic/line cards or *234PE* phone eq cards. Price without input cards $1349, with extra cards at $50 each.

MCI

MCI Inc, 4007 NE 6th Ave, Fort Lauderdale, Florida 33308, USA.
Phone: (305) 566-2853. Telex: 51-4362.
UK: MCI (Professional Studio Equipment) Ltd, 21 Claremont Sq, London N1 9IX.
Phone: 01-278 2283.

JH-428/440
Modular system largely using plug-in board construction. Channel module includes 16 channel assign buttons, with 'direct assign' facility straight through to associated tape track. Led indication. Mic amp pad 20 dB, max gain 60 dB, headroom more than 28 dB. Mute channel; eq lo/hi boost/cut total four frequencies, mid boost/cut half octaves 150 to 7k Hz. Monitor with individual quad pan, separate l/r and f/b control. Four es available at remix. Overall module states mic/tape/remix designated by selector on status module.

Auxiliary module provides cue select, solo, echo level, osc, slate output select, separate tb, fb and

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slate levels. Master module contains fb and es master, four echo returns and master level fader. Full quad panning as appropriate. Control room monitor module permits quad, stereo and mono monitoring of nine signal sources. Automatic muting of unwanted monitor sends as necessary. Solo trim and master monitor level facilities. Other standard inclusions: monitor select, meter select, vu/peak option, solo indicator and level control, monitor channel input select.

MCI Spectra-Vue utilises existing vu or light meters to read half octave spectrum distribution for selected signal. 18 half octave bands 45 to 16.5k Hz. Agc corrects input levels from —30 to +20 dB to reference. Optional standard extras: 24 track buss, phase reverse, tape solo on in/out module, individual es/fb access for tb etc, monitor trim and mute, quad studio monitor, alternate speaker switch, equalised peak reading light meters, 56 extra tie lines, phase meter, etc.

Prices: eg *JH-428-8 VU*, 28/8 standard console $16 785. *JH-440-40 LM* with 24 light meters, 40 channel console $48 941. Sterling prices approx £8500 and. £25 000 respectively, dependent on exchange rates

JH-528

Preliminary specification similar *428/440* series but facilitating automated mixdown. 24 channel select, selection indicator, eq in/out switch, fader/monitor switch, six separate subgroups, with 1 and 2 on sliders; local mute disconnects channel mute from automated muting system. Led indication associated with vca auto write/read functions with monitor and fader override available. Increased flexibility of 'communication strip'. Master strip as before with rearrangement and mix trim, calibrate override switch, extended main group and sub group pan select, solo, mute and override. 'Comp' reduces quad/stereo separation to 18 dB, filter rolls 12 dB/octave below 30 Hz.

Control strip facilities include monitor, send, solo trims, 'alt centre switch' to shift quad 'room centre' from engineer to producer position. Automated option provides full control of level functions only, including all subgroups. Data storage on associated slave tape machine. Level matching achieved by vca slewing between read/write levels, with variable time constant. Preliminary details received of compatible 24 track recorder with 76 mm tape: wider signal paths with increased data storage for automated mixdown.

McMARTIN

McMartin Industries Inc, 4500 Sth 76th St, Omaha, Nebraska 68127, USA.
Phone: (402) 331-2000.
UK: Lee Engineering Ltd, Ashley House, Ashley Rd, Walton-on-Thames, Surrey KT12 1JE.
Phone: Walton-on-Thames 28783/4. Telex: 928475. Cables: Leetcch.

B-800 Series

Modular, providing for push button selection of 27 input sources through eight mixing channels. Standard models *B-801* mono, *B-802* stereo, *B-803* dual mono, *B-802-S1* dual stereo and *B-802-S2* stereo-mono. First three channels lo mic; next four channels high level unbalanced aux sources; remaining channel hi level balanced. Special configurations as required. Step attenuators; 8W monitor amp modules; selective intercom/talkback; two panel vu meters.

B-500

Similar *B-800* Series, with disc input modules available. Basic five channel input to one or two output channels.

Accu-five

Five channel 'mini-console' in 9 cm high rack unit. Accommodates up to 13 mic inputs, with hi/lo input level switching on three channels, monitor and cue facilities. All inputs transformer isolated; cue/talkback facility.

MIDAS

Midas Amplification, 87 North Grove, London N15 5QS, UK.
Phone: 01-800 6341.
Belgium: Louis de Potesta, Rue Th Decuyper 134, 1200 Brussels.
Phone: 771 30 63.

Two basic ranges, of portable, mixing and studio systems.

Portable

For quality sound reinforcement and 2/4 track recording applications. Based on following modules: *PR 001* input/output module, mic/line optional, line gain and input attenuator 30 dB, 600 ohm balanced mic input; eq ±16 dB at 50 and 15k Hz ref 1 kHz, ±14 dB at 3.5 kHz, variable Q; two each fb and es normally pre and post; carbon track Ruwido fader; pan; pfl. *PR 002* similar, but fitted P&G fader and extended eq; bass cut, presence at 1.5/3.5/7 kHz; subgroup route switches optional. *PR 003* as *PR 002*, designed for recording; extra mute/channel switch/pan grouping. Output module *PR 010* includes post-fader break points; *PR 011* with line in/out monitor and amp. Fb and es/return module mixes and reinserts. Tb, pfl, limiter and crossover modules available; jack field optional.

Studio

Comprehensive range of modules, with facilities of varying complexity. Typical channel includes eq ±18 dB at 60 Hz, ±16 dB at 700/1k/1.5k/2.7k/4k/7k Hz, ±16 dB at 10 kHz, alternatively ±16 dB at 40/80/160 Hz, ±16 dB on variable control four ranges 30-300, 150-1.5k, 300-3k, 1.5k-15k Hz, and ±16 dB at 7/15 kHz. Hi pass filter 80/120 Hz, 18 dB/octave; two fb and es, former with pre/off/post; mute, pfl/afl; full pan, monitor and tb facilities. P&G *1820* fader standard, *1520* fitted to special order. Vu or ppm metering as required; led overload optional.

MUSTANG

Mustang Communications, 31 Nelson St, Scarborough, Yorks, UK.
Phone: 0723-63928.
Abroad: distribution network being set up.

Range of mixers primarily intended for performance and may find studio application. Mixers available in rack or free standing format, with cabinets for racking also available. Delivery 'usually held below 10 days'.

MM Series

Modular options based on *MM4* and *MM6* four and six input mixers. Associated modules for mic hi/lo, mag/ceramic pu, high Z tape, balanced line etc. Prices (trade) range *MM4* £52.96, *MM6* £62.61 with extras around £5 per module. Compatible power amps offered, and range of lighting control.

MMA Series

As above, but with integrated power amplifier. 50W and 100W versions, adding approx £30 and £40 respectively to the price.

NEVE

Rupert Neve & Co Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU, UK.
Phone: 0763-60776. Telex: 81381. Cables: Neve Cambridge.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801.
Phone: (203) 744-6230. Telex: 969638.
Suite 616, 1800 N Highland Ave, Hollywood, California 90028.
Phone: (213) 465-4822.
Canada: Rupert Neve of Canada Ltd, 2719 Rena Road, Malton, Ontario.
Phone: (416) 677-6611. Telex: 0696 8753.
Germany: Neve Gmbh, 6100 Darmstadr Bismarckstrasse 114.
Phone: (06151) 81764.
Elsewhere: other agents in major countries worldwide.

A complete range of mixing consoles is offered, together with full installation for recording studios. Standard designs, some available from stock, between 5/1 and 32/16/32 formats. Stock consoles include Kelso 10/2, Melbourn 12/2, Specification *8014* 16/4/8, Specification *8024* 24/24, Specification *8034* 20/4/16, Specification *8036/46* 24/8/16, Specification *8038* 24/16/24, Specification *8048* 32/16/32.

Standard designs available for film dubbing, radio and tv, including local radio scale. In all fields, range is from largest to smallest consoles. Despatch of stock consoles 'rarely longer than 12 weeks'; custom building requires six to eight months depending on size and complexity. 12 months 'no quibble' guarantee precedes regular maintenance service with one to three visits per year, and 'flying trouble-shooting' staff.

Computer-aided mixing facility shortly to be introduced, based on electromechanical servo system for optimum distortion performance (Necam).

PEAVEY

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

1200

Self-contained, portable mixer for recording and sound reinforcement work. 12 channels each including: balanced, low Z mic inputs, unbalanced high Z line inputs switchable, input/line attenuate, high/low eq on all channels, stereo pan, three sub groups switchable pre/post, channel slider. Sliders on master groups, with master eq low/mid/high; effects master, return with pan; reverb master, return with pan; balanced output with illuminated vu metering, adjustable. Price $949.

PHILIPS

Electro-acoustics Division, NV Philips Gloeilampenfabrieken, Eindhoven, Netherlands.
Phone: (040) 732904. Telex: 51121 PHTC NL.
UK: Pye Business Communications Ltd, Cromwell Road, Cambridge.
Phone: (0223)) 45191.
USA: Philips Audio Video Systems Corp, 91 McKee Dr, Mahwah, New Jersey 07430.
Phone: (201) 529-3800.

SM4

Modular range of units for flexible set up of custom systems, intended primarily for pa and theatre area as well as 'semi-broadcast' use; with associated power amps.

Modules include the following, with more to be introduced subsequently: *LBB 1140* mixing preamp, various inputs for pick up, music, mic and line, bass/treble ±14 dB, vu meter; *LBB 1142* 50W mixing amp, as preamp with amp; *LBB 1102* 50W power amp; *LBB 1143* 100W mixing amp; *LBB 1103* 100W power amp; *LBB 1104* 200W power amp; amp/attenuator *LBB 1151/01*; *LBB 1151/02* tone control amp, hi/mid/lo boost and cut; filters *LBB 1151/03*, as tone control amp before but with sliding frequency for anti-resonance treatment; *LBB 1151/05* simple comp-limiter; *LBB 1151/06* gong/chimes/alarm unit; am and fm tuner modules; control desks for small desk installations; sliders, vu module and mains control; signal push button module; five button, also available with illumination.

LBB 1146/00

Simple stereo mixer with various inputs for mic, music, tape. Five channels.

LDC 25

Designed for tv, radio and music studio using narrow 30 mm modules. 20 in and four out less than 1m wide, with space for extra four channels/groups. Channel modules have mic control, eq, hi/mid/lo, pan and mix to four busses; tb and fb reinsert on groups; desk is mainly of pcb construction, with divided ps system. Standard versions from stock 1976 onwards, price $20 000 to $40 000, depending on option.

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THERE'S NO BETTER VALUE!
THE PML 422 MIXER
AT £195 ex vat

Flexible, portable, 4 in x 2 out,
low cost, semi-pro mixer with EQ at 15kHz,
1KHz, 50Hz on input channels.

Switchable, stereo tracking limiters on outputs.

Elaborate signal routing

Echo send and return.

Plug-in circuit boards.

The ideal mixer building block.

Full details from

LAMB LABORATORIES

Lamb Laboratories Ltd Lamb House Church Street London W4 2PB Telephone: 01–995 4551.

■ SURVEY

PYE

Pye TVT Ltd, Coldham Lane, Cambridge CB1 3JU, UK.
Phone: 0223-45115. Telex: 81103.

SM8

Eight input channels selectable from three input channels: mono mic/line, stereo disc or stereo hi level. Channels include sensitivity, pfl, es, fb, pan. P&G faders standard. Custom version with switching for up to 48 sources. Talkback may be used externally if required. Eq ±8 dB at 3/5/8 kHz and 60/120/240 Hz and ±10 dB at 0.7/2.4/4 kHz. Fader backstop switches accessible for cue or machine start. Mono output from normal two groups working. Wide range monitoring and flexible switching, with interlock of talkback.

SM12

Compact 12/4 portable/studio/ob mixer based on narrow 30 mm modules. Channels include: mi/line; pan between predetermined groups; eq ±15 dB at 30/60/120/240 Hz, 0.5/1/1.4/2.4/4/7 kHz and 2/3/5/7/10/15 kHz; three subgroups pre/post each feeding one of two busses; phase; afl and pfl. Comprehensive group and channel monitoring. Master and appropriate return controls for echo and aux. Comprehensive tb.

QUAD/EIGHT

Quad/Eight Electronics, 11929 Vose St, North Hollywood, California 91605, USA.
Phone: (213) 764-1516. Telex: 662-446.
UK: Cinesound International, Imperial Studios, Maxwell Rd, Borehamwood, Herts.
Phone: 01-953 5545.
Canada: Century 21 Audio, 654 King Edward St, Winnipeg, Manitoba R3H OP2.
Phone: (204) 775-8231.
Commercial Electronics, 1305 Burrard St, Vancouver, BC.
Phone: (604) 685-0301.
France: Studio Equipment SARL, 24 Rue de L'abbe Groult, Paris 15.
Phone: 224-76-74.
Germany: Auvis Asona KG, Stollbergstrasse 15-17, D8 Munchen 22, West Germany.
Phone: (0811) 225057.
Belgium: Delta Equipment, Lucien Velu, 112 Rue de Calevoet, 1180 Brussels.
Italy: Laboacustica, Via Luigi Settembrini 9, 00195 Rome.
Phone: 381 965/355 506.
Norway: Siv Ing Venum & Co, Boks 2493, Solli, Oslo 2.
Venezuela: Electronica Gramcko, Av Sanz Edif Escar, Local B, El Marques, Caracas.
Australia: Rank Industries Australia, 58 Queensbridge St, S Melbourne, Victoria 3206.
12 Barcoo St, E Roseville, NSW 2069, Sydney.
Japan: Electori Co Ltd, Mondon Building 1-19-3, Kamiochiai Shinjuku-ku, Tokyo 161.
Phone: (03) 950-6266.

Range of consoles offered based on the following modules: *NS 120* noise gate; *EQ712* graphic eq; *2B* compressor, selectable 2:1/4:1 ratio, level, release, attack, variable meter display; *RT6* osc, six frequencies, *LHF-20* filter set, hi/lo pass; *MM71* standard line mixing module, two band eq, es and slider, with mic gain; *MM400* is *MM71* plus 12 frequency eq, insert switch/led, phase, overload indicate, pad, hi/lo pass filters—designed for vca applications, with custom variations available; Compumix *3200* processor for automated level control using tape track as storage; *EQ-312D* program equaliser, three band, twelve frequency eq. Also available: *LM6200* portable cabinet mixer, 6/2 format, self powered.

QUANTUM

Quantum Audio Labs Inc, 1905 Riverside Dr, Glendale, California 91201, USA.
Phone: (213) 841-0970.

QM-8A

Compact 8/4 console for use in studio, pa, sound reinforcement and mobile. Channels include: balanced mic/line switch; mic attenuate; boost/cut at 50/200 Hz and 3/10 kHz; output assign to any of four busses or pan between 1/3 and 2/4; two es; conductive plastic faders. Full monitor and group outputs; tb; echo return; quad master attenuator; submaster control, for individual output buss; headphone cue system; large vu meters; headphone cue system. Price $2599.

QA-3000

Flexible larger console design, based on the *QA-3000* input module. Channel includes complete output buss and associated monitor select. Hence versatility in subsequent expansion. Housing contains up to 20 input modules, master module and ps. Add-on to maximum of 28 input position. Comprehensive patch bay. Up to 16 output busses available in addition to four mixdown busses. Channel controls include mute; pan left/right, front/rear; es pre/post; four es busses; eq ±12 dB at 50/100 Hz, 300/800 Hz, 1.5/3 kHz and 7/12 kHz; solo; hi and lo pass filter; monitor source and mix; two cue sends; input select; 20 dB mic pad; gain trim; buss assign. Comprehensive standard group and return facilities. Price $15 000.

RAC

Rugby Automation Consultants, 19 Freemantle Rd, Rugby, Warwickshire CV22 7HZ, UK.
Phone: 0788-810877.
Benelux: Sound Techniques, Postbus 206, Alkmaar, Netherlands.
Specialists in manufacture of smaller custom mixers, majority less than 16 channel input. Many sold to hospital radio networks requiring simple mixer but with relatively specialised facilities.

As well as standard studio console arrangement build may be sloping-front or rack mounting. Circuits available separately as plug-in modules, with a range of 38, with application in studios, hospital radio, schools, colleges, av systems and pa as well as extension and modification of existing equipment. All mixers constructed on pcb system.

Delivery times 'normally between six and eight weeks'. Price example: 8/2 mixer with balanced *XLR* in, es, treble/bass eq on all channels, ppm on output and console-built requires around £450.

RAINDIRK

Raindirk Ltd, 33A Bridge St, Downham Market, Norfolk, UK.
Phone: 03663 2165/3617.

Modular mixing systems in four ranges; all may be arranged to specific customer requirements.

Mini

Low cost mixer in 10/4 format or custom; portable, desk or floor mounting. Up to 24/4 with eight track switching option. Mic/line selection, channel gain, bass, treble and mid (350/700/1.4k/2.8k/5.6k/11.6k Hz), boost/cut; hi and lo pass filters; two aux sends; pan. Osc, vu/ppm metering. P&G faders if required. Input channel extension units available.

Broadcast

Minimum 8/2 with extra input channels as required. Balanced throughout. Mic/line; phase; treble/mid/bass boost and cut; five-frequency hi pass filter; fb and output buss selection via pan; tb; Waters faders; vu/ppm metering.

Series II

10/2 to 36/24 with comprehensive eq and filtering. Four aux send; direct channel output; pan; dual pot quad system or joystick; mute grouping select; pfl; extensive tb and master monitor systems.

Major

Largest console; may be custom built to specifications from standard *ES* and *ER* modules. Full automatic system of remote tape machine functions linked with monitors. Allison *MLH* may be incorporated. Full details on request.

Ancillary equipment includes ppm drive cards, distribution amps, disc preamps, led peak limit indicator.

RAMKO

Ramko Research, 3516-C LaGrande Bvd, Sacramento, California 95823, USA.
Phone: (916) 392-2100.

Range of single channel *(SC)* and dual channel *(DC)* mixers. All units: height 20 cm, with horizontal led meters and touch pad controls, lighted, on all input, solo and mute and selection switches—no moving contacts. All solid state switching; self contained monitor and cue amps; mono mix outlet on all stereo consoles; cue on all channels; mute select via plug-in jumper wires. Inputs selectable: hi/lo level, 250 ohm balanced, or 100k ohm balanced bridging. Prices (numbers indicate channel content): *SC-5M* $605; *DC-5M* $742; *DC-5MS* $979; *DC-8M* $1199; *DC-8MS* $1760. Two year guarantee on parts and labour.

Series 35

Separates controls from audio functions via dc remote control. Range includes eight channels mono, dual channel mono, stereo, dual channel stereo and combinations, two units parallel for quad; 'fail safe' power supply. Distortion quoted as 0.3% or less, with —124 dBm equivalent noise on low level channels. Prices start at $1200.

RICHMOND

Richmond Sound Design Ltd, PO Box 65507, 1234 W 6th Ave, Vancouver, BC V5N 5K5, Canada.
Phone: (604) 736-7207. Telex: 04-54667 CANBASE VCR.

Range of theatre, mixing and portable consoles, modular design and array as required. Visual cueing system available.

88/816/1224

Theatre sound consoles in 8/8, 8/16 and 12/24 formats respectively. Various facilities, but all with internal ps, pcb plug in circuitry and patch bay. Aside from normal options, features include led indicators showing presence of low level signal in output channels, complementing normal vu display; 8 x 8 illuminated push button in/out switching matrix; 'Auto-pan' facility for semi-automatic crossfade; 12 phone jack connectors for instantaneous conversion to computer memory capability. Prices $3630 to $6600.

124/164/204/244/82/122/162/202

Mixing consoles with two and four groups output; channels variable as indicated by designation. Channel includes cue, es, three frequency eq, fb, input attenuator, monitor, echo return levels, pan. Masters on all subgroups. Vu meters and led overload indicators on output or playback channel. Prices $6500 to $10 100.

M82

Portable stereo mixing systems with eight, 12 and 16 inputs with use of extender chassis. Balanced line input, 0-60 dB attenuator, ±15 dB at 50, 1.5k and 10k Hz; fb, es, pan; cue push button. *XLR* input connectors, 6.25 mm output via phone jack. 74 x 34 x 11 cm. Chassis on 14 ga steel. Price $1600 and $2066 (studio); extender units $600 and $833 respectively.

SCHLUMBERGER

Schlumberger Instruments et Systemes, Centre de Rueil, 296 Ave Napoleon Bonaparte, 92503 Rueil, Malmaison, France.
Phone: 977 92 23. Telex: 26649 Labophy F.

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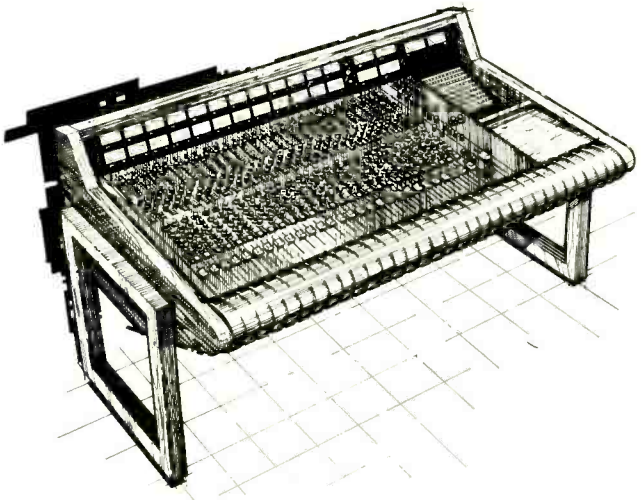
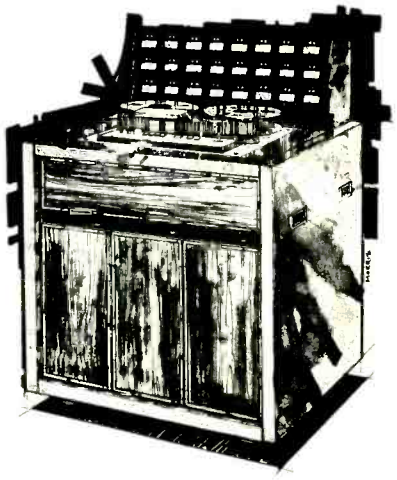
MCI

MCI (Professional Studio Equipment) LTD, 21 Claremont Square, LONDON N1 9IX 01-278 2288





The JH-428 is a comprehensive, cost effective recording console meeting all professional standards and offering the electrical and musical capabilities of consoles twice its price. There are no frills in this console, only functional complete musical control of the mix.

The entire console has been built small enough so that the average person can reach most of the controls without moving. Yet, the profile is low, creating minimum control room acoustic problems and permitting a clear view into the studio.

The JH-428 is styled in a durable synthetic walnut finish with control panels in a natural sugar maple colour. The armrest is large and well padded. These natural colours and comfort features minimize the tiring effect of late night mixing sessions.

For the small studio just getting started, every model of the JH-428 from 8 channels up comes fully wired and tested for 28 channels so the console can grow with the studio by simply plugging in additional modules. For the large studio, the JH-428's modular construction will permit full utilization of the recording facility by minimizing service "down time".

The JH-16 series of master recorders is available as an 8-track wired and expandable up to 16 tracks (ideal for the small studio). The JH-24 is available as a 16-track wired and expandable up to 24 tracks, which will meet all needs of the large professional studio.

A very useful (and some consider essential!) accessory is the AUTO LOCATOR 11, which can be programmed to locate any position on the tape precisely and speedily.

The JH-110 series is the latest range of professional recorders from MCI These machines are $\frac{1}{4}''$ and $\frac{1}{2}''$ machines which have been designed utilising the latest techniques, i.e. phase lock capstan servo, D.C. spooling motor and the state of — the art logic. This recorder has been designed to satisfy all European requirements.

The JH-528 series of mixing consoles designed to meet the needs of the large recording studio has in addition to all the facilities of the JH-400 series very much more comprehensive mid-range equalisation extending from 150 Hz to 8.5 kHz, with a choice of 24 frequencies in two independent groups. The console has 6 auxiliary sends which can be used for echo fold back or sub-mixes, with panning between groups five and six and slide-pots to control groups one and two.

The 528 is automation ready, all level functions control V.C.A's. There will be available an automation-processor together with a lock-up system enabling the multi-track machine to be locked up to a slave recorder so that data may be recorded on the slave machine without sacrificing tracks on the multi-track.

Both the JH-428 and JH-528 are available as consoles with 28 or 40 input-output groups.

They are available as 16, 24, 28, 36 and 40 channel consoles, and can be readily expanded to a maximum of 40 channels.

SURVEY

Range of consoles from small portable units to extensive multitrack configurations, produced on a large scale.

UPS 4000

Modular construction, based on die-cast alloy chassis plugging into cast modular frame; console may be tilted on its support. Modules interchangeable *in situ*. Electronics use ics widely; group routing via fet switching, grouped on plug-in mother boards; modules interconnect by mother board, reducing wiring demands.

Any system configuration supplied using combinations of following principal modules: input, with four balanced inputs, mic/line gain, hi-pass filter; eq, with boost/cut, eg Baxandall characteristic ±12 dB at 60 and 10k Hz, or presence at 0.7/1.2/2/2.8/4/5.6 kHz ±12 dB in 2 dB steps; band pass 24 dB/octave at 100/250/500 Hz and 4/6/8 kHz; routing module; auxiliary outputs, two es and two fb, both pre/post; echo return with gain to main group bussing; output amp, balanced; limiter/compressor, 'limiting function —10 dBm' with 25 dB headroom, threshold variable over 20 dB range, variable attack and release; fader with mute and pfl; mic tb amp with limiter; tb return, with two amps for various pfl and monitor functions. Automation facilities available oriented for use in broadcast or recording environments.

SHURE

Shure Bros Inc, 222 Hartrey Ave, Evanston, Illinois 60204, USA.
Phone: (312) 328-9000.
UK: Shure Electronics Ltd, Eccleston Rd, Maidstone ME15 6AU, Kent.
Phone: 0622-59881.

Range of mixers for pa and related work.

M68 Series

Simple 5/1 mixer systems, with level only channel control; mic input on four channels, aux on fifth; mic switchable hi/lo Z. Units may be ganged via aux input. Various connectors available. 7 x 27 x 13 cm. £59.20 or £76.80.

M688 Series

Stereo mic mixer similar *M68* series but with two group outputs. Four mic inputs switchable left/right plus stereo aux input. Single pan on mic channel four. Units may be ganged as before. 7 x 27 x 17 cm; weight approx 2 Kg. Price £76.

M67

Simple 4/1 mic mixer, 600 ohm input, fourth channel switchable line, bridging or 600 ohms. 7 x 27 x 18 cm; weight approx 2 Kg. Price £106.

M675

Similar *M67* but with disc and line inputs; cue on all inputs switchable; internal speaker, headphone outlet or line feed for monitoring. £96.

SONIFEX

Sonifex Sound Equipment, 15 College St, Irthlingborough, Wellingborough, Northants NN9 5TU, UK.
Phone: 0933-650700.

B1000

6/1 portable mixer. Flat scale fader, pfl, switched mic/line inputs, es, balanced input and output with *XLR* connectors, eq ±15 dB at 100 Hz and 10 kHz. Separate echo return. Two vu or ppm meters switchable line in/out. Separate monitor feeds. Headphone monitoring via meter select switches to phone jack. Prices: with *XLR* connectors £352; with DIN £319.

B2000

10/2 format mixer designed for table top/portable working. Channels include mic/line switching with gain control, with balanced inputs via *XLR* connectors, flat scale fader, es, fb, pan, mute. Balanced outputs for groups and subgroups. Separate monitor output and echo return. Two large vu or ppm meters switched to source or tape. Headphone through meter select switches and phone jack; channel eq ±15 dB at 100, 1.4k and 10k Hz. Additional separate units are available. Cards: mic amp; disc preamp; virtual earth mixer; line amp; hf/lf switched equaliser; mf switched eq; three frequency osc; ppm meter assembly; headphone amp assembly. Modules: complete channel and output modules available in mono and stereo forms. Price *B2000* with *XLR* connectors £765.

SONY

Sony Corpn, PO Box 10, Tokyo Airport Post Office, Tokyo 149, Japan.
UK: Sony (UK) Ltd, 219 Bath Rd, Slough, Berks.
Phone: Slough 34611. Telex: 847122.
USA: Sony Corpn of America, 9 W 57th St, New York, NY 10019.
Phone: (212) 371-5800.
Europe: Sony Overseas SA, Baarerstrasse, 59 CH-6300, Zug, Switzerland. Central point for more local European information.

MX 650

6/2 portable mixer with mic, line and phono inputs, two panpots, twin illuminated vus, osc and headphone socket. Price £139 inc 25% vat.

MX 510

5/2 portable mixer with mic, line, phono inputs, one panpot, two vus and headphone socket. £90 inc 25% vat.

MX8

Simple passive 6/2 mic/line input mixer. £33.95 inc vat at 25%.

SOUNDCRAFT

Soundcraft Electronics Ltd, 5-8 Great Sutton St, London EC1V 0BX, UK.
Phone: 01-251 3631. Cables: Soundcraft London EC1.
USA: Systems and Technology in Music, 2025 Factory St, Kalamazoo, Michigan 49001.
Phone: (616) 382 6225.
Holland: International Music Service, Energieweg 36-37, Vlaardingen.
Phone: 35 72 22.
Sweden: Studio Decibel, Katarinavagen 18-22, S-11645 Stockholm.
Phone: (08) 23 34 35.

16/2

Sound reinforcement console built into flight case. Available 20 and 24 channels if required. Channels include: 200 ohm balanced mic in, *XLR* connector, input attenuate, four band eq, fb, es, pan, mute/pfl slider. Echo return channel similar, with two inputs. Headphone monitoring fb and main groups. From £1000; multicore systems available.

12/4 Series II

Eight track capability, 16 track monitoring, communication and lineup facilities. 105 mm conductive plastic faders as option. Wide range metering faders and quad panning options. Available 16/20/24 channels. From £1175.

16/8 Series II

Format up to 16/8/24; communication and lineup facilities. 105 mm plastic faders standard. Metering options wide. Available 16, 20, 24 channels. From £2200. Channels include: mic/line; pad; mic; gain 4 band eq with hi-pass; two fb, one es; pfl/mute; channel/monitor route.

Mark 5 Modular

Cost effective, wide modular system, available in formats as required.

Mark 6 Modular

More extensive modular system than *Mark 5*, to be introduced autumn.

SOUND GENESIS

Sound Genesis, 445 Bryant St, San Francisco, California 94107, USA.
Phone: (415) 391-8776.

Four channel limiter module designed for utilisation with Tascam *Model 10* mixing console. Four channels may be independent, grouped in any pairs or quadraphonically via two control busses. Attack fixed 100 µs, release fixed at 2s; compression ratio 10:1.

SPECTRA SONICS

Spectra Sonics, 770 Wall Ave, Ogden, Utah 844041, USA.
Phone: (801) 392-7531.
UK: (modules and components): Sun Recording Services, 34-36 Crown St, Reading, Berkshire.
Phone: 0734-595647.

Custom and standard consoles for recording and broadcast purposes. Various configurations available based on modules including the following: osc with qve select frequencies, gain; hi/lo pass filter 40/70/100 Hz and 10/12.5/15 kHz; electronic filter with various standard frequencies; power amp; simple mic program eq at 100 Hz and 7 kHz; mic/program eq ±12 dB at 50/100/200 Hz and 2.5/5/10 kHz; rotary and joystick quad pan; rack mounting and console face complimiters variable 1.1:1 to 100:1, attack 0.1 µs to 1.2 ms, release limiter 0.09 µs, compressor 50 ms to greater than 10s.

1024-24

Available with 12, 16 and 24 group outputs, based on input module including line/mic switch, input attenuate, pfl, monitor submix route, two fb, eq at lo/mid/hi, 4/5 frequencies in each band, shelf curves at 50 Hz and 10 kHz switchable. Usual program assign and monitor select facilities. Prices: eg 12/12 $22 639, 20/16 $29 123, 24/24 $32 965.

STELLAVOX

Stellavox, 2068 Hauterive, Neuchatel, Switzerland.
Phone: 33 42 33.
UK: AV Distributors (London) Ltd, 26 Park Rd, Baker St, London NW1 4SH.
Phone: 01-935 8161. Cables: Cinesound, London, NW1.
USA: Hervic Electronics Inc, 1508 Cotner Ave, Los Angeles, California 90025.
Phone: (213) 478-5086.

AMI 48

Five inputs for 12V AB or phantom powered capacitor mic, 48V capacitor mic, dynamic mic. *XLR* or Preh connectors. Bass roll-off, bass/treble lift/cut, pan, 20 dB pad each input. Pfl, individual post-fade outputs. Switchable stereo compressor on two channels, limiters with led indication on each input. Stereo limiters with led indication on master group outputs. 880 Hz line up osc. Two illuminated ppm meters. 8 x 21 x 27 cm, weight 4.3 Kg. Price £1095.36, with limiter £1845.76.

STRAITA HEAD

Straita Head Sound, 7578 El Cajon Bvd, San Diego, California 92041, USA.
Phone: (714) 465-9997.

Custom consoles based on standard modules for music balancing and recording. Any configuration supplied. Typical facilities extend to multiple stereo reinsert, led peak reading vu meters, built in crossover for multiamp operation, three band eq switchable three frequencies in each, two aux subgroups pre/post; pad, phase, hi pass filter. Limited information received.

STUDER

Studer International AG, CH-5430 Wettingen, Switzerland.
Phone: 056 2687 35. Telex 53682 audch.
UK: FWO Bauch Ltd, 49 Theobald St, Boreham

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2 Ways that TRIDENT make . . . . .
. . . . . good sounds GREAT

THE NEW TRIDENT TYPE CB 9066 PARAMETRIC EQUALISER/FILTER is a recording tool without which no studio facility will be complete. This unit brings to the recording engineer flexibility and preciseness of control which cannot be matched by more conventional audio equalisers. Equalisation can now be introduced exactly where it is needed, eliminating muddy effects due to overspill and producing a clarity and attack which must be heard to be believed.

FEATURES:
* Low, Mid and High range, continuously variable control of frequency, Bandwidth and Q.
* Individual IN/OUT push-button switch on each range.
* Separate High-Pass and Low-Pass Filters with continuously variable control of Cut-off frequency and slope.
* Automatic acoustic-level adjustment for sharp and broad Q settings to compensate for apparent loss of loudness in sharp Q, modes.
* Silent IN/OUT switching of ranges and overall system.
* Completely self-contained in compact 19 in x 7 in x $1\frac{3}{4}$ in rack mountable unit with built-in Power Supply.
* Ideal for Studio, Disc Mastering and Broadcast applications.

THE SYNTON 903 PHASER/BANDFILTER besides offering phasing and vibrato effects, features the extra facility of a voltage contolled multiband filter. The effect of this filter can be mixed with the phasing or vibrato or can be used separately for wah-wah or percussion-like effects. The dynamic envelope follower adjusts automatically to the audio input signal so that no threshold adjustments are required in order to obtain sufficient control under low signal conditions.

FEATURES:
* Large phase shift, 1400 degrees.
* Multi-band filter.
* Built-in oscillator.
* Dynamic envelope follower.
* Remote control.
* Extensive programming facilities.

Trident Audio Developments Ltd., 4/10 North Road, London N7 9HN. Tel. 01-609 0087, Telex Tritape 264773

■ SURVEY

Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.
USA: Willi Studer America Inc, 3916 Broadway, Buffalo, New York 14227.
Phone: (716) 681-5450. Telex: 91-9138.
Canada: Willi Studer Canada Ltd, 14 Banigan Dr, Toronto, Ontario M4H 1E9.
Phone: (416) 423-2831. Telex: 06-23310.
France: 12-14 Rue Desnouettes, F-75015 Paris.
Phone: 533 58 58/9. Telex: 24744 F audifra.

089 Mk II
Intended for mobile and truck working as well as static studio operation. 12 input channels each with: line/mic/osc switching; phase; fine and coarse attenuator; variable Hz hi and lo pass filters; 80 Hz ±8 dB, 8 kHz ±8 dB, 0.4/0.7/1.2/2.2/3.9/6.8 kHz ±9 dB; two or four es/fb subgroups; mute. Also: filter modules, combination hi/lo pass with variable frequency and roll-off; stereo reverb similar channel module; and compressor/limiter ganged for stereo, variable compression and release, compression meter indication. Monitor selection all groups, subgroups and returns; tb. Two submasters for reinsertion. Two ppms, vu available if required. Break points on rear mounted jack bay.
189 Quadro
For stationary and mobile applications up to 16/4 mixdown and recording. Channels similar *089*, with vu or ppm indication on each channel as well as group masters. Two versions, with 16 channels and 16 monitor or eight channels and eight or 16 monitor. Facilities similar *089*, with corresponding extension for quad working. Comprehensive groups selection and quad pan joysticks on every channel.

TASCAM
Teac Corpn of America, 7733 Telegraph Rd, Montebello, California 90640, USA.
Phone: (213) 726-0303.

Model 10
Series of competitively priced mixing consoles, based on the following modules: expander; input; tb with slate and integral 5W amp; remote control; monitor mix with pan; quad pan with four joysticks; headphone monitor; mic inputs balanced and unbalanced; line amp. Prices vary 8/4 at $2350 to 24/4 at $5765. Limited information received.

TRIAD
Trident Audio Developments Ltd, 4-10 North Rd, London N7 9HN, UK.
Phone: 01-609 0087. Telex: 264773.
USA: Pacific Recorders and Engineering Corpn, 11760 Sorrento Valley Rd, San Diego, California 92121.
Phone: (714) 453-3255. Telex: 695008.
Audiotechniques Inc, 142 Hamilton Ave, Stamford, Connecticut.
Phone: (203) 359-2312. Telex: 06902.

Range of fully modular consoles permitting wide variation in configuration, as required. One year guarantee with each console, with full after-sales services; same-day module repair at factory. Delivery normally 12-16 weeks after receipt of order.
A Series
For large multitrack studios. 16 frequency graphic eq on any channel, four independent fb, six push-selected es subgroups; quad facility, dual scale vu or ppm metering; independent eq of echo and fb circuits; interfaced for automated working as standard option. Desks prewired for future expansion; phantom mic powering; electronic stop-clock and correlation meter standard. Prices £16 000 to £45 000.
B Series
For multitrack studios a level below those requiring *A* Series desks. Identical technical specification, for *B* series modules in console for table top or floor standing operation. Integral pfl speaker/amp and extensive jack bay. Built-in six-way distribution amp and complimiters standard. Prices £4000 to £23 000.
Portable
Shortly to be introduced; new low-cost portable mixer with high specification for pa, studio or theatre use. Based on standard mainframe with plug-in module options giving wide variation in electronic/mechanical configuration.
CB9066
Equaliser unit with built-in power supply. Hi and lo pass continuously variable filters, three-band eq with variable frequency and sweep frequency selection. Price £220 per single channel.

TURNER
Turner Electronic Industries, 175 Uxbridge Rd, London W7 3TH, UK.
Phone: 01-567 8472.

TPS 16/2
Portable and compact non-modular mixer series intended for live mixing and location recording. Channel controls include: 30 dB pad, sensitivity variable —60 to —20 dBm on 600 ohm balanced line; eq ±15 dB at 10 kHz, ±16 dB at 0.7/1.2/2.4/3.8/5.6/7 kHz, and ±15 dB at 100 Hz; pre/post on two subgroup sends, level variable; pan; pfl; P&G type *1820* fader. Subgroups out and remaining channels are mixed, output controlled by faders.

Mixer incorporates active filters for feeding multiamp configuration, 30-500 Hz, 500-4k Hz and 4 kHz upwards (frequencies given are —3 dB points). Additional output for stereo tape or aux pa is independent of main faders. Eq available for echo send/return. Flexible tb system; two vu meters switchable across all group and subgroup outputs and two subgroup returns; also pfl selection appears on meters when routed in.

Optional extras include multiway cable, connectors and *XLR* stage box; cans; variations in crossover; subgroups may be switched to provide four group output; breakpoints (phone jack); ppm metering. Mixer is in metal case for transport.

TWEED
Tweed Audio, Rosewood Industrial Estate, Kelso, Roxburghshire, UK.
Phone: 05732-2983.

Modular construction of custom consoles; channels include the following: mic/line input gain; eq 60/100/220/330 Hz, 10/12/14/16 kHz, 0.7/1.2/2.4/3.2/5/7 kHz ±15/18 dB; hi and lo pass filters, four frequencies each, 18/12 dB/octave. Routing module provides normal group and monitor switching, with up to two each of fb, es pre/post, solo/cut.
10/4
Designed as portable mixer for recording or broadcasting direct from concert hall. Uses standard modules in fixed frame. Facilities panel includes aux return with pan, routing and individual monitor gain controls. Metering vu or ppm as required.

TYCOBRAHE
Tycobrahe Engineering, 665 Valley Dr, Hermosa Beach, California 90254, USA.
Phone: (213) 376-8801.

Modular mixers for combinations of pa, sound reinforcement and live recording.
MXL24(—4)
24 input console for performer use. Sealed rotary level controls throughout; channel controls include: pan of monitor and main group bussing; input attenuate; three range eq, lo 50/100/150 Hz, mid 300/600/1.2k Hz, hi 2.5/4/7 kHz; monitor and main mix controls. Dual-band limiters fully synced for stereo operation, with hi/lo limiter frequency switch on main outputs. Eq circuitry uses active gyrators; power supply regulated over ranges 85-135 and 170-270 volts. Limiters attack 2 µs, release 0.5s, limit 8.8:1 100 x 62 x 25 cm, weight approx 40 Kg. List price for eight channel version $9400; for 24 channel version $13 000, inclusive of shipping case.

WESTREX
Westrex, PO Box 989, Beverley Hills, California 90213, USA.
Phone: (213) 274-9303.
UK: Westrex Co Ltd, 152 Coles Green Rd, London NW2 7HE.
Phone: 01-452 5401. Telex: 923003. Cables: Westelcol London NW2.
Italy: Westrex Co Italy, 65 Via Costantino Maes, 00162 Rome.
Spain: Westrex Co Iberica, Avenida Jose Antonio 636, Barcelona 7.
Japan: Westrex Co Orient, CPO Box 760, Tokyo.
Hong Kong: Westrex Co Asia, Room 1302, Luk Hoi Tong Building, 31 Queen's Rd Central.

ST3000
Various input/output combinations according to customer requirements. Modular construction. Typical channel includes: *ST3009* combining panel, with p/b bussing selection; *ST3003* channel control panel with pre/post es/fb selector, send gain cue push button and overload indicator; *ST3001* input amplifier, mic/line indicator, gain, 120 Hz hi pass in/out, phase, fine gain; *ST3002* eq unit, three boost/cut zones at 50 Hz, 0.7/1.0/1.4/2.8/3.5/4.2/5.6 kHz and 15 kHz; *ST3010* fader with slider and bottom of travel micro switch. *ST3001* input amp takes mic between —70 and —20 dB and line between —10 and +20 dB in 10 dB steps.
ST3050
Compact mixer for small studio or location work. Available with up to eight input channels and 1/2 groups out. Modules similar or identical *ST3000*; illuminated ppm or vu metering; all components 'fully tropicalised'.

YAMAHA
Nippon Gakki Co Ltd, Hamamatsu, Japan.
UK: Kemble (Organ Sales) Ltd, Mount Ave, Bletchley, Bucks.
Phone: Milton Keynes 71771.
USA: Yamaha International Corp, 6600 Orangethorpe Ave, Buena Park, California 90620.
Telex: 655423 YAMAHA BNPK.
Canada: Yamaha Canada Music Ltd, 1330 Portage Ave, Winnipeg 10, Manitoba.
Telex: 35398 YAMAHA CDA WPG.
Germany: Yamaha Europa Gmbh, 2084 Rellingen b Hamburg, Siemensstrasse 22/34.
Phone: (04101) 3 30 31. Telex: 2-189170.
Australia: Rose Music Pty Ltd, 17-33 Market St, S Melbourne 3205.
Telex: 32225 ROSEMUS.

EM-90
Simple six channel mixer for music use. Channels include switchable line/guitar/mic, two groups switchable, treble, bass, volume and reverb on/off. Master controls for volume, reverb. Built-in rhythm simulator with push select, and A=440 Hz reference. £170.
EM-60
Version of *EM-90* without rhythm simulator. Price £100.
PM-200B/300/400
Simple portable music and pa mixer. Various combination facilities including bass, treble, boost/cut, es switchable two sends on each channel; switchable metering; hi pass filtering; five frequency eq switchable to —8/12 dB on *PM-200B*. Vu metering of one or two output groups. Phone jack or *XLR* connections.
PM-1000
16/4 portable or studio mixer for recording or quality pa applications. Comprehensive eq and subgrouping, sliders all channels and groups. Tb, pan, input select, etc. Metering vu on all groups, additional small vu on two echo subgroups.

STRAIGHT TALK FROM THE COMPANY THAT INTRODUCED THE FIRST PROGRAMMABLE MIXING SYSTEM.

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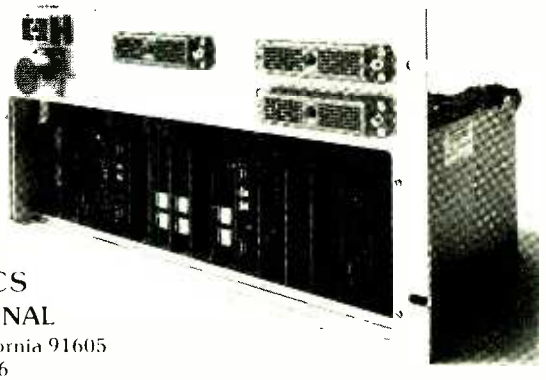
In answer to this, we have developed our new fully-digital Compumix™ system to incorporate computer technology with external processing & display hardware.



It's standing in the wings & promises such exciting things we can hardly wait to unveil it - but not before exhaustive operational testing.

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THAT'S STRAIGHT TALK FROM THE COMPANY WHO STARTED THE WHOLE THING.

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The advantages accruing from mixdown data storage and its later adjustment continue to increase as engineers become more familiar with the new techniques. In particular, vcas have evolved such that they overcome many previous objections, and resulting systems are simple and convenient.

Programmable mixing

PAUL C. BUFF*

THE REAL MEANING is belied by the name 'automated mixing'. A much more suitable definition would be programmable mixing. The sole purpose of such a system is rather clearly defined as a means of allowing the operator, or balance engineer to program the parameters of an audio console in a fashion which he and the record producer feel is required to produce the desired final result. Such a system does not make any decisions or calculations—hence it is *not* a computer.

The performance of a programmable system may be judged on three basic parameters, which are:

1. How accurately does it respond?
2. How quickly does it respond?
3. What capacity does it have for the storage of commands?

If the system simply obeys commands and does no actual thinking then what is the good of it? Why does the balance engineer not just operate the controls himself?

The answer is pretty evident to anyone who has attempted to mix down 24 tracks of modern music. Frequently there are simply too many parameters to control in real time at any given instant. Certainly, we get by. We get a 'mix' and, more important, we make hit records. (They also got by and made hit records a few years ago by singing into a horn coupled directly to the cutting stylus.)

With a programmable mixing system, the production team is free to concentrate on the subtleties of the mix, since changes can be pre-programmed to occur in patterns unobtainable in real time with real people. After all, multitrack has allowed the musicians and singers to perform musical feats which would be impossible in real time; so why not some help for the balance engineer? If a singer blows a note, he is free to punch in a correction without destroying the rest of the music on the tape. Should not, then, the mixing engineer be given the freedom to correct a mixing goof without having to re-start completely?

Programmable mixing now becomes comparable with the recording techniques employed in multitrack sessions. If you can get it all, in real time, more power to you. If it becomes necessary to mix in layers, or to punch in corrections, or to pre-program highly intricate manoeuvres, then do it.

After the mix is done, the performers and producers take the mix home and analyse the results. If they find a flaw in the performance, they simply come back in the studio and punch in a correction. Without programmable mixing, they have politely to ask the balancer to redo all of his work (in real time) exactly as previously. As often as not it is impossible to reconstruct accurately the mix, just as it would be impossible for the group to reconstruct the entire performance.

A programmable console can give the balance engineer the same kind of freedom that the performers have enjoyed since the advent of multitrack.

Interface

In order to prepare a console component for accepting programmed control, its mechanical movement must first be converted to an electrical form. This action is directly parallel with the microphone's job of converting sound pressure into electrical signals.

If the component happens to be a fader, either a voltage controlled amplifier (vca) or a digitally controlled amplifier (dca) may be employed. Similarly equalizers, panners, switches and any other component to be programmed must be converted for voltage or digital control. A digitally controlled switch in its most basic form would be a relay, although solid state switching is much more suited to the task. For achieving programmable console components, a voltage controlled or digitally controlled element performs the same job as its mechanical counterpart, with the exception that it can be controlled electrically. Mechanical parts are still needed, but their function becomes that of providing an interface between human hands and the electrically controlled components.

At this writing, the voltage controlled amplifier has evolved to the point of favourable performance relative to that of its mechanical counterpart (the gain control). However, voltage controlled resistors have evaded the design world to the point where no direct replacement exists for, say, a frequency controlling resistor in an equalizer. Fets or photoconductive cells will work, but their performance leaves something to be desired in terms of noise, distortion and linearity. Actually it's just as well since digital control of these components (as well as capacitors, inductors etc) is quite simply performed and is a much more exact science than analog control. **Fig. 1** illustrates a four-bit digitally controlled resistor together with the resultant values of resistance. The same sort of circuit will work equally well with capacitors or inductors.

Fig. 2 shows a typical utilization of a vca as a replacement to a conventional gain control circuit. In **fig. 2b** a reference voltage is applied to the fader, where it is attenuated to the desired degree, then applied to the control input of the vca. With this connection, the audio will perform the same as in the conventional circuit of **fig. 2a.** However, a reference voltage output now appears which is proportional to the audio gain of the circuit.

If we now evolve into the circuit of **fig. 3,** we have the basic form of a programmable gain element. When S1 is in the WRITE position, the audio gain is controlled in real time and the voltage which controlled it will be entered in memory for later use. If S1 is placed in the READ position, the audio will be controlled by the previous information, contained in the memory.

The circuit of fig. 3 would function similarly if the vca were replaced with a dca. The only major difference would be that the response would be step-approximated rather than truly variable. The resolution between steps is a function of the number of controlling bits. As can be seen in fig. 1, a four-bit representation would yield 16 steps. The employment of an eight-bit dca would yield 256 step resolution—more than adequate for the purpose.

As for the conversion of the analog control voltage to digital form, this is really not a problem, since commercially available eight-bit analog to digital convertors are priced as low as $8. In the case of equalizers and such, conversion is not normally necessary since the

*Allison Research, Nashville

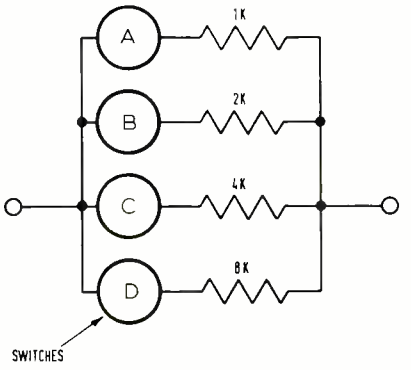
controlling switches themselves provide the necessary step function.

Memory system

Now that the interfacing of the console components is taken care of, the remaining requirement for programmable mixing is the memory itself. Various choices are available, ranging from paper punch tape or computer cards, on up to disc memories, core memories and integrated circuit memories. A look at the requirements will effectively narrow the choice down to one. Since the memory must be dynamic and must be synchronized with the music, we can quickly rule out paper tape. The sheer number of bits required (upwards of a million) pretty much rules out core and ic memories. The requirements of low cost, ease of handling and unlimited running time (bit capacity) makes disc memories look unattractive. What's left? The same stuff the music goes on. Good old audio tape. Its bit capacity is unequalled, running time is indefinite, it is easily synchronized; and it's cheap.

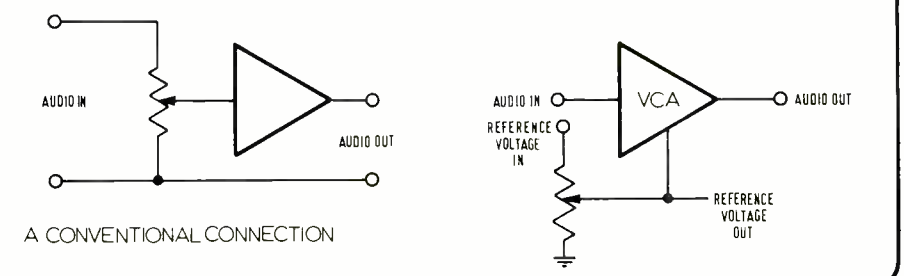
The most convenient form of data storage is on the master music tape itself. Synchronization is automatic and you'll certainly never lose the data tape. If spare tracks are not available on the master tape, the next choice is to carry the data on a separate recorder, synchronized to the master. This approach, however, will still cost you one track of music, as required by today's synchronizing equipment. Since successful programmed mixing requires only two tracks, the cost and convenience factor of synchronized machines bears some investigation unless it is to be used for purposes other than providing storage for mixing data.

FIG. 1 CONFIGURATION OF A DIGITALLY CONTROLLED RESISTOR



SWITCHES ON				
A	B	C	D	TOTAL RESISTANCE
0	0	0	0	INFINITY
0	0	0	1	8K
0	0	1	0	4K
0	0	1	1	2·67K
0	1	0	0	2K
0	1	0	1	1·6K
0	1	1	0	1·33K
0	1	1	1	1·14K
1	0	0	0	1K
1	0	0	1	·889K
1	0	1	0	·8K
1	0	1	1	·727K
1	1	0	0	·667K
1	1	0	1	·615K
1	1	1	0	·571K
1	1	1	1	·533K

FIG. 2 B VOLTAGE CONTROLLED CONNECTION



Encoding the data

Because many channels of mixdown data must be stored on one track of tape, some method of multiplexing must be used. Samples of all mixing parameters may be represented digitally, then applied sequentially to the data tape. If the sequencing is done rapidly enough the result, for all practical purposes, is a continuous representation of many channels of information. Upon decoding, the individual samples are directed back to the proper control channels. The process is very similar to the operation of a television system: what is actually seen on the screen is a sequential scanning of the individual elements of the composite picture. Since the scan rate is faster than that which the eye can perceive, we think we are seeing a continuous, full-time picture.

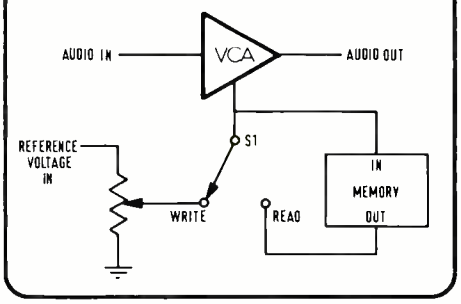
Unfortunately, if we are going to store data on conventional audio tape, we must live within the bandwidth restrictions of the medium. A safe data rate for such a purpose is around 10 000 bits per second (10 kHz). Using conventional bi-phase encoding techniques, and allowing for error correction bits, a scan rate of around 1 ms per eight-bit word is in order.

If we confine ourselves to the automation of levels only, with perhaps a few group masters and switch functions, a fairly practical scan rate of around 50 ms can be achieved fairly easily. However, even a 50 ms scan rate can cause problems, particularly in a system where the entire scan must be checked for parity before it is released as valid information. The problem lies in the fact that when a mix is updated, that is to say when revisions are to be made, all previous information must be regenerated through the complete encode/decode cycle, unless it is to be discarded. If the decode cycle requires a 50 ms validation period, this is the minimum time lost in the process. If the encoder and decoder are asynchronous, an additional waiting period averaging one half of the scan time will be imposed. By my calculations, accumulated delay (per update pass) for an asynchronous, scan validated, buffered memory system would be 1.5 times the scan rate.

For the typical system mentioned, the accumulated delay for ten update passes would run about 750 ms. Any attempt to program beyond level only for more than two or three update passes would result in intolerable delays.

In the design of my company's present automation equipment, we took a somewhat different approach to the situation. The data is encoded in quinary form (five states per bit) rather than binary (two states). This technique reduces the bulk scan rate to 500 µs per analog function (an analog function being roughly equivalent to an eight-bit binary word). Secondly, each function is validated independently so that it is ready for re-encoding as soon as it is decoded. Again, the encoder and decoder are asynchronous, so that a delay equal to the bulk scan rate is accumulated.

FIG. 3 PROGRAMMABLE GAIN ELEMENT



Overall, the 50% savings in bulk scan rate, plus the three-to-one savings in accumulated delay vs scan rate, net a six-fold increase in the number of functions for a given delay factor. A number of consoles with complete automation, short of equalization, are currently operating in the United States on this basis.

There are, however, two drawbacks which accompany the quinary code. The first of these lies in the inherent dependency on tape

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PROGRAMMABLE MIXING

machine alignment and on tape quality for proper operation. The second drawback is its difficulty in handling binary bits as opposed to analog functions. (As was pointed out earlier, analog functions are fine for controlling levels, but binary bits are more suited to the implementation of switch functions, equalizers and such.)

Even if the drawbacks were overcome, we're still faced with a problem of accumulated delays if really large-scale programming is to be done. Synchronous operation of the encoder and decoder would help, but a synchronized system could tend to become influenced by tape speed variations. Still present would be the delay between the movement of a console control (an asynchronous human command) and the arrival of the encode scan to the spot allocated for that particular function. Another alternative would be the use of multiple data tracks, but here again the number of tracks required for high degrees of automation could easily get out of hand, to say nothing of the cost and inconvenience.

The next step

One obvious thing which bears some investigation is the fact that, in a mixing situation, all parameters do not change simultaneously. One might move five or six faders at the same instant, but certainly not all faders, panners, equalizers etc. Through priority encoding techniques, the relatively slow sequential scan can be interrupted in favour of a 'priority word', which is developed by any parameter that changes. Since only parameters which change are effected by delays, a system which quickly responds to changes can have an extreme amount of capacity yet still act as if it had a very fast scan time.

My company is currently packaging such a system. Using proprietary binary encoding techniques using individual word validation and addressing, together with priority encoding, a capacity of over 60 000 bits (or 8000 eight-bit functions) can be achieved, with accumulated delays of under 5 ms, with respect to changes. The system can operate, without decoding errors, under adverse tape conditions, low signal-to-noise ratios and high amounts of tape speed variation.

As can be seen from the above paragraphs, the method of data storage is the one really critical determinant of system performance. The effect of accumulated delays must be carefully considered in any attempt to evaluate the anticipated performance.

Total system

Let us now assume that you are given a programmable mixdown desk and a 24 track tape to mix on it. Where do you start? What are the controls?

Every control which is programmable will have at least two unfamiliar operating modes, these being READ and WRITE. Level functions will probably have an additional UPDATE mode.

When a parameter is in WRITE mode, its operation will be the same as in a manual console. Movement of the control will result in a real time alteration of the audio. A control voltage or a digital representation of the position of the control and its movements will be available at the input to the encoder. If a data track is connected to the output of the encoder, and that track is recording, a record of the movements of the control will be impressed on the data track. Placing the parameter in READ mode will cause it to respond only to the information previously encoded on the data track. Movement of the physical control will have no effect on the audio.

UPDATE mode allows you to READ previous data and to add or subtract level from the previous data by moving the fader above or below an INDEX POINT or 'no modification point'.

Assume you start by placing the console in MASTER WRITE mode (all automation parameters in WRITE). Assign the encoder to data track A (one of the two data tracks). At this point, you may 'run down' the mix in the same manner as you would in a manual console. When you reach the point where you want to begin mixing, or programming, you would place data track A in record mode and attempt a conventional mixdown.

At the end of the song, you could place the console in MASTER READ and listen back to the mix. (The mix is now actually being controlled by the instructions you entered on data track A.) Assuming you felt that the programmed mix was a suitable basis for further refinement, you would now assign the encoder to data track B, leaving the decoder on track A. You are now free to re-write some of the parameters, READ the acceptable parameters, and UPDATE any parts you might want to raise or lower. You are not required to make the selection of modes and leave them but rather you are free to punch between READ, WRITE or UPDATE to make corrections during the pass.

After this pass, you may assign the decoder to data track B (the one you just encoded), select MASTER READ, and listen back to the mix and its revisions. If further revisions are needed, you may repeat the process, this time encoding A, while decoding B. In doing this, you will be erasing the original information on A, but you will still have the first revision on B and the second revision which you just did on A.

The process of revision may continue as many times as are necessary to achieve the desired result, assuming you are working with a system of suitably low accumulated delay. If, at a later date, changes are to be made to the mix, you may keep as much of the old mix as desired while making any revisions which might be necessary. At any time, the mix may be manually over-ridden, in whole or in part, by simply selecting WRITE mode and not recording any data.

Summary

In short, a programmable mixing system allows the full flexibility to perform conventional mixing, plus the ability to alter selectively any portion of the mix without having to redo all of it. Programmable mixing can be an invaluable solution to the old problem: 'The mix is great, but the drums should have been louder . . .'

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BROWELLS LANE, FELTHAM,
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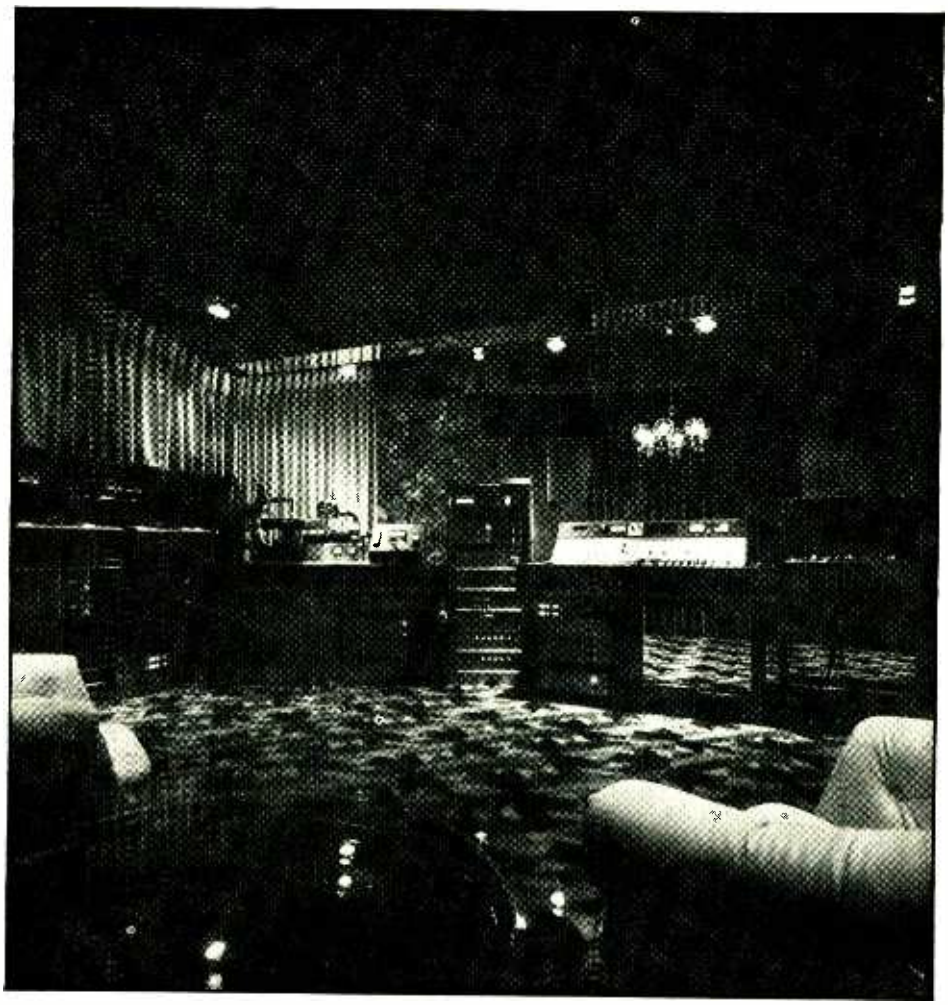
Direct-to-disc cutting is as old as the recording industry. While returning completely is practically impossible, given the automated control presently available, a tape generation can be saved. Noise, distortion and transient response performances are all improved.

Old idea-new twist

CARL J. YANCHAR*
KENT DUNCAN*



The mastering room

RECORDING MUSIC direct to disc was the' only method for the first half of the 20th century. Records were of amazing quality with the absence of tape hiss and quite distortion-free by avoiding several generations of tape and their accompanying electronics. Today, technology has brought us to a place where most recording is 24 track, a second generation for the mix, and in some cases a third generation to correct for differences in azimuth. level, to accomplish massive eq changes, or to produce effects by crossfading.

With all this ability to maintain control at each step through the project, we have noticed in a few sad instances the technology having the effect of making the music mechanical. With the advent of automation for level control, somehow the music almost seems to take a back seat to the amazing paraphernalia surrounding the engineer and producer in a mixdown session. While all of this equipment can be very useful as problem solvers, we can't help but step back and shout 'Stand up for the music!'

Buried as it is under automation, limiters, equalizers, digital delay, time cubes, several echo devices, phasers, de-essers, four track tape delay, 24 channels of audio (many of them electronic), sophisticated monitor racks that dwarf consoles of 20 years ago, time limits, and egos, somehow little ol' music seems a little lost. But far from being an indictment of the modern music business, this article is only a call to switch some of that junk off and let the music flow. In the process of doing just that, we have come across an old idea revisited —that of direct to disc recording.

Automation, babe in the woods that it is, has come into the fore of late and has become known as the panacea to achieve the dream of the producer without great trauma for the engineer and the album budget. Recording a live group direct to disc today is nothing but a special circumstance. There have been records recently where the original recording was direct to disc but the attempts have been far too few and often too costly.

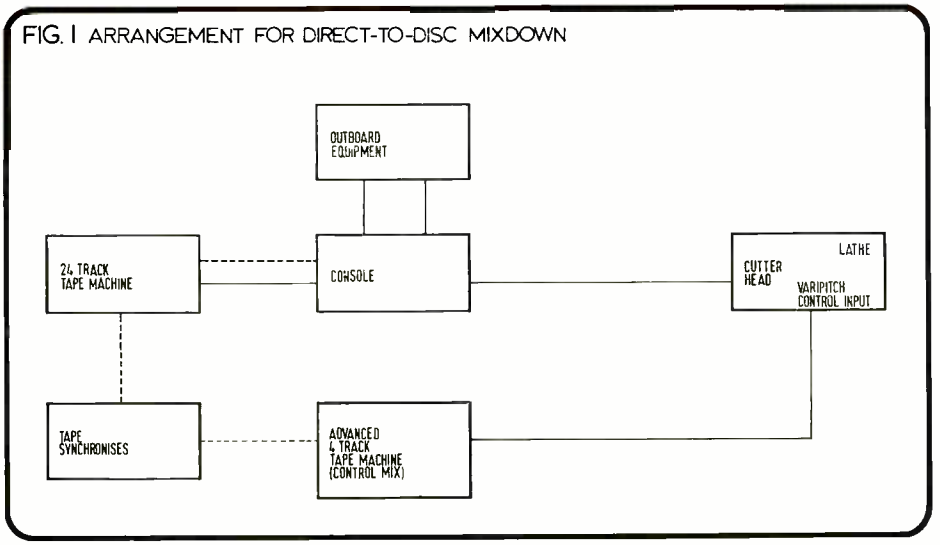
All the elements and methodology developed until now not only makes this feat technically difficult but artistically next to impossible. So given that we are locked into multitrack recording and overdubbing, the only possibility for proceeding direct to disc is forward from this point. Before automation, this would have been a nightmare, but with it and a little planning, it is a definite possibility.

Why bother? Consider what you would be doing. You would bypass:

1. Two tape machines—the mixing machine and the playback machine in the mastering room with their differences in flutter and wow, signal to noise, frequency response and head characteristics (especially if they are of different manufacture as is often the case).

*Kendun Recorders, Los Angeles

FIG. 1 ARRANGEMENT FOR DIRECT-TO-DISC MIXDOWN



2. Most of the time, two sets of noise reduction equipment; once again, the set used for mixing and the set used for playback. These are usually different units with slightly different characteristics. (We solve this at Kendun by moving Dolby cards with the tapes.)
3. One disc mastering console with its equalizers, filters, low-frequency crossovers and all the other goodies to help bad mixes make it to disc.
4. Overall limiting and equalization when the problem is just on one particular instrument.
5. Two or more monitor systems with different speakers, voicing filters and room acoustics.
6. Most problems (and that covers a lot of ground) that should be better corrected at the source rather than while mastering.

All this is nothing to sneeze or shake an alignment tool at. But what does it involve? Today's stereo records require the use of a variable pitch and depth system, usually for singles and always for albums. Normally, all this entails is adding a second playback head electronics to the mastering machine and some provision for providing the correct amount of preview distance. There are several possibilities:

1. Four, eight, 16 or 24 track preview head and duplicate sets of electronics in the mixing console—obviously far too complicated and expensive.
2. A digital delay line for the audio. This approach has been used in normal mastering, as proposed by the late Howard Holtzer. This method seems reasonable for Scully lathes but today would be far too expensive to provide the delay necessary for the Neumann system. Also, the idea of delaying the audio signal bothers us on the surface, for we then enter another area of possible distortion and trouble.
3. The third alternative brings us to the setup at Kendun. We utilize a custom Automated Processes console with extensive audio modifications done at our own studio. Using a 3M 79 24 track locked through an API Mini-mag to a 3M 79 four track, we lay a mix on the four track. We then advance the four track up the necessary 1.1 seconds or 0.84 seconds to provide the correct preview signal, and have easily overcome the obvious 24 to disc problems.

Other problems, such as eq changes, or control of other outboard gear, are accomplished using additional automated input modules which seems reasonable as a well recorded album (and a 24 to disc album always is) has little if any eq change from band to band.

Using this simple but effective setup, we feel significant steps have been made in improving signal to noise, distortion, and, most of all, transient response. Records are now in release on Columbia Records using this system, and extensive on-going experimentation and demos are being done with the Isley Brothers on T-Neck Records and with Stevie Wonder for Motown.

AGONY COLUMN

How do you deal with the novice or idiot producer who must make a huge show of being in charge? The worst problem is inept fiddling with the remix channel faders, which usually provokes disaster at a crucial point in a complicated mix when such a body tries a subtle readjustment but overcompensates. Customer relations meaning business, the studio decided to install a fine adjustment producers mixer—a set of rotary gain pots not as fierce as the channel fader, but enough for limited artistic control.

It worked brilliantly. The engineer could concentrate on his mix and its cues, and the producer was very happy, busy with his subtle variations. It's worth trying, for it's very cheap. You don't even have to wire the back of the pots . . .

Computer assistance of mixing functions has developed largely along voltage controlled lines, with attendant problems of distortion and level update. However, a mechanical, servo-driven console system can be designed to eliminate many such objections.

Computer assisted mixing

DEREK TILSLEY*

NOT THAT LONG ago recording music in a studio involved arranging the artists to perform in front of a large horn, and the sounds they generated had to be balanced by their positions in the studio and, indeed, by the loudness that the players produced from their instruments. The sounds were gathered by the horn and fed directly to disc-cutting apparatus. Electronic aids soon came to the assistance of the music recording engineer and microphones could be arranged within the studio and the electrical signals mixed and fed directly to disc-cutting equipment.

As recently as the 1960s, sound mixing consoles were extremely simple, many of them comprising a handful of large black rotary knobs and very little else. The advent of stereophonic recording meant that the sound mixer had to be more complicated. At first there were two outputs. Very soon thereafter three outputs were introduced, representing the left, right and a centre signal. This led the way to the concept of multitrack recording.

I think it is wise to analyse the reason for the rapid growth of multitrack recording from four to eight to 16, and these days, to 24 and even 30 track recording. (In the latter case, I refer to synchronising two 16 track tape recorders together.)

Before multitrack recording, it was necessary for the balance engineer and producer to organise and rehearse their performers as well as the balance engineer's actions on the sound control console, so that a complete piece of music could be recorded at a stretch. Any complicated manipulation of the sound mixer's controls had to be perfectly executed or a retake was necessary.

With the advent of multitrack recording, music from the studio could be recorded on many different tracks of a multitrack tape recorder. In the simplest application of multitrack tape recording, the musicians can be dismissed while the balance engineer spends as many hours as necessary adjusting the balance of the sounds, the degree of reverberation, the amount of equalisation and whatever other corrections are at his disposal through the modern console and its accessories. Another important advantage of multitrack techniques is the ability to build up the tracks one by one if necessary. There are many standard instances of backing tracks being laid in one studio, further instruments added in another studio, and the voice of a star singer recorded in still another.

Expanding mix

As the demand for an ever-increasing number of tracks has grown, the job of mixing down the prerecorded signals has become a mammoth task. Consequently, many balance engineers wish they had six pairs of hands and an infinite memory enabling them to recall, for example, the exact fade up and fade down of a particular set of instruments required for the finished product. There are also functions in the main studio control room which, because they are tedious and repetitive, lend themselves to the application of modern technology to assist the balance engineer. The primary object is to enable him to concentrate on producing an artistic result without being bothered with the electronics and mechanics surrounding his operation.

It becomes clear, therefore, that what is required is the application of digital or memory techniques to relieve the balance engineer of the repetitive and dull jobs in the control suite —in effect, to provide him with additional hands and additional memory. It is vitally important to avoid increasing the number of controls or detracting in any way from the immediacy of the artistic balance he is trying to create. Sound mixing consoles already have an impressive array of knobs and faders, and the balance engineer does not require further complexity in his work. The sound mixing console, and in particular the faders used on it, have been evolved after years of experience and represent the best known method of giving the balance engineer easy control of the level of each channel.

Control and indicator

The fader, normally linear, acts both as a smooth control and as an indicator of the relative levels of the signals being controlled. It is desirable that any assistance given to the sound balancer should retain these faders (as familiar to the sound balance engineer as the keyboard is to a pianist) and retain their function of being both control and an indicator.

At the present time, there are several systems on the market employing digital and memory techniques to help the sound balance engineer. These generally use a voltage controlled amplifier to vary the level of the sound signal in a given channel of the sound mixing console, with the traditional fader being employed to produce a dc voltage to control the vca. The dc voltage converted to digital form can then be recorded on to one or more tracks of the tape recorder, so that in replay this voltage can be regenerated to operate the voltage controlled amplifier bypassing the fader.

These techniques, although a praiseworthy attempt to help the balance engineer, have some acknowledged inherent defects. It is technically not difficult to provide a memory system which will reproduce the settings of controls on a sound mixing console. What is more difficult is to provide a ready and easy method by which the balance engineer can update the memory with further information, without imposing on him the need to operate or observe more controls or indicators than already exist on his sound mixing console. Because of the techniques currently available, it is not possible for the fader to retain its function as both a control and, at the same time, an indicator. Furthermore, when the balance engineer wishes to listen to his first attempt, the memory (information recorded on a track of the tape recorder) operates the level controlling elements directly and therefore a problem exists with immediate update of fader levels.

Of the existing systems there are basically two solutions offered. In one, the fader can be used to apply additional correction to the signal directly and the system computes the final level by adding together the level previously recorded on the memory to the further correction now applied. This has the disadvantage of completely losing the usefulness of the fader as an indicator of the level of that particular channel of the console.

The other solution to the problem of the operator updating the settings of his controls

*Rupert Neve & Co. Ltd.

by memory is to provide indicators to allow him to move the fader control to a coincident position with that recorded on the memory, and then allow the operator to press push-buttons to change over the memory function from replay to record as far as that control is concerned. This procedure is bound to have an inhibiting effect on the operator's ability to update his signals instantaneously.

An additional inadequacy of current memory techniques in assisting the sound balance engineer is the limitation on the number of attempts that he can make at a given balance which can be recorded in the simple memory system using tracks of a tape recorder. Let me emphasise again that I consider the most important problem to be devising a system of memory help for the sound balance engineer that enables him to see instantly the position of the controls on his sound mixing console and allows him to update them with equal ease, whether the console is under memory control or being operated without the memory in service.

A solution to these problems can be found by harnessing a computer to the sound mixing console and utilising electromechanical controls driven by the computer. The computer is 'synchronised' (an audio engineer's term) to the multitrack recording by the use of a time code recorded on one track of the multitrack tape recorder. This system means that only one track of the tape recorder is sacrificed. The computer provides, within reason, as many memories as any reasonable sound balance engineer could want. The electromechanical controls ensure that the actual control always positions itself visually to that level previously dictated by the balance engineer and recorded by the computer. The motor-driven controls which can be linear faders or rotary functions have a separate control track which is interfaced to the computer and provides positional information which is used to control the drive motor.

Updating any control

To update any control, the balance engineer would merely reach for that control and move it to an alternative position. A proximity switch would tell the computer to record the changed information and the balance engineer does not have to operate or observe any additional controls or indicators. This will then give the engineer the artistic facility for instant update of previously memorised attempts at his mixer without mechanical factors inhibiting his artistic interpretation.

Critics of motor-driven controls will no doubt argue that this is a step backwards into a previous decade of technology. Electro-mechanical devices have in the past a relatively poor reliability record compared to all electronic systems. But recently the development of such devices has enabled them to reach a very high pitch of reliability. Where such devices are appropriate to provide the best possible operator convenience, engineers should not object to their use.

The real advantage of motor-driven controls can be emphasised again with reference to the well-known auto-pilot system in an aircraft. When the aircraft is under the auto-pilot control, movement of all the control surfaces and throttles are performed automatically. However, whenever the pilot needs to take manual control instantaneously, all his control levers and knobs are in the correct position at the instant he takes over. A further source of unreliability could be the utilisation of clutches if these were incorporated to restore the low friction feel of the controls under normal manual operation. In practice, the additional load of a modern motor on to, say, a fader during non-memory assisted operation provides only a smooth damped feel; the only possible disadvantage is a limitation on the maximum rate of movement of the control by hand.

Additional distortion

Although modern voltage controlled amplifiers produce considerably better performance than a few years ago, it cannot be denied that additional distortion and noise is introduced into a sound mixing console employing these techniques. The conventional fader with, say, a plastic conductive track is undeniably the most noise and distortion-free method of attenuating an audio signal. The use of servo-driven faders maintains this distortion and noise-free fading.

The use of a computer opens the doors to additional assistance in the control suite. For example, it is highly desirable that the tape recorder transports used in the mixdown be controlled by the balance engineer from the console itself via the computer. The balance engineer can then, for example, mark a given point on the tape at the beginning, say, of a passage with which he is having difficulty. Pressing a single recycle button on the control panel will ensure that the multitrack tape recorder always 'rescues' itself back to this particular point, and the balance engineer can make attempt after attempt on a given tricky passage very quickly with his tape recorders under remote computer control.

Although it is outside the scope of this article, the computer can be harnessed to perform any function in the whole music recording control room which has to be performed under the control of the balance engineer or in synchronism with the music. For example, changes in the reverberation time of echo plates during the course of the music can be memorised and recalled by the computer. A further advantage offered by a computer is the ability to control all the switching functions in a sound console through its system. This removes the necessity for hundreds of push-button controls. One of the computer's standard routines could be the setting up of a console at the beginning of any mixdown session.

The computer

In addition to its capacity for many memories and its versatility in performing many functions, the computer has the advantage in that its instructions and its 'memory' can be transferred readily to a data storage device, eg a floppy disc. For those unfamiliar with computers, the floppy disc looks like a 45 rpm record in its sleeve and is thus flat and easy to store. All the information required for a complete mixdown can therefore be stored on such a floppy disc and placed with a multitrack master tape in its normal box. Some engineers will see in this facility the possibility of disc

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* For photos of Soundcraft and Allen ond Heath see page 63.

SOUNDCRAFT TWELVE INTO FOUR RECORDING CONSOLE

Angus McKenzie/Tony Faulkner

Distortion Measurement
Line input to group output terminated with 600 ohms.
Test frequency 1 kHz, +10 dBm input level: at +10 dBm output level, thd is less than 0.02%; at +18 dBm output level, thd is less than 0.07%.
Balanced 200 ohm input to group output terminated into 600 ohms at 0 dBm. Test frequency 1 kHz: —70 dBm at 10 ohms source impedance, thd immeasurable below noise (0.1%). —50 dBm at 10 ohms source impedance, thd immeasurable below noise (0.02%). 0 dBm at 100 ohms source impedance, thd less than 0.03%. —10 dBm at 200 ohms source impedance measured at 50 Hz test frequency, thd less than 0.16%.

Limiter Operation
10 dB of limiting at 0 dBm output level, thd less than 0.2%.
10 dB limiting at +10 dBm output level, thd less than 0.9%.

Noise Measurement (wide band)
At maximum mic gain (94.5 dB) with input terminated to 100 ohms source, signal to noise ratio is 34 dB. At 70 dB mic gain, signal to noise ratio is 58 dB. At any line gain up to about 30 dB, the signal to noise ratio is greater than 80 dB.

Frequency Response
Measured with a 1k ohm output load or greater, the —1 dB points are 20 Hz and 20 kHz (line) or 17 kHz (mic). The corresponding —3 dB points are 10 Hz and 35 kHz (line) or 24 kHz (mic). At 600 ohms output load, the bass response degrades to —1 dB at 40 Hz and —3 dB at 20 Hz. The manufacturers state that the output stage of the mixer will satisfactorily operate into 600 ohms load but performs much better into higher bridging loads, achieving outputs at clipping of +20 dBm.

Meter Options
Bell specification vus or BBC ppms.

Manufacturer: Soundcraft Electronics Ltd, 5-8 Great Sutton Street, London EC1V 0BX. Phone: 01-251 3631/2/3.
Price (UK): £975.
US agents: Verne Wandell, System and Technology in Music Inc, 2025 Factory Street, Kalamazoo, Michigan 49001, USA.
Phone: (616) 382 6225.
Price (US): $3450.

THE SOUNDCRAFT 'Twelve into Four' is again a very modestly priced mixer when one considers the facilities available. There are 12 input channels plus an echo return, four main output groups plus one echo send and one foldback group, and a 4/2 monitor mixdown facility. All of the microphone inputs are via standard *XLR* type connectors, and are balanced; the other inputs and outputs are all unbalanced and employ Type *A* PO jacks.

The mixer is not constructed in removable modules, but the savings in manufacture (avoiding expensive connectors and racking) have clearly been put to good use in the overall design and performance of the desk, which does not suffer from many of the 'bugs' one finds on other low-price mixers.

The mixer is very light indeed—a feature often apparently ignored by many manufacturers of 'portable' desks—and may easily be carried by one person without fear of personal injury. It is 1m wide, 65 cm deep and 14 cm thick, making it ideal for taking on recording locations or for public address work where high-quality is called for.

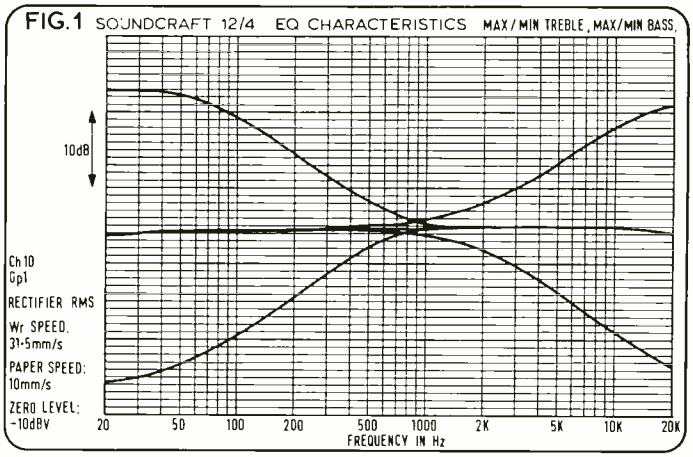
We start with the performance of the input channels. With channel and group faders set to maximum and the pan-pot hard over in one direction to feed one output group only, the maximum microphone voltage gain available was exactly 100 dB, which could be reduced to 37 dB by means of the continuously variable sensitivity potentiometer at the top of the channel controls. With identical channel and group fader settings, the line voltage gain was continuously variable from 80.5 dB to 20.75 dB by means of the same control. The line input is selected on immediate insertion of a jack into the input socket, which breaks the mic input. The gain control did not exhibit any irregularities in its law although, as discussed later, there were other problems when it was set fully counter-clockwise (ie at minimum gain).

The input impedance at 1592 Hz of the microphone input was checked, which measured as an average figure 675 ohms—rather on the low side (around 1k or so would give safer matching) but unlikely to cause any serious aggravation. The impedance was well maintained over a range of gain settings. On the line input, the modulus of impedance at 1592 Hz was 33 kΩ, which is again satisfactory. At 1 kHz, the maximum input voltage before the clipping of the first stage was as shown below:

Mic Input at Max Gain	Mic at Min Gain	Line Max Gain	Line Min Gain
—56.25 dBV	+0.25 dBV	—42.5 dBV	+16.25 dBV

Although these results are considerably better than many competitors, the Soundcraft might benefit from the inclusion of a switchable input pad; a simple passive 20 dB attenuation operating both on mic and line would make the input headroom much better —and incidentally, would make it superior to several expensive 'household name' consoles, where very high microphone outputs sometimes mean that a line input has to be used for a microphone output. The use of extensive equalisation not surprisingly reduced the input clipping margin, and a switchable 20 dB pad would also get the user out of trouble in this situation.

The equalisation section of the input circuitry operates over four separately controllable ranges, as shown in the two graphs. Treble and bass are self-explanatory offering +15.5 dB/–16 dB at 15 kHz and +18 dB/–18.5 dB at 50 Hz. The treble control does



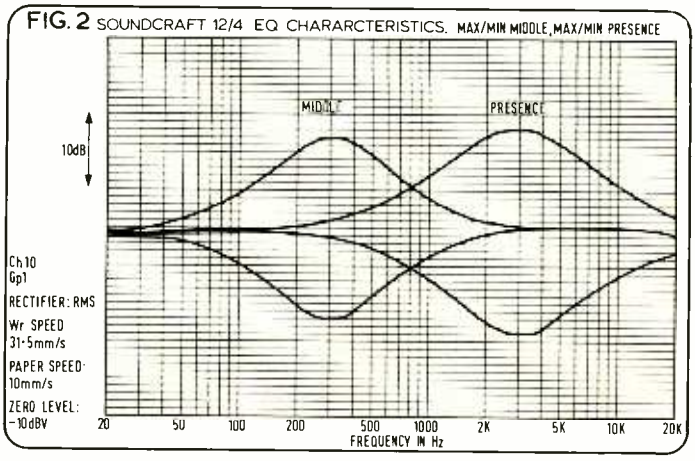
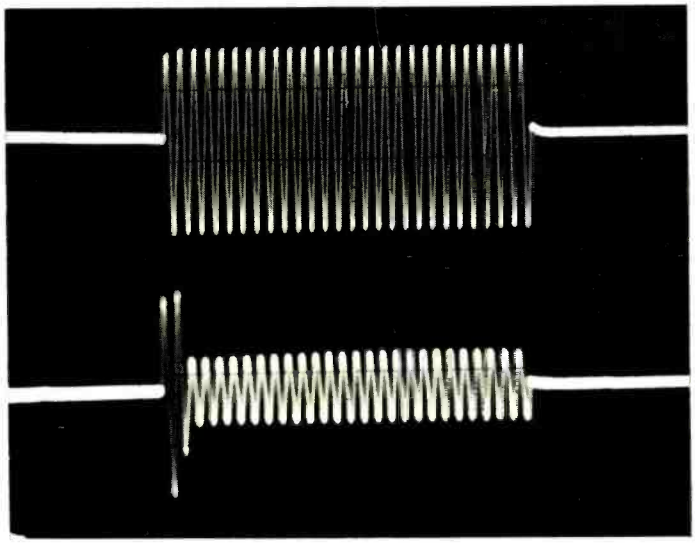
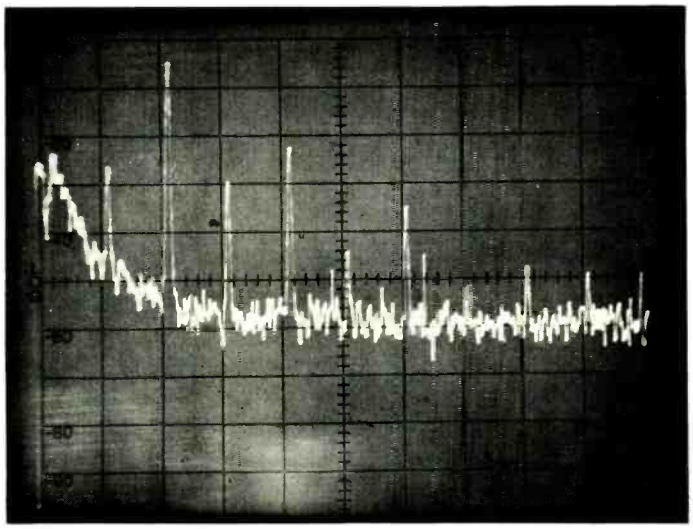


FIG. 3: *Limiter function. 10 dB limiting at 1 kHz, 500 ms release, 4 dB threshold.* **FIG. 4**: *spectral display depicting power-line harmonics before modification. Group fader at maximum, routing buttons in, y axis fsd = —50 dB at 10 dB/div x axis fsd = 500 Hz at 50 Hz/div.* **FIG. 5**: *test conditions as fig. 4 but after modification.*

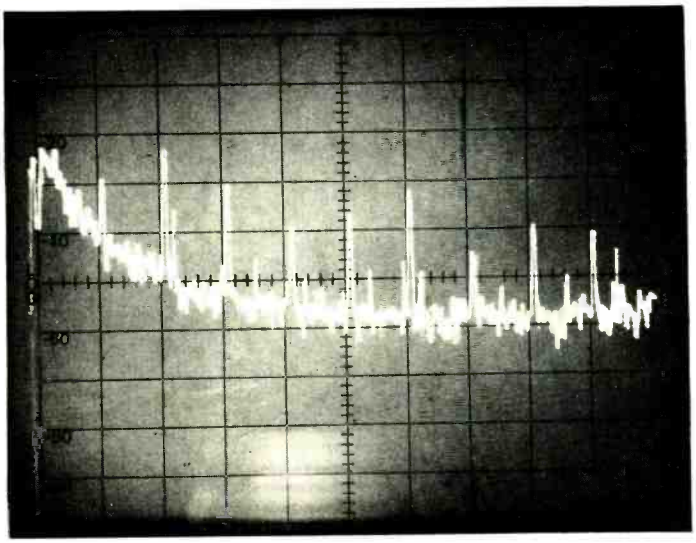


Above. **FIG. 3**



Above: **FIG. 4**

Below: **FIG. 5**



not have a shelving characteristic and is still rising at 20 kHz (+17 dB at max)—on the other hand, the bass control does shelve at around 50 Hz.

The two other tone controls are titled 'Middle' and 'Presence', as can be seen from the pen-chart recordings; the Mid operates around a centre frequency of 300 Hz (±12 dB) and the Presence around a frequency of 3 kHz (+13 dB/–14 dB).

Moving down the input channel controls, next are the foldback and echo-send gains. These feeds are, surprisingly, both permanently wired pre-fader, although presumably either or both could be made post-fader fairly easily for those who prefer it that way. Below these two controls is the pan-pot, the output of which can be routed by means of two square yellow knobs (unfortunately not labelled on the review sample) to pan between groups one and two, or three and four, or both. The law of the pan-pot had no particular problem although there was a fairly sudden jump from extreme left, say, to half-left. The pot loses 8 dB in its centre position as compared to full left or right, and this is not altogether an optimum value. In between the panner and the track routing, is a toggle-switch, which has positions for channel on, channel off, and a biased position of pfl which appears on the monitoring when the appropriate switching on the monitor circuit is applied, and can also be displayed on the metering by suitable switching.

At the bottom of the input module is the slider fader, which is a high-quality short travel type made by Ruwido—the positions of the slider are calibrated approximately in decibels at 0, –5, –10, –15, –20, –30, –40 and –∞. This calibration was checked on several faders, and was maintained within 2 dB or so, apart, of course from the bottom which was –78 dB at 1 kHz.

Final measurements relating specifically to the performance of the input section were those checking noise of the microphone amplifier. Sensitivity (gain) control was set to give an overall voltage gain of 80 dB between the balanced microphone input and the main group output. With the channel slider fader at maximum, and the group fader at –10 dB, the equivalent self-noise when the input calibration tone (1 kHz 200 ohm source) was removed and a 200 ohm resistor was substituted was –129 dBV; in more familiar terms, –126.8 dBm (although the use of dBm is more than dubious since the characteristic impedance is not 600 ohms) with the bandwidth limited to 20 Hz-20 kHz. This reading was found to include hum from the power-supply, and when the bandwidth was further limited to 200 Hz-20 kHz the figure improved to –131.6 dBV (–129.4 'dBm'). Excluding the hum pick-up (detailed later) the noise performance of the microphone preamplifier is clearly very good indeed.

The mixer includes a built-in mains power-supply incorporating a toroidal type mains transformer—although this precludes the need to carry a separate power-supply around with the desk, the advantage is in our opinion overruled by the presence of hum which manifested itself on several occasions during the tests. We contacted the makers, who were most helpful, and also suggested that part of the trouble might emanate from the lack of any regulated power supply on the particular sample supplied to us. We noted 50 Hz breakthrough in the form of rather nasty sidebands either side of a 1 kHz fundamental which we employed for our distortion measurements later discussed (these sidebands, ie 950 Hz and 1050 Hz, were only –52 dB) on an output of +1.8 dBV (1.23V rms, ppm5, 0 vu). Another occasion was when we investigated hum on the group outputs with the main faders at maximum—with none of the routing buttons punched, the 100 Hz was –80 dBV which is satisfactory, all things considered. However, selecting the relevant output group by means of the push-buttons on the input channels brought the figure up the more channels one routed through, until a shocking figure of –58 dBV was attained. Purely the action of depressing the button added the hum, without turning any channel on, bringing up any channel-fader or pan-potting to the relevant group. Apart from this hum breakthrough associated with the routing, the basic line-output hum and noise were satisfactory, with expected addition of some noise with the limiters switched in.

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SOUNDCRAFT 12/4

Before moving on to our complete measurements on the output section, we should mention the echo-return channel. This is in effect a 2-1 mixer for two echo returns which then feeds the main output groups via equalisation and routing similar to that employed on the mic/line channels. Therefore, although there are two echo-returns, the channel is mono, and if you want stereo echo-return, you must use two of the main mic/line channels. To the right of the echo-return department is the foldback group main (rotary) fader, the monitor switching to route foldback, pfl, or the output of the monitor mixdown to the main stereo monitoring outputs. There is a main monitor gain control but surprisingly no main echo-send group gain pot, which could prove an unfortunate omission with no quick way to correct the level being sent to the reverberation device if it starts clipping, for example.

The monitor output appears on two sockets on the mixer: one at the front for headphones (adjacent to the monitor gain control) and the other at the rear of the panel for feeding to the monitor amplifier. The rear output is run at 12 dB or so lower level than the front socket by means of a passive attenuator, so that headphone volume is high enough without having continually to juggle with power amplifier settings.

Although the philosophy behind this approach is clear, it degrades the performance of the power-amp feed by the necessity for winding up the gain of certain varieties of power amplifier in order to avoid running into clipping of the attenuated monitor signal. The 12 dB pad means that the rear monitor socket will only give +5 dBV before clipping (ie 1.8V), and there are circumstances where this might not be enough.

All of the other group outputs (main groups, foldback, echo send, front panel monitor) gave sufficiently high output levels before clipping. The front-panel monitor gave +17.5 dBV and all of the other groups gave between +19 dBV and +19.5 dBV into open circuit, with the exception of main group two which went into a curious oscillation 1 dB or so below clipping making its maximum output +18 dBV. The output for clipping of the main groups into a load of 600 ohms was degraded by 3.5 dB.

While measurements on maximum input and output voltage swings were being carried out, a problem was observed with the input channel gain potentiometer, as mentioned earlier. With the gain-pot set fully counterclockwise (ie minimum gain) there was a mysterious breakthrough of a high level input, eg 3V or higher. This breakthrough was only apparent with the sensitivity control right at minimum, and appeared at various points on the mixer whether or not the relevant channel fader was up, or routed through. We would associate this sort of problem with earth routing, and could be alleviated by holding the bottom of the potentiometer up (electrically speaking) by means of a small value fixed resistor in series selected after some experimentation. The breakthrough was not of pure signal, but of 'spikes' corresponding to peaks of the input waveform—particularly noticeable on the monitor output.

The measured harmonic and intermodulation distortion were very good. At an output of 0.775V rms the second harmonic content was 0.013% (−78 dB) with third and fourth harmonics each below 0.003%. Loading the output with 600 ohms did not worsen the distortion to any significant extent, although the output level dropped 0.5 dB. With 2.5V output at 1 kHz even into 600 ohms, distortion was still only 0.02% second, and 0.01% third and fourth harmonic contents. At 7.75V out into open circuit (ie 1.5 dB or so below clipping) the second harmonic distortion was as low, indicating that the output circuitry has clearly been most carefully designed. However, pure harmonic content is not the whole story, since 50 Hz sidebands at only −52 dB were visible as a result of the inadequacies of the internal power supply mentioned previously.

The intermodulation distortion of the mixer was also found to be very good using a 4:1 mix of 50 Hz and 7 kHz (SMPTE). At an output corresponding to ppm5, 0 vu, the im was 0.01%; 5 dB higher it rose slightly to 0.024%; at a level a further 5 dB higher (ie on the endstop of the ppm) it was 0.068%; 1.5 dB below clipping it was 7.75%.

The mixer supplied for this review included four ppms rather than the standard vu meters. This option, although it inevitably costs a bit more could be well worth paying the extra, although many users might prefer an alternative calibration of the meters. One often hears criticism from engineers who are used to working with vu meters that tapes recorded using ppms are frequently under-recorded. This is because ppms are very often set up such that a ppm reading of six signifies a recorded flux level of 320 nW/m—in practice 4 dB or so above Ampex Operating Level, and corresponding to the reference level at the top of a BASF, EMI or AGFA test tape. For our own recording sessions we regularly employ ppms but prefer to make ppm 6 (+4 vu) correspond to a level 4 dB higher on the tape which is a more realistic peak recording level with the latest generation of high output tapes—and also still leaves sufficient headroom for transients and unexpected peaks 2 dB or so higher.

The law of the ppms was checked through and found satisfactory, ie within ½ dB of what they should show, with the exception of meter two which was set to over-read by approximately 0.5 dB in addition to any minor law errors. The meters under-read 4 dB for a tone burst of 4 ms duration, which is within specification.

With one or two exceptions, the performance of this mixer impresses—it does not set out to give more than it can afford to do properly within the tight budget of a low-price product. It lacks the refinements of phantom powering, jackfields, talkback, internal oscillator, fully balanced inputs and outputs (though mic is balanced)—but the facilities which are there are good. The power supply is the biggest shortcoming, and any possible input overload problems (such as when using a lot of eq on mic/line, or when there is a high level microphone input) could be avoided by the inclusion of a simple switchable passive 20 dB attenuator pad in the input circuitry.

Monitoring is flexible enough for most applications of such a mixer, and the foldback (fed from input channels, output groups or off tape) as set up with the individual controls would do the job for which it is intended. The main output groups also include limiters (one each) which regrettably could not be linked for image stability in stereo or quad operation. The photograph shows the characteristic of the limiter, with a setting of 500 ms release and 4 dB threshold—the limiting was 10 dB and the photo shows before and after limiting a tone burst of 1 kHz.

All of the output impedances were satisfactorily low at 50 ohms or less, with the exception of the rear monitor socket which was higher, presumably on account of the 12 dB attenuator.

With one or two modifications, this mixer will be very attractive for those who cannot afford to buy a 'household name' desk, and is likely to satisfy musicians and engineers operating on a small budget who require a very basic console and can live without luxuries to which one so easily becomes accustomed with more comprehensive equipment.

Postscript

On completion of the basic review, Soundcraft decided that they would like to install a modification to the review sample. This was carried out, and made a remarkable improvement to the measured hum performance of the desk. Apparently this change has now been introduced in production at their factory and all future mixers in this category will be similarly improved.

		Before Modification	After Modification
Hum on Group Two output, fader at max and all routing buttons depressed	50Hz	—77 dBV	—81 dBV
	100Hz	—58 dBV	—75 dBV
	150Hz	—78.5 dBV	—84 dBV
	200Hz	—75 dBV	—91.5 dBV
50 Hz sidebands of 1 kHz test signal (ie 950 Hz and 1050 Hz) as during distortion tests		—52 dB	—85 dB

We also understand that several further modifications will be made on forthcoming production runs. A switchable passive attenuation pad will be provided to improve the input headroom, and the input gain potentiometer will incorporate an additional fixed resistance to prevent the breakthrough at minimum gain setting. Phantom powering for capacitor microphones can also be incorporated on request, obviously at some extra cost, which many users will find a convenience. *See* Letters *p32*—**Ed.**

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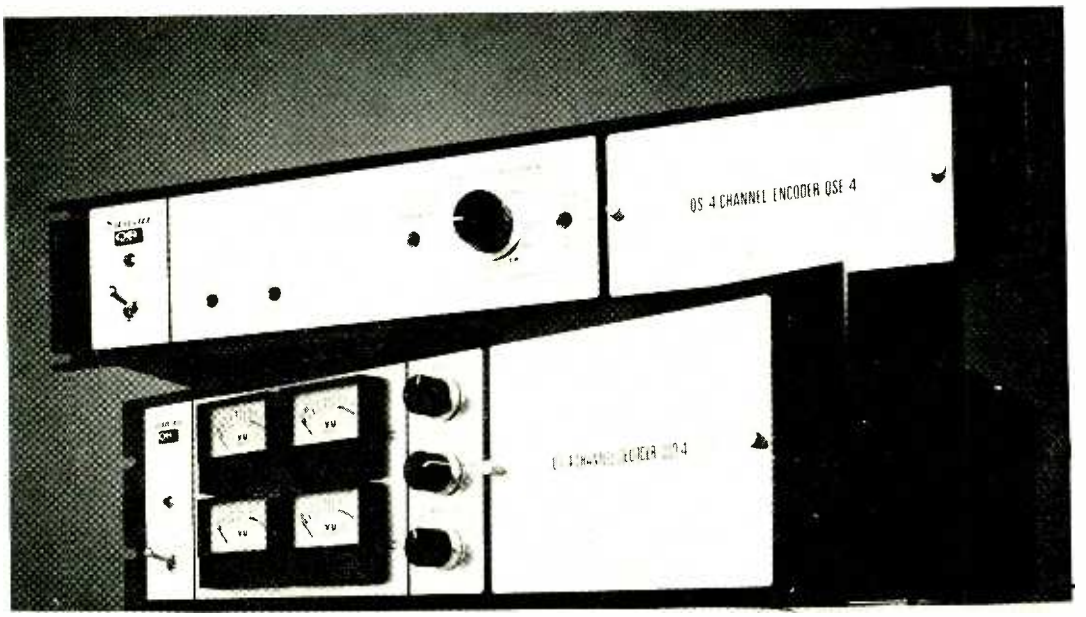

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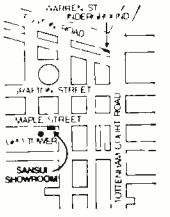

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ALLEN AND HEATH SIXTEEN BY EIGHT CONSOLE

Angus McKenzie/Tony Faulkner

MANUFACTURER'S SPECIFICATION

Mic Input
Impedance: greater than 200 ohms balanced.
Sensitivity: —80 dB.
Attenuation: 20 dB switchable.
Gain control: 40 dB continuously variable.
Equivalent input noise: —126 dBm.

Line Input
Impedance: 25k ohms unbalanced.
Sensitivity: —6 dBm.
Maximum level: +14 dBm.

Line Output
Impedance: down to 600 ohms unbalanced.
Nominal level: 0 dBm.
Maximum level: +18 dBm.

Overall
Signal to noise ratio: —75 dB.
Cross talk: better than —60 dB.
Intermodulation distortion: 0.3% overall.
Frequency response: 30 to 20k Hz ±1 dB.
Output level from console: 0 dBm.

Equalisation
Treble: ±16 dB at 10 kHz.
Middle: ±14 dB on a parametric frequency centre between 1.8 and 7.5 kHz
Bass: ±16 dB at 100 Hz.

General
Power requirements: 24V dc from an external power supply.
Weight: 104 kg (as shipped).
Dimensions (l x w x h): 150 x 87 x 23 mm.

Manufacturer: Allen and Heath Ltd, Pembroke House, Campsbourne Road, Hornsey, London N8. Phone: 01-340 3291. Telex: Batiste LDN 267727.
Price: £1800.
US agents: Audio Techniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902, USA. Phone: (203) 359 2312.
Price: $6795. This includes an extended Switchcraft patch bay (not fitted to UK models) and power supply. Extras include 48V phantom powering (12V standard) at $250 and meter illumination for an extra $100.

ASSESSING THE performance of a studio mixing console poses several problems for a reviewer, not the least being exactly where to start with so many functions to check through. The Allen & Heath posed a further problem, because its very modest UK price tag of £1800 for a 16 input, eight output desk implies that various compromises will have had to be made in order to keep the cost so low. All the same, whatever the price-bracket, any mixer should meet up to basic requirements which will either deem it fit or unfit for the job.

The mixer is attractively packaged and laid out in much the same way as most studio consoles. It is 1.6m wide and just under 1m deep. All 16 input channels are on the left, and the eight main output groups on the right. The monitor mixdown controls are incorporated in the output group modules. To the right of the output groups is an area suitable for the engineer or producer to put session paperwork, and at the back of this area is the jackfield.

The construction of the desk is modular, and each module includes the relevant input/output *XLR* and jack sockets. Microphone inputs are balanced *XLR* sockets; line inputs, tape-returns, cue output, echo-send outputs are all 6.25 mm Type A jacks unbalanced and group outputs are male *XLR*s although they are not balanced.

To begin, we measured the input impedance of the input module. The line input showed a variable figure, depending upon equalizer settings. The line input is by no means sophisticated in design—it looks straight into the mic line switch which then feeds the equalizer via a passive breakpoint (ie no gain control or attenuator available). Three channels were checked, and they agreed at 29 kΩ with the tone-controls flat and at a minimum figure of 10 kΩ with a lot of mid-boost—all readings being at 1592 Hz. This is clearly not a very satisfactory state of affairs—findings (later) concerning the overload performance suggest that the line input would definitely benefit from some change in concept and design.

The input impedance of the microphone amplifier was also inconsistent with different settings—not the equalizer this time, but the input attenuator pad. With the pad switched in by means of one of the pushbuttons on the module, the impedance presented to a microphone is 1.7 kΩ—a figure for which there is no criticism. On the other hand, with the pad switched out, the impedance falls drastically to below 400 ohms which is not satisfactory for many microphones and could produce bass loss. The microphone input also usefully applies a phantom voltage (23V) for condenser microphones such as *C451*, Calrec *CM 2150*, which can regulate the voltage to suit their requirement. This voltage, however, would not be suitable for 48V types (*U87* etc). Although phantom-powering should have no adverse effect on dynamic mics, our experience has not always borne this out. On one occasion, the output of one of our AKG *D202* dynamic microphones degraded to loud "frying eggs" noises, and this was isolated as the presence of phantom-powering. We turned off the voltage, and the microphone was restored to normal—we would therefore suggest that the Allen & Heath mixer include a phantom on/off switch to allow for this.

We next checked the sensitivities of the microphone and line inputs. With the channel fader set to maximum, the group fader at maximum, and the routing to one output group only (by turning the pan-pot hard in one direction) the voltage gain from the microphone input to line input was 105.5 dB. Such a high gain is rather excessive. The gain control for the microphone input has an alarming characteristic at the end of its travel, where the gain suddenly leaps at you. This characteristic is mentioned clearly in the instructions, but it is still quite an operational surprise. Below, we tabulate the input voltages required to produce an indicated

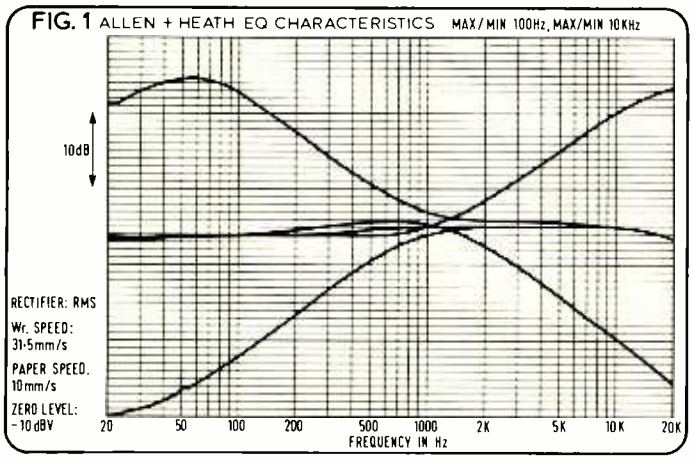


FIG. 1 ALLEN + HEATH EQ CHARACTERISTICS MAX/MIN 100Hz, MAX/MIN 10KHz

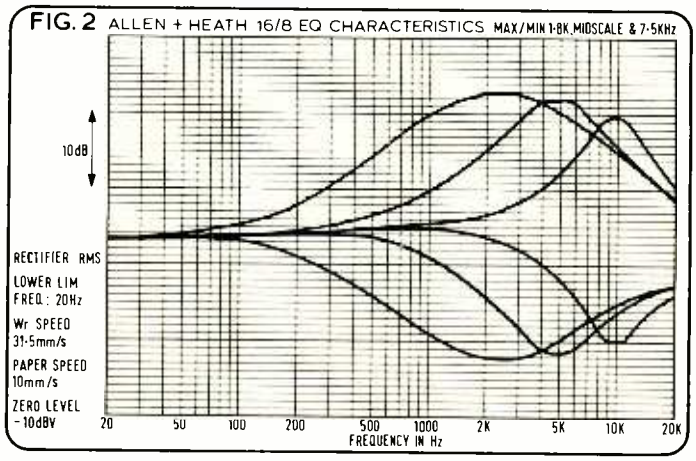
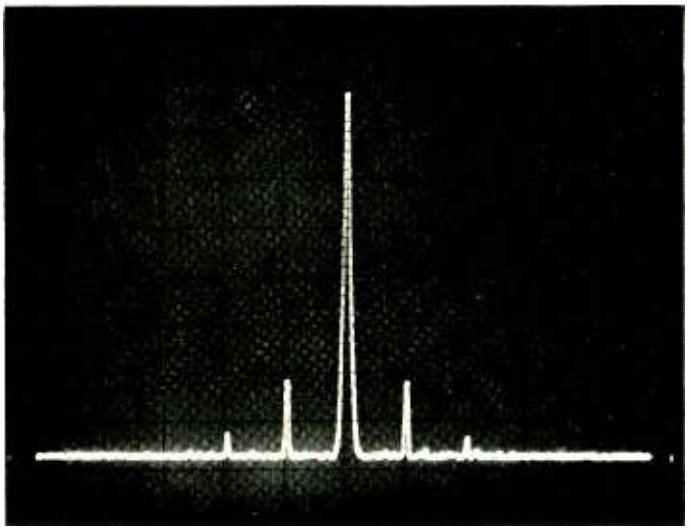
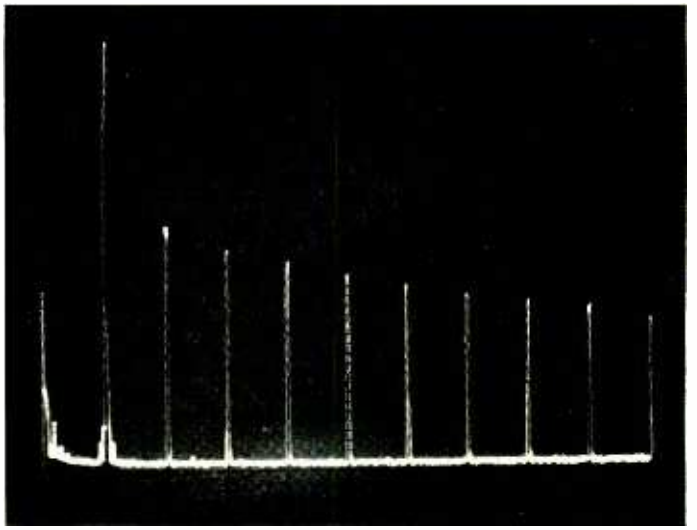


FIG. 2 ALLEN + HEATH 16/8 EQ CHARACTERISTICS MAX/MIN 1·8K, MIDSCALE & 7·5KHz

FIG. 3: *Intermodulation performance. Output level 0 vu (0 dBm). Mic input level —40 dBm with fader at —6 dB. Measurement by SMPTE method. 7 kHz centre frequency.*



X axis 50 Hz/div y axis 10 dB/div. **FIG. 4:** *Spectral display of alignment oscillator output, y axis fsd = 0 dBm, 10 dB/div x axis fsd = 10 kHz, 1 kHz/div.*



output of 0 vu indicated with group and channel fader set at maximum.

	No pad. Control at max	No pad. Control at min	Pad. max	Pad. min
Mic:	—107.75 dBV	—79.75 dBV	—54.25 dBV	—29.75 dBV
Line:	—16.5 dBV in all positions of attenuator and sensitivity			

Even at its very lowest, the microphone gain is still rather high, and this is reflected in the overload margins, which we investigated next and are shown below:

	No pad. Con at max	No pad. Con at min	Pad. Con at max	Pad. Con at min
Mic:	—83.25 dBV	—24.25 dBV	—56.25 dBV	+0.75 dBV
Line	With equalizers set flat +13 dBV			
	With maximum mid-lift —5.25 dBV			

(All figures refer to 1 kHz clip, with channel and group faders set to avoid line output/mixer amp overload.)

We do not feel that the overload capability is sufficient on microphone input. The mixer is clearly aimed at the pop music business and should make allowance for the high signal levels often encountered in this application. The margin could be improved by sacrificing some of the rather high gain, in favour of some more feedback around the microphone preamplifier.

The line input overload regrettably speaks for itself—in its present form, the line input cannot be attenuated on the mixer at all before it reaches the equalizer. It is evident that trouble can arise on mixdown as soon as the equalizer section is touched. A fully modulated master tape will often peak 4 to 6 dB (or more) above a flux-level of 320 nW/m, which on a typical studio recorder represents a voltage of the order of +12 dBV, already sailing too close to the wind before applying any eq. Even if one's standard operating level is dropped 4 dB (ie Dolby level = 0 dBm) the amount of eq added before clipping onset is very limited and below the capability of the comprehensive tone controls.

The noise performance of the microphone input was exemplary, at −126.5 dBV (ie −128.75 dBm) equivalent self-noise. This figure refers to 200 ohms and is limited to a bandwidth 20 Hz-20 kHz, being taken on a fast IEC rms characteristic meter—with the mixer set for an overall gain of 80 dB. The noise performance of the entire console was most satisfactory, as was the absence of hum and radio breakthrough.

Our next task was to investigate the equalizer section of the input module—the graphs tell most of the story, and there is no particular problem. With the tone controls set flat, the response is flat enough for any typical application and deviations from the specification of ±1 dB 30 Hz-20 kHz can be put down to the tone controls not being precisely centred. Perhaps an eq out switch would be of advantage but it's accepted that you cannot expect an £1800 mixer to have everything one finds on a £20 000 one. The equalizer has three ranges:

1. *10 kHz (treble).* This gives a variability of ±18 dB at 10 kHz. The curve is still rising at 20 kHz and we would prefer a shelving characteristic. At maximum treble, the 3 dB point of the network is 2 kHz.
2. *Mid.* This function has two controls, one controlling the frequency continuously across a considerable proportion of the mid-band, the other controlling the amount of boost or cut. The graph shows the maximum boost and cut available at three typical settings of frequency (counter clockwise, halfway and clockwise). The actual centre frequencies deviate rather from those printed on the module itself (indicated 7.5 kHz turns out to be 10 kHz). The Q of the circuit also alters quite a lot with frequency, but the facility of having a continuously variable centre frequency is useful. The available variation drops with higher centre frequencies, but is still ±15 dB which is more than adequate.
3. *100 Hz (bass).* A variation ±18.5 dB, −16 dB at 100 Hz is available with this control. The boost is a broad peak around 60 Hz with the 3dB point at 800 Hz. The cut is a basic roll-off all the way down to the bottom of the response curve.

We suspect that the lack of control in between bass and the lowest mid frequency adjustment at 2.5 kHz could be felt on certain occasions—but the continuously variable mid frequency is an attractive feature. The input module also includes a hi-pass filter which operates on the microphone input only, and although it has some effect, we feel it should be steeper. When the mic input was driven from a 200 ohm source, insertion of the bass roll-off made only 1.5 dB difference at 100 Hz, 3 dB at 50 Hz and 6 dB at 25 Hz.

Now on to the routing. The desk has eight main output groups, one cue (foldback), two echo groups and a solo (pfl) group. Routing to the main output group busses is by means of four push-button switches and a pan-pot. With the top button depressed, the pan-pot directs the output of the channel between groups one and two. The other three buttons route the output of the pan-pot to groups three and four, five and six, or seven and eight—or any combination thereof. So that if, for example, you want to feed the input to groups one, two, five and six in equal proportions at the same time, all you have to do is to punch the

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ALLEN & HEATH 16/8

buttons for groups one/two and groups five/six and put the pan-pot at centre travel. The law of the pan-pot is rather poor, in that a very small rotation of the control whisks the sound from hard-left to just off centre. The pan-pot has optimal loss of around 4 dB at the centre of its travel, as compared to the extreme left or right position. With the pot hard in one direction, the crosstalk on the opposite channel at 1 kHz was −71 dB, which is well within the specification. The breakthrough on mic of a line input was also very good at over −100 dB. Cue send is pre-fade, and the echo sends are both post-fade.

The auxiliary module is located physically in between the input and output modules. It includes sockets for the external power-supply (a very good Advance one was supplied with the mixer) in the form of a miniature three pin Bulgin, and 6.25 mm jacks for the monitor, cue, echo and talkback outputs, and also for echo and stereo tape return. The controls for the cue and echo output groups are in this module, the performance of which is detailed later with the distortion figures of the main output groups. An oscillator is built in which has two controls—one for frequency and the other for level. This oscillator falls short on account of the level of harmonic distortion. The picture of the harmonic content of a 1 kHz fundamental at 0.775V output tells the tale well—showing the second and third harmonics alone to be 1% or worse. Using the tone to check out a system would be most inconclusive since it sounds so rough to start with. The frequency is continuously variable from 805 Hz to 8.8 kHz, and the level can be varied from −68 dBV to +13.5 dBV—the output appears on the jackfield, and the oscillator can be turned off to avoid any possible breakthrough.

The next function of the auxiliary module is that of monitor selection. There is a variety of options available, and most requirements can be catered for. Monitor can be from stereo group out, stereo tape-return, the output of monitor mixdown as selected on the 16/2 monitoring mixer in the output modules (including sync with various switching), the cue output (which can also be either or both the input or output cue mix, by means of a potentiometer whose slider goes to earth), the solo (pfl) output, a mono mix, or whatever is routed on the output modules to the cut position. This system is clearly comprehensive enough for most applications, and also includes the possibility of 'wet' monitoring.

There are two functions remaining on the auxiliary module. The first is the stereo echo-return routing and level, and the second is the talkback section. The mixer has a microphone built-in which one can route to studio talkback, cue or slate (talk-to-tape). The quality is adequate and intelligible, although hardly high-fidelity —it also picks up a certain amount of bonking, if any part of the desk is knocked while it is being spoken into, but is adequate.

Meter monitoring is achieved by eight large vu meters, which read line in/out etc by means of the basic monitor switching. We were disappointed by the meter ballistics, which are rather slow to respond. The Bell specification for a vu meter states that it should reach 99 on the per-cent voltage scale in 300 ms (ie −0.1 dB). These vus underread 1.5 dB on 256 ms burst of 1 kHz, 4 dB for a 128 ms burst, and 7 dB for a 64 ms burst. This is not very good, and would encourage an engineer to drive the system too hard—particularly on material which can be difficult for even a good vu meter to present adequately, such as muted brass, or speech. However, this problem could be put right we feel sure, for clients who require more accurate meters and are prepared to pay the extra, since good meter movements do come expensive.

Output modules include a male *XLR* socket for the group output, and two mono jacks for multitrack tape return into the monitor mixdown facility. Two monitor returns are included on each module to facilitate monitor mixdown (with sync) of a 16 track recorder. Various combinations of line in/out and sync can also be routed to the cue output.

A reading of 0 vu corresponds nominally to 0.775V although the meters underread marginally by between 0.25 dB and 0.5 dB. Although many studios use 0 vu to represent a voltage level of 1.23V (ie +4 dBm=0 vu), the choice of 0.775V is reasonable bearing in mind the operating levels of possible associated equipment (such as Teac *3340* four track recorders) and also helps the overload margin. With controls set to avoid clipping the input stages, we checked the maximum output of each of the group amplifiers. The average figure attained was +15.8 dBV (+18 dBm) at 1 kHz. The same measurement was repeated for the other output groups, and the results are as follows:

Output clipping into open circuit (ie > 100 kΩ)

Main Group	Echo	Cue	Monitor	
+15.8	+12.5	+15	+10.7	(all dBV at 1 kHz)

The figures when the output was loaded with 600 ohms were not significantly degraded, and this was confirmed when the output impedances were checked at 1592 Hz, the results of which are shown below.

Main Group	Echo	Cue	Monitor
7Ω+47.5 μF	2.25Ω+73 μF	20Ω	4Ω+50 μF

These impedances are very low and mean that there is very unlikely to be any difficulty associated with loading the mixer, or with losses incurred with the use of long cables connected to the outputs, a good design feature.

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COMPUTER MIXING

cutting direct from the master tape through the computer-assisted mixing console without the need for a two or four track master tape and thus without the quality reduction inherent in another tape generation.

In addition to the requirement for some memory assistance in the music recording mixdown room, multitrack recording techniques are becoming increasingly popular in television. It has long been the wish of many television producers and directors to have the same flexibility of post-production facilities as is enjoyed by the film industry. This is mainly the ability to edit film simply, being capable of seeing exactly what is happening while the edits are being made, and also having the facility for post-production dubbing of music, dialogue and effects. Recent progress in the technology of electronic video tape editing and the introduction of multitrack recording techniques into television centres is leading the way towards this end. In recent years, there has been a considerable increase in the amount of post-production dubbing and rerecording undertaken in tv centres. As the video tape editing process requires the utilisation of a recorded time code (normally the SMPTE), the integrating of a computer-assisted mixing console is an obvious development.

Number of controls

This article would be incomplete without some reference to the number of controls on a sound mixing console, which should be put under the control of a computer or memory. There seems at this moment to be a tendency to put every function on the sound mixing console into this category. As I have emphasised, it is my belief that the one problem requiring most attention in giving electronic aid to the sound balance engineer is the ability to update the settings of the sound mixing console after they have been memorised. The solution proposed using motor-driven controls would be unduly expensive and pose considerable space problems, if every control on a mixing console is memorised. I believe it is a far better solution to provide a first-class man-machine interface on the main controls of a console (ie all the channel and group faders together with master echo send and return controls) than to attempt electronic memory assistance for every control and then to fail to provide good instantaneous up-dating facilities.

Finally, it is important to point out that in any discussion of memory techniques and sound mixing consoles, it is possible to lose sight of the prime requirement, which is to provide the highest possible quality of sound for the finished product. The advantage of harnessing a computer with its flexibility and large memory and the use of simple updatable controls on the mixer provide the balance engineer with the tools to achieve this result.

Summary

Memory assisted mixing has developed along the lines of recorded data on tracks of the tape recorder and using voltage controlled amplifiers for level control. A computer can provide more versatility and the use of electro-mechanical controls eliminates severe problems of operator update of control settings.

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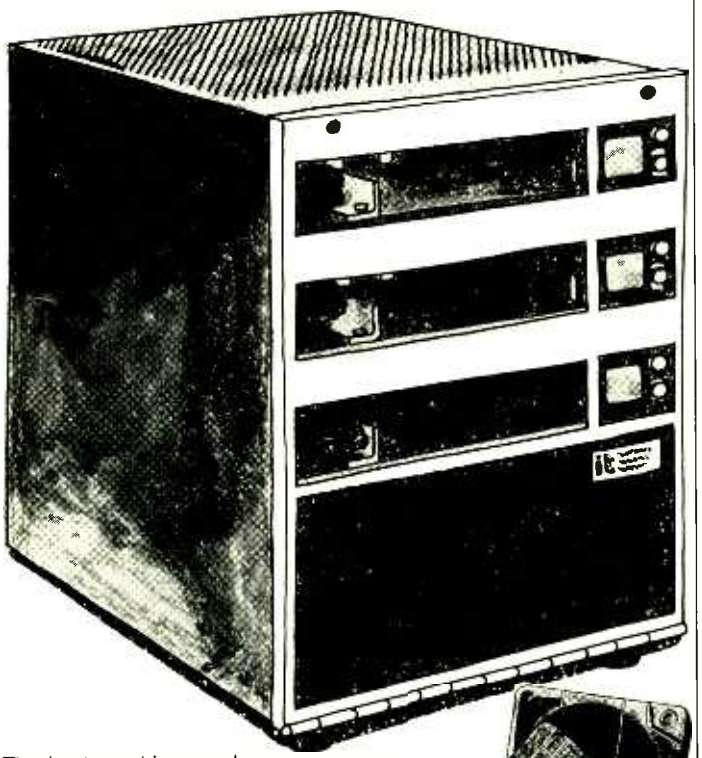

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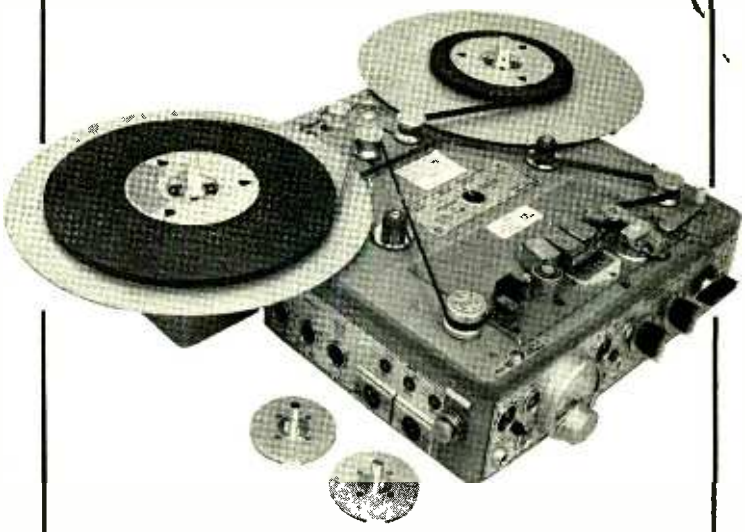

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ALLEN & HEATH 16/4

Before embarking on the final section of our tests, actually trying the desk out, we carried out some checks on harmonic distortion at typical operating levels. The main output groups, when fed through line input, were very clean at 0 vu out with second and third harmonics of below 0.02% (k_2 –74 dB; k_3=–78 dB). The echo groups were not quite as good at 0.05% second, and a good figure of 0.004% third harmonic of 1 kHz. The cue output had a second harmonic of 0.16% (–56 dB) which could be better particularly when you see how clean the main groups are. Finally, the monitor output, using the monitor mixdown function had distortion clearly audible at 0.775V out, and measured as 0.32% second harmonic, and 0.05% third. Thus, monitor and cue output amplifiers would certainly benefit from some attention but the most important ones, the main output groups, were most satisfactory.

We checked im distortion throughout the chain, feeding a 4:1 mix of 50 Hz+7 kHz to SMPTE requirements into the line input at a level of 0.775V, with the main group fader set at –6 dB and the channel fader set to give an indication of 0 vu—this gave a satisfactory reading of 0.12%. At an output of +5 dB ref 0 vu the im rose to 0.19%, and at +10 dB to 0.37%. Similar results were obtained when the test signal was applied at a level of –40 dBV into the mic input, and the photograph indicates the result.

The im distortion in the monitoring circuit was worse than the main group outputs at 1% for +6 dBV out (2V).

Finally, the desk was tried out in practice. Most of our findings on the test-bench were confirmed—the very low hum and noise was most apparent, as was the flexibility of the monitoring. The distortion inherent in the monitoring section was audible, as was the apparent necessity to run the output group faders near maximum. Although it is reasonable to work with them flat out when laying individual tracks down, it is often useful to raise or lower the gain of a stereo mix without having to juggle with 16 faders. Operating the output group faders below –10 dB courted clipping, and it might be an alternative for the gain to be reduced before the output fader and increased after it. The law characteristics of both the microphone preamplifier gain and pan-pot as discussed previously were not altogether satisfactory in operation.

We hope that the reader will appreciate that we have not made much allowance for the price of this mixer. Compromises have inevitably had to be made, such as Ruwido faders rather than the more sophisticated and much more expensive longer-travel conductive plastic types. At £1800 in the UK the mixer offers attractive value for money if you cannot afford to purchase a fully fledged studio mixer at a very much greater price. However, the mixer is not without problems, some of which could be relatively easily put right and some of which seem to indicate rethinking. The line input arrangement definitely needs looking at, as do the positions of the breakpoints in the mixer logic. The channel breakpoint is before the equalizer, immediately after the mic line switch, which is not really the most useful place, and the output break is after the group amplifier immediately before the output socket.

LETTERS

bigger problem than actually existed.

The paragraph concerning the horse race recording contains an error: The American Victor (25889) release actually states 'recorded in Europe' on the label and is pressed from an HMV matrix. The title was *Pick the Winner*—a horse race game for parties, composer(?) credit being given to one Fowler. The record also appeared here on the parent label.

The Columbia subsidiary label Harmony produced a short-lived series (6000H) on which each side contained two versions (one orchestral, one vocal) of a popular song, the two performances being distinguished at opposite sides of the perimeter by the letters A and B.

First honours must, I think, be accorded to England for the first record of this kind. An Emile Berliner seven-incher recorded in London on January 21, 1901, was entitled *Puzzle Plate* and bore three tracks on its single side . . . a monologue, a piano solo and a song with piano accompaniment. The accuracy of the grooving is as good as any Emile Berliner record of that period.

All of these were fixed-pitch jobs—but if the duration of each of the *Monty Python* tracks was only eight minutes and the disc size 12 inches at $33\frac{1}{3}$ rpm . . .

Yours faithfully, John Davies, 1 Walnut Tree Cottage, Burnham, Bucks, UK.

Dear Sir, Following my call to you this morning about the Pyral story you were good enough to publish on p. 16 of your August issue, I would point out that part of its phraseology inadvertently suggests that Pyral manufacture computer tape in their new Eastbourne factory. This is not the case; such tape comes from the parent company in France. As there are matters of inter-company agreements involved and your paragraph might appear to suggest they are being contravened, it is requested that an amending paragraph be published in STUDIO SOUND as quickly as possible to correct any possible misunderstanding among readers.

It is further pointed out that since issuing the original editorial on behalf of my clients, the UK manufacturing section of Pyral now trades under the name of Pyral Magnetics Ltd, and Pyral (UK) Ltd continue as distributors of other Pyral products manufactured in France. These of course include computer tapes.

Yours faithfully, Alfred Marks, Associate Director, Arthur Mattless-Williams Ltd, Unit 14, Airport House, Purley Way, Croydon CR9 4LB, UK.

The offending note seems at worst ambiguous. Still, anything for a quiet life . . .—**Ed**

REVOX A700

noise, and if it is not, clearly the replay ic should be changed.

As with the 77 series the heads are non-ferrite and seem to wear rather fast. This wear is greatly accelerated if rewinding is done frequently with the rewind button held down to allow recordings to be monitored. Although the tape is held against the head a mute brings the level down very considerably—in fact too much I think; allowing rewind without holding the button down mutes the head completely. Occasionally the mumetal screen in front of the head stuck, thus holding the tape permanently against the head. This has to be watched, since it will quickly cause head wear. All the machining of parts has been very accurately done; changing head blocks is simple, no re-azimuthing being necessary. I thought that some parts of the body work were rather flimsy, in particular the feet and some of the plastic work which can easily be broken. Although the recorder was designed to work vertically it performs equally well horizontally, although in this position access to the input and output sockets on the panel under the bodywork is awkward.

I agree absolutely with Hugh Ford's strong recommendation for this machine; although it may seem at first to be rather expensive, for the facilities offered it is very realistically priced. What other machine is available which can take NAB spools, has three speeds and interchangeable head blocks, is provided with consistent forward and back tension, flutter roller, excellent overall response and very low wow and flutter at anywhere in this price bracket? My own experience is that the machine can work very hard and reliably for long periods, although it does require care in use. It is obviously not so robust as its much more expensive rivals, but it out-performs its junior rival, the series 77. It would be possible to provide break points in both record and replay circuitry to insert noise reduction units, although quite a lot of electrical and mechanical work would have to be done to wire up the relevant sockets and switching. I particularly recommend the *700* for use in dubbing suites, quality checking rooms, and by music production companies who often have to play back tapes of all types and speeds in a hurry, but to a high standard. Already several studios have bought these machines and are well satisfied. All the pre-sets are easily reached by taking off the back cover, and it should be simple for a skilled engineer to set up the recorder to any required tape type. It is undoubtedly a machine that is going to be seen around for many years to come, not just in this country, but all over the world.

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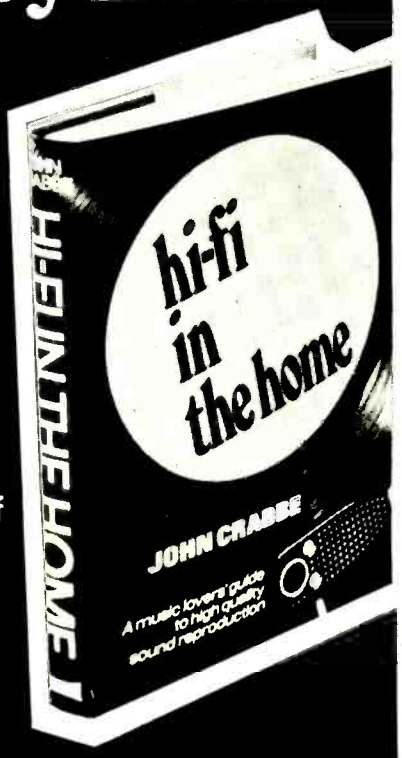

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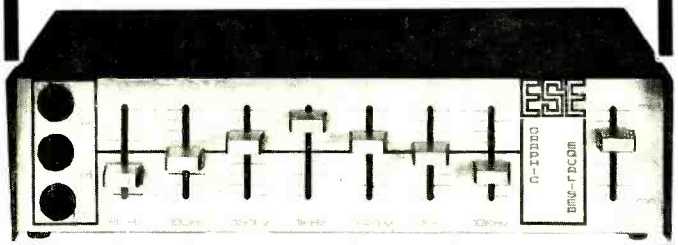

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