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EDITORIAL

EDITOR: RICHARD ELEN
ASSISTANT EDITOR: NOEL BELL
PRODUCTION: ANN HORAN
CONSULTANT: HUGH FORD
SECRETARY: WENDY MARSHALL

ADVERTISEMENT

GROUP EXEC MANAGER: PHIL GUY
SECRETARY: AUDREY SLATFORD
PRODUCTION: JACKIE McGRATH

PUBLISHER PAUL MESSENGER

Editorial and Advertising Offices:
LINK HOUSE, DINGWALL AVENUE,
CROYDON CR9 2TA, GREAT BRITAIN

Phone: 01-686 2599

International: + 44 1 686 2599

Telex: 947709

Telegrams: Aviculture Croydon

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STUDIO SOUND is published on the second Friday of the preceding month. The magazine is available on a rigidly controlled requested basis only to qualified personnel (see back page for terms) or for an annual cost of £16.50 UK, \$40 US surface mail, \$75 US airmail, £17.50 overseas surface mail or £32.50 overseas airmail to non-qualifying readers or where more than two copies are required in a studio or small organisation. All subscription enquiries, including changes of address (which should be *in writing* and preferably including an old address label or at least the 7-digit label code) should be made to the Subscription Department at the above address.

Studio Sound and Broadcast Engineering incorporates Sound International and Bear Instrumental.

US mailing agents. Expeditors of the Printed Word Ltd, 527 Madison Avenue Suite 1217, New York, NY 10022. Controlled Circulation postage paid at New York, NY.

Total average net circulation of 13,056 per issue during 1980. UK: 5,662. Overseas: 7,394.

Printed in England

studio sound

AND BROADCAST ENGINEERING

DECEMBER 1981
VOLUME 23 NUMBER 12
ISSN 0144-5944



A LINK HOUSE
PUBLICATION



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This month's cover photograph of the Fostex range was taken by Roger Phillips

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Once again, we regret to inform readers that technical problems have prevented us from publishing the latest part of Steve Dove's console design series. It will appear instead in the January issue.

Technology and technique

Featured in our Reviews section this month (and also shown on the cover) is the new range of budget recording gear from Fostex. And although many readers may be in command of facilities which far outstrip the specifications and purpose of such equipment, it is worth considering the past and future impact which such equipment can have.

So-called 'semi-professional' equipment first began to make itself apparent in the UK around the mid-seventies, in the shape of the Teac 4-track. Coinciding with this hardware availability, the incoming musical fashion (in Britain) dictated a move away from the sophistication of production, engineering and musicianship of the past, towards an alleged musical and technical simplicity which was to make performers, in some strange and metaphysical way, closer to their audiences. The resulting cacophony had a number of results, a few of which were positive, including the growth of smaller studios, which mushroomed all over the land. Record companies seized on the excuse (sorry, 'opportunity') to lower budgets and thus deter many less well-established acts who might otherwise have contemplated sophisticated product. Whole musical styles vanished overnight, at least for the time being, as did several large studios forever. The musical fashion, by now firmly annexed by the music business establishment, generally derided virtuosity on either side of the glass and that, with increasing economic problems, disposed of many professional freelance engineers and producers, and many studios who did not look to non-record company business as their prime source of income. Indeed, more than one studio lost work because its engineers were not prepared to lower their standards sufficiently (I jest not)!

Meanwhile, the small studio business boomed: traditionally successful acts who still sold records in the UK often recorded in 'second division' rather than premier studios; and many new chart outfits

recorded in 4-, 8- or 16-track basements, backrooms and garages. Limited musical requirements *did* enable studios to start from scratch and at least develop operating procedures to the point that they knew more or less how to do an overdub without looking it up in the manual.

Luckily the 'philosophy' died a quick death in the face of avarice, and the music gained its own hypocritical sophistication. A new breed of freelance engineers and producers appeared, who are now important and greatly experienced. Many studios were also able to raise their standards, technically and creatively, and of course they are now needing more tracks. Things appear to be gradually returning to normal.

Now there are signs that the next musical wave is on the horizon, and that this, in the usual cyclic way, will once again require recording and production virtuosity to match regained musical ability. Many of the newer studios will get left behind in the rush. Undemanding music is not a good teacher of recording expertise, but that expertise will be needed again any moment now. Some facilities will end up as demo studios where once they were accustomed to masters; some will not survive at all. The keys to survival will be diversification (into video, sound-to-picture, etc); ability to perform 'industrial' work (commercials, jingle packages for local radio, AV soundtracks, etc); and above all, professionalism—in looks, acoustics, maintenance backup, client assistance, efficiency and the rest.

As life returns slowly to the British record business, professionalism will become more than ever the blueprint for survival for the newer, smaller studios, including those who take advantage of the excellent value that today's semi-pro gear can offer. But unfortunately, professionalism is not supplied in the box along with the bottle of head-cleaner and the manual. Neither does it come cheaply, or easily; but it will become more and more necessary as the decade advances. And not only that: it makes aesthetic sense too.

Richard Elen

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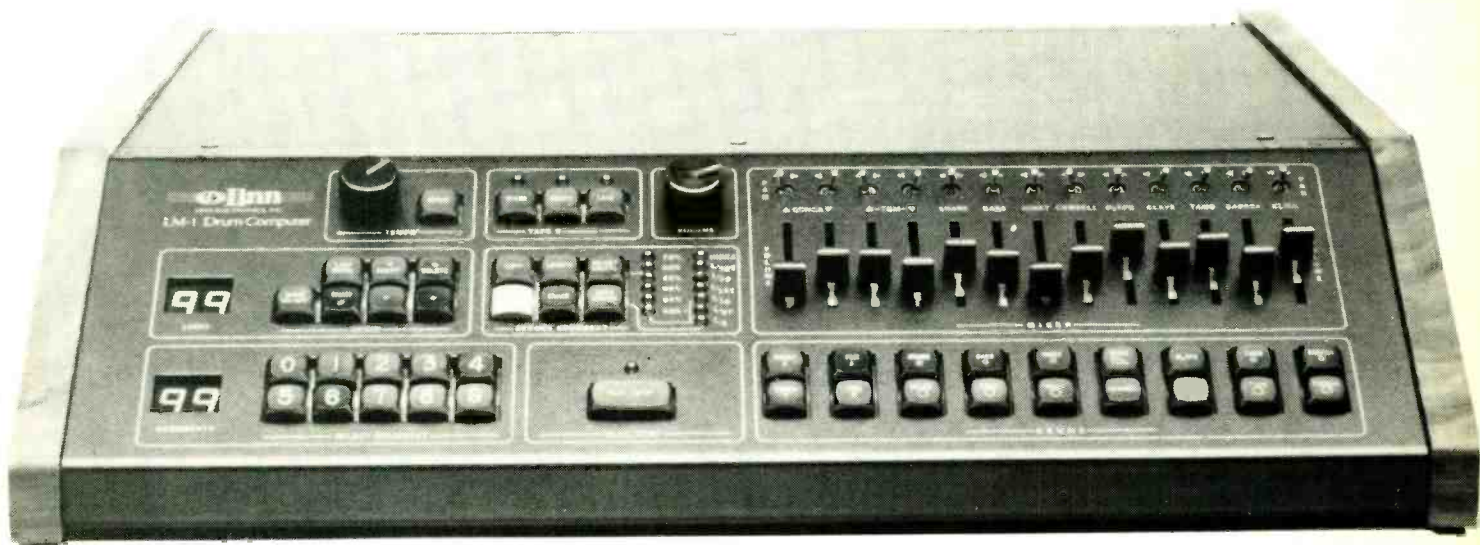


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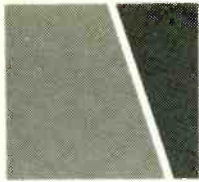
Operating the LM-1 is surprisingly simple – it's created for musicians. Unpack it, plug it in, and it's ready to play. You'll be laying down rhythm tracks in a matter of minutes. All you do is hit 'record' and let your fingers do the drumming.

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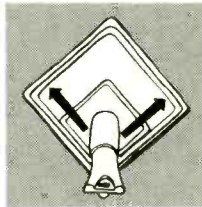
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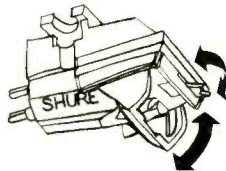
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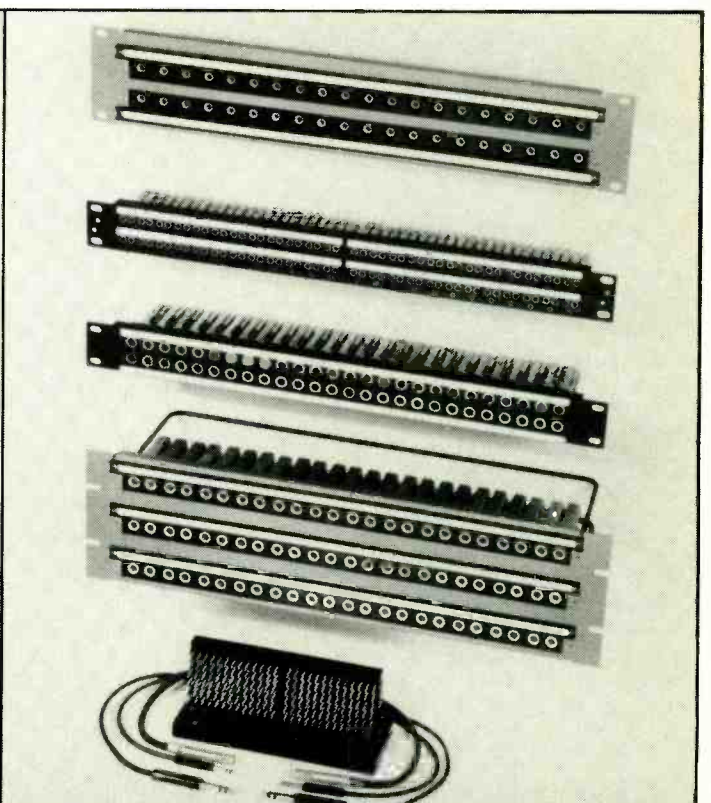
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- * Wide range of bias adjustment, suitable for all tapes.

- * Built-in 1kHz/10kHz test oscillator.
- * LED tape timer and peak indicator.
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- * Audio control section has the same functions as the 2" Otari MTR90 series. All audio functions and transport functions repeated on optional remote control.
- * Tacho output and DC servo capstan makes the MKIII-8 most suitable for audio/video locking applications.

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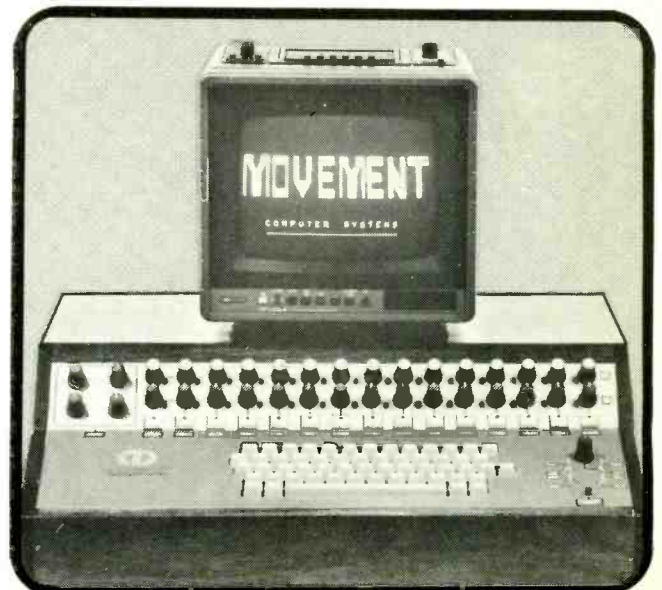
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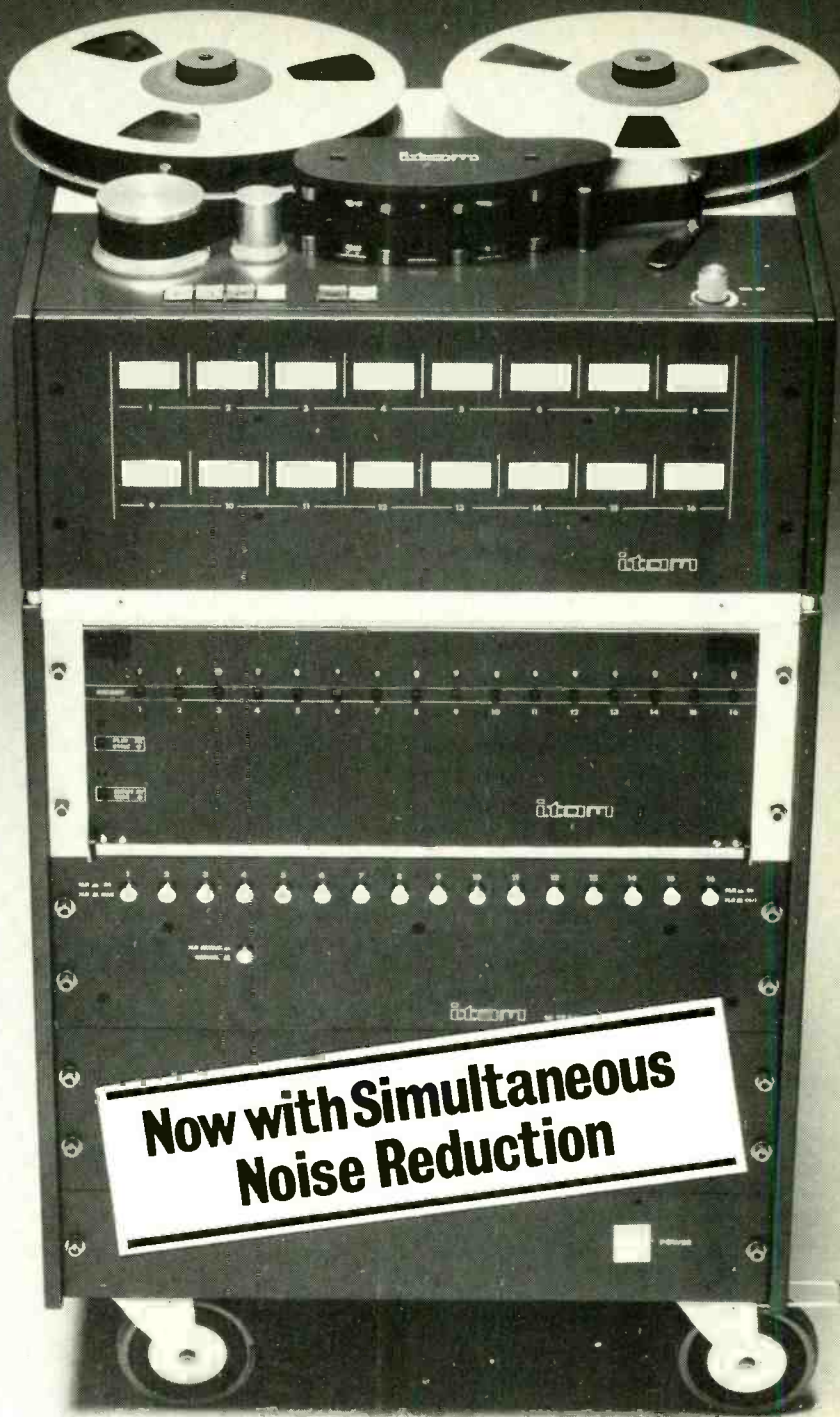


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- * DC Servo Capstan plus variable tape speeds.
- * Totally modular construction + plug-in EQ Cards.

- * Plug-in heads 8 or 16 track.
- * +4dBm input and output.
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itam

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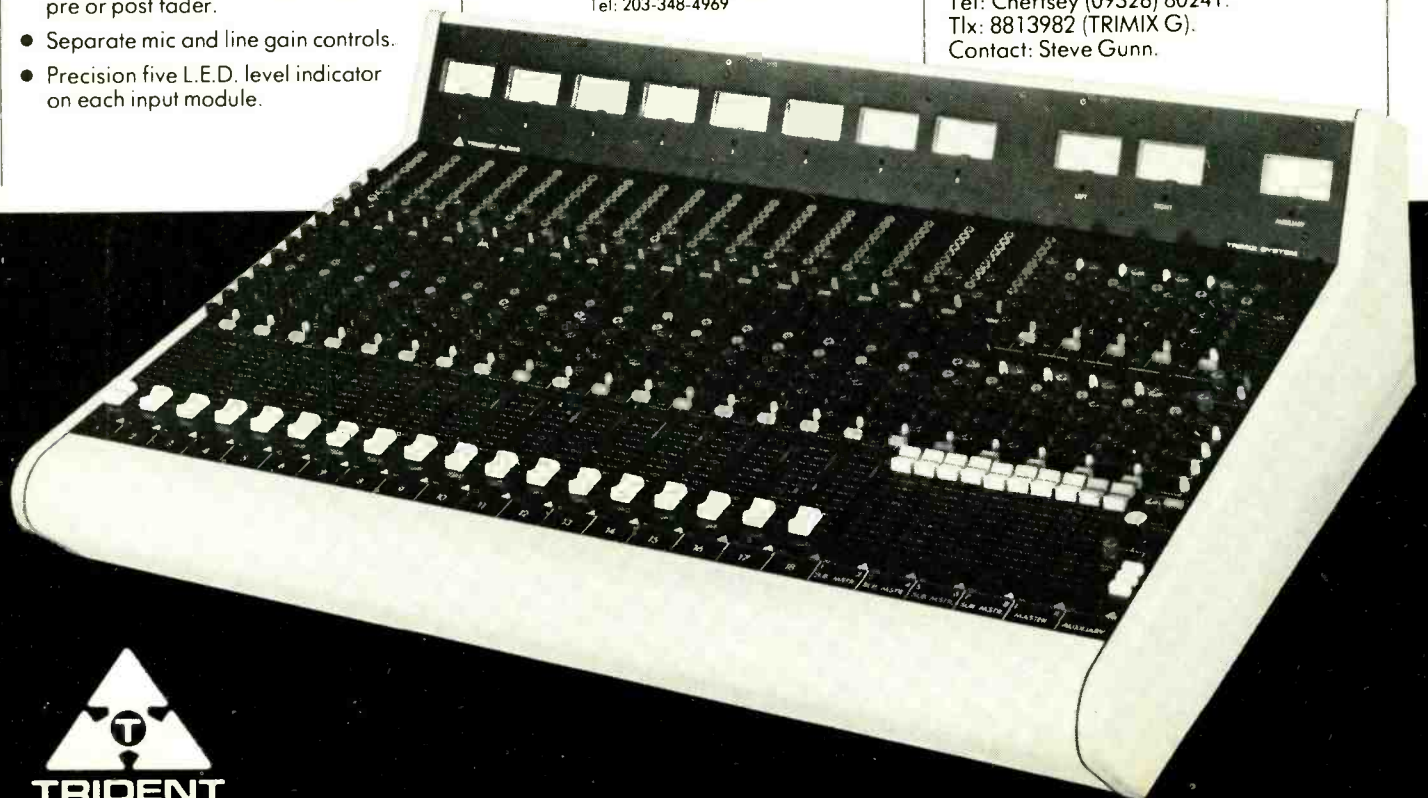
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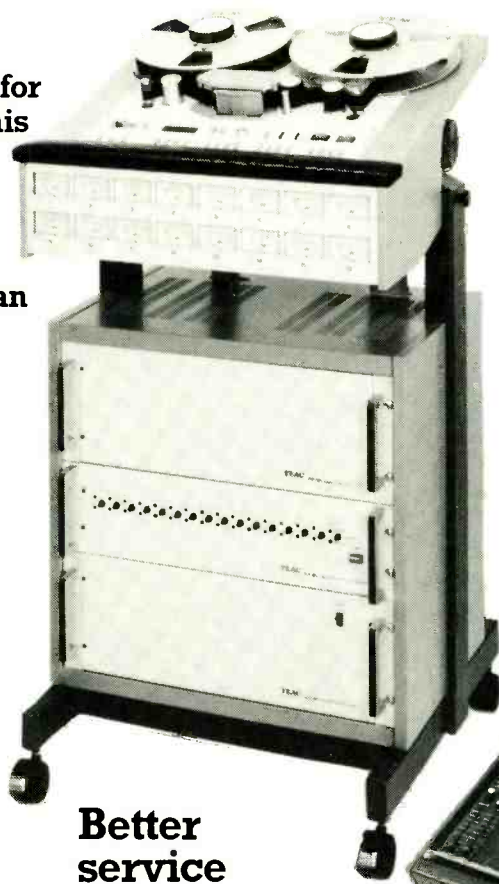
TEAC

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85-16

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32-2B

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Console version



Compact

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An even better noise specification and a dual circuit

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The B67 was and still is one of the most precise pieces of professional

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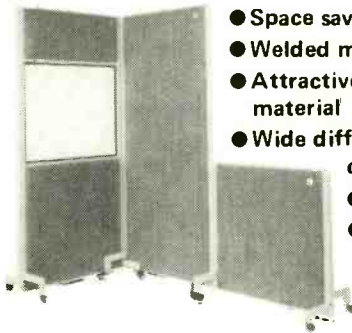
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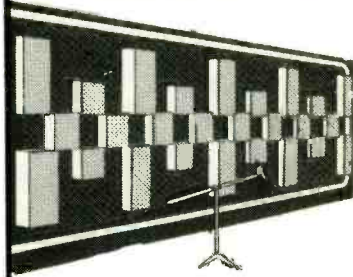
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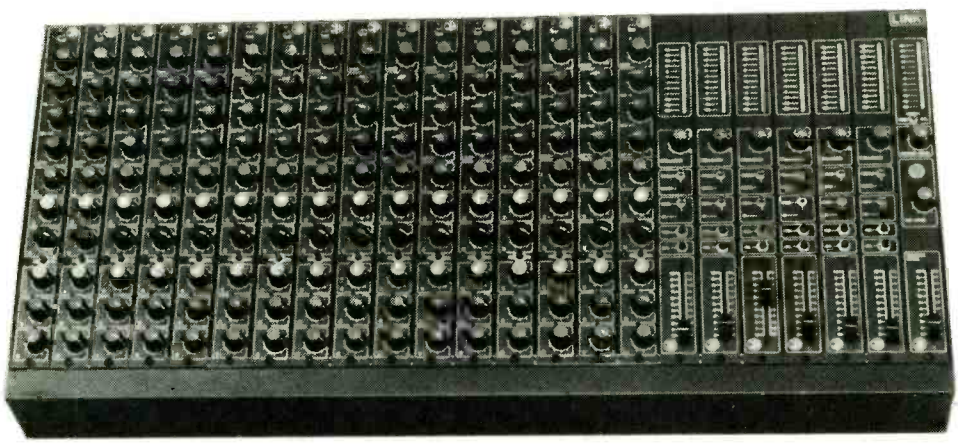
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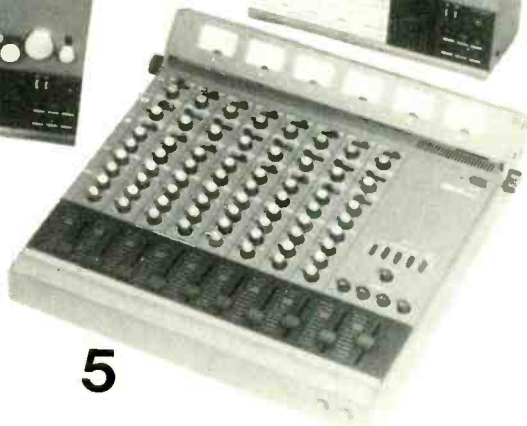
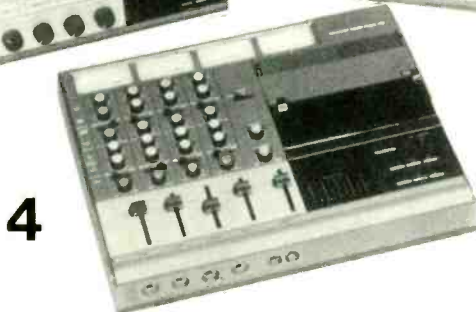
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Here is a selection from our October 1981 Mailing List. We send out an updated List approximately every 6 weeks.

To receive our up to date List regularly, telephone 0582 27195 or 26693 and ask to be added to our Mailing List.

MIXING CONSOLES

ALLEN & HEATH 12 x 2 (new) £300
 ALLEN & HEATH 12 x 2 (ex.demo) £250
 ALLEN & HEATH SR20 P.A. Desk in Flight Case with 50 metres of Multicore P.O.A.
 ALLEN & HEATH Model 2 8 x 4 x 8 (v.g.c.) £550
 ALICE 20 x 16 x 16 Custom Built £5,500
 ALICE ACM 20 x 8 x 16 Complete with stand and Patchbay £4,500
 ALICE 6 x 4 £200
 AUDIO DEVELOPMENTS 30 x 8 x 2 P.A. Desk with Flight Case, Stage boxes and Multicore £6,000
 BOSE PM2 Mixer (new) P.O.A.
 CERWIN-VEGA Disco Mixers £175 each

CADAC 28 x 24 x 24 Ushaped Console P.O.A.
 HELIOS 36 x 24 x 24 £10,000
 HELIOS 32 x 24 x 24 £9,500
 HILL B Series 24 x 4 x 2 P.A. Desk £1,400
 ITAM 10 x 8 £700
 ITAM 10 x 4 £400
 M & A 20 x 8 x 2 P.A. Desk (6 months old) £1,750
 NEVE 32 x 24 x 24 P.O.A.
 NEVE BCM10 10 x 4 - 8 x 2 modules (v.g.c.) £2,800
 NEVE 32 x 16 x 24 P.O.A.
 PYE 3 36 x 4 Broadcast Desk with full Patchbay £1,250
 RSD 30 x 8 x 4 P.A. Desk with 10 band E.O. £3,000
 RSD 20 x 2 P.A. Desk with Flight Case, Multicore and Stage box P.O.A.

RAINDIRK CONCORD 28 x 16 in-line Console with Producer Unit and Patchbay. Impressive (NEW) £8,875
 RAINDIRK Series 3 18 x 4 x 8 (v.g.c.) £3,300
 SONY Portable Mixer 6 x 2 (Battery powered) £150
 STUDIOMASTER 8 x 4 (new) £600
 STUDIOMASTER 16 x 4 (v.g.c.) £700
 STUDIOMASTER 16 x 8 (ex.demo) £1,400
 SOUNDCRAFT 3B 32 x 24 x 24 with Allison computerised Faders (new) P.O.A.

SOUNDCRAFT P.A. Desk with Flight Case and Multicore 20 x 2 £2,200
 SOUNDCRAFT Series IV 12 x 4 with 6 auxiliary sends (v.g.c.) £1,800
 SOUNDCRAFT Series 2 12 x 8 with 8 channels of sweep E.O. (v.g.c.) £2,250
 SOUNDCRAFT Series 2 16 x 8 (v.g.c.) £3,000
 SOUNDCRAFT Series 2 12 x 8 with 8 channels of sweep E.O. £2,500
 SYNCON A 28 x 24 with full Patchbay and Producers Desk. Privately used – excellent condition. £7,500

TRIDENT FLEXIMIX 16 x 4 x 2 £3,000
 TRIDENT B Series 24 x 16 x 16 (Immaculate) 8 extra monitors available if required £6,000
 TRIDENT Series 80 32 x 34 x 24 (v.g.c.) P.O.A.
 TRIDENT B Series 30 x 16 x 16 (v.g.c.) many improvements. £7,750
 TEAC Model 2A Mixer (v.g.c.) £115
 TWEED 10 x 4 with P & G Faders, PPM's. Excellent condition. Recently serviced by Tweed. £2,500
 ALLEN & HEATH 16 x 4 x 2 New £750
 TRIDENT TSM 40 x 24 x 40 £32,000

MULTITRACKS

AMPEX MM110024 track Machine £9,500
 AMPEX AG440B 4 track - 1/2" (2 available) P.O.A.

AMPEX AG440C 4 track - 1/2" with spare 1/4" stereo headblock

AMPEX MM1000 16 track with spare 8 track headblock and varispeed £5,500
 AMPEX 300 Series 4 track - 1/2" £350
 AMPEX AG440 4 track - 1/2" Machine with spare stereo headblock P.O.A.
 AMITY SCHROEDER 24 track with remote and varispeed. Excellent condition £7,000
 BRENNEL Mini 8 with remote and varispeed. (v.g.c.) £3,750
 BRENNEL Mini B £3,200
 ITAM 805 8 track - 1/2" Machine. Excellent condition. £1,600
 LYREC 532 24 track Machine. Nine months old with new auto-locate. P.O.A.

MCI 24 track Machine with 16 track headblock, remote, varispeed and auto-locate. £10,000
 3M M79 16 track Machine. Excellent condition. Pre-wired for 24 track with Audio Kinetics auto-locate. £8,000
 3M M79 24 track Machine. Excellent condition. Audio Kinetics auto-locate. £10,500
 3M M79 8 track Machine. Pre-wired for 16 track with Audio Kinetics XT24 auto-locate. Only 80 hrs. use. P.O.A.
 3M 24 track (new) P.O.A.
 3M 16 track (new) Pre-wired for 24 track. P.O.A.
 STUDER A80 Mk.1. 4 track in 8 track frame. Only 200 hrs. 2 and 4 track headblocks. P.O.A.

STUDER A80 Mk.1. 8 track £5,500
 SOUNDCRAFT 24 track Machine. (ex.demo) Auto-locate. P.O.A.
 SOUNDCRAFT B track Machine - 1" with 8EL Noise Reduction. £4,000
 SCULLY 280 8 track - 1" Machine £2,500
 OTARI 5050 8 track - 1/2" Machine P.O.A.
 TEAC 3440 (ex.demo - as new) £700
 TEAC 3440 with RX9 DBX (6 months old) £800
 TEAC 3400 with Model 2A Mixer £750
 TEAC 3340S 4 track Machine £500
 TEAC 80-8 8 track Machine £1,700
 TEAC 80-8 8 track Machine with DBX £2,200

STEREO MACHINES

AMPEX AG440C (v.g.c.) P.O.A.
 AMPEX AG351 £350
 AMPEX AG440 with or without Servo-Capstan (v.g.c.) P.O.A.
 AMPEX ATR700 3 3/4"/7 1/2"ips. (new) with Remote £750
 FERROGRAPH Studio 8 Machine in Console £900
 FERROGRAPH Studio 8 Machine. (Portable) £800
 LEEVERS RICH Pro-Line 1000 Machine P.O.A.
 OTARI MX7000 Machine in Console £500
 3M M79 7 1/2"/15ips. Machine in Console £2,200
 REVOX A77 - 1/2" track Machine with DOLBY. 3 3/4"/7 1/2"ips. £350
 REVOX A77 - 1/2" track Machine. 7 1/2"/15ips. £350
 REVOX B77 - 1/2" track Machine. 7 1/2"/15ips. (ex.demo) £475
 STUDER B67 Machine in Console. (ex.demo - as new) 2 available. P.O.A.
 TEAC A7300 £600

OUTBOARD EQUIPMENT

ALLEN & HEATH Feed Forward Limiter £98
 ALLEN & HEATH Stereo ADT Unit £150
 ALLEN & HEATH Mini Limiters £50
 ALTEC 27 Band Graphic Equalisers (1 pair) P.O.A.
 AUDIO & DESIGN GEMINI Comp/Limiter. £150
 AUDIO DEVELOPMENTS ADO55 Comp/Limiter £300
 BEL BC3 8TJ 8 channel Noise Reduction Unit. (2 available) £400 each

BENTLEY Drum Machine £75
 DOLBY301 (6 units available) £350
 DOLBY A301 (24 channels) P.O.A.
 DOLBY M24 (v.g.c.) £250
 DBX154 £2,100
 EMT 140 Stereo Reverb Plate with Remote £1,300
 EMT 140 Mono Valve Reverb Plate - electronics available to convert to stereo £300
 HH S500 Amplifier £150
 HH Digital Multi-Echo Unit £750
 KLARK TECKNIK DN34 P.O.A.
 LINDSEY 27 Band Graphic Equalisers (1 pair) £750
 MXR Compandors (new) £80 each

MXR Dual 15 (ex.demo) £225
 MXR Digital Delay Line - 4 memories fitted. £650
 MXR Pitch Transposer with Display £750
 MXR Mini Limiters (4 in Rack with Power Supply) £300
 MXR Dual 15 £250
 MASTER ROOM MR3 Reverb £700
 MASTER ROOM B Reverb £600
 NEVE 2254E Comp/Limiters (2 per Rack - as new) £450
 NEAL 102 Cassette Deck £150
 NAKAMICHI 300 Cassette Deck (v.g.c.) £250
 PANDORA Time Line (2 available) £350 each

PYE Mono Compressor £150
 QUAD 405 Amplifier £120
 REBIS RA402 £250
 SCAMP Rack with Power Supply (Modules available) P.O.A.
 TEAC AN80 Stereo Dolby Unit (2 available) £75 each
 TEAC DX8 Noise Reduction Unit £500
 TANNAY X05000 Electronic cross-over £275
 URIE 1176LN Mono Comp/Limiter £220
 URIE LA3A (2 available) P.O.A.
 URIE 565 Notch Filter (3 available) P.O.A.

PACKAGES

SOUNDCRAFT Series 2 16 x 8 with P & G Faders; BRENNEL Mini 8 with Remote and Varispeed. Both Units are in excellent condition and have less than one years use. £6,750
 SOUNDCRAFT Series 2 12 x 8 with 8 channels of sweep E.O.; BRENNEL Mini 8 £5,700
 SOUNDCRAFT Series 2 16 x 8 with P & G Faders, 8 channels of sweep E.O.; SOUNDCRAFT 8 track - 1" Tape Recorder. Both Units are in excellent condition and only used in private Studio. P.O.A.

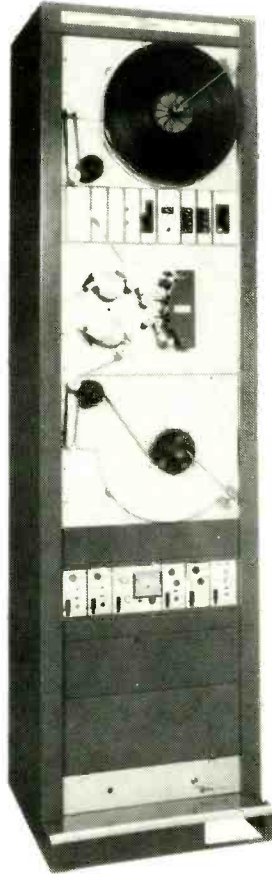
1

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- Forward and Reverse operation at standard speed.
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BEL BC3 Noise Reduction System. Fully modular, 19" Rack mounting, simultaneous encode/decode enabling monitoring off tape whilst recording. Can be decoded by DBX.



Call for papers

As usual the International Broadcasting Convention to be held in Brighton next year will include a full technical programme of papers covering new techniques, systems and developments appropriate to sound and television broadcasting. In order to encompass as wide a range of topics and contributions, the Secretary of the IBC Technical Programme Committee is inviting any interested authors to submit synopses of proposed contributions by January 5, 1982 at the latest. Any author wishing to submit a paper for inclusion in the IBC programme should contact: The Secretary, IBC Technical Programme Committee, IBC Secretariat, IEE, Savoy Place, London WC2R 0BL, UK. Phone: 01-240 1871.

Panduit catalogue

British manufacturer, Panduit Ltd, has just published a new six page short form catalogue (ref WCC-1) describing the company's range of cable ties, wiring aids and accessories. Copies are available from Panduit Ltd, Lordswood Industrial Estate, 61/65 Revenge Road, Chatham, Kent ME5 8YT, UK. Phone: 0634 660811/5.

IBA Sound Broadcasting

The latest edition of the *IBA Technical Review*, number 14, entitled *Latest Developments in Sound Broadcasting* is now available on application from the Engineering Information Service, IBA, Crawley Court, Winchester, Hampshire SO21 2QA, UK. Phone: 0962 822444. It includes articles on the acoustic design of self-op studios; the design and installation of small radio stations; measurement and technical quality assessment; local news distribution on ILR; Phase II ILR stations; directional MF antenna systems; and future developments in radio. Most interesting, however, are two articles on the IBA's work on surround-sound broadcasting.

The first of these articles, *Surround-Sound Systems Proposed for Adoption as International Standards* by R. I. Collins, reviews 2, 2½ and 3-channel Ambisonic surround-sound systems investigated by the IBA, and discusses the *MSC-1* system, developed by the IBA to circumvent an alleged incompatibility with stereo. The fact is, however, that—as we have pointed out in these pages before—the only people who seem to have been annoyed by

Sierra Video Systems

Kent Duncan of Sierra Audio has informed us that he is setting up a new acoustic consultation venture in Switzerland to service Europe. The new venture which is to be known as Sierra Video Systems, will be based in Montreux and will employ Tom Hidley as its chief architect. Both Sierra Video Systems and Sierra Audio will act as worldwide agents for Hidley designs and Hidley monitor loudspeakers.

Sound recording course

The British Kinematograph Sound and Television Society (BKSTS) is re-running, for the third time, its successful lecture course on the technology of sound recording. The course takes the form of eight consecutive weekly evening lectures and commences on Monday, January 18, 1982. The lectures commence at 7pm, and the venue is The CFS Conference Centre, Colour Film Services, 22 Portman Close, Baker Street, London W1. Full details and enrolment forms are available from: Bill Pay, Secretary BKSTS, 110-112 Victoria House, Vernon Place, London WC1B 4DJ. Phone: 01-242 8400.

the alleged 'phasiness' in rear information when *UHJ* Ambisonic material is replayed in stereo are those at the IBA who are responsible for developing the new system. Add to that the fact that they have eschewed the 2-channel *UHJ* variant (the BBC's *Matrix HJ*) and one can only conclude that the decision to depart from the sensible, hierarchical *UHJ* system (which is compatible all the way from with-height 'periphony' down to mono) and propose the 3-channel non-hierarchical *MSC-1* was simply a political desire to be different from the BBC (who are quite happy with *UHJ*, like everybody else). It also gave them just about the only item on sound broadcasting in the last *IBA Yearbook*. There seems to be no other reasonable explanation. In the meantime, the IBA's movement out of the *UHJ* surround-sound hierarchy has resulted only in confusion. It is quite difficult enough to interest people in Ambisonics (after their experiences with 'quad') without having the IBA confuse the issue with another related, but incompatible and unnecessary diversion, *MSC-1*. It should also be noted that the adoption of *MSC-1* would require modification of tuners and receivers to extract the 3-channel information, as well as the purchase of a decoder:

Oops!

In our survey of radio mics in the July 1981 issue we inadvertently gave an incorrect address for the UK distributor of Nady radio mics. The UK distributor is: Hardware House (Sound) Ltd, 1-7 Britannia Row, London N1 8QH. Phone: 01-226 7940.

On page 30 of our October issue we incorrectly stated that CE Hammond were the UK agents for the Sound Technology range of test equipment. The UK distributors for the Sound Technology range are: Precision Audio Marketing, Bimini House, Christchurch Road, Virginia Water, Surrey. Phone: 09904 4416.

Due to an error by our printers pages 112 and 116 in the review section of our November issue were transposed. We apologise to our readers for the confusion.

Otari—West Germany

Otari has opened a new sales and service office in West Germany to handle all Otari products. The new office which is located near Dusseldorf is headed by Ken Hirano, operations manager. Otari Electric Deutschland GmbH, Gielenstrasse 9, D-4040 Neuss, West Germany. Phone: 02101-274011/274012.

the BBC's *Matrix HJ* requires only the latter (which is very inexpensive). The suggestion that *MSC* (which stands for 'Mono-Stereo Compatible' like CBS' *CX* stands for 'Compatible Expansion') should be adopted as an international standard for surround-sound is simply absurd as there already is one—*UHJ*.

The suspicion in many people's minds that *MSC* is a political development (rather than a sensible technical one, which it isn't), is supported by the second article, *Surround Sound: An Operational Insight*, by C. P. Daubney. This is an excellent description of the IBA's experimentation with Ambisonics and gives a great deal of useful information including a description of the IBA's experimental Ambisonic console, built by Alice and the IBA. Unfortunately this console is now believed to be rusting away at Crawley Court, which is a great pity as it is the only Ambisonic console in the world (the reason why there aren't any others being a story in itself). Of course, this fact in itself doesn't detract from Daubney's excellent article, which is a useful discussion of Ambisonics and never mentions, or even admits the existence of, *MSC*. It would be best for all concerned if nobody else at the IBA did either.

Lorlin catalogue

Lorlin Electronic has produced a new catalogue giving full details of the company's range of switches. Items covered in the catalogue include miniature rotary switches and lever operated switches, plus pcb mount switches and miniature slider switches. Copies are available from Lorlin Electronic Co Ltd, Daux Road, Billingshurst, Sussex RH14 9SW, UK. Phone 040381 2942.

Address change

● The Association of Sound & Communications Engineers has established its own full-time secretariat headed by Ken Walker, and has moved its headquarters to: 4 Snitterfield Farm, Grays Park Road, Stoke Poges, Nr Slough, Berks SL2 4HX. Phone: 0753 39455.

Agencies

● Turnkey has been appointed sole UK distributor for the recently introduced Wright range of mics. Turnkey, 8 East Barnet Road, New Barnet, Herts EN4 8RW, UK. Phone: 01-440 9221. Telex: 25769.

● Neve has appointed AD & AD Recording Studios, 308 Shaw Boulevard, Manaluyang, Metro Manila, The Philippines, as an agent for its range of consoles.

● Leever-Rich Equipment has been appointed sole European representative (excluding Scandinavia) for the Garner range of tape erasers and degaussers. Leever-Rich Equipment Ltd, 319 Trinity Road, Wandsworth, London SW18 3SL, UK. Phone: 01-874 9054.

● Intersound has been appointed export sales and marketing agents for PAS (Professional Audio Systems), the American manufacturers of loudspeaker systems; and AC Electronic Services, British manufacturers of mixers, amplifiers and tape machines. Intersound, 103 Layston Park, Royston, Herts SG8 9DY, UK. Phone: 0763 44470.

● Industrial Cassette Developments Ltd, manufacturer of the *Graff* range of cassette machines, has appointed the following overseas agents. USA: Koperdak Enterprises, 1450 W Winona, Chicago, Illinois 60640. Phone: (312) 275-9748. France: Quinzan Audio, 7 rue de la Baume, F-25400 Audincourt. West Germany: Schuerer Foto, Hirschgartenallee 49, D-8000 München 19. Phone: (089) 170083.

● Soundcraft Electronics USA has appointed Northwest Marketing Inc as its agents in Washington, Oregon, Alaska, Western Montana and Idaho. Northwest Marketing Inc, 1800 NE 75th, Seattle, Washington 98115, USA.

dbx

Quietly successful with dbx (from around £200)

If you're committed to making it in the pro world, give yourself some professional advantages – like dbx noise reduction.

The new dbx 150 gives your tape machine the dynamic range of digital perfect drop-ins and de-coded monitor output without special switching. Rack mounting 1 3/4 inch slimline package means easy upgrading from 2 to 4 to 16 to 24 tracks.

Also in this format the new dbx 140 provides two channels of type II encoding and decoding, usable separately or simultaneously for use with cart machines and transmission lines to give a full 40 dB increase in dynamic range.



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Mike Llewelyn-Jones Francisco de Rojas 9, 2DER, 9 Madrid 10 Tel: Madrid 445 1301
Audio Vertrieb Peter Strüven GmbH Hamburg Tel: Hamburg 5245151

new products

Portable ENG mixer

British manufacturer Film-Tech Electronics has introduced a new portable sound mixer designed for ENG/EFP use. The *Compact 4-1 EFP*, as its name suggests a four into one battery powered mixer, and it measures 260 × 200 × 50mm and weighs 3kg. The mixer incorporates transformer balanced inputs and output and its facilities include a 20dB attenuator and two frequency (180Hz and 60Hz, 6dB/octave) bass cut filter on each input; an overall switchable compressor (ratio 4:1, attack time 20ms, decay time 75ms); 50dB output attenuator; line-up oscillator; headphone monitoring of output or tape return signal; plus a broadcast specification PPM fitted as standard (VU meter optionally available). The mixer is also capable of 48 or 12V phantom powering and 12V A-B powering from its own batteries. Accessories include a voltage sensing mains power supply which automatically compensates for differing mains input voltages.

Also available from Film-Tech is the original *Compact 4-1*, which is a smaller mixer, again four into one, but offering slightly less facilities. This model can be powered from its own batteries or from a portable tape recorder such as a Nagra or Stellavox.

Price of the *Compact 4-1 EFP* is £475, with the *Compact 4-1* costing £435. Mains power units are optionally available, price £50.

Film-Tech Electronics Ltd, 31 Lomond Crescent, Lakeside, Cardiff, South Glamorgan, UK. Phone: 0222 493230.

Feedback DPM609

Feedback Instruments has added the *DPM609* digital phasemeter to its range of test equipment. The *DPM609* uses a 3½ digit display to show 0° to 180° with a resolution of 0.1°, while separate LEDs indicate which of the two input waveforms is leading, thus giving the capability of full 360° measurement. The phasemeter can measure over the frequency range 10Hz to 100kHz and two pushbuttons (labelled sine and logic) enable the user to select optimum

performance to suit the input waveform. The *DPM609* incorporates a pair of symmetrical channels with 1MΩ inputs which will accept signals from 10mV to 10V rms sine, or from 1V to 30V peak-to-peak for logic waveforms.

Feedback Instruments Ltd, Park Road, Crowborough, Sussex TN6 2QR, UK. Phone: 08926 3322. Telex: 95255.

USA: Feedback Inc, 438 Springfield Avenue, Berkeley Heights, New Jersey 07922. Phone: (201) 464-5181.

KS Technic DM1 mini-mixer

KS Technic who produce the *Search-Recorder* detailed in our March issue, have sent us details of their *DM1* mini-mixer which although primarily designed for disco usage is also suitable for radio station applications. This mixer which is designed to operate in conjunction with a pair of Technics *SL1200 MkII* phono turntables or similar turntables, offers automatic control of most facilities with the option of manual override where required. Features include automatic and manual fading with LED indication; automatic level control with LED indication of recording level; electronic activation of DJ mic with volume fader and the facility for remote activation; voice ducking facility; electronic monitor channel switching; cue-in headphone monitoring or via VU meter monitoring; a choice of three aux inputs; slave amplifier switching; bass and treble eq; and balance control. Probably the most interesting feature is the facility for automatic 'phono change' whereby automatic fades are made from one turntable to the other, whilst at the same time switching the monitor functions to the second turntable.

KS Technic, Hybenvej 12, DK-2830 Virum, Denmark. Phone: 01 78.32.60.

Synchroniser/effects modules

Canadian manufacturer Commercial Electronics Ltd, has provided us with details of its *Omni Q TL Series* of synchroniser/effects modules. Designed primarily with the Teac *Tascam* and Otari market in mind the units are, however, suitable for larger installations. The modular system comprises the *TL1* and its expander modules the *TL2* and *TL3*.

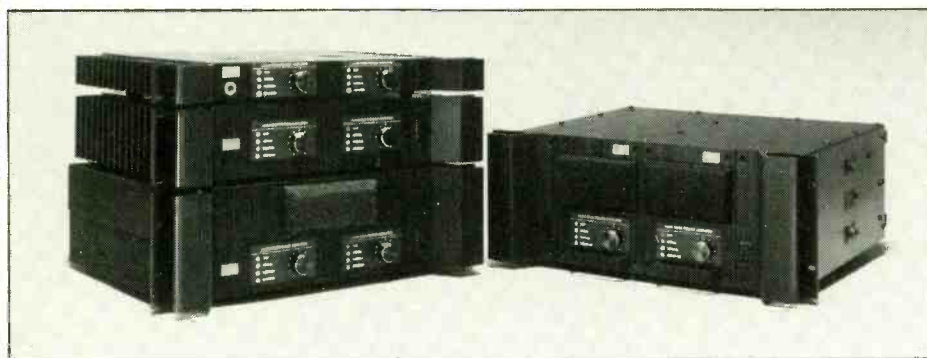
The *TL1* will slave virtually any tape transport incorporating a DC controlled capstan motor (plug-in interfaces are available for some AC and frequency controlled drives too) to its master or an internal clock. Synchronisation accuracy between master and slave is claimed to be better than 50µs, this being dependent upon the tape transport. The *TL1* generates timecode in minutes, seconds and frames, and the frequency response of the timecode channels is down 3dB at 15kHz, continuing to roll-off at 24dB/octave. The unit utilises both fast and slow slewing modes, for achieving sync and running in sync respectively. For film work, video or other special applications, the unit's clock can be run by an external sync pulse falling within a 20 to 80Hz range. No tachometer pulse is required, however, for normal synchronising of two multi-track machines, and no modifications are required to either machine. For special effects production the *TL1* provides a phase control to allow manual phasing of ±1 frame, allowing the production of some interesting flanging effects. In addition the *TL1* features a set of advance and retard controls allowing continuously variable offset of up to 29:59:29, thus facilitating delays from zero to almost half an hour.

The *TL2* expansion module adds a number of functions to the basic *TL1* synchroniser. These facilities include a LCD display showing the clock time for the master or slave, or the difference between them; a phase meter to give a more accurate representation of the action of the phase control on the *TL1*; and a dual autolocate which enables the slave to search for the parked master, and either stop when it finds it, or start the master and sync to it. The master can similarly locate to the last time read from the slave machine, while both machines can simultaneously locate to a jammed clock time. The *TL2* also provides remote transport controls to operate either the slave or master, or both, and these controls can be interfaced to virtually any transport on the market.

The *TL3* expansion module—which is currently only at the prototype stage, although production is scheduled for the latter part of this year—is essentially a remote control for the *TL2*. Facilities which the *TL3* will provide are to include a remote display; remote status LEDs; remote transport controls; a keypad for time entry; 10 memories; and punch-in/punch-out facilities.

Commercial Electronics Ltd, 1335 Burrard Street, Vancouver, British Columbia, Canada V6Z 1Z7. Phone: (604) 669-5525.

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UREI power amplifiers

UREI has announced a change to its range of four professional stereo power amplifiers introduced last year. The former *Model 6400* has been redesignated the *Model 6300* and has been re-engineered to fit in a more compact cabinet only 5½in high as opposed to the previous 7in cabinet. Power output of the unit remains at 225W.

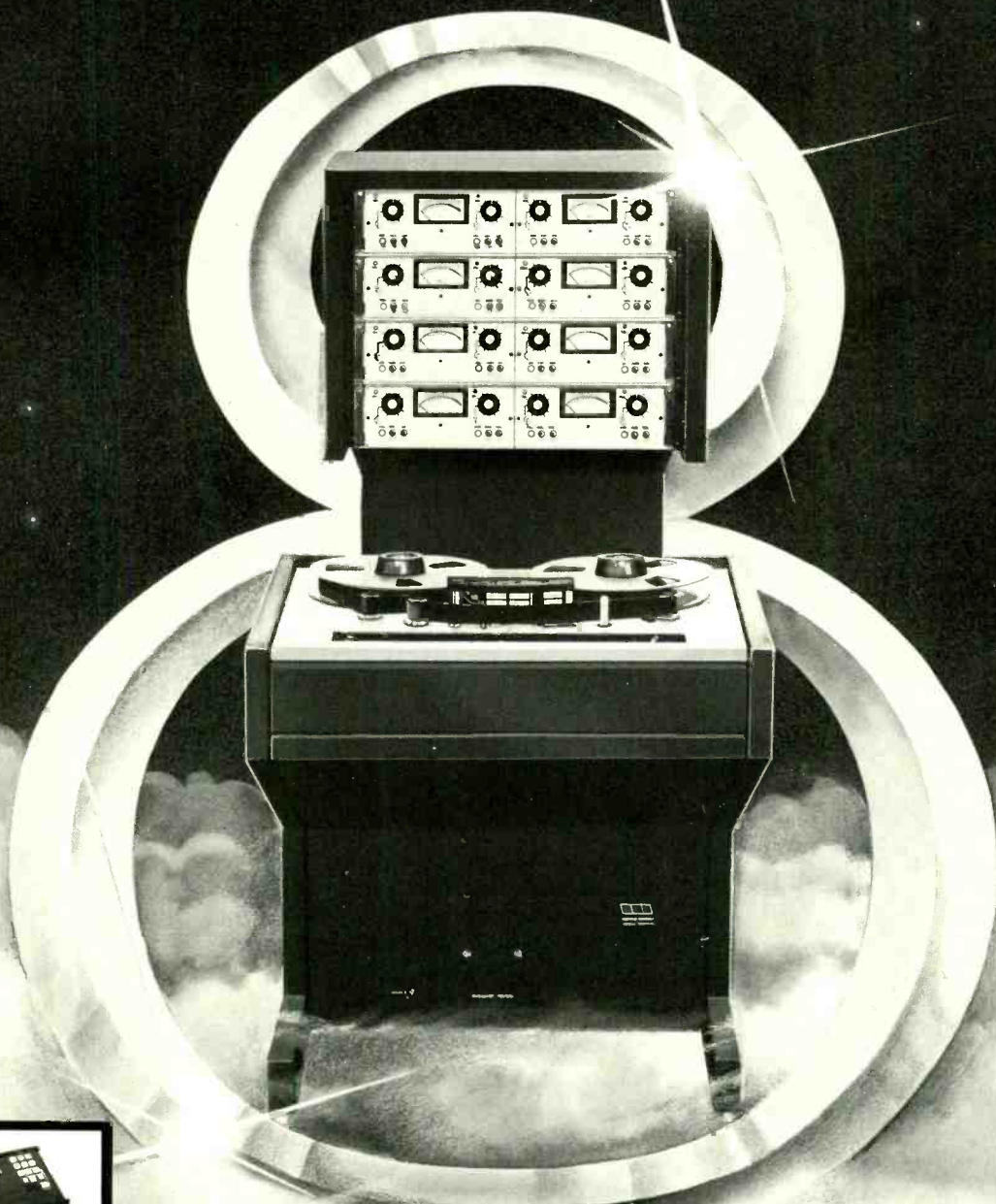
UREI inform us that all four power amps, the *6150*, *6250*, *6300* and *6500*, are now in production. All the amps feature common specifications and features, differing mainly in their power outputs, cooling, power supply and physical dimensions. Basic features include active, balanced input circuitry; fully complementary outputs; standby mode/loud-speaker disconnect protection; balanced bridging *XLR* and ¼in balanced/unbalanced phone jack inputs; and heavy duty 5-way binding post outputs with a rear panel bridge switch to facilitate high power mono operation.

Specifications: input impedance 40kΩ balanced, 20kΩ unbalanced; max input level +20dB; input sensitivity 1.1V for max output into 8Ω; voltage amplification, variable, max 32dB; hum and noise -100dB below rated output (15.7kHz noise bandwidth); frequency response 20Hz to 20kHz +0, -1dB; rise time <7µs; slew rate 50V/µs (8Ω load); IM distortion <0.05%; channel separation >100dB at 1kHz, >80dB at 20kHz (input shorted); damping factor >200 at any frequency 20Hz to 1kHz, >70 at 20kHz (8Ω load). Power outputs 80W (*6150*), 150W (*6250*), 225W (*6300*), 275W (*6500*) stereo into 8Ω, 20Hz to 20kHz, THD <0.1%.

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

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

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new products

High-performance op-amp

Precision Monolithics introduced two new op-amps at the end of 1980 which promise to offer a fundamental improvement in audio performance when utilised in applications where one would have formerly used the much-respected *NE5534*. These devices are now available in the UK from Bourns Electronics. Designated the *OP-27* and *OP-37*, the devices are available in TO-99 and 8-pin DIP packages. A major article on the devices appeared in the May 1981 issue of *Electronic Engineering*, and reprints of the article, plus data sheets and samples, are available from PMI and their distributors. The specifications are remarkable, and include a noise figure of 80nV p-p, 0.1Hz to 10Hz, $3nV/\sqrt{Hz}$ at 1kHz. Stability is quoted as $0.2\mu V/month$ and $0.2\mu V/^\circ C$, while the speed is quoted as $2.8V/\mu S$, 8MHz gain bandwidth for the *OP-27* and $17V/\mu S$, 63MHz gain bandwidth for the *OP-37*. V_{OS} is quoted as $10\mu V$, while CMRR is a remarkable 126dB over input voltage of $\pm 11V$. The gain is 1.8 million.

Precision Monolithics Inc, 1500 Space Park Drive, Santa Clara, Cal 95050, USA. Phone: (408) 246-9222.

UK: Bourns Electronics Ltd, Hodford House, 17-27 High Street, Hounslow, Middx TW3 1TE. Phone: 01-572 6531.

Fostex multitrack products

To match the *A-Series* of tape machines (see below) Fostex has produced the *Model 350 8/4/2*, 6-buss mixer which utilises an in-line monitor system, normally associated with much larger studio consoles, to provide full 8-track recording and overdubbing facilities. This mixer which may be coupled with the ancillary *Model 3060* 6-way meter bridge, features eight input channels (mic/line selectable); accessory send and return jacks on each channel; $\pm 12dB$ parametric type sweep equalisers; and four RIAA preamps which may be patched anywhere within the system. (This model is reviewed on page 62 of this issue).

A further mixer is the *Model 2050* 10/2 line mixer with eight line level inputs (tape/effects) each with gain and pan controls, plus an additional two main programme inputs. Features of this unit include a remix control and headphone output switchable PGM/Cue, ie either selecting the mix of the two main inputs and eight line inputs or the eight line inputs alone. Other accessory products include the *Model 3030* 2-channel, 10-band graphic equaliser with centre frequencies at 31.5, 63, 125, 250, 500Hz, 1k, 2k, 4k, 8k and 16kHz, a control range of $\pm 12dB$, and input level controls and bypass facility; the *Model 3040* Dolby-C noise reduction unit with four switchable encode/decode channels, designed to accompany the *A-4* 4-track tape machine; and the *Model 3050* digital delay unit. This latter unit is capable of giving controlled doubling, flanging chorus and phasing effects in addition to straight delay. Delay range is 0.27 to 137ms selectable in

10 steps, plus the delay may be continuously varied from $x 0.5$ to $x 2$ giving the facility to expand the usable delay range up to 270ms or down to 0.13ms. Facilities of the unit include input control, depth and speed modulation controls, feedback control and an output mix section.

As a foil to the Fostex $\frac{1}{4}$ in tape machines, the company has also produced the *Model 250 Multitracker*, a 4-track cassette recorder with an in-built mixer. The recorder section operates at $3\frac{3}{4}$ in/s, has record/playback and erase heads, and features $\pm 10\%$ pitch control facility and a return-to-zero function. Dolby-C noise reduction is incorporated (switchable encode/decode) and the tape transport uses two DC motors with servo-controlled capstan motor and motion sensing. The mixer section has four inputs accepting mic/line inputs plus two aux inputs and features tone controls on each channel, patch points to facilitate the incorporation of external signal processing, an independent echo send and return system; and pan controls. The *Multitracker* will be reviewed in a future issue.

Fostex Corp, 512 Miyazawacho, Akishima, Tokyo, Japan. Phone: 0425-45-6111. Telex: 2842-203.

USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, Cal 90650. Phone: (213) 921-1112.

UK: Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9304. Telex: 25769.

new products

2- to 8-track Tape machines

For address details see product guide

Ferrograph SP744

The Ferrograph *SP744* 4-channel recorder is based on the *SP7* Series of tape machines. Using the same tape transport as the *SP7S* models, it is a three speed machine with closed loop servo controlled capstan and full logic control. Features include motion sensing of tape tension, full remote control of deck functions, external varispeed facility, and a noise reduction interface facility. The *SP744* has three tape heads and separate plug-in amps for record and replay. Level controls on the front panel set line input and output. Four mic input jack sockets with adjacent mic/line switches are also on the front panel, while the line input and output Cannon *XLR* sockets (jack sockets optional) are conveniently situated on the top of the recorder. Two groups of switches reduce the number of switching operations normally required to set up record and sync channel assignments, one group switching record on each channel, while the other selects source, sync or tape.

Specifications: tape width $\frac{1}{4}$ in; reel size, accepts 'cine' or NAB up to $10\frac{1}{2}$ in; tape speeds $3\frac{3}{4}$ / $7\frac{1}{2}$ / 15 in/s; external varispeed 2 to 16 in/s; tape slip $< 0.2\%$; fast wind time approx 2min for 2,400ft; wow and flutter 0.15% ($3\frac{3}{4}$ in/s), 0.09% ($7\frac{1}{2}$ in/s), 0.07% (15 in/s); frequency response (record/replay) 40Hz to 14kHz $\pm 3dB$ ($3\frac{3}{4}$ in/s), 30Hz to 17kHz $\pm 2dB$ ($7\frac{1}{2}$ in/s), 30Hz to 20kHz $\pm 2dB$ (15 in/s); S/N ratio ref 3% distortion, unweighted including hum, $> 60dB$; mic inputs 220 μV , recommended source 200 Ω to 2k Ω ; line inputs, minimum signal 200mV, 20k Ω ,

recommended source $< 10k\Omega$; line outputs 2V from 50 Ω ; headphone output suitable for 8 Ω to 2k Ω headphones; noise reduction interface, record and replay input/output level 200mV, automatically bypassed when not plugged in; bias approx 100kHz adjustable for individual tapes; crasure $> 70dB$ at 1kHz.

Fostex multitrack range

First shown at the Los Angeles AES Convention, the range of tape recorders and accessories from Fostex is now generally available, UK distributors being Bandive, as indicated in our AES report. A number of new items are also available, making the entire system exceptionally flexible. The range includes three reel-to-reel tape recorders, the *A-2*, *A-4* and *A-8*, offering 2-, 4- and 8-track capability on $\frac{1}{4}$ in tape (the 8-track being the first of its kind). All three units use the same transport with three DC motors and FG servo-controlled capstan motor, the 8-track being a 2-head (erase, rec/play) design and the others the more conventional three. The 8-track utilises IEC equalisation and runs only at 15 in/s, while the other two machines also offer $7\frac{1}{2}$ in/s and may be ordered in NAB or IEC configurations. The 8-track includes built-in Dolby-C noise reduction offering a 72dB S/N ratio, while the 4-track includes a noise reduction switching socket for external NR control.

A particular feature of these machines, which are aimed at the musician, small studio and AV markets, is the capability of plugging in a footswitch for remote control of the record function in addition to conventional transport controls, which may also be removed. All three machines feature a 4-digit LED tape position indicator, edit mode and VU metering plus a return-to-zero function and solenoid transport control. UK recommended retail prices are $\pounds 1,177.80$ (*A-8*), $\pounds 736.77$ (*A-4*), and $\pounds 437.94$ (*A-2*). These machines, plus the companion *Model 350*

$8/2$ mixer, are reviewed in this issue, while the other aspects of the range are discussed elsewhere in the New Products section.

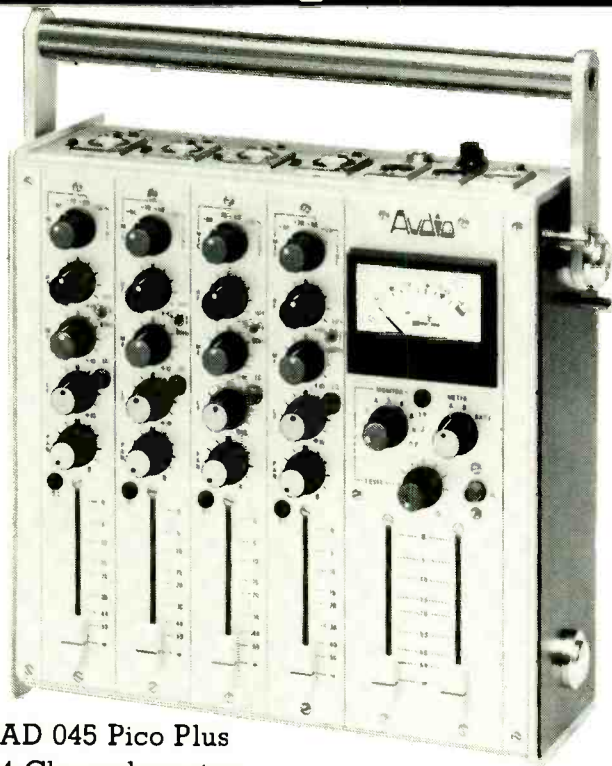
Lyrec TR55

First shown at the AES Hamburg Convention earlier this year, the Lyrec *TR55* $\frac{1}{4}$ in 2-track machine is an extremely compact recorder of modular design and with a number of facilities to aid servicing. The new recorder will accept any reel size from 3 to 14in; incorporates logic control with facilities for full remote control and synchroniser interface; incorporates full search logic; and uses servo-controlled solenoids for all mechanical movements. Tape transport is via servo-controlled DC motors with a tape winding speed of 500in/s, the motors being controlled by a double push-pull system such that tape tension is individually controlled by servo arms for constant take-up and back tension. Editing facilities are somewhat unusual as the *TR55* has no edit or dump mode facilities, edit points being located via a cue or search to zero system with a continuously variable tape winding speed. Once an edit point has been located, tape cutting is achieved via a tape cutter mounted in the machine's headblock which cuts immediately in front of the playback head. To aid servicing the *TR55* is of modular design with the tape deck logic mounted on a sliding sub-chassis, hinged audio amplifiers which swing down for access, and free access to all mechanical parts. The *TR55* is available as standard with $7\frac{1}{2}$ / 15 in/s tape speeds (any two speeds to order) with a varispeed facility of -50 to $+100\%$. Signal inputs and outputs are balanced and fully floating, and NAB or CCIR equalisation is available.

Specifications: tape width $\frac{1}{4}$ in; reel sizes NAB, DIN and 'cine' 3 to 14in; tape speeds $7\frac{1}{2}$ / 15 in/s; varispeed -50 to $+100\%$; speed stability $> 0.1\%$; rewind time approx 60s for 2,400ft; stop time max

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new 2- to 8-track Tape machines products

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3s from wind speed; tape tension 1.1N in any mode; start time approx 0.1s (7½in/s), approx 0.2s (15in/s); wow and flutter max 0.07% RMS weighted (7½in/s), max 0.04% RMS weighted (15in/s); equalisation NAB or CCIR; frequency response (record/reproduce) 30Hz to 17kHz ±2dB (7½in/s), 30Hz to 19kHz ±2dB (15in/s); S/N ratio 67dB RMS A-weighted (7½in/s), 68dB RMS A-weighted (15in/s) (ref 510nWb/m); erase efficiency >75dB at 1kHz; crosstalk >40dB at 1kHz; signal inputs balanced and floating, input impedance 10kΩ, -6dBm to +24dBm input level (adjustable) to produce 510nWb/m tape flux; signal outputs balanced and floating, output impedance 40Ω max, 510nWb/m tape flux produces output level 0 to +8dBm (adjustable), max unclipped output level +24dBm into 200Ω; tape timer accuracy ±0.1%.

TR55



Nagra T-Audio

The new Nagra *T-Audio* ¼in 2-track recorder is developed from the company's *T-1* instrumentation recorder and utilises a twin capstan open loop tape transport with servo-controlled tape tension. Features of the new recorder include interchangeable head unit; synchronisation system either for SMPTE timecode or 50/60Hz pilot tone; the facility to preset the recorder to four preset calibrations; four speeds 3¼/7½/15/30in/s; playback speed variable ±7%; high speed copying facilities; servo-controlled editing with built-in tape cutter; detachable function keyboard with a matrix display of channel states and warning display for power/phase lock/tape tension; and the capability of either AC mains or optional 11 to 14V DC power operation. In addition the recorder may be operated from several remote keyboards.

Preliminary specifications: tape width ¼in; tape transport, twin capstan open loop system with interhead tape tension sensor; tape tension 75g servo controlled, internally adjustable; tape speeds 3¼/7½/15/30in/s; varispeed ±7%; tape spool size max 7in with lid, max 12in without lid; tape spool types, accepts NAB, AEC, cine types; spooling speed 10m/s max; speed accuracy ±0.1%; wow and flutter ±0.04% (3¼in/s), ±0.03% (7½in/s), ±0.025% (15in/s), ±0.02% (30in/s); start time 300ms (3¼in/s), 350ms (7½/15in/s), 600ms (30in/s); equalisation CCIR; erase level 85dB at 1kHz, 1020nWb/m; frequency response 30Hz to 15kHz ±1.5dB (7½in/s, CCIR), 30Hz to 20kHz ±1dB (15in/s, CCIR), fast copying at 30in/s 60Hz to 60kHz ±1.5dB; distortion at 160Hz and 1.6kHz, 510nWb/m, +6dB, 2% (7½in/s) 1.5% (15in/s); S/N ratio 70dB RMS ASA A-weighted (7½in/s), 75dB RMS

ASA A-weighted (15in/s); inputs symmetrical floating, >10kΩ, nominal level (0dB) 390mV to 4.4V (internally switchable), clip level margin +16dB; outputs symmetrical floating, load 200Ω, nominal level (0dB) 775mV to 4.4V (internally adjustable), max output level +24dB, output impedance <30Ω.

Otari MTR-10 Series

Introduced earlier this year was the Otari *MTR-10 Series* of production/mastering tape machines to accompany the *MTR-90* multitrack. Available in two versions, the *MTR-10-2* 2-channel ¼in machine and the *MTR-10-4* 4-channel ½in machine, the latter also being convertible to a ¼in 2-channel recorder, the series feature modular electronics, with both models being available in differing tape speed combinations of 7½/15/30in/s or 3¼/7½/15in/s. The tape transport features a PLL DC servo capstan drive with microprocessor controlled spooling, tape speed and tape tension; ±20% stepless varispeed with digital readout down to 0.1%; and a return-to-zero facility. The transport deckplate is hinged for ease of access and the modular electronics are front panel mounted to aid servicing. The modular electronics include direct coupled outputs; transformerless active-balance I/O circuitry; dual independent electronic timers with display in hours/minutes/seconds; built-in test oscillators for 100Hz/1kHz/10kHz sinewaves and 1kHz/10kHz squarewaves; adjustable phase compensation, bias, record and playback levels; and a rear panel interface to transport and time-base functions for SMPTE interlock. Other features include NAB/IEC/AES switchable record/reproduce equalisation; selectable 3-position reference record-flux levels (320/250/185nWb/m); SRL switches for line input/output; a simple tape path with no swing arms; tape splicing block; selectable edit modes; tape shuttle control; NAB adaptors, and desk-height console fitted with casters. Options include autolocator with 10-position memory and shuttle; transformer balanced I/O circuitry; remote transport control; and remote varispeed controller.

Specifications: tape width ¼in and ½in; reel size 10½in NAB max; tape speeds 3¼/7½/15in/s or 7½/15/30in/s; speed deviation ±0.3%; pitch control ±20%; fast wind time <100s for 2,400ft; wow and flutter 0.06% unweighted (15in/s), 0.04% unweighted (30in/s); tape heads, three in line; tape transport direct drive DC servo capstan drive; equalisation switchable NAB/IEC/AES; bias frequency 250kHz; record level switchable 320/250/185 nWb/m; frequency response, ¼in 2-track 30Hz to 20kHz ±2dB (15in/s), 40Hz to 28kHz ±2dB (30in/s), ½in 4-track 30Hz to 20kHz ±2dB (15in/s), 50Hz to 28kHz ±2dB (30in/s); recording level 520nWb/m; distortion 0.3% max at 1kHz, 250nWb/m; S/N ratio 65dB unweighted NAB (15in/s) 2-track and 4-track, 66dB unweighted AES (30in/s) 2-track; crosstalk at 1kHz, >65dB ¼in, >60dB ½in; erasure >80dB; line inputs, input level +4dBm, minimum -6dBm; line output, max +28dBm, output impedance <40Ω, active, balanced; headphone output 0 to -10dBm at 8Ω impedance.

Otari 5050 Mark III/8

This new model is the successor to the Otari *MX5050-8D*, ½in 8-channel tape machine. The new machine retains the following features from the previous model; 15 and 7½in/s tape speeds; variable speed DC servo capstan motor; selective

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

Specifications: tape width ½in; reel size 10½in NAB; tape speeds 7½/15in/s, max deviation ±0.2%; pitch control ±7%; rewind time approx 90s for 2,500ft; wow and flutter (NAB weighted) <0.08% (7½in/s), <0.06% (15in/s); tape heads, ferrite erase, permalloy record and reproduce; tape transport, DC servo-controlled capstan motor, two torque reel motors; equalisation NAB or IEC; frequency response (overall record/playback) 20Hz to 20kHz ±2dB at 0VU, -10dB (7½in/s), 40Hz to 25kHz ±2dB at 0VU (15in/s); distortion <0.7% at 1kHz, 250nWb/m; S/N ratio 70dB NAB A-weighted (1,040nWb/m); crosstalk >55dB at 1kHz on adjacent tracks; test oscillator frequency nominal 1kHz and 10kHz; line inputs variable or fixed level selectable, unbalanced 50kΩ, fixed level +4dBm or -8dBm switchable (minimum -6dBm or -18dBm); external oscillator input minimum -18dBm, unbalanced 10kΩ; line outputs, fixed level +4dBm or -8dBm rear panel switch selectable, headroom +21dBm before clipping, load impedance >600Ω unbalanced.



Otari MX5050-BQII

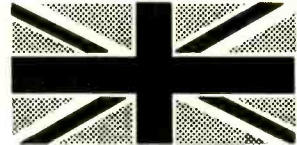
This new ¼in, 4-channel tape machine is the successor to the Otari *5050QXD* recorder. The *MX5050-BQII* has tape speeds of 7½/15in/s, motion sensing control logic, selective reproduce, variable speed DC capstan servo motor, built-in test and cue oscillator, and a plug-in head assembly. New features include microprocessor controlled transport, electronic realtime counter with LED display, automatic monitor switching,

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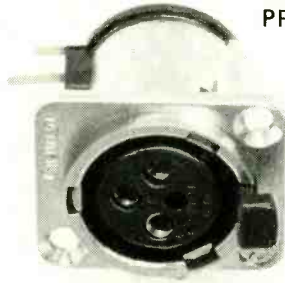


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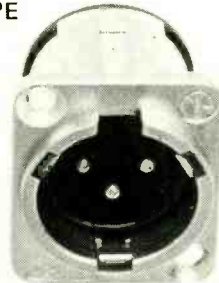


PRINTED CIRCUIT TYPE

NC3 FD-H



NC3 MD-V



NON-LATCHING TYPE

NC3 FZ

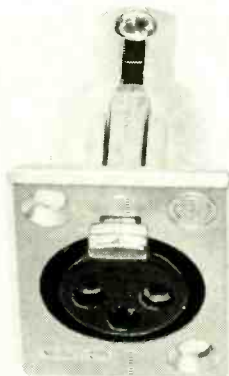


NC3 MZ



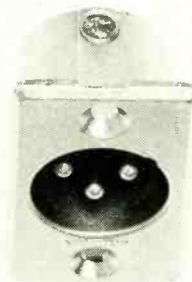
STANDARD TYPE

NC3 FP



*also available in
4 & 5 pin*

NC3 MP



Sole Agents U.K.

Eardley Electronics Ltd

Eardley House, 182-184 Campden Hill Road, Kensington, London W8 7AS

Telephone: 01-221 0606 Telex: 299574

new 2- to 8-track Tape machines products

For address details see product guide

selectable 20dB mic input attenuator, selectable track headphone monitoring, PPMs on each channel, and separate mic/line mixing on each channel. Other features include 10½in reel capacity, front panel editing and adjustable cue, bridging input, and low impedance output. Options include balanced 600Ω line I/O transformers and remote control unit.

Specifications: tape width ¼in; reel size 10½in NAB; tape speeds 7½/15in/s, max deviation ±0.2%; pitch control ±7%; rewind time approx 90s for 2,500ft; wow and flutter (NAB weighted) <0.08% (7½in/s), <0.06% (15in/s); tape heads, two erase heads (tracks 1/3 and 2/4) plus record and reproduce; tape transport, DC servo-controlled capstan motor, two torque reel motors; equalisation NAB or IEC; frequency response (overall record/reproduce) 20Hz to 18kHz ±2dB at 0VU, -10dB (7½in/s), 30Hz to 20kHz ±2dB at 0VU (15in/s); distortion <0.7% at 1kHz, 250nWb/m; S/N ratio 69dB NAB A-weighted (1,040nWb/m); crosstalk >55dB at 1kHz on adjacent tracks; test oscillator frequency nominal 1kHz and 10kHz; line inputs, minimum -6dBm or -18dBm switchable, unbalanced 50kΩ; mic inputs, minimum -72dBm, unbalanced, applicable mic impedance 150Ω to 10kΩ; external oscillator input, minimum -18dBm, unbalanced 10kΩ; line outputs, fixed level +4dBm or -8dBm switchable, load impedance >600Ω unbalanced, max line output level +21dBm into 600Ω, headroom +21dBm before clipping; headroom output -19dBm, load impedance 600Ω or more.

Revox PR99

Based on the Revox B77 range of tape machines, the Revox PR99 Series is the direct result of the demands of recording and broadcast studios for a more professional version of the B77 range with extended facilities. Incorporating balanced line inputs and outputs, 2-channel self-sync, flat-deck mounting for easier editing and optional balanced mic inputs — the PR99 is available in half track ¼in high speed (7½/15in/s, NAB or IEC EQ) and standard speed (3¾/7½in/s, NAB) versions, both of which are rack-mountable. Further versions include models with a built-in monitor amp, mono machines and playback-only units. Features include automatic sync/input switching; balanced line-in/line-out with calibrated/uncalibrated level adjustment; manual, remote control, or fader start



operation; full editing facilities; tape dump facility; 10½in reel capacity; plug-in modular audio electronics; logic controlled tape motion with infra-red tape sensor; removable die-cast head assembly; brushless AC-motors with direct-drive, servo-controlled capstan and electronically controlled spooling motors; front panel ¼in headphone output jack; and illuminated VU meters with LED peak indicators (peak threshold internally adjustable). Options include a varispeed remote control unit with 7-semitone coarse and 1-semitone fine adjustment.

Specifications: tape transport, two AC spooling motors and a single AC capstan motor, electronically regulated; tape speeds 3¾/7½in/s or 7½/15in/s; varispeed option 2½ to 11in/s or 5 to 22in/s; wow and flutter <0.1% (3¾in/s), <0.08% (7½in/s), <0.06% (15in/s); tape slip max 0.2%; winding time approx 120s for 2,500ft of tape; equalisation NAB all speeds, CCIR/IEC available on high speed version; frequency response (via tape, -20VU) 30Hz to 16kHz +2/-3dB (3¾in/s), 30Hz to 20kHz +2/-3dB (7½in/s), 30Hz to 22kHz +2/-3dB (15in/s); operating level 250nWb/m 0VU; level metering ASA standard VU meter plus LED peak level indicators (6dB above operating level, adjustable); distortion at 0VU <1% (3¾in/s), <0.6% (7½in/s), <0.6% (15in/s); S/N ratio >63dB standard speed version, >66dB high speed version; crosstalk, stereo >45dB, mono >60dB; erase depth at 7½in/s >75dB (1kHz); line inputs ≥5kΩ unbalanced, CAL +4dBu (adjustable ±10dBu), UNCAL sensitivity variable up to 10dB above CAL input; max line input level +22dBu (>40Hz); mic inputs 100kΩ unbalanced, LO -70dBu (max -24dBu), HI -42dBu (max +4dBu); optional balanced mic inputs, >1.2kΩ (40Hz to 15kHz), LO -82dBu (max -36dBu), HI -54dBu (max -7dBu); line outputs balanced, source impedance 50Ω, CAL +4dBu into 600Ω (adjustable -20/+9dBu) UNCAL output level variable up to 10dB above CAL output; max line output level +22dBu into 600Ω, +20dBu into 200Ω; headphones output max 5.6V, internal resistance 220Ω, short circuit proof.



Teac 44

A new addition to the Teac range of tape machines is the Model 44, 4-channel ¼-track machine utilising ¼in tape. Accepting up to 10½in reels, the new machine operates at either 7½ or 15in/s with NAB equalisation. The 44 features ±6% pitch control, unbalanced inputs and outputs and uses an AC hysteresis synchronous capstan motor

and AC eddy current induction type reel motors in the tape transport. This new model is due to be introduced at the 70th AES Convention in New York where fuller details will be available.

Specifications: tape speeds 7½/15in/s switchable; speed accuracy ±0.5% deviation; pitch control ±6%; wow and flutter 0.04% RMS (NAB weighted) 7½in/s, 0.06% RMS (NAB weighted) 15in/s; fast wind time 120s for 2,400ft; start time <1.5s to reach standard wow and flutter (15in/s); head configuration erase, record, reproduce; line input impedance 20kΩ unbalanced, max source impedance 10kΩ, nominal input level -10dBV, minimum input level -24dBV; line output impedance 1kΩ unbalanced, nominal load impedance 10kΩ, nominal output level -10dBV, max output level +2dBV; bias frequency 100kHz; equalisation NAB; record calibration 250nWb/m 0VU adjustable, LEDs preset at signal level of 10VU; frequency response (record/reproduce/sync, 0VU) 40Hz to 14kHz ±3dB (7½in/s), 40Hz to 22kHz ±3dB (15in/s); THD at 0VU, 1%; S/N ratio at 10dB above 0VU, 65dB A-weighted (NAB), 92dB A-weighted (NAB) with dbx noise reduction (both at 15in/s), 63dB A-weighted (NAB), 92dB A-weighted (NAB) with dbx noise reduction (both at 7½in/s); adjacent channel separation >45dB; erasure >65dB (1kHz, +10VU); headroom >23dB above 0VU record amp and playback amp. Note 0dBV is referenced to 1V in these specifications.



Telex 3000 Series

Telex/Magnecord has introduced a new tape transport to its Magnecord range. The 3000 Series transport is a 3-motor unit accepting reels up to 10½in with NAB type A or B hubs, and fits standard equipment racks. The new transport is available in 3¾/7½in/s or 7½/15in/s versions for either 120V 60Hz or 240V 50Hz. Compatible with the Telex RP85 record/play preamp, the 3000 Series may be ordered as a complete recorder/reproducer package or separately. Single, 2- or 4-channel systems are available and include the transport, amplifier(s), cables and rack-mount adapter.

Features of the 3000 Series transport include transformer isolated CMOS logic tape motion controls with LED indication of operating mode, automatic cycling facility with an infra-red end-of-tape sensing circuit, and automatic cue release (AQR) 3-position switch to control the tape lifters and provide simpler cueing and editing. A variety of interchangeable head configurations are available for ½-track, single-channel to ¼-track, 4-channel configurations and the headblock will accommodate up to four heads. The 3000 Series transport is fitted with a hinged rear panel which provides quick access to the unit's plug-in PCBs and plug-in connectors. ■

More time on your hands from MXR.

Providing extended delay times at an affordable price, the new MXR Model 151 Delay System II gives you over three full seconds of delay (three times that of similarly-priced digital devices). Specifically, the Delay System II can offer you up to 800 milliseconds of clean, quiet delay at a full 16 kHz bandwidth (over 200 milliseconds more than the closest competitor). As a digital recorder, the Delay System II's exceptional memory capability lets you capture entire musical phrases or obtain a wide variety of dynamic and musical studio-quality effects from flanging and chorus to echo and doubling in one rugged package.

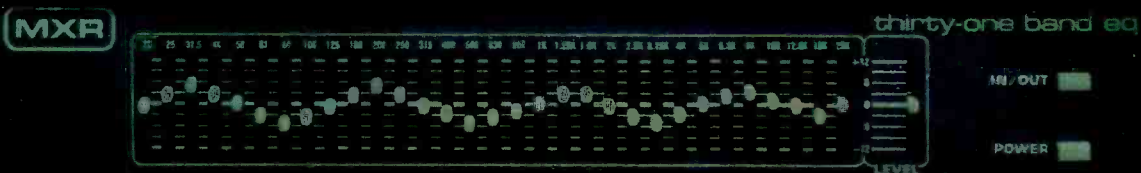
And it's easy to use in real time. The large front panel and simple control format make it a snap to quickly select from a vast range of time delay effects. The Delay System II's high-resolution four digit readout displays the precise amount of delay and the bandwidth is indicated by LED's, so there's no "squinting & thinking" to find out exactly where you are. Level-indicating LED's let you set up the optimum level in seconds.

The Delay System II fits right into your rack, looks great and provides clean, noise-free performance. A level switch is provided to optimize signal-to-noise for professional/home recording and onstage applications. The Delay System II also features easy access with both XLR and phone jack connectors (inputs and outputs) on the rear panel for instant interfacing with your patch bay.

MXR Delay System II—More time on your hands and more ways to use it as a creative tool on stage and in the studio. Hand-assembled in the U.S.A. with the finest components available in a compact, easy-to-use rack-mountable package.

MXR Professional Products Group

MXR Innovations (Europe),
Wallace Way,
Hitchin, Herts. SG40SE, Eng
Phone 0462 31513 Tlx 826967



product 2- to 8-track Tape machines guide

A number of the tape recorders given in this listing are available in larger formats. These are marked with an asterisk and will be included in our coverage of 16-track and above recorders next month. All frequency response measurements are given at 15in/s unless otherwise specified.

ABE (West Germany)

ABE Becker GmbH & Co, Mainaustrasse 5, D-7750 Konstanz. Phone: 07531 21536.

MTR Series*: 8-track on 1in, 7½/15in/s; frequency response ±1.5dB 30Hz to 18kHz; +30 to -50% varispeed; CCIR or NAB EQ.

ACCURATE SOUND (USA)

Accurate Sound Corp, 114 5th Avenue, Redwood City, Cal 94063. Phone: (415) 365-2843. Telex: 348327.

Model 2600 Transport*: 8-track on 1in, 4-track on ½in and ¼in, 2-track and full track on ¼in; ¾/15in/s.

AMPEX (USA)

Ampex Corporation, 401 Broadway, Redwood City, Cal 94063. Phone: (415) 367-2011. Telex: 348464.
UK: Ampex Great Britain Ltd, Acre Road, Reading RG2 0QR. Phone: 0734 85200. Telex: 848346.

ATR100: 1- or 2-track on ¼in, 4-track on ½in; ¾/17½/15/30in/s, also 2-track on ½in mastering format; frequency response ±0.75dB, 100Hz to 15kHz; closed-loop servo tape drive without pinch rollers; autocue and varispeed options; cue amplifier; 2-track ½in heads; 4-speed dual EQ padnet.

ATR700: 1-, 2- or ¼-track on ¼in; ¾/17½/7½/15in/s; frequency response ±3dB 40 to 100Hz, 100Hz to 18kHz ±2dB; space for extra head; DC servo capstan motor; tape lifter; varispeed; XLR connectors.

Ampex ATR100



MM1200*: 8-track on 1in; 7½/15 or 15/30in/s; frequency response ±2dB 50Hz to 18kHz 'overall' in sync and record modes; DC (phase lock) servo direct-drive capstan; search-to-cue facility; plug-in headblock with automatic tape tension correction. Optional extras include PURC (pick-up recording capability accessory) for 'clean, precise insert edits'; -50 to +150% varispeed; plus EECO time-code synchroniser and other video-orientated accessories.

ATR124*: 8-track on 1in; 7½/15/30in/s; frequency response ±2dB 25Hz to 20kHz; varispeed -50 to +200%; accepts up to 16in reels; NAB/IEC/AES assignable EQ; memory stores of channel and monitor modes; variable shuttle control; optional remote.

ASC (West Germany)

Audio System Componenten GmbH & Co, Seibelstrasse 4, D-8752 Hösbach. Phone: 0 60 21/53021. Telex: 04188571.

UK: Audio Systems Components Ltd, 32 Crown Lane, Theale, Berks RG7 5BG. Phone: 0734 302108.

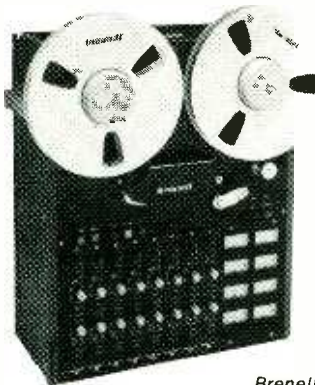
AS6002/38: 2-track, optional ¼-track head, ¾/17½/15in/s; frequency response 20Hz to 25kHz; plug-in headblock; optional extra head.

BRENELL (UK)

Allen and Heath/Brenell Ltd, Pembroke House, Campsbourne Road, London N8. Phone: 01-340 3291. Telex: 267727.

USA: Audio Marketing Ltd, 652 Glenbrook Road, Stamford, Conn 06906. Phone: (203) 359-2312.

Mini 8: 8-track on 1in; 7½/15in/s; frequency response ±2dB 30Hz to 20kHz; individual record/standby channel status; self-centering hubs to reduce mechanical vibration; horizontal or vertical operation.



Brenell Mini 8

CB ELECTRONICS (UK)

CB Electronics Ltd, 10 Fitzroy Crescent, Woodley, Berks RG5 4EU. Phone: 0734 694512.

400 Series*: 1- to 32-track on 1in or 2in; 15/20/30in/s; 24/25 frames, 16/35mm/s on film; frequency response ±2dB 20Hz to 20kHz; NAB and DIN EQ at 15in/s, AES at 30in/s; separate sync amp; phase correction master bias; silent gapless drop-in; noise gate on every channel; servo capstan; bi-directional servo on spool motors; 4-cue position autolocate with search and repeat.

CEI (Australia)

Consolidated Electronic Group, PO Box 21, Anderson Road, Thornbury, Victoria 3071. Phone: 44 07 91. Telex: 32463.

Cuemaster 77 Mk VC: full and 2-track on ¼in, 4-track also available; ¾/17½/15in/s; frequency response ±2dB 30Hz to 20kHz; slant 'S' tape path for easy access, varispeed spooling, auto capstan shut-off after 2min of non-operation; IEC EQ with NAB option.

Cuemaster 77 Mk VI: identical to VC model but with different deck size for 10½in reel.

Cuemaster Series 2000: mono or stereo on ¼in; 7½/15in/s or ¾/17½in/s; frequency response ±1dB 30Hz to 20kHz; modular construction; servo-controlled tape tension; NAB or cine reels; front panel cue and alarm indicator.

ELECTRO SOUND (USA)

Electro Sound, 160 San Gabriel Drive, PO Box 60639, Sunnyvale, Cal 94088. Phone: (408) 245-6600. Telex: 346324.

Tape recorder: full, 2-track and stereo on ¼in, 4- and 8-track on 1in, ¼in transport 7½/15in/s or ¾/17½in/s, 1in transport 7½/15in/s or 15/30in/s, frequency response ±2dB 30Hz to 20kHz; NAB EQ with IEC as option; built-in audio test oscillator; optional third reel for ease of tape editing; bias indicator light; edit footswitch; transport for 8-track is scaled-up version of smaller decks and is substantially larger.



Enertec F462

ENERTEC (France)

Enertec SA, Dept Audio Professional, 226-296 Avenue Napoleon Bonaparte, F-92505 Reuil Malmaison Cedex. Phone: (1) 732.92.23. Telex: 203404.

UK: Clive Green & Co Ltd, Britannia House, Leagrave Road, Luton LU3 1RJ. Phone: 0582 411513. Telex: 826138.

F462: full, 2-track or stereo on ¼in; 7½/15in/s, options for ¾/17½in/s and 15/30in/s; frequency response ±2dB 40Hz to 18kHz; optional varispeed; CCIR/NAB EQ; XLR connectors; optional local monitoring, zero locator; optional pilot track models.

FERROGRAPH (UK)

Ferroglyph Recorders, Unit 21, Royal Industrial Estate, Jarrow, Tyne & Wear NE32 9XX. Phone: 0632 893092. Telex: 537227.

USA: Neal-Ferroglyph (USA) Inc, 652 Glenbrook Road, Stamford, Conn 06906. Phone: (203) 348-1045. Telex: 643678.

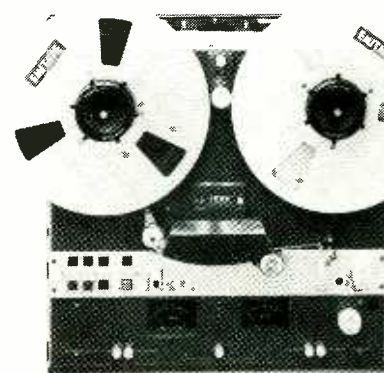
Studio 8: 1- or 2-track on ¼in (or 0.15in to special order); ¾/17½in/s or 7½/15in/s; varispeed; mic inputs optional; built-in monitor speaker amps; variable (preset) spool speed; bin/dump or standard edit; LED elapsed-time display; available with penthouse electronics.

SP7: 1- (full or ½) or 2-track (½ or ¼) on ¼in; ¾/17½/15in/s, 1⅞/13¾/17½in/s or 1½/11⅞/3¾in/s; frequency response ±2dB 30Hz to 20kHz; variable speed spooling; fast start on Run (0.1s for correct speed); three motors, heads and speeds; tape/source switching; IEC or NAB EQ; range of accessories available; logging and delay versions available with IBA approval.

Logic 7: 2-track (½ or ¼) on ¼in; ¾/17½/15in/s, 1⅞/13¾/17½in/s, 1½/11⅞/13¾in/s; frequency response ±2dB 30Hz to 20kHz; command memory; variable speed spooling; fast start on Run (0.1s for correct speed); three motors, heads and speeds;

38 ▶

Ferroglyph SP7



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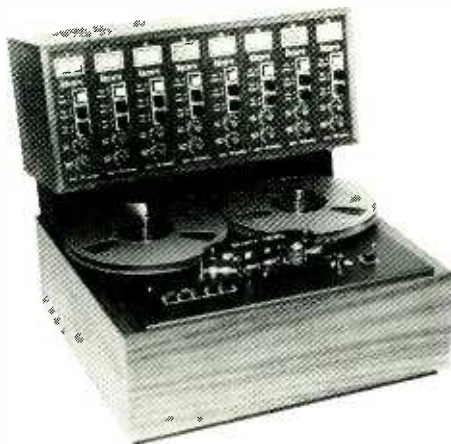
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product 2- to 8-track Tape machines guide

Itam 806



tape/source switching; range of accessories available.

Edit 7: replay only for editing use, can handle up to 8 1/4 in reels; 3 3/4/7 1/2/15 in/s with continuously variable fast wind speeds; mono or stereo versions; headphone provisions.

SP744: 4-channel version of *SP7* for multichannel work; three motors, heads and speeds; command memory; accepts all reel types and can handle up to 10 1/2 in reels with variable speed spooling; full sync capability.

FOSTEX (Japan)

Fostex Corp, 512 Miyazawacho, Akishima, Tokyo. Phone: 0425-45-6111. Telex: 2842-203.

USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, Cal 90650. Phone: (213) 921-1112.

UK: Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9304. Telex: 25769.

A-8: 8-track on 1/4 in (2 x 4-channel record, 8-channel reproduce); single speed 15 in/s; $\pm 10\%$ pitch control; frequency response $\pm 3\text{dB}$ 45Hz to 18kHz; IEC EQ; accepts 7 in spools; incorporates Dolby-C noise reduction; optional remote; return to zero.

A-4: 4-track on 1/4 in; 7 1/2/15 in/s; $\pm 10\%$ pitch control; frequency response $\pm 3\text{dB}$ 40Hz to 22kHz; NAB EQ optional IEC; accepts 7 in spools; optional remote; return to zero.

A-2: 2-track on 1/4 in; 7 1/2/15 in/s; $\pm 10\%$ pitch control; frequency response $\pm 3\text{dB}$ 40Hz to 22kHz; NAB EQ optional IEC; accepts 7 in spools; optional remote; return to zero.

ITEM (USA)

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

1100A Series: 1- or 2-track on 1/4 in, 4-track on 1/2 in; 7 1/2/15/30 in/s; frequency response $\pm 2\text{dB}$ 30Hz to 15kHz; crystal-controlled servo capstan with 7 1/2 to 30 in/s varispeed; servo-controlled spool motors; plug-in headblocks.

1100B Series: 4-track on 1/2 in, 4/8-track on 1/2/1 in and 8-track on 1 in; 7 1/2, 15 or 30 in/s; other features as 1100A Series.

1000 Series*: 8-track on 1 in; 7 1/2/15/30 in/s; frequency response $\pm 2\text{dB}$ 30Hz to 15kHz; features as 1100 Series, plus 14 in reel handling.

ITAM (UK)

Industrial Tape Applications Ltd, 1-7 Harwood Avenue, Marylebone Road, London NW1. Phone: 01-724 2497/7368. Telex: 21879.

806: 8-track on 1/2 in; 15 in/s; frequency response: $\pm 2\text{dB}$ 40Hz to 22kHz via tape; $\pm 3\text{dB}$ 70Hz to 17kHz for sync mode; relay-solenoid logic (based on

Studer/Revox transport); servo-controlled capstan with 100% varispeed; modular plug-in electronics; Dolby-A and dbx.

810: 8-track export only version of the 1670 16-track machine. 8-track on 1 in; 7 1/2/15/30 in/s; frequency response $\pm 2\text{dB}$ 30Hz to 22kHz; $\pm 50\%$ varispeed. Plug-in headblock with rotating tape guides; modular plug-in electronics; dbx.

LEEVEERS-RICH (UK)

Leeveers Rich Ltd, 319 Trinity Road, London SW18 3SL. Phone: 01-874 9054. Telex: 923455.

Proline 2000TC: 1- or 2-track on 1/4 in; 3 3/4/7 1/2 in/s, 7 1/2/15 in/s, 15/30 in/s; frequency response $\pm 2\text{dB}$ 30Hz to 18kHz; twin DC servo-controlled capstans with crystal reference; DC spooling motors with constant velocity, variable speed spooling; 5.9 32 in/s varispeed; dump edit; constant tape tension in all modes, speeds and reel sizes; NAB/DIN (IEC) switched EQ; plug-in open face headblock and modular electronics; provision for external capstan drive; various control panel options for TV, radio and recording studios.

Proline 1000SC: 1- or 2-track on 1/4 in; 3 3/4/7 1/2 in/s, 7 1/2/15 in/s, 15/30 in/s; frequency response $\pm 1\text{dB}$ 100 Hz to 10kHz; mains-locked capstan motor on 1000, or servo-controlled on 1000SC; servo tape tension control; variable speed spooling; plug-in open face headblock; modular electronics; varispeed for 1000SC; NAB/DIN (IEC) switched EQ; electronic adjustment of starting tensions and specially-designed air damping for optimum starting and spooling conditions.

E200: 1- or 2-track on 1/4 in; 3 3/4/7 1/2 in/s, 7 1/2/15 in/s; frequency response $\pm 2\text{dB}$ 40Hz to 18kHz; 'logic semi-interlock'; modular tape transport and electronics; servo-controlled tape tension; plug-in headblock; NAB or DIN (IEC) EQ on plug-in cards.

LYREC (Denmark)

Lyrec Manufacturing A/S, Hollandsvej 12, DK-2800, Lyngby. Phone: 02 87.63.22. Telex: 37568.

UK: Lyrec (UK) Ltd, 19 Encroft Way, Twickenham TW1 1DA. Phone: 01-891 2022.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Conn 06801. Phone: (203) 744-6230. Telex: 969638.

TR532*: 8-track on 1 in; 15/30 in/s; frequency response $\pm 1\text{dB}$ 60Hz to 18kHz at 30 in/s for record/repro; DC servo direct-drive capstan; search-to-cue and 7 1/2 to 60 in/s varispeed; full selsync plus 'aux sync' on all tracks; servo-controlled winding tape tension with adjustable winding speed limit; swivel-mounted transport; interchangeable headblocks; optional audio and tape controller; positive/negative tape timer; varispeed with speed read out; shuttle mode between two positions; playtime computing for shuttle distance.

TR55: 1- or 2-track on 1/4 in; 7 1/2/15 in/s; frequency response $\pm 1\text{dB}$ 60Hz to 18kHz; varispeed - 50 to + 100%; accepts reels up to 14 in; search-to-cue; variable wind speed. NAB or CCIR EQ.

MARK LEVINSON (USA)

Mark Levinson Audio Systems, 55 Circular Avenue, Hamden, Connecticut 06514. Phone: (203) 281-6333. Telex: 966405.

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

ML5 Recording System: comprises *ML5* recorder, *LNP2* preamp, Bruel & Kjaer mic system. *ML5* 2-track on 1/4 in (various other configurations including 24-track available); 15/30 in/s; frequency response $\pm 0.5\text{dB}$ 125Hz to 20kHz; NAB or IEC EQ; uses Studer transport.

MCI (USA)

MCI Inc, 1400 W Commercial Blvd, Fort Lauderdale, Florida 33309. Phone: (305) 491-0825. Telex: 514362.

UK: MCI (Professional Studio Equipment) Ltd, MCI House, 54-56 Stanhope Street, London NW1 3EX. Phone: 01-388 7867. Telex: 261116.

JH-110 Series: 1- or 2-track on 1/4 in, 4-track on 1/2 in, 8-track on 1 in; 3 3/4/7 1/2/15 in/s or 7 1/2/15/30 in/s; frequency response + 0.75/ - 2dB 50Hz to 20kHz at 30 in/s; DC capstan servo systems; three transformerless differential inputs and outputs; differential head coupling; linear phase response; switchable NAB/CCIR EQ; QUIOR circuitry; option to accept 14 in spools; return-to-zero facility; tape velocity indicator.

JH-24*: 8-track on 1 in; 15/30 in/s; frequency response + 1.5, - 2dB 30Hz to 26kHz; DC servo-controlled *JH-114* type transport for reels up to 14 in; QUIOR circuitry; NAB/CCIR/AES selectable EQ, remote controls as standard; transformerless electronics; spot erase; accessories include autolocator.

MECHLABOR (Hungary)

Electroimpex, PO Box 296, H-1392 Budapest. Phone: 321330. Telex: 225771.

STM-600 Series: mono, stereo, 2-track; 7 1/2/15 in/s or 3 3/4/7 1/2 in/s; frequency response $\pm 3\text{dB}$ 30Hz to 18kHz.

MCI JH-110C-8-HP



BROADCAST MONITOR RECEIVER 150kHz-30MHz



We have taken the synthesised all mode FRG7700M communications receiver and made several well thought out modifications to provide a receiver for rebroadcast purposes or checking transmitter performance as well as being suited to communications use.

PRINCIPAL MODIFICATIONS: * Radically redesigned front end stages yielding improved noise figure and overload levels, TOIP - 24dB (originally - 21dBm) * Flat audio response and lower AM distortion * Balanced audio line output * Buffered IF output for monitoring transmitted modulation envelope on an oscilloscope * Mains safety improvements

The receiver is available in free standing or rack mounting form and all the original features are retained: 12 memory channels, mains or battery operation option, IF bandwidths 2.7kHz, 6kHz, 12kHz, digital frequency and time display, timer for unattended recordings or external switching, advanced noise blanker, all modes including NBFM with squelch. Versions from 400 plus VAT.

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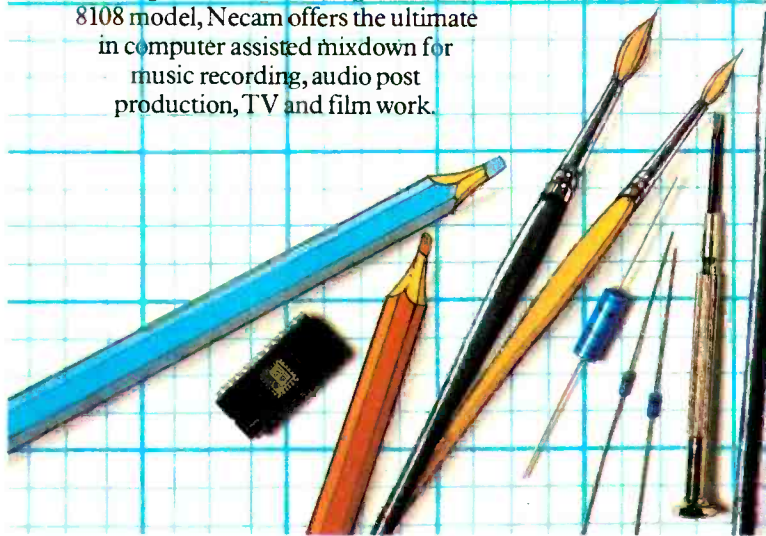
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Cambridge House, Melbourn, Royston,
Herts. SG8 6AU England
Tel: (0763) 60776. Telex: 81381

Rupert Neve Incorporated.
Berkshire Industrial Park, Bethel, Connecticut 06801.
Tel: (203) 744-6230. Telex: 969638

Rupert Neve Incorporated.
7533 Sunset Boulevard, Hollywood, California 90046.
Tel: (213) 874-8124. Telex: 194942

Rupert Neve of Canada Limited
2721 Rena Road, Malton, Ontario L4T 3K1, Canada
Tel: (416) 677-6611. Telex: 981502.



product 2- to 8-track Tape machines guide

3M (USA)

3M Company, 3M Centre, St Paul, Minnesota 55101. Phone: (612) 736-9567. Telex: 297434.
UK: 3M (UK) Ltd, PO Box 1, Bracknell, Berks RG12 1JU. Phone: 0344 26726. Telex: 849371.

M79*: 8-track on 1in; 7½/15in/s or 15/30in/s; frequency response +1/-2dB 50Hz to 15kHz; DC servo capstan and spool motors; Isoloop drive system; 3.9 to 49in/s varispeed; sync facility; Sonoplan autolocator.

MOBILE FIDELITY (USA)

Mobile Fidelity Sound, PO Box 2157, Olympic Valley, Cal 95730. Phone: (916) 583-2664.

Supermaster: stereo on ½in; 30in/s; frequency response ±1dB 15Hz to 30kHz (-3dB at 50kHz); record/replay electronics mounted on Studer A80 transport; electronics completely Class A push-pull with discrete electronics; individually buffered power supplies for each channel; no transformers, phase compensated electronics; electronics may be purchased separately.

NAGRA (Switzerland)

Kudelski SA, CH-1033 Cheseaux-sur-Lausanne. Phone: 021 91.21.21. Telex: 24392.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Phone: 02813 88447. Telex: 849469.
USA: Nagra Magnetic Recorders Inc, 19 W 44th Street, Room 715, New York, NY 10036. Phone: (212) 840-0999. Telex: 710-581 2443.

IV-S: 2-track plus *Neoplasync* on ½in; 3¾, 7½, 15in/s; frequency response ±1dB 30Hz to 20kHz; portable — mains or battery powered; built-in reference oscillator; NAB or CCIR switchable EQ; variety of options and accessories available including large reel adaptor, mic preamps, and Dolby.

4.2: 1-track plus *Neopilot* on ½in; 3¾, 7½ and 15in/s; frequency response ±1.5dB 30Hz to 20kHz; features similar to IV-S.

E: 1-track on ½in; 3¾in/s; frequency response ±2dB 50Hz to 15kHz; mains or battery powered portable derived from 4.2 transport; NAB or CCIR EQ; diagram and spare parts for field maintenance.
SN: 1-track (with or without pilot-tone) on 0.15in; 1½ and 3¾in/s; frequency response ±2dB 80Hz to 15kHz at 3¾in/s; miniature battery powered portable; variety of accessories available.
SNS: ½-track; 1½ and ¾in/s cm/s version of model SN.

T-1: 4-channel on ½in; 1½/3¾/7½/15/30/60in/s; frequency response direct module (AM) 40dB S/N 150Hz to 60kHz, FM module from DC in all cases 46dB to 5kHz. T-1 is an instrument recorder designed to operate to the IRIG intermediate band specification; twin capstan drive; built-in autolocator; search to zero; plug-in channel amps for AM or FM recording switchable constant amplitude/linear phase.

T-Audio: based on the T1 instrument recorder; 2- or 4-track on ½in; 3¾/7½/15/30in/s; frequency response ±1dB 30Hz to 20kHz; twin capstan drive; detachable remote and search-to-zero; accepts 12in spools.

T-RVR: 1- or 2-track plus timecode track on ½in; 1½/1¾/3¾/7½in/s; frequency response 58dB S/N 170Hz to 15kHz at 3¾in/s; rack mounting logging recorder; high speed search facility on playback x4 or x16; power required 20 to 30V DC. Accessories include second track; timecode track; timecode generator with master clock to IRIG B standard; continuous self-check circuit; time corrector x0.5 to x2 with pitch alteration.

IS: full track plus optional *Neopilot* on 3¾/7½in/s; frequency response ±2dB at -20dB 50Hz to 15kHz; mains or battery powered portable; capstan motor controlled with tachometric speed stabiliser, reel motors electronically controlled by tension arms; phantom powering; two mic inputs; high impedance line input; selection or metering; NAB or CCIR EQ.

OTARI (Japan)

Otari Electric Co, Otari Bldg 4-29-18 Minami,



Sony TC766-2

Ogikubo, Suginamiku, Tokyo. Phone: 03 333-9631. Telex: 26604.

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

UK: Industrial Tape Applications Ltd, 1-7 Harewood Avenue, Marylebone Road, London NW1. Phone: 01-724 2497/7368. Telex: 21879.

MX-5050-B: 1- or 2-track on ½in; 3¾/7½in/s or 7½/15in/s; frequency response ±2dB 30Hz to 20kHz; 4-band option-erase; ½-track record and replay, plus ¼-track replay; sync facility; NAB EQ with EIA, CCIR and IEC options; DC servo capstan with variable speed.

MX-5050 BQII: 4-track on ½in; 7½/15in/s; ±2dB 30Hz to 20kHz; DC servo capstan with ±7% varispeed; NAB or IEC EQ; interface for dbx or Dolby; separate transport and electronics module; plug-in head assembly.

MX-5050-Mk III-8: 8-track on ½in; 7½/15in/s; similar to MX-5050-BQII.

MX-7800: 8-track on 1in; 7½/15, 15/30in/s; frequency response ±2dB 30Hz to 18kHz; NAB EQ; DC servo capstan drive ±12% varispeed; head lifter defeat for cueing; plug-in heads.

MTR-10: 2-track on ½in, 4-track on ½in; 3¾/7½/15in/s or 7½/15/30in/s; frequency response ±2dB 30Hz to 20kHz; switchable NAB/IEC/AES EQ; DC PLL servo tape transport; microprocessor based; hinged top deckplate; adjustable phase compensation; bias, record and playback levels; integral multi-frequency square/sinewave generator; return to zero.

PHILIPS (Holland)

UK: Philips Electrical Ltd, City House, 420-430 London Road, Croydon, Surrey CR9 3QR. Phone: 01-689 2166.

USA: Philips Audio Video Corp, 91 Mckee Drive, Mahwah, New Jersey 07430. Phone: (201) 529-3800.

N4520: 2-track on ½in; 3¾/7½/15in/s; frequency response ±2dB 30Hz to 26kHz; NAB or IEC EQ; quartz locked direct drive.

SCULLY (USA)

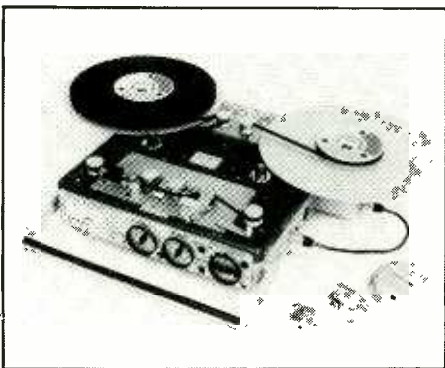
Ampro/Scully, Newton Yardley Road, Newton, Pennsylvania 18940. Phone: (215) 968-9000.

UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP. Phone: 09322 43124. Telex: 928475.

280B Series: full, ½-, 2- and 4-track on ½in, 4-track on ½in and 8-track on 1in; 3¾/7½/15/30in/s; frequency response: ±2dB 60Hz to 20kHz at 30in/s; DC servo or AC capstan; ±20% varispeed; remote control and Varisync options; **284B Series** accepts 14in reels.

250: 1- or 2-track on ½in; 3¾/7½, 7½/15in/s; ±2dB

Nagra E



50Hz to 18kHz; hysteresis synchronous direct drive capstan.

255: 3¾/7½in/s replay only version of 250 for broadcast use.

SONY (Japan)

UK: Sony UK Ltd, Pyrene House, Sunbury-on-Thames, Middlesex TW16 7AT. Phone: 09327 89581/876441. Telex: 266371.

USA: Sony Corporation of America, 9 W 57th Street, New York, NY 10019. Phone: (212) 371-5800.

TC766-2: 2-track on ½in; 7½/15in/s; frequency response ±3dB 30Hz to 22kHz; closed loop dual-capstan drive with AC servo control; four heads including ¼-track playback.

TC765: ¼-track version of TC766-2.

TC880-2: 2-track on ½in; 7½/15in/s; frequency response ±3dB 25Hz to 35kHz; similar to TC766-2 plus 'optical monitoring' with switchable VU; PPM or peak hold; calibrated input input and output controls; varispeed.

TC510-2: 2-track on ½in; 3¾/7½in/s; frequency response ±3dB 30Hz to 20kHz at 7½in/s; battery or mains powered portable; stop, record and playback on 3-position click-stop switch; varispeed.

SOUNDCRAFT (UK)

Soundcraft Magnetics Ltd, 5-8 Great Sutton Street, London EC1V 0BX. Phone: 01-253 9878. Telex: 21198.

USA: Soundcraft Inc, PO Box 2023, Kalamazoo, Michigan 49003. Phone: (616) 382-6300. Telex: 224408.

SCM381-8*: 8-track on 1in; 15in/s; varispeed +15-50%; frequency response +1/-2dB 30Hz to 20kHz; NAB EQ; removable front panel for remote control; capstan drives outside of tape; jack or multipin connectors; sync output.

STELLAVOX (Switzerland)

Stellavox, CH-2068 Hauterive/NE. Phone: 038 33.42.33. Telex: 35380.

UK: Future Film Developments, 36-38 Lexington Street, London W1V 3LE. Phone: 01-437 1892. Telex: 21624.

USA: ADB Alnaco, 6630 Tailor Road, Box 108, Blacklick (Columbus), Ohio.

SM8/SQ7: 2-track (*SM8*) and 4-track (*SQ7*) on ½in; 7½ and 15in/s; frequency response ±2dB 20Hz to 28kHz; battery or mains powered portable; built-in loudspeaker; twin PPM or VU metering; single transport control; mic/line inputs; 12/48V mic powering; mic attenuators.

SP8: 1- or 2-track on ½in; 3¾, 7½ and 15in/s; plug-in headblocks; frequency response ±2dB 30Hz to 18kHz in stereo mode at 7½in/s; similar to *SM8* with 50/60Hz pilot generator and cue track playback amp or synchroniser; EBU time code recording option also available.

TD88: 1-track (optional *Neopilot*) or 2-track (optional *Synchromote*) on ½in, 2-, 4- or 8-track on ½in and *Perfolape* for 16mm magnetic tape; 1½, 3¾, 7½, 15 and 30in/s plus 24 and 25 frame/s; interchangeable headblocks; varispeed option; plug-in head/electronics units.

STEPHENS (USA)

Stephens Electronics Inc, 3513 Pacific Avenue, Burbank, Cal 91505. Phone: (213) 842-5116.

Capstanless Multitrack*: 4-track on ½in, 8-track on 1in; 15/30in/s, plus 60in/s scan; capstanless tape transport system utilising servo-operated supply and take-up motors coupled with motion sensing; integral VSO system provides 10 to 80in/s varispeed; reels may be of differing sizes (and may be interchanged) as self-adjusting electronics 'guarantee proper tape tension'; optional self-contained 12V battery pack providing over four hours of recording time; sync lock for vertical sync pulse or 60Hz on tape; various remote control units and *QII* autolocator containing 10 memory locations available as extras. Standard deck is mounted in a custom built wooden cabinet. Portable cases are available on request. *Model 811D* electronics (4-, 8- and 16-track) features separate rotary channel-select switches for record/ready/sync selection.

STUDER/REVOX (Switzerland)

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf. Phone: 01 840.29.60. Telex: 58489.

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

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product 2- to 8-track Tape machines guide

USA: Studer Revox America Inc, 1819 Broadway, Nashville, Tenn 37203. Phone: (615)329-9576. Telex: 554453.

B67 Mk II: 1- or 2-track on ¼in; 3¾/7½/15in/s or 7½/15/30in/s; frequency response ±1dB 60Hz to 15kHz; varispeed and 'fader-start' options; NAB or CCIR EQ on plug-in cards; sync facility; tape dumping (motor off); accepts 11in tape pancakes.

A80/RC: 1- or 2-track on ¼in; 3¾/7½in/s, 7½/15in/s, 15/30in/s; frequency response ±1dB 60Hz to 15kHz; remote control and varispeed options; NAB or CCIR EQ on plug-in cards; variable spooling in edit mode; electronic tape timer plus 'zero locator'.

A700: 2-track (½- or ¼-track) on ¼in; 3¾/7½/15in/s; frequency response ±1.5dB 50Hz to 18kHz; crystal-controlled capstan; four mic inputs plus mixing; slide sync; varispeed and remote control as options.

B77: 2-track (½- or ¼-track) on ¼in; 3¾/7½in/s or 7½/15in/s; frequency response +2/-3dB 30Hz to 20kHz at 7½in/s; self-sync; slide sync, varispeed and remote control option.

B77 Special Versions: There are almost 70 variants of the B77, 2-track or ¼-track; standard 3¾/7½in/s, high speed 7½/15in/s in NAB or IEC, low speed 1½/3¾in/s, super low speed ±1½in/s; dissolve head amp for analogue control signals; dia-synchro for impulse type signals; free head for external electronics; autostart with variable threshold separately adjustable for each channel; self-sync with separate sync amp and monitoring facilities; and Dolby-B.

PR99 Series: 2-track on ¼in; 3¾/7½in/s and 7½/15in/s; frequency response ±1.5dB 50Hz to 18kHz; NAB EQ; fader start facilities; tape dump mode; balanced XLR inputs and outputs; optional balanced mic input; self sync and editing facilities; calibrated/uncalibrated operation; optional seven semitone varispeed; designed for the multiple needs of the broadcast studio.

A80VU MKII: 1/2-4-track on ¼ or ½in, 4- or 8-track on ½ or 1in; 7½/15in/s, 15/30in/s; frequency response ±2dB 30Hz to 18kHz; CCIR or NAB EQ; similar to A80/RC; prewired for autolocator; comprehensive remote control and varispeed; full selsync on all channels; variable spooling in 'edit' mode; amp functions may be remote controlled; pivoting transport; available in console or transport plus electronics module. *TL S2000* tape lock system can be used to synchronise two machines to an accuracy of ±100µs, with a lock-up time of about 3s.

A800*: 8-track on 1in; 7½/15in/s, 15/30in/s; frequency response ±2dB 30Hz to 20kHz; micro-processor controlled; electronic or manual editing; master NAB/CCIR switching; master bias setting; digital timer in realtime; zero locator; address locator; optional *Tape/lock* synchroniser; varispeed; complex metering and monitoring electronically switched.

TANDBERG (Norway)

Tandberg A/S, Fetveien 1, PO Box 53, N-2007 Kjeller.
UK: Tandberg (UK) Ltd, Unit 1, Revie Road Industrial Estate, Elland Road, Leeds LS11 8JG, West Yorkshire. Phone: 0532 774844. Telex: 557611.

USA: Tandberg of America Inc, Labriola Court, Armonk, NY 10504. Phone: (914) 273-9150. Telex: 137357.

TD20A: 2-track (½- or ¼-track) on ¼in; ¼-track 3¾/7½in/s, ½- and ¼-track 7½/15in/s; frequency response ±2dB 20Hz to 30kHz; phase correction network; selsync; front panel bias; optional infrared remote control; 4-motor drive; reel tension switch; mic attenuators.

TD20A-SE: similar to TD20A but features special equalisation capability (in addition to NAB/IEC) which reduces tape noise to -80dB at 15in/s. Also features *Dyneq* dynamic equalisation amplifiers which automatically adjust HF gain on record to avoid overloading. Both machines use *Actilinear* circuitry in signal handling.

TEAC (Japan)

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



Teac Tascam Series 80-8

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

A3440: 4-track on ¼in; 7½/15in/s; frequency response ±3dB 0VU 25Hz to 24kHz; ±5% varispeed; optional dbx noise reduction.

35-2: 2-track on ¼in; 7½/15in/s; frequency response ±3dB 40Hz to 22kHz; separate transport and electronics, built-in dbx. 4-track playback head included; front panel bias and EQ adjustment.

32-2: 2-track on ¼in; 7½/15in/s; frequency response ±3dB 0VU 40Hz to 20kHz; selectable EQ; closed loop transport system; varispeed; 2-position bias and EQ.

22-2: 2-track on ¼in; 7½/15in/s; frequency response ±3dB 0VU 40Hz to 22kHz; NAB EQ; accepts 7in spools; optional dbx.

22-4: 4-track on ¼in; 7½/15in/s; pitch control ±6%; frequency response ±3dB 0VU 40Hz to 22kHz; NAB EQ; accepts 7in spools; optional dbx.

44: 4-track on ¼in; 7½/15in/s; frequency response ±3dB 0VU 40Hz to 22kHz; ±6% varispeed; NAB EQ; accepts 10½in NAB reels; synchronous capstan drive.

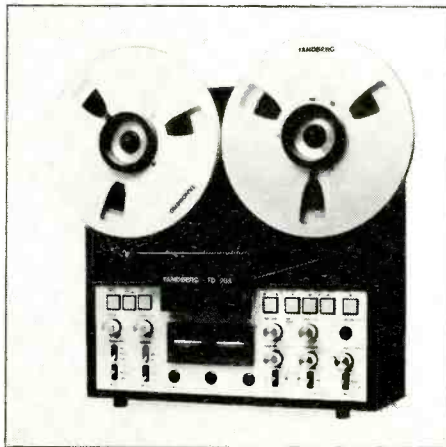
Tascam Series 80-8: 8-track on ½in; 15in/s; frequency response (sync mode) ±3dB 40Hz to 18kHz; features -10dB in/out interface; optional remote control and *DX-8* dbx noise reduction unit which includes auto switching; digital tape counter with search to zero; cue facility in fast wind; overload LEDs on each channel; vertical or horizontal operation.

TECHNICS (Japan)

UK: National Panasonic Ltd, 308-318 Bath Road, Slough SL1 6JB, Berks. Phone: 0753 34522. Telex: 847652.

USA: Panasonic Co, 1 Panasonic Way, Secaucus, New Jersey 07094. Phone: (201) 348-7000. Telex: 710-992 8996.

Tandberg TD20A



DIGITAL TAPE RECORDERS

The following companies manufacture digital tape machines which are not included in the Product Guides featured in this or our January issue: EMT (West Germany); JVC (Japan); Mitsubishi (Japan); 3M (USA); Sony (Japan); Technics (Japan).

Digital recording will be covered in greater depth in *Studio Sound* December 1982.

RS1500US: 2-track on ¼in; 3¾/7½/15in/s; frequency response ±3dB 30Hz to 30kHz; isolated loop tape path; DC servo-controlled capstan; 4-head including ¼-track playback; micline inputs; 3-way bias and EQ selection; remote control and battery adaptor (24V DC) options.

RS1700: similar to RS1500 but auto reverse.

RS1800: 2-track; 30in/s; frequency response -10dB 30Hz to 35kHz; auto play, auto repeat, etc.

TECNICOBEL (France)

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

MGB 60: 1- or 2-track on ¼in; 7½/15in/s standard, 3¾/7½in/s and 15/30in/s to order; frequency response ±2dB 30Hz to 18kHz; servo-controlled DC spooling motors; constant tape tension for all tape sizes; twin servo-controlled DC capstans with built-in varispeed; variable spooling speed.

TELEFUNKEN (West Germany)

AEG-Telefunken, Postfach 2154, D-7750, Konstanz. Phone: 07531 862460. Telex: 733233.

UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Phone: 02813 88447. Telex: 849469.

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

M15A*: 1- or 2-track (optional pilot tone or time code) on ¼in, 4-track on ½in, 8-track on 1in; 7½/15in/s, 15/30in/s; frequency response ±1dB 60Hz to 15kHz; autolocator with nine locations; varispeed; tuned record and bias switching for gapless click-free drop-in; interchangeable headblocks and modular electronics.

M12A: 1- or 2-track (optional pilot tone) on ¼in; 3¾/7½in/s, 7½/15in/s; frequency response ±1.5dB 30Hz to 16kHz; horizontal or vertical operation; interchangeable headblocks.

TELEX (USA)

Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420. Phone: (612) 884-4051. Telex: 297053.

UK: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA. Phone: 01-749 2201. Telex: 897749.

1400 Series: 1- or 2-track on ¼in; 3¾/7½/15in/s; frequency response ±2dB 35Hz to 22kHz; DC servo capstan.

230: series of heavy duty tape transports, 2-speeds, three motors suitable for remote controlled or automatic operation. Available in a wide variety of formats including 230L version as a logging recorder.

3000 Series: 1-, 2- or 4-track on ¼in tape transports including amps, cables and rack mount adaptor; speeds 3¾/7½in/s or 7½/15in/s. Features include automatic cycling, automatic cue release and transformer isolated CMOS logic controls.

UHER (West Germany)

Uher Werke Munchen, Barmseestrasse 11, D-8000, München 17. Phone: 089 78721. Telex: 0522932.

UK: Uher Sales and Services Ltd, 30-31 Lyme Street, London NW1. Phone: 01-485 0943/4.

SG630: 2-track (½- or ¼-track) on ¼in; 1½/3¾/7½in/s; frequency response 20Hz to 25kHz at 7½in/s; 4-motor *Omega Drive* without pinch roller interchangeable heads. 4000/4200/4400/C: ½-track mono (4000/C), ½-track stereo (4200/C) and ¼-track stereo (4400/C) on ¼in; 1½/3¾/7½in/s; frequency response 30Hz to 20kHz at 7½in/s; battery or mains powered portables; built-in monitor loudspeakers.

1200 Synchro: 1-track plus *Neopilot* on ¼in; 7½in/s; frequency response ±1dB 60Hz to 12.5kHz; connects to W352 unit, comprising a pilot-frequency amp, resolver and running-time moderator for frame-synchronisation.

AMPEX ON AUDIO



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THE ATR-700. A RUGGED PERFORMER THAT'S ALSO PORTABLE.

Our ATR-700 is a master performer. Perfect for those situations where quality is as important as efficient, trouble-free production. You'll find the ATR-700 to be a rugged performer for news and commercial assignments in the field, as well as a first class addition to your audio equipment in the studio.

You'll get standard features like important controls up front for easy operation, plug-in printed wiring assemblies for efficient service, and a built-in 4 in 2 out mixer.

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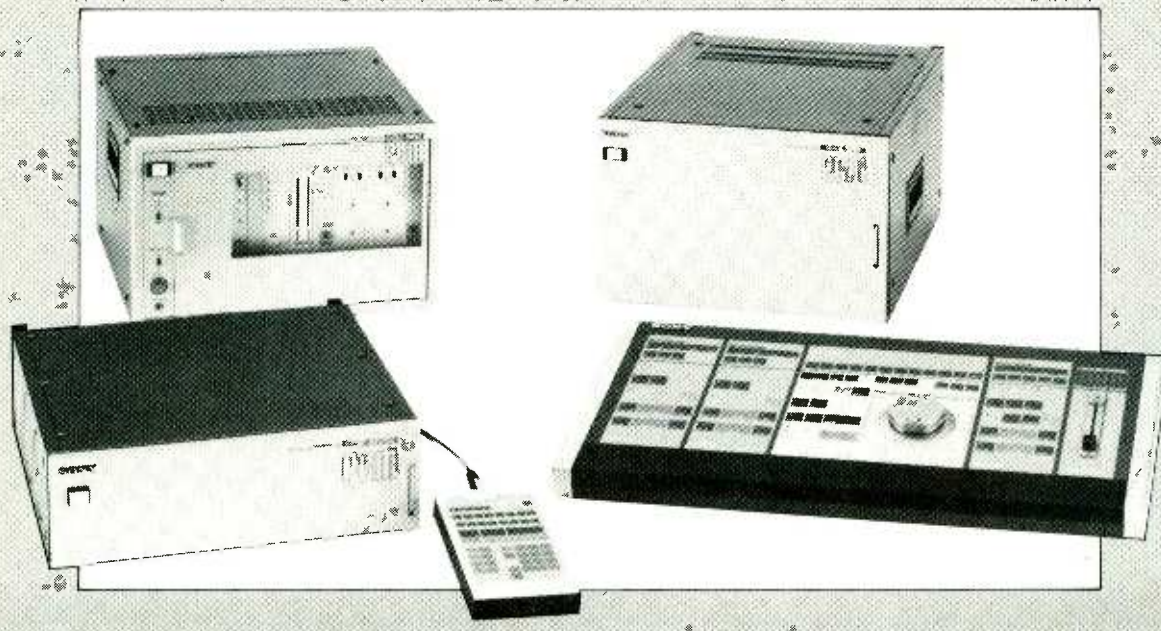
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Practical digital recording

Tony Faulkner



Sony's family of digital audio products

The next few years are going to mark a great 'sloughing of skin' for the recording industry with the advent of home digital audio and all its implications. The academics and 'musicality' esoteric hi-fi journalists will inevitably talk themselves blue in the face for a while yet about the latest old wives' tale concerning digital audio, much as they, or their equivalent numbers, did when LPs came along, and when stereo first appeared. The long-term future of the recording business depends ultimately on the health of the mass market, and it is undeniable that the new Compact Digital Audio Disc will have a huge effect in this area.

MY interest and active involvement in digital audio began in 1977 while I was Recording Manager for Enigma Records (UK classical division of WEA Records at that time). I had seen a photograph of some prototype Sony equipment in an AES Journal, and the whole concept fired my curiosity beyond control culminating in my arranging the loan of a set of gear for evaluation early in 1978. The first set-up was a PCM-1 (pseudo-video NTSC output, 44.056kHz sampling, 12 + 1 ranging bit quantisation) which fed a rather unreliable and rather worn early NTSC domestic Betamax videocassette recorder. The first sessions where we put the system through its paces thoroughly were in February 1978 with the London Gabrieli Brass Ensemble recorded in a church in St John's Wood, London. We wired the PCM-1 in parallel with the normal Studer B62/Dolby A361 analogue set-up, and left it to its own devices,

conducting the sessions as normal. The results from the digital equipment were stunning even over the less than ideal monitoring environment typical of recording on location. Later in the year we changed over to industrial U-matic videocassette recorders for their extra robustness and stability, since when using a pseudo-video digital 'black box' AD/DA converter one is vulnerable to major dropout problems if there are any deficiencies in the video chain. Ever since those days I have stuck with U-matics, although I understand the performance of the latest Industrial Betamax recorders is excellent. I consider it advisable to take a small black and white TV monitor on sessions to keep an eye out for potential video problems.

One's immediate reaction to 'going digital' is that one would just pull out one set of Cannon leads from the analogue gear, and then connect them to the PCM. Although such a

practice will obviously work, it is important to review some of one's attitudes in order to take full advantage of the improvements inherent in the medium. The first and most apparent effects of substituting a PCM set-up for the old analogue gear are the improvement in bass performance (-1dB at 2Hz on my machine), absence of noise-reduction envelope effects and the reduction in background noise, thereby freeing the sound considerably. Much as I otherwise respect the mathematical abilities of some experts, the effective subjective dynamic range of even a 14-bit digital recorder leaves any analogue system I have experienced sounding very noisy in a way one has never noticed before somehow. It is possible to juggle dB's around indefinitely, with a couple of extra decibels up one's sleeve, and to come up with analogue being the same as or superior to PCM. Unfortunately though, these learned equations do

not seem to agree in practice with what one's ears tell one, or at least what my ears tell me.

Since the point of going digital in the first place is primarily to be ready for consumer digital audio, it is well worth remembering that if one monitors the output of the PCM unit at all times after processing and deprocessing then one is effectively monitoring how the final mass-produced product will sound rather than having to wait for a test-pressing. It is advisable to control recording levels with some care; over-recording produces hard-clipping like an overdriven power amplifier, and under-recording by a significant amount will exaggerate the effects of increased distortion at low levels as the system 'runs out of bits'. With analogue recording, many engineers have grown blasé or careless about recording levels, and this situation is further encouraged by conventional mixer-desk metering. Most desks in

the UK seem to be equipped either with VU's calibrated in a variety of ways which bounce around sympathetically but give no consistently quantifiable programme measurement, particularly in classical music recording, or else the twitching 'intermittent windscreen wiper' action of a BBC-type PPM which although more accurate I personally find ultimately unsatisfactory. The digital recorders I have used, have all (or nearly all) had LED type metering far superior operationally in terms of absolute measurement and ballistic characteristics, and I would recommend relying on these meters rather than those on one's console.

With analogue taping one is generally reluctant to drive the tape hard to its limit all the time, because not only does the quality degrade noticeably even on first generation, but subsequent copies sound increasingly unpleasant. With digital, such a rule no longer applies, and it is best to put on as much level as possible and avoid hitting the absolute top for anything longer than the shortest duration peak. Copying digital-to-digital does not increase distortion at high levels and the clean recorded quality will find its way right through to the audio output of the domestic consumer's DAD laser-player.

Reverb tails

There has been much discussion about the reproduction of ambience and reverberation tails by digital recording. Under-recording dramatically on a system which has no 'dither' noise can in theory produce an effect whereby signals below a certain level are not reproduced at all, and this would obviously make reverberation tails disappear into a black hole. In my experience however, when levels are properly set, even with a 14-bit recorder, the reverberation tail disappears into system noise (studio noise, microphone and mixer hiss) much as it does with analogue recording only further down the tail in the absence of tape hiss, before it reaches the theoretical extinction point, which in the case of 14-bit and some 16-bit converters is masked in dither anyhow. In my experience digital recordings can sound a bit drier, closer and more 'clinical' than analogue ones, but by monitoring 'off-digital' throughout sessions such effects can be readily accommodated in mixing and microphone positioning. Curiously, transferring digital recordings onto conventional analogue tape sometimes seems subjectively to *add* some reverberation, if anything, presumably through the effects of compression, degraded noise-floor and print-through, so maybe we are fooling ourselves about analogue's supposed 'extra sense of ambience' anyhow,

having lived with its idiosyncrasies for 30 years.

My location recording equipment includes no analogue tape recorder at all. I first became a freelance independent engineer early in 1980 and I could find no justification for purchasing an expensive portable analogue machine with only a couple of years' commercial life. Consequently, if I am approached to engineer an analogue production, the sessions themselves are recorded digitally and the best takes are transferred onto a Studer console machine (with or without Dolby as required) for editing. This system is highly cost-effective since the PCM tapes may be reused at a later date, and the amount of analogue tape used is usually a third or so compared with straightforward analogue sessions. By working this way I regularly have the opportunity to hear the effects of analogue recording, and the alteration to subjective reverberation characteristics is interesting, as well as a loss of precision in stereo perspective, and the abrasive 'sandpaper' effects of HF modulation noise.

Since all of my recording sessions take place on location, going digital does tend to clutter the usual makeshift control rooms with clicking and whirring video recorders, which is an unfortunate side effect, shortly I understand to be improved with quieter transports. Nonetheless, I consider the videocassette approach

Digital control room set-up on location



to digital recording as ideal on two particular counts. Firstly the tape-machines are long-established in format and are easy to buy and sell, new or second-hand. Secondly *U-matic* tape-costs are practically identical to using $\frac{1}{4}$ in at 15in/s, except that the longer playing time of just over 60 min means that less tape gets wasted at the end of reels. The *U-matic* tapes are available from several manufacturers (although it is advisable to use one recommended by the system manufacturer), and the tapes may be reused with no audible or measurable loss of audio quality. Since editing is carried out electronically, session-tapes can be reused say six months after disc-issue: a substantial saving in tape-stock. The disadvantages of using *U-matic* are mainly mechanical ones, because many current designs of machine have to lace and unlace the tape around the rotating head-drum in order to go from play to wind, or play to stop, and some simple functions like 'instant replay' of a particular passage on a playback session take longer to perform than analogue and are accompanied by noises reminiscent of a one-armed bandit as the relays and servos function.

Traditionally, the classical music record business projects a long market life for its recordings, which are becoming increasingly expensive to make and are expected to earn their keep over a number of years, either in original guise or else reissued at mid-

Survival

Without having gone digital I know I would have encountered difficulties as far as survival in the British record industry is concerned. As it is, my ability to offer a PCM facility without having to write off a lot of existing analogue equipment has kept me afloat and enabled me to offer digital recording to smaller record companies who could not manage it otherwise. I have worked on around 55 albums since getting the equipment, and apart from one occasion where the converter was connected to the wrong mains voltage while on hire to another studio, I have experienced no major problems.

With analogue, one has to spend time in alignment (bias, equalisation, etc) and these practices are things of the past with digital. Routine maintenance of the video recorders is required, and heads require eventual replacement after a few thousand hours, but the performance of the transport mechanism itself does not affect short-term wow and flutter at all, which remains zero. I have often found that portable analogue recorders are prone to wow and flutter problems, presumably arising from being bounced around, in and out of vans, and it is good to rid oneself of this. With the portability and small size of so much modern equipment, I find it possible to load, unload and set up gear by myself when necessary, and a complete system including desk, digital equipment, mics, stands, cables, speakers, etc, may be squeezed if required into a saloon car with some thoughtful arrangement. Part of the weight reduction comes from the lack

Photo: Jeremy Turner

46 ▶

45

Practical digital

of transformers in my mixer-desk and in fact the entire recording chain is transformerless — Schoeps microphones, Soundcraft desk, Sony digital — even right the way through to the loudspeakers in a consumer's living-room assuming he has a DAD player. I am not convinced that a couple of transformers on their own do much harm, but a typical stereo analogue chain includes at least 10 up to the cutter (microphone, mixer, Dolby, cutter input) and multitrack probably adds around a further six if noise-reduction is employed, and this number of transformers must make some contribution to loss of quality.

Much of my recording work is done using very simple microphone arrangements, often a coincident or near-coincident pair of Schoeps, and it is pleasing that the added realism and precision of digital recording enhances the effect of simple stereophonic microphone techniques as well as contrarily exposing over engineering mercilessly. Somehow analogue recordings seem to knock the edge off crossed-pair-ilk presentations and they can collapse into mono-ish hazy balances particularly if pressing quality is poor. Using PCM the phase-stability, ruler-flat frequency response and the absence of hiss, modulation-noise, wow and flutter, and crosstalk, seem to help retain front-to back perspective. One is able to work further back than previously without the clouding of internal detail in a mush, and I find it much easier to convince producers of the merits of simple microphone techniques now that I am using digital gear.

In the past it has always been true that the studio profession has managed to stay at least one jump ahead of the home hi-fi market. Over recent years there has been a veritable explosion in the domestic market as far as availability and use of high quality sound reproduction equipment is concerned. Gone are the days where consumers can be regarded cynically as completely unconscious of quality, and I find it alarming that the quality of many records is now inferior to the potential quality reproducible by typical home entertainment set-ups. The 'quantum-leap' to digital recording will reinstate matters, and must be seen as the only way forward for the moment. In the recording business one does not seem able to stand still, one either moves on or falls behind. Quite how some of the studios will manage to finance re-equipping of their facilities is hard to see in the present state of the market, but things have to come to a head sooner or later, and the former would seem on the cards. For just over the price of a Revox B77 a domestic consumer can



Photo: Jeremy Turner

Mic arrangement for digital recording session with Pro Cantione Antiqua

buy a videocassette recorder with 14-bit digital audio processors already built-in, and these or similar units are finding their way onto the British market (*for example new models by Hitachi and Panasonic—Ed*). As this happens, consumers will have access to sound quality on-and-off -tape superior to that of the aged monitor power amps in one extremely well-known studio I visited recently, forgetting about their analogue multitrack recorders.

Editing methods

One important aspect of the 'Digital Age' as far as studios are concerned is the change from razor-blade/block editing to electronic editing by copying. Some years ago the video industry went over almost exclusively to electronic editing, and despite some initial resistance from operators used to the old ways, the changeover has proved very successful. The electronic editing of audio brings quite a few advantages, not least being the ability to 'rehearse' a join and modify it until one is ready to commit the deed to tape. Secondly, after editing an album, one's session-tapes are still complete and uncut, meaning that any minor artistic corrections necessary after the artists and producer have auditioned the master can be seen to without hunting through reels of stuck-together out-takes. The completeness of the session tapes also makes the tape immediately reusable. I find digital editing less time-consuming than analogue, and going back to the razor blade seems as outmoded and crude

as starting one's car with a starting handle.

It will be clear by now that my enthusiasm for the whole concept of digitised sound is by no means small. The history of recorded sound has gone in leaps and bounds of around the 30 years mark. Just over 30 years ago the LP replaced 78s, 25 years before that the age of electric recording began, just over 35 years before that Emile Berliner launched his flat disc, and 30 years before that in 1859 a Mr Leon Scott first demonstrated a machine to the Royal Association which could record sound using lamp-black and a hog's bristle.

It is very interesting to note that the drive towards such a dramatic change in sound-reproduction technology is coming principally from the consumer market rather than the studios. Fascinating as magazine and newspaper critics' comments might be, the only critics who really matter are our customers, the public. Increasingly their opinions about records are being made known to the business in the only way they can — loss of sales. It is fine to carry out witch-hunts blaming all and sundry for the collapse of record sales and resulting slump in the studio business, but the main reason is pure and simple: a 'vote of no confidence' from the market place, because we are no longer making enough of what the public wants to buy! Convenience plus improvement in overall quality is what the market requires at present, and in these areas the conventional LP is at the end of the line hard

against the station-buffers.

One final point I must add is that using PCM recording is very cruel to the rest of one's session gear — gone are the days when microphone-hiss, mixer-noise and hum get lost in the fog of analogue tape hiss.

I have spent many hours chasing hisses and hums in ancillary equipment I have never heard before, which tends to negate some of the anti-digital 'Luddite' brigade's alleged deafness of PCM. My microphone line-up has now been brought completely up to date with low-noise Schoeps hypercardioids, cardioids and figure-of-eights (as shown above in 90° crossed Blumlein-fashion), Shure SM81 cardioids, and Calrec CM1050 cardioids.

I have grown very tired of the anti-digital commentary and gossiping, not because I have any objection to fair comment, but because so much of it seems to emanate from minds which are either closed tight as far as acceptance of new ideas is concerned or else from individuals faced with 'wallet-ectomy' when the new technology is adopted. Few of the critics I have encountered have ever even heard an all-digital system, let alone used one, and it is essential for engineers to form their own opinions on such an important matter which will, in my judgement, decide whether the recording business sinks or swims in the next 10 years. Leaving artists to decide is one way, and trying to woo a pianist, singer or conductor back to analogue recording after digital sessions is virtually impossible. ■

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Balanced or balanced?

Ted Fletcher (Alice)

After completion of the article *Balanced or unbalanced?* (*Studio Sound*, November 1980) a considerable amount of theoretical and experimental work was done in order to attempt to explain some effects that had been noted on installation using differential input systems. The results may appear obvious to our theoretical friends, but the practical effects are less obvious and of great use to engineers who do not have the time or facilities to carry out this work.

WHY differential input? The use of balanced lines has been adequately covered by myself and others in the pages of *Studio Sound* over the last few years. A balanced line offers a way of getting a signal from one place to another with the minimum possibility of crosstalk to or from itself. Such crosstalk that appears on the line is in 'common mode' (the same phase on each conductor) and is rejected by the input stage that it feeds. This is easily shown by examining the classic simple differential input (Fig 1).

The long line has a differential signal applied to it (usually from a transformer). Over its length it accepts interference V_i onto both conductors. As the signals are differentially amplified, the wanted signals are added and the unwanted interference, subtracted — hence no interference.

Assuming that a common mode signal exists then a voltage V_i will appear at both positive and negative inputs of the amplifier system. Given that there is no common mode output (reverse thinking!) then the amplifier must have rejected this signal. Therefore the impedance to common mode must be the same on both inputs. The actual input ports of the differential amplifier are assumed to have infinite impedance so if there is no output for a CM signal, then the impedance to the negative input is $R_3 + R_4$.

Similarly, as the positive input is a simple divider, the impedance is defined as $R_1 + R_2$. Therefore $R_1 = R_2$ and $R_3 = R_4$; therefore all resistors are equal.

So far we have a differential input amplifier with optimum common mode performance. Now what does it do to the signal? Oh dear — look at Fig 2.

It is a fact of life that the voltage that sits on the positive input of an

operational amplifier also appears on the negative input (where feedback is involved). Thus as R_1 and R_2 are a voltage divider and are equal, then at point X and Y there is $\frac{+V}{2}$.

The impedance applied to $+V$ is $R_1 + R_2$ but the impedance applied to $-V$ is $\frac{2R_3}{3}$. This is definitely not ideal, being an imbalance of three times. Thus this system tends to unbalance the line! Let's fix it. Make $\frac{2R_3}{3} = R_1 + R_2$, thus $R_3 = 3R_1$,

$R_1 = R_2$ and $R_3 = R_4$. This then gives us accurate balance—but destroys the common mode rejection!

The explanation is simple: the $+V$ input sees a pure resistive impedance but the $-V$ input is affected by the dynamic characteristics of the amplifier and changes with the line balance.

Answers

After much calculation, experiment and bad language, three answers to the problem have appeared. The first is shown in Fig 3a and is the classic but rather expensive 'instrumentation amplifier' used extensively in test equipment. (Circuit system courtesy of Mike Sells, MJS Electronics.)

The second solution is courtesy of Ian Pettman (chief engineer Mercia Sound) and approaches the problem by achieving symmetry of loading with a second parallel phase reversed amplifier (Fig 3b).

The third solution is the deceptively simple and interesting circuit shown in Fig 4. The intention was to produce a simple circuit where both inputs react dynamically to the signal configuration. In this circuit the positive input port is turned into a mirror of the negative input by the

use of the phase inverting amplifier IC2.

The effect is that a balanced virtual earth amplifier is created where the open loop gain of IC1 is shared between both inputs. This means that for differential signals, points a and b are at a voltage earth (virtual earth) and the impedance to the line is $R_1 (= R_2)$. For common mode signals the impedance to each line is $R_1 + R_1 (= R_1 + R_2)$. When an imbalance is introduced, the common mode impedances remain the same but the impedance to the differential signals rises due to a bootstrap effect thus giving a slight but measurable automatic balance effect.

Practical considerations

In order to stabilise the circuit, it is essential that the passband of the inverting amp is many times wider than the main differential system. This is achieved by band-limiting IC1 symmetrically. The practical circuit is given in Fig 5.

R_1 is provided to reduce the differential input impedance when the input is disconnected. R_2 and R_3 are kept high to reduce earth-referencing effects of common mode signals. Bypass capacitors to R_1 and R_2 restrict the bandwidth and retain symmetry at high frequencies. R_4 is included to avoid high frequency instability caused by the output architecture of the TLO series chips.

The first subjective impressions of the system were the uncanny resemblance of the performance to a first class input transformer. Common mode performance is restricted by the accuracy of matching of R_2/R_1 and R_4/R_3 . While this circuit still retains an element of ground referencing (it won't stand very high common mode signals), the performance makes it suitable for almost all balanced line applications. ■

FIG. 1

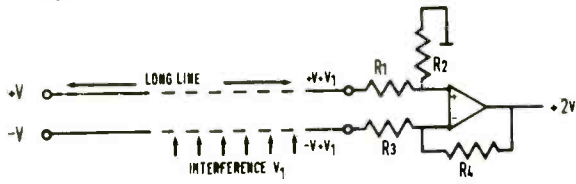


FIG. 2

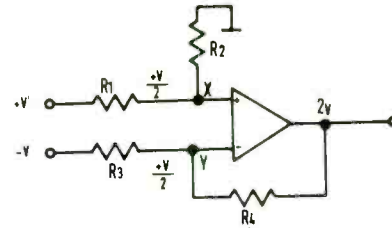


FIG. 3

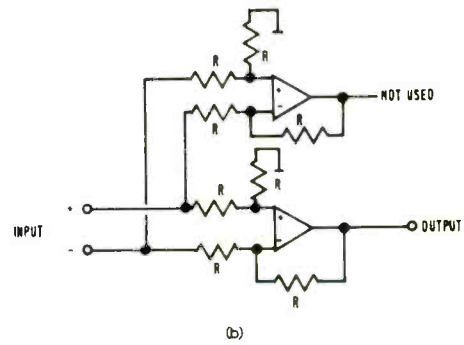
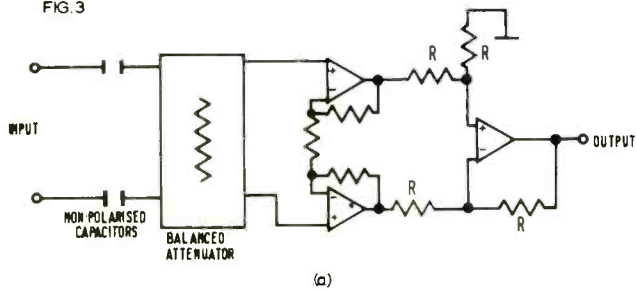


FIG. 4

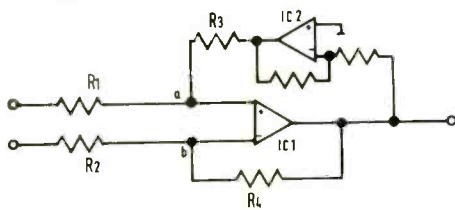
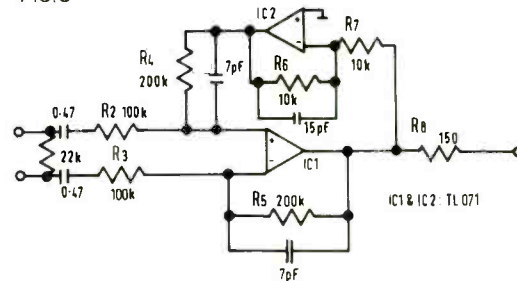


FIG. 5



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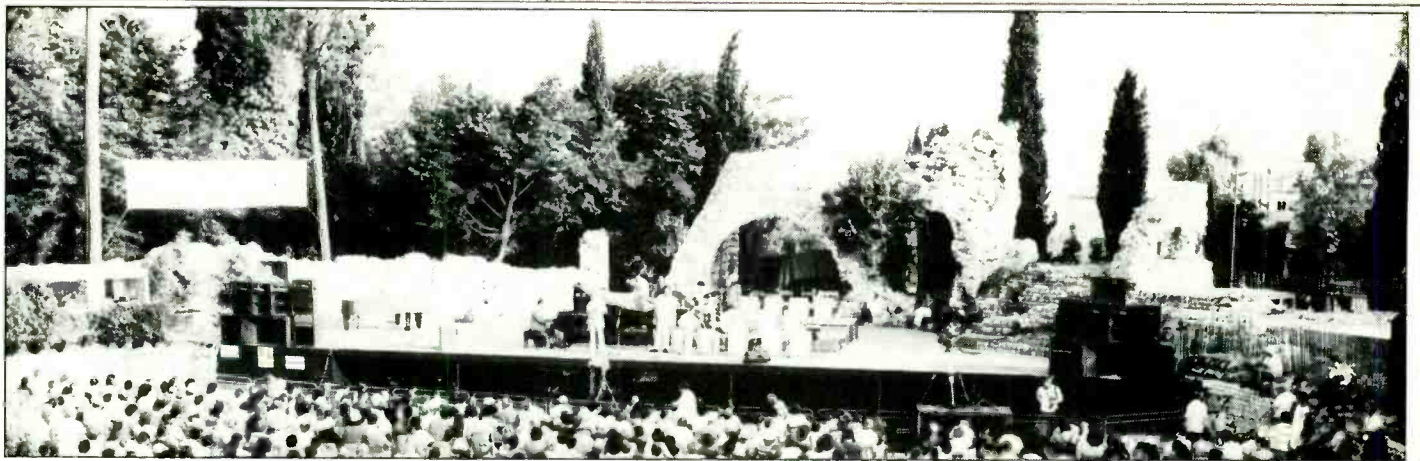
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Studiofile:1



Open air sound

The Nice Jazz Festival or Grand Parade of Jazz has been running for eight years now, in spin-off competition with the Antibes or Juan-les-Pins Jazz Festival which is held just along the coast. But whereas the Antibes Festival centres round formal concerts every night (at up to £15 a reserved seat for the likes of Ella Fitzgerald) the Nice Festival is much less formal. It's held in the Cimiez Monastery grounds and each night for 11 days there are half a dozen concerts running simultaneously in each of three open air stages or arenas. It costs just £5 a night to get in, with children £1. Cats and dogs are welcome, and free. Anyone persevering for the entire 11 days would have a choice of 231 concerts. But anyone who did trek up the long hill, a couple of miles out of Nice, to the Cimiez grounds every night of the festival would deserve a medal. The organisers tend to milk the musicians dry, with everyone guesting with everyone else *ad infinitum*. Moderation is the key to enjoying the festival. For anyone interested the cheapest way is probably through one of the package tours run by David Balfry Jazz Tours (1-3 Market Street, Warwick).

There are a couple of very interesting lessons for other festivals, in other countries, to learn from the Nice binge. The first thing is that the PA policy is very basic. Although the musicians on stage are close-miked, usually through a 24-channel mixer, the amplification system is surprisingly low powered. In one arena there are just four Bose units on each side of the stage; in the other two arenas (which each have similar amplification systems) there is a small stack of Altec bass bins, Cerwin Vega full range cabinets and a single Altec horn. These are driven by just three BGW 750 stereo amps. Because horn efficiency is high the sound level is adequate for most music. There is also less risk of audio spillover between the three open air arenas.

A Bose system, or an Altec-Cerwin Vega horn stack may not be everyone's idea of ideal music PA, but it did sound pretty good for most of the time. Of course, with wine at around 40p a bottle and the hot Mediterranean climate, critical judgment does cloud a little. The system only sounded obviously inadequate when it ran badly out of steam for Chuck Berry. But he's hardly jazz anyway. The British Capital Jazz Festival was staged just a couple of weeks later and provided an interesting comparison because many of the musicians had been playing at Nice.

The Capital Festival has already had a chequered career. Two years ago it was held at Alexandra Palace in North London. The 1980 caper was cancelled due to the Palace burning down the day before the scheduled start, taking half of Pink Floyd's sound system with it. Only Stephen Court of Court Acoustics could afford to look anything other than mortified; he had the job of replacing the lost gear on an insurance pay-out. The 1981 gig was planned for Clapham Common in South London, which seemed about the worst place in the world to hold a friendly festival. Perhaps it was fortunate therefore that the Clapham site was declared unsafe by the police following riots in the streets of South London and some direct threats of trouble from politicians. So Capital cancelled the first weekend and moved the second bout to

Knebworth, previously the scene of several pop festivals.

In France I spoke to George Wein, producer of both the Capital and Nice events. With a resigned sigh he made what turned out to be a pretty accurate prediction: "They'll use too much sound at the Capital Festival."

The total power used on the main stage at Knebworth was around 15kW, mainly from BGW 750 and 500 amps plus some Crown DC300As. The close-miked input was mixed into mono, split in a 5-way crossover and handled by vast double-storey stacks of Martin bass bins, Martin MF units and JBL and Vitavox horns. It was, as at the 1979 Alexandra Palace bash, clean but overpowering. The high power Capital sound is fine for electric jazz-rock fusion, but it's really not what's needed for more traditional (in the broadest sense of the word) types of jazz. A music that was born in bars, brothels and dance halls with little or no electronic reinforcement, can surely never sound right when piped through a 15kW system, to around 10,000 people sprawled in a field.

You can have too much of a good thing, you know. The classic proof of this came from Bob Dylan's concerts at Earls Court last summer. Britannia Row were doing the sound. One night it was awful, with Dylan's lyrics almost entirely unintelligible. But the next night there was a dramatic improvement; his voice

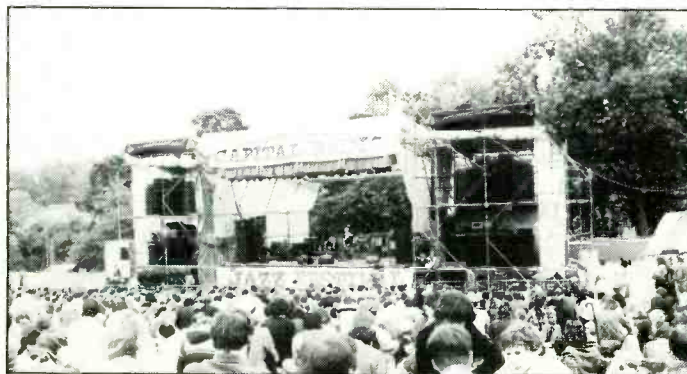
was clean and you could actually hear what he was saying and singing. I asked Britannia Row what they had done overnight. Had they perhaps re-equalised? No, there was only one difference between the two nights; on the second the level had been reduced by around 6dB. Even though the sound system was perfectly capable of reproducing the higher level without distortion, it had just been too darned loud for normal human ears.

The truth is that Capital Radio, and most of the people organising the Festival and in charge of the sound, just aren't into jazz. As far as they are concerned it's just another kind of music to be produced, mixed, amplified and offered on sale to an audience. When the Capital DJs compare their Festival they obviously haven't a clue who they are announcing. For instance Nicky Horne can hardly have inspired the confidence of jazz buffs in the audience when he read out the personnel of one band from a list as if it were in a foreign language, and proudly announced Eddie Cleanhead Vineson, instead of Vinson.

But all power to the station's elbow for at least promoting jazz. Hardly anyone else seems interested these days. Perhaps next year they could get an engineer with a jazz background to mix the PA sound and set the levels, at least for the "acoustic" bands.

The biggest surprise at Nice, and the most telling comparison with Knebworth, was the French attitude over taping and filming. At virtually every British concert (except perhaps the Grateful Dead) audio and video taping is taboo. But at the Nice Jazz Festival it seemed that almost everyone was equipped with either a Super 8 home movie sound camera, a stereo audio portable or a portable video recorder. The audience sprouted microphones like a country field sprouts mushrooms at dawn. No one seemed to care, and certainly no-one stopped anyone filming or taping.

George Wein acknowledges that



Studiofile:2

Katy revisited

Since the preparation of the report on Katy Recording Studio (*Studiofile*, September), the appointment of a new studio manager and personnel has brought about a radical update of this studio facility.

The new studio manager Eddy Luyckx brought in the services of English engineer Mike Butcher, DC Schneider from Los Angeles, and an English technical engineer who was working in France. The new team working in conjunction with John Storyk (Sugarloaf View) set about designing a custom monitor system and improving the already well equipped 48-track control room with its MCI 546 automated console and MCI JH-24 multitracks.

To improve the acoustics of the control room a curved horizontal resonator was constructed at the rear of the room giving bass absorption with mid frequency scattering. Minor changes to the ceiling include carpet-

New look control room with MCI 546 console



ing directly above the console to reduce any parallel surface effect. In addition the demolition of a false wall and opening up of a new entrance door has allowed the convenient siting of all tape machines to one side of the control room with a wooden rack system built in the form of a bridge over the tape machines providing space for amplifiers, crossovers, and desk power supply units. This rack system being cooled by air drawn through by an auxiliary air conditioning duct. Further new wooden racking has also been provided next to the tape machines to house the cassette recorders, extra 2-track and 4-track delay machines, Dolbys, auxiliary monitor amp, and auxiliary patchbay. An advantage of using wooden racking is that when properly constructed not only is it attractive, but it allays the earth problems of metal racks. The studio also has a new static outboard equipment rack to one side of the console,



Freshly renovated studio

with a mobile rack on a multicore TR19 active crossover with delay snake provided in the sound field.

The enlargement of the 5ft 8in studio door involved oxy-acetylene cutting equipment to remove a 12in steel RSJ. The new door was constructed on site and consists of two layers of lead sandwiched between layers of wood, giving a very heavy and efficient unit hung on robust brass hinges and fitted with rubber seals. The studio is fortunate in having an extremely capable carpenter who constructed all the wooden furnishings including the new loudspeaker enclosures. Ted Rothstein (John Storyk's associate) commissioned the new monitor system which comprises Altec 604 dual concentrics with two Yamaha sub woofers each side providing energy at the very low end, the system's reflex porting being tuned using the speaker impedance response method. The speakers are tri-amped from three Yamaha P2200 power amplifiers fed from an Acoustilog

with a mobile rack on a multicore TR19 active crossover with delay snake provided in the sound field. Fine tuning of the system is with modified UREI 539 1/3-octave equalisers, and the final result is a controlled frequency response with good stereo imaging.

In addition to the above changes, the studio's complement of microphones has been augmented with new Neumann, AKG and Crown PZM mics; the studio has received new décor and lighting; a new bar with video amusements has been provided; and a new shower/bathroom installed. Updating of the studio was completed in late August and the result is a comfortable and efficient working atmosphere. The studio has been healthily booked with clients including Anthony Quinn, Jaco Pastorius Adamo, Patrick Hernandez, Macheval, and Frederique Francoise.

John Rutledge
Katy Recording Studio, Chemin du Moulin 7, B-1328 Ohain, Belgium. Phone: 02 633.13.55. Telex: 64390.

Open air sound contd

it's illegal but also acknowledges that he can't do anything about it. So it seems do the musicians. The French organisers just shrug their shoulders (what else would you expect in France?) and the general policy seems to be that it does no-one any harm anyway. After all the best sound quality that anyone can get, even if they are using a Uher or Nakamichi with a crossed pair of AKGs strapped onto the top of a pole (as many of the audience are), is an accurate replica of the sound coming out of a Bose, Cerwin Vega or Altec PA speaker. The tape thus makes a nice souvenir for a jazz fan, but is unlikely to make a fortune for a bootlegger. More than likely the jazz fan will soon grow tired of listening to the taped sound of a PA system, and buy a few commercial disc records of the taped artist.

Predictably, taping and filming was most definitely not allowed at Knebworth. Notices warned the press that transgressors would have

their film or tape confiscated. The reason given was the terms of the artists' contracts were very strict on this point. What I would like to know is how artists who are quite happy to perform in front of an audience of microphones, cameras and tape recorders in Nice are suddenly rabidly opposed to the idea of doing likewise in Knebworth a few weeks later. My bet is that the musicians themselves neither know nor care whether they are taped by amateur enthusiasts. It's just another facet of the British record industry's traditional hatred of tape.

The real absurdity, which the French organisers recognise, is that anyone who wants to tape either the Nice or Capital Jazz Festivals, can do so with the utmost of ease, simply by recording the Festival radio broadcasts off the air. France Inter transmits both live and recorded programmes from the Nice Festival; Capital planned to tape 40 hours of music from Clapham Common, and even after cancellation of the first weekend, and transfer of the second

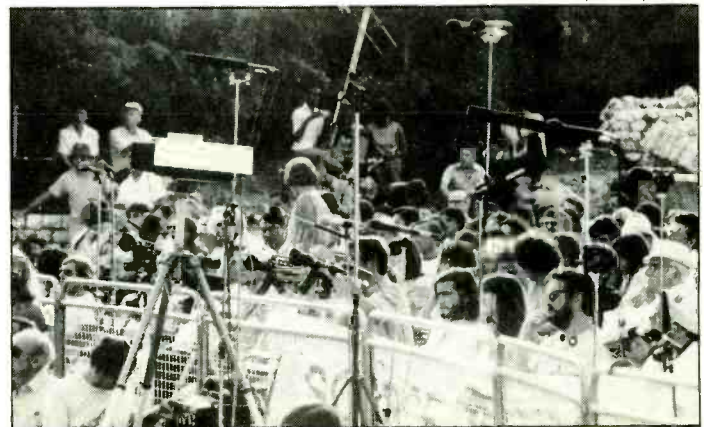
to Knebworth, still managed to put 20 hours in the can. Just a couple of weeks later, Capital was transmitting an hour and a half of music from the festival, every night of the week, at peak listening time.

The quality of a tape made from a decently mixed multitrack recording transmitted in FM stereo will of course be far, far better than a live

recording of a PA sound made with a portable. Capital were, for instance, using the 24-track Manor Mobile. So why do British concert promoters waste time, energy and goodwill banning tape recorders from events which will be subsequently broadcast? If they have thought about the answer perhaps we can hear it.

Barry Fox

Audience mic participation



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letters

Clément Ader

Dear Sir, I've just finished reading your article in the September 1981 issue, 'The Amazing Clément Ader', and found it most interesting and exciting. But I note several important omissions which to me are as serious as (for example) writing a paper on every aspect of the design of a current day phonograph and only mentioning one kind of cartridge such as the magnetic, but not also mentioning the ceramic and the crystal cartridges.

Though Mr Ader, according to the article, gave birth to the stereophonic era, it was a mere 18 years later that Thomas Edison at the Paris Exposition displayed a phonograph whose application was as excitingly different as was Mr Ader's use of the telephone. It was a phonograph that played stereophonic sound! The cylinder record contained three separate horns each with their own stylus. Though this development was not recognised as 'stereo', just as Mr Ader didn't recognise the importance of having the earpiece receivers wired left and right in proper relationship to the left and right microphones on theatre stage, it was given a name which oddly enough, today is used for stereo radio broadcasts. That is, Multiplex. I feel as long as the article mentions other numerous people in this time period whose inventions contributed to the field of stereo, mention should have been credited to the first stereo record

player, especially since it made its presence only 18 years after the 'stereo surface was first scratched'.

Also since the article gives so much credit to Alexander Graham Bell, citing that without the invention of the telephone, Mr Ader could not have become the father of stereo, and because the article even gives credit to Elisha Gray as depositing with the US Patent Office a similar telephone device on the same day Bell deposited his, but due to an omission on the part of the Patent Office, Bell got the lead, then another name should be mentioned. Johann Philipp Reis, invented and displayed a telephone in front of a group of scientists in 1861, fifteen years before Bell got his patent. Due to illness and lack of funds, Reis was unable to capitalise on his invention. So I guess the father of stereo can really thank Reis.

An interesting side note about Edison's stereo phonograph is that at a sales price of \$1,000 the first customer who could afford to purchase one was the Shah of Persia.

Yours faithfully, Yale Brevda, Yale Audio, 2702 Azele Street, Tampa, Florida 33609, USA.

niques workshop in which I participated at the May AES Convention in Los Angeles. Firstly, I wish to thank you for your attention to the subject in your pages. There were, however, some misleading statements in the report, which I feel should be corrected—or at least clarified:

(1) the diagram indicates that the PZM's are mounted with their plates on edge, at the floor; proper placement for the PZM's is for the transducers to be at the junction of the floor and the plexiglass plate, in order that this junction provides two boundary surfaces for the microphone;

(2) this arrangement does not 'eliminate' phasing problems, but it does minimise them;

(3) the emphasis of this utilisation of PZM's is for recording and/or reinforcement of stage productions; this central pair, augmented by flanking PZM's will, in my opinion, outperform any other technique for miking a stage for opera, musical, or dramatic productions; the 'PZM floor wedge' is also a good pick-up for small musical ensembles or soloists, whenever more conventional coincident stereo miking is not possible.

I hope that this will provide some additional insights into the use of PZM technology. Anyone interested in further information on the subject is invited to contact me.

Yours faithfully, Ron Streicher, recording supervisor, Audio Engineering Associates, 1029 North Allen Avenue, Pasadena, Cal 91104, USA. ■

PZM technology

Dear Sir, In the August issue of Studio Sound, Bob Anthony wrote about the microphone tech-

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Speed of sound

Any engineer who reads the *Daily Mail* from cover to cover must have been surprised at the story of John Gardner and his search for £60,000 worth of financial backing for British-made audio tape duplication equipment. With commendable enterprise John Gardner had advertised in *VCR*, a Bristol-based newsletter which seeks to put financial backers in contact with ideas worth backing. The story was picked up by the *Daily Mail* who said that Gardner's machine makes a 60min tape in just 16.5s. This is a duplication speed of 218 × normal speed, which means a bandwidth of around 4MHz coming off the heads and passing between the master and slave machines. No mean feat!

In fact the *Daily Mail* got it wrong. The tape is copied at 32 times normal playback speed on to a pancake, and tape from this pancake then automatically wound into C-0 cassettes at a speed of 16.5s for a C60. John Gardner and his firm, Tape Automation (previously Crowmay), may not have re-written the laws of physics, but they still deserve support for developing a British-made system of audio tape duplication.

CX—Continuing exasperation

CBS was demonstrating CX at Berlin, but with an automated system that could have been custom-designed to ensure that no one could hear any audible anomalies created by the replay of encoded material without a decoder. A disc, prepared in Germany and pressed in the USA, was replayed on an automatic player with the encoder automatically switched in and out while people listened through headphones. An illuminated sign indicated when the decoder was in and out. But at no time was there a direct A/B switch between encoded material played with and without a decoder. And this is of course what really matters. It's impossible to get a fix on balance and image shift when the crucial passages of music are interrupted by a lecture in German.

Predictably CBS UK made no efforts at notifying the British press of the German demonstration. And we now have learned the reason why so few British press were present at the London demonstration of CX earlier this year. The US engineers who flew over specially for the demonstration were asked only at the last minute to demonstrate to the press, and were surprised to see so few present. More and more the London launch of CX begins to look like a stage-managed gesture, rather than a sincere attempt at offering the press an opportunity to judge for themselves what CX can and cannot do.

Under considerable pressure CBS in Britain subsequently promised to put on some CX demonstrations for the benefit of the hi-fi press who weren't invited to the original London launch. A date was suggested but then, mysteriously withdrawn. Meanwhile, flak against CX is starting to appear in print and the recent joint launch by CBS and MGM of their home video catalogue helped explain what makes CBS tick when it comes to selling questionable systems like SQ and CX. Quite simply they don't

waste time *listening*. They just get on with the job of selling.

The MGM/CBS video launch was held at the CBS recording studios in Whitfield Street, London. Not-as-young-as-they-were executives from both companies proudly projected video clips from a *U-matic* recorder with the sound routed through a Quad 405 and a pair of JBL 4311 speakers. With hushed reverence we were first shown a sneak preview of films in the MGM pipeline. This turned out to be a video tape of an audio-visual slide presentation. They'd just pointed a video camera at a screen and projected the slides onto it. Not surprisingly the picture quality was terrible. But even that wasn't as bad as the sound quality. The sneak preview of mushy stills, a clip from a Meatloaf rock opera and some clumsily edited excerpts from video films (like *The Wizard of Oz* and *2001*) to be released in the UK on Beta and VHS formats were all accompanied by quite excruciatingly distorted sound.

The system wasn't at fault, it had checked out perfectly in the morning. It was the soundtrack on the video tape; compressed to around 10dB and recorded well into the red. As soon as the replay volume was cranked up the music started to sound like a buzz saw.

The first surprise was failure of the CBS/MGM executives to offer any apology. Inevitably, they were then questioned on the poor sound quality. First they acted hurt, then became sullen and later quite angry, lapsing into the stream of irrelevancies peppered with buzz words that top men often use to disguise their inability to answer a question factually.

"It was rushed through; it's in NTSC; we've developed CX stereo; do you think we'd offer the public anything less than perfection; most people listen through a 4in speaker anyway; we could have put the sound through the control room desk and made the sound better but that would have been unfair; it will be better on VHS and Beta than on U-matic; you want to hear high fidelity, we'll send you a copy of the Meatloaf album; do you think we would not do it right for Meatloaf?; if you go over to Berlin today there's a press conference on CX, then you'll hear what we can do; this demonstration was only meant to be a teaser; what did you expect" *and so on, and so on and so on.*

"Are the top men at CBS and MGM really so cloth-eared that they can't hear the difference between clean and distorted sound?" I asked a PR man for CBS. "That's a cheap shot," he countered huffily. I'll make it cheaper. Are some of them the same people who decided to back first SQ and now CX?

Mail order madness

Will Turnkey of New Barnet become the Scotcade of audio?

Mail order impulse-buying of gadgetry has for many years been big business in the USA. The trick is to find a novel product and describe it in such a catchy way in a magazine advert that the reader is suddenly consumed by a burning

passion to own one. Some people are addicted to *Exchange and Mart* and have a houseful of gadgets looking for a use. But high tech mail order is new to Britain. The Turnkey catalogue is clearly modelled on some of the US mail order catalogues and is equally dangerous to read. A single run of ads in the music and studio press for the Casio *VL-Tone* at £35.95 produced no less than 1,000 orders through the post. How curious that Casio shows so little interest in advertising or publicising its own products in Britain. As far as I know there has never been a press release from them about the *VL-Tone*.

The *VL-Tone* is an extraordinary gadget and as there must now be 1,000 of them in and around British studios, the sound will soon turn up on recordings. If someone asks you what the microchip is all about, you can't do better than show them a *VL-Tone*. The memory can store a melody of up to 100 notes played on the keyboard, with both pitch and phrasing accurately replicated. These notes can be edited and replayed with a choice of over 80 million different tones. There's also a choice of ten rhythm backings. Working backwards through the profit margins being charged along the distribution chain from Japan it's clear that *VL-Tones* must be coming out of the factory at around £7 each. Calculations like this are depressing. They confirm that Britain's chances of future success in the world of electronics lie in our role as a low volume producer of specialist equipment and as a service industry, geared to selling and using other people's mass-produced material as profitably and efficiently as possible.

Nice quote

Every year the Link House magazine *Hi-Fi News and Record Review* presents a couple of awards to those, who, in the magazine's opinion, have done most for the recording and music business. This year the recipients were Sir Charles Groves and Kenneth Wilkinson, better known as Wilkie of Decca. Wilkie didn't say much after receiving his award, but what he did say will doubtless be many times quoted in print. "I hate multitracking," he mused. "If you can't get a balance straight down on to 2-track you shouldn't be in this business".

Fixing problem solved

Finally, just what you always wanted from Roka of Berlin. How many times have you tried to attach audio cables to a brick or concrete wall with plastic staples and nails? The nails just break or bend and drop out. Roka, whose British agents are Tape Recorder Spares Ltd of London SE15, are now selling a double 'clip' made entirely of plastic. It has two parts, one rather like a plastic rawlplug and the other like an ordinary cable-fixing staple. You drill a hole in the wall with a masonry bit, and push in the rawlplug half. You then hit the cable clip hard with a hammer and it drives home into the centre of the wall plug to lock the cable solid. ■

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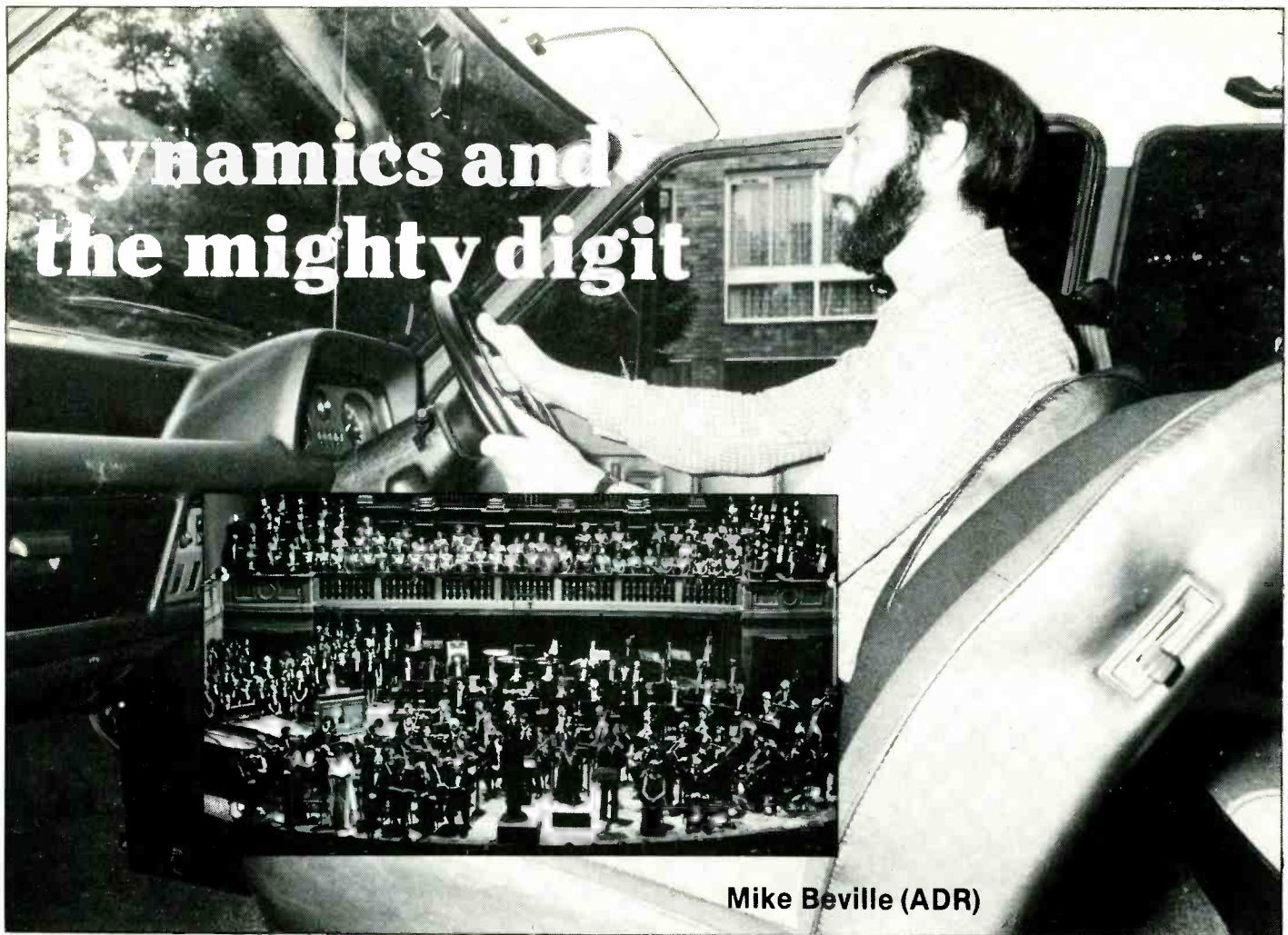
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Mike Beville (ADR)

THE effects and possibilities of microphone balance and multi-mic compression have already been considered (in part one, November 1981) as methods of maintaining the correct perspective in the critical 50 to 80dB SPL region when replaying material at domestic levels. These are not the only possibilities, however.

Gain riding

Another method of dynamic control (particularly favoured by broadcasters) is the manipulation of the master stereo fader, or adjustment of groups throughout the duration of the performance. The art here is to anticipate what is coming by several seconds and progressively attenuate the signal over a relatively long period prior to a crescendo, so maintaining maximum dynamic contrast. Following the crescendo in any subsequent low level passage, the signal can be slowly increased to maintain improved low level information (see Fig 3). This is fine as long as the musical changes are not too rapid, in which case a good deal of low level information could become inaudible. Besides the obvious problem of getting it right and making it unobtrusive, the amount of gain change that can be effected

The second half of this article continues the discussion of solutions to the problems of replaying wide dynamic range material (such as digital recordings) in normal listening environments, and proposes a novel method of dynamic range control which satisfies both technical and musical criteria.

without any noticeable change of perspective is probably restricted to about 6 to 8dB. Where, of necessity, a greater control range becomes essential, it is likely that the listener will become aware 'that something is going on'.

Compressor-limiter

Conventional compressors have not been extensively used in classical recording. When they are, it is likely to be in connection with operatic singers, or perhaps enthusiastic brass sections. Used on spots they can be very subtle and be arranged so as to reduce the voltage addition of a mic layout. Probably a ratio of 2:1 would be ideal; at low level the compressors will be released and the low level gain would set the 'floor' of the music, whilst as music levels increased, compression would commence and progressively reduce the contribution of all the spots. At high level the main stereo pair could

take over completely or be slightly reinforced, according to dynamic requirements. The compressors would be used in the same manner as described under direct mix compression. This method is likely to be inaudible and could extend the compression possible on a particular array. The release time of the compressors would be set to correspond to the natural decay-time of the music.

Compressing a completed, balanced stereo programme even at 1.5:1 might be considered too tight a ratio by many, although if restricted to a 6dB range is unlikely to be detectable. Bandsplitting will of course reduce the possibilities of any modulation effects.

Selective limiting can be applied with advantage to balanced programme. A 3-band limiter will momentarily attenuate each band at peak level without any noticeable effect to the listener. This form of dynamic equalisation can add to the

apparent impact of the peak signal, making it actually sound louder than the original, for the same peak value. The impact of the crescendo is actually enhanced, whilst the low level signal is reproduced consistently some 6dB higher. Subjectively the dynamic range appears unaltered, but electrically 6dB of level has been gained. A form of selective hf limiting is used by the BBC on their FM transmitters and similar control is usually available on disc-cutting systems. Extending this to enable lf and mf to be separately processed gives a significant gain.

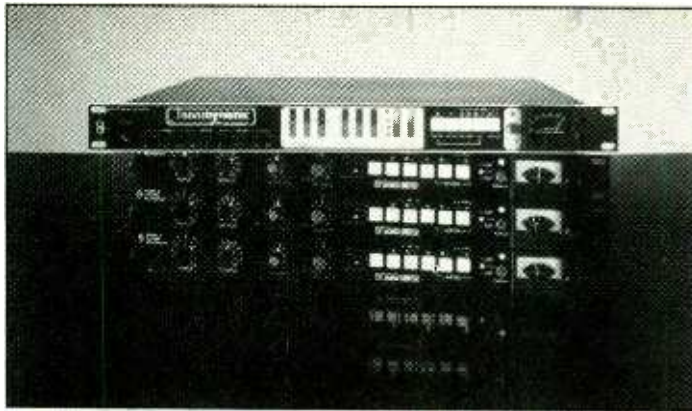
Direct mix compression

In 1976 whilst assisting on the APRS Engineers' Course, besides demonstrating the effect of mic compression, I was able to produce a similar result using a compressor having a 1.5:1 slope in parallel with the direct signal from the main stereo pair. Fig 4 shows a schematic of the system, whilst Fig 5 can be seen to show the net effect of adding the compressor to the direct signal. At peak level, the compressor indicates at least 20dB gain reduction and is added -20dB or so below the peak level of the direct signal. Reference to the **Voltage Addition Table** will show

that a signal when added -20dB down to another identical voltage, will add only 0.82dB to the higher signal. As the input level falls, the compressor increasingly adds to the direct signal until reaching a maximum effect when fully released at low level.

When the low level signal from the compressor (below threshold) is identical to the direct signal, there will be a 6dB increase in the low level gain. As the mix level of the compressor is increased (to add more gain at low level), the input threshold must be lowered or the operating slope of the compressor tightened in order to maintain the -20dB point at peak level. With the compressor +4dB up on the direct signal the low level gain will be 8.25dB; +10dB up on the direct signal will give 12.38dB low level gain (dynamic reduction). The net effect is of a very low input threshold with an even softer slope than set in the compressor. The whole input range can be subtly processed giving a proportional dynamic reduction throughout the range. An input range of 50dB reduced to 40dB is a slope of only 1.2:1. Other significant advantages are that the high level transients are unaffected and that any distortion or noise contributed by the compressor is reduced by 20dB against its conventional operating specification.

Although the experiment worked extremely well with a single compressor unit, subsequent tests confirmed that a system ideally capable of handling any input signal, would have to be bandsplit. Even so, a single compressor used this way will be superior to its normal mode of operation. The opportunity came to fully evaluate a tri-band system when my company produced its *Transdynamic* tri-band processor. A direct signal path had been made



ADR Transdynamic processor and EX-press limiters

switchable so that the unit could be used as a straight stereo master limiter; this same facility gave a direct-mix processing option for further experimentation.

The system was initially evaluated on commercial records produced from digital masters. It was tried up to a dynamic reduction of 15dB and appeared to work well without any side-effects—other than an increase in disc noise. To evaluate the system properly, a good clean feed was essential. The BBC helpfully arranged for a line from the mixer sited at the Festival Hall. In the quality monitor room, we were able to compare processed signal against the transmission (after gain riding the master fader); and both against the clean feed.

It was decided to establish 8dB of dynamic reduction in the *Transdynamic* and its associated *Complex* units. As it happened this coincided closely with the 7dB of manual compression applied on the transmission. Predictably, the processor tended to lead the manual adjustment, but in the main was within 2dB most of the time, widening to 4dB on occasions. At one exceptional

point there was a difference of 6dB for a brief period; in fact at that time the transmission was almost inaudible at our monitoring level. The average level was therefore consistently higher through the processor and was thought to sound slightly larger than life. Frequency balance was identical with absolutely no operational side effects. The larger than life comment was interesting, since this is frequently voiced in connection with multitrack layouts, which this form of compression emulates in respect of its dynamic characteristics. Due to the higher average action on the processor, the selection of a lower gain (say 4 to 5dB) might well have equated

better to the manual 7dB. Alternately a slight reduction in the monitoring level of the processed signal, might not have given rise to the observation in the first place.

The argument boils down to a trade-off between maintaining maximum dynamic contrast (achieved with gain riding), against the benefit of hearing even more of that subtle low-level detail that is so striking in the concert hall. As indicated earlier, the direct-mix technique can be applied to the mic array, using compressors on spots. Correctly adjusted they would add gain to low or even mid amplitudes, whilst progressively attenuating the channel until being -20dB with reference to the main array at peak level. To my knowledge this has never been properly evaluated. Whether compression is proportional (ie spread throughout the range evenly) or tends to operate over the 50 to 80dB region will be a matter of choice and technical arrangement.

Unlike gain riding where, due to longer time periods involved, the whole picture moves forward or recedes; the direct mix compression retains constant perspective. The low level signal appears to form a stable base, increasing high levels being proportionally but inaudibly reduced. In fact it can be viewed the other way round and will normally

60 ▶

VOLTAGE ADDITION TABLE

0dB = 6.021	0dB = 6.021
+1dB = 6.535	-1dB = 5.535
+2dB = 7.078	-2dB = 5.078
+3dB = 7.649	-3dB = 4.649
+4dB = 8.249	-4dB = 4.249
+5dB = 8.876	-5dB = 3.876
+6dB = 9.529	-6dB = 3.529
+7dB = 10.207	-7dB = 3.207
+8dB = 10.911	-8dB = 2.911
+9dB = 11.638	-9dB = 2.638
+10dB = 12.387	-10dB = 2.387
+11dB = 13.157	-11dB = 2.157
+12dB = 13.946	-12dB = 1.946
+13dB = 14.755	-13dB = 1.755
+14dB = 15.580	-14dB = 1.580
+15dB = 16.422	-15dB = 1.422
+16dB = 17.278	-16dB = 1.228
+17dB = 18.148	-17dB = 1.148
+18dB = 19.030	-18dB = 1.030
+19dB = 19.924	-19dB = 0.924
+20dB = 20.828	-20dB = 0.828
+30dB = 30.270	-30dB = 0.270
+40dB = 40.086	-40dB = 0.086

Voltage addition: 0dB is ref point for two identical voltages added. Table shows effect of increasing or decreasing one voltage on the sum of combined output.

FIG. 3 INCREASING SIGNAL TO IMPROVE LOW LEVEL INFORMATION

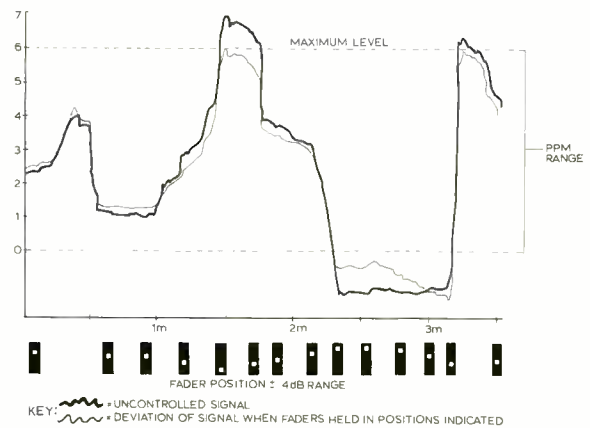
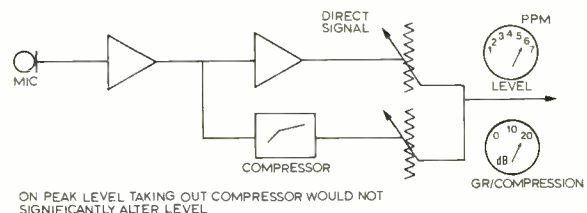


FIG. 4 SCHEMATIC OF BASIC DIRECT MIX COMPRESSION



ON PEAK LEVEL TAKING OUT COMPRESSOR WOULD NOT SIGNIFICANTLY ALTER LEVEL

Mighty digit

be compared against the same peak level as the original. As level drops the peak density (by comparison) increases to a higher average value. Thus on programme monitored at say 105dBA, a 10dB dynamic reduction will effectively enable peak level to be reduced to 95dBA with almost the same level being maintained in the 50 to 80 region. Depending on setup, dynamic reduction will be proportional down to about an SPL of 45dB (50dB down) where the effect is marginally greater (see the voltage addition effect in Fig 5).

The ideal answer would be for all domestic systems to have this form of sophisticated compression in order that listeners may determine optimum dynamics for their own listening preferences. Complexity of the system is likely to delay a domestic version, though it would be a logical extension to the control facilities provided on a preamp. Meanwhile, on the professional side, there is now a system of compression which for the first time can be used on wide-dynamic programme to create a subtle reduction in dynamic range.

It is envisaged that with the introduction of digital discs, greater attention will need to be paid to the limitations imposed upon the customer (see Fig 6). Getting the

balance right at a lower monitoring level could produce more satisfaction in home listening, both in respect of the ease of hearing low level detail with more ambient information—all happening at reasonable reproduction levels. If monitoring levels cannot be reduced, or there are policy reasons for mastering wider dynamic range, then the new processor would have a similar result and perhaps keep everyone happy.

There are situations in which this form of processing could play an integral part in the balance 'loop'. When dealing with very large orchestral/choral forces likely to involve excessive fader manipulation, a part automatic reduction of some 6 to 8dB could greatly simplify the operation and almost certainly improve the overall consistency of the balance. There may also be times when a simpler mic layout could be desirable and some of the compression effect lost could be recovered using the direct mix compression system. The next experiment I'm hoping to organise will involve a direct feed from a main stereo pair, using direct mix compression and comparing this to the multitrack balance.

At times a balance produced for radio is also required for TV; perhaps it is even duplicated at extra cost and inconvenience. By processing the radio balance some 10 to 12dB using direct mix compression, a very satisfactory result should be

achieved for TV transmission.

There is clearly a large potential market for 'in car entertainment'. This rather special listening environment should be given more attention and could be exploited by the production of programme material specifically processed for the rather restricted dynamic range. Pre-recorded cassettes prepared in this way would effectively compete against home copies which would not be so good in the car. With this new form of processing, classical recordings could be made to be acceptable for in-car use and open up a whole new market. The compact digital disc will be suitable for in-car installation, but due consideration should be given to ensure that records are specifically tailored for this particular dynamic range.

Without doubt, prospects for the digital era are very exciting, but hopefully the balance engineer will continue to exercise skill and moderation in creating a balance that will bring satisfaction to a wide public. Before the advent of the mighty digit, judgement was influenced by the imposition of technical constraints; with these lifted, it may well be too easy to forget the limitations imposed upon the customer.

On wide dynamic programme, monitoring level at the balance stage is critical and will determine the level at which the recording will be

optimally reproduced. The higher the level monitored, the more it will lack realism when played at typical domestic levels. Monitoring at a peak level of 95dBA would automatically reduce dynamic range and is more likely to be replayed at that sort of level by the majority of serious listeners; whilst at 90dBA it would still give reasonable results.

Because of the increased dynamics available, there will need to be a greater awareness of the range being recorded. There could well be three distinct areas that would warrant special attention and possibly special releases: the field of serious domestic listening; a vast potential market for in-car entertainment; and production for wide-dynamic headphone listening. In the case of headphones a special balance and technique is likely to be called for in order to optimise positioning (ideally getting it out of the head). This could involve at least two simultaneous recordings of the session with subsequent processing for the third.

Now that the technical problems of dynamic range have been overcome, perhaps the industry should consider some market research in connection with the customer and his various listening preferences and restrictions. With the immense investment required to go digital, it could make sense to know what the customer can cope with, and so ensure maximum satisfaction with the software.

FIG. 5 EFFECT OF ADDING COMPRESSOR TO DIRECT SIGNAL

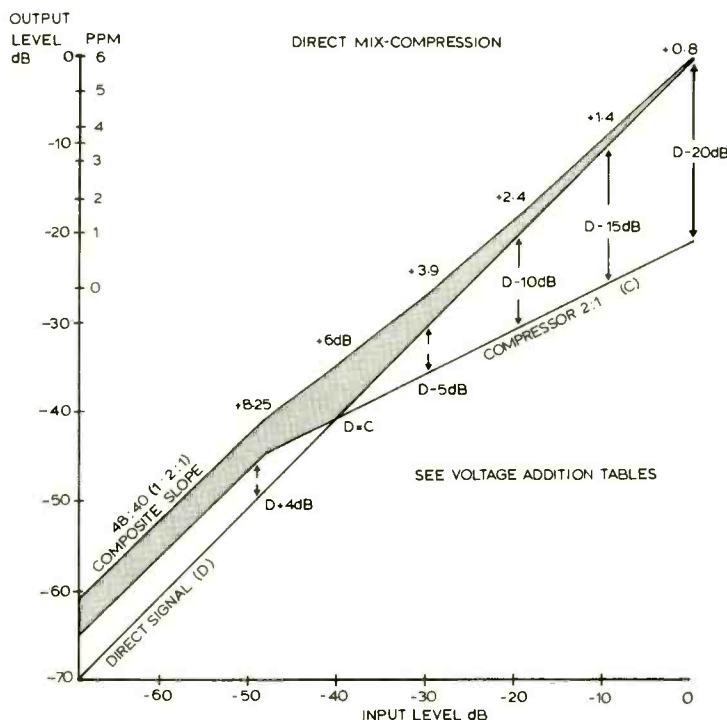
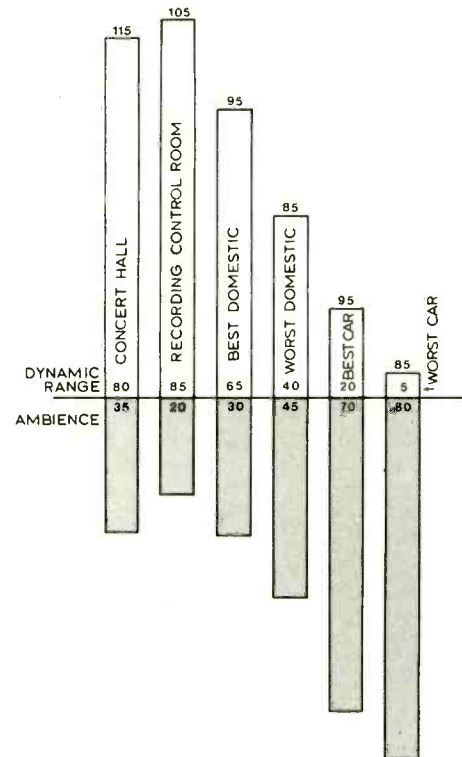


FIG. 6 LIMITATIONS ON THE LISTENER



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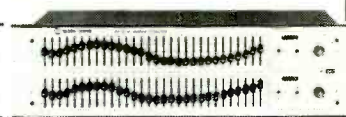
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The Fostex range



A-4

MANUFACTURER'S SPECIFICATIONS

Parameter	Reel-to-reel recorders			Model 350 recording mixer
	A-2	A-4	A-8	
Tape	1/4 in tape width, 1 mil base			Inputs: impedance 50kΩ; levels - 60dBV(1mV) mic, - 10dBV (0.3mV) line. Max + 12dBV(4V).
Format	2-track	4-track	8-track	Tape inputs: impedance 20kΩ; nominal input level - 10dBV, max + 12dBV.
Heads	Three	Three	Two (erase, rec/rep)	4-channel buss in: impedance 10kΩ; nominal input level - 10dBV.
Reel size	7in diameter 'cine'-style spools			2-channel buss in: impedance 20kΩ; nominal input level - 10dBV.
Tape Speeds	7 1/2, 15in/s ±0.5%	7 1/2, 15in/s ±0.5%	15in/s ±0.5%	Phono in (x4): impedance 50kΩ; nominal input level - 54dBV(2mV), RIAA equalisation
Varispeed	±10%	±10%	±10%	Phono out (x4): load impedance 10kΩ or higher, at - 10dBV nominal.
Line in	- 10dBV (0.3V) 30kΩ unbalanced		- 10dBV, 15kΩ unbal.	4-channel and 2-channel busses out: load impedance 10kΩ or higher, at - 10dBV.
Line out	- 10dBV (0.3V), load impedance 10kΩ or higher, unbalanced			Monitor out (x2): output load impedance 10kΩ or higher, - 10dBV.
Record level cal	0VU referenced to 185nWb/m		0VU = 250 nWb/m	Stereo headphone output: 4Ω minimum, 8Ω or higher typical load impedance, 100mW into 8Ω.
Equalisation	NAB (IEC available in Europe)		IEC	Frequency response, 4-channel buss out: 20Hz to 20kHz ±1dB; headphone: 50Hz to 15kHz ±2dB.
Wow and flutter	±0.06% peak (IEC/ANSI) weighted at 15in/s			Equivalent input noise: - 128dB, weighted.
Fast wind time	130s typical for 1,800ft of tape			S/N ratio: one mic input 68dB; eight mic inputs 58dB; one line in 75dB; eight line ins 58dB (all weighted).
Overall freq. response 15in/s	40Hz to 20kHz, ± 3dB		45Hz to 18kHz ± 3dB	Equaliser sections: 80Hz to 1.2kHz and 800Hz to 12kHz, both ±12dB adjustment.
7 1/2 in/s	40Hz to 18kHz, ± 3dB		—	Crosstalk: 65dB at 1kHz.
S/N ratio (sync/repro) ref 1kHz, 3% THD, wtd.	65dB	63dB	73dB (with Dolby-C)	THD overall: 0.03% at 1kHz nominal level.
THD	Better than 1% at 1kHz, 0VU			Power requirements: 120/220/240V AC, 14W.
Crosstalk (repro)	50dB at 1kHz		40dB at 1kHz	Dimensions: 18 1/2 x 3 3/4 x 16in/460 x 95 x 405mm (whd)
Erase	Better than 70dB at 1kHz			Weight: net 18lb/8kg.
Dimensions	14 x 13 1/2 x 6 3/4 in/360 x 340 x 170mm (whd)			
Weight	29lb/13kg			

Manufacturer: Fostex Corp, 512 Miyazawacho, Akishima, Tokyo, Japan.
 UK: Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW.
 USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, Cal 90650.

THE range of equipment under review comprehensively covers the need for a multitrack capability for musicians, small drama groups and others requiring up to 8-track recording equipment. The range includes a set of tape recorders with a matching mixer as well as a cassette-based multitrack machine (reviewed next month) and other ancillary units. In view of the low overall cost of the total system, as well as the many advanced features included as standard, it is quite conceivable that the advent of the Fostex range will cause many significant changes in the recording industry in general, as a substantial number of artists will be able to realise projects which up to now have been difficult or impossible to achieve due to the cost and complexity of 8-track recording.

The range has been conceived for recording at 'domestic' level for creative purposes. In view of

this, Fostex open-reel tape machines are designed to use 7in 'cine' spools and 1/4in 'long play' (1 mil) tapes so that a recording time of about 20min/reel at 15in/s is possible. All input and output 'line level' signals are unbalanced, of medium impedance and at a nominal level of - 10dBV. RCA phono jack connectors are used for the majority of audio connections, 1/4in mono jacks being used otherwise. Tape recorder remote leads use the only multiway connectors on the units.

There are three reel-to-reel recorders in the range, an 8-track 1/4in, a 4-track 1/4in, and a 2-track 1/4in. These all use the same transport, and measure 14 x 13 1/2 x 6 3/4in (whd) and weigh all of 29lb. The decks use three small DC motors, one for each reel and one to drive the capstan. The reel turntables are designed with one large prong to locate the reel and are supplied with clamp screws. They are indirectly driven by a healthy-looking rubber band

as is the large diameter capstan. The deck plate is a pressed metal design, although it is sturdy looking, and all functions are solenoid operated. Thus all the transport functions can be readily remote controlled, a boon for one man operation. Tape speeds of 15in/s and 7 1/2 in/s are offered on the 4-track and the 2-track machines although the 8-track only runs at 15in/s. All the tape machines have a built-in varispeed facility of up to ±10% and have a claimed speed accuracy of better than 0.5%. Wow and flutter is claimed to be in the region of 0.06% weighted (IEC) at 15in/s.

Each tape deck is provided with a 4-digit turns counter working off the supply reel. A return-to-zero rewind feature is also built in, as well as a mechanical tape lifter defeat to simplify location of a place on the tape, a mechanically latching hum shield and an edit mode on the deck to facilitate editing. Fast wind through an 1,800ft reel of tape is

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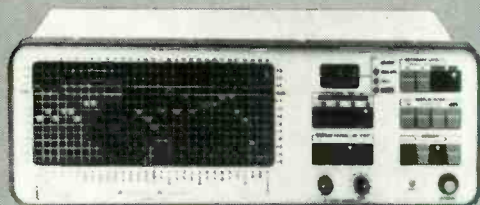
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claimed to be a reasonable 130s. The pinch wheel is protected around most of its periphery by an easily removable plastic guard and bears on the capstan. The pinch wheel arm is located under the deck so that the head block is not obscured by it: thus threading and editing are easy.

The headblock itself has three height guides in it and is capable of carrying three tape heads although only two are used in the 8-track machine. Two large diameter stabilising guides are mounted on either side of the headblock, and beyond these there are two tension rollers, which provide tape tension sensing at either end of the tape path. The internal surfaces of all the above guides have rotating plastic inserts. The heads are hung from a pressed metal plate and are provided with a 3-screw mount allowing height and azimuth adjustment. The azimuth setting screw is spring loaded and does not appear to have an especially fine thread. Although motion sensing is not used, the deck control circuits infiltrate stop commands so that it is safe to go directly into play from fast wind in either direction.

Controls on the tape decks are very neatly laid out in the lower right hand corner and consist of six pushbuttons in two rows of three. The top row has the return to zero and the fast wind functions, while the bottom row has the stop button located in between the play and record buttons. Above these are two switches to enable the edit mode and the speed switch — this last is used to switch the noise reduction out of circuit on the 8-track — and the varispeed control pot. The varispeed control is very smooth in action and the pot has a detent to positively locate the nominal tape speed. The tape counter and its set zero button complete the tape transport controls.

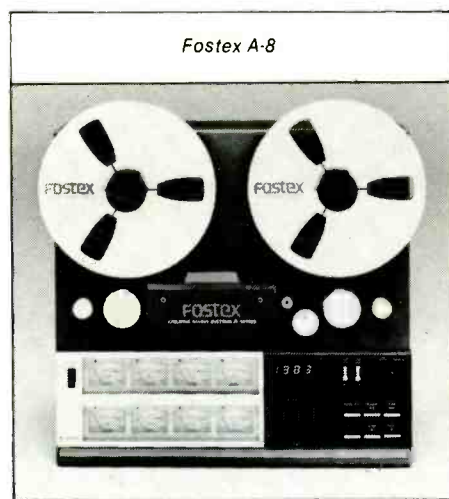
Record mode is enabled by simultaneously pressing play and record, at which point any track selected will go into record. Dropping out of record is achieved by releasing the appropriate track select switches. An excellent innovation, however, is the provision at the back of the machines of a 1/4in jack into which a normal guitar footswitch may be plugged. This may be used to initiate and terminate record functions on selected tracks when the deck is running in the play mode, thus freeing the hands of the operator. The edit mode switch disables the take-up reel motor and the tension arm micro-switch so that a long section of tape may be spilled without difficulty. A safety feature is incorporated in that when 'edit' is selected only the play mode can be entered. Furthermore, if the transport is in some other mode when edit is selected the transport will stop. This avoids accidental tape spills which could happen if this switch was used in fast forward.

Model A-8

The 8-track recorder, model A-8, as mentioned above, is provided with one speed (15in/s) and is a 2-head design, erase and record/replay. In view of the extremely narrow track widths used, the new Dolby-C system of noise reduction has been adopted as standard on this deck, although this may be switched out should some alternative external system be preferred. Only four record amplifiers are used, so that a maximum of four tracks may be recorded at any one pass of the tape. A further limitation is that the record amps are switched so that they relate either to the top or the bottom four tracks: thus, recording on tracks 1, 2,

7 and 8, for example, in one pass of the tape would not be possible. Eight VU-style meters are provided in two banks of four, and a record warning LED is mounted above the appropriate meter. When a track is selected as ready to record, the LED above the appropriate meter will flash, warning the operator. Also, this confirms that the right bank of tracks is in use. Record mode is enabled by pressing the record and play buttons simultaneously, at which point a warning LED under the tape counter reset button will light, as will those LEDs relating to any tracks selected. If no tracks have been selected all the LEDs on the selected bank of tracks will flash to signal that the recorder is in the 'record-ready' mode.

The controls provided on the 8-track recorder are extremely simple to use. Apart from the group of controls which relate to the transport functions of the machine, nine push switches are dedicated to the control of the recorder. These consist of four



track select switches, above which is the switch which routes the record function to either the top or the bottom group of four tracks. Below the record select switches are switches which select line in or replay for the group of tracks selected. On the 8-track Fostex, the group of tracks which is not being addressed by the record function is always in the replay mode. The other tracks (which are in the 'ready to record' state) remain in replay mode, being switched to line in when record is initiated. If one of the monitor select switches is set to line in, that track will remain in line in regardless of its record status. As the recorder is a 2-head design, replay is necessarily the same as sync replay. On the 8-track recorder, the erase head is close to the record/replay head so that rapid drop-ins are quite practical.

There are no level controls on the 8-track recorder for the user to worry about while recording. By removing a plate at the bottom of the recorder, all the trimmers necessary for a complete line up of the machine are revealed. Although only four tracks can be accessed at any one time, separate controls are provided for all eight. Obviously line up of the machine for a different tape is more difficult than it would be for a 3-head machine, but in the event it is quite a straightforward procedure. Apart from the lack of a

record EQ trimmer on the review machine (there is room for it on the board but that section has not been implemented) which made it difficult to optimise the top end performance, line-up to a completely different tape formulation presented no real problems. The frequency response of the machine was within the tolerances quoted in the specifications (IEC EQ is used on the 8-track), and rough measurements indicated that the S/N ratio without noise reduction was 50dB below the reference level of 250nWb/m. In view of the extremely narrow track width this performance is entirely creditable, especially as the reference level is some 10dB below the 3% THD point of the tape. This would indicate that about -60dB of S/N is possible and that using the noise reduction provided, the hiss component, by far the most annoying, would be further reduced by about 20dB. However, in common with many other 'domestic' machines, the noise produced by the replay amp is only 5dB or so below the tape noise which is unimportant at the moment, but might avoid one being able to take full advantage of quieter tape formulations should these become available in the future.

If the cover of the machine is removed — with due regard to the warning notices in English and French about the wisdom of such an attempt — the extremely neat layout of the machine is revealed. The large mains transformer is mounted well away from the heads in between the reel turntables with the three small motors underneath it. The power supply boards for the machine with their fuses are easily accessible at the top of the chassis, and the transport and logic control board, which is the full width of the recorder, can be swung down for easy service. Below this is a motherboard for the record and replay electronic cards which has the master bias oscillator mounted on it. The plug in record/replay cards (each card contains two channels) hang from this motherboard, being held in place by an easily removable plate. The trimmer pots which are on the lower edge of these cards are easily accessible from the base of the recorder for line up, as mentioned above. It is impressive to note that plugs and sockets are used for all interconnections within the machine as well as number- and letter-coded ribbon cables. All the circuit boards are silk-screened on both sides with component numbers and the function of trimmers showing the high priority given to ease of maintenance during design.

Model A-4

The A-4 4-track tape recorder uses the same tape deck and has a similar structure to the 8-track recorder described above. At a first glance, the major difference is that the bottom row of four meters on the 8-track have been replaced by four input level controls, and on the back panel a 6-pin 240° DIN socket has been added to aid interfacing to an external noise reduction system. This recorder is more conventional in that it is a three head design and no internal noise reduction is provided (why not?). The other features of the A-8: varispeed; edit; return-to-zero; and the foot-switch drop-in control have been retained. In addition the A-4 has two speeds — 15in/s and 7½in/s. The front panels of the machines are otherwise identical in appearance but obviously the various switches controlling the machines have new functions. The transport speed switch has

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taken the place of the noise reduction switch in the A-8 and the switch that selected the bank of tracks for record is now the sync replay switch. This use of one switch to control all four tracks is a little restrictive as you cannot replay a track out of sync if you want to, for example when creating tape phasing effects or to restore synchronism when, by accident, an overdub has been made while still in replay mode.

Internally, the A-4 is similar in structure to the A-8 except for the record/replay boards, and as these only deal with one channel they are a lot less crowded. Once again, all the adjustments necessary to line the recorder up are accessible from the base of the machine, these adjustments including separate controls for replay and sync replay output level and EQ for each tape speed. This is a very good feature as it means that, if the machine is correctly lined up, disturbing level changes when dropping in should not occur, while level-sensitive noise reduction systems such as Dolby-B or -C can be used without severe mismatch problems. On the record side, no record EQ pot is fitted for the high speed once again (strange philosophy this) although the board has been designed for one and it is indeed fitted for 7½in/s line up. All other record adjustments are the same for both speeds so the record bias and level must be the same for 15in/s and 7½in/s. This is quite a common situation even in professional machines and should prove satisfactory in the A-4. Line up of the A-4 proved easy to perform (having the separate replay head helped a lot) and it was evident that an adequate range of adjustment was provided on the trimmers. This model, unlike the 8-track, uses the NAB equalisation curve and the line-up achieved was well within spec ($\pm 3\text{dB}$) with the top end being maintained well up to 20kHz. A low frequency peak of around 3dB at about 120Hz seems to be characteristic of all these machines (the exact frequency of this peak varies from model to model and between sync and replay, so I would assume that it is something to do with the head configuration) and is the main deviation from a curve that is otherwise commendable. I was expecting to be impressed by the noise level of the A-4 after the good performance of the A-8 but in this I was disappointed: the noise level seemed worse than the A-8 and, on listening, had a harsher quality. Rough measurements indicated that the unweighted noise was about 8dB worse than on the A-8. As this seems an unlikely situation in view of the wider tracks, and as both sync and replay outputs gave a similar performance I must admit to being somewhat mystified. As with the A-8, the replay amp unweighted noise level was some 4dB below that of virgin tape so it seems unlikely that this should be the cause, nor does the adoption of the NAB characteristic fully explain this. The most probable explanation is that this particular machine had a noisy record amp.

Model A-2

The A-2 is the 2-track member of the set. Once again the same transport is used and the features of the 4-track are all present on this machine, although no internal noise reduction is provided and the noise reduction control socket provided on the A-4 is not present on this recorder (again, why not!). Once again the appearance of the recorder is similar to the others although in this case the four small meters of the A-4 have been replaced by two

larger ones. These have been supplemented by peak overload LEDs which flash when the output(!) level at the phono sockets is greater than +3dBV. Under the meter, input and output level controls have been provided. One of the control switches has been allocated to the output meter, such that in one position (CAL) it measures the output of the machine before the output level control, in the other the actual output level after the output controls is measured. The other switches are for record select on either track, and output select for either track. Each track can be switched so that line input, sync output or replay will appear on the output sockets.

Construction of the A-2 is very similar to that of the A-4 except that only two record/replay cards are mounted in the motherboard and, surprise, the high speed record EQ trimmer is actually there. Pity that it doesn't do much, though, as it only appears to affect the top end performance by about 5dB at 25kHz and little else. As the same motherboard is employed in the A-2 and the A-4 it might be possible to have the noise reduction control socket implemented on the A-2. The A-2 lined up well and, apart from the lift at about 100Hz mentioned before and the fact that the top end EQ on record could not be turned down enough, conformed quite well to the NAB characteristic. The noise level achieved with this recorder was altogether better than that obtained with the A-4: the replay amp residual noise was some 4dB worse than the noise level produced by tape which had been recorded on, while tape wiped on the machine had a noise level some 4 to 6dB higher than this. It was interesting to note that the sync output did not have a very much poorer noise performance than normal replay, although its top end response was not as good.

Model 350

An 8-channel recording mixer, model 350, was supplied for review with the machines. This, like all the other Fostex equipment, is extremely small and neat, measuring 18½ × 3¾ × 16in (whd) and weighing 18lb. The optional meter penthouse was also supplied; this contains six VU-style meters and is attached to the rear edge of the mixer at an angle chosen by the user. The unbalanced mic inputs have an input impedance of 50kΩ and use standard ¼in jack sockets. The input level range is from 0.5mV to a maximum of 4V at this socket. External transformers could, of course, be used to accommodate professional mics or to provide more gain. Apart from the connector to the meter



Model 350

penthouse, all other connections use RCA phono sockets. Each channel has a tape input socket, a pair of phono sockets acting as a patch point which are linked when not in use, and a channel direct output. On the channel, the selector switch (mic/line, off, tape) is followed by an input gain trimmer with an overload LED (above the channel fader) monitoring the mic amp. The signal is then routed through the patch point to the channel fader which feeds the EQ unit. The output of the EQ unit feeds the channel direct output point and also the panpot, which is routed to either pair of output groups. These last are controlled by ganged faders and lead to the line-out sockets. A stereo auxiliary buss is also provided and is very cleverly organised so that its input may be selected to be from the channel pre-fader point, the channel post-fader point or the tape input jack. This means that it can be used as a stereo (or 2-mono) foldback buss, a reverb buss (in the post fader position) or a monitor buss while recording. As all line/tape switching is performed on the tape machines, this arrangement is eminently satisfactory. Each of the four main groups have an extra input point with a level control for such things as reverb return, and a similar input exists for the auxiliary buss although no level control is provided. The monitor output has no overall level control on the mixer, which I found a nuisance, and is controlled simply by five switches. One of these is allocated to each output group (A, B, C, D). Output groups A and B are treated as a pair, as are groups C and D. If monitor select switch A is used by itself, output A will appear from the centre of the monitor image; if both A and B are selected, however, A will appear from the left and B from the right. Monitor switches C and D act in a similar fashion. The remaining monitor switch selects the output of the auxiliary buss and takes precedence over the other switches. The monitor outputs have no level control on the mixer, and appear from two phono sockets at the back, ready to be plugged into your hi-fi. However, this monitor output is also routed through a level control to an internal amp which can drive the two headphone sockets (¼in stereo jack) provided on the front panel of the mixer. This useful amp provides a maximum of 100mW into 8Ω.

The EQ provided on each channel of the mixer is interesting in that only two mid-band sweep sections are provided. Each has a maximum lift or



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cut of 12dB from 80Hz to 1.2kHz for the lower section and 800Hz to 12kHz for the upper. No bass or treble controls are provided. This was rather curious to work with, although a good range of sounds could be achieved with the system once 'thinking backwards' became a habit. Also provided on the mixer are two good quality stereo RIAA preamps, with floating inputs and outputs.

Manuals

The manuals provided for each unit were of a high standard, consisting of about a dozen pages of printed information and clear photographs. The manual for the A-4 tape recorder was not available, which is why the noise specification of that machine cannot be evaluated. Each manual has a fold-out front cover with detailed numbered photographs of the equipment followed by a brief description of the function of each item. This is expanded on within the remainder of the manual, which also includes detailed suggestions as to interconnection of the units and hints on how to get the best performance out of the system. A section in each of the recorder manuals gives a fairly detailed description on how to line up the machines and diagrams showing which pots to adjust and, more importantly, those which should be left strictly alone (for example, the trimmers which set up the internal operating levels of the Dolby-C system on the 8-track). This is supplemented by the fact that all the circuit boards are silk-screened with component numbers, polarities and, in the case of trimmers, function on both sides of the board. The maintenance section of the manual includes detailed instructions on demagnetising the heads and a recommendation that this should be done frequently.

Using the system

Installation of an 8-track system proved simplicity itself, although no leads were provided apart from the captive mains leads on the units. The manuals recommend that interconnecting leads should be kept as short as possible with a maximum length of 10ft to avoid top loss and hum pick-up. This is a penalty of the medium impedance circuitry used on these recorders but should not prove a serious problem in practice. Once the inputs and outputs of the A-8 were connected to the appropriate mixer sockets, the A-2 connected to the stereo buss output, and the monitor outputs connected to an amp and speaker system, mains was applied and recording could start. The tape recorders are normally mounted vertically, although feet are provided for them to be mounted in a horizontal position. Unfortunately, if they are mounted horizontally a hole must be cut in the table surface to accommodate the interconnecting leads and plugs. An optional rack-mounting kit is also available. The whole set-up, including some miniature monitor speakers, could be fitted on a surface area of 4ft x 2ft and used comfortably, which compared with other systems is nothing short of astonishing. I found that the mixer was easy and fun to use and quite surprisingly flexible. The varispeed facility on the 8-track was really impressive in that, with careful use, I was able to re-synchronise tracks from a second generation 4-track tape on to a copy of the first generation 4-track master to synthesise an 8-track recording. At first sight, I thought that this would be impossible as the two tracks did not remain in sync for long, but the precision and stability of the varispeed was such that I was able to accomplish this successfully. This is something that is unlikely

to work in even the best of studios, and I was very impressed that it proved possible with the Fostex machines. I was also most impressed by the quality of sound produced by the 8-track recorder: even without noise reduction the noise level was not unbearable and with noise reduction the system worked extremely well, the major contribution to the noise in the above example being that existing on the masters that had been copied. No crosstalk problems were encountered during mixdown, although a certain amount occurred while overdubbing.

I was especially impressed by the Dolby-C noise reduction system provided. Many musicians are unhappy with the Dolby system of noise reduction, which is possibly due to them using it in poorly lined-up cassette recorders. The Dolby-C system



used on the A-8 provides far more noise reduction than would Dolby-B and I found it to have no apparent vices. (It should be noted that Dolby-C, like Dolby-B, only affects high frequencies — whereas Dolby-A introduces noise reduction across the whole frequency range.)

Recording and overdubbing on the A-8 proved that the system was extremely quick and easy to use, and that quite complex effects could be arranged with the mixer. To my surprise, despite warnings in the manual, adjacent track jumping was not completely ruled out although care and a good measure of luck was required. However, the headphone mix was very much altered by crosstalk in the tape heads, as it is in other semi-professional multitrack recorders. This is a pity although I imagine that, in view of the tape width, very little could be done to improve this. The restriction of only being able to record on a maximum of four tracks did not trouble me, nor did the track grouping. The more I have used the system, the more versatile and enjoyable I have found it. It is worth noting that a relatively inexperienced user should be able to use the system profitably with no other reference than the manuals provided. The results obtained with this setup were of a quality that was most impressive and reasonably noise free.

When testing the recorders for line-up I was impressed by the fact that, although the head block and deck are made of pressed steel rather than cast as in more expensive recorders, the stability of the transport did not seem to be affected by pressure on the headblock or even on the edges of the tape heads. This compares favourably with some professional machines, where merely replacing the

head cover can upset the azimuth settings! As 1/4in transports are far easier to make than 1/2in or 1in ones, I would expect that the A-8 would prove to be adequately stable in the long term.

I must admit that I cannot feel quite as enthusiastic about the 4-track and 2-track machines. Perhaps they are bound to fall in comparison with the A-8. One of the notable features of the 8-track is the absence of level controls on the tape deck, thus avoiding unnecessary and possibly ill-advised adjustment. On the 4-track, input level controls were provided for which I could find no pressing need, while I would have far preferred to have Dolby-C on this machine, for example, especially as the complete complement of an A-8, A-4, A-2 and the mixer would still compare favourably in price with a competing 8-track machine, while the potential of such a system would be really extensive. However, it is a pity that in a situation where a mixdown of the 8-track on to the 4-track might be required to allow further overlays, the spectre of tape noise would once more rear its ugly head. And one of the delights of the A-8 is that it does not require bolt-on goodies to make it work! Still, the comprehensive set of line up adjustments on the A-4 is undoubtedly a good feature. I am surprised by the lack of a record EQ trimmer, as it is necessary to compromise the optimum bias setting to achieve the best frequency response, and in view of this it is no doubt best to stick to the recommended tape type. However, the range of the trimmer provided on the A-2 seems largely useless (it reminds me strongly of another make of recorder) and I think that the use of a lot of EQ to try and achieve a flat frequency response beyond 20kHz can only worsen the noise performance of the machine for little real benefit. This may be the explanation of the rather poor noise performance of the 4-track machine. The A-2 stereo recorder mystifies me to some extent. Once again I find that there are too many front panel controls, although this is understandable as the machine could also be sold as a stand-alone unit. I question the utility of an overdub mode on a 2-track recorder as the cassette-based multitrack system would prove more flexible, and once again I cannot understand the lack of a noise reduction system, the more so if overdubbing is to be attempted on the recorder. After all, if not required it can always be turned off. At least the control socket for a noise reduction system provided on the A-4 could have been implemented on the A-2. Last but not least, I cannot understand what conceivable use peak overload LEDs are on the output of a tape recorder (wisely the manual does not mention these at all).

It is important not to let the above criticisms cloud the fact that the overall concept and design of the Fostex system is quite exceptional. The number of features included as standard is staggering and includes some innovations (such as the footswitch to control record) that should be present in any recording studio. It is a pity that the A-2 and A-4 are not as 'taut' in concept as the A-8, but they are still commendable machines with a host of useful features. The model 350 mixer complements the tape machines very well and has great elegance and simplicity, although I would have liked to have had a monitor level control (or at least a 'dim' switch) on it as well as an oscillator, which would have been a very useful adjunct (to help set up all those input level controls!). As a final temptation, 7in tape reels fit on ordinary bookshelves; 10 1/2in ones don't.

George Chkiantz

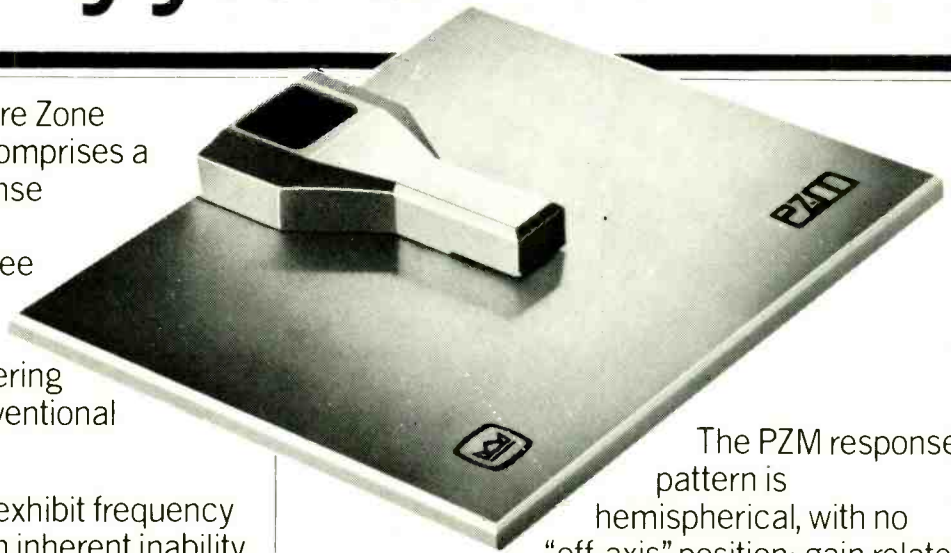
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2-track



4-track

Otari MTR-10

MANUFACTURER'S SPECIFICATION

Tape width: 1/4 in (6.3 mm).
Format: 1/2-track, 2-channel record and reproduce.
Reel size: 10 1/2 in max, NAB and EIA hubs.
Tape speeds: 30, 15 and 7 1/2 in/s.
Wow and flutter (DIN peak WTD): 0.04% at 30 in/s; 0.06% at 15 in/s; 0.08% at 7 1/2 in/s.
Speed accuracy: within ±0.03%.
Motors: Capstan — DC servo-controlled motor; reels — two DC brush motors.
Line inputs: transformerless balanced; 20kΩ; min input level for 0VU recording: -6dBm; max input level before clipping: +34dBm; nominal level: +4dBm. (Balanced floating inputs with optional transformer: 10kΩ.)
Line outputs: transformerless balanced; source impedance: less than 5Ω; load impedance: 200Ω or greater; max output level before clipping: +28dBm; nominal level: +4dBm. (Balanced floating outputs with optional transformer.)
Phones: unbalanced, load impedance: 8Ω or greater.
Connectors: line input: female XLR-type; line output: male XLR-type; phones: 1/4 in phone jack; external oscillator: 1/4 in jack.
Equalisation: NAB and IEC switchable; AES at 30 in/s.
Overall frequency response: 30 in/s: 40Hz to 28kHz ±2dB; 15 in/s: 20Hz to 20kHz ±2dB; 7 1/2 in/s: 20Hz to 18kHz ±2dB.
S/N ratio overall at 520nWb/m:

Tape	NAB EQ	IEC EQ	
Speed Unweighted	Weighted	Unweighted	Weighted
30 in/s	66dB	68dB	66dB 68dB
15 in/s	63dB	65dB	64dB 66dB
7 1/2 in/s	64dB	66dB	63dB 65dB

Distortion: less than 0.3% at 250nWb/m.
Crosstalk at 1kHz: greater than 55dB.
Depth of erasure: greater than 80dB (Scotch 250 tape).
Reference flux level: switchable H: 320nWb/m; M:

THE Otari *MTR-10* is basically a 2-track, 1/4 in, machine but it is also available as a 4-track, 1/2 in machine and can, I understand, be easily converted between formats.

Mounted into a console with wheels, two of which can be locked, the tape transport occupies the top and can be hinged up for maintenance with a locking stay being provided to hold the transport almost vertical. Below the transport is the electronics rack containing the audio electronics on three plug-in boards and four boards for other functions, with space for three further boards. Underneath this is the power supply, the elec-

250nWb/m; L: 185nWb/m. For Scotch 226 tape, H(320nWb/m) is factory set.

Power requirements: single phase AC 100V, 117V, 200V, 220V or 240V. 50 and 60Hz. 180W.

Dimensions: (whd) 23 x 35.6 x 25.6 in (584 x 905 x 650 mm).

Weight: 155lb, (70kg).

Standard accessories: NAB hub reel hold down knob x 2; reel adjusting disc (shim) x 2; lamp (large) x 2; lamp (small) x 1.

Optional accessories: auto locator *CB-109*, remote control box *CB-111* (with search zero and pitch control), remote control box *CR-705A*, balanced floating input transformer assembly *ZA-52W*, balanced floating output transformer assembly *ZA-52X*.

Price: £3,300, 4-track 1/2 in version £4,250.

Manufacturer: Otari Electric Company Limited, 4-29-18 Minami Ogikubo, Suginami-ku, Tokyo 167, Japan.

UK: Industrial Tape Applications, 1-7 Harwood Avenue, London NW1.

USA: Otari Corporation, 1559 Industrial Road, San Carlos, Cal 94070, USA.

tronics and the power supply units being readily removable for servicing.

At the back of the console are the finned heat-sinks at the rear of the electronics and the power supply chassis, the heatsinks being unprotected mechanically and easily bent — some simple form of protection would be desirable. The mains power connects to the power supply chassis with an IEC connector with the audio inputs and outputs being XLRs at the rear of the electronics chassis which also has connectors for noise reduction, remote control, external sync and an autolocator.

Control of the audio functions is at a sloping front panel which is hinged for access with the tape movement controls being on the tape transport.

The basis for the tape transport is a flat alloy casting about 6mm thick with holes for the motors and various other features. The DC reel motors mount on to the casting, with brackets which are not very substantial, and drive the spools directly with excellent spool clamps being provided for either NAB spools up to 10 1/2 in diameter or cine spools. When using cine spools these locate on splines on the motor shafts and are clamped with the reel holders which have a collet fixing on to the shafts. Alternatively the clamps can be slid down the shafts and collet fixed when they provide three spigots for NAB spools which are clamped with a spring loaded rotating section which clicks into

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place. I think that these are the best NAB adaptors that I have seen and I thoroughly recommend them for use on other machines.

Reverting to the Otari transport the tape passes from the feed spool to a damped tension arm and to a damping roller equipped with a small flywheel and thence to a rubber covered tape motion detector equipped with a tachometer disc which senses forward or reverse tape motion.

From here the tape enters the headblock area with two fixed guide posts at the input and one at the output, the plug-in headblock being secured to these guides. Within the headblock there are no tape guides or rollers, the tape just passing over the ferrite erase head and the metal record and replay heads, provided that the two tape lifter pins are not actuated by their damped solenoid.

After the headblock the tape is driven by a large diameter capstan which is directly driven by a DC servo-controlled motor equipped with a magnetic tachometer. The pinch roller is on the end of a solenoid operated arm which has three positions, the outer position for loading and fast winding, the intermediate is a 'ready' position and the third the record/replay position.

From here there is a lightweight sprung tape presence arm, the position of which is optically detected, and finally a large diameter roller followed by the take-up spool. Control of the tape tensions and general tape transport housekeeping is done by microprocessor, the latter being fed with spool rotational speeds from tachometer discs on the spool motors at the rear by the solenoid operated band brakes, tape speed from the tachometer roller and the capstan motor and spool size from optical spool size detectors which work by reflection from the spool rim through the top of the tape transport.

Beneath the tape transport all major components are attached by plugs and access to all parts is excellent with the transport having a number of PCBs for tachometer amplifiers and the like, plus the tape speed indicator and the tape timer.

The displays for these are seven segment numerical displays located on the top of the tape transport surface, to the left the tape timer showing real time for the three tape speeds up to $\pm 9\text{hr } 59\text{ min } 59\text{s}$, with adjacent set zero and search for zero buttons, the latter working with positive and negative times.

Above the tape timer a 4-digit display shows tape speed in in/s or as a percentage of nominal speed with adjacent buttons switching the display on/off and a second button selecting in/s or percent speed.

Opposite these features a 3-position rotary switch selects 30, 15 or $7\frac{1}{2}$ in/s with the remaining transport controls being on a strip nearer the operator.

To the left is a centre sprung cue lever and an illuminated cue button which allow the tape to be shuttled in either direction at any speed in contact with the heads. However the cue button serves two other purposes, to disengage the tape lifters in the fast wind modes and also to engage a constant 120 in/s fast wind if the cue button is simultaneously pressed with the fast wind button — an excellent feature for producing a first class tape wind.

Proceeding to the right, a 3-position switch selects the tape speed mode from fixed speed,

variable speed controlled by an adjacent multiturn pot or external speed control from a pot or a frequency source.

An edit/unload button when in the stop mode applies the reel brakes or in the play mode only actuates a dump edit.

At the centre of this panel a splicing block is provided with both 90° and 45° angles with a metal strip protecting the panel from razor blade damage. Access to the heads for editing is very good and in the stop mode the reels can be easily rocked with tape tension being maintained.

Finally there are five illuminated pushbuttons to control the transport four of which are the conventional fast controls, replay and record. The fifth button acts as a stop button but is also a load button, the loading procedure being unusual. Initially the transport has braking applied but once the tape is threaded over the tape tension sensor, pressing the load button releases the brakes and allows the tape to be fully threaded. Once in this condition the load button flashes to tell the operator that the microprocessor doesn't know about transport conditions. Either rotating the spools or starting the transport in any mode gives the microprocessor the opportunity to calculate reel diameters etc, and extinguishes the flashing light which remains extinguished until the tape is unloaded.

In operation the transport handled tape well at a constant tension of 80g which is ideal for $\frac{1}{4}$ in tape with the tensions only rising significantly when entering the fast wind modes.

Even at the highest speeds the winding was generally satisfactory using matte-backed tape and with power failure the transport came to a fairly gentle halt without any likelihood of tape damage.

As the tape threading path is not obvious it is felt that the addition of a line on the transport to indicate the tape path could be a useful addition, as it is possible for the tape to run away and be unstoppage if it is incorrectly threaded.

Turning now to the angled operator's panel this has twin illuminated VU meters which include red peak overload LED indicators. Normally these and the machine's inputs and outputs operate at fixed levels but depressing switches below the VU meters activates variable level pots below the meters and illuminates yellow warning LED indicators above the pots. To the right are two red record/safe toggle switches with individual red warning LEDs which flash together with the record button when the machine is in the ready state. Dropping in or out of record may be done with these switches for individual tracks or with the record button for both tracks.

Two further toggle type switches select the replay source from either input, reproduce or sync, the latter automatically switching to the input when in the record mode, the source being displayed with three LED indicators for each channel.

At the extreme right of the operator's panel is a stereo headphone jack socket with a stereo level pot and at the extreme left there are illuminated displays showing the selection of NAB or IEC EQ and the selection of the reference level for 0VU. This may be switch selected in the audio electronics to be 185, 250 or 320 nWb/m.

Finally in this section of the panel there are test

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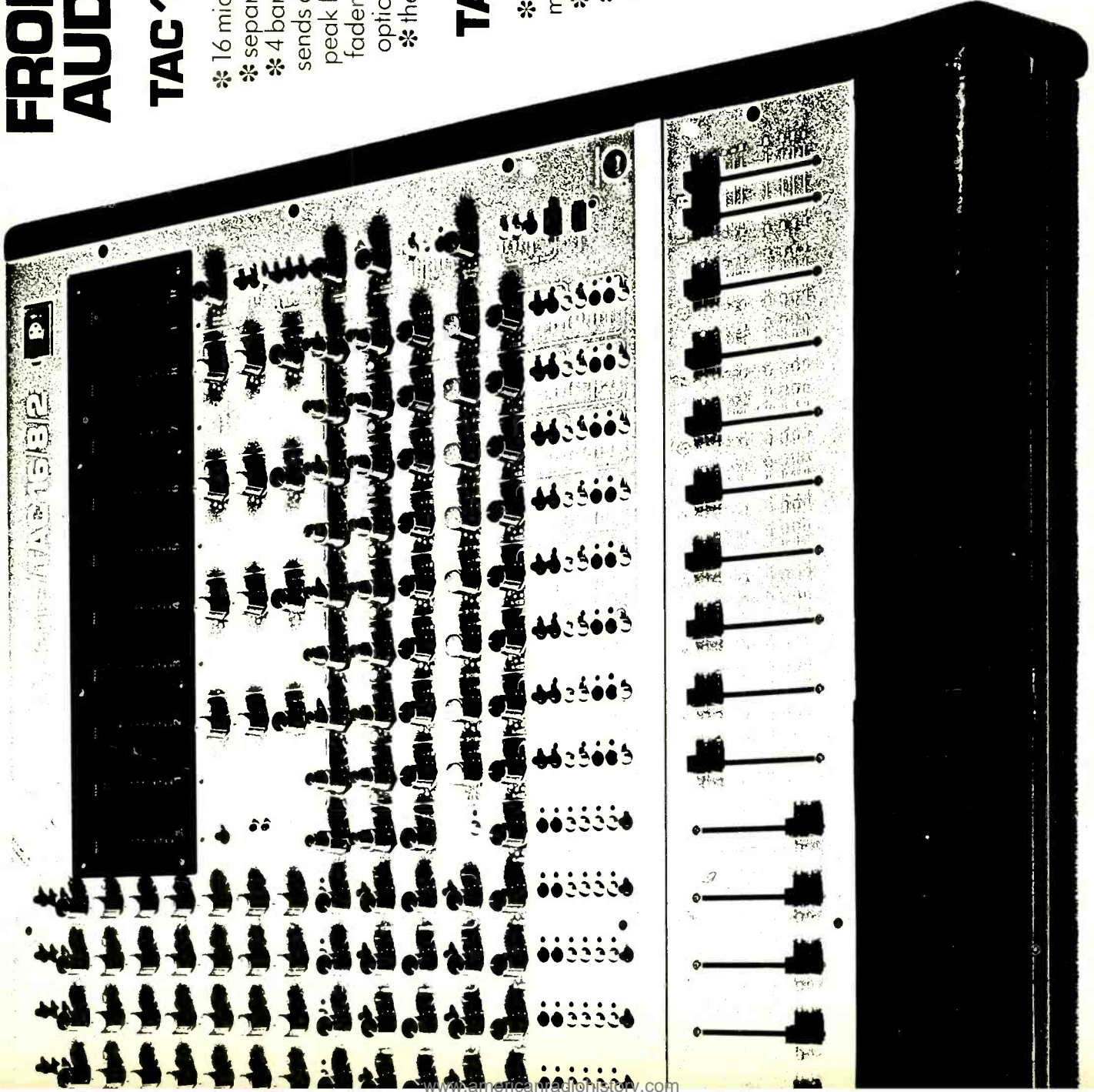
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- * P & G faders * full communication facilities
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oscillator facilities together with an external oscillator jack socket. A rotary switch selects the input to be line, the external or the internal oscillator, the latter providing 100Hz, 1kHz or 10kHz sine-wave signals plus 1kHz or 10kHz squarewaves.

Proceeding to the electronics frame all the boards are manufactured to an extremely high standard with impeccable component layouts, full component identifications and socketed integrated circuits.

No adjustments exist on the transport control board with the central processor unit (CPU) board having a test pushbutton recessed behind the front panel and a twin-colour red/green LED indicator showing test/run which is used for setting reel motor torques in conjunction with two gain controls on the reel motor control board.

The capstan control board which includes a mass of ICs has six multiturn pots for setting gain and damping at the three tape speeds with four further on-board adjustments and a red/green front panel LED showing capstan lock. Experience due to a faulty IC shows that this LED should be located on the tape transport in an obvious position as it is possible for the transport to run at an incorrect speed with no obvious indication to the operator.

Coming now to the audio section the audio control board provides a switch selection of two different bias settings for the three tape speeds, there being six multiturn bias setting pots screwdriver operated behind the front panel. Three similar pots allow the test oscillator level to be set at 100Hz, 1kHz and 10kHz. A slide switch selects either NAB or IEC EQ at the two lower tape speeds for both record and for replay with the 30in/s EQ being fixed for the AES $17\frac{1}{2}\mu\text{s}$ standard. Finally a 3-position slide switch selects the reference fluxivity for 0VU from 185, 250 or 320nWb/m.

The record and replay electronics for each channel are contained on a single board which has multiturn pots for reproduce gain, sync gain and reproduce standard record level (0VU). Screwdriver operated pots adjust the HF replay EQ at the three tape speeds with a further LF compensation pot being switchable in or out of circuit by means of a slide switch.

On the record side three screwdriver operated controls provide HF record EQ for the three tape speeds with a further three similar pots for phase compensation. The remaining three controls are multiturn pots for setting the record level (0VU), input sensitivity and individual channel bias, the master bias control normally being used to simultaneously adjust all channels.

Mounted on the board itself are the bias traps, four pots and a slide switch for switching the audio output to balanced or unbalanced.

At the very bottom of the console the power supply has eight red LED indicators for the individual power rails and the power on/off switch.

Frequency response

As supplied the replay frequency response was checked at 30in/s using an MRL calibration tape and found to be within +0.4dB, -0.6dB from 125Hz to 20kHz with the performance at the lower speeds using IEC EQ and BASF calibration tapes being within +1dB, -0.5dB from 31.5Hz to 18kHz at both speeds — a creditable performance.

Changing from IEC to NAB EQ followed the

correct time constants accurately, the range of the replay equalisers at 15in/s being shown in Fig 1 for the HF equaliser and the switchable LF compensation which had a very wide, but easily controlled, range. It will be noted that the HF equaliser had very little available cut which might be inadequate as the heads become more polished.

The optimised record/replay frequency response for the three speeds is shown in Fig 2 which demonstrates a remarkably flat response at all speeds with minimal LF deficiencies even at 30in/s where the 'wobble' is only 1dB total excursion. In the sync mode the frequency response, as expected, falls off at short

wavelengths but is quite adequate as shown in Fig 3.

At 15in/s the range of the record equalisers was reasonable as shown in Fig 4 for Ampex 406 tape at 3.5dB over bias at 10kHz and should cope with any current tape types, the performance at other tape speeds being similar. It was also found that the bias adjustment had a good range and that it was easy to accurately adjust the bias.

Noise

Noise in the replay output was measured without tape running, in normal replay mode and also with

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FIG. 1
MTR-10
15 IN/S PLAY EQUALISERS

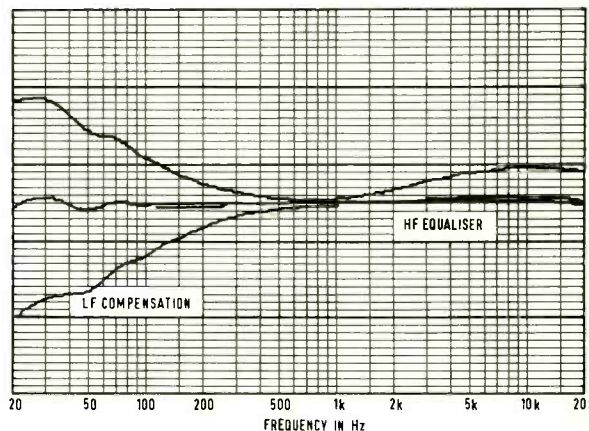


FIG. 2
MTR-10
RECORD/REPLAY
FREQUENCY RESPONSE AT
-20dB REF 320nWb/m

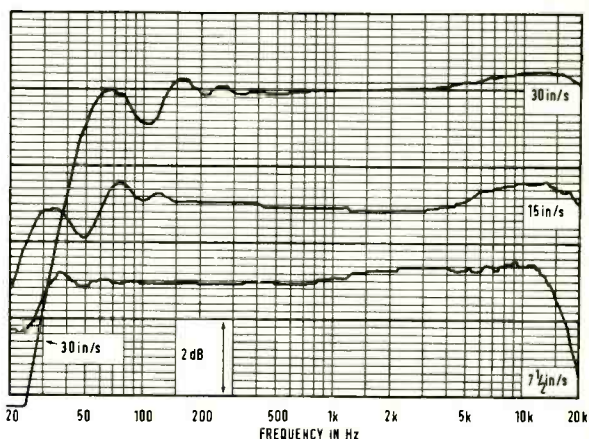
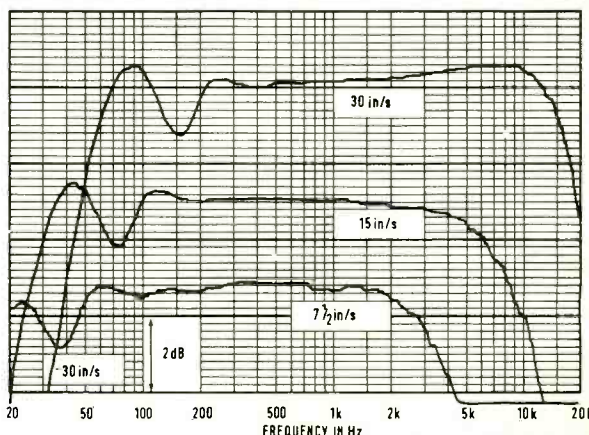


FIG. 3
MTR-10
SYNC MODE FREQUENCY
RESPONSE



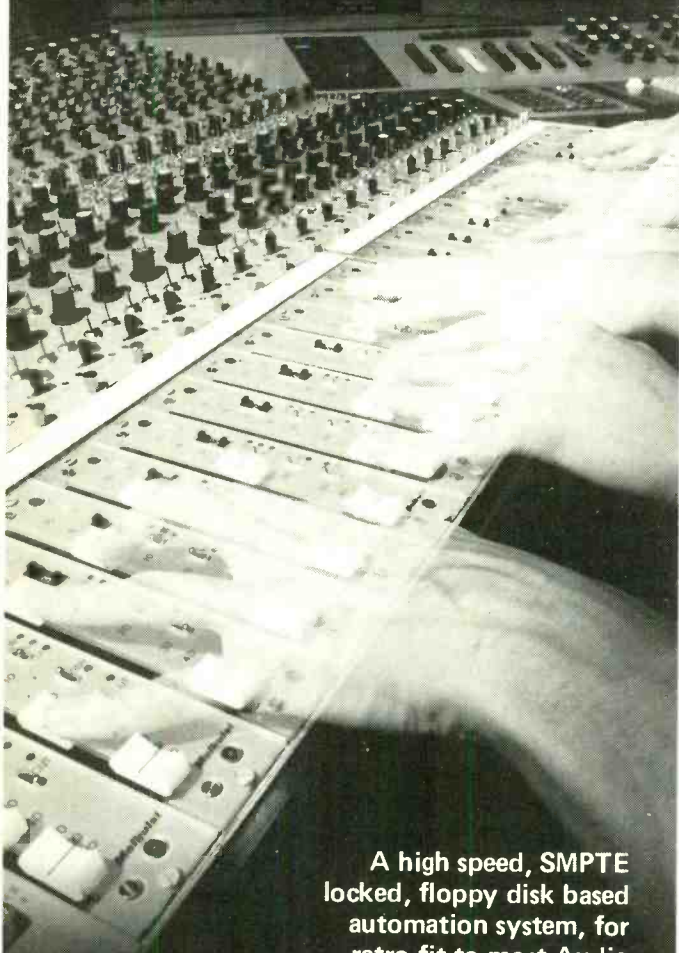
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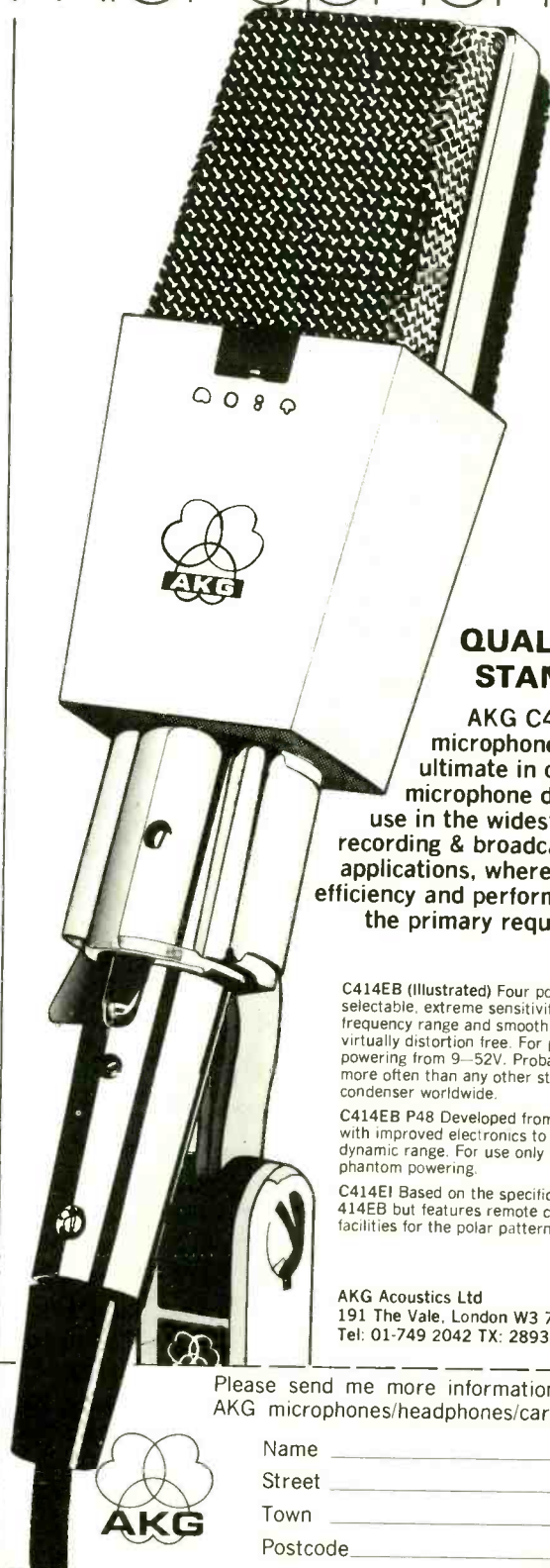
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Ampex 406 tape which had been recorded on the machine with bias and no audio signal. Little difference was noted between the two channels and **Table 1** shows the excellent margin between machine noise and tape noise.

In the sync mode the machine noise was virtually the same as in the replay mode, but as to be expected, the tape noise was slightly lower in view of the reduced bandwidth.

No tones such as hum or crosstalk from the digital electronics were noted at significant levels in the audio output and in spite of the absence of any humscreen over the heads hum pickup was not a problem.

Distortion

Using Ampex 406 tape at 3.5dB over bias at 10kHz at 15in/s and pro-rata at other speeds, the third harmonic distortion was measured at a fluxivity of 320nWb/m and also the 3% third harmonic distortion point determined as shown in **Table 2** using AES and IEC equalisation.

The above performance is entirely satisfactory for the tape type and it was found that even harmonic products were at an extremely low level, indicating a very clean bias waveform.

Checking the function of the phase correction recording squarewaves showed it to be a useful function offering a considerable improvement with little effect upon frequency response and the results of recording and reproducing a 1kHz squarewave at 15in/s are shown in **Fig 5**.

Inputs and outputs

The impedance at the balanced audio inputs was found to be constant with any gain settings at 26k Ω with a maximum input level in excess of +22dBm and a CMRR ratio of 65dB below 5kHz falling to 55dB at 20kHz. The input sensitivity to record 320nWb/m on Ampex 406 tape could be varied from -9dBm to +11dBm — a sensible range.

The balanced audio outputs were found to have a very low output impedance of about 0.5 Ω with a very high maximum output capability of +29.3dBm loaded into 600 Ω . The output level when replaying a fluxivity of 320nWb/m could be varied from +11dBm to 0V.

At the headphone jack the maximum output at the onset of clipping was 13.7V with the source impedance being 150 Ω .

Metering

Both VU meters were found to have the ASA C16-5 standard ballistics together with a genuine VU rectifier characteristic. In the high reference fluxivity setting 0VU corresponded correctly to 320nWb/m as received with the fluxivity switch operating correctly for 250nWb/m. However the increment between medium and low was too small by 0.5dB.

Testing the peak level LED indicators showed these to become illuminated 10dB above 0VU — a sensible setting — with the response time of the indication being less than 100 μ s.

Wow, flutter and speed

Measurement of the wow and flutter to the IEC quasi-peak weighted standard gave excellent results as shown in **Table 3** for the beginning, middle and end of an NAB reel of tape.

Checking the speed accuracy for the three

FIG. 4
MTR-10
15IN/S RECORD EQUALISER

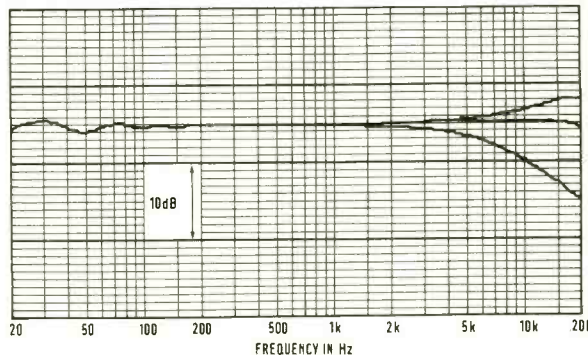


TABLE 1

CONDITION	REFERENCE LEVEL (320nWb/m) TO NOISE		
	30in/s AES	15in/s NAB	7½in/s NAB
Band limited 22Hz to 22kHz RMS	66.0dB	67.5dB	67.0dB
A-weighted RMS	80.0dB	78.5dB	78.0dB
CCIR-weighted RMS ref 1kHz	73.0dB	72.0dB	71.5dB
CCIR-weighted quasi-peak ref 1kHz	69.0dB	67.5dB	67.5dB
CCIR/ARM ref 2kHz	80.0dB	77.5dB	78.0dB
		15in/s IEC	7½in/s IEC
Band limited 22Hz to 22kHz RMS		67.5dB	67.0dB
A-weighted RMS		78.5dB	78.0dB
CCIR-weighted RMS ref 1kHz		72.0dB	71.5dB
CCIR-weighted quasi-peak ref 1kHz		67.5dB	67.5dB
CCIR/ARM ref 2kHz		78.0dB	78.0dB

NOISE WITH AMPEX 406 TAPE WITH AES AND IEC EQ

	30in/s AES	15in/s IEC	7½in/s IEC
Band limited 22Hz to 22kHz RMS	58.5dB	56.5dB	54.5dB
A-weighted RMS	64.0dB	63.0dB	58.5dB
CCIR-weighted RMS ref 1kHz	55.5dB	54.0dB	50.0dB
CCIR-weighted quasi-peak ref 1kHz	51.5dB	49.5dB	45.0dB
CCIR/ARM ref 1kHz	62.5dB	60.5dB	56.0dB

FIG. 5

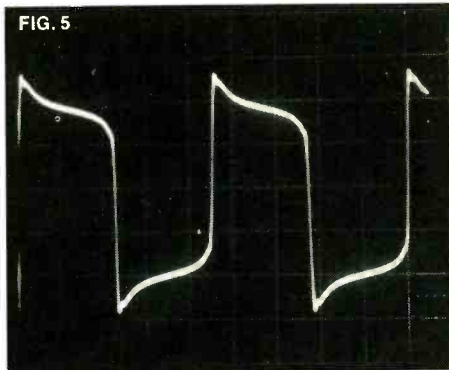


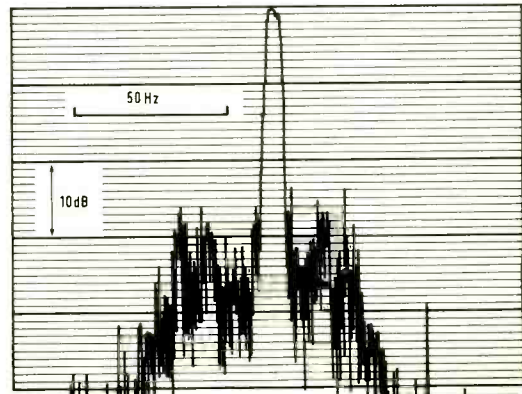
TABLE 2

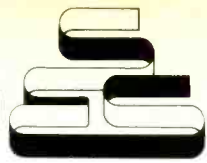
Tape speed	30in/s	15in/s	7½in/s
Distortion at 320nWb/m	0.3%	0.5%	0.56%
3% third harmonic ref 320nWb/m	+8.5dB	+8.0dB	+9.5dB

TABLE 3

SPEED	BEGINNING	MIDDLE	END	SPEC.
30in/s	0.033%	0.025%	0.030%	0.04%
15in/s	0.045%	0.045%	0.030%	0.06%
7½in/s	0.055%	0.040%	0.045%	0.08%

FIG. 6
MTR-10
ANALYSIS OF 10kHz TONE





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speeds showed any errors to be less than 0.002% with the drift from one end of an NAB reel of tape to the other being only 0.005%. The available variable speed was found to be 123.3% to 75.4% with the accuracy of the display being within its resolution and the variable speed having little effect upon wow and flutter.

Fig 6 a spectrum analysis of a recorded and reproduced 10kHz tone at 15in/s shows the flutter spectrum to be free from excessive frequency modulation, the results being good for an analogue machine.

Other matters

Erasure of a 1kHz tone at 15in/s using Ampex 406 tape showed a good performance with in excess of 90dB erasure.

As shown in Fig 7 the phase jitter at 10kHz between the tracks was minimal at $\pm 2^\circ$ with the

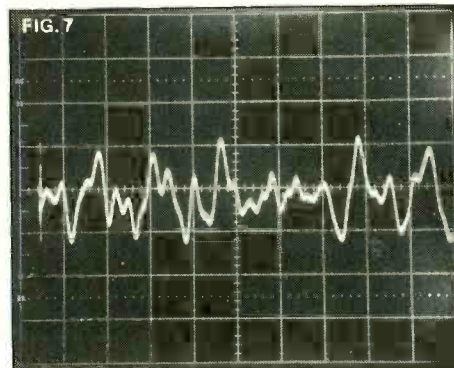


FIG. 8
MTR-10
CROSSTALK

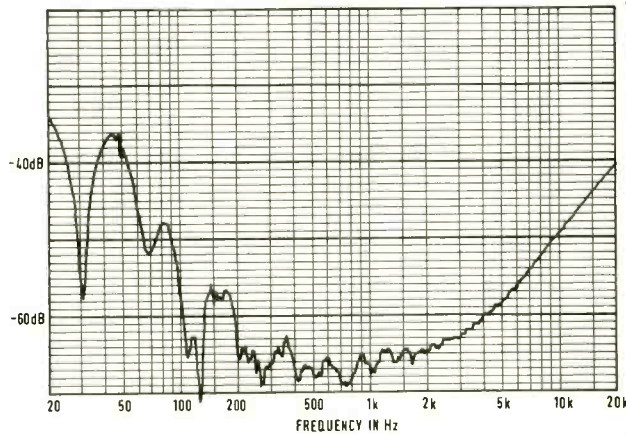
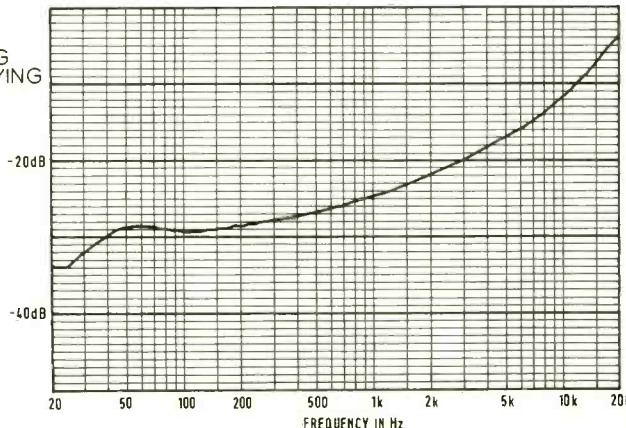


FIG. 9
MTR-10
CROSSTALK - RECORDING
ONE TRACK AND REPLAYING
IN SYNC



mechanical azimuth adjustment being easy to set very accurately and stable.

Fig 8 shows the record/replay crosstalk between the tracks with particularly good LF performance, the sync crosstalk when recording one track and replaying the other in the sync mode being shown in Fig 9.

The headroom capability of the replay and record chains was found to be more than adequate with the record amp being capable of driving +28dB above 320nWb/m with Ampex 406 tape.

The test oscillator was found to be fine for level checking, but to have rather high odd harmonic distortion, being 2% at 100Hz and 1kHz falling to 1% at 10kHz. The frequency was very accurate — within 0.01% and the rise time of the squarewave output 5 μ s with little droop.

Summary

The Otari MTR-10 has an exceptionally high standard of construction in the electronics department with sensible controls which allow accurate and quick alignment.

Mechanically the machine does not match the big European manufacturers' standard, but what can one expect at the price? Even then the mechanical performance was very good and the machine handled tape kindly.

Great care has clearly been taken in the overall functional layout of the machine which has many unusual features for a machine at this price. Overall I thoroughly recommend this machine for its performance which could justify a considerably higher price.

Hugh Ford

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*Specification unweighted, 20 Hz to 20kHz.

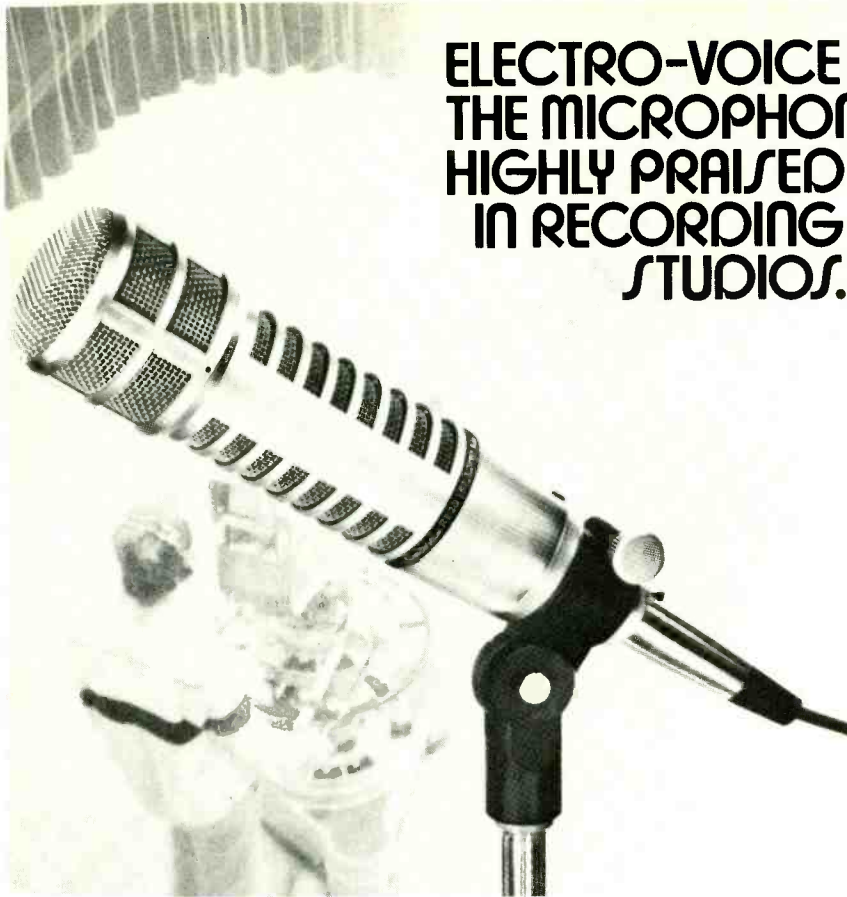
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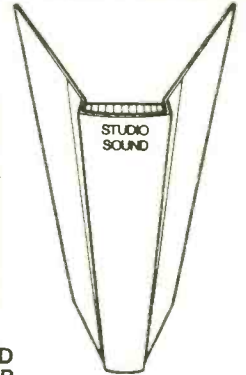
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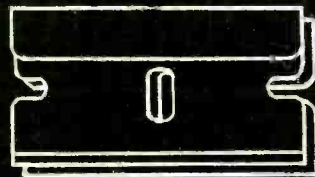
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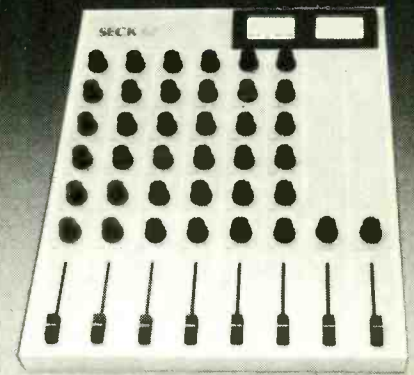
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Soundcraft THE CHALLENGER

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

Soundcraft Electronics U.S.A.
20610 Manhattan Place, Suite 120
Torrance, CA 90501
(213) 328-2595 Telex 182-499

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The console designers at Harrison Systems have identified many traditional inefficiencies and have eliminated these in the design of MR-2.

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Almost all hand-wiring in the frame has been eliminated. Mother-board-mounted multi-pin connectors are used for inputs and outputs.

Seldom-used features (like Quad) have been eliminated and replaced with more desirable and useful features.

Module width has been reduced to 40.6 mm (1.6"), thus reducing metal-work cost for a given console size.

In other words, every small detail of the MR-2 design has been critically optimized for efficiency. This efficiency does not mean, however, a reduction in signal-handling quality or reliability. In fact, just the opposite is true.

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Patch points now operate full line level (+4 dBu or +6 dBu) and are isolated and balanced.

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