February/March 1974 25p

studio sound

AND BROADCAST ENGINEERING

BURWEN 2000, DBX 187 and DOLBY 364 reviewed and field-tested

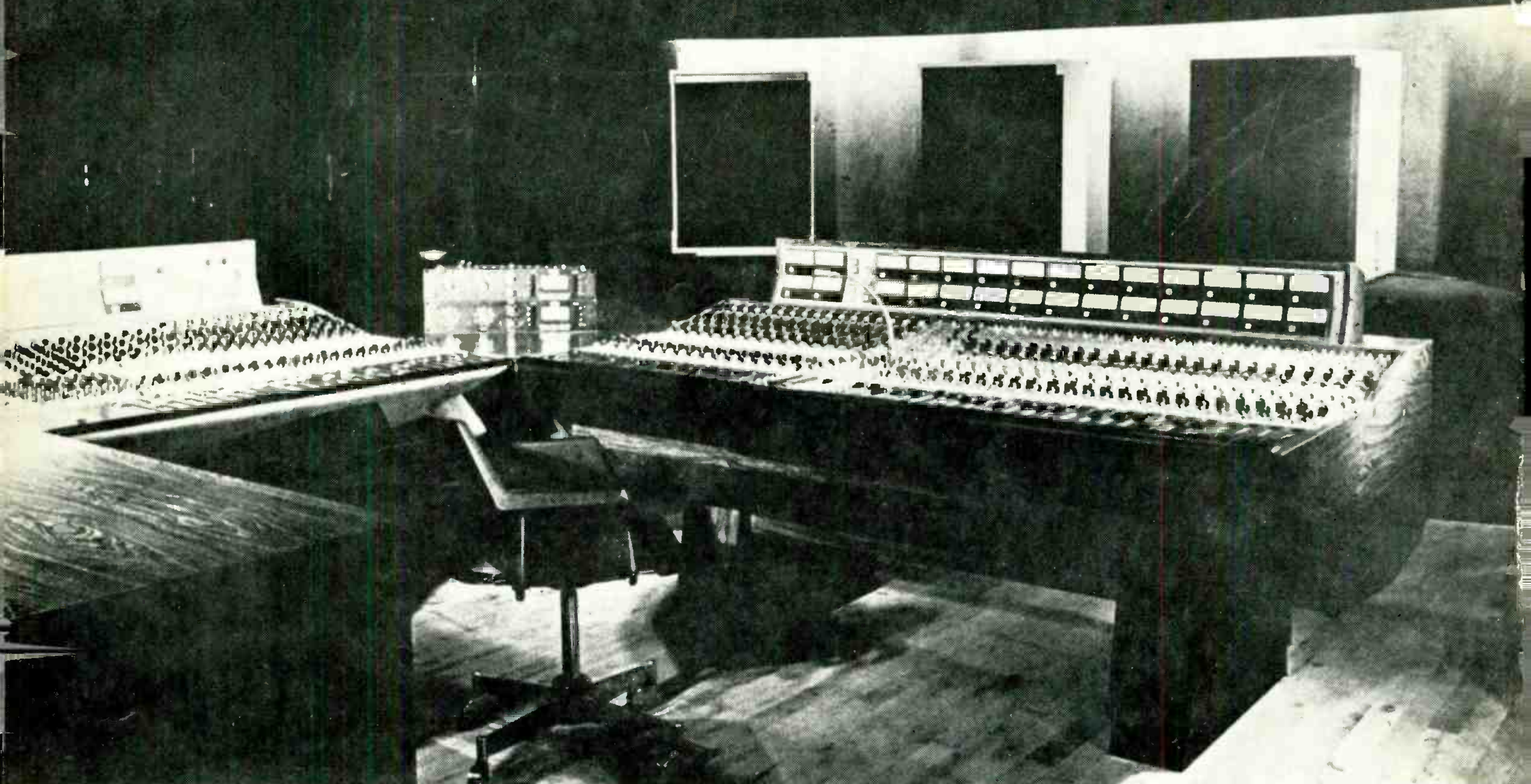
SURVEY OF COMPRESSORS, LIMITERS AND NOISE CONTROLLERS

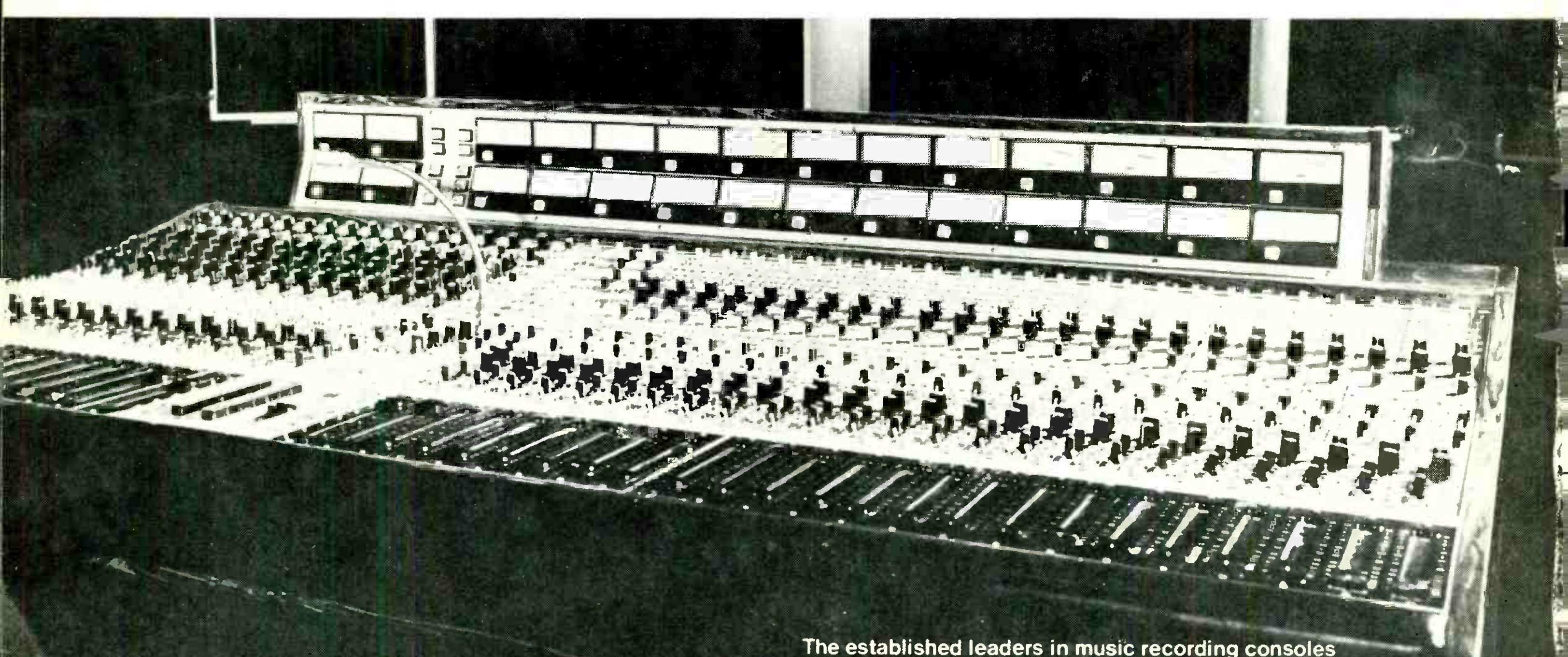
Cadac and Quadraphonics

Morgan Brussels – the first studio in Europe to be designed and built from scratch for quadraphonic recording – chose the new Cadac quadraphonic music recording console – not a standard stereo console with a few joysticks added, but one specifically designed and built to handle all types of recording in this medium.

Our close relationship with studio practices and techniques consequently is reflected in the console engineering and logic systems, which makes Cadac the obvious choice of people engaged in the art of sound recording.

So? Don't ask us.... ask them.





The established leaders in music recording consoles and techniques.

cadac

Cadac (London) Ltd
Lea Industrial Estate Batford Harpenden AL5 5EL
☎ Harpenden (STD 05827) 64351 Telex 826323

studio sound
AND BROADCAST ENGINEERING

EDITOR DAVID KIRK
ASSISTANT EDITOR JOHN DWYER
ADVERTISEMENT MANAGER RICHARD WESTBROOK

THE LINK HOUSE GROUP

Editorial and Advertising Offices: LINK HOUSE, DINGWALL AVENUE, CROYDON CR9 2TA. Telephone: 01-686 2599

CONTENTS

CORRESPONDENCE AND ARTICLES

All STUDIO SOUND *correspondence should be sent to the address printed on this page. Technical queries should be concise and must include a stamped addressed envelope. Matters relating to more than one department should occupy separate sheets of paper or delay will occur in replying.*

Articles or suggestions for features on all aspects of communications and musical engineering will be received sympathetically.

Manuscripts should be typed or clearly handwritten and submitted with rough drawings when appropriate.

BINDERS

Loose-leaf binders for annual volumes of STUDIO SOUND *are available from Modern Bookbinders, Chadwick Street, Blackburn, Lancashire. Please quote the volume number or date when ordering.*

FEBRUARY/MARCH 1974 VOLUME 16 NUMBER 2/3

BRITISH READERS of Studio Sound will probably not have been surprised by the non-appearance of our February issue last month. For overseas readers, however, we should explain that virtually all commerce and industry has been restricted to three days' electricity supplies per week. An overtime ban by coal miners has coincided with an oil shortage and, at the time of writing, there seems little hope of an early end to either. For the same reasons, this issue is smaller than usual.

From a gloomy subject to something more positive. We learn from the Association of Professional Recording Studios that the opportunity of attending a one week technical training course at the University of Surrey may be extended to all persons presently employed in sound recording. There is no age limitation and the scheme therefore offers a valuable means of gaining practical outside experience.

The proposed *Summer Course* 1974 will last one week and cost a basic £45 per student (non-residential) or £60 (residential). Pop, classical and speech recording techniques are to be covered at a practical level, in addition to the principles of acoustics, score reading, sound recording systems, electronic synthesisers, and sound reproduction. Surrey University are very well equipped (Neve, Calrec, Spendor, Neumann, EMT/Studer) and the course can be strongly recommended. Applications should be made to the APRS secretary, 23 Chestnut Avenue, Chorleywood, Hertfordshire WD3 4HA.

David Jessel's resignation from London Broadcasting is an unhappy sequel to the many difficulties besetting Britain's first legal commercial radio station. The deplorable technical quality and unpolished presentation of LBC's early days were accepted by most observers as being mere teething troubles. Any station that attempted night and day live presentation would inevitably experience greater strain than an outfit that hid for most of the time behind a cartridge player or gram turntable. LBC have now been on the air for four months, however, yet the teething troubles remain. For the listener, the only apparent improvement has been that advertisements seem fewer and therefore less obnoxious. LBC's experiences lend credence only to those who argued that commercial radio in Britain could not possibly make money and that it was therefore best left alone. As matters stand, comparing the BBC with its commercial 'rivals' is rather like comparing our national train service with the Bluebell Railway.

SUBSCRIPTIONS

STUDIO SOUND, *published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. The journal is available without charge to all persons actively engaged in the sound recording, broadcasting and cinematographic industries. It is also circulated by paid subscription to manufacturing companies and individuals interested in these industries. Annual subscription rates are £3 (UK) or £3.30 overseas.*

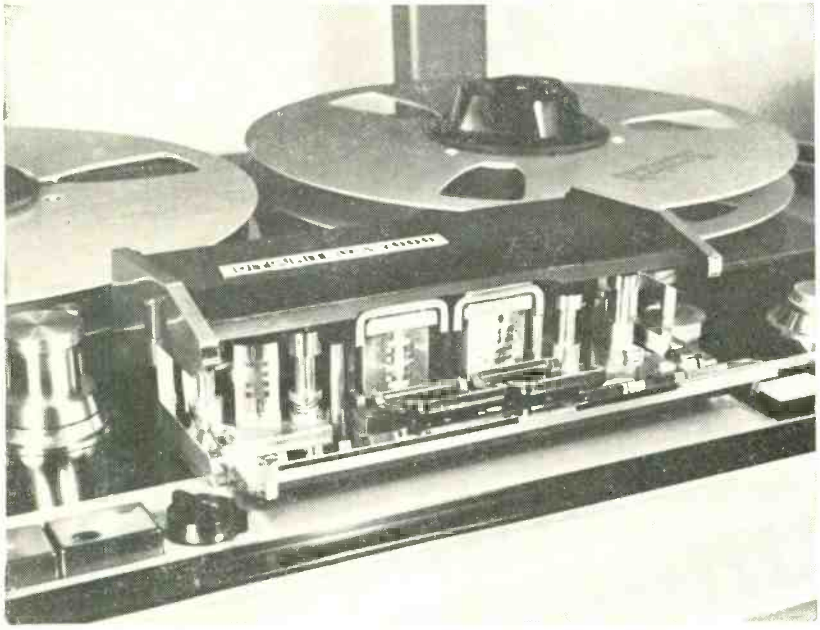
STUDIO SOUND *is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.*

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Total average net circulation of 7,374 per issue during 1972.

this is Otari

OTARI MX-7000 $\frac{1}{2}$ INCH



4 CHANNELS on $\frac{1}{2}$ inch tape
For mastering or multitracking
$3\frac{3}{4}$ / $7\frac{1}{2}$ / 15 ips or $7\frac{1}{2}$ / 15 / 30 ips

£1890 + V.A.T.
INC. CONSOLE

IMMEDIATE DELIVERY

From Japan's biggest manufacturer of Tape Duplication equipment, the DP4050 reel to cassette copier.
Highest attainable in cassette performance.
Foolproof operation for non-skilled personnel.
Eight times copy speed.
Complete relay-solenoid operation.
Automatic cycle through Record-Rewind-Stop.
Absolute consistency in manufacture through large volume production.

£2377 + V.A.T.

OTARI

JAPAN'S LARGEST MANUFACTURER OF TAPE DUPLICATION EQUIPMENT

Supplied to: EMI., Decca, etc.

OTARI ®

Industrial Tape Applications
105 High Street, Eton, Windsor, Berks. Tel: (95) 52663 Telex 21879

ITA

You edit the tape. We edit the prices.

VIDEO TAPE AT DIXONS TECHNICAL

	RECOMMENDED PRICE	DIXON PRICE
SCOTCH $\frac{1}{2}$" 2400 ft.	£10.00	£8.50
SCOTCH $\frac{1}{2}$" 3000 ft.	£16.30	£13.50
BASF $\frac{1}{2}$" 2400 ft.	£10.75	£8.50
SHIBADEN $\frac{1}{2}$" 2400 ft.	£10.80	£9.10
RACAI ZONAI 2400 ft.	£10.00	£8.00
SCOTCH $\frac{1}{4}$" 1200 ft.	£3.76	£3.00
BASF $\frac{1}{4}$" 1200 ft.	£3.75	£3.00
ZONAI $\frac{1}{4}$" 1200 ft.	£3.80	£3.00
AKAI $\frac{1}{4}$" 1200 ft.	£4.00	£3.50
DIXTEC CCTV $\frac{1}{2}$" 2400 ft.		**£5·50**

NEW IMPROVED QUALITY

OUR TAPES SUPPLIED IN AIR TIGHT CONTAINERS

Exclusive to Dixons Technical. Fantastic quality Dixtec CCTV $\frac{1}{2}$" 2400 ft: **£5·50**

To:
DIXONS TECHNICAL LTD, 3 SOHO SQUARE, LONDON, W.1.

Name...

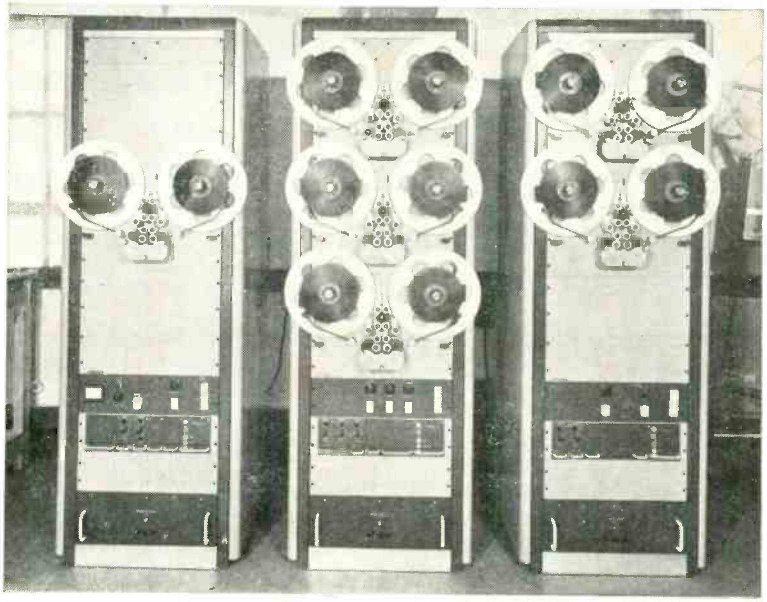
Address..

....

VI/SS/2

Dixons Technical Ltd
OF SOHO SQUARE

Just to give you the basic idea we call it the . . .



Perfectone Rack-Mounted Simplex/Duplex/Triplex Trans-Ultra Studio Recorder for 16 or 35 mm Film with Rythm-O-Start Drive System.

Perfectone is quite a name in itself especially for the highly sophisticated 'OR-Multi' recorders that have set the standard throughout the industry. The new, compact, adaptable and most reliable rack-mounted equipment is fully worthy of the name offering undoubted broadcast quality and a load of useful facilities at considerably lower cost.

Trans-Ultra film transport mechanisms — proved very successful in portable recorders — are mounted in standard 19 in. racks for recording and transfer work. All recording units incorporate a separate reproducing channel and either 16 or 35 mm mechanisms can be fitted to the racks in any Simplex, Duplex or Triplex combination. The most popular system is made up of three machines. In this, two replay units and one recording unit can be locked in perfect synchronisation with, say, a film projector by the Rythm-O-Start electronic interlock system.

A big advantage of the new rack recording/replay package compared with standard racks is the reduction in size and weight and the combination of all facilities for synchronising, mixing and transfer work in the studio.

Unique to Perfectone is the outstandingly convenient Duplex version with integrated CCTV picture projection system.

With this or any arrangement of the facilities to match your requirements (and no more), the new Perfectone equipment adds up to superb value for money.

Ask us to send you the literature — or if nothing less than the absolute quality of the best in the world is good enough, we'll be pleased to give you information about Perfectone 'OR-16' or 'OR-Multi' models.

Perfectone

EVERSHED POWER-OPTICS LTD,

Bridge Wharf, Bridge Road, Chertsey, Surrey KT16 8LJ.
Tel: Chertsey 61131 Telex: 929945 Lenservo Chrtsy.

HAMPSTEAD HIGH FIDELITY FOR THE HIGHEST QUALITY STC MICROPHONES

Main distributors of STC professional microphones. The complete range is available from stock. Professional terms available.

h HI FI

HAMPSTEAD HIGH FIDELITY
91 Heath Street, Hampstead, London NW3 6SS
Telephones : 01 - 435 0999 and 01 - 434 6377

4105
Cardioid microphone
Small, lightweight and robust, suitable for high quality sound reinforcement
Impedance 30 Ω

4037 A & C
Omnidirectional
Moving coil
Frequency response : 30 Hz - 12 kHz. Sensitivity : –84 dB ref IV
Suitable for interviewing

4104
Broadcast quality commentator's noise cancelling lip microphone
Sensitivity –84 dB ref IV. Impedance 30 or 300 Ω
A highly damped ribbon unit ensures freedom from non linearity and low frequency surges

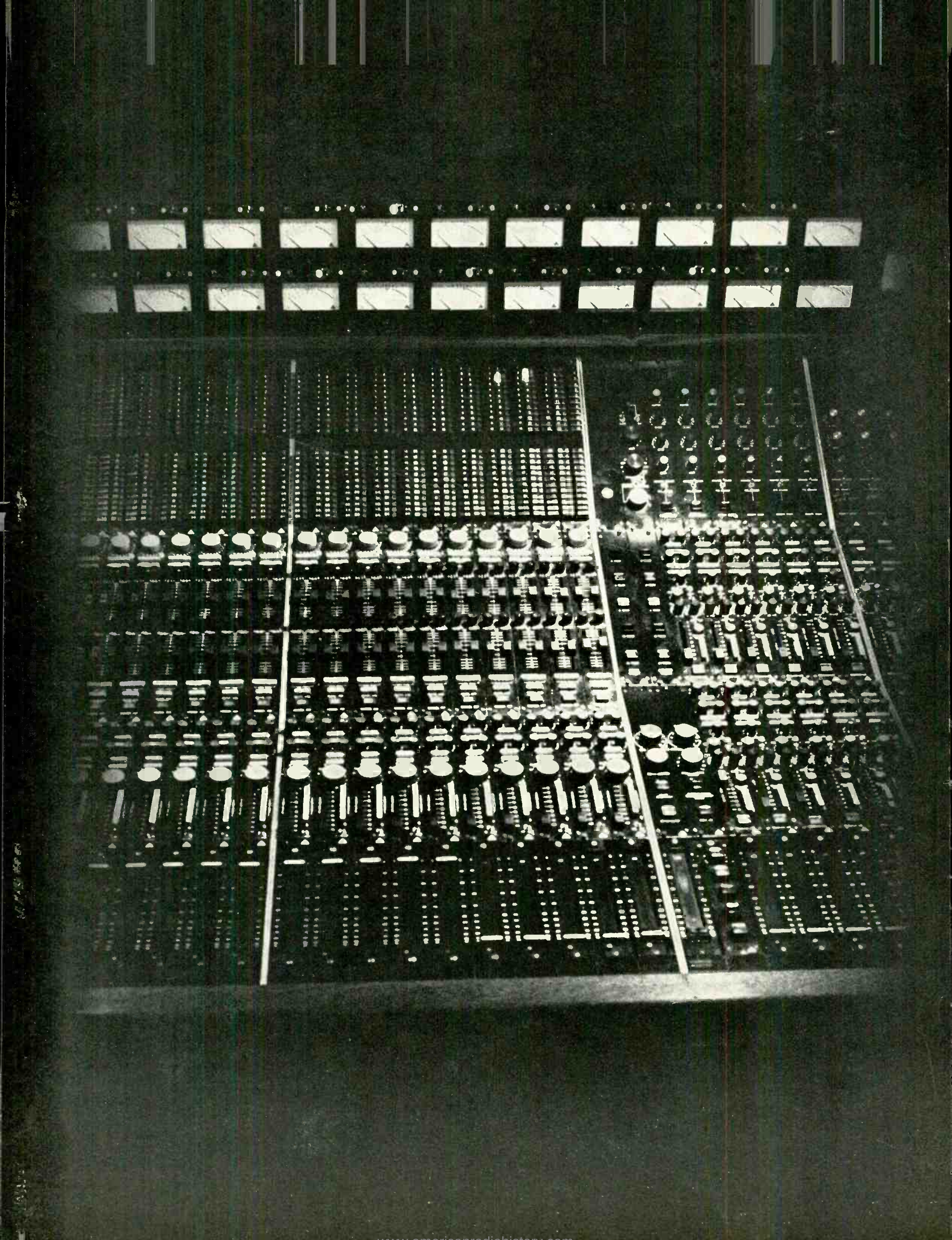
4115
Lightweight Broadcast quality noise cancelling ribbon microphone
Impedance 30 Ω
Sensitivity 85 dB ref IV

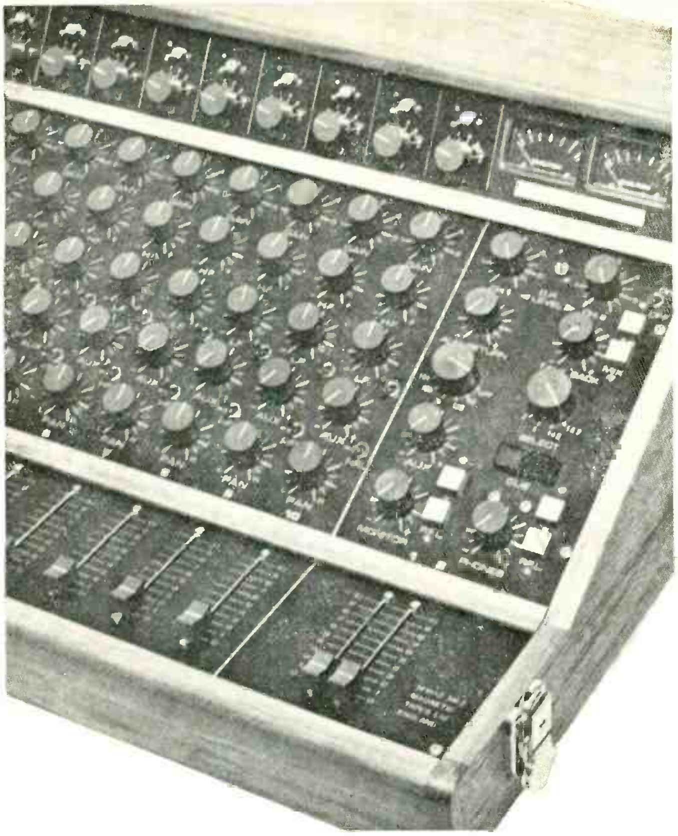
4021
Omnidirectional
Moving coil 40 Hz - 12 kHz. Impedance : 30 Ω. Output : –80 dB ref IV/dyne/cm²

TOP
4001 G
High frequency pressure unit 15 Ω as used by leading loudspeaker manufacturers

BOTTOM
4001 K
High frequency pressure unit 8 Ω as used by leading loudspeaker manufacturers

4038
Bidirectional Ribbon
30 Hz - 15 kHz
Impedance : 30 Ω or 300 Ω. Output : –80 dB ref IV at 30 Ω





WHY CHILTON MIXERS?

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

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

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

M10/2 Mk 2 BASIC ....£275.00+VAT
16 input version......................£415.00+VAT
12 in 4 out..............................£495.00+VAT

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

Telephone 01-876 7957

A professional recording makes all the difference

We offer a complete service in putting together a spoken word programme. Whether it be with music, sound effects or slide synchronisation, we have the knowhow and the facilities to give you an efficient package including .... *sound recording, editing and dubbing, multiple cassette copying, multiple reel to reel copying*

For more information write or phone

fpa Fraser-Peacock Associates Ltd
94 High St. Wimbledon Village
London SW19 947 1743/2233

BIAS ELECTRONICS

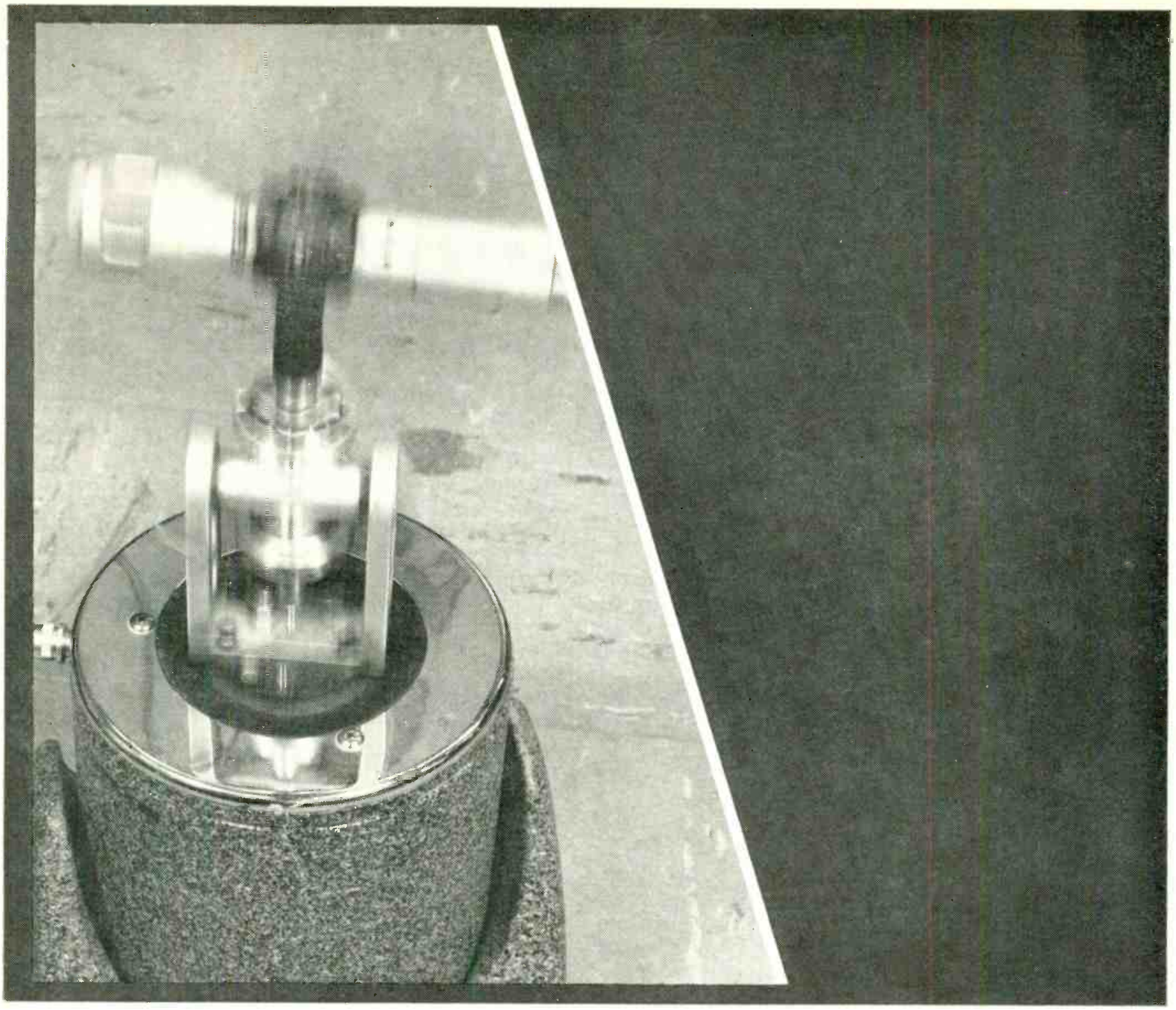
PROFESSIONAL RECORDERS

for broadcasting and studio use

Our range includes console, transportable and rack mounting machines

Mono-stereo $\frac{1}{4}$", 4 track $\frac{1}{2}$", 4 track $\frac{1}{4}$" slow speed radio station loggers. All to IBA requirements.

BIAS ELECTRONICS LTD. 01-947 3121
Unit 8 Coombe Trading Estate, 112-120 Coombe Lane, London SW20 0BA



Shake, rattle & roll.

Welcome to our chamber of horrors. Inside the Shure Quality Control laboratory, some of the most brutal product tests ever devised are administered to Shure microphones. The illustration above shows a "shaking" machine at work on a Shure microphone and noise-isolation mount. It's only one in a battery of torturous tests that shake, rattle, roll, drop, heat, chill, dampen, bend, twist, and generally commit mechanical, electrical and acoustical mayhem on off-the-production-line samples of all Shure microphones. It's a treatment that could cause lesser microphones to become inoperative in minutes. This kind of continuing quality control makes ordinary "spot checks" pale by comparison. The point is that if Shure microphones can survive our chamber of horrors, they can survive the roughest in-the-field treatment you can give them! For your catalog, write:

Shure Electronics Limited
Eccleston Road, Maidstone ME15 6AU
Telephone: Maidstone (0622) 59881
84 Blackfriars Road, London SE 8HA
Telephone (01) 928 3424

SHURE®

REVOX

Ease the hastle cut the time

With this new VHS77
30 ips + 15 ips REVOX with Sel Sync.
ECHO and A.D.T.
Tape delay of only 1/20th second produces the most natural echo yet.

HI Speed Duplication
Duplicates Masters in half or quarter normal time without loss of quality at 30 ips with a frequency response to over 40k Hz.

Editing
Made a dream, not a nightmare. One note may occupy around a foot of tape

Stereo
Tapes recorded to broadcast standard.

Sole U.K. Supplier:

All versions of the A77 available for immediate delivery.

THE NEW REVOX A700

Full tape transport logic control.

Servo controlled tape tension and capstan.

3 speeds.

Integrated circuits.

4 independent inputs.

Rugged construction.

Automatic programme.

Pause control.

Slider faders

Linear tape counter in mins. and secs.

Scotch 207 UK's LOWEST PRICES

ITA Industrial Tape Applications
105 High Street, Eton, Windsor, Berks. Tel: (95) 52663 Telex 21879

LEVEL CONTROL EQUIPMENT

Effective Solutions . . .

F760X **LIMITER-COMPRESSOR-EXPANDER**—provides a range of compression slopes with separate overall limiting plus, Expander/gate facilities to cut noise and channel cross-talk (available without expander).

F700X **COMPRESSOR-EXPANDER**—with a range of compression slopes from 2:1 to 20:1 (limit), plus Expander/gate facilities (available without Expander section).

E800 **EQUALISER**—one of the most versatile on the market; 27 optional switches frequencies in three overlapping ranges (45 Hz-520 Hz; 250 Hz-6k Hz; 2k Hz-17k Hz) providing broad and sharp bandwidth options with ±20 dB peak/dip. Also High-pass filter and HF shelf-lift.

F768X **VOCAL-STRESSER**—combines the F760X unit with an E800 Equaliser in a $3\frac{1}{2}$" rack unit. The Equaliser can be routed before or after the compressor, or into its control side-chain to reduce modulation effects.

E900 **SWEEP-EQUALISER**—*four* continuously variable frequency sections (45-600 Hz; 250 Hz-4k Hz; 2k Hz-10k Hz; 3k Hz-17k Hz) with overlapping coverage giving broad and sharp bandwidth options; ±20 dB peak/dip.

E500 **BAND SELECTIVE PROCESSOR/DE-ESSER**—for use in conjunction with and external limiter-expander. Any portion of the audio range can be routed for selective treatment without modulation effects on the main programme content. Ideal for any mastering suite where transfer problems have to be confronted and resolved.

P400 **AUTOPHASE** programme controlled phasing effect unit in stereo rack mounting format.

P200 **MANUAL PHASER**—a simple yet effective phasing module.

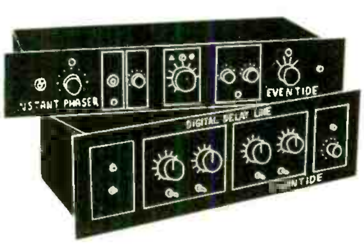
AUDIO DESIGN RECORDING

St. Michaels, Shinfield Road, Shinfield Green, Reading, Berks.

Tel. Reading (0734) 84487

THE AMAZING EVENTIDE OMNIPRESSOR®

CHART OF FUNCTIONS



NEW

from

FELDON AUDIO

Feldon Audio Limited
126 Great Portland Street
London W1N 5PH

Telephone 01-580 4314
Telex 28668

REW Audio Visual Co

London's leading distributors for Studio, P.A. and Professional Equipment

TEAC A3340 (Professional Model)

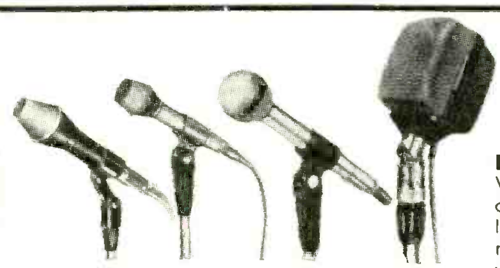
R.E.W. are main suppliers to professional users of this new 4 channel tape recorder. Main features include full sel-sync on all 4 channels, 15 and $7\frac{1}{2}$ i.p.s., solenoid mechanics and $10\frac{1}{2}''$ reels. Other recorders available with similar facilities would cost over £1,000.
R.E.W. price on application.

THE NEW REVOX A700 NOW IN STOCK

REW are now London Distributors for MAC-LAB high power P.A. Speaker Drivers. Special trade prices for professional users.

AKG
Microphones

Accepted as the studio standard. Most models available over the counter including capacitors. REW are main West End distributors.



AKG D190E. All purpose high quality mic.
AKG D109. Neck microphone.
AKG D202E1. 2 Capsule studio standard mic.
AKG D1200E. Highly versatile stage mic.
AKG D12. Studio mic for bass instruments.
AKG D224E. The ultimate dynamic mic.
AKG C451E. Famous studio capacitor mic.

SHURE
Microphones

The most widely used range of microphones for Public Address and Stage use. REW are Main West End distributors.

SHURE 515 SA UNIDYNE B. Inexpensive handmic.
SHURE 588 SA UNISPHERE B. Good all round P.A. mic.
SHURE 545 UNIDYNE III. Probably the most famous P.A. mic.
SHURE 565 UNISPHERE I. Unidyne III with pop shield.
SHURE 548 UNIDYNE IV. High quality solo P.A mic.
STUDIO RANGE AVAILABLE FOR QUICK DELIVERY TO ORDER
REW are also main agents for BEYER, CALREC, SONY. CAPACITOR, SENNHEISER,— ORANGE, RESLO RADIO MICS. and LONDON DISTRIBUTORS FOR KEITH MONKS MIC STAND.

AMCRON

REW are LONDON DISTRIBUTORS FOR CROWN (AMCRON) AMPLIFIERS. All models of these superb amplifiers are available ex-stock for Sale or Hire. Amcron amplifiers set the standard for studio monitoring or P.A. amplification.
REW offer the Amcron amplifiers at the trade prices shown to bona fide professional users or trade organisations.

DC300A
Will give up to 500 watts from one channel with distortion lower than 0.05% Hum and noise is below 110 dB 150 watts, and the DC300A is now able to operate into loads as low as 1 ohm.
£376+VAT

D150
Offers up to 140 watts from each channel, or 330 watts as a mono amplifier. Again very low distortion, and rugged construction make the D150 ideal for smaller PAs and fold back systems.
£216+VAT

D60
Will provide up to 60 watts from each channel, and is of the same high quality as the D150. As a mono amplifier it will give over 100 watts. The D60 is only $1\frac{3}{4}$in. thin.
£112+VAT

IC150
Superb quality dual channel preamplifier designed to operate with D150 power amplifier. Signal to noise ratio almost immeasurable.
£142+VAT.

All Amcron Amplifiers are guaranteed for 3 years.

REW Audio Visual Co

All products are only sold at professional prices against company orders.

West End Professional Sales Basement Studio
146 Charing Cross Road, London WC2 Tel. 01-836 3365

Head Office, Video Studios and Development Dept., REW House, 10-12 High Street, Colliers Wood, London SW19 2BE. Tel. 01-540 9684/5/6. Telex 896194

NEW equipment for the professional sound-recording studio from brenell

DESIGNED AND MADE IN THE U.K.

MULTI-CHANNEL EQUIPMENT

We have set a new price/performance standard with our 4, 8 and 16 channel studio recorders offering full facilities for the production of master recordings. PPM or VU meters on each channel. Equalisation to CCIR, NAB and IEC characteristics. Remote control for tape transport and record functions. The equipment is in full production and studio use in both U.K. and overseas.

STUDIO RECORDERS

for 2-channel reducing, field recording and full-track mastering.

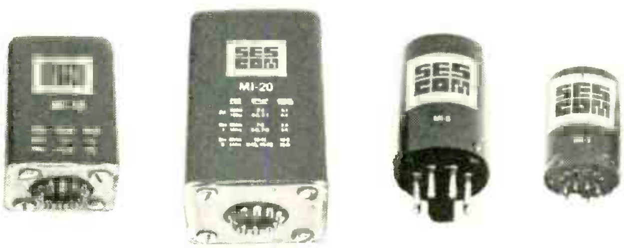
TAPE TRANSPORTS

We offer a widened range of 2 speed and 4 speed modules from 15/16 to 60 IPS, $\frac{1}{8}$" to 1" tape width, with heavy duty solenoid operation and remote control facilities.

brenell

BRENELL ENGINEERING CO LTD
231-5 Liverpool Road, London N1 1LY Tel. 01-607 8271 (5 lines)

HIGH QUALITY AUDIO TRANSFORMERS SESCOM'S NEW "MI-SERIES"

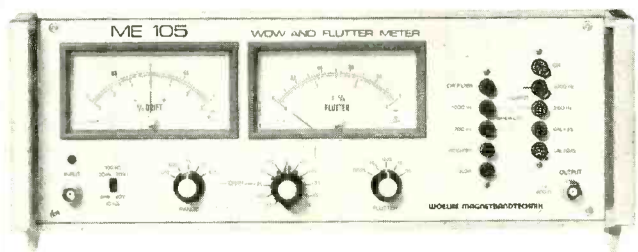


- Low Distortion Typical <.2%
- All Popular Secondary Impedances
- Electro-Magnetic Shielded
- Electro-Static Shielded
- Four Power Levels −30dbm, −10dbm, +18 dbm, & +30dbm.
- Low Cost
- Stocked for Quick Delivery

(Send for Complete Catalog)

QUALITY ENGINEERED SOUND PRODUCTS
SESCOM, INC.
P. O. Box 4155, Inglewood, CA 90309 USA
Telephone (213) 678-4841

WOW and FLUTTER METERS

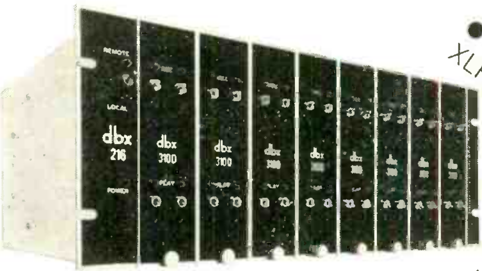


Illustrated is the ME 105, the very latest type of Wow and Flutter Meters manufactured by Woelke Magnetbandtechnik, Munich, Germany, and distributed exclusively by us in the U.K. Anyone concerned with the most accurate measurement of drift (down to plus/minus 0.1%) and wow and flutter (down to plus/minus 0.03%) will be interested in the ME 105. Fuller, final details on application.

LENNARD DEVELOPMENTS LTD.

206 CHASE SIDE, ENFIELD, EN2 0QX MIDDX. Tel. 01-363 8238

noise reduction takes a giant step forward with the dbx 216



With the dbx 216 professional tape noise reduction system, you get every one of these advantages over less advanced approaches:

- **in excess of 30 dB of noise reduction** which gives you an extra safety margin and lets you forget about noise build-up even in 24 channel applications
- **10 dB headroom improvement** eliminates tape saturation or tape recorder overload worries
- **100 dB dynamic range** makes level setting less critical
- **no pilot tones or level matching required,** just turn on and record
- **true RMS level sensing** guarantees perfect code/decode tracking and transient reproduction throughout the record and playback cycle
- **simultaneous record and playback functions** eliminate mode switching, remote control necessity, etc.
- **spare two-channel module** supplied with a 16-channel system reduces down-time to near zero
- **complete cable assemblies** with prewired mating XLR connectors make installation a simple 30-minute plug-in operation
- **expandable modular design** allows purchase of as few as four channels, with easy subsequent expansion to 8, 16, 24, or any number of channels
- **available at a price of £3,400** from Scenic Sounds Equipment, 27-31 Bryanston Street, London W1H 7AB 01-935-0141
- **for full product information write to the factory**

dbx, Incorporated, 296 Newton Street, Waltham Massachusetts 02154 USA

dbx

NEWS

APAE

THE NEXT exhibition of the Association of Public Address Engineers, *Sound 74*, will be held from March 12 to 14 1974 at the Bloomsbury Centre Hotel, London. In a statement issued at a press conference in December the Association said that 30 exhibitors had already booked space. There was room for a few more, though those wishing to exhibit should apply early. *Sound 74* was certain to be larger than its predecessors.

The president of the Association, Mr John Robins, said that the Association was now in a very good financial position and was operating at a profit. He said that he wished press relations could have been better during the past year and the present conference was an attempt to put this right. The 'Northern APAE', as it has become known, had been very successful indeed but, because it had been largely an impromptu affair which had grown from an exhibition by only six companies, it had not been possible to tell the press about it in good time.

He said that in future it was possible that this second exhibition would be held in different provincial centres each year. The first was held at Leeds on October 31, 1973.

Admission to *Sound 74* will be free. Tickets will be available from the APAE secretariat or from exhibitors. The exhibition will be open from 10.00 to 18.00 each day except on Thursday, when it will close an hour earlier. Lectures on sound reinforcement techniques will be held in the City Room of the hotel. Details will be published soon.

The annual general meeting of the APAE will be held in the City Room at 18.00 on March 13. The President's dinner will be held in the Trafalgar Room on March 12 at 20.00. Members and their guests are invited to a party at the hotel on March 13 at 21.00, after the agm.

CD4 patent suit

JVC's CD4 four channel system is in apparent infringement of a patent issued to Mr Kenneth Hamann, according to a statement issued by the company of which Mr Hamann is president.

The statement, released at the end of November, said that US patent 2,849,540 was applied for in 1954 and that it 'specifically covers the use of a 30k Hz subchannel signal to record multichannel audio information on discs and other mediums and defines certain electronic means to decode that information into a listenable form'.

JVC America, the statement continues, were invited to enter into licensing arrangements with Hamann 'for the use of the invention covered by the patent that pertains to the JVC *CD4* Discrete Quadradisc system'.

Apparently it was Mr Hamann who produced and engineered the first live quadraphonic broadcast on October 27, 1958. On that occasion the 'Dukes of Dixieland' were presented in a programme broadcast by two AM and two FM stations in Cleveland, Ohio.

In 1963 Mr Hamann produced a series of live and recorded three channel broadcasts which included a concert by Stravinsky at Oberlin college. For these he used one stereo FM station, and an AM station to broadcast a single rear channel. Next year, the statement says, the Cleveland Recording Company celebrates its 40th anniversary, 'which makes it America's oldest independent recording studio'.

Mr Lowy of JVC in Great Britain said that he had not heard of the patent suit but thought that it was probably someone 'trying it on. The *CD4* system has been patented for the last eight years.'

Pye market CBS

PYE TVT are now agents for CBS broadcast products in the UK and some European countries. Among the products are the Vidifont character generator, the PAL *8000 series* image enhancer, and a number of audio products such as *Audimax* and *Volumax*.

3M building plans

THE 3M COMPANY are building a 930 m² extension to their Gorseinon, Wales, plant to house what they say will be Europe's most advanced tape coating machine. The machine will begin working in the summer of 1974. It will be able to coat all the different Scotch magnetic tapes with the oxide mix specified for the tape being manufactured, from cassette tape to computer, instrumentation and video tape.

The coating machine has been designed throughout by 3M and will cost £1,250,000. This figure includes the building in which it will be housed. The building will be fully air conditioned and will have specially surfaced walls and ceiling which will help to keep the place clinically clean.

The Gorseinon plant was first built in 1962. It now serves the UK, the EFTA markets, the Eastern Block countries and those EEC countries not served by 3M's Italian plant at Caserta, near Naples. When the new building is finished the Gorseinon plant will be six times its original area. Altogether 3M are adding an extra 2,880 m², including the new plant and mechanical, electrical and production service areas.

3M for Zoom

ZOOM TELEVISION have ordered what they describe as 'the first video printing press in Europe'. They say it is the first 3M high speed video duplicator to be delivered to Europe. 'The duplicator . . . uses the contact method of video tape duplication.' The 3M Company have called the system *STAM*, which stands for sequential thermal anhysteretic magnetisation. The equipment will be delivered during 1974 and Zoom say it will help them 'satisfy the increasing demand for television studio master production and duplication. With the advent of cassette machines the demand is expected to soar in the next two years.'

Tv tests stop

THE BBC stopped some television test transmissions on December 11. The tests affected were the daytime trade test transmissions on BBC2, which were stopped to reduce energy consumption. Also affected was BBC2's *Playschool*, which was transferred to BBC1. Now transmissions on BBC2 start with the news summary at 19.30

The BBC said they appreciated that the loss of trade test transmissions would cause considerable inconvenience to the television trade, but they hoped that the remaining signals would be adequate to install and service sets.

BASF Shares

BASF SHARES may soon be listed in London. Mr Rolf Magener, member of the BASF management board, said at a press conference on the introduction of BASF shares to the Amsterdam stock exchange, that the next place that BASF shares would be listed would probably be London. He also said that because of the scarcity of raw materials the company would have to intensify its activities in the field of special artificial materials and lessen their activities in bulk artificial materials.

Priceless

BOOSEY & HAWKES, agents for ARP synthesisers, have asked us to point out that some of the prices shown in our survey in the November issue were wrong. Accordingly they have sent a list of over 40 prices which they have asked us to publish. Unfortunately we do not have room. The prices published in the November issue were checked with Boosey & Hawkes by telephone before we went to press, therefore we do not feel we can accept responsibility for any mistakes that may have occurred.

Similarly, we published a new products item in the November issue in which we said the company name was Dover Systems. We have had a letter from a firm called clover systems asking us to point out that their name is clover not dover and that, since we published dover not clover, we have caused them some inconvenience. They add: 'we are . . . re-doing our artwork to eliminate the cause of the confusion'.

Altec agency

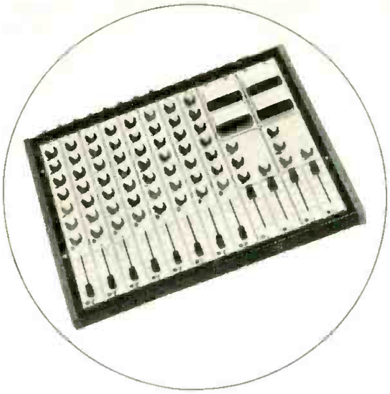
THE AGENCY for Altec industrial audio equipment has been taken over by Theatre Projects Sound Ltd, 10 Long Acre, London WC2E 9LN. Telephone 240 5411.

Ampex appointment

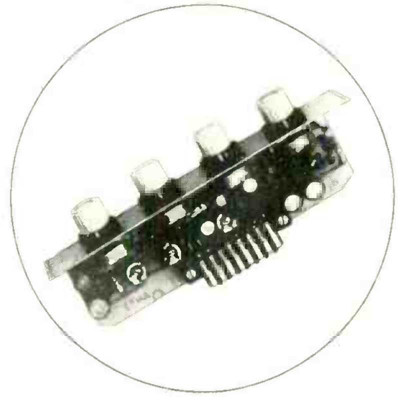
STEPHEN BIRD has been promoted to manager of advertising and sales promotion for Ampex (UK) Ltd. Mr Bird had been press officer at Ampex for the last two years.

Stancoil contract

STANCOIL LTD have won a contract to supply and install all the equipment for the Swansea commercial radio station. The station will begin to broadcast on July 1, 1974. Stancoil are supplying five Alice mixers; compression, balancing and noise reduction equipment; turntables; cartridge machines; and all the cabinets for the equipment.

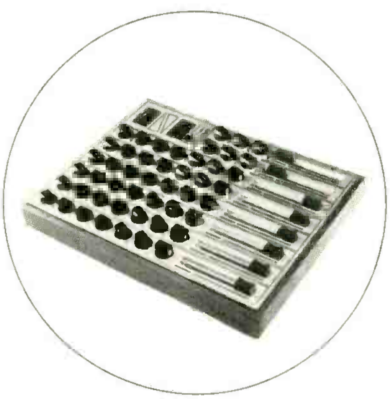


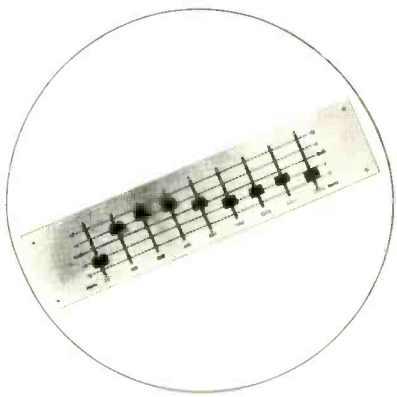
The **QUASI RANGE** presents a low cost custom semi-modular mixer. The units are robustly constructed on an all-steel chassis, with attractive teak side cheeks. Connectors may be of jack or Cannon type. Up to 12 modules can be accommodated with two or four outputs. The inputs may be high or low Z and jack switching may be incorporated. They feature continuously variable sensitivity, three-band equalisation, echo and cuc outputs, linear fader, panpot and routing switch if applicable. The output module contains two channels incorporating equalised echo return, main faders and output meters.



The original black **modular range** has been re-designed to provide an economical multi-track system. All new system modules incorporate their input and output connectors, and this minimizes their base cost.
Input modules XLR mic. input and line on jack, mic./line sensitivity, three-band equaliser, echo and cue circuits, channel fader, panpot, decade routing switch to eight outputs, PFL/channel cut facility.
Ouput modules mix amp, output fader, echo return with two-band equaliser, monitor fader and panpot.
Auxiliary modules echo send with top lift, cue send with two-band equaliser, talkback to studio and cue, oscillator, main monitor level, monitor select, voltage regulator.

Two new low cost signal processing modules are available, these may be fitted to any existing equipment by the four potentiometer bushes. A front panel and connector are supplied. The 6:1 **COMPRESSOR** has variable input, output, attack and release controls. It can be used for special effects, peak level control and for automatic mixing. The **NOISE GATE** is an electronic gating device. The control parameters are input level, gating threshold, attenuation depth and gate release time. Possible applications are: Noise reduction, feed back suppression, intercom, special effects.

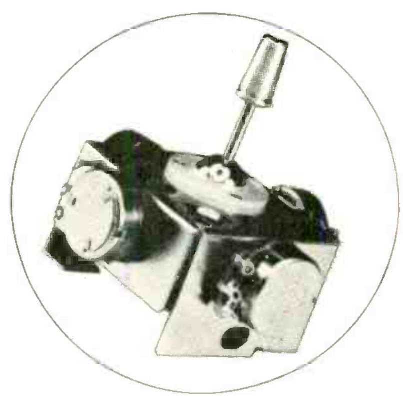




The new **GRAPHIC EQUALISER** allows the response curve of an audio system to be varied at nine frequencies at octave intervals by an amount of plus or minus 12dB. The curves are designed so that they blend in to give a smooth response. The slide faders give a graphic indication of the response. The unit is constructed on a single P/C board and is available in rack mounting format. Various applications include: Wide range programme, monitor and P/A environmental equalisation and noise suppression.

The **MINIATURE MIXER** is a six channel stereo unit employing a single P/C board construction and incorporating facilities found in mixers many times the size and price. The console is mounted in a teak case and connection is via phono jacks. The input channels feature sensitivity, treble, mid bass, echo, cue pan and fader controls. Main outputs have individual echo returns and VU type meters monitor the outputs. The unit may be operated from batteries or an external low voltage supply.

The **QUADROPHONIC POTENTIOMETER** provides a third dimension in electro-mechanical control technology. The joy stick enables independent control of two functions, using a single control. The unit consists of four potentiometers mounted at 90° on a steel chassis. These are mechanically inter-linked to the joy stick assembly. The resistive units are carbon type with a very low hop on/hop off resistance at the stick's extremities Circuit diagrams are available listing possible applications: Quadrophonic control, combined tone network, two or four-channel cross-fading and mixing, control systems.



Allen & Heath Ltd.

Pembroke House, Campsbourne Road, London N8 7PE. Tel: 01 340 3291

REACTIONS AMONG studio folk to the energy restrictions have been varied, but most, though they would never admit as much, regard it as a bad blow I phoned about 20 studios just after the three-day week had taken hold and asked how each was affected. One studio simply replied 'badly'. 'We've just got to hope it's over soon'.

Another studio told me they thought studios should get together to share the work out among themselves, so that if one studio was without power they could send clients along to another that wasn't.

One studio had provided themselves for an emergency and had found their foresight rewarded. They had a 30 kVA generator and lots of fuel: 'We could keep going for a year or so if necessary,' said their spokesman gleefully and told me he thought the three-day week was a lucky break which would send a lot of sessions his way. It's an ill wind . . .

Most studios, though, had had to grit their teeth and come to terms with the situation. Nearly all had assumed that they would have to work for three days though many of them had not been told so officially. Studios doing film work could do five days at 65 per cent of full power, although **Anvil** for example, had been told they could work five days on features and television films but not on documentaries or record work. Another big sound recording studio that does a lot of film work said they had taken it upon themselves to do a five day week.

Many studios had either hired or bought generators and I assume they all had licences for them. Some had generators powerful enough to provide all the heating and lighting they needed whereas others had to restrict electricity to the recording equipment and use candles or whatever for lighting. There were some problems with running film sync equipment, so this could only be used during the period when mains power was allowed.

Another common complaint was about the noise and dirt the generators caused, and everyone mentioned the high cost. In most cases those studios who had been allowed overtime worked right round the clock—72 hour week. One studio had put its engineers on 15 hour shifts.

I made enquiries at the Department of Trade and Industry and asked how the emergency regulations applied to sound recording studios. Their immediate reaction was 'Naturally they'll be doing a three day week like everybody else,' said in a tone that was meant to convey the poverty of my intelligence for even asking. I next enquired at the then two-day-old Energy Department and got a very different reply. The official answer was much the same: 'Studios should assume that they are caught by the three-day working order.' Unofficially, though, the answer was 'We don't know'.

The reason for this is that civil servants are unsure whether recording studios are commercial or industrial premises, although the studios regard themselves as an industry. 'It's a very fine legal point,' I was told. 'We could go to our lawyers and let them sort it but you can imagine how long that would take'. I wonder increasingly, where the government and civil service in general and the three-day week in particular are concerned, just who is kidding whom.

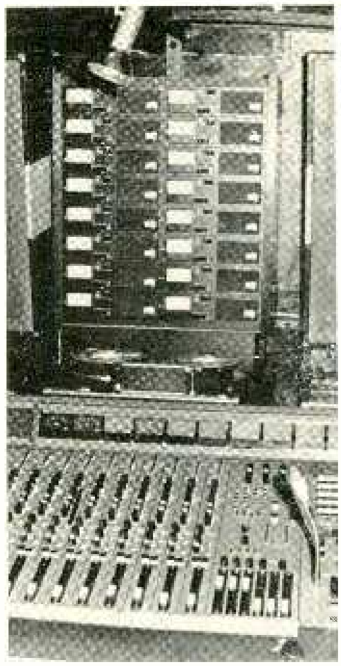
Despite what the sceptics have said, it looks like **Amity** are going into production with that machine of theirs. What is more, I've actually seen one in a studio.

Cliff Cooper told me over lunch that some of the knocking people had been giving his company had hurt: 'We don't think we've been given a fair chance. It's very difficult for a small company like us to get started.'

I said that perhaps his misfortune might have been that he was preceded by a firm called Unitrack. Also, it had been a long time since Amity had gone into the tape machine business and, as yet, the industry had seen very little of their work. He agreed, but he said that Amity would make ten machines in the next ten months.

We arrived at Columbia (British) Promotions in Wells Street where Amity have equipped a studio on the fourth floor. 'They're doing demo work initially but it's good enough for mastering,' Roger Jeffery said. Roger was largely responsible for the work.

The main reason we'd come, of course, was to see the Amity machine. The one at Columbia was eight track but Roger told me it could easily be converted to 16. The deck plate is a casting the top of which has been milled flat. The head block has been built as one unit, so that no adjustments are necessary. 'What about lining up, then?' I asked. Roger said the azimuth and the back and forward tilt could be adjusted by taking a plate off the top of the assembly.



An Amity tape machine, this time in Orange's mobile truck. Note the spool locking rings.

It will be no surprise that Amity have used Papst motors in the deck. The casting I mentioned tilts up for access to the guts of the thing and a stroboscope is fitted to the motors inside. The means of fixing the reels involves putting a milled locking ring over the hub and tightening the ring.

Cliff and Roger were keen to emphasise the hand cueing facility: the reels are released from the drive when they are turned by hand and the drive clicks back again as soon as you've finished cueing.

Single record and playback buttons put all the electronics into the replay or record modes. The logic allows the machine to go straight into replay or record; Cliff called it 'any mode logic'. The price of the machine is £3,980 plus VAT. The 16 track machine will cost about £6,500.

Until the engineer, Martin Gardiner, came back from lunch, Roger had to physically restrain Cliff from showing us how the machine worked. There was a tape already on it. When Martin did come back we saw it in action. The machine seemed good and tight —there was no sloppiness or tape spill. It's impossible to say on first seeing it, but I should imagine there'll be quite some interest in the Amity tape machine.

The mixer is also by Orange; it was made by Brian Hatt who, though he no longer works for Orange, still has strong links with them. The Columbia console is a 16/4/2 with a 16 track monitor mixer. There are four cues or echo channels and two Audio & Design limiter compressors. Solo facilities have been provided on any input channel, any tape track, or any cue group, and the engineer can solo any echo send or foldback channel. The jackfield is standard: 'All the usual things as well as all the mic inputs come up on the jack bay'.

Amity also built the speakers, the studio screens and the acoustic treatments. There was no cavity in the wall that was to separate the control room and the studio so they built another wall against it. Roger said the sound insulation was about 35 dB.

The doors and walls have all been 'fattened', as Roger put it, and the windows triple glazed. Not only did they train an engineer for Columbia, they let them have an engineer until the new chap was ready: 'We want to offer a complete service. For the price it is the best there is, certainly for a music publishers.'

Orange are already thinking of moving into other areas, making their own faders, for instance. Their record label seems to be doing well. My guess is that, before very long, even the tea boy will have a *Cornishe*, or is that way of ending an item too cornische?

Deep in darkest Anerley, not far from Croydon here, is a small studio owned by **SGS Productions.** When I called, in mid-November, it had been open a month, and Roger Simms showed me round. 'It took us a year to build, mostly in our spare time. It took a lot of blood, sweat and tears.' The building was, at one time, a bakery.

The studio measures 5.3m by 3.6m. The walls are lined to a depth of 13 cm with battens, Rockwool, glass fibre and acoustic tiles. There was also an acoustic treatment which Roger was very mysterious about: 'The walls and ceiling are specially treated with RG; you won't know what that is

28 ▶

ALL HI-FI SYSTEMS ARE JUST NOISE!

Video cassette systems are altogether different. You can see what you hear! There are various video cassette systems. Action Video have spent nine months evaluating and comparing them; we have settled on the "U-Matic" system. This gives you 60 minute colour programme capacity; stereo sound; remote control and editing; automatic repeat and search; suitable TV standard (PAL/NTSC/SECAM); built-in speaker; auto-loading ¾" tape quality; off air tuner.

No other video cassette system can match the economy and reliability of the U-Matic.

Because we stock every available make in the country, including SONY, JVC NIVICO, TEAC and now NATIONAL PANASONIC, we can advise you on what's best for your requirements; and we don't stop there – we can provide any of the services you'll need to get the best out of your system.

We like talking about video, so call us.

Action Video Part of the Action Group

45 Great Marlborough Street London W1V 1DB Telephone 01-734 7465/7 & 01-434 1494/8

■ DIARY

and I can't really tell you about it; it's something we've done ourselves. But it works very well.'

Although the studio isn't floating on the box within a box principle the drum booth has a pad on the floor which acoustically isolates the drummer from the floor and the rest of the building. Two similar isolating pads are available in the studio along with a number of screens. The ceiling is good and low and the studio is very dead. I can believe that, as Roger said, separation is very good.

The wall separating control room and studio has a window 1.8m by 0.9m. From the desk you get a good view of the studio.

The control room measures 3.3m by 2.6m. In it there is an Allen & Heath 16/8 desk, an Ampex *AG440* four track tape machine, and four Tannoy Gold speakers in Lockwood cabinets.

Roger told me he used all AKG mics: *D202s* and *C28*s. He said that, although he knew it was rather unorthodox, he sometimes used a ribbon microphone on the bass drum. He isn't the first I've come across to do that, either. I asked him if he still had any ribbon microphones left. 'You have to watch that very carefully, of course. It doesn't seem to have done any damage. You have to do the unethical thing sometimes to get what you want.' For echo SGS use a Grampian spring.

The monitor speaker amps are Spendors. If speaker foldback or playback is needed, the inputs of the two centre speakers in the control room are switched to the two speakers in the studio. There are two separate foldbacks on cans. These are driven by Teleton power amps.

The two track machine is a high speed Revox. There is also an Akai which Roger says he uses to play tapes that people bring in and so prevent the heads of the Revox from getting mucked up.

Roger told me that both he and his partner, George Wallis, are as interested in production as they are in engineering. Confident, too: 'We intend to turn out a hit record out of here within nine months . . . and that's as sure as you're sitting there'. I should add that I was, in fact, sitting.

Roger told me they'd done a lot of work in other studios and, like many people these days, found hiring and working in other studios unsatisfactory. 'You were worried the whole time because you'd hired the studio and the thing had to be right at once. You couldn't relax and take it easy. Here, if it's not going well we can leave it.'

The expense of other studios worried him. His partner's son is lead guitarist with the Pink Fairies and UFO. Roger had worked with Jeff Beck. The Fairies' first album has just come out and, since it was made before SGS was ready, it had to be made at another studio; Roger says it cost £2,000 to do two weeks' work.

The resident engineer at SGS is John Liley. Roger said he thought he would also employ a topless female engineer at some time in the future to attract business, and he means it too. I can imagine all sorts of problems, but I leave those to the reader's imagination; this month's competition is to suggest what was overheard between the producer and the topless engineer. We'll print the best of them, laws of obscenity permitting.

There is plenty of room for expansion at the back of the building. I would think that SGS should do well, if there's any justice. They charge £5.50 an hour for four track recording and £2.20 for tape. All these prices include VAT. They are looking around for an eight track machine and have got as far as fixing the price at £8.80 an hour, when they do go eight track.

In my postbag, among the threatening letters, I got a rate card from **Great Northern** Recording Studios. GNR—doesn't that take you back?—run an eight track outfit up in Cheshire.

As you all know, GNR used to be four track: two to Scotland and two back, ha ha. My fan will know that I admire candour, and GNR begin their rate card with a bold headline which says: 'The disadvantages of Recording at Great Northern'. Then: 'We are 320 km from London, which most Londoners would say was a disadvantage. However . . .' They then go on to list the advantages: a great sound ('although we say so ourselves, it is equal to any sound anywhere'); a pleasant atmosphere; that they are open 24 hours a day and seven days a week; ample parking space; generous discounts on block bookings; and 'we have some of the finest musicians in the country available, bookable on request, through Great Northern'.

The eight track machine is a Scully and GNR have two Philips stereo tape machines, an AKG *BX20* reverb unit, JBL monitors, and mics by AKG, Neumann, Beyer and Calrec. They charge £15 an hour for eight track and £10 for four, plus VAT.

Their desk rather intrigued us. The rate card said the desk had been made by Decca, and for a horrible moment we thought we should have put them in our mixer survey. I phoned Phil Hampson of Great Northern, who told me that the desk had been in Decca's West Hampstead studio. Decca had built it for their own use. Although the desk is about ten years old, Phil told me, it had been changed a lot for eight track working.

All of a sudden there seems to be a lot of valve gear about, most of it coming from record company studios. No need to scoff at valve gear either; there are one or two people who would give their eye teeth for one of those Fairchild valve compressors — any offers? John Ratcliff (see letters) would like information about a service manual for the Gaumont *Kalee* 1832 compressor limiter. Again, any offers?

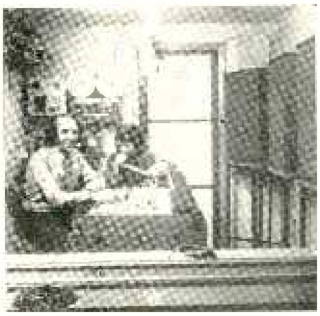
Phil also said GNR spent most of their time doing their own productions. Certainly this is becoming increasingly common and explains the proliferation of recording studios in the last year. GNR started one year ago. They went eight track in February and increased the studio's size during the summer. They've been at their present size since mid-August. GNR's phone number is 061-368 6114.

Bob Woolford has sent a postcard from Airdrie in Scotland. 'Look out for Billy Connally on Transatlantic; I'm up here recording him at the Tudor Hotel with a full house each night—thank heavens for Camping Gaz fires.' The photos on the front were of the Commando memorial and Loch Ness.

Kingsway, London. After many trials and tribulations, Kingsway have finally installed their JBL *4350* monitor speakers. Terry Yeadon was good enough to ring me up with the news and I asked him what he thought of them: 'Amazing,' he said. 'There are no honks or colorations — they're just smooth and nice.'

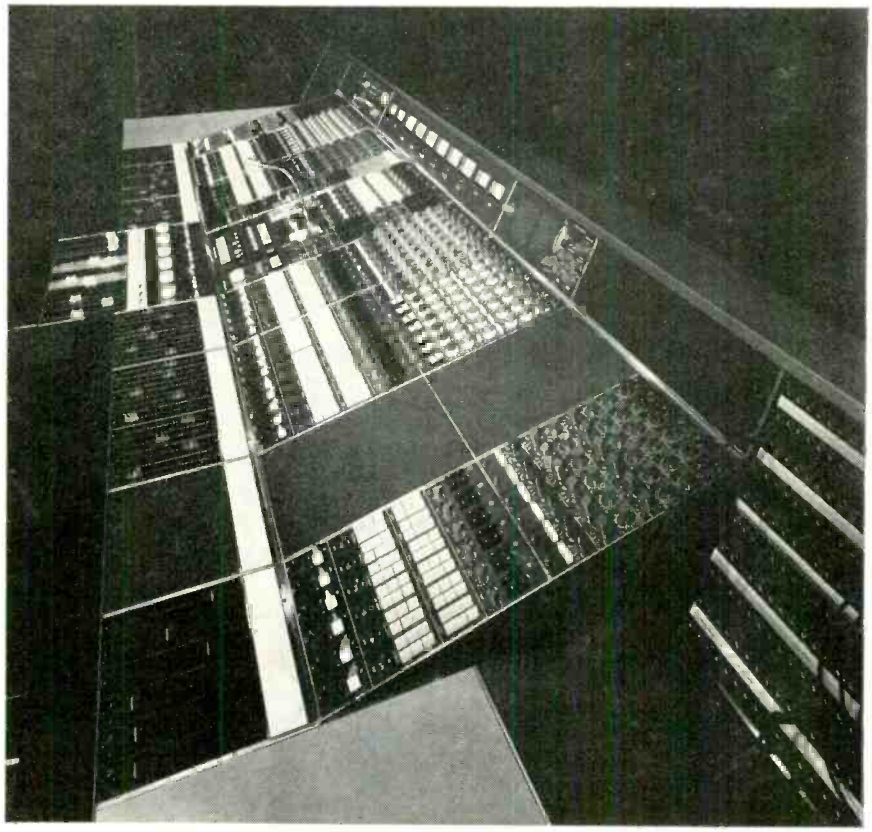
If bought new, the JBLs cost around £640 each. For that you get a massive cabinet 864 mm high, 1,219 mm wide and 508 mm deep which contains two 38 cm bass drivers, one 30 cm midrange unit, a horn midrange unit, and a supertweeter. The speakers have electronic crossovers. Terry told me they were driving them with a Crown *D150* each.

Kingsway have been thinking about four channel ever since they started building the studio, and Terry said they would now start thinking about which speakers to put at the back; there isn't room for two more *4350*s. He said they would probably look for a similar sound speaker from the JBL range. And that . . . for various political, sociological, economic, but mainly electrical, reasons . . . is that for this month; the printers ran out of candles!



Top to bottom: General view from SGS control room; Simms sings Songs for Swinging Recording Engineers; George Wallis and Roger Simms in control; the Allen & Heath board.

Nothing else would do for TWICKENHAM FILM STUDIOS



It had to be Custom-built *...with an eye to the future*

by incorporating sophisticated equalisation, smooth film pan pots, integrated remote controls plus a lay-out of facilities to the customer's exacting requirements

We can give you the same kind of service together with Neve world-famous standards of performance and reliability.

Have your next console custom designed by Neve

Rupert Neve & Company Ltd.,
Cambridge House,
Melbourn, Royston,
Hertfordshire SG8 6AU,
England.
Tel: Royston (0763) 60776
telex 81381
cables Neve Cambridge

Rupert Neve of Canada Ltd.,
7528 Bath Road,
Malton,
Toronto,
Ontario,
Canada.
Tel: 416 677 6611
telex 0696 8753

Rupert Neve Incorporated,
Berkshire Industrial Park,
Bethel,
Connecticut 06801,
U.S.A.
Tel: (203) 744 6230 telex 969638.
Hollywood Office.
Tel: (213) 465 4822

Although a motionless human eye embraces a wide angle of vision, the angle of usefully high definition is much smaller than most people realise. Hence the danger of relying on off-axis vision when monitoring a wide array of programme level meters. The author describes an unusual method of displaying up to four signal channels on an oscilloscope.

Constructing a peak-reading oscilloscope

PART TWO

JAMES CRABBE

AN OSCILLOSCOPE is an almost indispensable piece of equipment to the busy engineer. With its help he can test components, monitor complex waveforms or run frequency response analysis of audio or tv equipment. The recent survey of oscilloscopes in Studio Sound (January 1973) gave details of a wide range of instruments suitable for use in the audio field. Any one of these would be eminently suitable for monitoring the output of either a two or four channel PRO (provided the screen was large enough). However, in many applications it is preferable to have the monitoring amplifiers and the visual display 'under one roof' for ease of access and operation. For a simple two channel PRO, it is only necessary to incorporate certain features found in every 'scope. No X-amplifier or timebase circuitry is required as all we want to see are horizontal lines, not complete waveforms. Of course, if a complete 'scope were available, one could monitor the wave complex either continuously or at any point in time. However, except in certain circumstances, this is either a waste of time, or else a positive distraction in monitoring levels. Certainly I could find in my experiments no advantage in being able to see either the whole or just a rectified 'half' of what was going on; the simple bright line is far better at showing what is wanted on the tape.

A very simple design of oscilloscope can be used. Many experimenters may have their own ideas on this, for example whether to use a valve or transistor design. As a cathode-ray tube is itself a type of valve, using high voltages, perhaps another valve will not hurt. On the other hand, it is a shame not to take advantage of the advances in transistor technology. The writer opted for the former alternative, as one valve will do very well the work of several transistors and as high voltage power supply was there already. It was a simple matter to fit one valve into a small chassis space. If for any reason the experimenter wishes to use transistors in the 'scope monitor, he could adapt the design shown in the August 1973 edition of *Practical Wireless*, which is expensive and easy to construct (2).

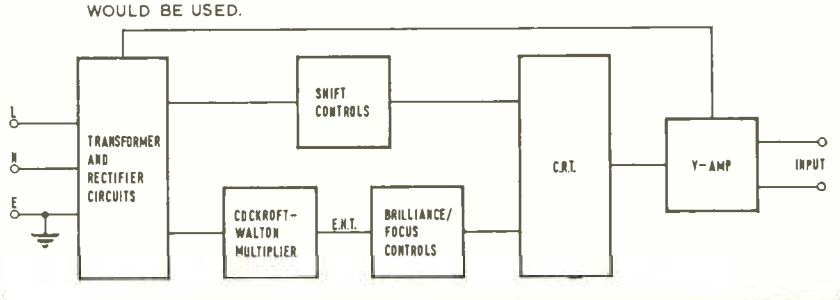
A block diagram of the visual display module is shown in **fig. 1**. The transformer and rectifiers supply power for the crt and the Y amplifier. A Cockroft-Walton multiplier provides eht for the tube; several of these in cascade can provide higher voltages if necessary depending on the type of tube used. For two channel monitoring, an 8 cm screen size is sufficient so a single gun tube such as the *3BPI* or *VCR 139A* could be used. The *3BPI* uses a 6.3V heater, has a slightly larger screen size (8 cm as opposed to 7 cm) and has greater deflection sensitivity. However, it is usually used with symmetrical (ie push-pull) deflection which requires more complex circuitry than the *VCR 139A*. As a simple asymmetrical amplifier is quite sufficient in this particular application, and as the deflection sensitivity is also more than adequate, it was decided to use the *VCR 139A*.

The complete circuit is shown in **fig. 2**. A single transformer supplies all the voltages necessary for the tube and amplifier. The 250-0-250V secondary feeds a 400 piv 1A bridge rectifier which provides the ht of 300V. This is smoothed by C1, C2 and R1, although a 10H low-frequency choke could replace R1 if space was not at a premium. The X and Y shift controls enable the spot to be placed anywhere on the screen, though it would normally occupy dead centre. Crts require very high voltages on their anodes as this enables good brilliance and a sharply defined trace to be obtained. The sensitivity of the deflecting plates depends on the final anode voltage, and for a *VCR 139A* this works out at $\frac{170}{Va}$ mm/V.

In this design, the final anode voltage is about 600V, giving a sensitivity of near 36V/cm assuming p-p voltages. D2, D3, C3 and C4 make up the Cockroft-Walton voltage doubler, with R2 and C5 the smoothing components. The final output is applied across a potential divider network with the crt grid connected to the negative end. The final anode and one of each pair of deflector plates are directly earthed, together with the anode end of the divider network. The crt cathode, connected to the slider of R3, is less negative than the grid and gives the effect of positive cathode bias. R3 therefore becomes the brilliance control. R4 provides the focusing potential on the second anode while R5 and R6 are the shift controls. One side of these two potentiometers is made negative to earth by a connection with the junction of R7 and R8 and the other side made positive to earth by a connection with the junction of R9 and R10. The two deflector plates can thus be biased over a wide voltage with respect to the final anode, and any lack of alignment in the structure of the crt is corrected, together with any electrical drift in the trace from the centre of the screen. The deflecting voltage is applied to the Y plates via C6. Any leakage in this capacitor will shift the spot to one side or other of the screen, perhaps to

32 ▶

FIG. 1 BLOCK DIAGRAM OF VISUAL DISPLAY MODULE. IN A FOUR CHANNEL UNIT, EITHER A DOUBLE BEAM SWITCH OR A SPLIT BEAM TUBE WITH TWO Y-AMPLIFIERS WOULD BE USED.



References: 1. Survey: oscilloscopes, *Studio Sound* August 1973, page 52. 2. G. A. Cozens; 'A Student Oscilloscope,' *Practical Wireless* August 1973, page 336.

■ CONSTRUCTING A PRO

such a degree that the shift controls will be unable to return it, so a good capacitor must be used here. The heater winding (4V, 1A) must be separate from the 6.3V used for the valve heater. C7 is connected between the crt grid and an output socket. This provides the facility for grid, or brightness, modulation which could be used in expanding the PRO to 'brighten up' at the higher peak voltages.

As the frequency response requirement of the Y amplifier is only about 10 to 25k Hz, a simple design is quite sufficient for this particular application. However, the response is linear up to 500k Hz, with a useful gain well beyond that, so that the PRO could also be used for similar applications in the rf frequency range. For use with frequencies above 1M Hz, a more complex amplifier could be used, for example one with an iron-dust cored coil in the anode circuit of the valve. The valve used, V1, is a *6AC7* which takes its anode potential from the 250 to 300V ht line via R15 and R16A. A simple potentiometer is used to control the gain and this is sufficient for most applications as the knob can be provided with a scale calibrated in dB steps. A linear pot will probably be easier to mount and to calibrate; those made in Japan (e.g. by TTC) are inexpensive and fairly easy to obtain.

For a two channel PRO, the outputs of either one linear or two logarithmic PRO amplifiers are connected to the input amplifier of the visual monitor. However, for a four channel PRO, we need to have either a twin gun or split beam tube (e.g. the *O9D* or *O9G*) with two Y amplifiers, or a single gun tube with one Y amplifier and a double beam switch. The *O9D* and *O9G* have a 12 cm diameter screen, green in colour and of medium persistence (as is the *VCR 139A*). The heater voltage is again 4V, with a Va3 of 1.2 kV. Like the *VCR 139A*, it uses a *B12B* base. This tube is a twin (split) beam tube, as opposed to a twin gun tube, and is suitable for either symmetrical or asymmetrical deflection.

For those wishing to use a single gun tube or who already have a suitable single beam 'scope and want to monitor four channels, a simple double-beam switch (the block diagram of which is shown in **fig. 3**) is eminently suitable. The output of a square wave generator is fed to two amplifiers so that, when Y1 is operating, Y2 is switched off, and vice versa. The output of the two amplifiers is then fed into the Y amplifier of the oscilloscope. Once again, the writer opted for a valve design, although a transistor circuit could also be used here. The circuit is adapted from a Mullard design and is shown in **fig. 4**. V1, an *ECC81* double triode, is the multivibrator producing two trains of antiphase square pulses which are fed to two identical Schmitt amplifiers V2 and V3. When a negative square pulse arrives at the left hand grid of V2, this half becomes non-conductive. The other section is conductive, however, and in the absence of any signal applied to its grid passes a standing anode current, depending on R8 and RV9. When a positive pulse arrives at the left hand grid of V2, this passes a large current, and a considerable voltage drop occurs across R8 and RV9. Thus the cathode becomes positive with respect to the right hand grid of V2, and this potential is sufficient to cut this half off. V3 works in an identical fashion but in antiphase. Adjustment of RV9 varies the standing anode current of the right hand sections of V2 and V3 during the conducting half cycles and thus acts as a trace separator. RV12 and 13 vary the magnitude of the input signals. RV3 is a preset potentiometer which is adjusted until the square wave output of V1 is symmetrical about its axis. The frequency of the square wave is set by C1 and for the value given is about 2k Hz. This value should prove adequate for use in the audio frequency range but, for higher frequencies, the square wave generator must be modified to supply a correspondingly higher square wave frequency. The ht for the valves can be taken from the 'scope ht power supply, as can the valve heaters, which take about 0.9A at 6.3V. The ht consumes about 6 mA at about 300V. If a source of square waves is required for amplifier testing, or indeed testing the PRO itself, then sampling sockets can be fitted via C2 and C3. TV12, RV13 and RV9 can be linear fader controls, if desired, to match the fader used for the Y amplifier control. Resistors R6, R7, R14 and R15 can be 250 mW rated carbon, 500 mW rating being used for the other resistors (high stability where indicated). All capacitors should be 350V working.

Construction of the PRO monitor is best carried out on a modular basis. This simplifies assembly and makes servicing easier if anything untoward should occur during the life of

FIG. 4 CIRCUIT OF DOUBLE BEAM SWITCH FOR USE WITH 4-CHANNEL P.R.O.

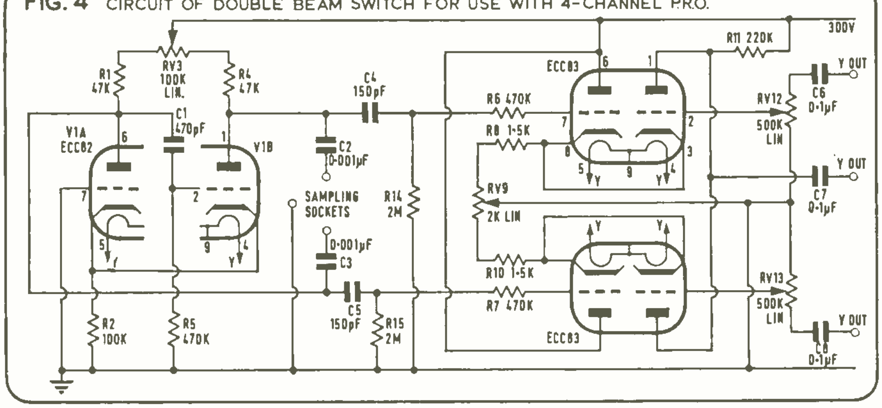


FIG. 3 BLOCK DIAGRAM OF DOUBLE-BEAM SWITCH, FOR USE WITH 4-CHANNEL P.R.O.

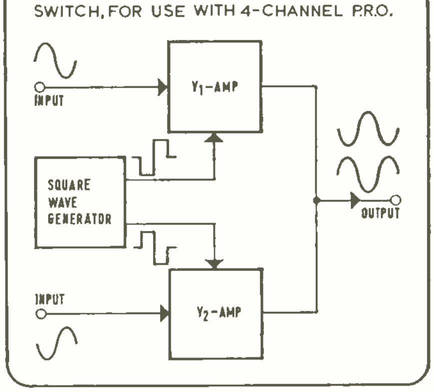
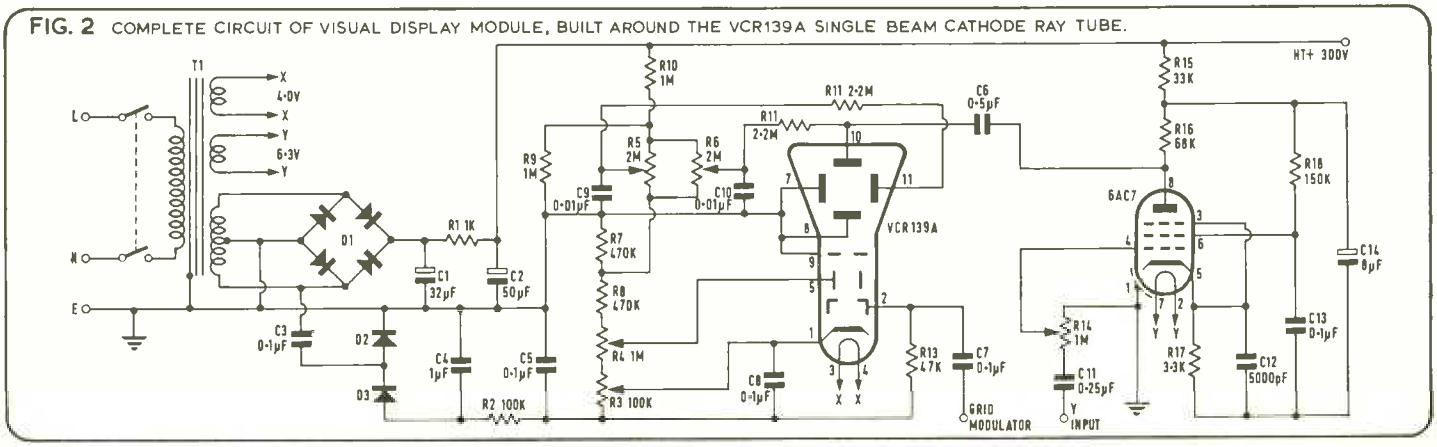


FIG. 2 COMPLETE CIRCUIT OF VISUAL DISPLAY MODULE, BUILT AROUND THE VCR139A SINGLE BEAM CATHODE RAY TUBE.



the equipment. Either printed circuit boards or *Veroboard* can be used; the writer prefers *Veroboard* as each printed board has to be specially etched, whereas the *Veroboard* has its copper connections already intact. The only task required is judicious positioning of the components on the board. Details of this have not been given as each constructor will have his own idea about mounting, dependent on the number of channels that the PRO is required to monitor. Suffice to say that construction is not critical regarding the layout of the transistor audio amplifiers given last month in part one. Leads between modules are best kept as short as possible, screened leads being used for any long connections. If monitoring is desired at frequencies above those normally encountered in audio use, then leads must be kept very short, especially in the construction of the visual monitor itself. The oscilloscope power supply transformer must be sufficiently behind the crt to avoid any chance of hum injection (10 cm is adequate). If possible, a mumetal screen should be used to surround the crt to prevent any external interference effects. Old surplus monitors and oscilloscopes are probably the best sources of mumetal screens but, if one is unobtainable, then a tube of sheet tin could be used.

If portability is required, especially if the equipment is used with an external oscilloscope, the transistor amplifiers can be powered from batteries using either two Ever Ready *PP9* (giving 18V) or two *PP1* (giving 12V). The amplifiers do not seem to be voltage critical within this range but should not be used higher than 18V, or lower than 12V. If a mains supply is needed, then one is given in **fig. 5.** This shows a comprehensive power supply giving either 12 or 18V stabilised, using an integrated circuit stabiliser, type *MFC 4060* from Motorola, and a heavily smoothed but unstabilised 25V dc supply. In the prototype, two transformers were used as they were to hand. A single transformer with the appropriate isolated secondaries would of course do just as well. The bridge rectifiers used are capable of giving 1A output but the ic stabiliser cuts this down to 100 to 200 mA, quite sufficient for this application. VR1 is used to tap off a fraction of the output voltage to feed back into the ic, where it is compared with a reference voltage generated within the stabiliser, and the output is adjusted to make the two equal. The voltage at pin four of the ic must be at 4.5V and this is secured by means of adjusting VR1. The output voltage will be within about 0.2 per cent of the nominal voltage for loads up to 100 mA. A switch SW3 provides for either 12 or 18V output, VR1 being adjusted for the correct output in each case.

The unstabilised 25V supply, which gives about 1A maximum, is used to power ancillary equipment to the PRO, to provide for complete audio as well as visual monitoring, as the equipment was originally designed as an integrated monitoring system. But more of that later. First let us summarise all that has been dealt with so far.

Circuits showing details of two and four channel peak reading oscilloscope monitors have been described. Either linear amplifiers, which give a logarithmic scale on the 'scope screen, or logarithmic amplifiers, which give a linear scale on the screen, can be used.

A normal service oscilloscope, or a specially designed 'built in' monitor, can be used to give the visual readout required. For two channel monitoring, a single beam 'scope will suffice. However, for monitoring four channels, a double beam instrument is needed. Two types of visual display can be used for the latter. In the design described, the display is similar to that shown in **fig. 6a** with traces one above the other. If the oscilloscope has the facility of independent dot positioning on the X-axis however, the traces can be laterally displaced along the X-axis, similar to that shown in **fig. 6b.**

Whatever the number of channels used, setting up and calibration is fairly straightforward. In **fig. 6,** the scale is shown calibrated in dB on one side of the trace; the scale is linear, as would be used with the logarithmic amplifiers. Other methods of calibration could also be used, for example ppm markings instead of the dB scripts. This could lessen the number of markings on the scale, if space was an important factor. With linear amplifiers, either dB or per cent modulation could be used, depending on the use that the PRO was intended for. More space is available for calibration if an oscilloscope with independent dot positioning on the X-axis is used. However, no trouble should be encountered when monitoring four channels without this facility providing the scale is accurately marked.

Dealing with the linear amplifier first: measure up the screen so that each dot is symmetrically in position, using the X and Y shifts. Applying a voltage to the input of one channel, set peak level to about ¾ of the maximum trace length required. Tentatively mark this 0 dB. Decrease the applied voltage in steps of 5 dB and mark accordingly. Check the 0 dB mark and increase the voltage another 3 dB. Mark this position, and also a +6 dB position if desired. Unfortunately, the scale will be logarithmic so it might be advantageous to mark the scale at less than 5 dB intervals near 0 dB and at greater intervals lower down the scale. The scales can be permanently marked on a sheet of, say, perspex, using *Letraset*, and placed directly in front of the screen. Other materials than perspex can be used but the material must not warp. With a logarithmic amplifier, the scale can be calibrated in the same way but the scale will be linear. To calibrate to ppm markings, set peak level as before and mark this 6. Decrease the applied voltage by 16 dB, to give a marking of 2, adjusting VR1 for minimum effect. (See **fig. 4** in part One.) Increase the voltage by 8 dB and adjust VR1 and VR2 for a reading of 4. Increase the voltage by another 8 dB and adjust VR2 and VR3 for a reading of 6. Increase the voltage by another 4 dB, and adjust VR4 for a reading of 7. Repeat until no further adjustments are required, checking that 3 and 5 are at appropriate 4 dB steps. The scale on the front of the screen should be made as linear as possible for the best readability.

That completes the description of setting up the PRO. The final article deals with its incorporation into a complete monitoring system, practical use during recording, and further modifications that could improve the system.

FIG. 5 CIRCUIT OF POWER SUPPLIES FOR TRANSISTOR OPERATED DEVICES IN THE COMPLETE PRO DIODES CAN BE W005 OR SIMILAR.

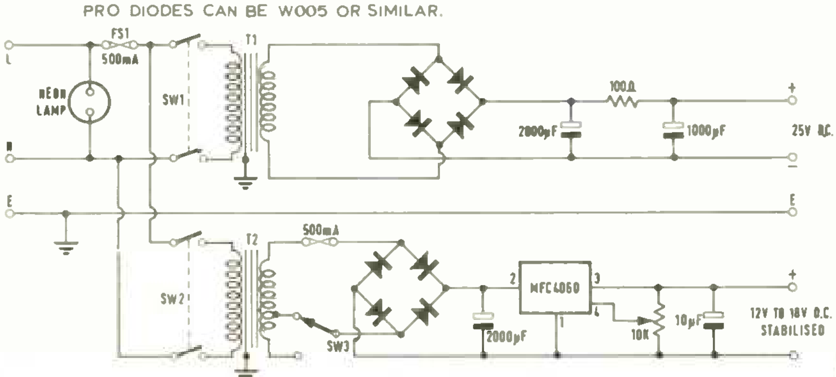
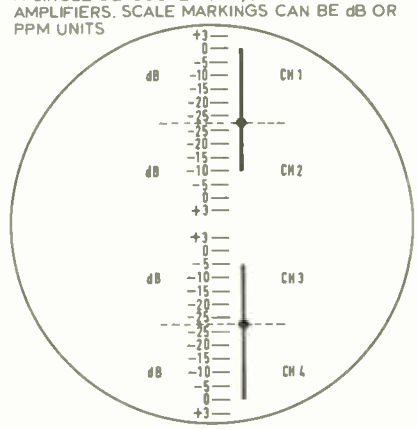
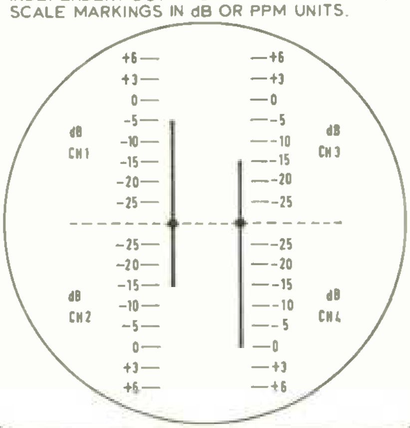


FIG. 6 (a) VISUAL DISPLAY OF 4-CHANNELS ON A SINGLE DB 'SCOPE TUBE, USING LOG AMPLIFIERS. SCALE MARKINGS CAN BE dB OR PPM UNITS



(b) VISUAL DISPLAY OF 4-CHANNELS WITH INDEPENDENT DOT POSITIONING ON X-AXIS. SCALE MARKINGS IN dB OR PPM UNITS.



Perhaps as part of a wider effort to convince other nations and their satellites that the Irish Republic isn't still living in the nineteenth century, Radio Telefis Eireann have made great technical and political advances in recent years. In an effort to combat the wealth of propaganda that encourages us to believe British is always Best, John Dwyer recounts his impressions of Irish broadcasting in general and the new Irish Radio Centre in particular.

Inside Radio Telefis Eireann

PART ONE

IT'S A PREJUDICE most of us have, I imagine, to suppose that everything in Ireland is second best. Rather like the surprise a trendy liberal tries to stifle when he hears a Negro with an Oxbridge accent, it's as much a surprise to learn that most people in the Republic of Ireland are as well off as we in Britain are.

Just as the GLC were crowing about giving free travel to the elderly I was reminded that the elderly have had free travel all over Ireland for about ten years now. In an RTE documentary film in which a couple of dozen inhabitants of Northern Ireland were watched carefully as they made their first visit to the Republic, a southern Irishman remarked, when he compared his wage with one of the northerners', that he couldn't live on what the northerner earned. Dublin, far from being a reactionary place, is one of the few places in these north-European isles to sport a mixed sauna parlour. There hasn't been, as one report put it, a whisper of public criticism.

Thus, when I'd finished walking round RTE's new radio centre, I found few of my preconceptions about Irish radio still intact. I was surprised to discover, for example, that it was RTE that had pioneered rediffusion in Ireland, not any of the commercial firms. The systems RTE have installed in Dublin and in Drogheda, a town 25 miles north of Dublin near the coast, each offer six tv channels: BBC1, BBC2, HTV, UTV, RTE and another tv channel which RTE naturally hope will be their second; that matter is going through the *Dail*, or Parliament, at the moment. The services also offer two vhf stereo radio channels. In Great Britain rediffusion is usually restricted to the two BBC tv channels and the local IBA channel, with two or three radio channels.

Christy Killeen, who showed me round the Radio Centre, told me that Cork and Limerick also wanted the new service: 'We can't put it in quick enough to satisfy the demand'. RTE had had to tender for the installation of these systems in competition with commercial concerns like Rediffusion.

The radio service

You cannot overestimate the importance of a well-developed radio network in a rural country like Ireland. Since the famines of the nineteenth century the population has been not only small but falling, and the lines of communication that developed always did so a step or so behind the need for their improvement.

In 1841 the population of the whole of Ireland had been 8,175,124. Ten years later the figure was 6,554,074. The worst effects of famine and emigration were felt in the area that is now the Republic. There, in 1851, the population was just over five million. By 1901 it was 3,960,823, and 50 years later it was 2,960,593. The 1971 census figure put the population at 2,971,230.

In England there are now 352 people per km^2. In Ireland the figure is 42. To make things worse, as the population fell the country dwellers that were left started to drift to the towns, making rural areas even more isolated than they had been before. The telephone service was nothing like adequate. Even now there are 112 telephones per thousand of the population compared with 341 over Great Britain and Northern Ireland.

These figures are important, for I think they partly explain the reasons why Irish radio developed as it did. As they show, the fall in population continued well into the twentieth century. While it continued, Ireland was losing many of its young men and women to America and England. As their contribution to American life shows, the millions who went to America were probably the most resourceful, the ones that Ireland or any other country could least afford to lose.

Therefore once a radio service had started it was natural that it should be used to promote and stimulate demand for Irish industry and goods. In this way it could be used to create jobs and attractive careers for those who would otherwise have left. Also, the Irish Free State, which had just been set up amid considerable difficulties, had little money to spare, despite the need for broadcasting and the prestige it would give a young nation. So, for all these reasons, three months after the service was opened in 1926 advertisements began to be accepted.

For a long time the only regular advertisers were the organisers of the Irish Hospitals Sweepstake. Sponsored programmes were introduced in 1932 and cropped up from time to time, but were never a major contributor to the station's running costs. Spot advertisements came in the late 1950s. In 1968 sponsored programmes were greatly reduced and spot ads were distributed throughout the day.

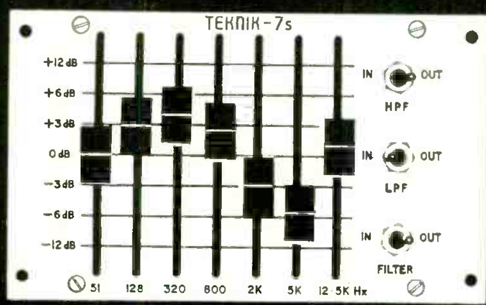
Going back to the early years, since 1922 approaches had been made to the GPO for licences to run commercial stations. At one point it looked as if Irish broadcasting might follow the American pattern. Then, for reasons which I will try to explain in a minute, the government decided this might be unwise and decided to run broadcasting themselves.

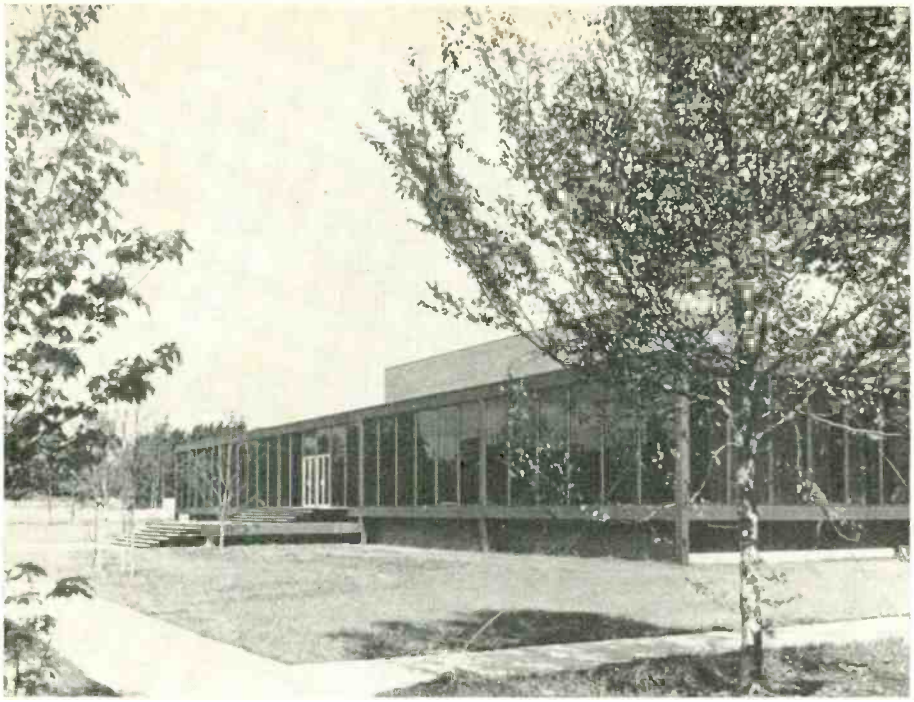
RTE and the government

In the past, Irish radio has been subjected to a little more direct government pressure than, say, the BBC has been. The present Minister for Posts and Telegraphs, Dr Conor Cruise O'Brien, admitted as much in his Estimates speech in the *Dail* in May 1973: 'In theory in Britain . . . the government can invoke drastic powers over the BBC and IBA. In practice no British government appears likely to exercise such powers; the position of the governors of the BBC is protected in effect by unwritten conventions. Such conventions are obviously less stable here. Without at this stage entering into recriminations over past dramatic events, what is necessary now is to rebuild confidence in the integrity and autonomy of public service broadcasting in this country.'

No more than Dr O'Brien do I wish to dwell on past events, but I would like to offer an explanation of the present relationship between government and broadcasting. The BBC had started as an association of 200 wireless manufacturers. They had applied in great numbers to the Postmaster General for permission to set up transmitters in order that there might be a service which would allow them to sell great numbers of radio sets. The PMG decided that it would be wise for them to combine their interests in a single body responsible for broadcasting. They should only compete with one another when those who wanted to receive their joint service went out to buy a radio set.

36 ▶


TEKNIK-7s
+12 dB
+6 dB
+3 dB
0 dB
-3 dB
-6 dB
-12 dB
51 128 320 800 2K 5K 12.5K Hz
IN OUT
HPF
IN OUT
LPF
IN OUT
FILTER



New Radio Centre, Donnybrook

Thus, in 1922, the British Broadcasting Company was formed. Only later, in 1926, was the British Broadcasting Corporation formed by Royal Charter which freed it of any commercial influence but required it to give a service 'to the satisfaction of the Postmaster General'.

Although that last phrase is and always has been important, the first four years as a company set the pattern for the BBC's attitude to government control from then till now. This was exemplified by Lord Reith's refusal to allow the BBC to be compelled to broadcast propaganda during the war, when he was Minister of Information. I quote from the 1973 *Official Handbook for Britain*, which says: 'The BBC and the IBA are independent authorities in the day-to-day operations of broadcasting, including programmes and administration. The Government, however, retains ultimate control, and the Minister of Posts and Telecommunications is answerable to Parliament on broad questions of policy and may issue directions to the BBC and IBA on a number of technical and other subjects.'

The BBC's licence and Agreement of July 7, 1969, says, in paragraph 13, section Four: 'The Postmaster General may from time to time by notice in writing require the Corporation to refrain at any specified time or at all times from sending any matter or matter of any class specified in such notice; and the Postmaster General may at any time or times vary or revoke such notice. The Corporation may at its discretion announce or refrain from announcing that such a notice has been given or has been varied or revoked.' The IBA charter has similar provisions.

These are the powers which Dr O'Brien said were unlikely to be exercised. In fact there have been only two occasions when the exercise of such powers were exercised, both before the Licence was issued. In 1955 the '14-day rule' was issued, which said that tv and radio could not discuss anything which was to arise in the Lords or the Commons within a fortnight. There was also a requirement, mentioned in the Pilkington report, that the BBC and ITA should not send controversial political broadcasts other than those arranged in agreement with the leading political parties.

The history of RTE had rather a different beginning. In the first half of this century Ireland went through a number of political upheavals, changes of government and periods of civil disorder that made it necessary for Ireland to have the benefit of an effective means of mass communication long before the second world war. By the 1930s political stability had been established, but when radio was being considered in the early twenties Ireland, though still a British Dominion, had just become the Irish Free State. Because the terms of the treaty under which the Free State was created were unacceptable to many who had fought against the British in the preceding years, a civil war broke out in 1922, the year the treaty was ratified.

The official reason given for making Radio Eireann a branch of the civil service was that to put such a powerful medium of communication into commercial hands might prove dangerous. But if you look into the background against which that decision was made it seems reasonable to suppose that the government justifiably considered dangerous any hands but its own.

After the civil war the government understandably wanted to restore national unity. They realised that to throw away the opportunity of running a radio service by allowing it to be run by commercial concerns would be to throw away one way of making that task much easier.

In 1953, however, Radio Eireann were given greater control over their own affairs. In October 1958, the Minister for Posts and Telegraphs appointed Mr Justice George Murnaghan as chairman of a commission charged with studying ways to introduce a television service. As a result of their report Radio Eireann became a statutory corporation or state-sponsored company under the Broadcasting Authority Act of 1960. The nine members of the broadcasting authority were, and still are, nominated by the Minister of Posts and Telegraphs.

This meant that the Radio Eireann Authority, of which the first chairman was Eamonn Andrews, were now responsible for operating both sound and television services and were, in theory, free of government control. De Jure, they were: De Facto, I'm not so sure. Since the act was only passed 13 years ago it would have been surprising indeed if no memory of the previous situation had lingered. From time to time, too, there had been sporadic outbreaks of terrorism committed by a few and affecting many. In such situations what governments call 'responsible reporting' becomes more necessary than at other times. This explains why, even now, there is some government influence over RTE.

With the Northern situation as it was until recently, it would be unfair to claim that this was entirely another example of a government being reluctant to relinquish their power over broadcasting long after the original reasons for having that power have disappeared. RTE, as Dr O'Brien hinted in his speech, are nothing like as badly off as ORTF in France.

The chief instrument by which this influence is exercised is Section 31 subsection 1 of the Irish Broadcasting Authority Act of 1960. The wording is similar to that passage I have quoted from the BBC's Licence and Agreement of a year earlier, though more concise: 'The Minister may direct the Authority in writing to refrain from broadcasting any particular matter or matter of any particular class, and the Authority shall comply with the direction'.

The difficulty has arisen from that conciseness which, paradoxically, has made the law rather vague. In the Estimates speech I referred to earlier, Dr O'Brien said: 'Generally speaking I would like to see the responsibilities of the Authority more explicitly defined by law and the Authority then left to discharge its responsibilities without interference of any kind from the government in programming. This would mean of course that Section 31 subsection 1 of the Broadcasting Act 1960 would go . . . The autonomy I have in mind for the Authority is not anything anarchic or arbitrary but a freedom defined and limited by clearly specified law. Instead of the incalculable and unpredictable varieties of possible responsibility placed on an Authority by the existing Section 31 subsection 1 the new legislation would provide explicit definition of the responsibilities of the Authority.'

Until now the vagueness of the wording made the Authority err on the side of caution, partly for fear of losing their jobs; a year or so ago the government sacked the entire Authority. The single directive which caused the trouble was that issued by Dr O'Brien's predecessor, Mr Gerry Collins, when the Lynch government was in power. On October 1, 1971, he issued a directive as follows: To refrain from broadcasting any matter of the following class, ie any matter that could be calculated to promote the aims or activities of any organisation which engages in, promotes encourages or advocates the attaining of any particular objective by violent means'.

Mr Collins left the RTE Authority to work out what that meant for themselves. The result was that the Authority had to circulate a code of practice outlining this interpretation and saying, in effect, that there were to be no face-to-face interviews with members of the IRA.

What influence there is, then, stems not from Section 31 itself but from its vagueness and from the fact that the Authority is appointed by the Minister, who can, if he wishes, sack all of them. Only since the present Irish government, a coalition, was elected in March 1973 has there been any sign that broadcasting would be free by implication as well as by statute. One sign of this new spirit of freedom was that this year, for the first time, he circulated the notes on the Estimates—notes normally available only to Irish Deputies (MPs)—to the press. 'I feel that to open windows rather than to close them is the more natural function of broadcasting and television and also the one of which our national culture, generously interpreted, stands the more in need.' Later in the speech he said: 'The freedom of RTE shouldn't be less than that of any good newspaper'.

The network

From the time that radio broadcasting began in Ireland in 1926 until fairly recently, Radio Eireann's studios have been in adapted temporary premises at the GPO building in O'Connell Street. At the beginning the station was known as 2RN—a pun on the last two words of the song title 'Come back to Erin'.

Broadcasting began on January 1, 1926, in a tiny studio in Little Denmark Street, Dublin. The transmitter was at McKee barracks, north-west of the city centre, and had a power of 1 kW. For a national station this was low, especially when you consider the sensitivity of the radio sets available in 1926.

The Denmark Street studios had been leased to 2RN by the Department of Posts and Telegraphs. The *Dail*, or assembly, had passed legislation 18 months before to authorise a broadcasting service under government control.

The first broadcast was made by Dr Douglas Hyde, a founder of the Gaelic League. The league had been founded in 1893 to preserve Irish as Ireland's national language, to study and publish existing Irish literature and to cultivate a modern literature in Irish. Dr Hyde was to become the first President of the state. 'Our enterprise today,' he began, 'marks the beginning not only of the new year, but of a new era—an era in which our nation will take its place amongst the other nations of the world . . .'

After his speech a selection of Irish airs was played by the No 1 Irish Army Band. At that time there were only a few thousand receivers in the country. The station staff numbered five, including the director, and there was a resident orchestra of four.

Later that year Radio Eireann moved to temporary premises in the GPO building in O'Connell Street, the same building from which, ten years before, Patrick Pearse had led what would now be called 'an abortive coup' against British rule.

In 1927 a small transmitter began broadcasts from Cork and in 1932 the Athlone transmitter, which most people associate with Irish radio, opened at a strength of 100 kW. In 1954 the Dublin and Cork transmitters were replaced by more modern ones with powers of 5 kW, and the main Athlone transmitter was replaced in 1955. A new high-powered medium wave transmitter to replace that at Athlone will be in service by the end of 1974 at a total cost of nearly £700,000.

The Athlone transmitter, on 530m, is the national transmitter. The Dublin and Cork transmitters are local transmitters each of which broadcasts on 240m. Dublin's population is just over half a million and the population of Cork, which has had its own fully-staffed and equipped radio studios since April 6, 1927, is about 122,000.

A shortwave service was planned to begin after the war but the project was abandoned because of the heavy cost.

Ireland's first vhf transmitter went into service on July 24, 1966. By the end of that year all five vhf transmitters were working. The five are on the same sites as the five main television transmitters: Maghera, Co Clare; Mullaghanish, Co Cork; Truskmore, Co Sligo; Kippure, Co Dublin; and Mount Leinster, Co Carlow. These operate on 94.1, 93.5, 89.7, 95.3 and 94.9 MHz respectively. There are satellite vhf transmitters in Donegal, Cork and Kerry. All the vhf transmitters can broadcast stereo programmes and vhf radio reaches 98 per cent of Ireland's population.

64 ▶

LETTERS

Wither the Beeb?

Dear Sir, At first glance John Dwyer's article 'Wither the Beeb?' (December 1973) would seem to be well reasoned. But why, oh why, does he spoil it all by indulging himself in hysterical outbursts? The worst of these descends to the level of criticising the BBC's policy over loo paper. Mr Dwyer here has his facts wrong. There are minutes of meetings held around September 1972, when the subject was brought up, which show that the BBC rent Bush House and it was the landlords who attempted to economise by changing the loo paper, not the BBC.

Unfortunately I am not privy to most of the facts and statements that Mr Dwyer quotes so I have to take their veracity on trust. This said, let me quote from an excellent booklet published by the BBC External Services entitled *Broadcasting Beyond One's Frontiers*. In the chapter dealing with attractive listening in a news context:

'Most listeners are not likely to be eye witnesses or friends of eye witnesses . . . and credibility for them will depend psychologically on the credibility of very small details which form a part—maybe an apparently unimportant part—of the overall account. Checkable accuracies and checkable inaccuracies, however small, tend to have a cumulative effect on the credibility of each and all parts of the output of a broadcasting organisation and therefore of the organisation itself.'

Similarly I would say that, for me at any rate, these small inaccuracies which I *know* to be inaccuracies must detract from my faith in John Dwyer's article as being balanced, factual account. And, by extrapolation, my faith in your whole magazine as to the veracity of articles printed therein. Mr Dwyer, in his article, states:

'In a vacuum of information something far worse than truth takes its place'. By his article Mr Dwyer has shown that, in a welter of information, truth's rightful place can be taken up by something worse.

Yours faithfully, John Ratcliff, Lecturer in Sound, Ravensbourne College of Art and Design, Wharton Road, Bromley, Kent BR1 3LE.

OTHERS HAVE said the loo paper story was untrue. If so I apologise. The trouble was that, although I believed the story to be true, I did not make it sufficiently clear that I was trying to provide a little comic relief at this point, which is why the story was not as carefully checked as the rest. With limited time, some things have to be considered less important than others.

The passage Mr Ratcliff quotes is quite right, I think. The knowledge (though I would never use 'know' in quite the way Mr Ratcliff has) that something is incorrect makes one doubt any work in which an error appears. In the BBC article I wanted to use a 'fact' which appeared in a biography of Edward Heath. I spent about a day checking what had appeared in the book only to find (not from the BBC, I may add—they would tell me nothing) that what the book said was quite wrong. I shall use the book sparingly from now on.

In speaking to Mr Ratcliff since receiving his letter, I learn that he does not know of any other inaccuracies besides the one he quoted. Since the article was published, I have not been told of any other errors (to say which is asking for trouble) but I leave other readers to judge for themselves how accurate the piece is.

John Dwyer

Stellavox AM1 field trial

Dear Sir, Firstly, we would like to thank Mr McKenzie for the amount of time he spent with us going over the modifications felt necessary to the Stellavox AMI mixer in the course of its field trial (published January 1974).

The mixer design is deliberately 'back to front' (numbered One to Five from right to left), in order that the operator's right hand falls naturally on the input channel faders. The master faders and meters are on the left to line up conveniently with the meters of the Stellavox *SP7* recorder placed above and behind the mixer. There is, of course, no reason why say three microphones should not be fed into channels Three, Four and Five, so occupying the centre of the mixer when not all channels are in use.

We will shortly be able to supply bridging bars to couple two channels together.

The original design required that the master be used only for fading or fully open and gain was deliberately lost for this reason. We (the importers) agree with Mr McKenzie that some gain reserve should be available. We in fact increased the master gain 15 dB for reserve and 5 dB for improved input distortion performance. As was mentioned to Mr McKenzie, the modified unit did not have the correct resistors in its high sensitivity position; with the correct resistors the total gain is 74 dB.

The input stage modifications not only allow for inputs up to −20 dBm for full output but also increase the input impedance in the dynamic or phantom position to 1.2 kΩ. Although our own AKG *D202* microphones do not crackle with phantom power present, we have suggested that Stellavox fit three-position switches so the voltage can be removed when necessary.

The stray field from the magnetic lid catch is very small when the lid is shut and does not create any great hazard.

The new *APS-7* power supply and charger includes ic stabilisation, and has lowered the hum level by about 26 dB.

Yours faithfully, Robert Woolford, AV Distributors (London) Ltd, 26 Park Road, Baker Street, London NW1 4SH.

Burwen 2000 review

Dear Sir, Regarding Mr Ford's assessment of the Burwen 2000, I would wish to make the following comments.

1. *Mains input*. We are now bending the receptacle contacts away from the electrolytic which incidentally is insulated with mylar.

2. *VU meter*. As noted in our specification sheet, the VU output is derived from the precision rectifier output, therefore reading the compressed tape signal and not the input signal. Compared with the input, 20 VU on the meter corresponds to 60 VU at the input and the response is not flat due to the pre-emphasis in the system. Nevertheless the meter indication is useful for indicating tape overload.

3. *20 Hz tape compensation*. It is true that adding the compensation on the record side increases the record level. This was done for the purpose of maintaining the best possible signal-to-noise ratio. I have not yet run into a practical musical signal of sufficiently low frequency and high level that this has been any problem.

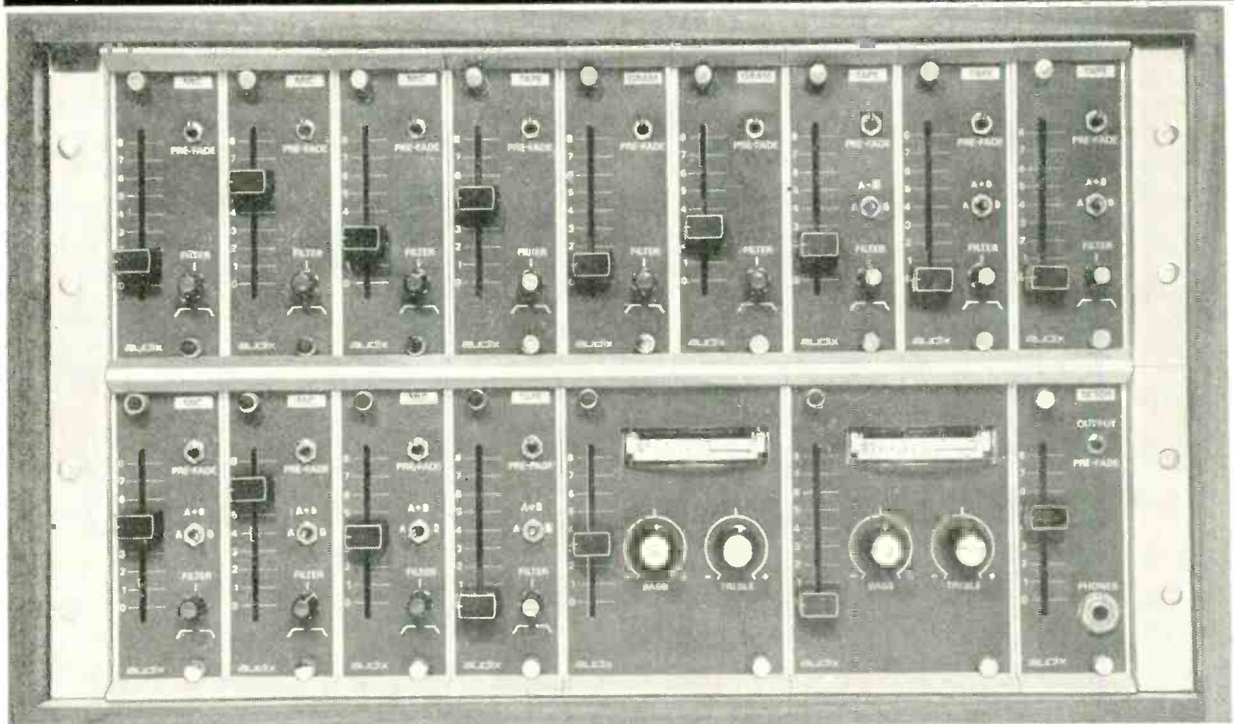
4. *Low frequency filtering*. Inherent in a compression expansion system which works at low frequencies is a possibility of feeding in a sub-audible signal which can cause compression but will not get through the tape machine to cause complementary expansion. This is the reason for the 18 dB/octave filter cutting off at about 14 Hz ahead of the compressor. If the microphone is subjected to a large sub-audible input, such as knocking the microphone, this effect can occur. We did a lot of experimental work on this subject in the design of the system. Unfortunately, the precision rectifier which measures the tape signal cannot be made insensitive at the low frequencies by filtering within it because it is part of a feedback system which can become unstable under certain conditions if filtering is used. Therefore, the best we have been able to do is filter ahead of the whole compression system. While no filtering is perfect I find that it is sufficient to enable a microphone with extreme low frequency response to produce good results on voice or outdoors picking up automobiles going down the street provided a windscreen is used.

If the *2000* is used with a transmission medium such as a consumer tape recorder which does not have low frequency response below say 50 Hz, or is used with a telephone line which cuts off at say 300 Hz, then the input to the *2000* should be preceded by a high pass filter having a cutoff frequency equal to that of the transmission medium. Bear in mind that the system has been designed for practical music. The proof of the importance of any low frequency errors that occur is in listening to some good musical material such as the organ recital you mentioned.

Yours faithfully, Richard S. Burwen, President, Burwen Laboratories Inc, 209 Middlesex Turnpike, Burlington, Mass 01803, USA.

...and this is standard equipment!

audix
SOUND SYSTEMS AND ELECTRONICS



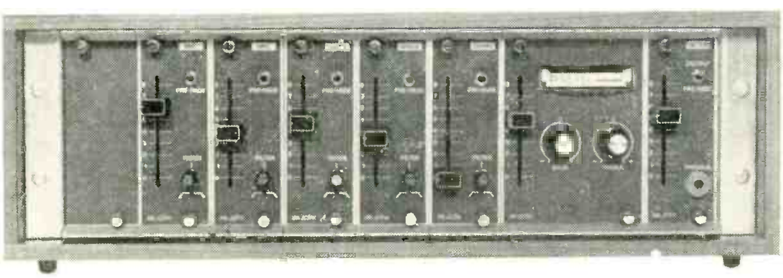
The Capable MXT-200 Audio Mixer.

COMPARE YOUR REQUIREMENTS WITH THESE FEATURES THEN DESIGN YOUR MXT-200

OR ASK US TO.

Input Facilities
* Up to 15 plug in Mono, 2 group, or stereo input modules per combiner.
* Modules for Microphone, gramophone, Tape, Radio Cine and line sources.
* Exceptionally versatile bass and treble equalisation on one easy to use control.
* Linear motion faders for smooth mixing.
* Interlocked pre-fade listen switching.

Output Facilities
* Mono or Stereo Combiners with large scale VU or PPM metering, fit two combiners for 2 group working.
* Linear motion fader and separate Bass and Treble controls for output signal adjustment.
* Line level output with high overload capability.
* Monitor Module with PFL/Output switching, headphone socket and line level output.



MXT-200 THE MIXER

The standard equipment is built up in 19 inch frames, each 9 modules wide. The frames may be stacked or placed end to end and housed in a console, rack or cabinet. You only order the input modules you now need. Additional modules may be plugged in the frames as your requirements change.

ASK FOR FURTHER INFORMATION

audix

MANUFACTURERS OF SOUND SYSTEMS AND ELECTRONICS

AUDIX LIMITED · STANSTED · ESSEX CM24 8HS
TELEPHONE: BISHOP'S STORTFORD 813132
(4 lines) (STD 0279)

Survey: Noise reduction units and complimiters

ALLEN & HEATH
Allen & Heath Ltd, Pembroke House, Campsbourne Road, London N8.
Phone: 340 3291.

Compressor
Input: Continuously variable from —30 dBm, at 22kΩ input impedance.
Output: Continuously variable from 0 dBm to drive loads down to 600Ω.
Compression: 6.1 fixed ratio.
Maximum compression: 30 dB.
Compression threshold: —3 dBm.
Meter output: 1 mA, forward reading scale.
Attack time: Variable from less than 5 ms to more than 100 ms.
Release time: Variable from less than 100 ms to more than 2s.
Noise: —67 dBm.
Distortion: 0.5%.
Power requirements: 21V positive rail supply at 50 ma.
Price: £18.

Noise gate
Input: Variable from —35 dBm at 22kΩ input impedance.
Output: 0 dBm, to drive loads down to 600Ω.
Attenuation depth: Variable from —35 to 0 dBm.
Attack: Less than 0.5 ms.
Release time: Variable from less than 100 ms to more than 2s.
Trigger level: Variable from —39 dBm.
Trigger input impedance: 47kΩ.
Noise: —80 dBm.
Distortion: 0.3%.
Power requirements: 21V positive rail supply at 40 mA.
Price: £18.

ALLISON (USA)
Agents: F.W.O. Bauch Limited, 49 Theobald Street, Boreham Wood, Herts.
Phone: 953 0091

Gain Brain limiter
Gain reduction range: 30 dB.
Noise level: At least 83 dB below threshold of peak limiting (20 Hz to 20k Hz).
Distortion: Thd 0.3% 40 to 15k Hz.
Attack time (peak section): 1.5 dB overshoot 1 µs after application of 50k Hz tone burst exceeding the threshold of limiting by 15 dB.
Attack time (rms section): 7 ms to 40 ms for 90% of ultimate gain reduction. Dependent on waveform complexity amount of limiting and position of function control.

500 keyable programme expander
Attack time: For gain to increase from —60 dB to —1 dB after the application of a control signal whose level exceeds threshold): less than 20 µs.
Release time: For gain to decrease by 30 dB after removal of a control signal): Variable from 50 ms to 6s.
Active expansion ratio: 2:1 from 0 dB to 15 dB expansion; increasing to 4:1 at 60 dB expansion.
Threshold of expansion: Variable from —35 dBm to —20 dBm.
Insertion loss: 0 dB, internal control provides up to 20 dB gain.
Frequency response: 20 to 40k Hz ±1 dB.
Distortion: 0.5% thd under normal operating conditions. (Measured distortion may exceed this figure if very short release times are used.)
Signal to noise ratio: 85 dB below rated output.
Input impedance: 600Ω (emitter follower).
Maximum input and output levels: —17 dBm.

ALTEC (USA)
Agents: Theatre Projects Limited, 10 Long Acre, London WC2E 9LN.
Phone: 240 5411.

1591A compressor amplifier
Gain: (Mic) 90 dB with 1588A plug-in preamplifier. (Line) 40 dB with 15095 transformer bridging 600Ω line.
Frequency response: ±1 dB, 20 to 20k Hz.
Power output: +18 dBm as straight amplifier.
Harmonic distortion: At +18 dBm, 0.5% thd, 30 to 20k Hz. At 25 dB of compression, 1% thd, 40 to 20k Hz. At 35 dB of compression, 2% thd, 40 to 20k Hz.
Noise level: —120 dBm equivalent input noise from microphone input. Output noise with gain controls of minimum is 70 dB below full output.
Source impedance: (Mic) 150/250Ω with *1588A* plug-in preamplifier. (Line) Up to 15Ω with *15095* transformer (Microphone input may use a *1579A* equalized amplifier for 47kΩ magnetic phono pick-up).
Load impedance: 150 and 600Ω (Transformer isolated output).
Maximum compression: 35 dB.
Attack time: 30 ms (63%).
Release time: Selectable, 0.5 or 1.5s (63% recovery).
Threshold: Selectable, 0 dBm or +8 dBm output.
Compression ratio: Selectable, 10.1 at 0 dBm: 10:1 or 5:1 at +8 dBm.
Controls: Mic gain, Line gain, release time, compression ratio and threshold, power switch 12V/24V ac, 50/60 Hz at 10W 12V dc at 0.16A or 24V dc at 0.17A Ground negative.
Dimensions: 90 x 480 x 146 mm.
Weight: 4kg.
Accessories: *1588A* plug-in transformer isolated microphone preamplifier. *1578A* plug-in unbalanced input microphone preamplifier. *1579A* plug-in RIAA equalised amplifier for magnetic phono pickup. *15356* plug-in transformer for line matching.
Price: £157.47.

APOLLO
Manufacturers: Apollo Electronics, 96 Mill Lane, West Hampstead, London NW6.
Phone: 794 8326

CL36 compressor limiter
Frequency response (±0.5 dB): 20 to 20k Hz.
Input impedance: 600Ω unbalanced.
Maximum input level: +19 dBm (7V rms).
Output source impedance: 50Ω unbalanced.
Terminating impedance: 600Ω or higher.
Maximum output level: +19 dBm (7V rms).
Gain, below threshold: 0 dB ±1 dB (unity).
Unweighted output noise level: —80 dBm (80 µV rms).
Maximum compression: 36 dB.
Total harmonic distortion: 1.5% for 36 dB compression, 0.5% for 30 dB compression.
Threshold level control: —18 to +6 dBm ±1 dB in steps of 3 dB.
Release time control: 2 to 50s (for 12 dB compression).
Operating voltage: 24V dc.
Current consumption: 35 mA approx.
Dimensions: 190 x 45 x 142 mm.
Weight: 0.63 kg.
Connector: 16 way DIL plug with gold-plated contacts.
Price: £38.20.

EX60 expander
Frequency response 40 to 20k Hz (—3 dB).
Input impedance: 10kΩ.
Maximum input level: +19 dBm (7V rms).
Output source impedance: 50Ω.
Terminating impedance: 600Ω or higher.
Maximum output level: +19 dBm (7V rms).
Gain, above threshold: 0 dB ±1 dB (unity).
Signal-to-noise ratio: 90 dB below rated output:
Expansion range control (adjustable): 0 to 60 dB ±2 dB.
Threshold level control (adjustable): 0 to —22 dBm ±2 dB.
Attack time: 20 µs.
Release time control (adjustable): 0.1 to 4.5s.
Expansion ratio from 0 dB to 30 dB: 2:1 gradually increasing at 60 dB to 4:1).

HM30 complimenter
Input and output impedance: 5kΩ.
Voltage gain: Unity.
Maximum input level as limiter: +8 dBm (2V); +18 dBm (6V).
Maximum compression for 1% distortion: 24 dB; 34 dB.
Distortion for 12 dB compression (20k Hz band): 0.3%; 0.25%.
Compression slope as limiter: 15:1; 20:1.
Attack time for 12 dB compression: 100 µs; 50 µs.

AUDIO DESIGN
Audio Design Recording, St Michaels, Shinfield Road, Shinfield Green, Reading, Berkshire.
Phone: 0734 84487
Range of audio dynamic controllers, data received too late for inclusion. Details on request.

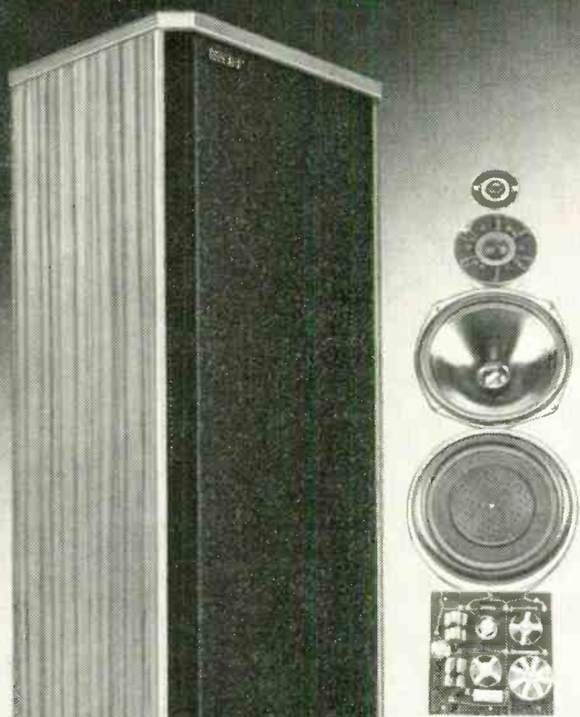
AUDIX
Audix Ltd, Stansted, Essex CM24 8HS.
Phone: 0279 813132.

SP704 limiter
Input: 10kΩ balanced and floating, 0 to 15 dBm in 3 dB steps.
Output: 1Ω source unbalanced, 0 dBm into 600Ω or higher 40Ω balanced, 0 dBm into 600 ohms or any bridging load also available.
Maximum output: +20 dBm into 600 ohm (+19 dBm balanced).
Noise: —80 dBm.
Distortion: 0.03% residual (at 500 Hz). Less than 0.1% operating.
Frequency response 20 to 20k Hz ±0.5 dB.
Ratios: 8:1 internal drive, 2:1 external drive.
Threshold: +4 to +12 dBm by 2 dB steps, and off.
Attack: 5 ms at 12 dB of control (auto).
Release: 0.1, 0.2, 0.5, 1, 2s and auto.
Indicators: Lamp at threshold and at 10 dB gain reduction.
Power supply: 110 to 120/220 to 240V. 50 to 60 Hz.
Dimensions: 89 x 483 mm (hw).

42 ▶

Celestion Loudspeaker Engineering advances the state of the art to a new plateau

Ditton 66 Studio Monitor



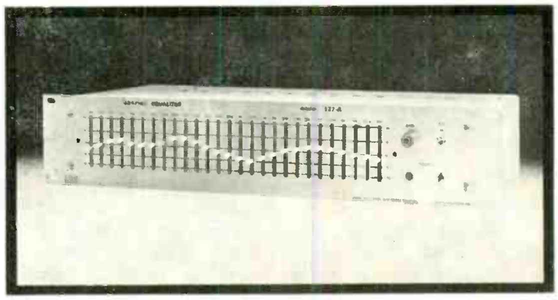
1.) Celestion's new super tweeter. 2.) New design 'pressure' mid-range unit. 3.) Ultra Linear 12" Bass drive unit. 4.) A.B.R. ensures controlled bass down to 16Hz.
5.) Precision crossover for perfect system intergration.

A new Loudspeaker of advanced design suitable for studio use and for home installations of the highest quality.
UNITS: HF 2000 (dome 'pressure' type) MF 500 (Mid-range Dome 'pressure' type) Ultra linear 12" bass driver and 12" ABR. The crossover has resulted from considerable research and crossover points are at 500 Hz and 5000 Hz 80 Watts Maximum, 4-8 ohm. This monitor loudspeaker system has an exceptionally wide and flat frequency response. Very low order harmonic and inter-modulation distortion. Precise response to transients. Beautifully maintained polar response ensures absence of unwanted directional effects and provides a highly satisfactory stereo image throughout the listening area. Matched pairs.
SIZE 40 × 15 × 11½ Natural Teak or Walnut Cabinet

Celestion

Loudspeakers for the Perfectionist

ROLA CELESTION LTD.
DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP



Graphic Equalizer

- *27 adjustable equalizers on ⅓-octave ISO center frequencies.*
- *10 dB boost or 10 dB attenuation at any center frequency.*
- *stepless, noiseless vertical controls, precision calibrated.*
- *state-of-the-art active filter circuitry.*
- *low distortion, low noise.*

UNIVERSAL AUDIO

F.W.O. Bauch Limited
49 Theobald Street
Boreham Wood, Herts.
Tel: 01-953 0091

4B02
Input: 10kΩ bridging, line level.
Output: 50Ω source, unbalanced to feed external transformer level 0 dBm nominal.
Maximum output: +24 dBm into 600Ω.
Noise: —80 dBm operating. —90 dBm gate 'off'.
Frequency response: 20 to 20kHz ±0.3 dB.
Distortion: 0.03% residual, at 500 Hz; 0.1% operating.
Ratios: 1.5, 2, 3, 4, 6 and limit.
Thresholds: —12 dBm to +10 dBm by 3 dB steps, and off.
Attack: 1, 2, 5, 10, 20 ms.
Release: 0.1, 0.2, 0.5, 1,2s and auto.
Noise gate threshold: —10, —20, —30, —40, —50 dBm.
Gate attack: 2 ms
Gate fade out: 30 ms nominal
Dimensions: 178 x 40 x 254 mm (whd).

BURWEN (USA)

Noise eliminator

See page 49

CATHEDRAL

Cathedral Sound, 'Fourways', Morris Lane, Ormskirk, Lancashire L39 85X.
Phone: 074 484 328

CLA/1 complimiter
Compression threshold: —20 dBm.
Output level: Preset between —15 and +5 dBm.
Compression ratio: 1:1 variable to limit.
Attack time: 0.1 to 5s variable.
Distortion: (—10 dB output) better than 1%.
Power requirements: 30V at 20 mA.
Module dimensions: 88 x 100 mm excluding plug.
Price: £15.50, post and VAT paid. Available with Painton 15 way plug and socket, £2.20 extra.

CHADACRE

Chadacre Electronics, 63 Stratford Broadway, London E15 4BQ.
Phone: 534 1207.

9521 compressor
Input impedance: 50kΩ.
Output impedance: 600Ω.
Ratio: 1:1 through 6:1.
Noise level: 90Ω dB.
Medium attack/release: 0.5s.
Special attack/slow release: 3 ms/7s.
Price: £22 (pcc with switch and controls).

DOLBY

Dolby Laboratories Inc, 346 Clapham Road, London SW9.
Phone: 720 1111.

A301 noise reduction unit
Layout: Two independent signal processors per *A301* unit; each may be switched into either record or playback mode.
Signal Connections: One *XLR* input and output for each processor (Tuchel connectors optional).
Overall frequency response: Better than ±1 dB, 20 to 20k Hz.
Overall total harmonic distortion: At +8 dBm, 0.1 at 1k Hz; 0.2% from 40 to 20k Hz.
Output clipping point: +18 dBm.
Noise reduction: 10 dB from 20 to 5k Hz, rising to 15 dB at 15k Hz; with noise reduction switched off, system becomes unity-gain line amplifier.
Overall noise-level: 80 dB below +8 dBm.
Crosstalk: 80 dB, processor to processor, 20 to 20k Hz.
Matching between units: 1 dB at any level and any frequency.
Operating temperature: Up to 45°C.
Operating controls: None.
Panel meters: NAB and DIN level setting meters for recorder gain calibration.
Construction: Modular, eight plug-in circuit modules together with plug-in chassis module for power supply and audio transformers. Fibre-glass printed circuits, solid state devices throughout (103 silicon transistors including stabilised power supply).
Size: 225 x 483 x 270 mm.
Weight: 13 kg.
Power requirements: 100 to 125V and 200 to 250V voltage selector 50 to 60 Hz single phase, 22VA.
Price: £560.

360 noise reduction unit
One single processor, which can be set for either record mode or play mode. Control by illuminated push-button switches on front panel.
Signal connections: *XLR* input and output.
Signal levels: Input and output levels adjusted by multiturn potentiometers accessible from front of unit. Minimum input 350 mV for Dolby Level, 600 mV for DIN level. Maximum output level +22 dB into bridging load; +21 dBm into 600Ω; +20 dBm into 200Ω.
Overall frequency response: ±1 dB from 30 to 20k Hz.
Overall total harmonic distortion: At +8 dBm, 0.1% at 1k Hz. 0.2% from 40 to 20k Hz.
Noise reduction: Dolby *A* type characteristic providing 10 dB of noise reduction from 30 to 5k Hz, rising to 15 dB at 15k Hz. With noise reduction action switched off, unit becomes unity-gain line amplifier.
Overall noise level: Record-playback, 80 dB below Dolby level.
Matching between units: ±1 dB at any level and any frequency, 30 to 20k Hz.
Operating temperature: Up to 45°C.
Construction: Plug-in noise reduction module *22* removable through panel. Fibreglass printed circuits, solid state devices throughout.
Weight: 5.5 kg.
Power requirements: 100 to 130V and 200 to 260V 50 to 60 Hz single phase, 14 VA.
Price: £240.

B320 noise reduction unit
Layout: Two independent signal processors per unit, each may be switched into either record mode or playback mode.
Signal connections: One *XLR* input and output for each processor (Tuchel connectors optional).
Inputs: 10 kΩ balanced bridging transformers accepting all normal line levels. Provision made for addition of termination resistors, if required to match line impedance.
Outputs: Balanced, levels and impedance to order. Normal options are 0VU (+4 dBm) 600Ω (US standard) 1.55V (+6 dB) 30Ω (Continental standard) +8 dBm peak 600Ω (UK broadcasting standard). Output termination switches provided on 600Ω units.
Meters: Front panel meters for level standardisation. Dolby level corresponds to 185 pWb/mm (Ampex operating level) on open reel duplicates and 200 pWb/mm on cassettes.
Overall record-playback frequency response: ±1 dB, 20 to 20k Hz.
Overall total harmonic distortion: At +8 dBm (600Ω) 0.1% at 1k Hz.
Output clipping point: +18 dBm (600Ω); better than +16 dB (30Ω).
Noise reduction: *B*-type characteristic 3 dB at 600 Hz; 6 dB at 12k Hz, 10 dB from 15k Hz upwards.
Overall noise level: 80 dB below —8 dBm (600Ω) or +6 dB (30Ω).
Crosstalk: 60 dB processor to processor, 20 to 20k Hz.
Matching between units: 1 dB at any level and any frequency.
Operating temperature: Up to 45°C.
Construction: Modular, five plug-in circuit modules together with plug-in chassis module for power supply and audio transformers. Fibreglass printed circuits, solid state devices throughout.
Dimensions: 225 x 483 x 270 mm.
Weight: 13 kg.
Power requirements: 100 to 125V and 200 to 250V, voltage selector 50 to 60 Hz single phase, 18 VA.
Price: £390.

B324 broadcast encoder
Layout: Two independent encoders for stereo operation.
Meters: Front panel meters for level calibration. Dolby level corresponds to 50% modulation (+37.5k Hz deviation in fm transistors).
Operating modes: Pushbuttons provided for selection of the following modes: **(a)** Conventional (not encoded). **(b)** Conventional Dolby *B* encoded; **(c)** 25 μs Dolby fm time constant changing network inserted after *B* encoding which, together with transmitter pre-emphasis, provides 25 μs characteristic. Additional rotary switch control for selection of increased modulation level, operative only in 25 μs Dolby fm mode, calibrated in 2 dB steps from 0 to +8 dB.
Dolby Tone button: Controls injection of calibrated Dolby Tone at 50% modulation level. Operative only in Dolby transmission modes. Oscillator is modulated in characteristic manner, preventing confusion with other tones.
Remote operation button: Allows operation of Dolby Tone and cancellation of selected Dolby transmission mode by grounding respective rear-mounted jack connector.
Output clipping point: 8 dB above 100% modulation.
Encoding characteristic: *B* characteristic; +3 dB at 500 Hz; +6 dB at 1k Hz; +10dB from 4h Hz upwards.
Noise level: 70 dB below +8 dBm (600Ω) or +6 dB (200Ω).
Construction: Six plug-in circuit modules together with plug-in chassis module for power supply and audio transformers. Fibreglass printed circuits, solid state devices throughout.
Other features: As *B320*.

EMI

EMI Electronics Ltd, Hayes, Middlesex.

EMI 8025 compressor
Power supply: ±24V.
Input impedance: 10 kΩ in parallel with 50H.
Voltage gain below knee: Adjustable from 0 to 20 dB by means of the compression range control.
Compression: Range variable from 0 to 20 dB: ratio is selectable to 1:1 (linear), 2:1, 3:1, and 5:1 by a switch.
Output level: Level of maximum compression is adjustable from 0 dBm to +24 dBm.
Sensitivity: Peak input level, to give full compression is adjustable from —16 dB to —24 dB relative to 775 mV.
Attack time: 1 ms.
Recovery time: Selectable to 125 ms, 250 ms, 500 ms, 1s, 2s, or 3s by means of a front panel switch.
Frequency response: Within a 1 dB envelope from 60 to 8k Hz and within a 2 dB envelope from 40 to 15k Hz.
Distortion: 1% at 40 Hz with a recovery time of 500 ms or more.
Signal-to-noise ratio: 60 dB over the band 40 to 15k Hz.
Temperature range: 0 to +50°C.
Price: £167.

44 ▶

THE TPA 100D IS THE MOST ADVANCED 200W POWER AMPLIFIER MADE IN EUROPE

Most professional recording and broadcasting studios in the U.K. use TPA series amplifiers.

CLIENTS USING TPA SERIES AMPLIFIERS INCLUDE:

BBC Radio & T.V. ■ ATV Network Ltd ■ Thames T.V. Ltd ■ I.T.N. Ltd ■ RCA Ltd ■ De Lane Lea Processes Ltd ■ Electricity Research Council ■ Ministry of Technology ■ Cavendish Laboratory ■ British Scientific Instrument Research Centre.

HH ELECTRONIC MILTON CAMBRIDGE TEL 0223 65945

WANTED!

A THIRD HAND

Our VOICE OPERATED AUTO-FADE unit will help solve your problems.

When producing voice over music sound tracks.

Priority announcement facilities for public buildings. Unit used over the past two years successfully by Radio Broadcast, Hospital Radio and Education Authorities.

Incorporates

Variable Clamp Level
Variable Delay
Variable Speech Level

For full details consult

PARTRIDGE ELECTRONICS
A. C. PARTRIDGE LTD.

21-25 HART ROAD, BENFLEET, ESSEX SS7 3PB
Phone: SOUTH BENFLEET (STD 03745) 3256

0·002% THD 100 watt per channel power amplifier

0·002% THD at all levels up to 10 watts and all audio frequencies. Less than 0·02% THD at all frequencies and all levels up to 50 watts, typically 0·004% at 1kHz and 50 watts. Intermodulation distortion is less than 0·03%.

The amplifer is unconditionally stable and does not ring even into a 2μF capacitor.

The two channels are power limited at 120 watts rms and a tracking short-circuit cut-off protects each of the four power supplies. There is also a thermal cut-out.

Both channels will deliver continuously more than 100 watts into a 4 ohm load or 70 watts into an 8 ohm load.

The frequency response is within 1dB from 10Hz to 20kHz and the noise is more than 100dB below 70 watts into an 8 ohm load.

The case size is 430mm x 300mm x 76mm.

naim audio

The price of the NAP200 Amplifier is £140 + VAT.

15 CHURCHFIELDS RD·SALISBURY·WILTS·SP2 7NH·Tel:3746

EMT

EMT Wilhelm Franz KG, D-7630 Lahr/ Schwarzwald, Postfach 1520, West Germany.
Agents: F. W. O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts.
Phone: 953 0091.

156 stereo compressor limiter

Inputs: Two for stereo, balanced and floating.
Input impedance: 5kΩ minimum.
Input level: Continuously adjustable within the range +4 dBm (1.2V) to +15 dBm (4.4V).
Maximum input level (independent of nominal level setting): +24 dBm (12.3V).
Outputs: Two for stereo, balanced and floating. Output level adjustable in fixed steps: +4 dBm (1.2V); +6 dBm (1.55V); +8 dBm (2V); +12 dBm (3V); +15 dBm (4.4V).
Output source impedance: 15, 20, 30, 40, 50Ω at output level of +4, +6, +8, +12, +15 dBm.
Total distortion at 1k Hz: 0 dB gain, 0 dB internal level: 0.6% maximum.
Frequency response referred to 1k Hz: 30 to 10k Hz ±1 dB. At 15k Hz —1.5 dB.
Signal-to-noise ratio termination: 200Ω source, 600Ω, 70 dB rms at 0 dB gain.
Crosstalk: 35 dB at 1k Hz.
Maximum gain control range of compressor and limiter: 40 dB.
Limiter attack time: 100 μs.
Release time with 10 dB jump in level: 0.25 to 2.5s.
Compressor gain: 0 to 18 dB.
Compression ratio: 1.5:1 to 4:1.
Attack time: Internally adjustable 1 to 4 ms. Set at factory for 2 ms.
Release time for 10 dB gain variation: 5 to 3.5 s.
Expansion ratio: 1:1.5/1:2.5.
Compressor release time for 10 dB gain variation: 1.5 to 7.5s.
AC power line voltage ranges: 100 to 130V. 200 to 250V. 50 to 60 Hz
Power consumption: 40 VA.
Weight: 13.3 kg.
Price: £1,185.

256 compact compressor

Smaller compressor developed from the EMT *156*. Designed for use in microphone channels of mixing consoles.
Power supply: 24V dc ±1V constant current consumption 160 mA, constant power consumption approximately 3.8W. Operation from higher dc voltages possible by series connection of an external resistor.
Input and output: Balanced, floating.
Input level: —20 to +22 dB.
Output level: —20 to +22 dB.
Connection: 13 pole *T2706* on rear.
Dimensions: 190 x 40 mm.
Price: £310 (approximately).

NEVE

Rupert Neve & Co, Cambridge House, Melbourne, Royston.

2243A limiter compressor

Input: 10Ω bridging earth-free.
Output: Source impedance 80Ω balanced and earth-free. Maximum output +26 dBm into 600Ω.
Gain: 0 dB (preset).
Noise: —75 dBm in the band 20 to 20k Hz for the linear and limit modes, rising in the compression mode to a maximum of —60 dBm at 6:1 ratio.
Frequency response: 20 to 20k Hz ±1 dB.
Limit ratio: Greater than 100:1.
Level: +8 dBm within 0.5 dB on preset, adjustable from +4 dBm to +12 dBm in steps of 0.5 dBm.
Attack time: 5ms.
Recovery time: 100 ms, 200 ms, 800 ms, and 'auto' 50 ms/5 s.
Compression ratio: 1.5:1, 2:1, 3:1, 4:1, 6:1.
Threshold: 0 dBm, within 0.5 dB on preset, adjustable from —20 dBm, to +10 dBm in 2 dB steps.
Attack time: 5 ms.
Recovery time: 400 ms, 800 ms, 1500 ms and 'Auto' 50 ms/5s.
Gain: 0 dB below compression threshold, adjustable 'gain make up' available from 0 dB to +20 dB.
Meter: Switched to indicate either gain control up to 16dB or signal level from —12 dBm to +12 dBm. Action approximates that of a ppm.

2257 background noise suppressor

Attenuates audio signals below a predetermined level: variable attentuation depth and recovery time. For use in film dubbing or music mixdown operations to remove unwanted noise from prerecorded tapes.
Threshold control: Sets level of input signal below which attenuation occurs. 0 to —40 dBm in 2 dB steps. Lamp indicates when threshold is exceeded.
Attenuation depth: Selects degree of attenuation of unwanted signal. 3 to 33 dB in 3 dB steps.
Recovery: Recovery time of 100 ms, 270 ms and 1s. The unit may be switched in and out of circuit by operation of the key.
Gain: 0 dB (preset on rear panel).
Frequency response: 20 to 20k Hz ±0.5 dB.
Noise: with attenuation depth set to —3 dB, less than —85 dBm measured wideband 20 to 20k Hz.
Distortion: +20 dBm into 600Ω, less than 0.03% at 1k Hz, less than 0.05% at 10k Hz, less than 0.1% at 100 Hz.
Maximum output: +26 dBm into 600Ω.
Input: 10 kΩ bridging, balanced and earth free.
Output: 80Ω source impedance, balanced and earth-free.
Power requirements: 24V dc (negative earth) 60 mA.
Dimensions: 222 x 46 x 273 mm.

Foregoing now updated to models *2263* and *2254A*; data received too late for inclusion. Details on request.

NTP

N. Tonnes Pedersen A/S, Copenhagen, Denmark.
Agent: Feldon Recording Ltd, 126 Gt. Portland St., London, WIN 5PH.

179-120 compressor amplifier

Supply voltage: 24V dc ±10%.
Maximum ripple voltage: 0.1V p-p.
Current consumption: 90 mA.
Temperature range: —20 to +60°C.
Input impedance within frequency range: 5.6 kΩ, and 15.6 kΩ and 20 kΩ bal.
Output impedance: 2Ω.
Frequency range (0.5 dB points): 20 to 20k Hz.
Minimum load impedance: 100Ω.
Compression ratio: 1:1, 2:1, 3:1, 5:1, 20:1.
Attack time: 100 μs/20 dB to 200 ms/20 dB. (11 steps).
Recovery time: 60 ms/20 dB to 4s/20 dB and one 'Auto' position (11 steps).
'Auto' dual time constants: 200 ms upon 15 s.
Recovery delay: switchable O or 50 ms.
Distortion under static conditions: 0.5% up to 20 dB gain reduction.
Signal-to-noise ratio: 80 dB A-weighted at compression threshold.
Output: 0 to 1 mA for 0 to 20 dB compression.
Limiter attack time: 1.5 ms combined with a full-wave logarithmic clipping circuit.

PARTRIDGE

Partridge Electronics, 21-25 Hart Road, Thundersley, Benfleet, Essex.
Phone: 03745 3256

4132 complimeter

Input: —55 to +13 dB at 10 kΩ.
Output: 1.5V into 2 kΩ.
Frequency response: 20 to 20k Hz ±1 dB.
Noise level: —7 dB.
Voltage: +24V.
Price: £15.50.

PYE

Pye TVT Ltd, Cambridge CB1 3JU.

PYE TVT COMPRESSION UNITS 5732/3.
Gain: 0 dB ±0.5 dB (with no compression).
Frequency response: +0.5 to —1 dB, 30 to 15k Hz. +0.2 to —0.5 dB, 60 to 8k Hz.
(in all compression and limiting conditions).
Output level: +24 dBm.
Input level: 24 dBm.
Compression ratio: 1:1, 2:1, 3:1, 5:1, switched.
Limit range: For an increase of input level of 20 dB above the threshold, output level increases less than 1 dB.
Attack time: Compression, less than 0.5 ms. Limiting, 1 ms ±0.5 ms.
Decay time: 100 ms, 200 ms, 400 ms, 800 ms, 1600 ms, 3200 ms.
Threshold level: Control calibrated in 2 dB steps.
Compression: 24 dBm to +16 dBm, Limiting —6 dBm to +24 dBm (+8 dBm relative to indicated threshold level).
Distortion: With 600Ω load, less than 1% measured at 30, 1k and 8k Hz.
Input impedance: 10 kΩ at 60, 1k and 8k Hz.
Output impedence: Less than 50 ±7.5Ω at 60, 1k and 8k Hz.
Temperature range: —10 to +55°C (ambient operating).
Supply requirements: 110V to 220V, 50 to —60 Hz. 3W (one amplifier).
Dimensions: 89 x 480 x 380 mm.
Price: £330.

DBX (USA)

Agents: Scenic Sounds Equipment, 28 Bryanston Street, London W1H 7AB.
Phone: 935 0141.

187

Four channel switchable record or play unit. Detailed specification on page 46.
Price: £875.

177

Two channel simultaneous record/play.
Price: £667.

152

'Semi-professional' two channel switchable record or play.
Price: £195.

154

Four channel version of **152**.
Price: £295.

157

'Semi-professional' two channel simultaneous record/play.
Price: £257.

216
16 channel simultaneous record/play complete with spare two channel module.
Price: £3,400.

SHURE (USA)

Agents: Shure Electronics Limited, Eccleston Road, Maidstone ME15 6AU.
Phone: 0622 59881.

62V

Input impedance (below threshold): 50 kΩ or 300Ω (latter for 25 to 600Ω sources).
Frequency response: 40 to 20k Hz ±2 dB.
Distortion (any level of regulation): 3% (thd).
Attack: For a 20 dB step increase above threshold, gain is within 2 dB of final value in 500 µs.
Recovery: For a 20 dB step decrease to threshold, gain is within 2 dB of final value in 700 ms.
Battery life: 200 hours.

STUDER

Agents: F.W.O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts.
Phone: 953 0091.

compressor limiter

Two separate channels for mono operation, which can be coupled for stereo work.
Input: Balance and free from earth.
Input impedance: 10 kΩ between 30 and 15k Hz.
Nominal input level: —15 dB (0.14V).
Source impedance: 200Ω nominal Input level: +15 dB (4.4V) maximum.
Output: Balanced and free from earth.
Load impedance: 600Ω
Distortion: 0.5% between 100 and 10k Hz.
Frequency response: 30 to 15k Hz ±0.5 dB.
Signal-to-noise ratio: 70 dB referred to an output level of —15 dB.
Crosstalk ratio: 75 dB. Compressor gain: 30 dB maximum.
Gain before reaching threshold: variable 0 to 20 dB.
Limiter threshold level: —15 dB.
Limiter compression ratio: 25: 1
Limiter attack time constant: 50 µs.
Compressor threshold level: —15 dB.
Compression ratio: 1.5: 1, 2: 1, 3: 1, 5: 1.
Compressor attack time constant: 2.5 ms.
Release time (after a gain reduction of 20 dB selectable in four steps) : 0.3s, 0.75s, 2s, 5s.
Price: £270.

TELETRONIX (USA)

Agents: F.W.O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts.
Phone: 953 0091.

LA3A levelling amplifier

Input impedance: 600Ω (floating).
Maximum input level: +20 dBm (30 dB gain position)
Output load impedance: 600Ω (floating).
Maximum output level: +24 dBm (+27 dBm on peaks).
Gain: 50 dB or 30 dB (±1 dB).
Frequency response: ±1 dB 20 to 20k Hz.
Signal-to-noise ratio: 80dB at threshold of limiting (30 to 15k Hz bandwidth).
Threshold of limiting: —10 dBm at 30 dB position; —30 dBm at 50 dB position.
Distortion: 0.5% thd. from 30 to 20k Hz.
Attack time: 250 µs to 0.5 ms.
Release time: 500 ms to 5.0s depending on the duration of the peak causing the onset of limiting.
Power requirements: 110 to 125V 50/60 Hz, 6w. Switch provided for 220 to 250V, 50/60 Hz.
Dimensions: 89 x 216 x 235 mm.
Weight: 2.9 kg.
Price: £228.

UNIVERSAL AUDIO (USA)

Agents: F.W.O. Bauch Ltd, 49 Theobald Street, Borham Wood, Herts.
Phone: 9530091

1176LN limiting amplifier

Input impedance: 600Ω, bridged T control (floating).
Output load impedance: 600Ω (floating).
Frequency response: ±1 dB 20 to 20k Hz.
Gain: 45 dB ±1 dB.
Distortion: 0.5% thd. from 50 to 15k Hz with limiting at 1.1s release setting (as with all limiting devices, distortion of low-frequency peaks increases as release time is shortened).
Signal-to-noise ratio: 81 dB at threshold of limiting, 30 to 18k Hz.
Attack time: 20 µs for 100% recovery. Adjustable to 800 µs with front panel control.
Release time: 50 ms minimum, 11s maximum (for 63% recovery). Adjustable with front panel control.
Power requirements: 110 to 130V 50/60 Hz, 6w. Strapping provided for 220 to 260V, 50 to 60 Hz.
Dimensions: 89 x 483 x 204 mm.
Weight: 5 kg.
Price: £298.

DBX 187 COMPANDER

By Hugh Ford

MANUFACTURERS' SPECIFICATION

Number of channels: Four, switchable.
Input: 10 kΩ bridging.
Output: Transformer coupled, 600Ω nominal with 80Ω source resistance. Operates normally with 150Ω load.
Frequency response: For full compress-expand cycle ±1 dB (20 to 20k Hz).
Noise reduction: At +4 dBm, input hiss and high frequency asperity noise are reduced by 10 dB on signal with dominant energy below 500 Hz.
At —16 dBm input there is an additional 10 dB of noise reduction.
At —36 dBm input there is an additional 20 dB of noise reduction.
At —56 dBm input there is an additional 30 dB of noise reduction.
Equivalent input noise: —90 dBm maximum.
Distortion: For full compress-expand cycle 0.1% typical, 0.25% maximum.
Maximum input level: +28 dBm.
Maximum output level: +24 dBm (20 to 20k Hz).
Nominal level for unity gain: +4 dBm at 1k Hz.
Connectors: Connectors: Input: 3 pin *XLR* Female. Output: 3 pin *XLR* Male. Remote Control Cable: Pinch Jones *P312CCT*.
Dimensions: 89 x 483 x 267 mm.
Weight: 5.45 kg.
Power: 115V ac ±10% 50-60 Hz 50W.
Price: £875
Manufacturers: DBX Inc, 296 Newton Street, Waltham, Massachusetts 02154 USA.
Agents: Scenic Sounds Equipment, 28 Bryanston Street, London W1.

THE DBX type *187* noise reduction system is a four channel unit electrically identical to the larger models. The model *187* contains four noise reduction channels which may be individually switched either to record or play or alternatively bypassed with direct relay switching from input to output. Switching is achieved either by operating front panel lever key switches or by remote control, the selected functions being indicated by two coloured led indicators for each channel on the front panel. Also located on the front panel are the power on/off switch and the local/remote control switch, both of which are illuminated rocker switches.

To the rear of the unit are the remote control socket, mains socket and fuse, internal termination in/out switch and the four *XLR* connectors per channel which comprise record in, record out, play in and play out.

Mechanically the unit only occupies 89 mm of standard rack, the main frame being of substantial construction, but both the top and bottom being rather flimsy. Not only is there a chance that the top or bottom could be easily pressed-in to short on to the bare conductors of the printed circuit boards, but also the top and bottom were found to be very poor hum screens which means that considerable care is needed in deciding where to mount the units.

Internally the construction is to a high standard, the individual noise reduction channels each being mounted on a high quality plug-in printed circuit board and the common power supplies being mounted on the main chassis. Other than a record gain and a replay gain control for each channel, which are potentiometers screwdriver-adjusted from the front panel, each printed board houses three preset controls which DBX suggest may need adjustment once a year. Personally I dislike preset controls and these controls require the use of a low distortion oscillator and a wave analyser (not a distortion meter) for proper adjustment.

So much for the hardware of the DBX; now to the principles of operation. The larger part of the noise reduction is obtained by compression of the input signal, such that a 2 dB change in input level becomes a 1 dB change in level on tape and vice-versa on replay. Fig. 1 shows that this square law characteristic covers an input range down to -60 dBm, when the DBX then reverts to a linear relationship between input and recorded signal.

Reference to the block diagram of the DBX (fig. 2) shows that pre-emphasis of high frequencies is applied before compression of the input signal. This serves the purpose of raising the recorded levels at high frequencies

48 ▶

FIG. 2 BLOCK DIAGRAM OF DBX NOISE REDUCTION SYSTEM

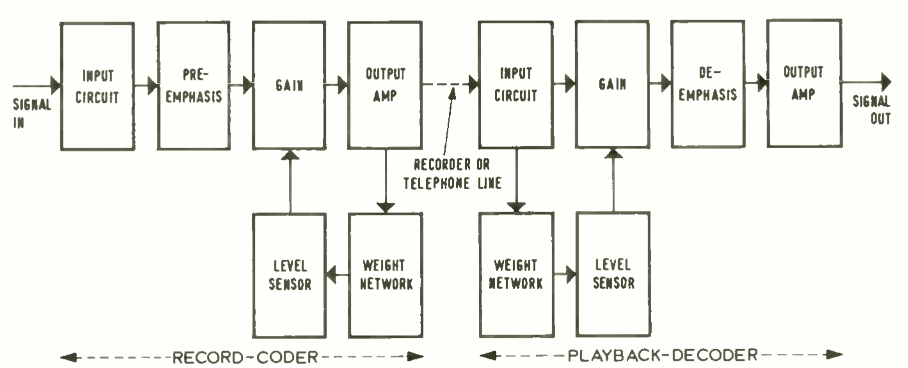


FIG.1 DBX CODING CHARACTERISTIC

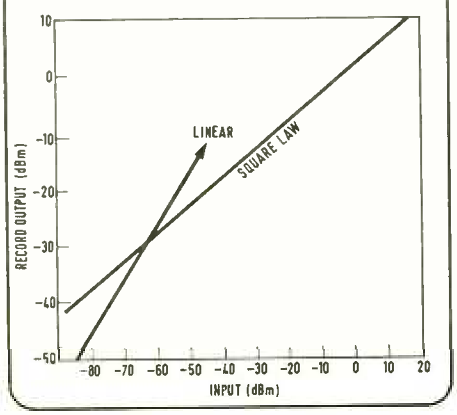
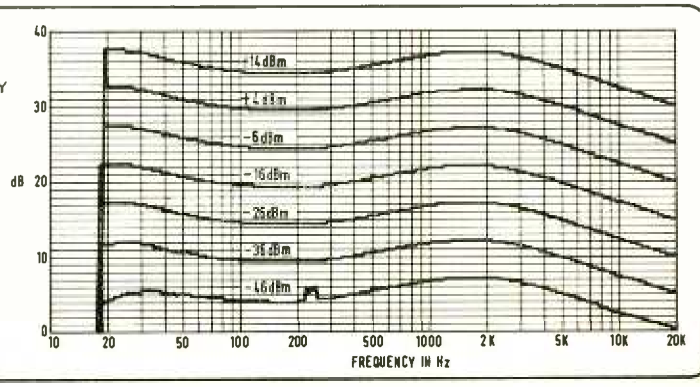


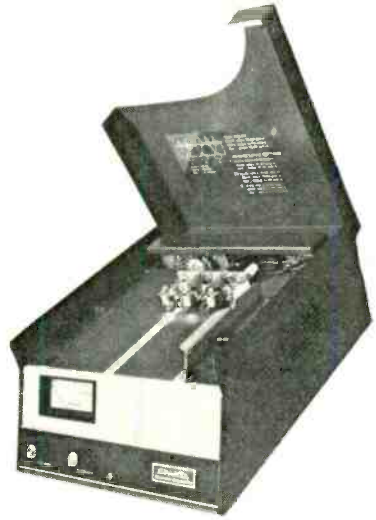
FIG. 3
DBX
RECORD FREQUENCY
RESPONSE
REFERRED TO
INPUT LEVEL

PEN..... 100mm/S
PAPER.....3mm/S



Computer Equipment Company Ltd.

Sole Distributors of: **SPARTA**



Broadcasting equipment

for Europe, Africa and the Middle East

SPARTA PRODUCTS 'JUST RIGHT'

- selection
- quality
- price

CD 15 TIME DELAY and reverb unit

CENTURION II stereo broadcast console. Provision for up to 12 channels. Matching 6-mixer/18 input extender also available.

CENTURY SERIES modular tape cartridge machine. Quad cabinet also available

GT 12 CUSTOM TURNTABLE. Choose 4-pole or synchronous versions

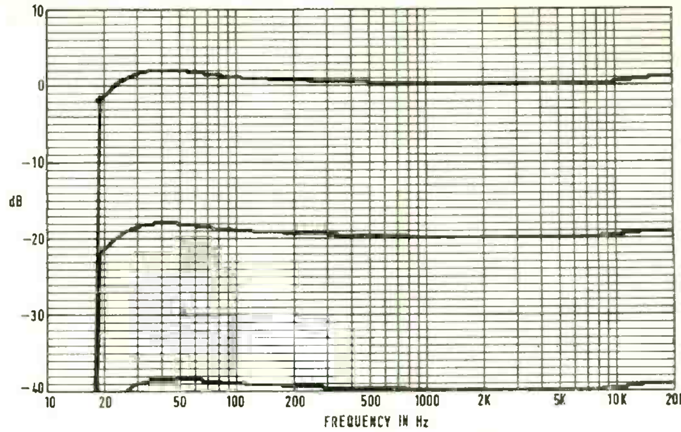
for further information ring
Mike Angelou on (0494) 32529

Computer Equipment Company Limited

Shaftesbury Street, High Wycombe, Bucks.

FIG. 5
DBX
INPUT/OUTPUT
FREQUENCY
RESPONSE

PEN.....100mm/S
PAPER.....3mm/S



so that tape modulation noise products are less obtrusive. Because the level sensing is a strictly rms operation, the sinewave response of the record section does not show any high frequency boost (**fig. 3**) which is only apparent when complex waveforms are recorded (**fig. 4**). A further aspect of the use of rms control sensing is that phase shift in the recorder or other transmission medium will not disturb the decoding of the transmitted signal, as it would in the case of peak sensing.

Inputs and outputs

The signal inputs from either the incoming line or from tape are both balanced inputs when in the record and replay modes respectively. In other modes, the inputs are relay connected to the outputs without any intervening electronics. It follows that the input impedance also depends upon the function selected and in the 'active' modes the input impedance is 25 kΩ with the internal terminating switch out; however, with the internal termination switched in the play input impedance became 588Ω and the record input impedance increased to around 74 kΩ. At the time of writing, I do not understand the logic of this arrangement which requires considerable care in arranging the correct terminations because of the direct switching between input and output when a channel is switched to its inactive mode. In other respects the impedances are sensible with sufficiently high impedances for line bridging and a common mode impedance of 172 kΩ at 1.592 Hz with in excess of 60 dB common mode rejection below 1k Hz. In the record mode, the input sensitivity control had a range of between +0.6 dBm to +6.5 dBm input for +4 dBm output to tape at 1k Hz, while in the play mode the input range from tape for a +4 dBm output was -2.2 dBm to +7.4 dBm, the overload point being in excess of +25 dBm input in both cases—a very adequate margin.

Like the inputs, the output is switched directly to the input in the 'inactive' modes; but, in the active modes the output is a fully floating transformer coupled output with an internal impedance of 95Ω at 1,592 Hz, which is of course adequately low for driving any of the normal standard line impedances.

Finally among the input and output facilities is the remote control socket which provides facilities for switching any of the individual four channels to record, play or bypass. This is simply accomplished by connecting the required permutation of eight pins of the remote connector to the pin which is connected to the internal 24V power supplies. In the remote mode, the internal mode selector switches are effectively disconnected by diodes so that they cannot interfere with remote operation.

Static performance

Fig. 5 shows the overall frequency response of the DBX when a record and replay channel was connected back-to-back with a 'solid wire' tape recorder. Investigation into the frequency response at different levels showed that it always stayed within the limits ±1 dB from 25 to 20k Hz and that the tracking from input to output was within ±0.2 dB over the usable dynamic range.

Overall noise was measured as -81 dBm over the band 20 to 20k Hz, with a weighted figure of -87 dBm(A) at the output; however, hum was a variable hinderance when measuring the noise as a result of varying hum induction through the top and bottom of the instrument's case.

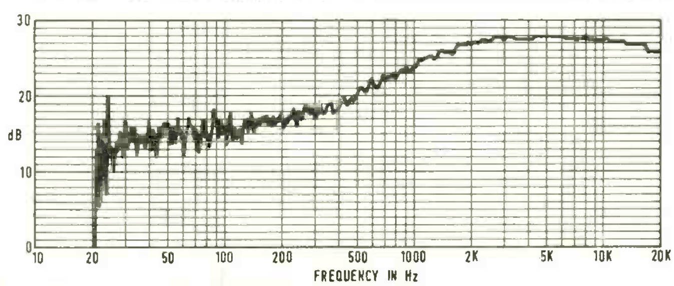
On the other hand, with one channel driven at +20 dBm input, crosstalk to the adjacent channel over the entire audio frequency spectrum was below -100 dB, truly excellent.

The measurement of harmonic distortion at 63, 1k and 6.3k Hz gave good figures consistently below 0.1 per cent third harmonic at all input levels up to +20 dBm and measurement of intermodulation distortion by the SMPTE method gave the following results:

Input level	Intermodulation distortion
+20 dBm	0.35%
+10 dBm	0.30%
0 dBm	0.27%
—10 dBm	0.19%
—20 dBm	0.12%

FIG. 4
DBX
RECORD FREQUENCY
RESPONSE WITH
PINK NOISE IN
1/3 OCTAVE BANDS

PEN.....16 mm/S
PAPER.....1mm/S



The degree of attainable noise reduction was investigated by applying white noise at the junction of a record and replay chain connected back-to-back, feeding signal into the record input and analysing the output by rejecting the fundamental signal frequency and measuring the residual noise. It was felt that the use of white noise, in conjunction with an 'A' weighted measurement of the residual noise in the output, should give the best correlation to the audible effect of the DBX on the basis that tape noise at 38 cm/s is close to white noise and also that the 'A' weighting curve is based on the subjective effect of white noise.

Based on the above methods, the following degree of noise reduction was obtained:

Input signal level	Effective noise reduction
+4 dBm	10 dB (A)
—16 dBm	21 dB (A)
—36 dBm	30 dB (A)
—56 dBm	40 dB (A)

Clearly the above figures show a substantial noise reduction at low input levels and in theory the degree of noise reduction at higher input levels will be fairly similar to the figures at low input levels as a result of the masking effect.

Dynamic performance

Following the measurement of the effective noise reduction it was felt desirable to investigate the effect of very low frequencies on the input background, in view of the possibility of the ambience during a recording being 'pumped' by the presence of very low frequency signals. DBX do give warning in their operating manual that very low frequency input may give troubles, and reference to a paper 'Infrasonic Measurements' by V. Bruel and P. Olesen in the *Bruel & Kjaer Technical Review*, No. 3 1973, shows that sound pressure levels below 20 Hz are relatively common at the most alarming levels. The possibility of troubles in this direction was assessed subjectively by applying a mixture of white noise and very low frequencies to the input of the DBX and listening to the decoded output as the level and frequency of the very low frequency was varied. The practical outcome of this experiment was to show that the DBX is not frequently conscious to any great extent and that there is little danger of audible 'pumping' of ambience provided that low frequencies at the input are kept to levels below 0 dBm.

Attention was next turned to the signal that is recorded on tape: the application of short tone bursts at a fairly long repetition frequency was found to produce considerable overshoot of the recorded signal but this overshoot was restored to normal upon decoding. Fig. 6 shows an input burst of 10k Hz tone together with the resulting signal applied to the recorder which overshoots by about 6 dB and then recovers to its correct amplitude after about 2 ms. Similar results were obtained with bursts of other frequencies. This situation is all very well if the recorder can tolerate the increased level, but with heavy transients this may not be so, and the result to be anticipated is a 'soggy' attack on transients where very high levels are attained.

The restoration of gain after transients, which would manifest itself in the form of noise 'pumping', was next investigated and found to be very rapid. Measurement of noise after a transient showed little overshoot, and that which did exist had a duration in the region of 100 ms. It is therefore unlikely that any audible effect will be detected.

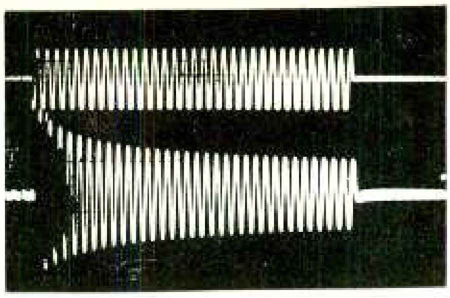


Fig. 6

However, listening tests with a variety of signals fed to the DBX from a live microphone produced the most disturbing effects at times, with particularly nasty 'noise overhang' being heard with the flute. As with so many devices, it is a question of trading the signal-to-noise advantage in the 'static' state against the dynamic effects. Most unfortunately it is a law of nature that the more one improves the signal to noise ratio the more obvious other defects become.

Summary

In terms of specifications, the DBX certainly does what it claims and it only has a few shortcomings so far as pure engineering is concerned. These are the rather peculiar problems of correctly terminating the inputs and outputs when switching the processors in or out of circuit, and the hum pickup problem associated with the flimsy top and bottom covers of the case.

My abbreviated listening tests showed, as is only to be expected with a wide band noise reduction system, that the operation of the noise reduction function is clearly audible.

Postscript

I was telephoned by DBX from the USA to explain the peculiar function of the terminating switch, in that it only terminated the tape replay with a nominal 600Ω and did not terminate the input signal. It was explained that the purpose of the termination was to terminate certain Ampex recorders which do not like to look into high impedances and that the intention was not to provide 600Ω input and output impedances. I am still of the opinion that this arrangement is most complicated, and that even in the case of the recorders which do need a 600Ω termination this system could cause terrible complication if maintenance was attempted on the recorder with the DBX *187* in the bypass mode since the recorder is unterminated in this condition, as it also is if the *187* is switched off.

BURWEN 2000 NOISE ELIMINATOR

By Hugh Ford

MANUFACTURERS' SPECIFICATION:

Typical at 25C with 10 kΩ load unless otherwise specified.

Channels: Prewired for one or two. Each channel is switchable manually or by remote control from record to play. In the record mode the play signal is passed at unity gain. The channels are completely independent except in characteristic *C* when both are in the record mode or in the play mode. Channel cards containing seven modules may be plugged into either channel and operated without modification or adjustment.

Input: 0 VU: +4 dBm normal, internally adjustable from −6 to +9 dBm. Maximum +20 dBm. Impedance: 100 kΩ bridging with 600Ω ±1% termination available via rear panel switch.

Common mode rejection: 85 dB minimum, dc to 1k Hz. 65 dB minimum with 600Ω source unbalanced. 70 dB minimum at 10k Hz. Common mode impedance 2 MΩ each input to ground. Overload input: ±25V dc or rms.

Output: Open circuit: +20 dB, 11V instantaneous peak. 600Ω load: +18 dBm, 9V instantaneous peak. 150Ω load: +16 dBm. 3.4V instantaneous peak. Output impedance: less than 0.5Ω dc to 100 Hz; 10Ω at 20k Hz. Short circuit protection included. Connections: Single ended, common grounded to chassis.

Frequency response: Characteristic *A* ±0.1 dB 20 to 20k Hz. Characteristics *B* and *C* ±0.2 dB. Record-Play: Characteristic *A* ±0.2 dB max 20 to 20k Hz at 0 VU, ±0.3 dB at −60 VU. Characteristic *B* and *C* ±0.4 dB max at 0 VU. Low Frequency Compensation. Adjustable 0 to +15 dB at 16 Hz. Playback tape compensation: Corner frequency and level adjustments 3k to 20k Hz.

Record-playback noise: Characteristic *A*: −94 VU, 20 to 20k Hz. Characteristic *B* −90 VU. Characteristic *C* −89 VU.

Compression characteristic: Accuracy ±0.3 dB from −80 to +16 VU at 400 Hz.

Gain-off mode: Input-record, 0 dB ±0.1 dB at any load from 150Ω to open circuit. Play output 0 dB ±0.1 dB.

Harmonic distortion: Record-play: 0.1% at +18 dBm input and output into 600Ω at 400 Hz. Off mode 0.02%.

Stereo operation: Characteristic *C* only, two or four channels provide the same instantaneous gain, maximum gain remotely adjustable

Peak VU output: Tape record or play signal produces +3.9V dc at 0 VU.

Remote mode switch input: Record mode, two channels: relay contacts to ground or to +2 to +30V. Logic levels, 0 to +1V or +2 to +30V selected by internal switch.

Controls (record, off, play, automatic): Separate for channels One and Two. Characteristic *A, B, C*, two channels ganged. Power on-off.

Power input: 115V or 230V ±10%. 50 to 60 Hz, 25W per two channels.

Dimensions: Single 483 x 45 mm rack panel for one or two channels. Depth behind panel 14in. Panel gold anodised.

Input connectors: Switchcraft *D3F*. Mating connectors required (two per channel) Switchcraft *A3M* or Cannon *XLR3-12C*.

Output connectors: Switchcraft *D3M*. Mating connectors required (two per channel) Switchcraft *A3F* or Cannon *XLR3-11C*.

Price: £3,449.77 for two channels as tested. £27,000 for 16 channels.

Agents: International Instruments Ltd, Cross Lances Road, Hounslow, Middlesex.

THERE ARE currently three serious contenders in the studio noise reduction business. These comprise, both in order of claimed noise reduction and of cost, Burwen, DBX and Dolby, the latter being the cheapest. Dolby use the frequency band masking effect to 'hide' noise, while both Burwen and DBX use elaborate versions of tried compression and expansion techniques. DBX use a square law curve for compression and expansion (such that 2 dB change in input level produces a 1 dB change in the processed (recorded) signal) and claim a 30 dB noise reduction. Burwen use a cubic compression/expansion curve such that a 3 dB change in input produces a 1 dB change in processed (recorded) signal with a resulting claimed noise reduction of up to 50 dB associated with a claimed dynamic range of 110 dB from tape at 38 cm/s.

Just a glance at the specification shows that very considerable thought has gone into the Burwen system and inspection of the unit itself immediately gives the impression of a very high standard of engineering. Two channels, which can be independently switched to record or replay, are mounted in a 44 mm high 483 mm rack mounting chassis, it being possible to mount units directly on top of each other so that a 24 channel configuration only occupies just over half a metre of rack height.

The front panel is decidedly uncluttered, housing the power on/off switch, mains pilot lamp, characteristic switch, and tape equaliser switch, all of which are common to the two channels. There are two individual channel controls which are rotary switches providing

50 ▶

the functions record, off, play and automatic, the record or play functions being indicated by a yellow and a green pilot light for each channel.

At the rear of the unit there are the usual mains connector, fuse and voltage selector switch for either 115V or 230V operation. The remainder of the rear panel is occupied by the input/output connectors which comprise female *XLR* connectors for the input and tape play connection, male *XLR* connectors for the output and tape record connection, a five-pin *XLR* for remote facilities, and a single BNC socket for remote control of record/replay for both channels. The internal construction is entirely modular with virtually all components plugging into the main frame, including the mains transformer and stabilised power supply. Each channel's components are mounted on a high-quality printed board, which itself houses various clearly identified function modules.

The design of the chassis is such that the printed boards plug in from one side of the unit which incorporates a removable cover, so access to the preset controls for equalisation and adjustment of input and output levels (which are mounted on the end of the printed boards) can be gained by simply removing the end cover. Similarly, access to test switches on the end of the printed boards is also easy. While the number of variable potentiometers amounts to nine on each channel, these are all multiturn potentiometers and all but four are essential for adjustment of equalisation and levels.

While the overall standard of construction is really excellent, I was a little concerned about the mechanical clearance between the mains connections on the voltage selector and input socket and the ends of the smoothing capacitors. Untidy soldering in this department could easily cause shorts between mains and the chassis, in spite of the capacitors having an insulated sleeve.

Fig. 1 shows a block diagram of the Burwen system from which it is to be seen that, before any attempt is made to compress the input, it is subject to pre-emphasis. The degree of pre-emphasis is controlled by the front panel equaliser switch which has three positions. Characteristic *A* is designed for tape recording at 38 cm/s and provides a treble boost of 13 dB at 20k Hz as well as a 5.4 dB boost at 20 Hz. Characteristic *B* has a similar bass boost but a 4 dB treble boost at 20k Hz, while characteristic *C* has identical parameters to characteristic *B* but also gangs the gain control of the two halves of the unit for use in the stereo mode. Both characteristics *B* and *C* are designed for use at lower tape speeds, in fm broadcasting etc. At first sight the idea of treble boost strikes one with horror but in fact the effect of treble boost is the reverse to that which one would expect because the system's amount of compression is controlled by the high frequency content of the input signal. Further inspection of the block diagram shows that the pre-emphasised signal is passed through the gain controller to a high frequency limiter, the output of which is used to feed the gain control. The output of the high frequency limiter also feeds the tape recorder with a signal of intentionally reduced high frequency content in order to avoid tape saturation at short wavelengths.

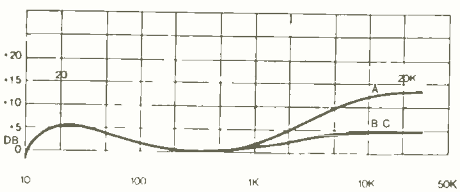
On the replay side of the chain, the reverse process takes place, using virtually identical circuitry.

In addition to this basic noise reduction circuitry, there are a number of refinements which may be switched into operation. Firstly, Burwen point out that tape recorders normally exhibit a rather poor response at very low frequencies from about 30 Hz down. The defect may be corrected in the record chain of the unit by means of an internal multiturn potentiometer which provides variable boost below 100 Hz. Two further potentiometers on each board become operational with the front panel tape equaliser switch and provide a top cut facility in the replay mode with adjustable turnover point and slope. The purpose of this facility is to compensate for the inability to align recorders for the forthcoming high resolution tapes which will require higher bias and more equalisation than is available in many recorders.

Finally, the auxiliary socket on the rear panel provides for external gain limiting and also for the ganging of gains. Most important, it also provides for a 'peak VU meter' output. This

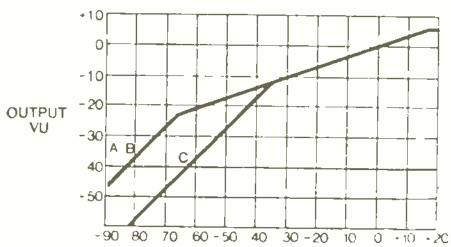
52 ▶

Fig. 3



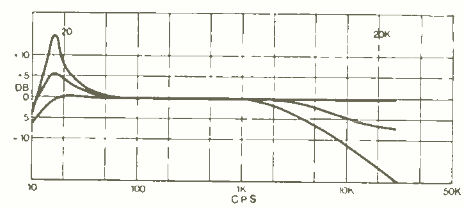
CPS
RECORD PREEMPHASIS

Fig. 2



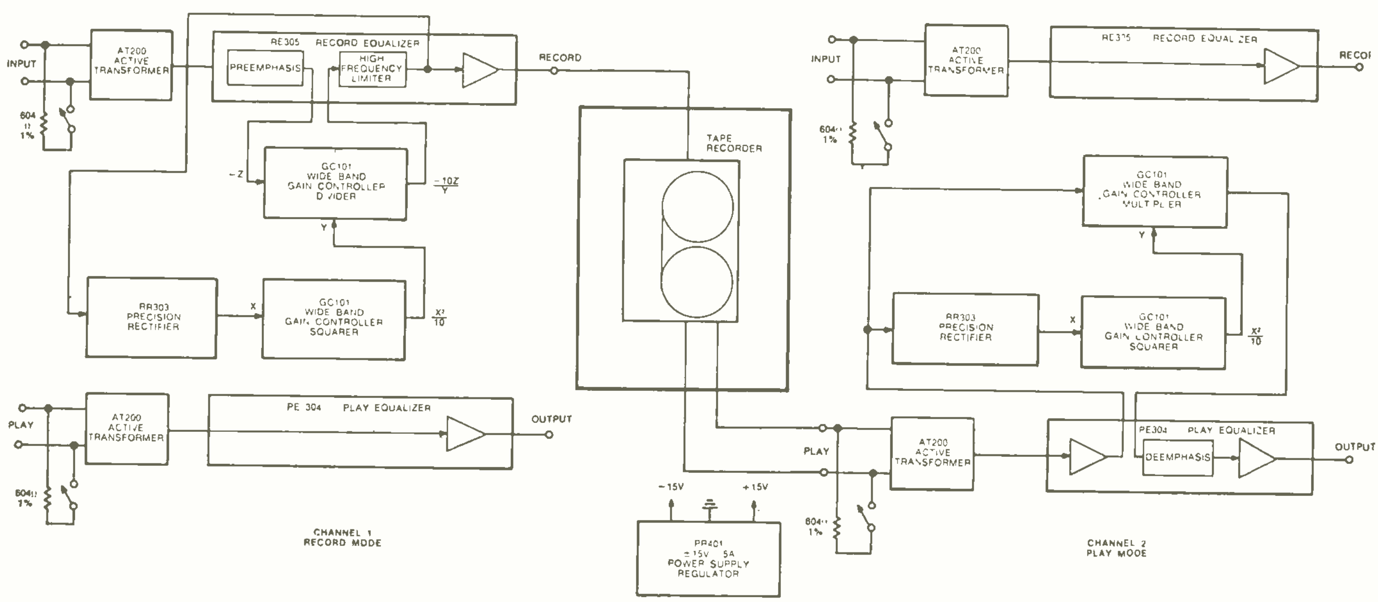
INPUT VU AT 400 CPS
RECORD COMPRESSION

Fig. 4

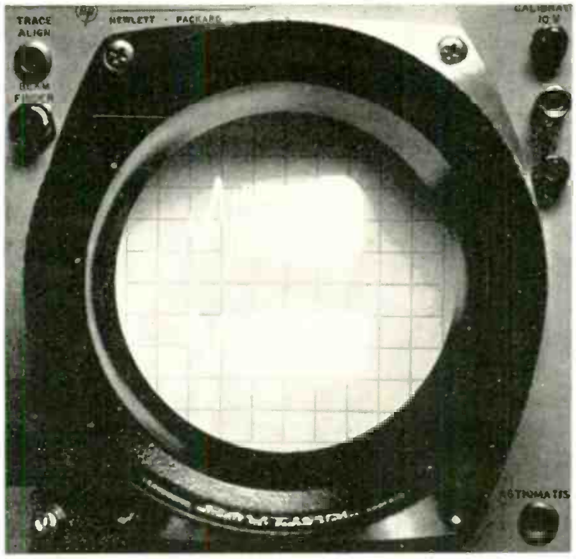


CPS
COMPENSATION FOR RECORDER AND HIGH RESOLUTION TAPES

Fig. 1



What would you do if your tape was so good nobody believed you?



You have to see our sound to believe it

That's the situation we found ourselves in, with our Ultra Dynamic formulations. Audio demonstrations weren't enough. People refused to believe their ears. We had to *prove* how good we are. So, we developed a visual demonstration of sound that enables people to see the difference between our UD tape and any other tape they choose. By looking at an oscilloscope screen, they can compare energy output, range, distortion, signal-to-noise ratio and presence of dropouts.

Our first big public screening was in 1971. Since then, we've been touring with our demonstration. And since then, people have started to believe their ears as well as their eyes. If you don't have an opportunity to see one of our demonstrations, try the Maxell Ultra Dynamic tape, and try to believe your ears!

Technicalities

We use a Hewlett Packard dual trace storage oscilloscope and a Hewlett Packard audio sweep generator. The lower trace on the oscilloscope provides a view of the output signal of the sweep generator. The upper trace provides a view of the same signal having been recorded and played back so you can see the performance characteristics of the tape. In the picture above, Maxell Ultra Dynamic tape is shown against the sweep generator trace. The flare at the right indicates extended high frequency response. The uniformity of the trace indicates an extremely accurate overall response.

Maxell Ultra Dynamic Tape

Frequency Response (dB)	
1,000 Hz	+1.0
7,500 Hz	+6.0
12,500 Hz	+8.0
15,000 Hz	+10.0
Output Uniformity (dB)	
7,500 Hz	0.2
Distortion (%)	3.0
Dropout	0
Saturation Level (dB)	+15.0
Signal to Noise Ratio (dB)	63
Erasure (dB)	69

ULTRA DYNAMIC TAPE

UD 35-7 (7" reel) 1800ft.	£3·60
UD 35-7VP (7" reel in vinyl case) 1800ft.	£4·75
UD 35-10 (10½" NAB reel) 3600ft.	£8·25
UD 50-7 (10½" NAB reel) 2500ft.	£7·25
UD 50-10 (½" tape in 10½" NAB reel) 2500ft.	£9·25
UD 50-10 (1" tape in 10½" NAB reel) 2500ft.	£18·35

LOW NOISE TYPE

LNE 35-7 (7" reel) 1800ft.	£3·15
LNE 35-5 (7" reel) 900ft.	£1·75
LNE 25-7 (7" reel) 2400ft.	£3·80
LNE 25-5 (5" reel) 1200ft.	£2·00

ADD 10% V.A.T. TO ALL PRICES

Available from leading Hi-Fi stores or order direct.

maxell®
The answer to all your tape needs

Sole U.K. Distributors
AEL
ACOUSTICO ENTERPRISES LTD

I wish to order ....
I enclose £ .... Cheque/P.O.
Name ....
Address..

Unit 7, Space Waye, North Feltham Trading Estate, Feltham, Middx. Tel: 01-751 0141 (4 lines) is in fact an output related to the peak levels, with a short rise time and slow recovery time and designed for driving VU meters. If you can't persuade them to use ppms, then fiddle the VU meter output. A very good idea too!

Of necessity this is rather a foreshortened description of the Burwen Noise Eliminator, and a full description may be found in the *Journal of the Audio Engineering Society*, Vol 19, No 11, pages 906 through 911.

Inputs and outputs

The signal inputs and the replay inputs are all balanced, the balance being obtained by means of active transformers instead of conventional lumps of iron. The advantage being less hum pickup, less distortion and an excellent common mode rejection. The input impedance may be switched to either a nominal 100 kΩ or a nominal 600Ω, the measured values on one channel being respectively 100.6 kΩ and 598.8Ω. Common mode rejection was measured at 85 dB (100 Hz) and 94 dB (10k Hz) which is really excellent performance but one must bear in mind the increased hazards from pickup of spurious signals with a potential 110 dB dynamic range in hand; with this sort of performance, only microvolts of pickup are embarrassing.

With the input sensitivity set for 0 VU to be equivalent to 0 dBm (which is as the unit was delivered but which may be adjusted over the range −7.5 dBm to −10 dBm) the maximum input signal before clipping was +20 dBm, which gives adequate margin. Unlike the inputs, the record output and the main output are single-ended with a very low internal impedance and capable of delivering +21 dBm into an open circuit or +18.5 dBm into 600Ω at clipping point.

Mains hum in the outputs, with the two sections of the Burwen connected back-to-back (i.e. a solid wire tape recorder between the record and replay sections) and the unit set for 0 dBm to be 0 VU, was extremely low, as follows:

Hum frequency	Hum in output
50 Hz	—109 dBm
100	—115
150	greater than —120 (7μV)

Under similar steady state conditions, the harmonic distortion at 0 dBm (1k Hz) was less than 0.1 per cent with a third harmonic contents less than 0.04 per cent. Perhaps more meaningful, the intermodulation distortion measured by the SMPTE method using characteristic *A* was measured at the following extremely low values:

Input level	Intermodulation
+18 dBm	0.14 per cent
+10 dBm	0.047
0 dBm and below	0.02

With dynamic compressors and expanders, the measurement of frequency response cannot be done by the conventional application of a sinewave signal because the frequency of the input signal intentionally alters the system gain. Burwen recommend that the measurement be done by setting internal test switches for constant gain and this procedure gave a really flat response within ±0.2 dB from input to output under all conditions. However, being of suspicious nature, I do not always trust manufacturers' recommendations for any form of measurements and prefer to use my own techniques. In the case of the Burwen, pink noise was applied to the input and a one-third octave analysis of the output signal was obtained. This proved to be flat within the capabilities of the measuring equipment, which is ±0.5 dB from 20 to 20k Hz.

Burwen's pre-emphasis curves were also investigated with pink noise, and again found to be exactly to specification within the limits of the testgear.

The final 'steady state' measurement was directed towards the noise content of the output with the input terminated in 600Ω and the two sections of the unit connected back to back with a 'wired' tape recorder, and also with a play section only. Burwen's specification quotes noise over a 20 to 20k Hz band, with my nearest compatible figure being between 3 dB points at 22.5 and 22.5k Hz with an attenuation of 20 dB/octave. As will be seen from **Table 1** our worst disagreement is only 1.2 dB and anyway the noise figures are very good.

Dynamic performance

It has already been said that the Burwen works on the principle of a cubic curve, where 1 dB change in recorded level is produced by 3 dB change in input level. However, the continuation of this curve down to tape noise level would have the effect of also expanding tape noise. The Burwen reverts to a linear input/output function below certain recorded levels which are set to be about −23 VU on tape in the characteristics *A* and *B* and −12 VU in characteristic *C*. This 'breakpoint' may also be externally controlled.

Checking these characteristics produced curves identical to those specified by Burwen but, much more important, the overall linearity between the input and output was found to be within ±0.1 dB for input/output levels between +10 dBm and −90 dBm.

This is all well and good but applying short tone bursts to the input does show distortion of the first and last cycles of the waveform at the record output. At higher frequencies this distortion appears to be restored on replay but at low frequencies the effect remains as shown in **fig. 5**. It only remains to be seen if such effects are audible. Many claim that they are not, but I strongly suspect that this depends to a large extent upon the monitoring system being used. A further point is that the distortion in the record signal is in the form of a substantial overshoot which might provoke trouble in less well designed tape recorders.

Several attempts were made to measure the time required for the unit to restore its original gain after the application of an impulse but no meaningful results were obtained because of the difficulty of measuring in the order of 100 dB dynamic range at high recording speeds. However, it should be remarked that the rate of gain restoration is high but in some circumstances the process is quite audible.

As may only be expected, the difference in noise level in the presence of a signal as compared with the no-signal noise depends upon the signal-to-noise ratio of the tape recorder in use. **Fig. 6** demonstrates this effect with a

TABLE 1

Output noise (input terminated in 600Ω) dB ref 0 VU

Characteristic	Record/play Wide band	Record/play 22 to 22k Hz	Record/play dB (A)	Play only Wide Band	Play only 22 to 22k	Play only dB (A)
A	84.6 dB	92.8 dB	95.0 dB (A)	88.4 dB	97.4 dB	99.1 dB (A)
B	80.4 dB	89.4 dB	91.6 dB (A)	81.5 dB	92.9 dB	95.0 dB (A)
C	78.6 dB	88.3 dB	90.6 dB (A)	80.5 dB	91.7 dB	93.8 dB (A)
OFF	88.0 dB	98.2 dB	100.8 dB (A)	90.2 dB	101.2 dB	103.5 dB (A)

Fig. 5

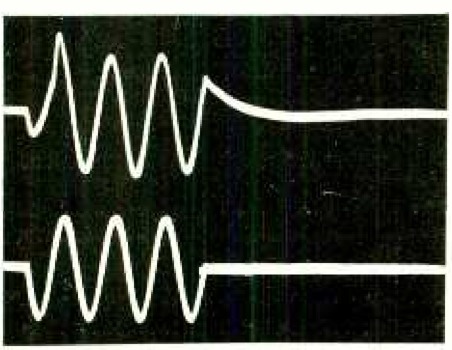


FIG. 6 BURWEN 2000 POTENTIAL 'BREATHING' EFFECT

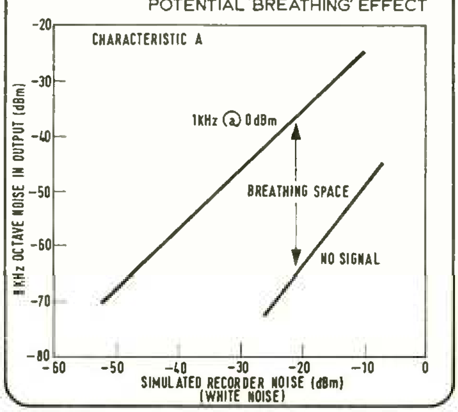
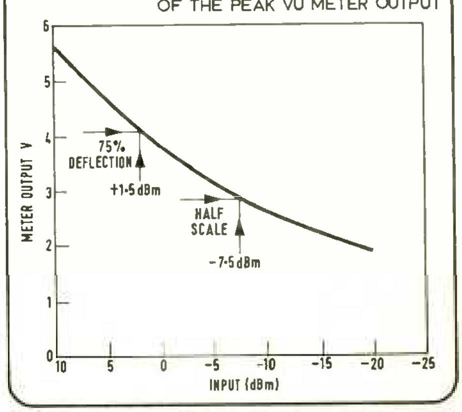


FIG. 7 BURWEN 2000 CHARACTERISTIC CURVE OF THE PEAK VU METER OUTPUT



simulated recorder generating white noise at various levels and shows that the likelihood of 'breathing' being detected increases as the quality of the recorder improves within certain limits.

Auxiliary features

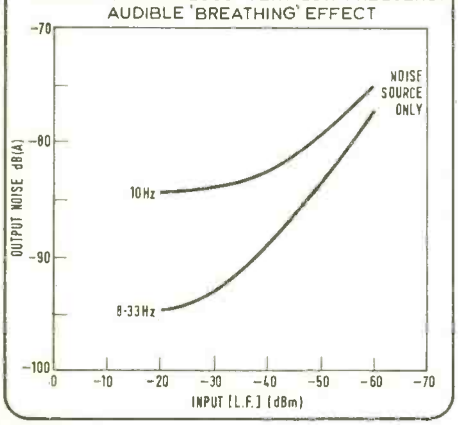
As with all features of the Burwen, the adjustable record pre-emphasis in the bass was precisely to the manufacturer's curve but could be adjusted to provide slightly more boost than is suggested. Maybe it is taking things a bit far to provide equalisation right down to 16 Hz and it could provoke tape recorder distortion in machines where the replay response is responsible for the fall-off in bass response. I therefore suggest that this facility should be approached with some caution; there is no need to use it if you don't want to.

Again, the playback tape compensation controls for use with recorders that cannot equalise for modern tapes exactly followed the manufacturer's specification with a maximum possible treble cut of 11 dB at 10k Hz and with a variable 3 dB point down to 3k Hz. I would have thought it safer if Burwen had also put the bass compensation in the replay chain as it could not give distortion problems in this department; maybe there is a good reason for putting it in the record department.

The profit to be obtained from the new high energy tapes may well be doubtful using 'post recorder' equalisation as I am sure that, in order to get the optimum performance, not only should bias be set for optimum but also there is a case for modifying record and replay equalisation characteristics. Furthermore, recordings made using this non-standard procedure will be incompatible between machines.

The final auxiliary feature is the 'peak' VU meter output which is intended to feed a conventional VU meter via a resistive network, such that it responds rapidly to peaks and holds the reading for a reasonable time. The rise time to 75 per cent deflection was approximately one cycle of 5k Hz sinewave, a further 100 mS being required to make the 90 per cent deflection mark. The reading then held, with a decay time in the order of 600 mS to 10 per cent deflection. On the face of it this is a very useful feature but inspection of **fig. 7**, which shows the relation between input voltage and the dc meter drive voltage, shows a most unsatisfactory state of affairs. Firstly, the difference between 100 per cent deflection and 75 per cent deflection which normally corresponds to 3 dB on a VU meter is found to correspond to some 8.5 dB, which is far too coarse a function to be useful. Secondly, the meter drive is almost an exponential function tending to a dc offset below 50 per cent deflection, the actual offset being 0.31V when characteristics *A* or *B* are selected.

FIG. 8 BURWEN 2000 VERY LOW FREQUENCY AUDIBLE 'BREATHING' EFFECT



Overall impressions

Purely from the viewpoint of written specifications and published curves, it is a rare pleasure to be able virtually exactly to confirm what a manufacturer publishes and an equally rare pleasure to find a published specification which is practical, really meaningful and precise in terminology.

The Burwen *2000* does exactly what is claimed and I can only say that, with the minor exceptions which I have already mentioned, the standard of construction and of overall engineering is superb. In particular it is pleasing to find equipment with sensible input and output levels and impedances. Everyone must know the basic requirements for compatability with the common line configurations, and it is not difficult to meet these requirements, but one meets many damned silly arrangements in both cheap and expensive equipment.

While the operational aspects of the *2000* are the subject of a separate field trial, I naturally could not resist the opportunity to play with the unit under operational conditions. Using a variety of tape recording machines running between 38 and 4.75 cm/s, and high-quality pre-recorded material as a source of sound, in all instances the improvement in tape performance can only be described as dramatic.

Unlike the Dolby system, the alignment of levels is not critical and deviations in a recorder's frequency response do not present any worse problem than they would without the *2000*. However, while I did not notice any dropout problems, it should be noted that such defects will be multiplied in severity. From the point of view of machine and tape noise, really severe and intentional degradation of the recorder's performance to an absurd degree still gave excellent performance with the *2000*.

However, things came somewhat unstuck when tests with a live microphone were initiated. In order to provide a very wide dynamic range, the Burwen was fed from a Bruel & Kjaer 25 mm capacitor microphone which has a potential dynamic range of 131 dB(A).

Immediately the set-up was put into operation, very severe 'breathing' effects were noticed but it was difficult to associate them with any particular sort of live material until the laboratory cat took it into its head to use the microphone stand as a rubbing post! To cut a rather long story short, it was eventually found that the Burwen takes exception to very low frequency inputs below 20 Hz or so. This problem was measured by applying pink noise at −20 dBm to the input together with very low frequency sinewaves. **Fig. 8** shows the relation between the *A* weighted output noise and the lf input level under these conditions, with the low frequency as a parameter. The worst condition corresponded to a low frequency of 8.33 Hz, which at high levels could produce 'breathing' to the extent of 21 dB(A). This snag with the Burwen naturally means that the combination of input equipment must have a frequency response that is very well down below 20 Hz if potential 'breathing' effects are to be eliminated.

In other respects my live testing did not reveal anything obvious in the way of operational snags, and I will leave it to the field trial to do some really serious live testing.

Summary

This is a very expensive device that certainly produces dramatic results and is very well engineered. However, the thought of paying £27,000 to Burwenise a 16 track recorder is rather horrific, though this is the sort of application where it can be really useful. However, a single unit can come into its own for 'cleaning' poor quality lines and links and in this sphere it is likely to be a very much cheaper solution to noise problems than renewing other equipment.

Reverting to performance, it was disappointing to find a low frequency 'breathing' effect and also disappointing to find a rather poor voltage law at the 'peak' VU meter output. While the latter is purely an auxiliary function and need not be used, the former requires precautions in operation and unfortunately shows up at its worst when the *A* characteristic is used with tape at 38 cm/s. In other respects I have nothing but praise for the Noise liminator's performance.

DOLBY 364 CINEMA NOISE REDUCTION UNIT

By Hugh Ford

AT FIRST SIGHT it may appear to be a little out of line with the reviews of other magnetic tape noise reduction systems to include the Dolby *364* cinema noise reduction unit. However, the *364* is electrically identical to the normal Dolby *360* and *361* so far as the noise reduction circuitry is concerned though it does contain additional features peculiar to the cinema and does not include record facilities. Because record facilities are not included, it was of course essential to use a Dolby encoder for evaluating the *364* cinema unit, and a Dolby *360* unit was used for this purpose. It therefore follows that this review applies equally to the two types of unit so far as the Dolby noise reduction system is concerned.

Over the past 40 years, sound reproduction in the home has made dramatic progress from the days when 'Unless the user is content with end-of-the-evening distortion, he would have to reduce the grid bias on the output valve after about three hours working' (*Amateur Wireless*, March 1934) to vhf, stereophonic, solid state, integrated circuit, wide band, 0.1 per cent distortion, 70 dB signal-to-noise reception—waiting to be faithfully recorded on magnetic tape. Similar progress has been

54 ▶

made from 30 line 13k Hz bandwidth television transmission to the current 625 line 6M Hz colour system.

However, in comparison to these fields of progress there has been remarkably little progress in the common sound quality to be found in cinemas where the basic sound system is virtually unchanged since the 1930s. Part of this sad state of affairs was brought about by the standardisation of the 'Academy Curve' in 1938. This frequency response curve was determined by finding the optimum high frequency roll off for a number of cinemas when reproducing normal good quality optical prints. The outcome was a high frequency attenuation of 3 dB at 4k Hz and then rolling off at 12 dB per octave. It does not need much thought to see that the reproducing characteristic makes it quite impossible to produce good sound quality, for any attempt to increase the recorded high frequency level will lead to excessive distortion.

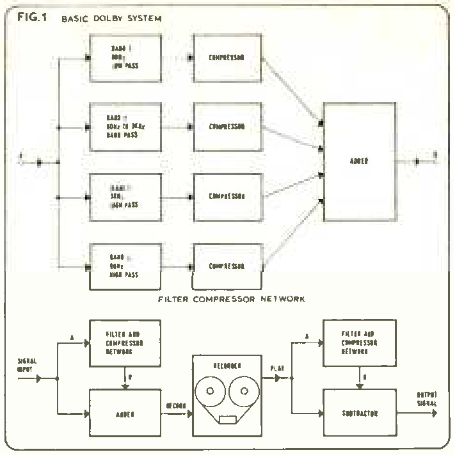
A contributory problem in good quality sound reproduction in cinemas is the large variation in auditorium acoustics; this problem has received little attention until comparatively recently and has been the subject of a number of papers in the *SMPTE Journal*.

The Dolby *E2* cinema equaliser has been designed to provide simple correction for the variation in frequency response of cinemas in the form of a 'house' equaliser which is individually adjusted for a given cinema. The *E2* comprises 27 third octave equalisers as well as overall high and low frequency equalisers, all of which are adjusted by on-site measurement.

While the *E2* overcomes some of the acoustic problems, the *364* noise reduction unit has been designed to attack severe problems in the basic recording and reproducing chain. The *364* comprises a normal Dolby *A* system which can only be operated in the replay mode, as well as a semi-Dolby 'clean-up' function for use with poor quality non-Dolby prints and by necessity the 'Academy Curve' for use with normal prints. As with normal Dolby units, a tone oscillator is included, together with a meter for calibration of Dolby level from film. The desired function is selected by illuminated pushbutton switches on the front panel which are arranged in two groups: the first group to be selected is for either optical or magnetic prints and the second group provides for either 'Dolby film', 'New non-Dolby print' or 'clean-up'. The only remaining front panel controls are the 'Dolby tone' pushbutton and two multiturn potentiometers located behind a removable front panel and providing level adjustment for the input and output levels. Also located behind the front panel is the plug-in noise reduction module which consists of a high quality fibreglass printed board on which are mounted all the basic noise reduction components.

To the rear of the unit are the *XLR* input and output connectors, the mains power supply socket, fuse and voltage selector, and facilities for linking the 'Dolby Tone' oscillators of a number of Noise Reduction Units. There are no other adjustments or controls, therefore operation of the unit once the input and output levels have been pre-set is simplicity itself.

FIG.1 BASIC DOLBY SYSTEM



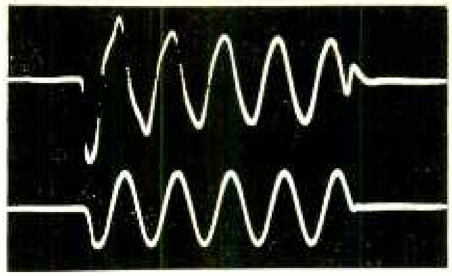


Fig. 5

Dolby Principle

The underlying principle of the Dolby *A* system is the 'masking effect' whereby a single tone reduces the apparent level of noise at nearby frequencies to a greater extent than it reduces the apparent level of noise at other frequencies. Unlike competitive noise reduction devices, the Dolby system splits the audio spectrum into four bands and compresses each band to an extent depending upon its information content. Furthermore, the Dolby system only compresses medium level signals and does not apply any variable gain to either high level or low level signals.

Reference to **fig. 1** shows that identical compressor networks are used in the record and replay modes, the change in function being made by either adding or subtracting the correction signal in relation to the original signal. As is to be seen, the correction signal is derived from the four separate compressors which are driven by filters that divide the audio spectrum into the following bands: below 80 Hz, 80 to 3k Hz, above 3k Hz and above 9k Hz. It follows that, for instance, if a 5k Hz signal is applied to the system, the noise reduction will remain in operation in all but the 'above 3k Hz' band. This has the natural advantage that potential noise 'breathing' effects, or noise 'pumping' will be minimised in comparison with the wide band noise reduction systems such as the Burwen and DBX. Also, as each band can have its optimum time constant of operation, both signal overshoot and noise 'hangover' can be minimised in comparison with wide band systems.

As a direct result of only performing an expansion/compression function over a limited dynamic range, it is of course necessary to define this range in terms of a signal level. This is the purpose of 'Dolby level' which is a reference level available as a standard flux level on magnetic materials, or as a standard depth of modulation on optical film.

Inputs and outputs

Both inputs and outputs are balanced and floating connections with normal *XLR* plug and socket connections. The minimum input signal level for a 'Dolby Level' indication was 336 mV at 1k Hz, the internal multiturn gain control giving a satisfactory level adjustment for signals up to +10 dBm, above which the control became coarse in action. However,

MANUFACTURERS' SPECIFICATION

Operating controls: Illuminated pushbutton controls located on front panel.

Panel meter: Dolby films and magnetic tracks have recorded on them a length of characteristic Dolby tone signal. Proper calibration of a unit is achieved when the tone indicates Dolby level on the front panel meter. To assist in setting levels at other points subsequent to the unit a Dolby tone oscillator is built in.

Signal connections: *XLR* input and output (cable connectors supplied with unit).

Input circuit: Bridging transformer. 10k Ω balanced floating.

Output circuit: Transformer (20Ω output impedance), balanced floating: will drive any load from 200Ω upwards.

Signal levels: Input and output levels adjusted by multi-turn potentiometers accessible from front of unit. Minimum input 350 mV for Dolby level. Maximum output level +22 dBm into 600Ω; +20 dBm into 200Ω.

Overall total harmonic distortion: At +8 dBm, less than 0.1% at 1k Hz; less than 0.2% from 40 to 20k Hz.,

Noise reduction: Dolby *A* characteristics, providing 10 dB of noise reduction from 30 to 5k Hz rising to 15 dB at 15k Hz in 'Dolby film' position; 6 dB rising to 10 dB in 'clean up' position. On 'new print' setting, unit becomes unity gain line amplifier with Academy filter characteristics.

Overall noise level: Playback, 80 dB (unweighted, 30 to 20k Hz bandwidth) below Dolby level.

Stability: System does not require routine alignment.

Operating temperature: Up to 45°C.

Construction: Plug-in noise reduction module accessible through front panel. Glass fibre circuit boards, solid state devices throughout.

Finish: Steel case, grey stoved plastic textured finish; front panel clear anodised with black characters.

Dimensions: 44 x 483 mm rack mounting. Maximum projection behind mounting surface 228 mm. Maximum projection in front of mounting surface 22 mm.

Weight: 5 kg.

Power requirements: Unit is designed for operation from centrally switched power source. Power cable provided. 100 to 130V and 200 to 260V, 50 to 60 Hz single phase, 14 VA.

Price: Type *364*: on application. Type *360*: £210.

Manufacturers: Dolby Laboratories Inc, 346 Clapham Road, London SW9.

such levels are very unlikely to be found in practice. The measured input impedance varied from 18.6 kΩ at maximum sensitivity, down to 15.8 kΩ at minimum sensitivity; it is therefore satisfactorily high for bridging any of the common line impedances, and does not show any significant variation with level setting.

On the output end, the maximum output for a 'Dolby level' recording was +16.7 dBm into a high impedance, and the level could be sensibly adjusted down to –10 dBm which gives a more than adequate range for any normal applications. The measured output impedance at 1,592 Hz was a little over 16Ω and did not exhibit any variation with level setting. The output clipping level was +23 dBm into a high impedance and remained above +20 dBm into loads of 200Ω, giving a very satisfactory margin for normal operating conditions.

Static performance

So far as frequency response is concerned, there are three basic conditions of operation with the *364*; these are the optical old print function, the magnetic old print function, and the Dolby new print function. In the former case, the 'Academy Curve' is of course essential and **fig. 2** shows that the correct curve is maintained without any compression or expansion. However, the frequency response does rise again above 13k Hz which would normally be an undesirable condition. With optical film, there is little noise at high frequencies so this characteristic is not as objectionable as it would appear to be at first sight.

The new magnetic print response is shown in **fig. 3**, which has a similar characteristic to the optical response but with an extension of the high frequency roll-off by about one octave.

In the Dolby new print function, the frequency response was plotted by encoding the signal with a *360* processor and then decoding the signal with the *364* cinema unit with the results shown in **fig. 4**, which shows excellent tracking against level above 100 Hz. Below 100 Hz it will be noticed that there is some mistracking but only to the extent of 2 dB error at 30 Hz. The droop in low frequency response in all operating modes is of course to advantage because of the inherent low frequency claw and sprocket noises in any perforated film system.

In the 'clean-up' mode of operation, the frequency response is not altered from the above but the input signal is expanded by 6 dB over the input signal range 20 to 40 dB below Dolby level. This of course has the effect of reducing the apparent noise by 6 dB but naturally does have some unnatural effect on a good quality soundtrack. However, in the case of poor quality input signals the overall effect is very pleasing.

Turning to the noise performance of the system, the noise in the Dolby *364* output was measured as –74.5 dB (wideband), –82.0 dB (20 to 20k Hz) or –85.5 dB(A) relative to Dolby level. Mains hum components in the output were extremely low, no hum harmonic being above –91 dB relative to Dolby level.

The actual noise reduction performance was measured by applying white noise to the Dolby's input and measuring the noise in the output under the various operating combinations as follows:

FIG. 2
DOLBY 364
FREQUENCY
RESPONSE
NEW OPTICAL
PRINT,
NON-DOLBY

PEN.....200mm/S
PAPER.....3mm/S

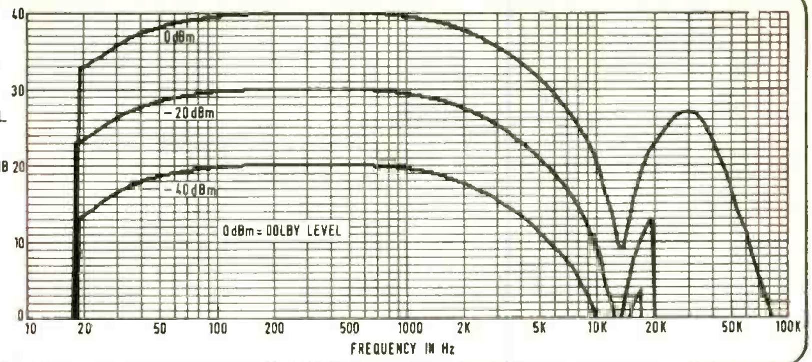


FIG. 3
DOLBY 364
FREQUENCY
RESPONSE
NEW MAGNETIC
PRINT,
NON-DOLBY

PEN.....200mm/S
PAPER.....3mm/S

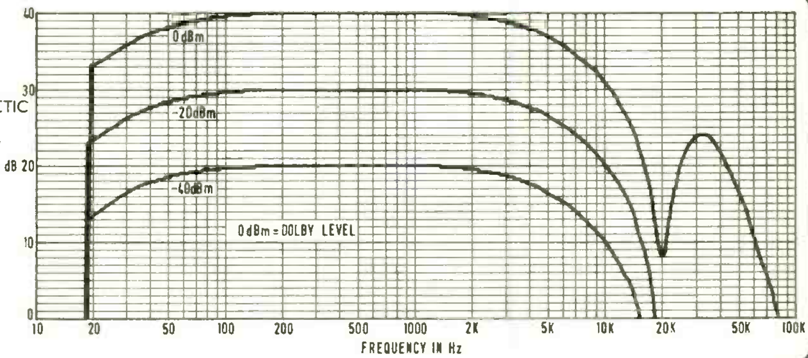
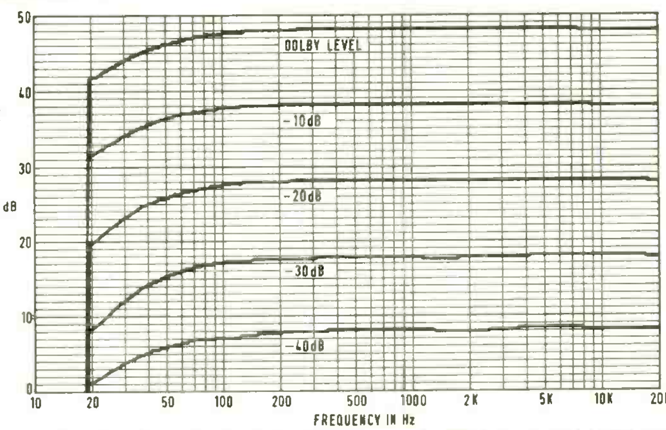


FIG. 4
DOLBY 360/364
FREQUENCY
RESPONSE
FULL CODE/DECODE

PEN.....200mm/S
PAPER.....3mm/S



Function	Noise in output	
	Wideband	Weighted
Optical new print	—57.5 dB	—59.0 dB (A)
Optical clean-up	—63.5 dB	—65.0 dB (A)
Optical Dolby	—61.5 dB	—63.5 dB (A)
Magnetic new print	—55.5 dB	—56.0 dB (A)
Magnetic clean-up	—61.5 dB	—62.0 dB (A)
Magnetic Dolby	—61.5 dB	—63.5 dB (A)

These figures show a clear 6 dB improvement in noise with the clean-up function when compared with the straightforward optical or magnetic new print condition. The noise performance in the Dolby print condition cannot however be directly compared with the other functions because of the vastly improved high frequency response offered. In fact the Dolby print figures can be compared directly with the input noise with good accuracy as the frequency response is virtually flat over the bandwidth under consideration. Considering the actual input noise of –50 dB (–52.5 dB(A)), the full Dolby function gives a noise reduction of 11.5 dB either weighted or unweighted, which is achieved by a noise reduction of 10 dB at the lower frequencies and a reduction increasing to 15 dB in the octave band centred on 16k Hz.

The distortion performance of the Dolby was investigated by again connecting a *360* in the encode function to the *364* cinema unit with both units set for Dolby level to correspond to 0 dBm. The total harmonic distortion

56 ▶

at 1k Hz at +20 dBm output was 0.17 per cent and, at a level of 0 dBm, the total harmonic distortion was 0.07 per cent at 1k Hz, 0.18 per cent at 6.3k Hz, and 0.14 per cent at 63 Hz.

Intermodulation distortion as measured by the SMPTE method was measured in the Dolby mode, and in the Magnetic new print mode with the following results which confirm the satisfactory performance from the aspect of distortion:

	Intermod distortion	
Input level	Dolby	Magnetic new print
+10 dBm	0.27%	0.46%
0 dBm	0.05%	0.065%
—10 dBm	0.08%	0.02%
—20 dBm	0.13%	0.02%

Dynamic performance

Investigation into the performance when tone bursts are applied to the Dolby *360* encoder and *364* decoder was done by connecting the units in series with Dolby level set to 0 dBm. The application of various frequencies for a wide variety of periods showed that appreciable distortion in the overall coded and decoded signal was confined to the first half cycle. Fig. 5 shows the result of applying a 5k Hz burst to the input, as seen at the coded output and after decoding. While the coded signal overshoots by approximately 3 dB, this is confined to the first cycle and is less overshoot than has been observed with other noise reduction systems. After decoding, all other aberrations in the decoded signal have been eliminated and neither the coded nor decoded signals showed any longer term effects which are commonly associated with smoothing time constants.

Further testing with a noise source inserted between the encoder and decoder showed that the restoration of gain was not in any way obvious as noise 'pumping'. Likewise, my usual tests with musical instruments, jangling keys, speech, crashes and bangs had negligible side effects.

Of necessity this review of the Dolby *364* cinema noise reduction system has also performed as a partial review of the Dolby *360* and, for that matter, the Dolby noise reduction system itself. From the point of view of cinema sound, I have no doubt whatsoever that the *364* offers a very substantial improvement on the antiquated systems which are universally in use. While the optimum improvement is of course obtained with Dolby encoded prints, the clean-up function is well worthwhile in its own right.

The general standard of engineering is high with sensible input and output configurations and simple installation and operation. A really excellent operation and maintenance manual is provided and the Dolby units are supplied complete with all necessary plugs, sockets and spare indicator lamps.

As for the Dolby noise reduction system itself, it is the only system that I have investigated which does not have unpleasant side effects. While it does not offer as much noise reduction as its competitors, it does not suffer from the inherent limitations of wide band systems.

FIELD TRIALS

DBX 187

By Angus McKenzie

MANUFACTURERS' SPECIFICATION

See page 46

BEFORE DETAILING the various tests made on the DBX *187* noise reduction system, and comparing it with the Dolby *A* system in operation, I will begin by discussing the basic reasons for using a noise reduction system at all.

From the earliest days of sound recording, audio engineers have had to reduce the dynamic range of the programme by using a number of different methods over the years. At first, with acoustic recording, it was necessary to re-orchestrate much music, allowing the musicians themselves to restrict the dynamic range when they were playing around the recording horn.

After the introduction of electrical recording, in the mid-1920s, engineers used gain controls to restrict the range recorded on to the wax discs then used. Broadcasting engineers also had the same problem and they compressed their complete programmes, allowing them to be heard by listeners receiving a very weak signal. In an effort to achieve a greater clarity on a medium which had a restricted signal-to-noise ratio, engineers began in the 1930s to mix the outputs of more and more microphones to obtain the required sound.

The public began to accept the reduced dynamic range as being both normal and correct. Probably a general awareness of the possibilities of an improved dynamic range did not become prevalent until the expansion of vhf fm radio and the establishment of microgroove gramophone records. Even today, in an orchestral concert relayed from the Royal Albert Hall, for example, the BBC will raise the level of quiet passages by up to 16 dB. This allows listeners to medium wave AM stations in poor reception areas, or in cars, to receive the entire programme without losing the quiet sections in noise of one form or another. Vhf listeners also will not be so aware of any deficiencies in their own receiving equipment if the programme they are listening to is always kept well above the basic noise level of their system.

Domestic audio equipment has now reached such a high standard of reproduction that the public are beginning to demand more realistic reproduction for certain types of programme. Part of this realism is the transmission, either by radio or by a record, of a dynamic range as wide as that of the original performance. In order to attempt to record such a wide dynamic range in the past, engineers had to peak very high recording levels, thus achieving a good signal-to-noise ratio, but at the expense of up to five per cent or more distortion on music. This high tape distortion results particularly when original master tapes made in one country have to be copied at a high level for another. A reduced recording level will quickly reduce distortion and considerably clean up the general sound quality heard, but on most material an objectionable tape hiss will become apparent, particularly when the programme is copied. It is easy to see then that, when a noise reduction system is available, an engineer will be more inclined to record at a lower level and also often record a wider dynamic range. Many engineers admit that their balance techniques have been changed with the introduction of noise reduction systems. The serious use of eight, 16 and even 24 track tape machines has in the past only been realised for most studios by the inclusion of a noise reduction system.

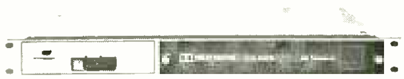
By far the most widely acknowledged system is Dolby *A*, which has been in use internationally by most record companies and recording organisations for some years. This system gives approximately 12 dB improvement in signal-to-noise ratio. Since a good 6.25 mm stereo tape recorder will give an overall signal-to-noise ratio of 64 dB or so using an average studio tape for two per cent distortion, the improvement using Dolby for the same rated peak distortion will be to 76 dB. To reduce the distortion therefore to a value which in practice becomes almost inaudible in instant peaks of musical programme, it is necessary to reduce the peak recording level by about 4 dB, thus giving only a 72 dB signal-to-noise ratio on tape. This latter figure can in any case only be achieved when the recording equipment is in good working order and the tape being used does not have an inherently noisy background. This signal-to-noise ratio of 72 dB is easily good enough for recording most music programmes but of course deteriorates by 3 dB when a copy tape is made which is also noise reduced. A fourth generation tape will have twice the noise power of a second generation and will thus be degraded to approximately 66 dB. A fourth generation tape frequently results from a foreign copy master being copied to make intermediate masters for tape duplication and copying.

Readers will see therefore that noise reduction for mastering is, by today's standards, essential. It becomes even more essential for multitrack recording where the outputs of many tracks have to be mixed together at different levels with various types of equalisation and limiting added to give a reduction that itself has a very low inherent noise level. When a multitrack recording is made, it is often

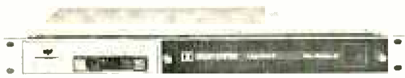
58 ▶

There is a Dolby noise reduction unit for every professional application

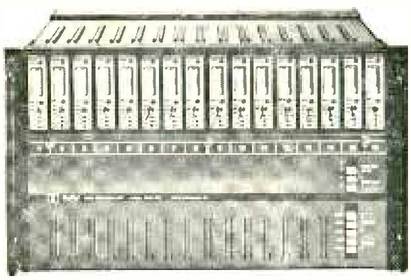
Professional Recording and Transmission Applications



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

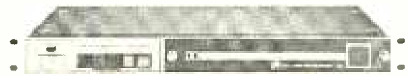


361
The Dolby 361 is similar to the 360, providing a single channel of A-type noise reduction, but with relay switching of operating mode and tape recorder connections. The changeover can be controlled automatically by the recorder.



M-Series
The Dolby M16 A-type unit is designed specifically for professional multi-track recording, and incorporates 16 channels of noise reduction in a compact chassis only 10½ inches high. The similar M8 is an 8-track version, and the M8X allows simple extension of the M16 for 24-track use.

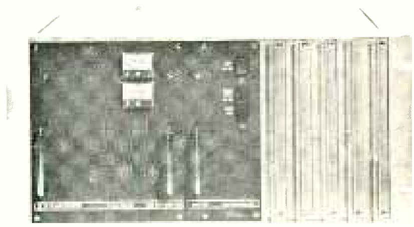
Motion Picture Industry



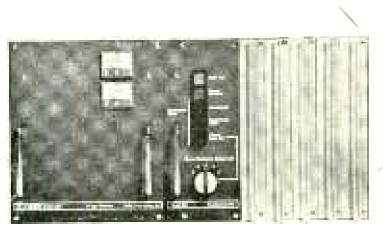
364
The Dolby 364 Cinema Noise Reduction Unit is intended primarily for use with Dolby A-type encoded optical sound-tracks. The 364 also includes a standard 'Academy' filter for conventional tracks, a clean-up circuit for old or worn prints, and provision for playback of magnetic sound-tracks with or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

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

Professional Encoders for Consumer Media



320
The Dolby 320 Duplication Processor is a professional quality unit with B-type (consumer) noise reduction characteristics. The unit is used for encoding duplication master tapes in the high-speed duplication of Dolbyized cassettes, cartridges, and open-reel tapes. The 320 is a two-channel unit.

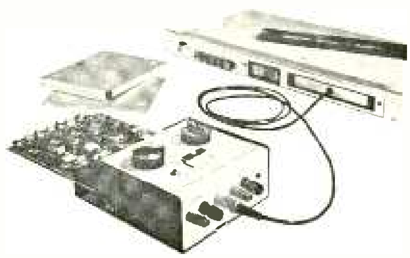


324
The 324 Broadcast Encoder allows broadcast stations to encode stereo FM broadcasts with the Dolby B-type characteristic. The unit provides for an optional reduction of high frequency pre-emphasis, reducing the need for high frequency compression, and thus allowing a significant additional improvement of reception quality.

Noise Reduction Module

Cat 22
The Dolby noise reduction module, Cat 22, is the basic functional unit employed in all A-type equipment. The Cat 22 is available as a spare or in quantity to OEM users for factory installation. A half-speed version of the module (Cat 40) is also available.

Test Set (A-type)



Cat 35
The Dolby NRM Test Set, Cat 35, permits rapid verification of performance of Cat 22 Noise Reduction Modules without their removal or the need for additional test equipment.

For detailed information contact
Dolby Laboratories Inc
1133 Avenue of the Americas
New York NY 10036
Telephone (212) 489-6652
Telex 125797

346 Clapham Road
London SW9
Telephone 01-720 1111
Telex 919109

Dolby™

necessary for the engineer quickly to establish a peak level on each track given by the musicians so that he will not continually have to monitor the levels on these tracks.

Since over-recording on any track necessitates a retake which can irritate musicians, or even ruin an otherwise excellent take, some engineers are inclined to record many tracks at a lower level, thus avoiding any possibility of over modulation. In such circumstances, ideally more than 12 dB of noise reduction would become extremely useful. It is impossible, however, to obtain more than the Dolby's 12 dB of noise reduction without various side effects becoming noticeable. It is hoped that this field trial will be a guide to the compromises than an engineer would have to make if he chooses the DBX system.

Theoretically, the DBX system can give as much noise reduction as an engineer would ever want but unfortunately the human ear is such an incredibly fine transducer that faults in noise reduction systems, especially dynamic ones, can sometimes be easily noticed. Many a system, both in the past and being designed today, has excellent static performance measurements but nearly all fall down when tested in dynamic field trials. To obtain a quick idea of the efficiency of the DBX system, I decided to record a mono DBX processed signal on to one track of a four track tape machine, with the output of track One connected to track Two, the output of track Two to track Three, and the output of track Three to track Four. The output of track Four fed a DBX replay section, and thence back to my mixer, with a tape recording at 38 cm/s. Quite frankly, the fourth generation recording of the original sound replayed from track Four was totally unacceptable, severe pumping of high frequencies being audible with a continual hiss modulation, and also an extremely unpleasant varying bass resonance which seemed to exaggerate very considerably the original dynamics. It did not take long to realise that this was produced by the signal passing four different channels of the same replay head in succession, thus accentuating any bass woodles produced by the wrapround characteristic of the replay gap. The bass boost in fact appeared at approximately 125 Hz and even without the DBX was fairly easily noticeable, although just acceptable and controllable.

Just tolerable

The DBX processed signal taken on track Two and deprocessed, therefore adding second generation, was only just tolerable. This in itself makes the use of the DBX on multitrack recordings slightly doubtful if rerecording from one channel to another (especially if mixing in other tracks) is required. Since more rerecording in the DBX state seemed to have proved unreliable, all the remaining tests were made by recording a single generation and studying the performance of the playback in various situations.

Speech recordings made in an anechoic chamber using recording equipment of impeccable quality, and also using a very fine quality recording tape, were rerecorded on to a Philips *Pro 36* using the DBX system for track Two and the Dolby *A* system for track One. The tape machine was very carefully aligned. In the replay channels, but before deprocessing with the appropriate equipment, a high quality mixer was inserted allowing various signals including pink noise to be injected at the same time as the processed tape was replayed. The mixed programme was then deprocessed in the normal way, and the results from both types of noise reduction system compared with the original.

Any anechoic recording will show up very easily slight faults in a recording or reproduction system and even the Dolby system produced a replay sound which was just detectably different from the original. The DBX sound was at this stage only very marginally inferior, it being difficult to detect any differences. It was felt that a typical noise characteristic produced by 38 cm/s tape replayed through a modern transistor replay amplifier was fairly similar to that produced by pink noise, and such noise was therefore mixed in in varying degrees with the replay signals before deprocessing. The noise introduced, which was equivalent to third generation tape noise, produced only the slightest modulation noise in the mid frequency band of the Dolby recording but caused audible pumping of all frequencies in the DBX recording. A further increase of noise produced clearly audible pumping in the Dolby as well as the DBX. It was debatable as to which was more annoying subjectively since, although in terms of dB the Dolby pumped less, the restricted frequency range of the pumping seemed to make it more obvious. However, when an ordinary speech recording was made from an ordinary studio source the pumping was not so obvious since some of the side effect was masked by slight natural reverberation. I considered this test of great interest since for the first time it actually showed up fairly easily even Dolby noise reduction.

Speech and pink noise

I next decided to apply the metronome, speech and pink noise recording test, which failed so unfortunately with the Burwen. The dynamic levels of the different programmes were reproduced subjectively perfectly by the Dolby without any noticeable transient problem on the metronome. Although the DBX reproduced the general dynamics correctly with no audible pumping in the normal sense, a curious phenomenon occurred, which was noticed at all attempted recording levels. The initial transient on each metronome tick appeared to be clipped, and each tick was then followed by what I can only describe as a minute audible dropout. If this effect can be produced by a metronome, then surely transients produced in an orchestra could also well be affected and might cause trouble at a later stage in the recording process.

Bearing in mind Hugh Ford's comments about dynamic treble boost being given on record and cut on replay, with the DBX sensing an rms value of the input waveform, I listened carefully to the subjective background noise reproduced behind various frequencies recorded on DBX processed tape. A curious phenomenon seemed to arise which initially caused considerable confusion, until the DBX was switched out of circuit. This phenomenon was the apparent increase of modulation noise when the process was in use, giving noise degradation rather than noise reduction. A low frequency mush became audible when a 10k Hz high level tone was recorded, which almost completely disappeared when the DBX system was turned off. This effect also came through clearly on a recording of vocal music which will be referred to later. At lower levels, and when low frequencies were recorded, it was not at all easy to hear hiss in the presence of signal, which had been predicted by some engineers who disfavour any noise reduction system. An inherent degradation of tape noise therefore by either adding pink noise or reducing the tape speed to 95 cm/s did show up this system fault, which incidentally was only barely detectable on the Dolby system.

Change of tape sensitivity

The effect of a change of recording tape sensitivity was then checked by making two recordings of a section of Mahler's *Tenth Symphony*, the second 2 dB higher than the first, and in the DBX processed state. The tapes were edited in the same place as those also used for the Burwen field trial. The edit was fairly easily noticeable but the volume after the edit did not become uncontrollable although it was noticeably louder in general than before the edit. In practice such a level change produced by variable sensitivity of the tape would probably be unacceptable and any attempt to correct the edit by redubbing in the DBX state might exaggerate any pumping effects. This difficulty of editing will obviously put off many engineers who might otherwise consider the DBX system but, if a very consistent tape is used in the studio and there is daily checking of the recording equipment, it might be possible to reduce the error considerably, particularly if each clean tape is quickly checked for sensitivity before a recording session starts. Alternatively, perhaps an automatic record level control could be designed which would set the record level when the machine started recording on each new reel. However, this would be very expensive to install.

An equaliser was inserted in the replay chain from the tape recorder, once again before deprocessing. Errors in equalisation were then simulated. It was quite obvious that any error in equalisation would be in effect doubled after the deprocessed output, and this error occurred at all dynamic levels as opposed to Dolby equalisation error in only a small section of dynamic range. A badly equalised replay amplifier would therefore cause more obvious ill effects with the DBX than with the Dolby. The gain error in replay, however, becomes less noticeable with the DBX than with the Dolby, particularly when the error is fairly considerable, such as 6 dB. A replay error of 6 dB was introduced in both the Dolby and DBX recordings by boosting the level in the replay chain. No detectable difference in the DBX deprocessed signal was audible, but the Dolby recording sounded unusually bright and quite definitely wrong in the relationships between different groups of frequencies at intermediate dynamic levels. A 2 dB error with the Dolby was not, however, audible.

To check a typical equalisation and an incorrect recorder adjustment situation, organ music was rerecorded on to my Philips *Pro 36*, using the DBX system, the recorder having been lined up at 95 cm/s for BASF *LP35LH* tape. The DBX recording was made without touching any presets but on standard play BASF *LGR30* tape. Although the reproduction was audibly muffled, surprisingly little pumping was audible, and certainly no tape noise was heard at all. The DBX system seemed in general to perform quite well at lower tape speeds, particularly when the input programme did not have too wide a dynamic range. With a wide dynamic range recording, however, a slight hiss introduced on peaks of modulation as compared with the complete silence with no modulation became noticeable.

Demonstration disc

An experimental pressing was supplied by the DBX agents to demonstrate the basic system as a replay medium for gramophone records. The record was cut at an appreciably lower level than normal, and therefore had rather lower than usual distortion. The signal-to-noise ratio was staggering and no rumble was audible. Although I could not immediately detect any obvious pumping effects, the entire reproduced sound sounded larger than life, and unlike any recorded sound I have heard before, the programme being classical wind band music recorded in the USA. As with the Burwen, but to a significantly lower degree, I noticed reverberation dropping out a little but this was not too serious.

In view of all the above facts, I felt it would be fair to the equipment to try it on a live recording, and for this purpose I arranged for the main stereo Dolby output of my control desk to feed two tracks of a quadraphonic tape machine, while the stereo non-Dolby outputs of the desk fed the DBX system and then the other two tracks of the recorder. It thus became possible to a/b test in stereo a Dolby recording against a DBX one. A tape having a very good signal-to-noise ratio was used and a peak recording level of approximately 1.5 per cent distortion adopted. On replay, only the most minute hiss was audible on the Dolby stereo tracks, whereas on the DBX tracks no hiss at all could be heard. After approximately a minute of listening without knowing which tracks I was listening to, since my colleague carried out the switching, I firmly picked out which recording was which. On the DBX very slight hiss modulation was audible on peaks of solo vocal. Bass pumping effects were also noticeable since the orchestral double bass had been fairly close miked. The accentuated bass woodle effect produced by the DBX almost certainly was the cause of this bass pumping but this effect is likely to be present on almost any tape machine. After some while a large chorus entered, singing very quietly, and here hiss pumping was immediately noticeable on the DBX recording. I found it a little disturbing, but not extremely bad, and can say that although I definitely preferred the Dolby recording I would have preferred the DBX recording to no noise reduction at all.

Better than no noise reduction

My feeling that a DBX noise reduced tape is better than having no noise reduction is quite definite, although I must emphasise that I would myself only consider the DBX for original mastering. For multitrack work it offers considerable advantages over Dolby, the main one being the great range of mismatch of input peak recording level that could be applied to each channel without either going into noise or distortion problems. This can lead to much slicker setting up of recording equipment on a recording session where the musicians have only a limited amount of time or the music producer wants to keep down the time taken to do the initial recording. A mix-down of a 16 track tape can then be accomplished at a later stage, adding any equalisation necessary without fear of too much tape noise presenting serious problems.

Great care should be taken if the original DBX processed master has to be played back at another studio. It should be noted that any 16 track copies in the DBX processed state might well give problems for reasons already outlined. I cannot recommend any editing of DBX coded tapes and for all these reasons suggest that stereo or quadraphonic reductions of DBX masters should be Dolby *A* rather than DBX processed, since the Dolby system is both more universally accepted and in any case safer for making copies for other companies or studios.

Many advantages

Since with pop recording it is not really essential for the line out on reduction to be identical to the line input on the session, the use of the DBX system can be said to have many advantages. The cost of a quadraphonic system suitable for record *or* replay, or alternatively two modules for stereo record *and* replay, is marginally cheaper than the equivalent Dolby. The levels are not so critical and in any case the DBX units can be set up for unity gain quickly by easily-adjustable presets on the equipment. A 16 track installation is in effect considerably cheaper than the Dolby for it contains both two spare channels allowing immediate replacement of any faulty channel, and also the facility of processing and de-processing all 16 channels for approximately the same price that Dolby charge for unidirectional switchable processing. The model under trial had a very flimsy case and internal damage could result if any even moderately heavy equipment was placed on top. All the inputs and outputs were easily accessible, and all functions are remotely controllable. An interesting facility is the completely automatic drop out of the system if the mains fails, all inputs being immediately connected straight through to the relevant output.

No problems occurred with the equipment in operation since all my equipment has a lower source impedance and high bridging impedances. The system seemed to be well engineered and what is extremely important is that the agents have been most helpful in providing information and back-up services.

A final summing up. I must still recommend the Dolby *A* system as being better for classical music and music where the output taped programme must be as close as possible to the original. For multitrack work, with properly set-up tape machines and careful alignment of peak levels on all tracks. The use of the Dolby system is, I consider, still superior to the use of the DBX. However, under some conditions of high-pressure operation particularly when used internally in one organisation, the DBX can be recommended with caution, although only for multitrack recording or when no editing is required.

BURWEN 2000 NOISE ELIMINATOR

By Angus McKenzie

MANUFACTURERS' SPECIFICATION

See page 49

BOTH THE American manufacturers and the English agents for the Burwen *2000* noise eliminator have for some while been making quite incredible claims about its performance. The price of a straight stereo record/replay module is frankly astronomical compared with that asked for alternative types of noise reduction. However, if there were no snags in operation, and the equipment came up to full specification without any audible side effects, many engineers would be prepared to consider the system. To be fair to the Burwen, however, I decided to ignore the price and let the system stand or fall on its merits.

The chief claim is a somewhat staggering figure of 110 dB available signal-to-noise ratio. The availability of such a wide dynamic range could be extremely useful. It could virtually eliminate tape hiss and hum problems, and vastly improve landlines or other transfer media which would otherwise be very poor, or almost useless, for music.

I first played back a demonstration tape made by Burwen and loaned to me with the equipment. I am prepared to admit that no tape noise was audible at all and, on turning up the monitor gain almost flat out without any sign of noise, I was almost blown out of the room when my studio loudspeaker amplifier nearly blew its fuses at a loud drum beat. Having established sensible listening levels with some speech on the tape, I began to feel insecure, noticing a pumping effect in the speech combined with a suspicion of modulation noise appearing on transients. Later on the tape I was interested to hear a church organ in which the reverberation was almost non-existent. Somewhat puzzled by this, I decided to try to use the Burwen for a recording of the Royal Albert Hall organ made at a public recital last September.

I recorded the event in quadraphonic and stereo sound using the Dolby, and also in stereo using the Burwen. I am sure that the Burwen system was aligned in accordance with manufacturers' instructions and I decided to record the output from the microphones virtually flat in response over the entire audio range without any equalisation before going through the Burwen. In effect this meant that a certain amount of low frequency rumble would be going through the system unattenuated, as this was felt to be typical of the way in which many good engineers make their recordings. When the tapes were played back, the sound quality was generally excellent but I constantly had the feeling that the sound was larger than life, although I could not initially find the problem. It was at the end of a passage involving a break in the music of nearly 3s that I realised that the problem was connected with the incorrect reconstitution of the original dynamics. The reverberation appeared to die away much too quickly as compared with both the Dolby recording and my memory of the performance heard live.

60 ▶

■ BURWEN 2000 FIELD TRIAL

On playing a later quiet section from the same piece of music I had the suspicion that the volume of the quietest passages was being expanded downwards by many dB. At the end of a particularly quiet passage, a member of the audience coughed and this brought up considerable tape noise which was very noticeable for half a second or so. Since in static tests the Burwen seemed to reconstitute levels correctly I decided that the best way to measure this dynamic effect was to use a peak programme meter on playback, but fed with a calibrated gain amplifier having variable gain in 10 dB steps. On the Dolby recording, the quietest passage peaked 40 dB below the peak level of the loudest passage. The Burwen recording peaked some 12 dB lower than this. In any case music levels on this occasion peaking less than −30 dB seemed to be reconstituted by the Burwen between 8 and 12 dB too low. For me, this unfortunately ruled out the use of the Burwen system for serious music recording.

The manufacturers claim that it is necessary to record very low frequencies in order to give the correct information to the replay processor. They supply presets which alter the bass response on record in order to get a linear bass response. Herein lies one of the fallacies, since usually the recorded response of a machine is actually flatter in the bass than the replay response and therefore no bass correction should be made on record. In any case, at its price, the Burwen should have some kind of an automatic low frequency sweep button which could record the usual sweep on tape at the beginning of a reel and could then on replay automatically activate a bass correction system. I have no accurate means of estimating the playback response of my Philips *Pro 36* below 31 Hz at 38 cm/s but I would imagine that the response would fall off fairly sharply. It seems therefore totally impracticable for anyone to attempt to flatten the response externally to accommodate a noise reduction system, even if this could correct the accentuation of dynamic range.

I next attempted a rather brutal recording: a combination of an electronic metronome beating at a slow rate with pink noise, overlaid with my own speech. Once again the set-up was adjusted very carefully, particularly the in and out levels. While the metronome and pink noise on their own sounded fairly satisfactory, the addition of speech caused rather obvious pumping of the pink noise signal. It must again be assumed that the true dynamics of the input were not being reconstituted after recording.

3:1 compressor

Since the Burwen system is in effect a 3:1 compressor, any level mismatch between tapes of n dB due to the differences of tape sensitivities between one reel and another will be amplified to a difference of $3n$ dB after replay. A section of a live recording of Mahler's *Tenth Symphony* which one of my colleagues made recently was copied twice on to a non-Dolby tape, on to a Dolby tape, and on to a Burwen processed tape. The second copy in each case was made with the tape recorder's level set 2 dB higher than nominal. An edit was carefully made at an appropriate passage and I then listened to the resulting tapes. The edit was undetectable in the non-Dolby tape and only barely detectable in the Dolby one, the latter only because I knew where it had been made. In the Burwen processed recording, however, not only was the edit noticeable but the dynamics became completely uncontrollable after the edit, the peak level becoming some 6 dB higher than that before the edit. A master tape prepared in this way could therefore become uncontrollable and impossible to copy, possibly even damaging the cutter head if an engineer was caught unawares. Remember that a tape sensitivity difference of 2 dB will result if one reel in a batch is 1 dB more sensitive than average, while another is 1 dB less sensitive. This last test therefore is perfectly valid, and unfortunately rules out the use of the Burwen system completely for any recordings in which editing is likely to be necessary.

One mystery, as yet unexplained, but obviously due to the operational time constant in the side chain, is the performance of the Burwen in the replay mode when a steady tone on tape is played in suddenly. The output level from the Burwen took over 2s to reach full level, the starting level being approximately 6 dB too low. In the record mode the Burwen behaved in a reciprocal manner, the output processed level gradually reducing. Back-to-back, the Burwen behaved reasonably but this is of no use since it necessitates a passage of music being replayed from the beginning to re-establish any semblance of correct dynamic levels when replay is commenced. This logic error would, for example, exclude a section of a Burwen processed recording being replayed straight in from leader tape, either for disc cutting or broadcasting, unless the section prior to the required one was appreciably quieter.

I then attempted to use the Burwen on a stereo cassette tape recorder when the Dolby system (*B* in this case) was switched out. Several types of material reproduced via cassette astonishingly well, with a dynamic range that at first hearing sounded miraculous. Unfortunately a speech announcement followed on the programme being transferred and it was then that the modulation noise effects of the Burwen became obtrusive. A violent pumping up and down of cassette tape hiss with the speech recording became more oppressive than the steady hiss audible if the system were not used at all, and clearly even the Dolby *B* system seemed better, although the available noise reduction in the presence of low intensity signals was of course far less.

Bearing in mind all the above remarks, I am sorry to say I consider that the purchase of the Burwen *2000* for use with many types of material should be given very careful thought. In my opinion the merits are heavily outweighed by the basic faults, or difficulties in its use. For certain applications, in which it is required to record input signals which are not likely to be repeatable and whose peak intensity is not known, the Burwen system could possibly be very valuable. Some uses, in research for example, could be anticipated and the *2000* could also be employed in making otherwise bad landlines of use. For multitrack Pop recording, the Burwen might be used if very great care is taken. It is worthy of note here that the Burwen system is tolerant of incorrect signal levels from the mixer. For example, if you record 15 dB above or below operating level by mistake, the tape will not be horribly distorted or hissy as it would be otherwise. However, its use in serious music is fraught with snags. In any case, surely the price of £3,449.77 for just two processors finally rules the Burwen out of court.

DOLBY 364

By Angus McKenzie

MANUFACTURERS' SPECIFICATION

See page 54

MANY SOUND recordists not connected with the film industry have justifiably criticised the quality of optical film recordings. Even cine sound technicians would surely now admit that optical sound quality is so poor as to be almost absurd in 1973 when compared with the quality obtainable on other media. Before 1939, attempts were being made in the cine industry to improve the quality of playback systems in the cinema. However it was found that, when a wider frequency range was introduced, much more grain noise became apparent. Also, older prints which had become covered with minute scratches produced by abrasion gave a very noisy background with continuous crackles in addition to the grain noise.

A form of noise gate was introduced which cut down the area of light passing through the film. This exceptionally crude form of noise reduction was partly successful but produced noise pumping clearly audible in the cinema. A degree of standardisation of playback equipment was attempted and a vague playback equalisation curve was adopted, which cine engineers referred to as the 'Academy Curve'. It seems difficult to tie cine engineers down to agreeing what this playback curve should actually be but it was intended to represent a combination of subjective effects produced by the earlier poor cinema loudspeakers, badly acoustically designed auditoria, and playback equipment having a degree of bass and high frequency roll off. It also seemed to allow for an average minor azimuth error in the optical photocell scanning equipment.

Before attempting to improve the basic optical recording system by the use of Dolby *A* noise reduction, it was necessary to find out all the basic parameters connected with film sound recording and reproduction. Dolby, in co-operation with Rank, measured the response of several cinemas by playing back optical film test tapes through the electronic equipment and measuring its performance. They also played back special pink noise tapes into the same system and over the cinema loudspeakers in the auditoria. The early pink noise tests were

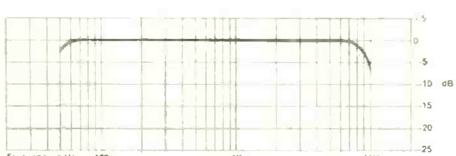
62 ▶

made using octave bands and a sound pressure level meter measured their intensity in the auditoria. Approximate graphs were plotted and it was soon realised that the total amount of high frequency loss measured was far greater than that which had been anticipated. Initially, graphic equalisers were used in an attempt to improve the frequency response in the auditoria. Later, however, it was found that the average response of cinema loudspeakers was so variable that a one-third octave equaliser had to be designed. Twenty-seven preset controls enabled the average system to be correctly equalised. The original prototype proved to be very successful and so the Dolby equaliser was produced commercially. It had the 27 preset controls each with an available variation of ±8 dB from nominal, and also an overall bass and treble control to allow for any general response deficiencies in the equipment.

Having improved the overall frequency response of the entire cinema equipment, music tapes replayed into the system sounded far more exciting but optical sound tracks, particularly from older films, reproduced with much too much background noise to be tolerable. At this stage, some experimental Dolby-coded optical sound tracks were made and reproduced over an equalised system which also included a normal Dolby replay unit. The results were rather encouraging since the available response from optical film is better than many engineers might believe. This available response is shown in fig. 1. An active network was then designed which would allow normal films to be played back through the same system after equalisation but with a controlled roll-off giving a sound quality equivalent to that produced by the legendary Academy Curve. Ordinary optical films thus sounded better but still had the same type of faults previously noted.

At this stage several film companies, including EMI and Rank, began co-operating and decided to produce experimentally some Dolby sound tracks for current films. The first complete Dolby optical sound track was made in America, and was of the film *The Speed Merchants*, which included a considerable amount of film of motorbikes travelling at speed. I was able to hear this played back through the new Dolby *A364* system on a studio monitor speaker under excellent listening conditions, and was impressed by the very high optical sound quality, although the film had been played back many dozens of times. A certain amount of background noise was audible, but the frequency response was much wider than that given in a normal cinema. A considerable subjective decrease in distortion was apparent. Some of the speech recording was not up to the highest standards but the film definitely showed the potential of the Dolby system's use for optical film.

Fig. 1



Interesting track

I was able to hear one extremely interesting recent film sound track, first from a normal new print without Dolby but replayed with the Academy Curve switched in. Then came a Dolby optical sound track, Dolby decoded, the Academy Curve switched out to give a much wider frequency response. Although I was surprised at how good the new non-Dolby print sounded on the very high quality optical playback system, in comparison to older films, the superiority of the Dolby optical track was very dramatic. It was possible to hear change of atmosphere very easily. Also audible was the build-up of noise from non-Dolby magnetic recordings edited together to produce the master which had then been transferred to the Dolby optical film. Grain noise was still apparent but the action of the Dolby made it subjectively far less annoying. The absence in the Dolby coded track of the usual nasty peak at about 3k Hz gave speech a more pleasant sound and consonants reproduced much more clearly. Sound effects were much more realistic, and distortion was subjectively lower. Background music sounded up to the standard that one might achieve nowadays on modern domestic audio equipment playing back a 1950s mono lp record in good condition with a similar amount of apparent background noise.

Whereas the normal Dolby optical playback system gives a full weighted 12 dB improvement, an additional function is provided designated 'clean up'. In this position, the Academy Curve is still maintained when optical prints are being played back, but in addition some 6 dB of Dolby replay noise reduction is added over the full frequency range of the system. The knee points of the Dolby operation were carefully chosen to give the minimum amount of pumping, and indeed only a slight amount was audible when a ten-year-old Cinemascope sound track of *Spencer's Mountain* was replayed. A small amount of high frequency presence was lost, but the grain and wide band impulse noise caused by the abrasive wear of the old film was reduced.

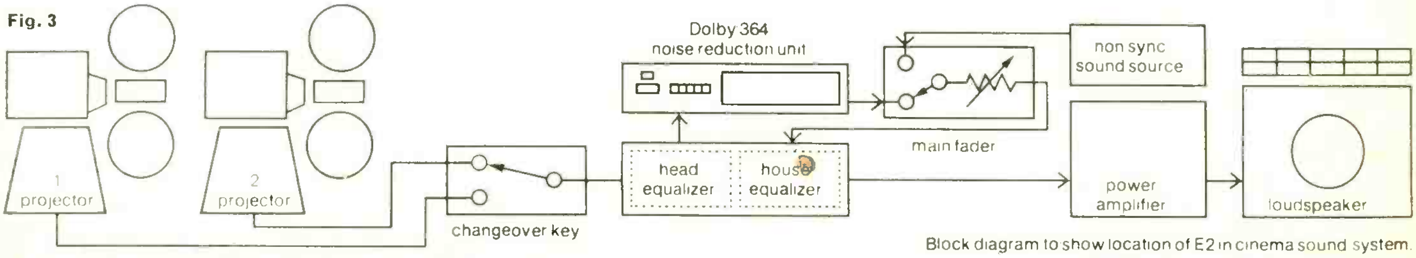
An early Dolby optical sound film of a section of Bach's *St Matthew Passion* was replayed through the system and I noted once again a typical comparison of playback quality against a good mono lp record which might have been produced in the mid-1950s. I became more disturbed by the wow and flutter of the playback system than by any slight lack of high frequency response or minimal distortion introduced into the optical system. Bringing in an additional Academy Curve made a harpsichord in the recording become completely inaudible. It also had the effect of bringing many woodwind instruments too far forward in the balance, at the same time as removing all the presence in the sound. Violins sounded scratchy and unpleasant and overall the sound quality became rather poor. An interesting transformation occurred, however, when the Dolby was taken out but the Academy Curve retained. The sound became far more lively and, although high frequencies were severely attenuated, I gained the subjective impression that more top was audible. I feel that, if great care is taken in the choice of some minor modifications to the Academy Curve, it might be possible to replay Dolby optical sound tracks in ordinary cinemas not fitted with Dolbyed replay equipment. I doubt whether many members of the audience would notice that anything was amiss.

I am certainly convinced that the optical sound recording system is dramatically improved by the use of the Dolby noise reduction process. EMI are at the time of writing about to distribute the first film made in this country with a completely Dolby sound track, recorded with noise reduction from the original 35 mm tapes through to the final optical print. They have announced, together with Rank, that many of their chains of larger cinemas will be fitted with the Dolby *A364* and equalisation systems. All these cinemas will therefore have their acoustic responses modified to give a significant improvement and the new EMI film *The Little Prince* should have a very exciting sound track. Perhaps in the past, cine engineers

64 ▶

Fig. 2

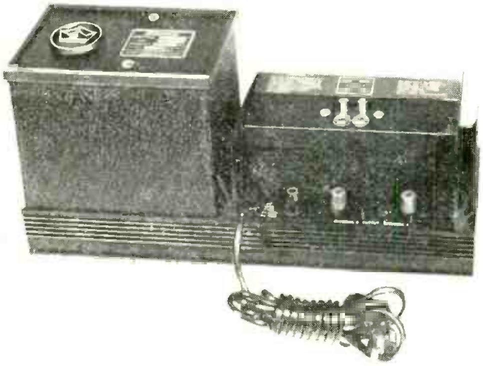
Fig. 3



Block diagram to show location of E2 in cinema sound system.

amcron AMPLIFIERS

"THE ONES WITH A PEDIGREE!"



The D150 shown here is probably the most peculiar looking amplifier around. There is a fancy front panel available if required.

However, the D150's performance is just as remarkable, and it lives up to the family tradition created by the famous DC300, and continued with the fabulous DC300A. If you don't already use Amcron, you have the pleasure yet to come.

D150 POWER AMPLIFIER

100 watts per channel into 8 Ω load
140 watts per channel into 4 Ω load
Distortion below 0.05% at all times

Amcron amplifiers carry a three years' warranty on materials and labour. Full descriptive leaflets gladly sent on application.

MACINNES LABORATORIES LTD.

MACINNES HOUSE
Carlton Park Industrial Estate, Saxmundham, Suffolk IP17 2NL
Tel. Saxmundham 2262, 2615

Dewtron (Regd. Trademark) modules have been going for many years now. There is a module for practically any sound effect you can think of. More especially, there is a whole range of synthesiser circuit modules identical to those used in the professional equipment, like the "Gipsy" synthesiser, now available direct, and also as used in the illustrated model "A1". Note the revolutionary "Modumatrix" system which replaces outdated patching . . . no plugs or sockets; instant reset facility (pat. applied for). Write now for full Dewtron catalogue of accessories and voltage-controlled LOG-LAW modules, etc. Forget the rest . . . get the BEST. Dewtron craftsman precision with professional results.

Catalogue 15p

D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset, BH22 9AR, England.

WE SPECIALISE IN BRAND NEW

TOP QUALITY BRITISH P.V.C. MYLAR AND POLYESTER RECORDING TAPES WITH FITTED LEADERS, Etc., EX 3"

Thanks to bulk purchase we can offer tensilised HI-FI tapes, manufactured by a British firm of world repute. All boxed individually (sealed if required) in polythene. Our tapes are not to be confused with imported sub-standard or used tapes. Full money refund if not delighted.

This month:- "DRY SPLICE" (19p) given FREE with every order.

Std.				L.P.				D.P.				Boxed	
	Length	ea.	3 for		Length	ea.	3 for		Length	ea.	3 for	emptyspls	
3"	150'	10p	29p	3"	220'	12½p	35p	3"	400'	22½p	65p	3"	3p
4"	300'	20p	50p	4"	450'	25p	70p	4"	600'	34p	97½p	4"	8p
5"	600'	30p	87½p	5"	900'	40p	£1·17½	5"	1200'	62½p	£1·85	5"	9p
5¾"	900'	35p	£1·02½	5¾"	1200'	52½p	£1·52½	5¾"	1800'	85p	£2·50	5¾"	9p
7"	1200'	45p	£1·27½	7"	1800'	65p	£1·92½	7"	2400'	£1·05	£3·05	7"	10p

All orders despatched by return. *Postage and Packing 9p per order*

STARMAN TAPES, 421 Staines Road, Bedfont, Middlesex

STUDIO INSTALLATIONS

T. B. Technical, *Audio Systems Consultants*, can provide engineers for planning installation, and maintenance of all professional audio equipment.

Also

Audio Test Equipment Hire

T. B. TECHNICAL LTD.
90 Wardour Street, WIV 3LE
01-437 1892/3

DOLBY 364 FIELD TRIAL

have been too inclined to believe that a good picture would distract an audience from the poor sound quality. It seems now that this significant advance should greatly benefit audiences who are just becoming aware of good quality sound.

The Dolby *A364*, incidentally, is identical in style to the *A361* series and also includes a magnetic track button. This allows the Academy Curve to be modified to one having significantly less roll-off. The effect of the Academy Curve is reproduced in **fig. 2** and will be seen to be very dramatic, even having a drastic cut-off as low as 6k Hz. The way in which the system should be installed in a typical projection room is shown in **fig. 3**. The Dolby optical system is purely a playback device and cannot be used for recording in its normally available format. The accompanying equaliser is mounted in a similar housing of the same size and has normal input and output terminations. The *A364* includes a button which sends modulated tone from the equipment equivalent to Dolby reference level.

On a new print, not only is more than an extra octave of sound reproduced, this being the difference between a typical optical film playback curve and the Academy Curves shown, but also some 5 dB noise improvement can be seen by the use of Dolby processing. When a film becomes worn, however, the improvement between normal Academy and Dolby processed film is more marked, since the wide range impulse noise is not filtered out particularly well by the academy curve but is greatly helped by the action of the Dolby, the improvement being 7 dB.

From all the above remarks, I strongly recommend cinemas to equip with Dolby even if they are going to replay older films. Television companies would also do well to install the equipment since so many of the old films sound very noisy and the clean-up function of the Dolby should help greatly. It now only remains for the film industry to consider seriously Dolby processing their recordings throughout, thereby assisting in the reduction of the noise build-up normally found in film sound track productions.

INSIDE RTE

RTE recently announced that they would be increasing the number of studios in the provinces. Each of these will include at the very least an unmanned studio with sound equipment, a connection to the radio network and, eventually, some television facilities. Work has already begun on two studios, offices and workshops in Galway. A full-time member of RTE's editorial staff will work at the studios, which should be working by the middle of next year. Premises have also been acquired at Limerick and negotiations are going ahead to get premises in Sligo, Waterford and other local centres.

By comparison, the BBC broadcast from 230 transmitters. There are 151 radio studios in London and the regions and 40 unmanned semi-automatic stations. Vhf radio reaches 99.4 per cent of the population but stereo coverage is only 60 per cent.

You could say, therefore, that RTE is considerably less diffuse than the BBC and has done rather better in providing stereo transmitters. This would be partly true. However, in fairness to the BBC, RTE have had the benefit of co-operation with the BBC and perhaps the biggest advantage RTE have had over the BBC has been Ireland's geography.

Ireland is a compact country, not a long thin thing like ours. It is also less mountainous. There is a central undulating plain 250 feet above sea level which is surrounded by mountains except to the east, where there is a lowland stretch between Dundalk and Dublin. In England the mountains tend to be up the middle of the country, dividing east from west, and further north the mountains predominate, broken only by the central valley of Scotland and the Glen Mor rift. Radio communication, particularly with vhf, is difficult under such conditions. Ireland's transmitters tend to have been placed on the mountains around the edge of the country, and the average coverage of each transmitter has every chance of being wider.

Continued next month

Classified Advertisements

Advertisements for this section must be pre-paid. The rate is **7p** per word, minimum **70p**. Box Nos. **20p** extra. Semi-display rates on application. Copy and remittance for advertisements in **APRIL 1974** issue must reach these offices by **14th FEBRUARY 1974** addressed to: The Advertisement Manager, **Studio Sound**, Link House, Dingwall Avenue, Croydon CR9 2TA.

NOTE: Advertisement copy must be clearly printed in block capitals or typewritten.

Replies to Box Nos. should be addressed to the Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after Box No. indicates its locality.

FOR SALE—TRADE

★**Indigo Sound Studios** have for disposal Brenell 4 track, ½s tape mastering machine in excellent condition, at *half* current list price for quick clearance. Write or phone for demonstration, 74 Gartside Street, Manchester M3 3EL. 061 834 7001.

★**Neve** 16 channel, 8 group out Console, 4 compressor/limiters, 4 filters, £5,000 offers. Scully Mono Cutting Lathe, Pultec Equilizers, Fairchild Limiter etc., £2,000 offers. Tel. 01 836 4864.

★**Tame those dB's** . . . Plug in professional quality FET compressor module £15.50. For the 'slick operator' . . . 'Voice over' module £15.50 S.A.E. details. Cathedral Sound SS, "Fourways," Morris Lane, Halsall, Lancs. L39 8SX.

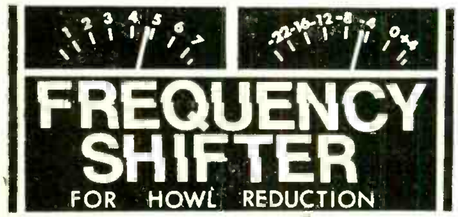
★**Tape bargains.** Brand new Agfa standard play ¼" tape, 1200 ft. on 7" spools in boxes, factory fresh. 1-5 reels £1.20 each, 6-10 reels £1.10 each, 11-over £1.00 each. P. & p. 20p for 1 reel, 5p each additional reel. Add 10% VAT to total (including p. & p.). Jackson Studios, Rickmansworth, Herts.

PEAK PROGRAM METERS TO BS4297

also 200KHz version for high speed copying.
Drive circuit, 35 x 80mm. for 1mA L.H. zero meters to BBC ED1477. Gold 8-way edge con supplied.

		4 off	10 off	50 off
Complete kit	**£10·00**	**£9·50**	**£9·00**	**£8·50**
Built and aligned	**£14·00**	**£13·30**	**£12·60**	**£11·90**

ERNEST TURNER PPM meters. Below scalings stocked Type 642, 71 x 56mm **£9·90**; 643, 102 x 79mm **£11·77**
TWIN MOVEMENT, scale 86 x 54mm **£31·00**.



★Public address. ★Loudspeaker talkback. ★Telephone broadcast programmes when earlier leaves received on.
Unity gain mains powered box 190 x 190 x 55mm, with bypass switch and overload light, shifts input 5Hz up in frequency and allows 6-8dB more gain before howl-round.
★Other shift versions for weird music effects.
★SPECTRUM INVERTORS for speech security

a Unbalanced 2-pole jack in and out. Zout = 2 Kohm **£58**
b Unbalanced 2-pole jack in and out. Zout = 20 or 600 ohm **£68**
c Balanced 3-pole jack or XLR in and out. Zout = 20 or 600 ohm **£84**
Post: Europe air and foreign **£1·70** Boards **£0·90**

Shifter circuit boards for WW July '73 article:
Complete kit and board **£21** *including p.s.u. and* *designer*
Board built and aligned **£28** *mains transformer* *approved*

SURREY ELECTRONICS
24 High Street, Merstham, Surrey
CASH WITH ORDER less 5% U.K. post free, add VAT

★**A new dB tamer** from Cathedral . . . Compressor/Limiter module CLA/1, £15.50 post and VAT paid. Low distortion oscillator module OSC/2 £15.50 post and VAT paid. Quantity discounts available. S.A.E. details, Cathedral Sound, Fourways, Morris Lane, Halsall, Lancs. L39 8SX.

SOWTER TRANSFORMERS
FOR SOUND RECORDING AND REPRODUCING EQUIPMENT
We are suppliers to many well-known companies, studios and broadcasting authorities and were established in 1941. Early deliveries. Competitive prices. Large or small quantities. Let us quote.
E. A. SOWTER LTD.
Transformer Manufacturers and Designers
7 Dedham Place, Fore Street, Ipswich IP4 1JP
Telephone 0473 52794

STUDIO FACILITIES

mjb **recording and transcription service**
Vinyl pressings and acetate demodiscs. Limiting, compression and equalisation facilities; high undistorted cutting levels with feedback cutter heads. Booklet available.
ST. MICHAEL'S, SHINFIELD ROAD, SHINFIELD GREEN, READING, BERKS.
Reading (0734) 84487 Member A.P.R.S.

★**J & B Recordings.** Tape to disc—latest high level disc cutting, all speeds. Mastering pressings, studio mobile. 14 Willows Avenue, Morden, Surrey. MITcham 9952.

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

★**County recording service** stereo and mono masters and lacquer discs from your tapes. Telephone Bracknell 4935. London Road, Binfield, Bracknell, Berks.

★**4-track** studio recording. Tape to disc service. Yarmouth Recording Studios.

RECORDS MADE TO ORDER

DEMO DISCS MASTERS FOR RECORD COMPANIES	VINYLITE PRESSINGS

Single discs, 1-20, Mono or Stereo, delivery 4 days from your tapes. Quantity runs 25 to 1,000 records PRESSED IN VINYLITE IN OUR OWN PLANT. Delivery 3-4 weeks. Sleeves/Labels. Finest quality NEUMANN STEREO/Mono Lathes. We cut for many Studios UK/OVERSEAS. SAE list.
DEROY RECORDS
PO Box 3, Hawk Street, Carnforth, Lancs.
Tel. 2273

COMPACT CASSETTES
PROFESSIONAL HIGH-SPEED DUPLICATION
Dolby B—compression and equalisation available—competitive prices on small runs—full productions undertaken—music and language specialists.
Contact Chris Sands
AUDIO EDUCATION COMPANY
01-723 6635

RAC MIXERS

Custom built mixers for groups, P.A., hospital broadcasting, recording, discos etc.

RAC plug in—audio modules for building your own mixers.

Shure, AKG, Calrec, Sony, mikes and stands in stock.

Sony, Tandberg, Nikko and Lux dealers.

RUGBY AUTOMATION CONSULTANTS
19 Freemantle Road, Bilton, Rugby, Warwickshire. Tel. 0788-810877 (Rugby)

Call, write or phone us.

★**7in.** pressings manufactured in our own pressing plant—speedy delivery. Yarmouth Recording Studios, Scratby, Great Yarmouth. Tel. Great Yarmouth 730136.

★**Sound News Productions.** Britain's oldest full-time Tape/Disc/Tape transfer service. Direct transfers, pressings for private and for the trade. Fund raising advisory service for societies, choirs, bands. 18 Blenheim Road, London W4. Tel. 995 1149.

★**Budget** studio low cost—high quality recordings. Many facilities including synthesiser, £3.50 P.H. Tel. 405 1210 Holborn.

SITUATIONS VACANT

DISC JOCKEY
RADIO STUDIO

Spot Radio is a full professional self-op D J Studio in central London. Ideal for radio programmes and audition tapes. We also run a training scheme for new broadcasters.

Write or call Allan King for details.

01 437 4765

Spot Radio, 59 Dean Street, London WI.

★**International** Discotheque requires responsible young electronics engineer for installation work. Formal qualifications not necessary, but must enjoy hard work and foreign travel. Tel. David Payne on 01-937-1555 for interview.

Electronic Engineers – looking for a job where you are your own boss?

Neve, the acknowledged world leaders in the manufacture of professional audio consoles and ancilliary equipment, are looking for engineers to be responsible for complete projects from conception to delivery. Every aspect of production is covered, and the people we want must be able to work under their own initiative with the minimum of supervision.

Posts are available for:

Senior	Engineers with starting salaries from	£3,000
Intermediate		£2,400
Junior		£1,800

Depending upon experience, qualifications and personal qualities of drive and ambition.

In addition posts are available, within similar salary ranges, for design engineers and test engineers willing to work—or to learn to work—to the highest professional standards in this interesting and creat..e field.

To find out more phone or write to
Pat Wythe,
Neve Electronic Laboratories,
Cambridge House,
Melbourn,
Royston, Hertfordshire SG8 6AU.
Telephone Royston 60776

Neve

FOR SALE—PRIVATE

★**Emt** 927 professional turntable/pickup, trolley mounted, bargain, £35. Marconi Audio Wattmeter, £10. Sugden A2111 Amplifier, £40. Tel. Steve 01 892 2545.

★**Truvox PD204** 4 track recorder, full mixing, monitoring and multiplay facilities. Hardly used, £50 o.n.o. Ring 0847 2326,

★**E.M.I.** TR52/2D tape recorder, unused and as new. £85. Tel. Broadwindsor 545.

★**E.M.I.** TR51A full track tape machine. 38 and 19 CM/S, £85. Condition virtually as new. Tel. Portsmouth 25573.

★**Revox** HS77—7½/15 half track tape unit. Two years old, excellent condition, with cover. £200 o.n.o. Tel. 01-579 6034 evenings.

★**Tandberg 11** professional portable sync. sound tape recorder with Sennheiser directional microphone. Excellent condition, only £200. Tel. 348 1619.

★**Unbelievable** but true, almost unused E.M.I. TR52, slow speed, £80. Phone: 01-427 2563.

WANTED

★**Lee Electronics.** The Tape Recorder and Hi-Fi Specialists wish to purchase good quality Tape and Hi-Fi equipment for cash. 400 Edgware Road W.2. Phone PAD 5521.

MISCELLANEOUS

★**Tape and Cassette Recorder Repairs** by Specialists. The Tape Recorder Centre, 82 High Holborn, London, W.C.1.

INDEX TO ADVERTISERS

Published by the Proprietors, Link House Publications Limited, 10-12 South Crescent Store Street, London W.C.1, and Printed by Arthurs Press Limited, Woodchester, Stroud, Glos. GL5 5PB.