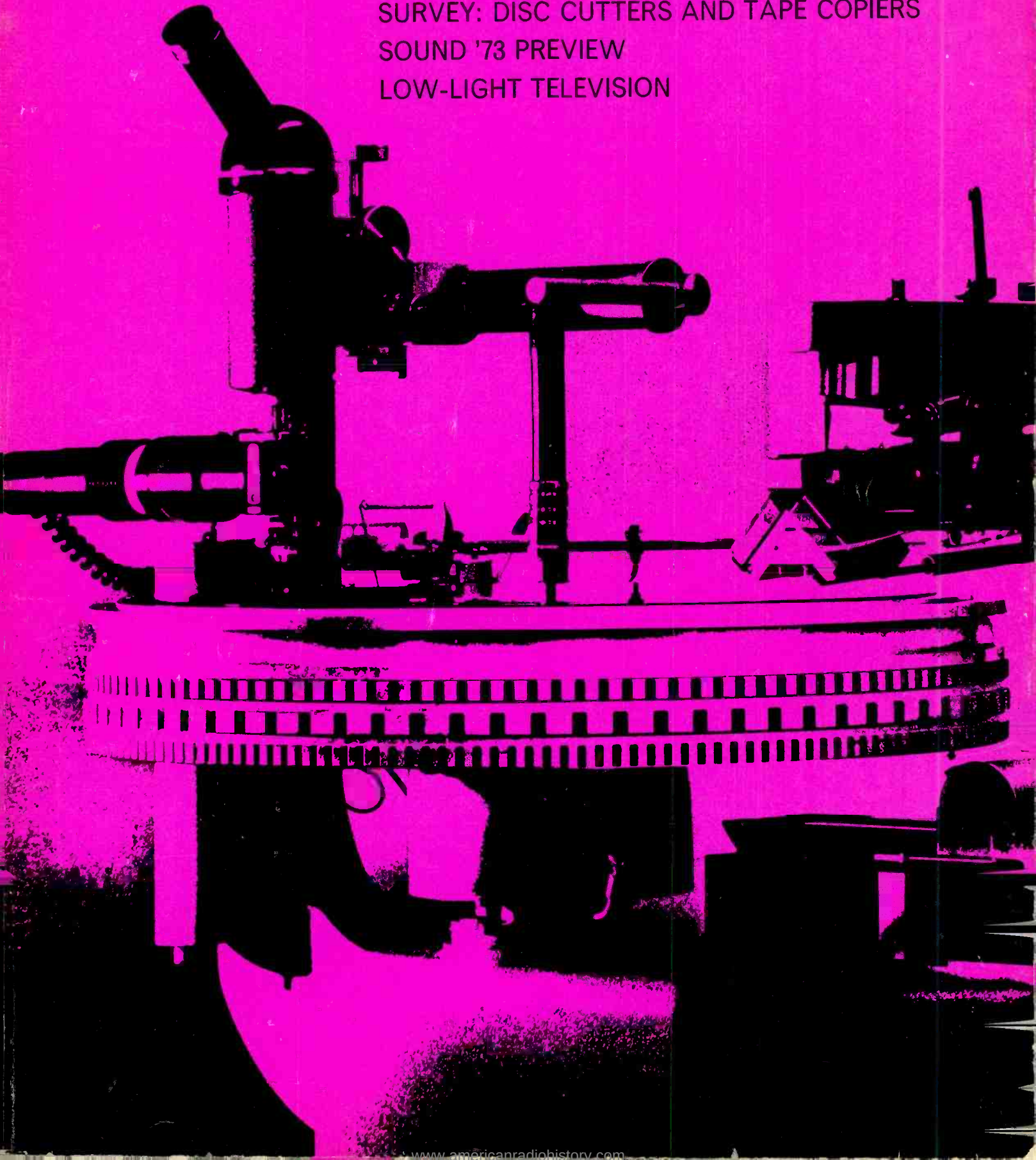
April 1973 25p

studio sound

SURVEY: DISC CUTTERS AND TAPE COPIERS
SOUND '73 PREVIEW
LOW-LIGHT TELEVISION



CREATIVE SUCCESS....

Console designed for
Soundpush-CMS Studios,
Blaricum, Holland.

This console was supplied 32 into 8,
wired for up-dating to 32 into 16
considering future studio expansion.

Whatever the recording .....

Automatic function selection by push-button control of the audio systems, including complete sync facilities eliminating the need for multi-switching in order to change over from normal recording into overdubb or re-mix.

cadac

Cadac (London) Limited

STANSTED · ESSEX · ENGLAND · Tel: Stansted 3437 & 3132

MANUFACTURERS OF AUDIO CONTROL EQUIPMENT FOR THE SOUND RECORDING INDUSTRY

studio sound
INCORPORATING TAPE RECORDER

EDITOR DAVID KIRK
ASSISTANT EDITOR JOHN DWYER
ADVERTISEMENT MANAGER TONY NEWMAN
AUDIO GROUP ADVERTISEMENT MANAGER ROBIN WELLS
AMERICAN REPRESENTATIVE STEPHEN H. LAMPEN

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

American Office: P.O. Box 99569, San Francisco, California, 94109, U.S.A.

CONTENTS

FEATURES

OPTU-ELECTRONIC AUDIO LEVEL DISPLAY
By Rune Espelien 35

SOUND '73 PREVIEW 44

DISTORTION: CAUSE AND EFFECT
Part Two
By Tony Eden 50

THE dBm OR THE dB(V)?
By Angus McKenzie 54

SURVEY: DISC CUTTERS 56

SURVEY: TAPE DUPLICATORS 60

COLUMNS

NEWS 22

NEW EQUIPMENT 24

LETTERS 28

PATENTS
By Adrian Hope 30

DIARY
By John Dwyer 36

VIDEO: MARCONI XQ1402 LOW-LIGHT TUBE
By Roderick Snell 40

REVIEWS

INFONICS 102 CASSETTE COPIER
By Hugh Ford 72

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. We are happy to advise potential authors on matters of style.

BINDERS

Loose-leaf binders for annual volumes of STUDIO SOUND *are available from Modern Bookbinders, Chadwick Street, Blackburn, Lancashire. Price is 85p. Please quote the volume number or date when ordering.*

APRIL 1973 VOLUME 15 NUMBER 4

WOULD YOU ENCOURAGE your son to enter the sound recording industry? Probably not, since present working conditions make it one of the least secure vocations in existence —second only to cinematography.

The first serious step towards improving the status of recording engineers took place at Lansdowne Studios on January 31. An inaugural meeting of the Engineers Guild was chaired by the president of the Association of Professional Recording Studios, Jacques Levy. One of the Guild's first acts was to bite off their own head by declaring that they would not be involved in trade unions, politics, conditions of work, or rates of pay. 'These things,' Mr Levy claimed, 'are provided elsewhere'. Indeed? Then 'elsewhere' has totally neglected its duties.

The one trade union with any interest in this industry, the ACTT, is recognised by only a few of the larger studios and virtually none of the many small ones. Few junior studio staff receive any formal training, few are allocated reasonable working hours, few receive more than token wages, and few enjoy even the security of a used-car salesman. The majority work in conditions tending to cause premature deafness.

Why do youngsters tolerate these limitations? Attracted by what they consider an alternative to the commercial rat-race, they find themselves instead in the thick of it. And since every opening faces a queue of other keen souls to replace any disillusioned junior, the tendency is to remain as long as sanity and a hard-pressed love of music allow.

The Guild desire to see sound recording recognised as a profession, a latterly devalued term defined as (1) *an employment not mechanical and requiring some degree of learning;* (2) *a religious belief or pretence.* Which definition they choose must depend largely on their attitude to formal technical training. The Tonmeister concept has not exactly been welcomed in this country, despite capable work by the University of Surrey, so what will the Guild suggest as an alternative? Some kind of recognised qualification, whatever its level, would in the long term be more profitable than the present system resting on vague 'studio experience' and actually meaning 'jobs for the boys'. Qualifications can indeed be a *dis*advantage under present conditions as one Oxford graduate in physics discovered recently when sacked by a studio manager fearful of being ousted by his junior. And this was no back-street studio.

Mr Levy and others are known to fear trade union involvement in the recording industry. To quote the words of the APRS president on an earlier occasion, 'eventually they'll say it takes 14 people to operate a desk'. Admittedly many unions have displayed the most deplorable contempt for the general public but this is all the more reason for a presently union-free industry to put itself in order.

COVER

Kodalith photograph of a Neumann cutting lathe at EMI Abbey Road, from an original by Tim Bishopp.

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 ($8 or equivalent) 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.*

PAST ISSUES

A small number of certain past issues may still be purchased from Link House, price 31p each including postage. Photostat copies of any STUDIO SOUND *article are available at 25p including postage.*

Budget priced compact cassettes

from 26p

Low Noise
Guaranteed
Screwed
Not Welded
Library Case

Prices		1	10	100
POST & PACKAGE	C60	29p	28p	26p
1-10 cassettes 10p	C90	39p	37p	35p
11-100 cassettes 25p	C120	52p	46p	44p

Price per cassette

VAT not included

These prices are liable to alteration without notice.

fpa Fraser-Peacock Associates Ltd
94 High St. Wimbledon Village
London SW19 01-947 1743/2233

Registered Office: 94 High St. Wimbledon Village London SW19

PLEASE SEND ME C60 C90 C120

CHEQUE/P.O. FOR

NAME

ADDRESS

Registration No. 779084 (England)

spendor

The "New standard in loudspeaker design"* is now even better

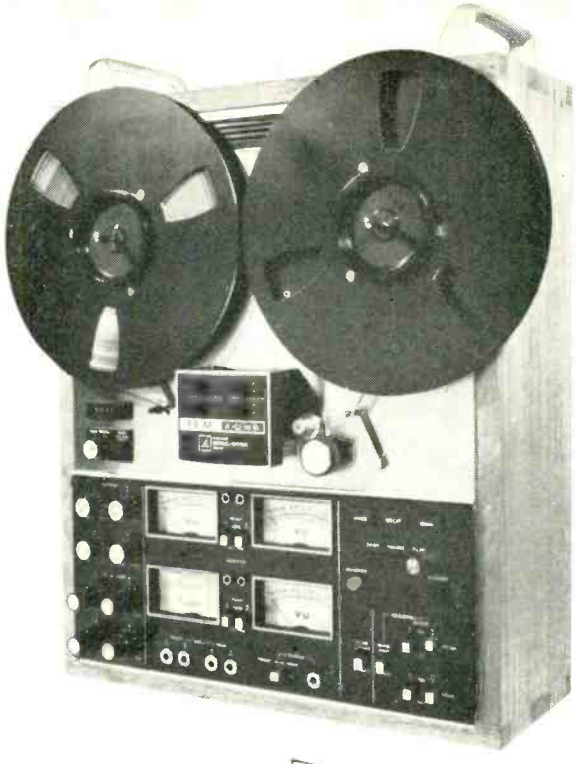
Spendor introduce the BC III

Nominal impedance	8 ohms
Frequency response	±2½dB 50Hz-14kHz
Frequency range	30Hz-20kHz
Power rating	70 watts peak programme
Units	Spendor 12″ Spendor 8″ Celestion HF1300 Celestion HF2000
Dimensions	31½″ x 15½″ x 15½″
Weight	70lb
Price	On application

*John Shuttleworth, 'Studio Sound', September 1970

Spendor Audio Systems Limited

Kings Mill . Kings Mill Lane . South Nutfield
Redhill . RH1 5NF . Phone Nutfield Ridge 2554



The current complexity and prohibitive cost of multichannel recorders has previously deterred the musician from utilizing the full potential of a professional recorder as a creative medium.

Nice 'n' Easy

At the touch of a button it is now possible to produce L.P. quality masters or demos in the relaxed atmosphere of your own studio for under £500.

Comprehensive

The Industrial Teac is so comprehensive that such tapes may be produced with only a pair of headphones, a microphone and a mixing lead.

Low Multitrack Noise

The fact that we have broken the -63dB noise and £1000 price barrier is no coincidence. A -63dB noise level coupled with absolute simplicity is creating a new generation of smaller recording studios.

Direct Selling

Our policy of direct selling together with large scale production is obviously reflected in our selling price of £492. To ease any financial burden we have negotiated with U.D.T. the lowest terms currently available.

Curtains

The end of the studio is nigh? Certainly not, since the introduction of this recorder is creating a new generation of recording studios.

D & D

Delivery immediate to your door— Demonstrations to studios within 150 miles of London.

Domestic version available at £465.
Complete MINI STUDIO around £1100.

NEW LOW TAPE PRICES
We can offer Scotch 207 3600ft. at 25% BELOW TRADE PRICE for moderate quantities.

Sole U.K. Distributor
INDUSTRIAL TAPE APPLICATIONS
105 High Street, Eton, Windsor, Berks.
Tel: (95) 52663

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 models from 15/16 to 60 IPS, ¼" 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)

See and hear the world's finest Audio Equipment at:

Britain's Premier Hi-Fi Audio Exhibition

SONEX 73

Excelsior Hotel, London Airport (Heathrow)
Wednesday 28 March to Sunday 1 April inclusive from 11am

Tickets and posters for you and your clients may be obtained from B.A.P. Ltd, 31 Soho Square, London W1V 5DG □ Car Parking □ Free coach service from Hounslow West Underground □ Special Audio Features and technical presentations

Sonex 73, the 4th International Exhibition sponsored by the Federation of British Audio, 31 Soho Square, London W1V 5DG

HS77 15-7½

The high speed Revox is firmly established as standard equipment in the majority of London Theatres, Local Radio Stations, and Recording Studios

PRICE £230

Delivered to your door

SEL SYNC +£20

IMMEDIATE DELIVERY

SOLE U.K. SUPPLIER

VHS77 30-15

WIDE BANDWIDTH 40 Hz-40 KHz of particular interest to research establishments

TAPE DUPLICATION The equalisation characteristics 17.5 and 35 μ Sec are such that a 1:1, 2:1 or 4:1 speed ratio will produce a copy tape of the same recording characteristic as the master

HIGH TAPE VELOCITY of 30 ips (76 cms) is invaluable for the analysis of data and transient information

TAPE ECHO 50 milli seconds or 100 milli seconds

Delivered to your door

£298

I.T.A. for REVOX REVOX HIRE

105 HIGH ST., ETON, WINDSOR, BERKS.
Tel. WINDSOR (95) 52663

Contact Barry Lambden for further information
London's most competitive rates
Finance available through UDT only 9½%
Subject to increase after 1st April '73

NEW LOW TAPE PRICES

We can offer Scotch 207 3600 ft. at 25% BELOW TRADE PRICE for moderate quantities

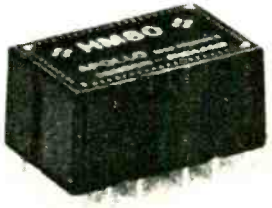
EVERY NUN NEEDS A SYNTHI

Electronic Music Studios (London) Limited
49 Deodar Road London SW 15 01-874 2363
New York 408 East 78th Street N.Y. 10021 USA

The Synthi Range by **EMS**

A GOOD ALL ROUNDER

HM80 Hybrid Module



approx. actual size

This is a general purpose Hybrid AC control module. It provides a dynamic control range of 80 db and it is capable of performing any function that lies between the frequencies of 3 Hz and 200 KHz.

Furthermore it will operate with single supply voltage ranging from 4.5 to 24 Volts with negligible variation of all other characteristics except of course the maximum input and output voltage swing which is mainly determined by the supply voltage.

This miniature encapsulated 24 pin Dual-In-Line module contains also all the necessary coupling and decoupling capacitors and therefore the external components are limited to those necessary to perform the individual function required.

The internal pin connections have been specially arranged to make the design of printed circuit boards very easy and the module will plug into a standard 24 pin D.I.L socket for maximum flexibility.

The outstanding quality and reliability of this module makes it ideal for use in the professional field and along with the specification sheet comes a very comprehensive application report dealing with all aspects of sound recording equipment.

Furthermore we undertake to design free of charge any application required but not listed in the application report.

For further details write or phone:

APOLLO ELECTRONICS
96 MILL LANE, LONDON NW6 INQ
Telephone: 01-794-8326

AUDIO CONNECTORS

BROADCAST PATTERN JACKFIELDS, JACKCORDS PLUGS & JACKS. QUICK-DISCONNECT MICROPHONE CONNECTORS. AMPHENOL (TUCHEL) MINIATURE CONNECTORS WITH COUPLING NUT. HIRSCHMANN BANANA PLUGS & TEST PROBES. XLR COMPATIBLE IN-LINE ATTENUATORS. LOW COST SLIDER FADERS BY RUF.

FUTURE FILM DEVELOPMENTS LTD.
90 Wardour Street WIV 3LE

01-437 1892/3

WE SPECIALISE IN BRAND NEW

TOP QUALITY BRITISH P.V.C. MYLAR & 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	empty spls
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

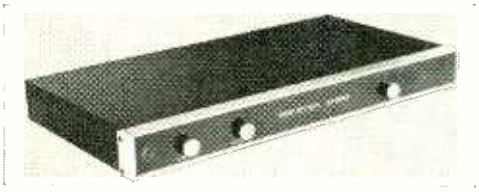
All orders despatched by return. *Postage and Packing 9p per order*

STARMAN TAPES, 421 Staines Road, Bedfont, Middlesex

amcron AMPLIFIERS

In Amcron, you will recognise world-renowned Crown International amplifiers—beyond all question, the best of their kind in the world. Only the product name has been changed to avoid any possible confusion of identity. The range shown here will meet the needs of studios, groups, theatres, and indeed wherever power is demanded with the absolute maximum quality and reliability.

All quoted output powers are Root Mean Square values.



D.60 the 100 watt amplifier

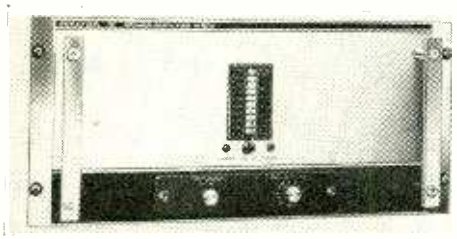
Two channel extra-compact power amp. In stereo—40 watts per channel at clip point into 8 ohms; 62 into 4 ohms; in mono, 100 watts into 8 ohms. At 30 watts per channel into 8 ohms power response is ±1 dB from 5 to 30,000 Hz, THD is below 0.05% and hum and noise 106 dB below. Built-in protection against mis-use. Input sensitivity 0.75V into 25 Kohms. Size 17in x 8¾in x 1¾in high.

D.150 the 330 watt amplifier

Two channel model. 100 watts per channel at clip point into 8 ohms. 140 watts into 4 ohms loads. 330 watts into 8 ohms used mono. Power response ±1 dB from 5 to 20,000 Hz at 75 watts per channel into 8 ohms. THD less than 0.05%. Damping factor greater than 200 up to 1 kHz. Hum and noise 110 dB below at 75 watts per channel into 8 ohms. Input sensitivity 1.19V ±2% into 25 Kohms for 75 watts out. Built-in protection against mis-use. Size 16½in x 5in deep x 8in high, less front panel (Front panel optional extra, £15). 19in rack mounting fittings also available. Price, less front panel

DC.300A the 1,000 watt amplifier

Power at clip point (per channel) 200 watts into 8 ohms: 350 watts into 4 ohms: 500 watts into 2.5 ohms. Used mono—greater than 650 watts into 8 or 4 ohms. This new unit will operate into loads as low as 1 ohm and no longer requires protection fuses as did its predecessor the DC 300. Power response ±1 dB from zero to 20,000 Hz at 150 watts per channel into 8 ohms. Total harmonic distortion 0.02% at 300 watts per channel into 4 ohms. Hum and noise below 110 dB at 150 watts per channel into 8 ohms. IM distortion 0.05% from 0.01 watt to 150 watts per channel into 8 ohms. Input sensitivity 1.75V for 150 watts out per channel into 8 ohms. Size, with front panel, 19in x 7in x 9¾in (suitable for standard rack mounting).



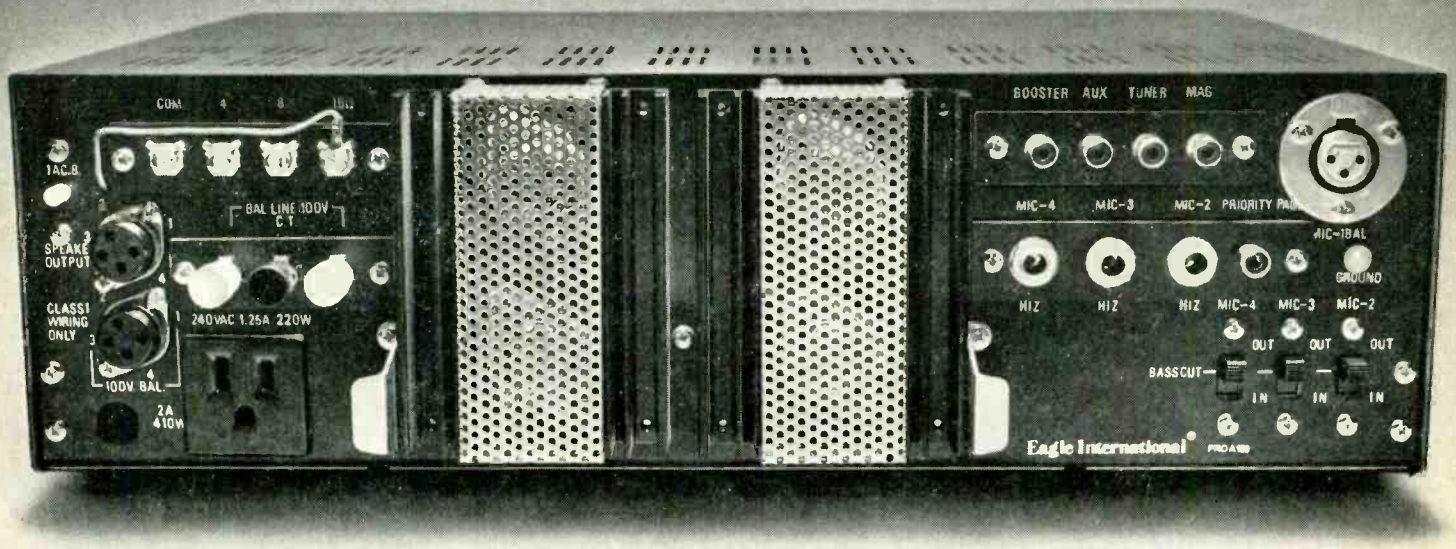
M.600

Single channel power amplifier. 600 watts into 8 ohms or 1,000 into 4 ohms with THD less than 0.1%. Frequency response ±1 dB from zero to 20 kHz. Two M.600s can be linked to give a massive 2,000 watts into 8 ohms. With built-in automatic two-speed cooling and protection devices against mis-use. Weight 80lbs nett. Size 19in x 8¾in high x 16⅞in (standard rack mounting).

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

MACINNES LABORATORIES LTD. STONHAM, STOWMARKET. IP14 5LB.
Telephone Stonham (044 971) 486.

It's what's behind our new amplifiers



Pictured here, the PRO A120, one of the three new professional PA amplifiers Eagle have in store for you this year.

This one has an RMS output power of 120 watts behind it. And there's a 65 watt amplifier and a 35 watt mains/mobile model too.

All three have 100 volt balanced line outputs as well as 4, 8, and 16 ohms.

All three have a priority page circuit which preempts all music and other voice transmission.

They all function as mixers too. And there are slide controls and memory markers on each for easy operation.

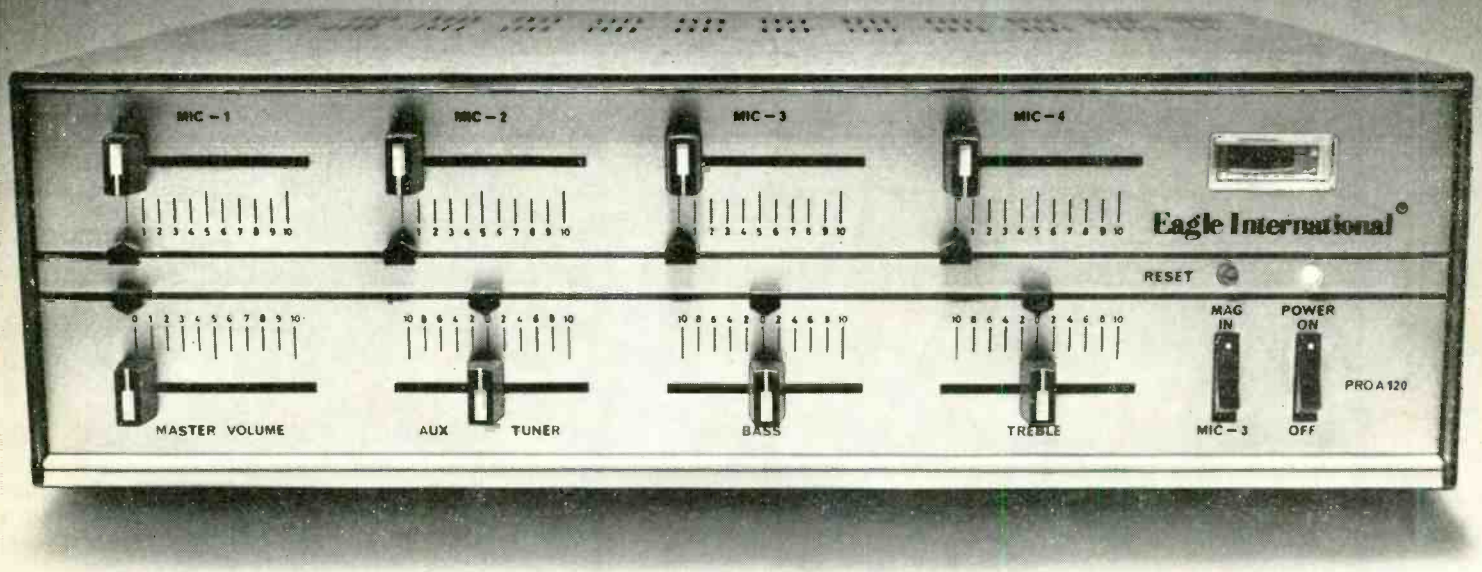
Have a look down our list of specifications and see just how many other features we've included.

Could be you'll find the price tag something of an attraction too.

PRO A120 Professional PA Amplifier
Output Power: 120 watts RMS
Frequency Range: 35-20,000 Hz.
Inputs: Mic 1: Hi 5 mV @ 50,000 ohms or Lo 200 uV @ 200 ohms (using PPLZ).
Mic 2: 5 mV @ 50,000 ohms.
Mic 3: 5 mV @ 50,000 ohms switchable to Magnetic Phono: 4 mV @ 47,000 ohms (RIAA)
Mic 4: 5 mV @ 50,000 ohms.
Aux/Tuner: 400 mV @ 100,000 ohms.
Signal to Noise Ratio: Better than 75 dB.
Output Impedance: 4, 8 and 16 ohms and 100 volt line output.
Operating Voltage: 220-250 volts AC.
Dimensions: 350 x 130 x 310 mm.
List Price: £125.00 (excl. VAT)

PRO A65 Professional PA Amplifier
Output Power: 65 watts RMS
Frequency Range: 40-20,000 Hz.
Inputs: Mic 1: Hi 5 mV @ 50,000 ohms or Lo 200 uV @ 200 ohms (using PPLZ).

that makes them so attractive from the front.



Mic 2: 5 mV @ 50,000 ohms.
Mic 3: 5 mV @ 50,000 ohms switchable to Magnetic Phono: 4 mV @ 47,000 ohms (RIAA)
Aux/Tuner: 400 mV @ 100,000 ohms.
Signal to Noise Ratio: Better than 70 dB.
Output Impedance: 4, 8 and 16 ohms and 100 volt line output.
Operating Voltage: 220-250 volts AC.
Dimensions: 350 x 130 x 310 mm.
List Price: £95.00 (excl. VAT)

PRO A35 Mains/Mobile Professional PA Amplifier
Output Power: 35 watts RMS
Frequency Response: 50-18,000 Hz.
Inputs: Mic 1: Hi 5 mV @ 50,000 ohms or Lo 200 uV @ 200 ohms (using PPLZ).
Mic 2: 5 mV @ 50,000 ohms.
Mic 3: 5 mV @ 50,000 ohms switchable to Magnetic Phono: 4 mV @ 47,000 ohms (RIAA)
Aux/Tuner: 400 mV @ 100,000 ohms.
Signal to Noise Ratio: Better than 70 dB.
Output Impedance: 4, 8 and 16 ohms and 100 volt line output.
Operating Voltage: 220-250 volts AC or 12 volts DC.
Dimensions: 350 x 130 x 310 mm.
List Price: £75.00 (excl. VAT)

Eagle International

Eagle International Precision Centre Heather Park Drive
Wembley HA0 1SU Telephone 01-903 0144

Please send me your catalogue containing details of the new Eagle Professional Amplifiers and other P.A. Equipment.

Name_____

Address_____

_____

SS1

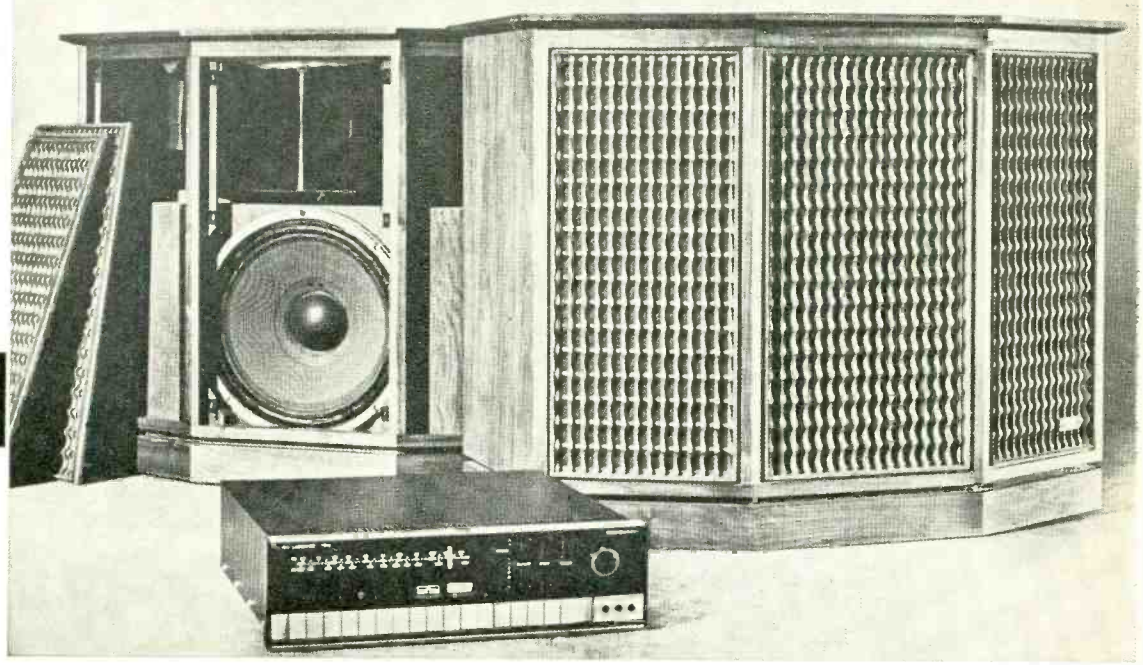
Now available in the U.K.– the world renowned ALTEC LANSING range.

Built a little better

ALTEC LANSING

For further details write to sole U.K. Distributors: ACOUSTICO ENTERPRISES LTD., 6-8 Union Street, Kingston-upon-Thames, Surrey. Tel. 01-549 3471/3 (3 lines).

Altec speakers systems and stereo components are designed to offer you finer specifications for better listening and the latest features for better control of what you hear and the newest innovations for professional recording studios. And that's why we say they're built a little better.



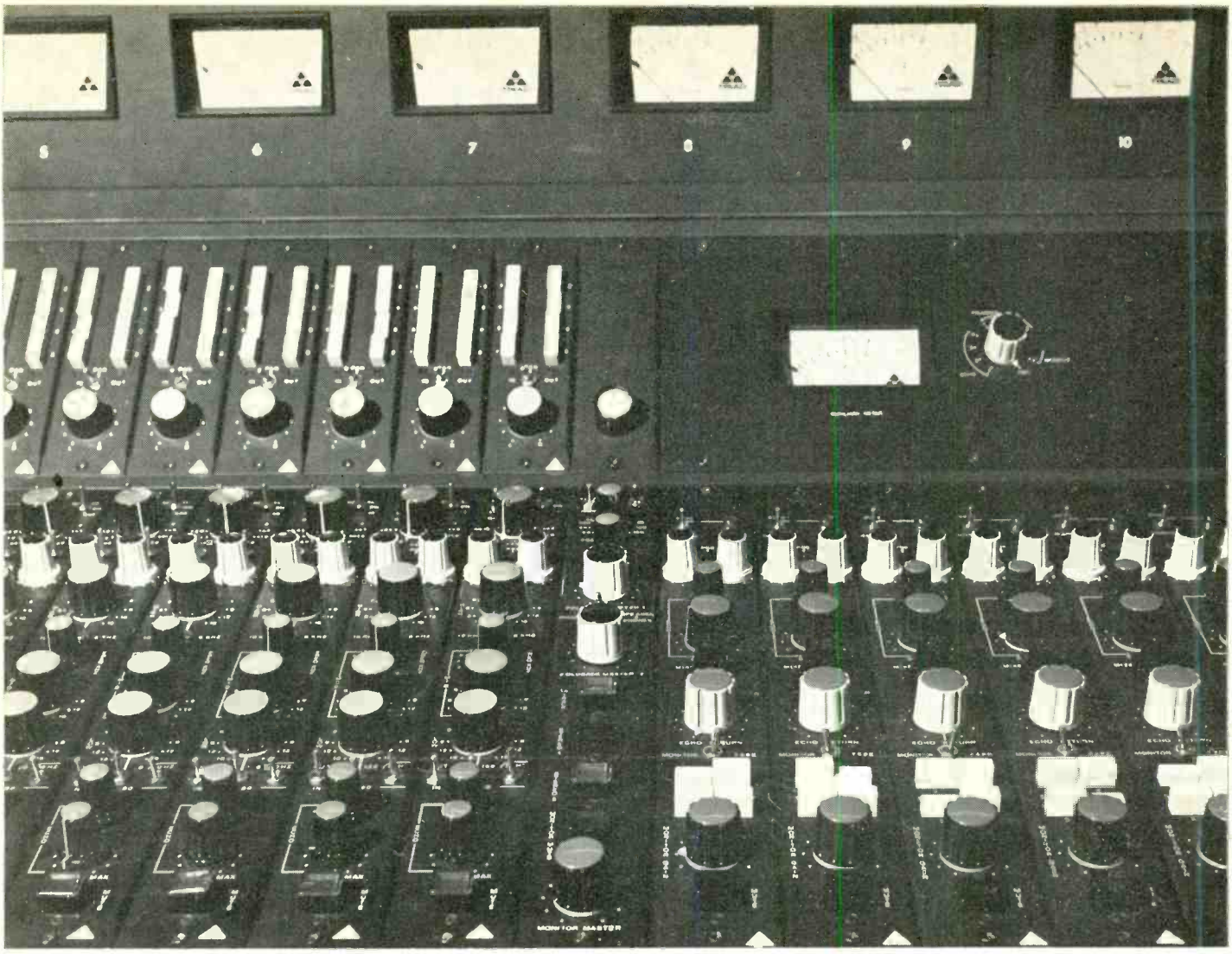
F760X—RS STEREO LIMITER—COMPRESSOR—EXPANDER

It's all here—every facility you've ever required in the field of level control—expansion, compression and limiting; stereo matched to obviate image shift during operation. Eliminate increased noise due to compression; reduce channel noise, studio cross-talk and ambience. Available on short delivery in both modular and rack formats.

AUDIO DESIGN RECORDING

TEL: READING (0734) 84487

ST MICHAELS
SHINFIELD ROAD
SHINFIELD GREEN
READING BERKS UK



Sound design by Triad....

Comprehensive facilities for multi-track recording combined with functional design and performance beyond reproach, add to this a price tag that will not break any hearts, and the result is a Triad 'B' series console. Available with any number of input channels, and normally supplied with 8 group outputs and 16 track monitoring, two foldback, four echo routes, full equalization and complete access at large jackfield. If this isn't enough, the Triad 'A' series offers just about the most complete specification available, and can now be supplied fully automated for maximum versatility.

TRIAD

CREATED FOR ENGINEERS BY ENGINEERS

Trident Audio Developments Limited 4-10 North Road, London N7 9HG
Telephone 01-609 0087 Telex, 27782

An example of the Midas modular system mixers.

Medium scale chassis, with space for sixteen inputs. The input modules shown include, sensitivity control and fader, pan and output group switch, fold back with pre-fade/post-fade switch, bass, treble, presence equalisation and reverb/ echo mix.

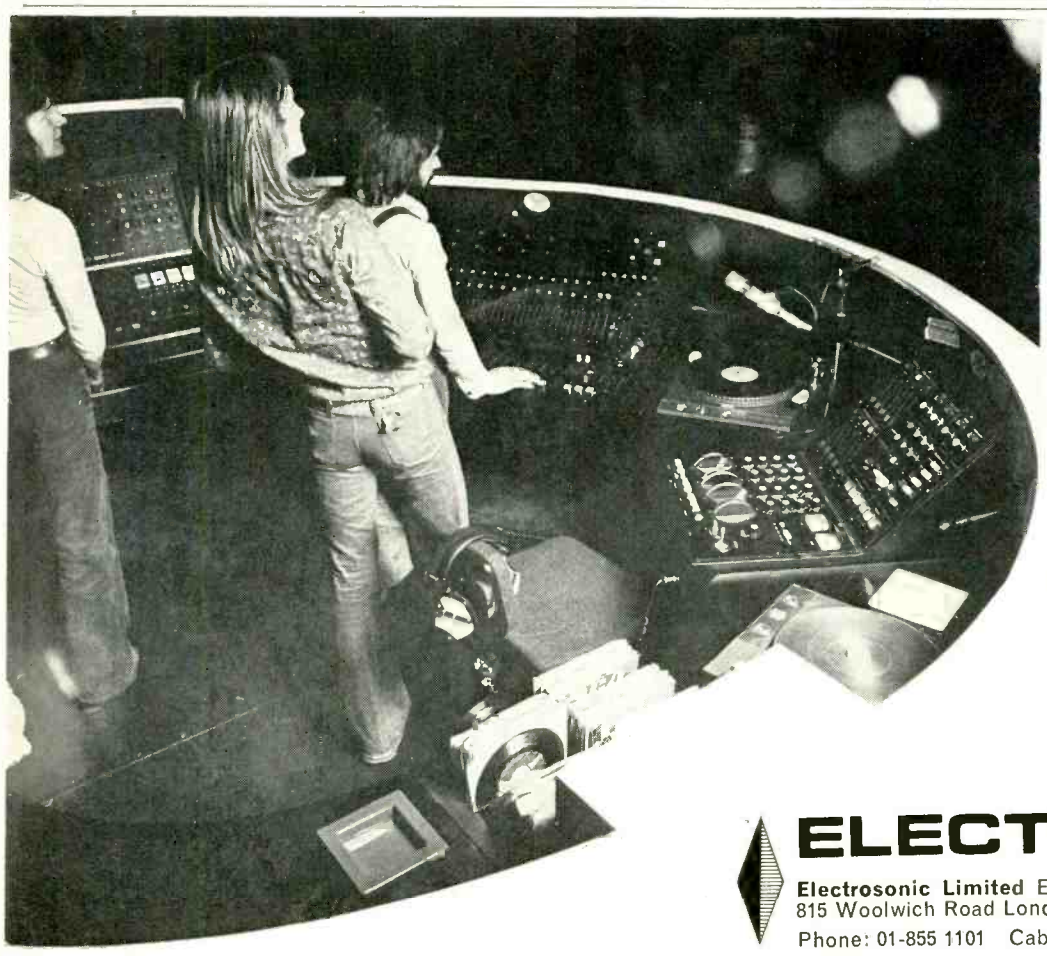
The top level has four output modules with PPM calibrated Vu Meters and compressors.

The middle level accommodates the fold back output, talk back and headphone facilities, acoustic compensation filters and triple range crossover network. The lower level also includes a send and return panel.

Specifications

Inputs 0.2 mV into 200 ohms, 10 mV into 50K ohms.
Outputs normally OdbM into 600 ohms.
Overload range 60 db, low and high Z, channel outputs 16 db above Odb, Vu indication.
Line outputs Max level + 16 dbM
Signal to noise Ratio At maximum channel gain 66db, Typically 80db at normal gain settings
Distortion Less than 0.1% THD

Midas Professional Amplication. 87, North Grove, London, N.15. Telephone 01-800 6341



ELECTROSONIC—
Designed and manufactured the integrated sound, lighting and projection system at the HARDROCK, MANCHESTER

The Hardrock Control Console is shown on the left.

ELECTROSONIC—
Will be pleased to supply a specification for any project large or small.

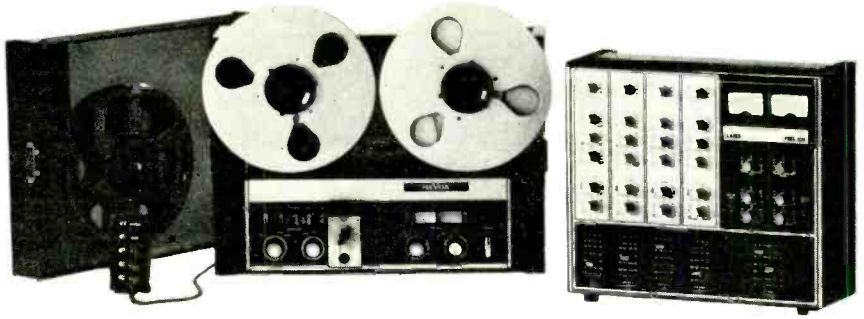
ELECTROSONIC—
Have supplied lighting and projection systems for: Emerson Lake and Palmer— Pink Floyd—The Who—Yes— The Rolling Stones— Family— King Crimson.

ELECTROSONIC

Electrosonic Limited Electronic Control and Audio Systems
815 Woolwich Road London SE7 9LT
Phone: 01-855 1101 Cables: Multiplex London SE7

all you need is the plug–

we supply the rest!



for a complete portable recording studio

LAMB LABORATORIES

PRESENT THEIR MINI-STUDIO

COMPRISING

A REVOX A77 high speed tape recorder with Sel Sync, variable pitch and illuminated remote control unit.

PLUS

The LAMB 4 channel stereo mixer with in-built compressors—Full channel equalisation—Pan Pots and echo send controls.

The mini-studio kit is completed by 4 Beyer microphones and 4 stands (2 with booms)—Beyer DT100 headphones—Power Supply—Carrying cases—and **ALL** interconnecting leads.

Remember, all you have to supply is the plug!

DURING SONEX '73

If you're visiting Sonex, see the LAMB Mini-studio at our Hospitality Suite. At the beautiful Skyline Hotel—where you can also readily park, dine and be entertained. Simply take one of our scheduled mini-buses (which will return you to the Sonex venue) 400 yards down the road and enjoy the superb facilities of the Skyline.
March 28, 29, 30, 31 9.30 a.m. to 10 p.m.

If you can't make it to Sonex, just fill in the Coupon and we'll provide all the operating instructions and the specifications you'll need to have your own completely Portable Mini-studio. Post it to-day!

Detailed information on Mini-studio/Mixer

NAME .....

ADDRESS .....

.....

.....

TELEPHONE SS43

LAMB LABORATORIES

Lamb House, Church Street, Chiswick, London W4 2PB
Telephone 01-995 4551. Telex 934047. Cables Lambex London

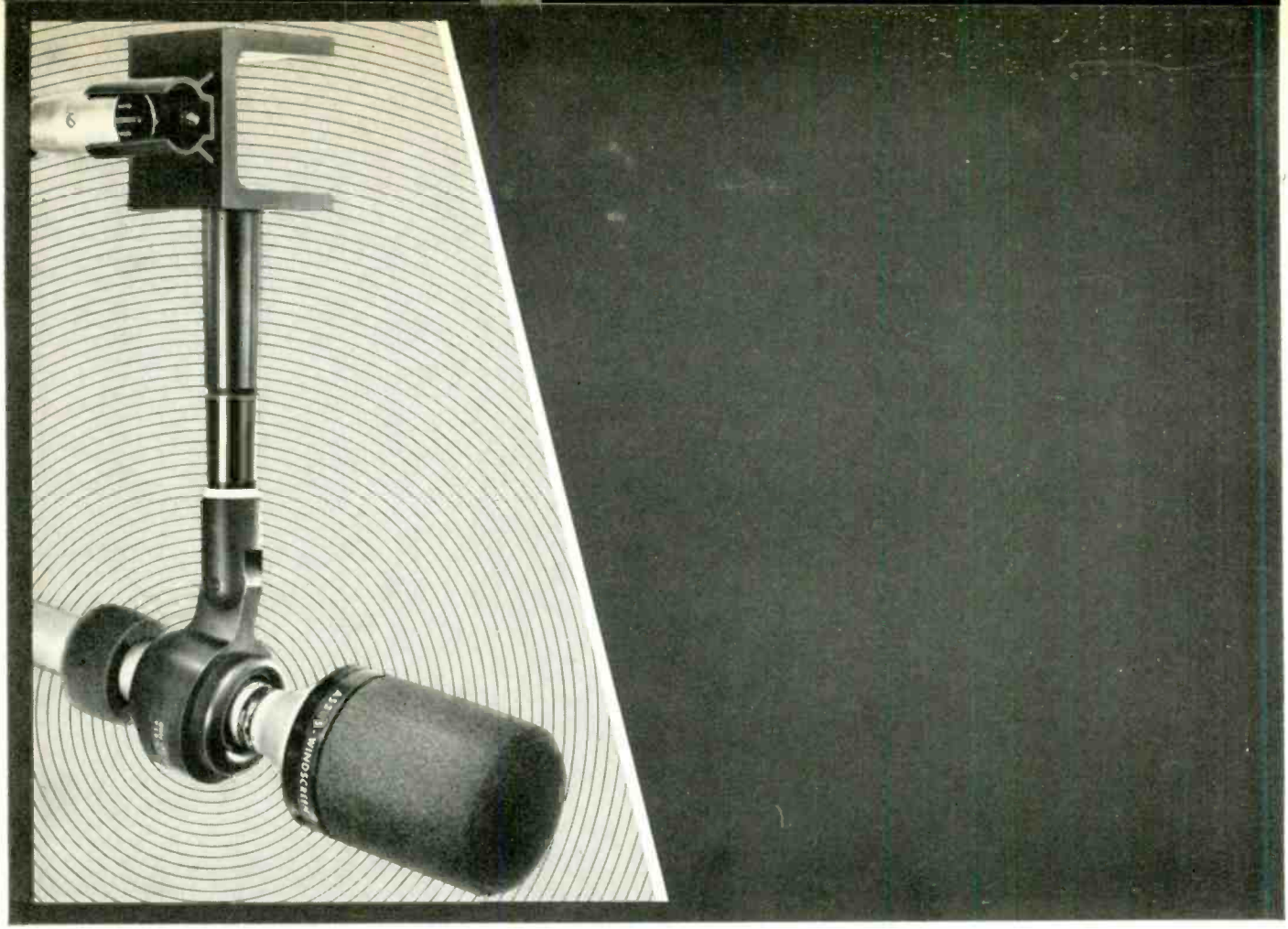
"The alternative to
QUAD
is not a
colour television set
but a seat
in the
concert hall"

QUAD

for the closest approach to
the original sound

Send postcard for illustrated leaflet to Dept SS
Acoustical Manufacturing Co. Ltd., Huntingdon, Tel: (0480)

QUAD is a Registered Trade Mark.



The ubiquitous SM53.

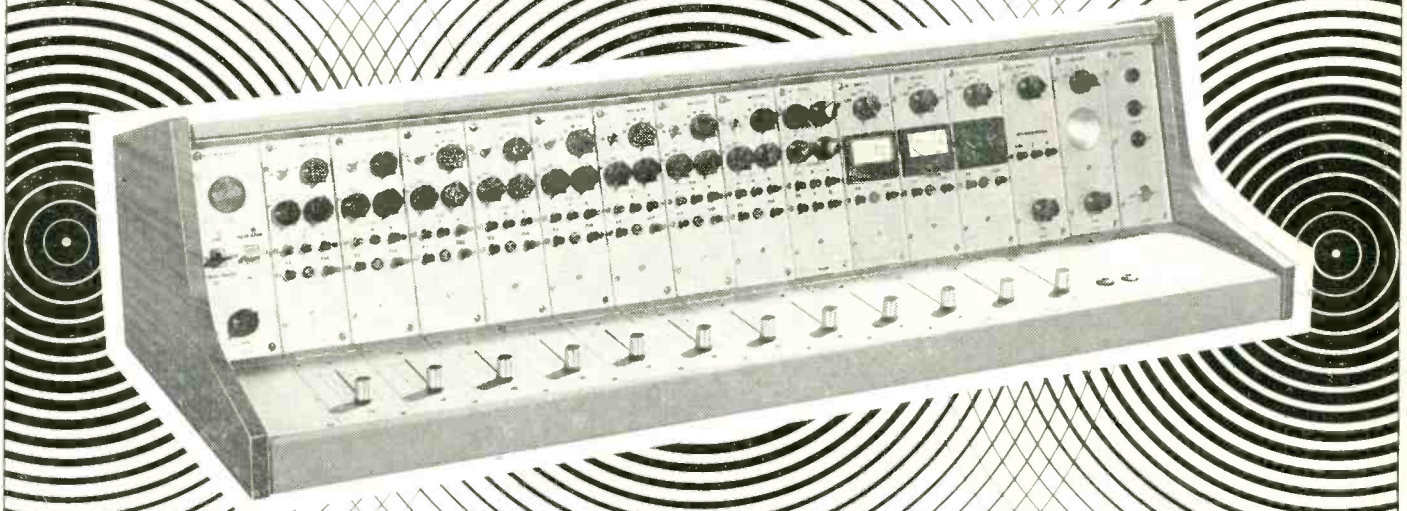
The *Shure SM53* professional unidirectional microphone is seen with increasing frequency in the best of company because it affords eight distinct performance advantages: (1) a wider front working angle with uniform tonal quality; (2) effective noise rejection through a true cardioid pickup characteristic; (3) a built-in shock mount for effective mechanical noise isolation; (4) extraordinary ruggedness for performance consistency after severe shocks; (5) a superior hum rejection system; (6) an integral breath "pop" filter; (7) a minimized proximity effect for constant tonal quality; and (8) full field serviceability. Interested?

Shure Electronics Limited
84 Blackfriars Road
London SE1 8HA, England

SHURE

audix
SOUND SYSTEMS AND ELECTRONICS

MODULAR AUDIO MIXER



SERIES MXT-800

The MXT-800 series of audio mixing modules can be supplied to form compact 2 or 4 group mixers suitable for use in local broadcast and the smaller recording studios. Each mixer is custom built and can incorporate P.P.M. or V.U. metering, and additional master output group, limiter, talkback, monitor, echo, oscillator, pan, and line equaliser modules.

Overall mixer specification:–

Frequency response:–	±0.4dB 20Hz–20KHz including input and output transformers.
Distortion:–	Typically 0.02% at normal levels. Less than 0.1% 20Hz–20KHz at +18dBm.
Noise:–	Microphone channels:– noise factor less than 2dB ref. 600 ohms. All other inputs:– –75dBm.
Gain:–	Maximum system gain, microphone 100dB. Line 20dB.

audix

MANUFACTURERS OF SOUND SYSTEMS AND ELECTRONICS

AUDIX BB LIMITED
STANSTED · ESSEX
TELEPHONE: STANSTED 3132/3437 (STD 027-971)

WHEN STUDIOS CONSIDER
A TOP QUALITY
DYNAMIC MICROPHONE ...

... IT'S STILL THE AKG

D202

Demonstrations without obligation available on all
AKG professional microphones and reverberation units.

FOR FULL INFORMATION CONTACT:

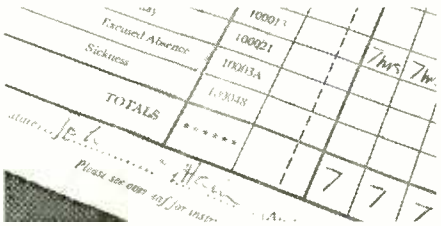
AKG EQUIPMENT LTD.
182/4 Campden Hill Road
Kensington London W8 7AS
Telephone 01·229 3695.

AKG

The simple case for using Scotch Magic Transparent Tape

Ordinary transparent adhesive tape

Very visible. Ordinary tape makes a very visible join and spoils the appearance of the item.



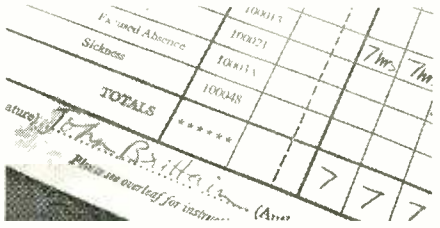
Difficult to write on. Because of its shiny surface ordinary tape is difficult to write on.

"Ghost" effect on copies. Ordinary tape gives a ghost effect on copies and photographs making the subject underneath difficult to read.

Non-permanent. Ordinary tape shrinks and yellows with age leaving an unsightly black line round the edges. It also tends to crinkle and peel off if exposed to moisture.

Scotch Magic Transparent Tape

Almost invisible. Magic Transparent Tape is much less obvious. It tones in with the background so the join becomes almost impossible to spot.



Easy to write on. Magic Transparent Tape is easy to write on—ballpoint and pencil reproduce perfectly. You can type on it too.

"Ghost-free" copies. You get perfect copies with Magic Transparent Tape. The taped section is just as legible as the rest.

It's permanent–so it won't shrink, discolour or peel off. Magic Transparent Tape isn't affected by sunlight, moisture or temperature change. It stays just the way you stick it down no matter how long you leave it.

You notice the improvements. Not the tape.

If you would like a free sample of Scotch Magic Transparent Tape, fill in this coupon and send it to: Commercial Trades Marketing, 3M United Kingdom Ltd., 3M House, Wigmore Street, London, W1A 1ET.

Name

Company

Position

Address

SS/4/73

3M

3M and Scotch are trademarks
3M 2086

NEWS

Nixon administration attack public television

A PLAN to strip the American Public Broadcasting Service of its responsibility for program production and scheduling was disclosed recently by the board of the Corporation for Public Broadcasting. This presidentially appointed body intended to restrict the network to relaying programs among the 232 public television stations. Announcing the plan, Mr Henry Loomis (CBP president) indicated that he had the support of the Nixon Administration whose disapproval was aroused by discussion programs such as 'Washington Week in Review' which the Administration consider 'too liberal'. The Administration were also keen to see the removal of Mr William Buckley, a strongly 'right wing' broadcaster who had in turn criticised Mr Richard Nixon's policies as being 'too liberal'.

Mr Loomis denied that the Nixon Administration had given way to pressure from commercial broadcasters. He admitted that, prior to becoming president of the Corporation Public Broadcasting last November, he had never watched a public television program.

The chairman of the Public Broadcasting Service, Mr Robert Schenkkan, has since commented that the decision would not be acceptable to the licensees. Other PBS representatives added that the dispute might eventually have to be resolved by Congress.

IBA asked to preview sexual education series

THE INDEPENDENT Broadcasting Authority have been asked to preview a Granada Television series 'The Facts Are These' scheduled for broadcast to schools during 1973. The series, produced for children of 15 and 16, includes education in venereal hygiene and contraception. The complainant, a Mrs Mary Whitehouse, commented: 'It would appear from statements in the press that the producers are starting from the assumption that premarital sex is more or less normal'.

Attempt to bar BBC play

ATTEMPTS BY relatives of David Lloyd George to obtain an injunction against a recent television play failed to satisfy the Attorney General. The play was produced for the BBC 2 series 'The Edwardians' and was criticised by the former prime minister's nephew, councillor William George. Although he had not actually watched the play, he felt: 'The author relied on completely inadequate sources and was historically very inaccurate. Most attention has been concentrated on my uncle's morals, and alleged association with women. I am surprised that the point has not been raised which stuck most in my gullet. This was the suggestion that Lloyd George, with the knowledge of his wife, commited perjury. The records do not justify the attribution of perjury to him.' Councillor George said he spoke with knowledge of family papers not shown to any outsider since before the 1914-18 war.

Sir Lew Grade bans ATV documentary

AN 80 MINUTE documentary film about Michael Collins, an IRA leader killed 51 years ago, has been banned by Sir Lew Grade from transmission in the United Kingdom. The £10,000 film was written and narrated by the Welsh actor, Mr Kenneth Griffith, who agreed that his film might 'inflame strong passions'. Mr Griffith considers the British Government of the day to have been responsible for the trend of events in Northern Ireland. His film criticised Lloyd George, Winston Churchill and Eamon de Valera for their actions at the time.

Taste and standards

'TASTE AND Standards in BBC Programs' is the title of a pamphlet issued by the BBC to all its producers during February. The 11 page guide discusses cases of bad language assumed to have given offence to viewers and listeners, selecting as examples: *bl**dy*, *bl**ding* and *G*d*. These, the pamphlet declares, have different meanings for the older and younger generations. An example of 'excessive nudity' was given as a scene in the historical series *Elizabeth R*; a naked girl leaving the bed of the King of France. Portraying the bedroom habits of monarchs in the Tudor period was considered to contribute little to historical understanding.

Granada abandon Poulsen documentary

AFTER HAVING their 60 minute documentary 'The Friends and Influence of J. L. Poulsen' banned twice by the Independent Broadcasting Authority, Granada finally withdrew the production at the end of January and began preparing a new and updated version. This was to be presented to the IBA during March. Mr Denis Forman, joint managing director of Granada, said Granada's lawyers (Goodman Derrick & Co) 'passed the program as suitable after the closest scrutiny that I have ever seen a program subjected to, and we understand there were no objections from the IBA lawyers'. The IBA had apparently stopped the program primarily because they felt it should have given certain people mentioned in the Poulsen bankruptcy proceedings more opportunity to defend themselves against statements made in court and reported in the film. However. such an opportunity had in fact been extended to all those mentioned in the film (excluding Mr Reginald Maudling and Mr John Cordle who had already declined to make public statements). The majority had declined.

On February 5, production staff connected with the documentary were supported by other Granada, Thames TV and Midlands ATV staff in a 30 minute television blackout as a protest against the IBA ban.

The Maple Leaf-four

Value added tax

READERS ARE reminded that prices quoted in this issue may become subject to Value Added Tax from the beginning of April.

76 ▶

A Nigerian student training in educational broadcasting techniques at the London studios of the Centre for Educational Development Overseas. A Leevers-Rich E200 is being used to produce a tape program for children. Most of the CEDO students are qualified teachers and receive instruction in script-writing, presentation, editing and system operation. Courses last from ten days to 16 weeks.

getabitmore.

472 Functions (Gain, switch and position control)

100 Millisecond scan rate

Bi-phase digital encoding with SMPTE time coding compatibility.

Exclusive Leveloc[tm] updating facility

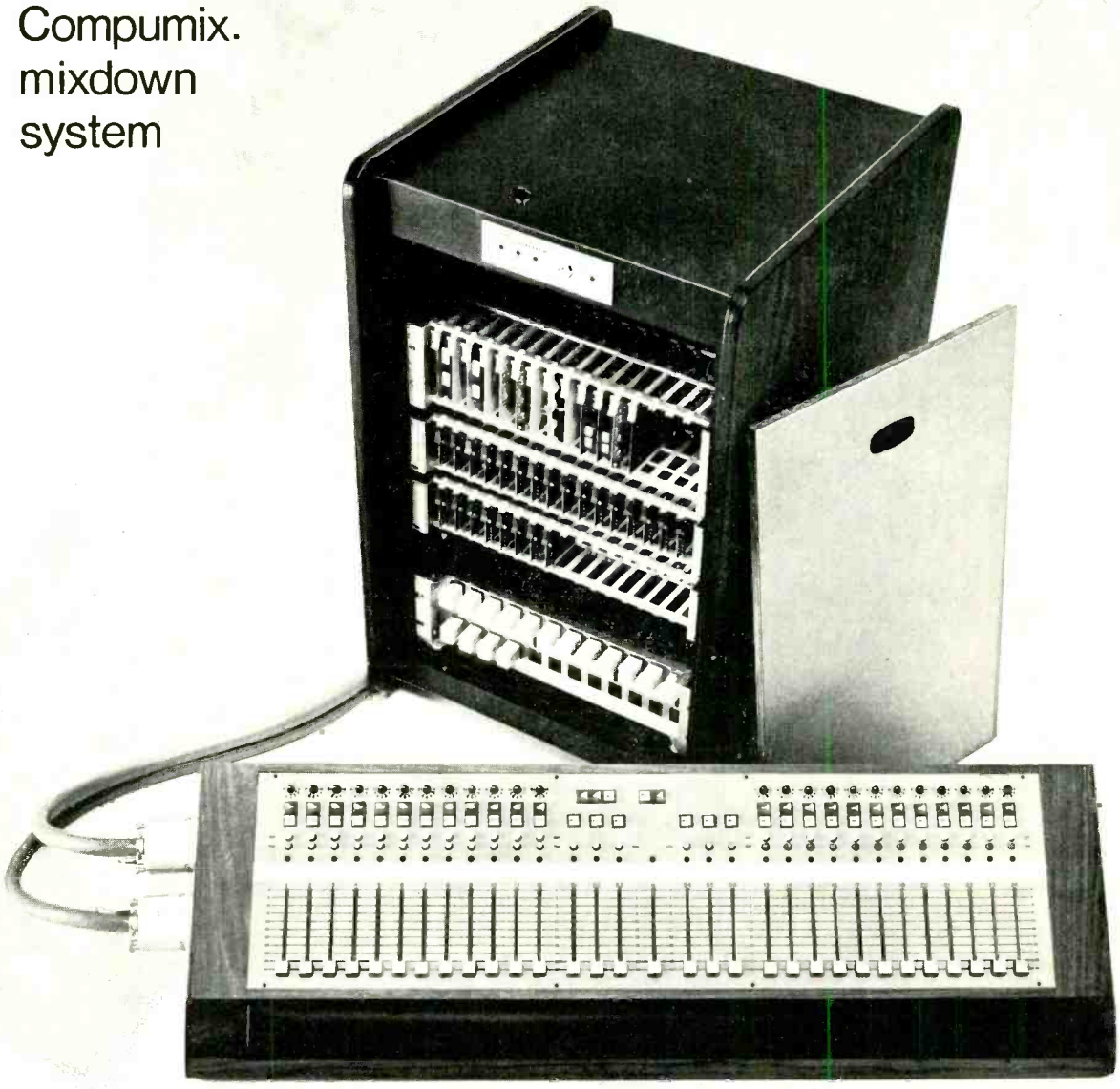
VCA resolution ± .1 dB (O-45dB)

Dropout and splice immunity (Buffer memory)

Expandable and fully compatible function encoding

Tape machine speed variation tolerance ±15%

Compumix. mixdown system



quad/eight electronics

11929 Vose Street □ North Hollywood, California 91605 □ 213/764-1516

NEW EQUIPMENT

Variable speech rate unit

LEXICON OF Massachusetts are making a device which provides pitch-independent time control of recorded speech and can be used to synchronise a script in any situation. Voice signals are recorded on a cassette and then converted into digital signals. These are passed through circuits which compress or expand them, after which they are reconverted to analogue form. The speed of speech can thus be varied between 0.5 and 2.5 times that of the original with a frequency range of 50 Hz to 11 kHz. The equipment measures 356 x 330 x 152 mm, weighs 8.2 kg, and will operate from 50 or 60 Hz mains at 110/230V.

Agents: F. W. O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.

Hybrid audio module

AN AC CONTROL module with a wide variety of suggested applications is now being produced by Apollo Electronics. The *HM80* module is compatible with a standard 24 pin DIL ic socket and operates from 4.5 to 24V negative ground. Gain may be varied across 80 dB with ±0.5 dB linearity within the control range. Total harmonic distortion under normal operating conditions is specified as 0.1 per cent, frequency response being 3 Hz to 200 kHz ±0.5 dB. Application reports (available on request) include measuring equipment, subsonic Alfa wave amplifiers, microphone and tape amplifiers, equalisers, telephone simulators and voltage controlled filters. **Fig. 1** shows a suggested vc square wave oscillator configuration and **fig. 2** a compressor/limiter giving up to 20 dB compression.

Manufacturers: Apollo Electronics, 96 Mill Lane, London NW6 1NQ.

Budget videotape

WITH THE basic price of 12.5 mm videotape still around £10 per 730m, considerable interest may be aroused by Dixons announcement of *Dixtec CCTV* tape at £5.50. Quality is claimed to be equal to the dearer brands.

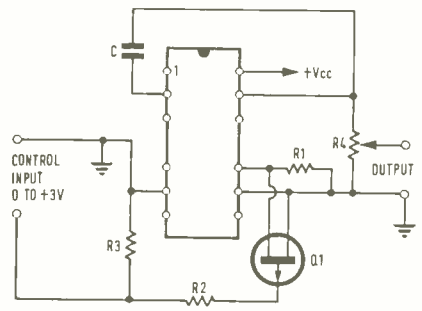
Agents: Dixons Technical Ltd, 3 Soho Square, London W1.

High power Spendor

A LARGER AND more powerful monitor loudspeaker has been introduced by Spendor: the *BC3*. Measuring 800 x 400 x 400 mm, the new model is rated at 70W peak program and has a nominal impedance of 8 ohms. Frequency range is 30 Hz to 20 kHz (50 Hz to 14 kHz ±2.5 dB). Four units are incorporated, 304 and 203 mm diameter Spendor drivers plus *HF1300* and *HF2000* Celestions. The *BC3* is expected to cost £150.

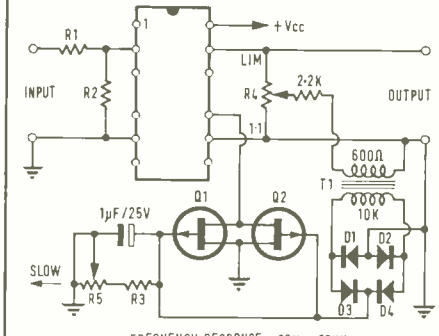
Manufacturers: Spendor Audio Systems Ltd, Kings Mill, Kings Mill Lane, South Nutfield, Redhill, Surrey.

FIG. 1 VC SQUARE WAVE OSCILLATOR



FREQUENCY CONTROL RANGE. 1 TO
FOR C = 1000pF, f = 1-10KHz
FOR C = 0·01μF f = 100Hz-1KHz
R1. 18K, R2 . 10K, R3 100K
R4.. 10K LOG OUTPUT LEVEL CONTROL
Q1 .. 2N3820 FET

FIG. 2 0 TO 20dB COMPRESSOR LIMITER



FREQUENCY RESPONSE 20Hz-20KHz
THRESHOLD LEVEL -10dBm, 250mV
COMPRESSION RANGE . 20dB
GAIN BELOW THRESHOLD UNITY
OUTPUT LEVEL AS LIMITER 0dBm
COMPRESSION RATIO . 1:1 TO LIM .
MINIMUM OPERATING SUPPLY 9V DC
R1 47K, R2 1·5K, R3 100K
Q1, Q2 2N3820 FET
T1 GARDNERS MU7526 OR EQUIVALENT
D1, D2, D3, D4 TI 1S44 SILICON DIODES
R4 . 5K LOG. COMPRESSION RATIO CONTROL
R5 1M LIN RELEASE 0·1 - 5 SEC

Audio modules

A NEW SERIES of audio modules is now being manufactured by Key Electronics. They are constructed on 89 x 64 mm glass-epoxy printed circuit boards and are available in completed or kit form. *MIC-A/St/1* is an fet input stereo microphone amplifier selling at a basic £15.20 completed and tested. Above ten off, the price falls to £12.90, from 25 off to £11.60, and from 100 off to £10.65. The kit starts and ends at £8.50.

Comparable price structures relate to the other five modules. Type *MIX/St/1* is a 10 + 10 input unity gain stereo mixer at £7.70. Type *VU/GPA/St/1* is a stereo VU drive and general purpose amplifier at £5.40. The *LDA/1* is a 600 ohm line drive amplifier offering up to +19 dBm output at £8. A ppm driver to BBC specification, the *PPM.1a* costs £17 excluding movement. Lastly, *TC/St/1* is a modified Baxandall stereo tone control (±12 dB at 100 Hz at 10 kHz) at £11.45.

Manufacturers: Key Electronics, 16 Gainsborough Road, Queens Park, Bournemouth BH7 7BD, Hampshire.

Multiposition slide switches

A RANGE OF slide and pushbutton switches manufactured by Jeanrenaud is now being marketed by ITT Europe. Model *CL6* offers up to six positions as single pole two, three, four, five or six way; two pole two or three way; or three pole two way. The *CL12* similarly offers a maximum of 12 positions in all formats between single pole 12 way and six pole two way. Versions with 3 μm gold on brass contacts are available for industrial applications, with a specified life of 50,000 operations. For other purposes, silver-plated brass contacts offer a 15,000 operation expectancy. Also in the Jeanrenaud range, 19 x 19 mm switch modules available with push and push/push actions. The *TFB* module has a maximum rating of 20 mA at 24V dc, insulating resistance being at least 10,000M ohms.

Agents: ITT GC Europe (EPD), Edinburgh Way, Harlow, Essex.

Sela mixers and Advent cassette recorders

SELA MINIATURE audio mixers, designed to operate directly from Nagra recorders, are now being distributed in Britain by Cintron. Manufactured in Sweden by Svenska Elektronik, the Sela *2880* has four inputs to suit balanced capacitor or dynamic microphones (50 to 200 ohms) and can also be switched to 0 dB line (10k ohms). Output is two channel feeding the Nagra (50 mV into 2.5k ohms) or program line (3V into 600 ohms). Equalisation comprises ±10 dB at 100 Hz and 10 kHz (2 dB steps)

26 ▶

The Grandmaster

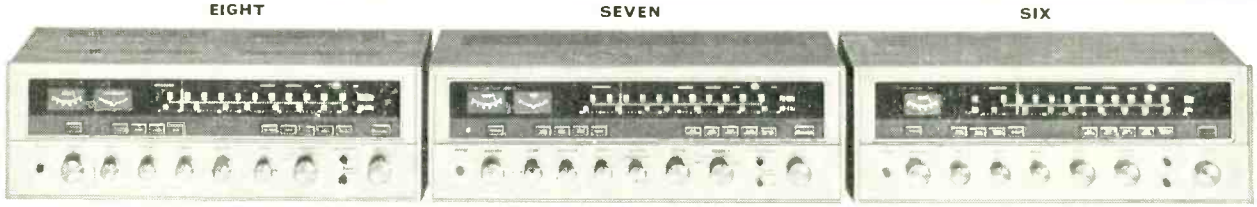
Sansui, the grandmaster of the stereo-world, just made three new bold moves. The EIGHT. The SEVEN. The SIX. Moves which get Sansui once more into the forefront of imaginative audio engineering. These new items unite, for the first time, the outstanding characteristics of different type components resulting in an astonishing high level of versatility and performance.

For detailed and free information on these new Sansui items please contact the addresses below.

Sansui	Continuous RMS power at 8Ω	Power Bandwidth (HF)	Total Harmonic distortion	FM Sensitivity (IHF)	Selectivity
EIGHT	60/60 watts	10-40.000 Hz	less than 0,3%	1,7μV	better than 60 dB
SEVEN	47/47 watts	10-50.000 Hz	less than 0,3%	1,8μV	better than 60 dB
SIX	39/39 watts	10-50.000 Hz	less than 0,3%	2 μV	better than 60 dB

Sansui

EIGHT SEVEN SIX



England: VERNITRON LTD., Thornhill Southampton S09 QF - Tel.: Southampton 44811 □ Ireland: INTERNATIONAL TRADING GROUP LTD., 5 Cope Street. Dame Street - Dublin 2 □ West Germany: COMPO Hi-Fi G.M.B.H., Reuterweg 65 - 6 Frankfurt am Main □ France: HENRI COTTE & CIE, 77 rue J-R. Thorelle, 77 - 92-Bourg-la-Reine □ Luxembourg: LUX HI-FI, 3 rue Giesener □ Austria: THE VIENNA HIGH FIDELITY & STEREO C°, Burggasse 114 - 1070 Wien 7 □ Belgium: MATELECTRIC S.P.R.L., Boulevard Léopold II, 199 - 1080 Brussels □ Netherlands: TEMPOFOON N.V., Kapitein Hatterastraat 8, Postbus 540 - Tilburg □ Greece: ELINA LTD., 59 & 59A Trilis Septemvriou Street - Athens 103 □ Italy: GILBERTO GAUDI s.a.s., Corso Di Porta Nuova 48 - Milano □ Norway: FRIGO NORSK A.S., Eilert Sundtsgatan 40 - Oslo 3 □ Sweden: MAGNETON, Sveavagen 61 - 113.59 Stockholm □ Denmark: QUALI-FI INGENIØRFIRMA, Christiansholms Parkvej 26 - 2930 Klampenborg □ Finland: AUDIOVOX OY - Kornetintie 2 - Helsinki 38 □ Cyprus: ELECTROACOUSTIC SUPPLY C° LTD., P.O. Box 625 - Limassol □ Portugal: CENTELEC LDA, Avenida Fontes Pereira de Melo 47, 4.odto - Lisboa 1 □ Malta: R. BRIZZI, 293 Kingsway - Valletta □ Switzerland: SONOVOX AG, Wallstrasse 11 - 4051 Basel □ Canary Islands: R. HASSARAM, Calle la Naval 87 - Las Palmas □ South Africa: GLENS (PTY) LTD., P.O. Box 6406 - Johannesburg □ SANSUI AUDIO EUROPE S.A., Diacem Bldg, Veslingstraat 53/55 - 2000 Antwerp, Belgium □ SANSUI AUDIO EUROPE S.A. FRANKFURT OFFICE, Reuterweg 93 - 6 Frankfurt am Main West Germany □ SANSUI ELECTRIC C° LTD., 14-1, 2-chome, Izumi, Yoginami-ku - Tokyo 168 - Japan

with low-pass filtration at 20 kHz (–5 dB) and 32 kHz (–18 dB). A speech filter provides 18 dB per octave cut below 100 Hz. Dimensions are 360 x 320 x 550 mm. The *2880* weighs 6 kg and costs £336.

Cintron are also handling the Advent *201* two channel cassette recorder. This employs a Wollensak tape transport and Dolby B noise reduction system and sells for £165.

Agents: Cintron, Grove House, 551 London Road, Isleworth, Middlesex.

Visual track analyser

SELLING AT £8.95, the Willis *Magna-See* kit comprises a tin of magnetic fluid, a developing bath, magnifying lens, tape cleaning fluid, and a reel of low-tack tape. After a recorded tape has been immersed in the bath, and surplus fluid allowed to evaporate, magnetic powder is deposited on the recorded tracks which are then rendered visible. The powder may subsequently be removed or transferred to paper by means of the low tack tape.

Manufacturers: Willis Computer Supplies Ltd, PO Box 10, Southmill Road, Bishop's Stortford, Hertfordshire.

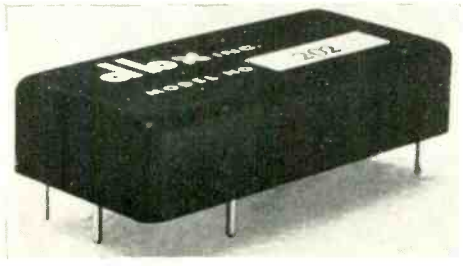
Ppm boards

FIBREGLASS PRINTED circuit boards for the peak program meter circuit described by Hugh Walker in our January 1973 issue are now available from Surrey Electronics, 24 High Street, Merstham, Surrey. The 70 x 65 mm boards are fitted with gold plated eight-way edge connectors and cost 75p. Complete kits for the ppm driver are available at £8, including six cermet trimpots, six 5 per cent zeners, four *BC109C* and the gold edge connector. Surrey Electronics also offer the circuit assembled and tested at £12. Suitable meters are 600 ohm 1 mA left hand zero such as the Ernest Turner *642-PPM* at £9. All prices include postage and packing.

Linear vca

NEW FROM dBx, the *202* voltage controlled amplifier comes encased in a 50 x 25 x 12.5 mm can with 3 mm gold-plated printed circuit board pins. Gain varies from –100 to +30 dB depending on the applied control voltage. Excellent linearity and unit-to-unit tracking are claimed. Input noise is specified as 6 μV with peak signal levels up to 100V, 20 kHz bandwidth and 0.07 per cent distortion.

Manufacturers: dBx Inc, 296 Newton Street, Waltham, Massachusetts 02194, USA.



Automated cinema projector

AN AUTOMATED PROJECTION system based on a 16 mm *Elf-Lite* projector has been developed by Clewer Audio Visual Services. Initiated from a single pushbutton located in the manager's office or the auditorium, the system follows a preset sequence to dim house lights, mask the screen, fade background music and commence sound and picture. On completion of a 2¼-hour film, the projector rewinds the film in 25 minutes ready for a subsequent program.

Suppliers: Clewer Audio Visual Services Ltd, Suwiley House, 466 Bath Road, Slough, Buckinghamshire.

Acoustic alarm

A HIGHLY PENETRATING audio signal, either frequency or amplitude modulated, is produced by the Cybertone audible warning unit. Equally suitable for fixed or portable applications, the 40 x 46 mm unit is entirely self-contained and is described as highly reliable

since it does not employ make/break contacts. Operating voltage is 12V dc at 20 mA and temperature tolerance is –20° to +55°C.

Manufacturers: A. P. Besson Ltd, St Josephs' Close, Hove, Sussex BN3 7EZ.

Filter module

A NEW AUDIO frequency filter has been announced in the USA by Spectra Sonics. Model *506* can provide three separate outputs from a single input signal, using external switching. Two configurations are available, the high pass *506H* filtering below 40, 70 or 100 Hz. Model *504L* passes below 10, 12.5 or 15 kHz. Quoted frequencies are –3 dB points, rolling off at 18 dB per octave. Card dimensions are 64 x 127 x 13 mm and the US price $69.

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

Dc/ac transvertor

TWO NEW transvertors from Valradio: models *B12/400S* and *C24/500S*. Both are to sell at £197 and have a frequency stability better than ±0.25 Hz at 50 Hz. They are described as suitable for industrial video recorders, film cameras, audio recorders and small computers, up to a loading not exceeding 500W. Model

B12/400S raises 12V dc to 115 and 230V 50 Hz, 400W maximum. The *C24/500S* accepts 24V dc and produces 500W. Each unit incorporates a low level stable oscillator followed by an intermediate amplification stage feeding into output transistors.

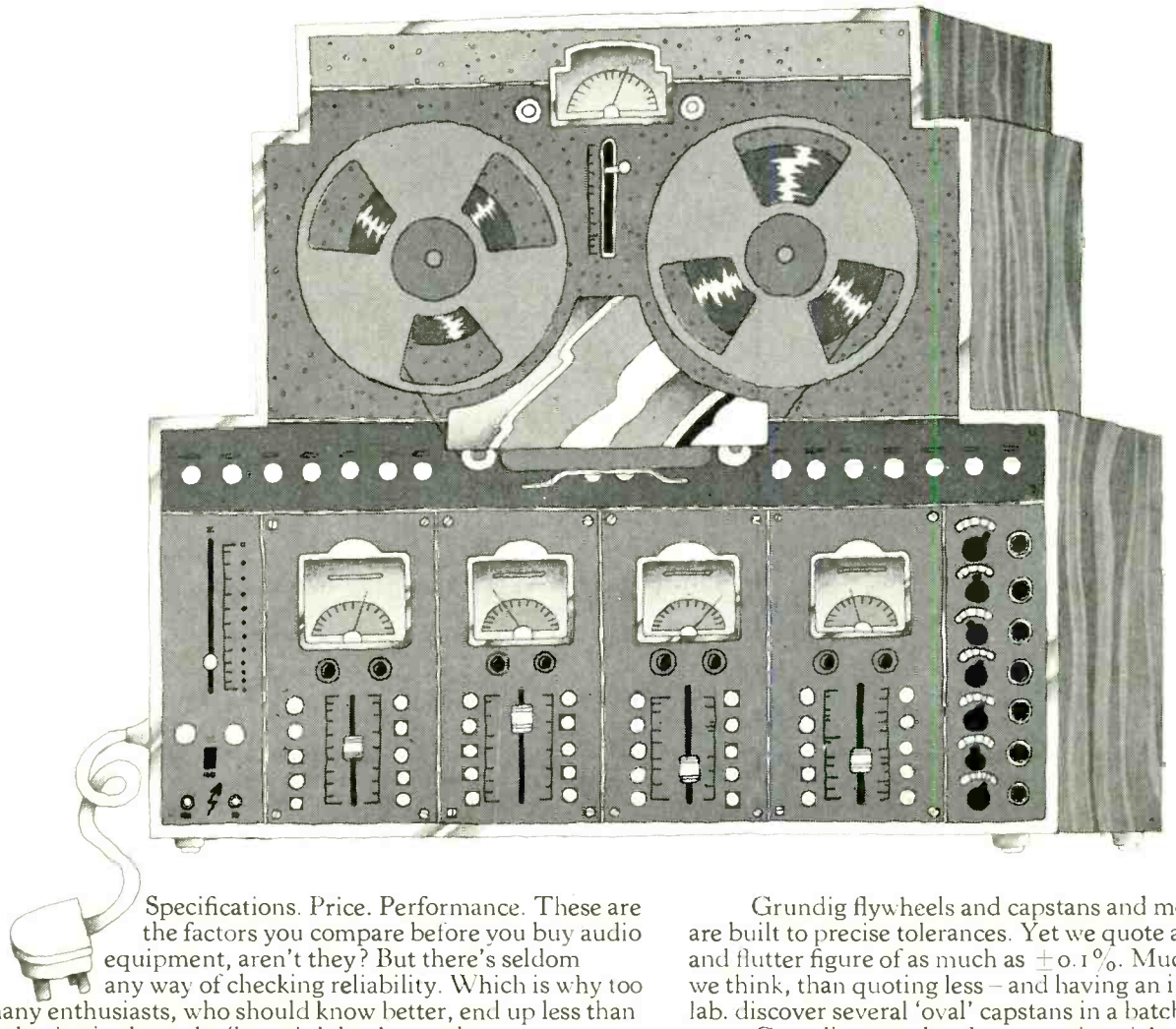
Manufacturers: Valradio Ltd, Browells Lane, Feltham, Middlesex TW13 7EN.

Four channel headphones

ACOUSTIC RESEARCH have been appointed UK agents for Superex, the second largest US manufacturers of headphones. Of particular interest in the Superex range is the model *QT-4B* four channel headset incorporating four acoustically isolated and electronically independent elements. If the principle seems open to question, Superex are unequivocal: 'True four channel sound, with even more spatial drama than stereophones offer'. The *QT-4B*, as illustrated, employs conventional ear clamping configuration and weighs 455 gm. Other headphones in the Superex range are the *PEP77D* mains electrostatic (£56), *PEP79* self-energising electrostatic (£39.90), and a series of seven moving-coil models.

Agents: Acoustic Research International, High Street, Houghton Regis, Bedfordshire.

A 3-head, 30-20,000 Hz, 24 Watt, 4-track stereo, semi-professional, £95 let-down.



Specifications. Price. Performance. These are the factors you compare before you buy audio equipment, aren't they? But there's seldom any way of checking reliability. Which is why too many enthusiasts, who should know better, end up less than enthusiastic about the 'bargain' they've made.

At Grundig we don't believe in publishing fancy figures. We'd rather our machines lived up to their specifications – and continued to do so. For instance our published top end response is 16,000 Hz. But 16,000 Hz it'll stay, long after less hard-headed machines have worn down. Our output power rating is continuous rms power.

And sounds it.

Grundig flywheels and capstans and motors are built to precise tolerances. Yet we quote a best wow and flutter figure of as much as ±0.1%. Much better, we think, than quoting less – and having an independent lab. discover several 'oval' capstans in a batch!

Grundig recorders have no gimmicks, but good reliable mechanism, tape cleaners, and robust, positive and accurate controls.

And sophisticated circuitry, with minimal discrepancy between stereo channels.

So whichever Grundig you buy, it'll give you a lot more than figures to impress your friends.

Eight models to choose from.

GRUNDIG

The difference is incredible

Grundig (Great Britain) Ltd., London, SE26 5NQ

LETTERS

The Ambiguous Watt

Dear Sir, I wholeheartedly agree with your Editorial in the December issue on the 'Ambiguous Watt'.

A letter is not the place to enlarge on whether the phrase 'rms Watts' has any meaning at all but, assuming that most people use it to mean average Watts, one may legitimately ask whether average Watts are an appropriate measure of the output capabilities of an amplifier or of the input capabilities of a loudspeaker. My own opinion is that, except for very specialised applications (for example using an amplifier to drive a capstan motor or using a loudspeaker in sound insulation measurements), one is not interested in the maximum average performance of the device. The really vital factor is that the amplifier should not distort for the largest *instantaneous* power outputs demanded by the signal. I suspect that a workable measure could be built up from consideration of the point where *perceptible* (to be defined carefully in an International Document) voltage (or current) slipping occurs. Let us say that this point gives values of output voltage (or current) swing (peak) of U (or I), then if the load is R we can call the peak output U^2/R (or I^2R). A similar argument can be carried out for loudspeakers.

I am carrying out some experiments on power amplifiers to see what sort of numbers come out when one uses a criterion like the above, and also to see if a *long-term* average (say one hour) power rating would be necessary as well.

In the meantime let us all try to give up using 'Watts—no qualifications at all', 'Watts, speech and music,' 'Genuine rms Watts' (sic), 'Music power,' 'Watts rms delivered to *a* load,' and 'Watts Programme' to list only a few quoted in your December issue.

Yours faithfully, J. M. Bowsher, University of Surrey, Guildford, Surrey.

[*We are not responsible for advertisement copy!* —**Ed.**]

Pointless Curves?

Dear Sir, As editor of a 'consumer audio magazine' whose loudspeaker reviewing policy seems to fit the description offered by John Shuttleworth in his article *Loudspeaker Measurement Parameters* (December), I would like to comment on his remarks. There are two separate issues involved: the usefulness or otherwise of electrical impedance curves, and the extent to which a measured frequency response may be misleading.

On the latter, I happen to believe that loudspeaker design at its best has now advanced to the point where objective measurements of response can correlate quite well with subjective assessments of overall tonal balance. The remaining doubts here concern the variety of ways in which measurements may be made, each 'legitimate' and with its own rationale, but all giving different results in terms of raggedness of response, if not in general balance. (See 'What Price Loudspeaker Response Curves?' by Ralph West, *Hi-Fi News & Record Review*, September 1971.) When we eventually have a method of measurement which is: (1) definitely repeatable; (2) may be applied to all loudspeakers; and (3) is *not open to reasonable dispute*—then we shall start publishing frequency response curves with our reviews.

Regarding impedance curves, I confess that we had not assumed our readership to be so ignorant as to confuse electrical impedance at the terminals with frequency response in the air, but Mr Shuttleworth's fears may apply in some cases and we are now adding a warning note to the curves. Our thanks for this suggestion.

Impedance curves are not, I would suggest, quite as pointless as Mr Shuttleworth implies. Modern speakers frequently descend to 3 ohms or less at some frequencies, and in consequence more than a few amplifiers are not able to give of their best. Also, the phase-shifts in consumed current arising from reactive loads (represented by steep slopes on the impedance curve) can sometimes do curious things even with highly respected amplifiers, a fact discovered to everyone's puzzlement and distress at several audio exhibitions. Amplifiers are not yet by any means as perfect as is commonly imagined—unless working into a 10 ohm pure resistance! Yours faithfully, John Crabbe, Editor, *Hi-Fi News & Record Review*, Link House, Dingwall Avenue, Croydon CR9 2TA.

Loudspeaker impedance

Dear Sir, One point John Shuttleworth failed to mention in his December article on loudspeaker measurements: Despite the tendency to regard DIN standards as inadequate, in the area of speaker impedance tolerances they are really quite tight. In fact all the speakers mentioned—Spendor, Rogers and the Quad ESL—would probably fail to meet it!

Yours faithfully, Reginald Williamson, Bay Cottage, 18 Unthank Road, Norwich NOR 28E.

Specifications

Dear Sir, Your December issue Editorial is concerned with a subject about which I feel fairly strongly. I am a confirmed supporter of properly informative and accurate specifications, and a pre-requisite of these is a standardised system of methods of measurement. It is not generally recognised in this country that these already exist for audio equipment, at least for amplifiers, loudspeakers and now record playing units, as well as radio receivers and soon radio tuners. I find it very surprising that, in spite of the work put in by industry, consultants and the staff of the British Standards Institution, there appears to be a positive aversion to using these standards, which lay down methods of measuring and expressing the result of, among other things, manufacturers specifications. In case anyone *should* be motivated to look at them, the reference numbers are BS3860, BS2489, BS4850 and BS4054. (Tuners will be included in a supplement to BS4054 to be published probably in 1973.)

It may be objected that these specifications are not internationally accepted and there is some truth in this, for, if UK engineers do not promote their use, who will? There is no such reticence on the part of our German counterparts. DIN standards themselves are not easy to use for two reasons. One is that they are rarely self-contained, making many cross-references to other DIN standards. For a full use of the well-known DIN 45.500, for instance, about 120 other DIN standard documents are required, excluding test records and tapes, and some of these documents appear to be permanently in draft form and not generally available. Also, many are only available in German and anyone who has seen the mess even quite a competent non-technical translator can make of a technical document will understand what that implies. Anyone unconvinced, who has access to IEC documents, might look at 29B (Germany) 20. The translation here was almost certainly under strict technical control but there are things you can write in German that are nonsense in English.

It may also be suggested that some of the BSI standards are out of date. Again, there is some truth in this and the reason is that the International Electrotechnical Commission are gradually publishing two massive Recommendations, Publications 315 (covering all types of radio receiver) and 268 (sound system equipment), together with corresponding documents concerning tape and disc players as units rather than system components. When these are published in full, or nearly so, the appropriate BSI committees will consider bringing the corresponding British standards into line with the IEC recommendations, as is normal BSI policy.

Regarding 'The Ambiguous dBm', the situation was further changed at the recent IEC SC29B meeting in Oslo, and the critical wording in Publication 268.2 is to be changed. The basic reason for this is that abbreviations for units are the responsibility of IEC TC25 and it is that committee who cannot accept the 'dBm' abbreviation, quite apart from the confusion explained so clearly by your distinguished contributors. The chairman of TC25 attended the SC29B meeting and, after much discussion, the 'V7' proposal was not accepted. The only admissible expression was 'dB (0.775V)'. Those who support the dB(V) as a preferred reference feel that the very clumsiness of the expression will cause it to fall into disuse. Yours faithfully, J. M. Woodgate, 28 Adelaide Road, Chislehurst, Kent BR7 6BB

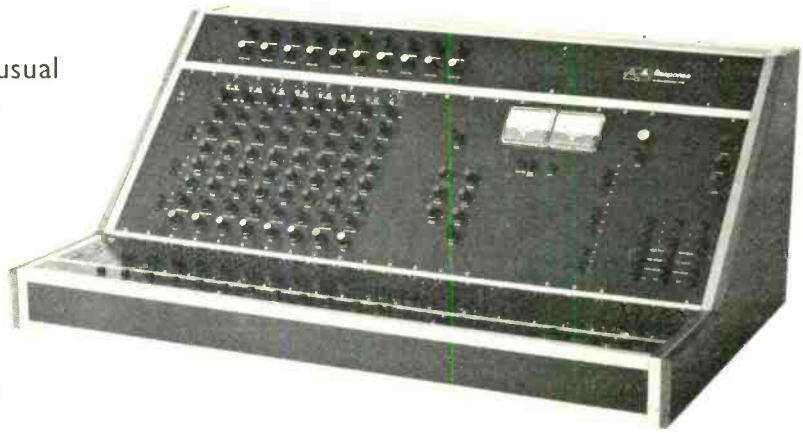
Response

by Audio Applications Limited

SMS SERIES MIXERS

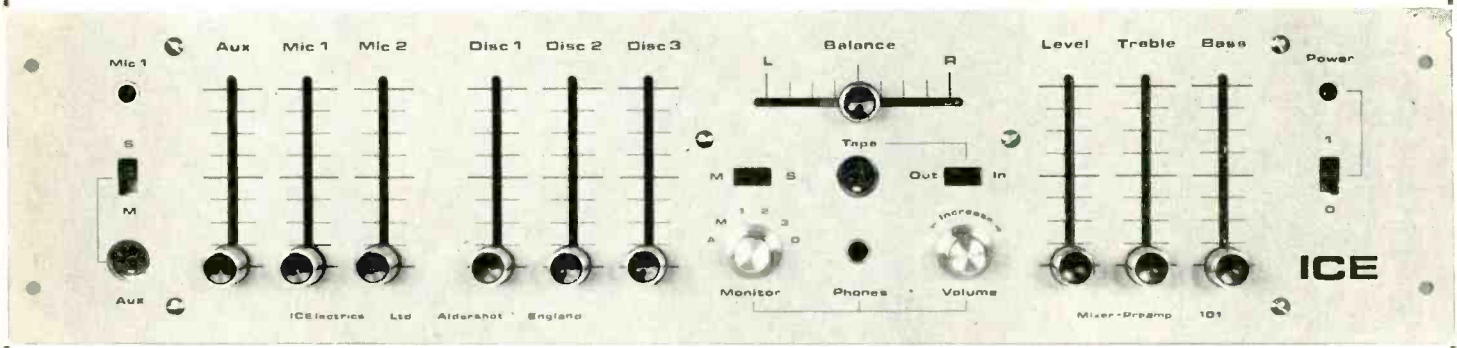
In addition to providing all the usual facilities of a transportable studio quality mixer, we have included exceptional monitoring facilities, making this model a real pleasure to use.

Alastair Chater would like to tell you all about our various mixers. Why not 'phone him?

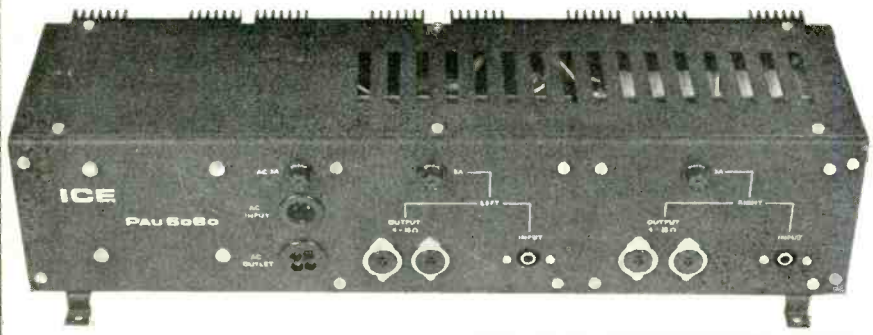


AUDIO APPLICATIONS LIMITED, Kensington Barracks, Kensington Church Street, London, W.8.
01-937-6615

SIX-CHANNEL STEREO DISCOTHEQUE MIXER



BUILD YOUR TOP QUALITY DISCO USING THE SMP 101 MIXER AND THE PAU RANGE OF STEREO POWER AMPLIFIERS.



PAU 60+60 60 Watts RMS Per Channel
PAU 30+30 30 Watts RMS Per Channel
(NOTE: The SMP 101 will drive 4 Power Amps. Total 480 Watts.)

Console Kits also available (2 or 3 decks)

Hear a demonstration at our showroom or send for details.

ICElectrics Ltd.,
15 Albert Road,
ALDERSHOT (0252-28513)
Hants.

TRADE INQUIRIES WELCOME

PATENTS

THE FOLLOWING list of Complete Specifications Accepted is quoted from the December and January issues of the Official Journal (Patents). Copies of specifications may be purchased at 25p each from The Patent Office, Orpington, Kent BR5 3RD.

December 6, 1972

1303021
Sansui Electric Co Ltd
Sound reproduction system

1303036
Akai Electric Co Ltd
Video tape recorders

1303054
Freeman, R J and Freeman, H
Information reproducing system

1303119
Sony Corporation
Magnetic recording and reproducing apparatus

1303181/2/3/4
Computer Optics Inc
Display systems

1303203
AKG Akustische U Kino-Gerate GmbH
Reverberation system

1303207
Brown Boveri & Co Ltd
Electron tube protection apparatus

1303268
Socias, A
Cassette tape recorders

1303277
Bell & Howell Co
Power transmission mechanism

1303423
Booth, B H
Aid for the teaching of music

1303518
Sonicaid Ltd
Ultrasonic detection instruments

1303602
Shackman, A
Loudspeaker assemblies

1303612
Brown Ltd, S G and Ibbotson, T D
Ear defender headsets

1303621
Messerschmitt-Bolkow-Blohm GmbH
Directional wireless systems

1303657
Muirhead Ltd
Facsimile apparatus

1303694
International Business Machines Corporation
Magneto-optic transducing system and method for reading superimposed magnetic recordings

1303719
Sony Corporation
Magnetic recording and reproducing apparatus

1303720
Standard Telephones & Cables Ltd
Gain control circuits

1303792
Gabr, S Z M
Electro acoustic transducer

December 13, 1972

1303808
Plessey Co Ltd
Speech analysers and synthesisers

1303867
Matsushita Electric Industrial Co Ltd
System for processing music to produce a tremulant effect

1303945
Mattel, Inc
Disc record drive

1304030
Libbey-Owens-Ford Co
Antenna type windshields and methods of producing them

1304050
Philips Electronic & Associated Industries Ltd
Circuit arrangement for producing a marker in a television image

1304061
Hitachi Ltd
Chrominance signal generator having a patterned filter

1304091
Staar SA
Tape recording and/or playback apparatus

1304104
Philips Electronic & Associated Industries Ltd
Receiver tuning arrangements

1304118
AKG Akustische U Kinogerate GmbH
Apparatus for producing artificial reverberation

1304134
Nippon Electric Co Ltd
Magnetic recording - reproducing system

1304210
Texas Instruments Inc
Target scanning camera

1304213
Handland (Photographic instrumentation) Ltd, John
High speed cameras

1304221
Eastman Kodak Co
Film snubber for a sprocketless motion picture projector

1304268
Standard Telephones & Cables Ltd
Image display device

1304276
Ricoh KK
Magnetic recording and reproduction

1304288
Farnell-Tandberg Ltd and Dakin A W
Production of sound tracks on cinematographic film

1304363
EMI Ltd
Recording apparatus

1304383
RCA Corporation
Amplitude control circuits

1304461
RCA Corporation
Multiple channel display system

1304492
Philips Electronic & Associated Industries Ltd
Circuit for producing an aperiodic vibrato signal

1304533
Zenith Radio Corporation
Chroma amplifier for a colour receiver

1304554
RCA Corporation
Liquid crystal display device

1304564
S-Atlas-Werke GmbH
Magnetic tape cassette recorder

1304594
Western Electric Co Inc
Acoustic optic devices

1304606
Western Electric Co Inc
Single sideband modulation using digital filters

1304613
Kolbel, G F
System for the presentation of a visual display with accompanying sound

1304637
Columbia Broadcasting System Inc
Scanning apparatus

1304648
Proll Modling Co Inc
Musical instrument

December 20, 1972

1304774
Palmer, W W
Tone control circuits

1304801
Tesla Narodni Podnik
Electrostatic spiral transducer

1304910
Standard Telephones & Cables Ltd
Pulse regenerator equalisation

1304929
International Business Machines Corporation
Meth :d and apparatus for synthesising vocal sounds

1304988
Siemens AG
Echo compensation circuits

1305075
Mullard Ltd
Electromagnetic horns

1305100
Borg-Warner Corporation
Recording systems

1305101
Bruce Diamond Corporation
Reproducing stylus

1305111
Western Electric Co Inc
Visual display apparatus

1305117
British Aircraft Corporation Ltd
Antennae for transmitting and receiving radiation

1305148
Sony Corporation
Magnetic erasing head

1305234
International Standard Electric Corporation
Convergence circuits

1305244
Toho Machine Co Ltd
Mounting of tone arms for record playing units

1305303
AKG Akustische U Kino-Gerate GmbH
Capacitor microphone

1305305
Licentia Patent-Ver-Waltungs-GmbH
Uhf communication systems

1305307
RCA Corporation
Reduction of tape stiction

1305331
Sony Corporation
Magnetic recording and reproducing apparatus

1305359
GABR, S Z M
Arrangements for cancelling feedback

1305456
Heil O
Electroacoustic electromagnetic transducer

1305480
Siemens AG
Stearable antenna arrays

December 29, 1972

1305506
ITT Industries Inc
Differential pressure units

1305622
Dolby Laboratories Inc
Signal compressors and expanders

1305635
Sony Corporation
Video signal generating apparatus

1305683
International Standard Electric Corporation
Internal delay stabilisation device for transponder

1305735
Multitone Electric Co Ltd
Communications systems

1305801/2
General Electric Co
Information storage using a conductor-insulator-semiconductor structure

1305819
Post Office
Method and apparatus for detecting a speech signal in the presence of noise

1305891
Bolkow, L
System for radio transmission of guidance commands

1306130
Nippon Hoso Kyokai
Converting equipment of standard television broadcasting signals

1306178
Standard Telephones & Cables Ltd
Television video signal processor

1306194
AKG Akustische U Kino-Gerate GmbH
Spring system

1306197
Bell & Howell Co
Motion picture projector with film cartridge support assembly

1306366/7
Communications Patents Lyf
Wired broadcasting systems

1306376
Thomson-CSF
Bandwidth compandor system

32 ▶

BEYER DYNAMIC

M 69 M 69 SM

Unidirectional Studio Microphone

The M 69 is an unusually sensitive microphone with outstanding cardioid characteristics. It makes high-quality transcription possible even under acoustically unfavourable conditions. The well-balanced response curve of the microphone maintains the highest fidelity in the reproduction of speech and music. Version SM with VOICE-OFF-MUSIC switch.

Specifications:

Frequency Response: 50-16000 Hz. Output Level at 1 kHz: (0 dbm ≙ 1 mW per 10 μbar) 0.24 mV/μbar (—50 dbm) Polar Pattern: Cardioid Output Impedance: 200 ohms. Connections: 3-pin plug T 32621+3=200 ohms, 2=ground. Dimensions: 6.7" x 0.9"ø, head 1.7"ø Also available with Cannon connector XLR-3-50T

M 88 N

Dynamic Moving Coil Microphone

With hypercardioid characteristics and unusually high sensitivity. Due to its very good front to back ratio it is less subject to feedback and provides excellent discrimination against unwanted sound. It is used by broadcasting and TV-studios, recording artists, bands and instrumentalists.

Specifications:

Frequency Response: 30-20000 Hz. Output Level at 1 kHz: (0 dbm ≙ 1 mW per 10 μbar) 0.25 mV/μbar (—50 dbm). Polar Pattern: Hypercardioid. Output Impedance: 200 ohms. Connections 3-pin plug T3262 1+3= 200 ohms, 2=ground. Dimensions: 6.5" x 0.9", head 1.9"ø.

Also available with Cannon plug XLR-30-50 T (M 88 N (C))

M260 M 260 SM

Dynamic Unidirectional Ribbon Microphone

The M 260 is especially suited for speech and music reproduction. It has excellent transmission qualities. The dampening effect backwards is almost constant over the whole frequency range.
Version SM with 3 position Voice-Off-Music switch.

Specifications:

Frequency Response: 50-18000 Hz. Output Level at 1 kHz: (0 dbm ≙ 1 mW per 10 μbar) 0.09 mV/μbar (—58 dbm). Polar Pattern: Hypercardioid. Output Impedance 200 ohms. Connections: 3-pin plug T 3262 1+3 = 200 ohms, 2=ground. Dimensions: 6.5" x 0.9", head 1.7"ø. Also available with Cannon connector XLR-3 50T

M 500 N

Dynamic Unidirectional Ribbon Microphone

A ribbon microphone designed for capturing the full intensity of modern music while suppressing undesirable side effects such as popping, breath noise and hissing. Flat frequency response, high sensitivity and excellent front-to-back ratio are the distinguishing features of this new BEYER-DYNAMIC PRODUCT.

Specifications:

Frequency Response: 40-18000 Hz. Output Level at 1 kHz (0 dbm ≙ 1 mW per 10 μbar) 0.13 mV/μbar≈ (—55 dbm). Polar Pattern: Hypercardiold. Output Impedance: 500Ω ± 15%. Load Impedance: > 1000Ω. Connectors: 3-pin Tuchel T 3262, 1+3—500Ω. 2=ground M 500 N (T) = Tuchel T 3007 spez., 1+2 = 500Ω, 3 = ground M 500 N (C) = Cannon XLR — 3 — 50 T, 2+3 = 500Ω, 1 = ground. Dimensions: Head diameter 56 mm, shaft diameter 28 mm, length 180 mm, weight 210 g.

M 160

Dynamic Unidirectional Microphone for Studio Purposes

By using the double ribbon principle the highest possible reproduction quality of music and speech is guaranteed. Non-linear distortions are imperceptible.

Specifications:

Frequency Response: 40-18000 Hz. Output Level at 1 kHz: (0 dbm ≙ 1 mW per 10 μbar) 0.1 mV/μbar (—57 dbm). Polar Pattern: Hypercardioid. Output Impedance 200 ohms. Connections: 3-pin plug T 3262 1+3 = 200 ohms, 2=ground. Dimensions: 6" x 0.9", head 1.5"ø. Also available with Cannon connector XLR-3-50T.

To: BEYER DYNAMIC (G.B.) LTD.
1 CLAIR ROAD
HAYWARDS HEATH, SUSSEX

Please send me full particulars and illustrated brochure of BEYER DYNAMIC Products.

NAME.....

ADDRESS .....

.....

STUDIO MICROPHONES

PATENTS

January 4, 1973
1306471
Eastman Kodak Co
Motion picture projectors
1306584
Vockenhuber, K and Hauser, R
System for reproducing motion pictures
1306848
Sony Corporation
System for producing an electrical output signal in correspondence with a magnetic flux generating source
1306898
Porsche KG Dr-Ing HCF
Loudspeaker arrangement in a vehicle
1306912
PPG Industries Inc
Liquid crystal cells
1306999
Pacific Plantronics Inc
Headsets
1307059
Bosch Photokino GmbH, Robert
Device for simultaneously winding and unwinding an endless band
1307146
Staar, SA
Apparatus for reading magnetic tapes stored in cassettes
1307212
RCA Corporation
Waveform source for television receiver
1307269
Chicago Musical Instrument Co
Electronic musical instruments having dc keying
1307270
Chicago Musical Instrument Co
Electronic musical instruments having a unified keying circuit

January 10, 1973
1307480
Philips Electronic & Associated Industries Ltd
Cassette for a magnetic recording disc
1307531
Bellis, T G
Antifade devices for aerials
1307560
Matsushita Electric Industrial Co Ltd
Apparatus for facsimile using prism-shaped fibre optics
1307566
International Standard Electric Corporation
Decoder for the high colour fidelity reproduction of a PAL encoded colour signal
1307587
International Business Machines Corporation
Multiple transducing element magnetic heads
1307608
Matsushita Electric Industrial Co Ltd
Multi-track dual gap magnetic head assembly
1307722
Soc D'Applications Generales D'Electricite Et De Mecanique
Magnetic recording apparatus
1307725
Pasquali, G
Musical sound generating device
1307761
Ampex Corporation
Verifying the recording of information on a magnetic recording medium
1307777
EG & G Inc
Method and apparatus for producing compressed digital representations of a visible image
1307821/2
RCA Corporation
Web cartridge

January 17, 1973
1308056
Solartron Electronic Group Ltd
Input circuits for electrical instruments
1308079
Forster Elektronik GmbH
Combination of a data processing or writing head and an endless tape magazine
1308082
International Business Machines Corporation
Method of making a magnetic head assembly
1308158
Matsushita Electric Industrial Co Ltd
Tape recorders and/or players
1308175
RCA Corporation
Television camera utilising a colour encoding filter
1308192
Matsushita Electric Industrial Co Ltd
Tape recorder
1308629
International Standard Electric Corporation
Method of determining the varying equipment delays for pulse transponder
1308636
Agence Nationale De Valorisation de La Recherche
Electrical filters enabling independent control of resonance frequency and of bandpass especially for a speech synthesiser
1308704
Honeywell Ltd
Tape guide arrangements
1308956
Matsushita Electric Industrial Co Ltd
Multi-element magnetic head
1308974
Instrument Systems Corporation
Electronic voice annunciating device
1309400
Licentia Patent-Verwaltungs—GmbH
Reproduction arrangement for reproducing information stored on a disc in a spiral groove

January 31, 1973
1309489
International Standard Electric Corporation
Snow and ice removal system for an antenna
1309531
Bio-Dynamics Inc
Adaptor for use with an audio reproducing machine
1309570
General Electric Co Ltd
Degradation detection in a pcm system
1309632
Metro Goldwyn-Mayer-British Studios Ltd
Mechanisms for transporting cinematograph film
1309818
Sued-Atals-Werke GmbH
Magnetic tape recorder having a friction wheel drive for the spool carrier of the tape
1309951
International Business Machines Corporation
Time domain equaliser and method of measuring distortions in a data transmission system
1310036
LTV Electrosystems Inc
Signal synthesiser
1310165
Elektroakusztikai Gyar
Sound radiator
1310178
Nippon Columbia KK
Tape movement detecting devices for tape recorders

Higher-fi from telephones

WITH THE current worldwide obsession for broadcasting telephone calls, basically not a bad idea but in practice often excruciatingly boring, the proposals for a higher-fi telephone transducer to be found in BP 1,293,670 from Siemens AG have some relevance to the present pages.

The operating frequency band for telephones is approximately 100 Hz to 35 kHz. According to Siemens, most known telephone transducers (i.e. microphones and speakers) have a drop in the upper limit of the transmission range. They say this is usually fairly expensive to correct but the frequency response can be flattened out much more cheaply with their own proposals. Briefly these involve mounting a metallic (e.g. titanium) diaphragm which has a piezo-ceramic coating glued to it and connected to an amplifier and diode in the headset itself. The means of mounting is apparently the novel departure, this taking the form of a ridged circle of silicone rubber which grips the diaphragm round its edge by two annular rings (**fig. 1**). By reason of its inherent flexibility, the silicone rubber allows the diaphragm to vibrate with resonance peaks which correspond not only to the fundamental of the diaphragm but also to other harmonic frequencies. These have vibration nodal lines in parts of the diaphragm other than the gripped regions. The parts of the diaphragm which are separated by the second harmonic nodal line move in opposite directions and it is claimed that the resulting resonant peaks are less pronounced; thus the final frequency response smoother and the sounds clearer. The patent specification is itself not the clearest of documents but presumably Siemens get reasonable results in practice. One thought may cross cynical minds. The public at large are now so used to what a peaky telephone sounds like that it may well reject an improvement on the grounds that it sounds as if there is something wrong with it.

Fluid bearings for tape

IN BP 1,293,205, IBM discuss the use of fluid bearings between tape and transducer heads. The usual fluid is, of course, air and the obvious advantage is reduced wear on the head and the tape. But, nothing in this world being perfect, all manner of problems arise—especially in maintaining the 1:1 ratio of transduced signal characteristics for forward and backward tape drive.

Fig. 2 shows a conventional fluid bearing head. The head *22* has a gap *20* nominally at the centre of a curved region *14* of a guide surface *12*. The curved region *14* merges into straight regions *16* and *18* and the wrap angle produces a separation between the tape and surface *12* of about 2 μm.

But the tape does not follow the ideal path at *24*. Where the wrap angle is about 10° or less, there is insufficient arc length between the points *26* and *28* to keep the tape stable and it often rucks downstream. This rucking results from non-symmetrical pressure distribution between the tape and surface *12*, a negative

34 ▶

FIG. 1

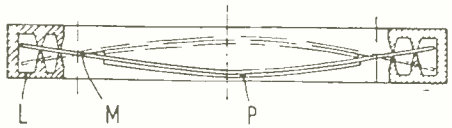
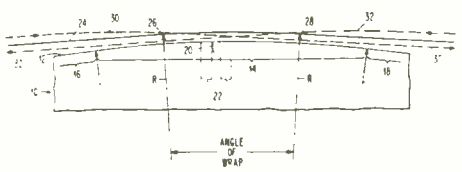


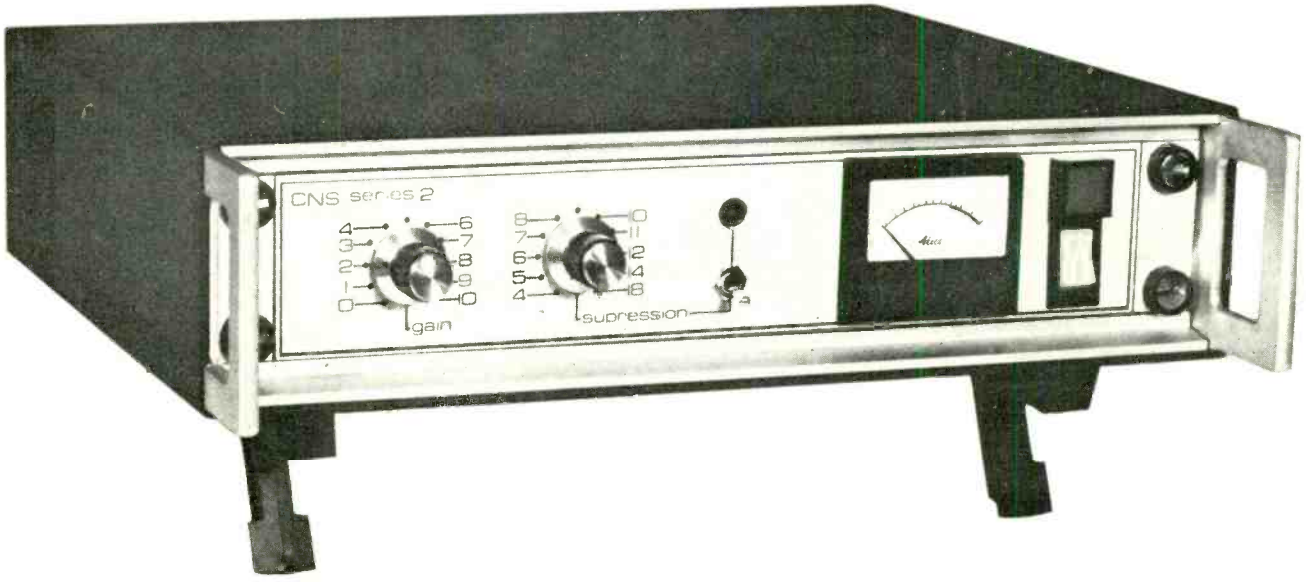
FIG. 2



Alice built—TO STAND ON ITS OWN

Series II CNS Unit MAINS POWERED

As a follow up to our very successful
Cross-talk and Noise Suppression Module
The Series II Free Standing Unit offers all the
Functions of the Module Plus Continuously
Variable Suppression.



INPUT GAIN	●	Continuously Variable Rotary Control.
SUPPRESSION	●	Rotary Control Giving a Range of 4 to 18 dB.
SUPPRESSION IN/OUT	●	Miniature Toggle Switch.
SUPPRESSION INDICATOR	●	Light Emitting Diode.
POWER	●	220/240V 50/60 Hz, via Cannon Mains Socket.
AUDIO TERMINATIONS	●	Jack Sockets, Standard or Cannon Type to order.

PRICE **£98.00** Un-bal. Delivery Ex-Stock.
£121.00 Bal.

Alice **(STANCOIL LTD).,** ALEXANDRA ROAD, WINDSOR, ENGLAND
Tel: Windsor 51056.

pressure region arising because the bearing fluid (air) cannot flow into the space beneath the tape quickly enough when the tape is moving at high speed. So the tape gets dragged down out of its true and ideal line of travel. What is more, unless the gap *20* is absolutely exactly half way between the points *26* and *28*, the tape performance will be different for forward and backward directions of travel.

What IBM propose as a solution is to provide slots (see **figs. 3** and **4**) at *44* and *46* upstream and downstream of the gap *20*. These

FIG. 3

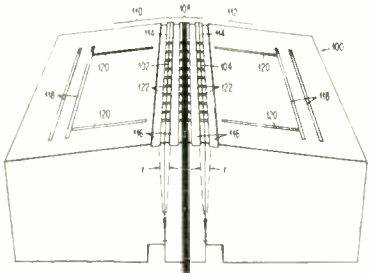
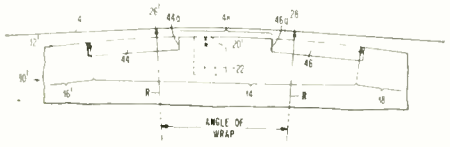


FIG. 4



slots communicate with atmosphere at their sides and so prevent the possibility of any negative or positive pressure discrepancies arising at either side of the gap *20*. Doubtless the exact dimensions of the slots will require very careful calculation or a great deal of trial and error experimentation. Will slots which work for one type of tape work properly for another?

Fluid coupling for tape drives

NORMALAIR-GARRETT (Holdings) Limited in BP 1,294,178 have had claims accepted for the fairly basic principle of using fluid transmission between tape deck motors and the take-up and take-off shafts which they drive. So apparently the Patent Office Examiners regard the idea as new.

Fig. 5 shows take-off spool *10* and take-up spool *15* with tape *11* passing past heads *12*, and tape pinch drive *13*, *14*. All this is quite conventional and driven by a motor *19* via gear trains *16*, *17*. But the motor *19* also drives a gear train *20*, *21* to rotate the outer half of a rotary vane fluid damper *22*. This is a conventional fluid transmission with viscous fluid such as oil, the internal half of the drive being directly coupled to the take-up spool *15*. Thus the take-up drive is from the motor *19* but via a viscous fluid coupling.

In another design, both the feed and take-up spools are driven via fluid dampers of this general type. The theory is that the tape can never be over tensioned and there seems no reason why this should not work well. But surely it has already been tried?

Automatic arpeggios

BP 1,295,994 from the Chicago Musical Instrument Company takes a great deal of wading through and for me the going was even tougher because I fear the end product in terms of sounds produced by the invention will be pretty nasty. But duty dictates that I report it. The patented gadget will make it possible for musicians to incorporate musical flourishes into their playing despite the fact that they lack the technique to do it for themselves.

The instrument may be an organ or electronic 'piano' with a conventional keyboard having a left-hand portion and a right-hand portion. A series of tone producing circuits are keyed by the right-hand keyboard in the usual way but the organ also has an arpeggio switch which can feed voltage to a triggerable circuit. The circuit has an output coupled to an amplifier, itself coupled to the input of a cascade circuit. The arpeggio switch also feeds a reset circuit.

The cascade circuit has a series of separate stages which progressively respond to a potential increase applied from the circuit input, each stage being connected to a series of signal control gates. These control gates are arranged in groups of chromatically adjacent musical notes (e.g. F, F and G; G ^{sharp}, A and A ^{sharp}, etc).

When one of the keys of the left-hand part of the keyboard is pressed, it will produce a normal note by conventional means and will also close a key switch which will apply a voltage via lines *32* to the emitter of all the control gates for the same basic material note (**fig. 6**). Each of the control gates will so far block this potential from its collector line *38* to an associated keyer circuit *12* for a relevant one of the series of tone producing means (**fig. 7**). This blocking effect can be removed for any control gate by making its base more negative than the applied potential on its emitter. And obviously the gate will conduct in the manner of a pulse if the voltage applied to the base is in the form of a pulse. These pulses are produced by the cascade circuit *24* mentioned above and fed along the lines *28* to the chromatically associated groups of control gates *29*. So a first pulse passes to the gates *29* associated with the notes F to G; a second pulse comes along the next line *28* to the gates associated with the notes G ^{sharp}, A and A^{sharp} and so on with the sequence continuing so that each of the chromatically associated groups of control gates is successively triggered with time spaced pulses. It follows that, depending upon what keys are depressed on the left-hand portion of the keyboard (i.e. what chord is being played there), the corresponding tone producing means will momentarily be energised in sequence to provide an automatic arpeggio.

Adrian Hope

FIG. 5

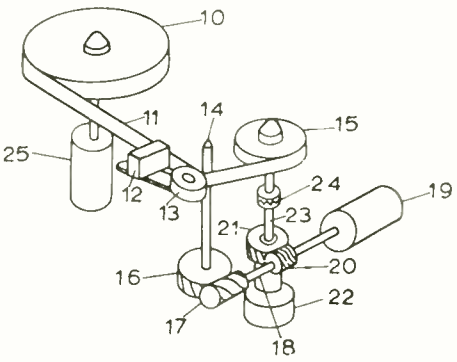
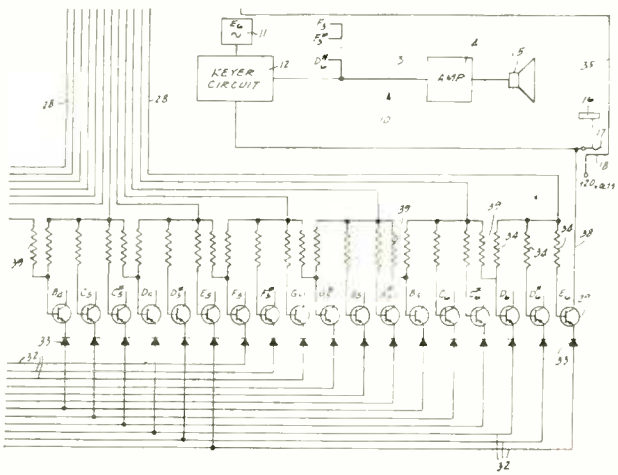
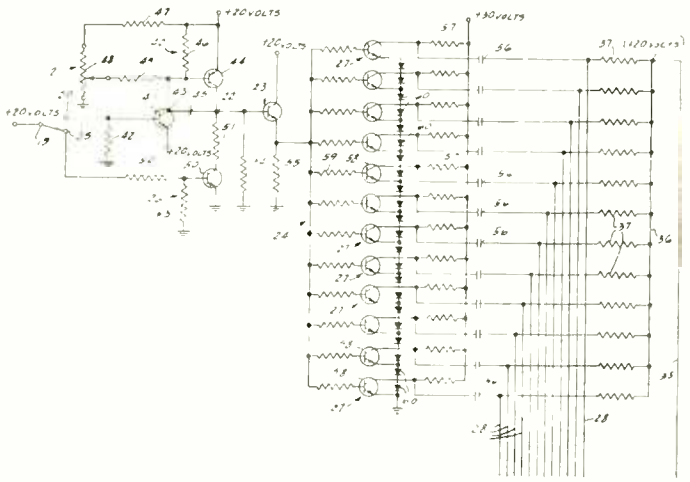


FIG. 7

FIG. 6





Opto-electronic audio level display

RUNE ESPELIEN*

Incremental light-emitting diode meters offer much more than an alternative to moving-coil units. In addition to being resistant to physical shock, digital displays can be designed to store the maximum level reached during an unmonitored program sequence. Perhaps more promising, remote devices may be triggered at any preselected program threshold.

*Digital Design, Box 1220, 7001 Trondheim, Norway

A PROGRAM LEVEL meter is part of the monitoring hierarchy around the sound console. It may be classified as an output device which gives a visual indication of the sound level. For audio systems in direct connection with radio transmitters and/or tape recorders, it is extremely important to know the *peak* level in order to avoid over-modulation.

The conventional moving-coil movement or light-spot galvanometer can be replaced by a string of light emitting diodes (leds). Red diffused-lens leds give better readability, less susceptibility to washout from high ambient light, and are resistant to mechanical shock. And, on the human engineering side, the column of light leads to a faster and easier reading without eye-strain. Such a display of instruments may also be equipped with terminals for dimming the display, which leads to comfortable viewing independent of ambient light conditions.

Analogue to digital conversion eliminates the need for logarithmic amplifiers and provides a high degree of stability and accuracy. Digital logic circuitry has proved its reliability in computer circuits during the last decade and is gaining increasing attention in sound control.

Each ppm consists of three basic parts: an analogue to digital converter, a display, and a memory.

The a/d converter receives the analogue voltage (i.e. the sound program level) at the input of the instrument and converts it to a digital code proportional to the input level. The logarithmic characteristic timing network that determines the integration and fallback is included in the a/d unit. These parameters can easily be varied within wide limits to satisfy different requirements, simply by changing component values in RC-networks. Fallback time can even be altered from outside to suit different situations.

Resolution

The resolution of the ppm is given by the number of bits in the digital code. If the instrument is to cover a range of 50 dB, which is good enough for most applications, a six bit code is required to give 1 dB resolution all over the scale range. A six bit code can give $2^6=64$ different binary combinations while a five bit code can only give $2^5=32$ combinations, which is not sufficient to display the level in 1 dB steps over a 50 dB measuring range. However, a five bit code can be used if the operator is content with 2 dB resolution.

The ppm display unit receives the digital code from the a/d converter, decodes it and displays it as a column of light (not, it should be emphasised, as a moving spot).

The height of the light column corresponds to the input level, and a thermometer type of instrument like this is much more comfortable to read than the wildly twitching pointers and moving spots of conventional ppms. Even with a peripheral view, the operator can easily read the length of the light column. This is important as the operator is usually busy with a vast number of processing controls.

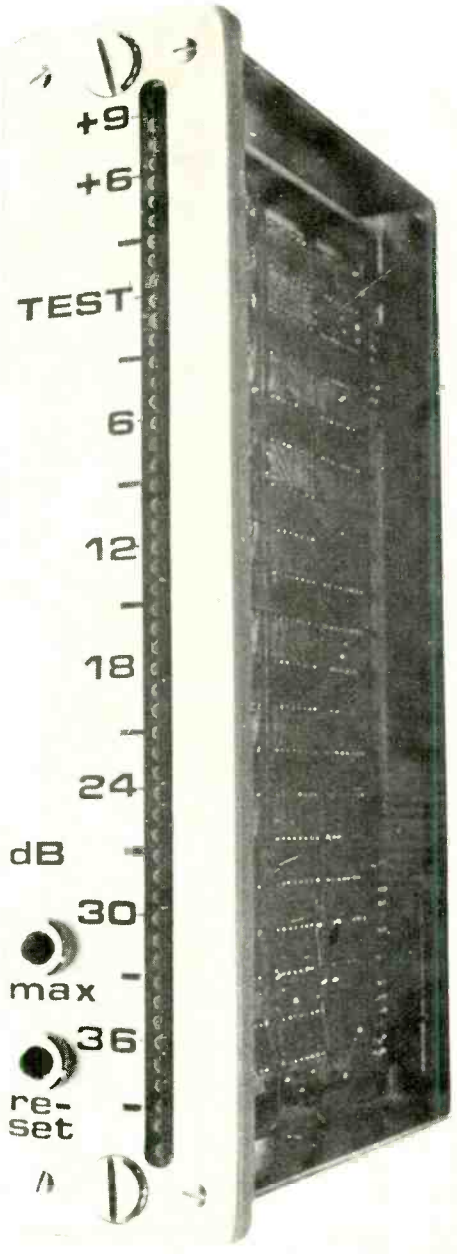
The memory

This, the third unit of the system, consists of a few arithmetical elements which operate on a pure digital basis. The maximum peak value can be stored until the memory is cleared by the operator. Due to the a/d conversion at the input, logical operations like this can easily be obtained at negligible extra cost.

Digital logic circuitry has become the most widely used means of solving data handling and sequencial control problems. While circuit costs fall, the variety of available functions grows. The digital code can be fed to remote equipment, should a future need for this arise. Program can be routed in coded form to the producer, co-engineer, or to wherever this information is needed. Conversely, digital information from several ppms can be multiplexed and transmitted bit-serially on a single line.

The monitor display unit mentioned earlier displays a column of light but the transmitted information might equally well be decoded to obtain numeric readout of the program level, then displayed on seven segment readouts.

The design is kept simple and clean but complex solutions may be realised, to individual need.



DIARY

By John Dwyer

THE NEWS that Bonochord had made an offer for Neve was released towards the end of December last year. Neve's press statement said that they had accepted the offer and that 'the direction and Management of Rupert Neve and Co would remain unchanged'.

Briefly the terms of the takeover were as follows: Bonochord would first acquire 51 per cent of Neve's shares with a payment of £170,000 plus £4 for every £1 that Neve's profits went over £100,000 for the 25 month period up to the end of 1973. This payment would be limited to £89,760.

The second part of the deal concerned buying the remaining 49 per cent of the shares. Bonochord would pay £5 for every £1 of the average profits of Neve over three successive years. It would be up to the Neve shareholders whether that three year period would end on December 31 of 1975, 76 or 77, but if they had not decided by 1977 then Bonochord could acquire the remaining shares after 1977.

Neve's fortunes have improved greatly over the last couple of years. Up to the end of November 1971 their profits were only £4,000 but thirteen months later Neve were predicting that their pre-tax profits for 1972 would be £20,000 and that in 1973 they would make £80,000 on sales of about £1,250,000. At the time of the takeover Neve had outstanding orders worth about £600,000 and assets of around £250,000.

I asked Mr Metcalf Collier, secretary of Neve, why the firm's profits had risen so sharply. He explained that there had been a number of production difficulties in the past which had now been sorted out. I also asked him if the figures hadn't been made to look a little better than perhaps they were, to which he replied that this was certainly not the case.

The history of Neve's new owner has hardly been that of one success after another. Although Bonochord made £204,000 in the six months to the end of June, 1972—an increase of £79,000 on the corresponding period of 1971—as little ago as 1969 Bonochord were in what one financial journalist described as 'a truly bombed-out state'.

The firm had been founded as Allen & Hanbury's (Acoustic Aids) Ltd in May 1939. The market for their products, hearing aids, was big enough but they had reckoned without the Government's making someone else's hearing aid free on the National Health. The public, it seemed, needed a hearing aid you had to pay for like the Czechoslovaks needed Adolf Hitler.

In 1949 the name of the firm was changed to Bonochord and the company went public ten years later. In the decade after that the only bright spot in Bonochord's fortunes, if you can call it a bright spot, was the knighthood of their chairman, Theodore Constantine, in the 1964 New Year Honours list; he had worked as a constituency chairman for the Conservative Party.

Three years later Bonochord contracted a bad case of diversification to the head and bought, would you believe, a group of printing firms. They kept them, I need hardly say, for a matter of months.

In 1969 Mr Robin Rigby became chairman and began a ruthless but necessary campaign to weed out the unprofitable parts of the company, rationalise (and we all know what that means) the rest and buy up other, more profitable, enterprises.

In March 1970 Bonochord bought a firm called Terminal Insulators Ltd for £115,000. TI made electrical and electronic components and plastic mouldings and the *Investors Chronicle* of September 4, 1970 said that the new company would enable Bonochord to reach new profit levels. In October of the same year, Bonochord took over Hammant & Morgan, makers of light electrical control equipment for the toy industry.

In December Bonochord merged with APT Electronic Industries, makers of power supplies, language laboratories and radar equipment. APT were important to Bonochord because they had collared a number of Government contracts for radar equipment. But, although APT had made £93,000 in 1970, compared with £71,000 in 1969, the *Investors Chronicle* remarked gloomily: 'APT faces poor demand for electronic equipment and keen competition for language laboratories'.

During September of 1971 Bonochord bought Aveley Laboratories, who had exhibited at Internavex a 'new, improved and more comprehensive range of language laboratories of advanced design'. The £118,420 deal included a firm of opticians called Bourne Optical—an area that Bonochord were to develop later on when they bought Thompsons, a Cardiff opticians' firm, in December of last year.

But the most important buy of 1971 was the acquisition of the Austrian firm of Viennatone, with its subsidiaries, for £348,000. Viennatone made, sold and exported hearing aids and were very successful; ever since Bonochord took them over, in fact, Viennatone seem to have been propping up Bonochord's less able subsidiaries.

Terminal Insulators did not run as planned. In the annual report for 1971 the chairman, Robin Rigby, was obliged to make the rather embarrassing announcement that the forecast had been exceeded in spite of the large loss made by Terminal Insulators. He went on: 'Because of accounting errors, which led to erroneous information being supplied, your board was not aware of the high level of this loss when the interim results for the half year ended June 30, 1971 were announced on October 7, 1971.'

Terminal Insulators had lost more than £100,000 during 1971 and the losses had continued through the first half of 1972. The chairman was careful to point out, however, that the losses had been 'stemmed' and 'with the introduction of new management it is considered that a return to profitability would be received on a modest scale in the last quarter of this year.'

Concerning APT, in the same annual report the chairman said that it would take too much valuable cash to put APT's power supply business right. The power supplies, which had once been about 80 per cent of APT's business, had now dwindled to about ten per cent. Accordingly Bonochord sold the power supply division of APT to Unitech Ltd for 'between £200,000 and £250,000'. The remainder of APT has now become the radar division of Bonochord and seems to be successful; at the beginning of February they announced they had won another contract for three automatic tracking radars worth £100,000.

Nevertheless, if you read what Mr Rigby had to say about some of Bonochord's subsidiaries you realise how lucky Bonochord were to have bought Viennatone: Hammant and Morgan were 'a little disappointing'; Path Engineering, a firm of precision engineers, were 'still by no means buoyant'; Shepherd Finance Ltd continued to show improved results' and Jennings Electronics Industries 'had their loss reduced' . . . somehow, and it is to their credit, Bonochord just aren't in the Slater Walker class.

Some other recent Bonochord takeovers are worthy of attention. The first of these are the acquisitions of H & E White and Fairlawn Finance, whom Bonochord amalgamated to form what they called 'a flourishing unit'. The next offer to buy was sent to Livingston Hire, the studio equipment and measuring instrument hire firm, to whom they offered £1,400,000. At the time of the takeover, Livingston, who operate both here and in West Germany, were forecasting profits of £167,000 for the year to April 30, 1973. Cannon Street Investments, who held just over 50 per cent of the Livingston shares, agreed to accept the offer.

Livingston were the first Bonochord buy in what they obviously intended would be a series of moves into the audio equipment market. In July the *Financial Times* predicted that various factors 'could lead to further acquisitions before long' and of course they were right.

The reasons why Neve were so attractive were that, first of all, they had good sales and profit figures; secondly, that Bonochord needed to complement the range of studio equipment that their Aveley subsidiary are about to market; and thirdly that Neve had had long experience of both studio equipment and its market. For their part, Neve were willing to succumb to Bonochord mainly because Bonochord had an established and successful

38 ▶

PROSON 73

Here's your chance to hear studio master tapes and live/recorded demonstrations on professional equipment.

AKG
AMCRON
AMPEX
AUDIO APPLICATIONS
GALE

Proson 73 Exhibition
Trade only 28 & 29 March 1973
Public 30 & 31 March and 1 April 1973
Free shuttle-bus to and from Sonex 73 Exhibition
at Excelsior Hotel and from Heathrow Airport.
Parking available. Admission free by ticket only.
Free refreshments. Tickets available from
Proson 73 Gale Electronics & Design Limited
39 Upper Brook Street London W1Y 1PE

How to get there

Sheraton-Heathrow Hotel
LONDON AIRPORT

DIARY

European sales organisation—something Neve wanted badly.

There is one other interesting facet to the takeover. As is well known, Neve are associated with Christian missionary work, though nobody is quite sure how. By a coincidence, Mr D. C. Rennie, C Eng, FIEE, joint managing director of Bonochord, is also a director of Billy Graham Evangelistic Alliance Ltd.

The IBA have announced, rather before anyone thought they would, the names of the two London commercial radio contractors; in January the IBA had said the names of the lucky winners would be announced at the end of March, but the announcement came at the beginning of February.

The General station has been won by Capital Radio, a consortium chaired by Richard Attenborough and comprising Bryan Forbes; Michael Flint, the former head of Paramount Pictures UK; David Jacobs; Air studios' George Martin; Alan Bartlett (of Bristol Industrial Securities); Robert Stiby; William Beets, Graham Binns; Ronald Denny; John Littlejohns; and the man who started the company, Weybridge dentist Barclay Barclay-White. Apart from individuals, the group also includes Rediffusion, the *Observer* newspaper and Local News of London, a newspaper consortium comprising 22 local newspaper groups.

The consortium which will run the News station is London Broadcasting, headed by Sir Charles Trinder, a former Lord Mayor of London. This is the consortium to which IBC studios belong. George Clouston, IBC's manager, will be on the board in charge of production. Another member of the consortium is Sir Gordon Newton, former editor of the *Financial Times* and newly appointed chairman of Vavasseur, the firm that have made a takeover bid for John Bentley's Barclay Securities. Sir Gordon will be chairman of the editorial committee.

The other members of the board are Michael Levete, who will be managing director, Canadian broadcaster Kenneth Baker (marketing), Roland Freeman (local government), Alfred Geiringer (wire services), Adrian Ball (networking), Mollie Lee (women's affairs), Brenda Maddox (Education), and Michael Rapinet (company secretary).

The London Broadcasting Company was started by Roland Freeman, once a chairman of the GLC's finance committee and now head of a firm of public relations consultants. He met Michael Levete, an executive of the Charterhouse banking group, while engaged on a London building project. By the time LBC makes its first broadcast Mr Levete will have resigned as chief marketing executive of Charterhouse, who have a large shareholding in LBC.

One member of the LBC board has already resigned: Norris McWhirter, brother of Ross 'Oh-What-A-Lovely-Warhol' McWhirter. I understand that Norris resigned just after the Warhol fiasco 'to avoid embarrassment to the company. There was no pressure from us whatever'.

Other members of the LBC consortium are Universal News Services, Selkirk Holdings, a leading Canadian broadcasting company; and John E. Dallas Ltd. Shareholders not on the board include Colin Kelsey, Norman Strauss and John Maddox.

When the names were announced, Michael Levete said that he thought the news station would cost about £1,000,000 to set up and would lose money during the first two years. Listeners would be ten minutes from a news bulletin during peak listening times and never more than 20 minutes from one at any other time.

It is believed that the cost to LBC of renting the transmitter from the IBA will be £180,000 in the first year rising to £230,000 in the third and final year of the contract. The corresponding figures for the General station could be as high as £315,000 and £380,000.

Next the IBA will allocate the contract for the Birmingham station to one of the four groups who have applied. By far the biggest of these four are Birmingham Broadcasting. The IBA have made it quite clear that you won't get any contract if you don't have any loot. Birmingham Broadcasting have not only the loot but the backing of some of Birmingham's most prestigious citizens—not that that will have any bearing on the prestige or otherwise of the programs they would produce.

Marquee. The studio reopened at the beginning of January after closing to have a new MCI 24 track desk installed. Marquee say it is the first 24 track in the country. The acoustics in the control room were designed by Ken Shearer.

Dave Kent-Watson of Indigo tells me that they have been very heavily booked lately and have had some enquiries for eight track recording. As a result, they have now bought an eight track Ampex *MM1100* machine which Dave tells me were delivered in late February. 'Rates for eight track recording will be very competitive at £16 an hour,' he said. 'Reduction to stereo will be £12 an hour.' Indigo's other rates are £12 for four track, £8 for two track and £6 an hour for mono.

Other big news from Indigo is that they have signed a publishing deal with De Wolfe Publications in London.

Air. As just about everybody knows, Roxy Music have visited AIR to produce and record a new album; Rick Wolf was produced by Roger Cook; Fleetwood Mac did mixing and overdubbing; John Williams produced by George Martin, as was the Huggett Family; Casuals, Shoot, Gary Moore Band, Mott the Hoople, Wishbone Ash, Terry Stamp all did sessions; Brenda Arnau mixed some tracks; Kings Singers did a mobile in Church; provisional bookings include ELO and Roy Wood's Wizzard and demos are being recorded for the new James Bond film 'Live and Let Die', for which George Martin has composed the music.

On the staff side, Geoff Emerick, who left Apple at the beginning of February, has joined AIR after taking a short holiday. For those who haven't heard of Geoff Emerick—and it seems there are one or two within mic range of the APRS—he engineered *Sergeant Pepper* and his work on it won the first Grammy for a British pop lp. Later, he and Phil McDonald of Apple won a Grammy each for *Abbey Road*, an album which EMI say has sold more copies than any other Beatles album—at the last count the score was 7,600,000 copies worldwide.

Malcolm Davies has now taken over as studio manager of Apple. I wish him even more luck than Geoff Emerick.

Sound Developments. Sessions on Horlicks commercials for J Walter Thompson and Carling Black Label for McCann Erickson; Sound Developments also did WEA Records' presentation for the Midem festival at Cannes. Other sessions have included Party Pops album of instrumental hits, produced by Bruce Baxter for Pickwick; Ernie Entwhistle and Carl Simmons, whom Adrian Sear describes as a 'Jerry Lee Lewis type rock and roller', were both produced by Hal Carter's company Dash productions. All the above were engineered by Adrian, as were some sound effects for Peter Sinfield, producer for Roxy Music now doing his own album at Command.

Impulse. This studio, way up on Tyneside, went four track about two years ago and they tell me that since they added a four track Ampex to the set-up studio time has more than doubled. Because of this they were able to start alterations for a second, eight track studio in September of last year. The new suite will be ready by about April 23, after which the original studio will be converted into a dj studio, ready by May or June. Impulse started about six years ago and played, I am told, a large part in the success of the Lindisfarne folk group. They still retain a heavy interest in the group's publishing business. Recent Impulse releases include a Derek Brimstone album for Rubber Records, and an lp called Geordierama, for MWM Records. They also did incidental music for Tyneside Theatre Productions' Peer Gynt, which was played by part of the Northern Sinfonia. At the moment they are busy recording an lp by Hedgehog Pie.

Roger Squire. A film unit making a documentary about Radio One for Anglo EMI have spent a whole day at Squire. The result of their visit will be used to show the kind of set-up a dj uses to prerecord his material.

Advision. Gary Martin engineered an album for Stomu Yamash'ta. Stomu is regarded as one of the world's leading percussionists and writes for, produces for, and directs his own theatre—the Red Buddha. He opened at the Roundhouse on January 29 and finished on March 3.

More recently, Darien Spirit have been recording their first as yet un-named album under the production of Steve Rowlands. The group are Scottish and include two former members of the Bonzo Dog Band. Martin Rushent engineered the album, which will be released on Charisma. Steve and Martin also co-operated on a Philips album and single by Rosetta High Tower, ex lead singer with the Orlons. The single will be One More Heartache with the Bee Gees number The Walls Fell Down on the flip side.

Finally, I went to a press do given by Zoom Television not long ago and I will be reporting on them next month. Also in next month's 'Diary' will be a report on SB Independent Radio. I've had a number of complaints that I tend to cover the same old studios month after month. I accept this criticism but if 'Diary' is to be compiled within the time allotted there are only so many new studios I can visit; others send me the information regularly and if I can I repay this courtesy by giving them some space. So it's up to you.

VIDEO

By Roderick Snell

MULLARD XQ1402

LOW LIGHT TUBE

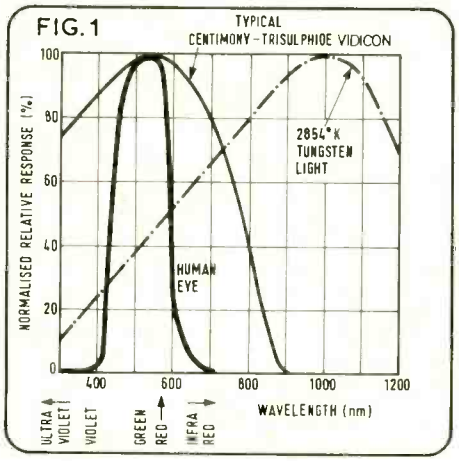
REGULAR VIEWERS of 'Tomorrow's World will be aware that cameras (sophisticated of course) can now be made so sensitive that one can televise scenes too dark for the eye. Readers of the technical press might in turn believe that flat solid-state image sensors the size and thickness of a postage stamp are just round the corner. Still the majority of closed-circuit television pictures remain at best obviously 'non-broadcast' and at worst scarcely viewable. Whether it is simple monitoring for security in a shop, safety in a London Underground station, or seeback in a recording studio, the most common problem seems to be lack of light. Most cctv users accept this as an unavoidable weakness of the camera and, if they have the money, invest in high power lighting grids, portable 'spots', and so on.

Aside from increasing the light level (or making better use of available light), there are at least three other worthwhile approaches: increasing the lens diameter, improving the camera, and improving the pickup tube.

A wide aperture lens certainly accepts more light but one is then left with an uncomfortably shallow field of focus. Decreasing the focal length (i.e. increasing the acceptance angle) is often worthwhile; the 25 mm focal length of the normal fixed lens can be reduced by a factor of two and costs between £40 and £100. This wide angle is suitable for many applications and gives two stops improvement in sensitivity for the same depth of focus.

There are quite large differences between cameras of the same price range. Once bought, there is usually little one can do other than make sure the vidicon beam and target adjustments are optimised for the light level being used. But, given an initial choice, testing prospective purchases at low light levels is worth the trouble. Testing two British-made cameras recently, the cheaper of the two had more than one stop of usable pictures at low light levels. Both cameras used the same separate mesh 25 mm vidicon tube but it was significant that the more sensitive of the two used a field effect transistor in the head amplifier and worked the tube in the 'high field' mode, which is to say the maximum allowable mesh voltage was applied to the tube. This costs more to engineer because higher powers are then needed to drive the scan coils.

If none of the above has given the required sensitivity, one of the new generation of silicon target camera tubes is worth considering. First developed by Bell Telephone Laboratories for their *Picturephone* project, these tubes use a mosaic of over 500,000 silicon diodes in place of the semiconducting antimony trisulphide



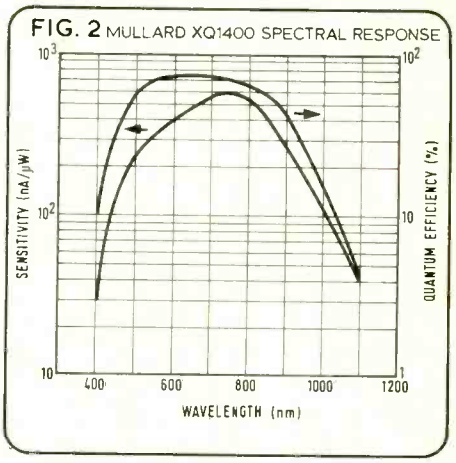
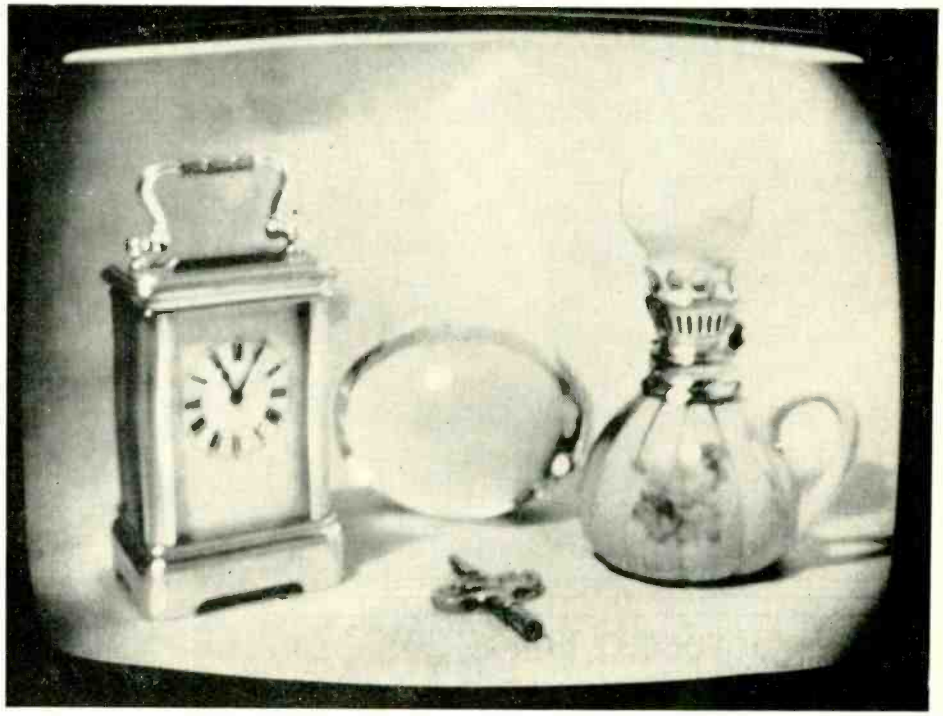


FIG. 3



layer of the normal vidicon target. Bells' *Picturephone* requirements were long life, high sensitivity and extreme ruggedness. Any tube that could be damaged by direct sunlight or focused spotlamps, like the normal vidicon, would not do but the resolution and blemishes could be worse than those in normal cctv. The last three years have seen much work in this field and silicon target tubes are currently available in the UK from English Electric, Mullard, Thompson CSF, RCA and Texas Instruments. The 25 mm tubes from these manufacturers are direct *mechanical* replacements for antimony trisulphide vidicons and will work in many cctv cameras with a few electrical changes. Industrial grades of tube cost upwards of £170 which, although roughly six times the cost of equivalent antimony vidicons, may save so many lighting and lens problems that they become the easiest and most economical way of doing the job.

The Mullard *XQ1402* was chosen for the review because, unlike some other silicon

42 ▶

To: Dixons Technical Ltd.,
3 Soho Square, London, W.1.

Please send me full details of your range of audio-visual equipment by return of post

Name.....

Address.....

.....

SS/2C4

.....

Dixons
Technical Ltd
OF SOHO SQUARE

SHORT CUT TO SOHO SQUARE.

At Dixons Technical we have the widest range of audio-visual equipment available in Britain. And the expertise to match.

Which is great if you happen to be near Soho Square.

But if you live out of town, why should you have to travel perhaps hundreds of miles, just to see us?

Well, quite simply, you don't!

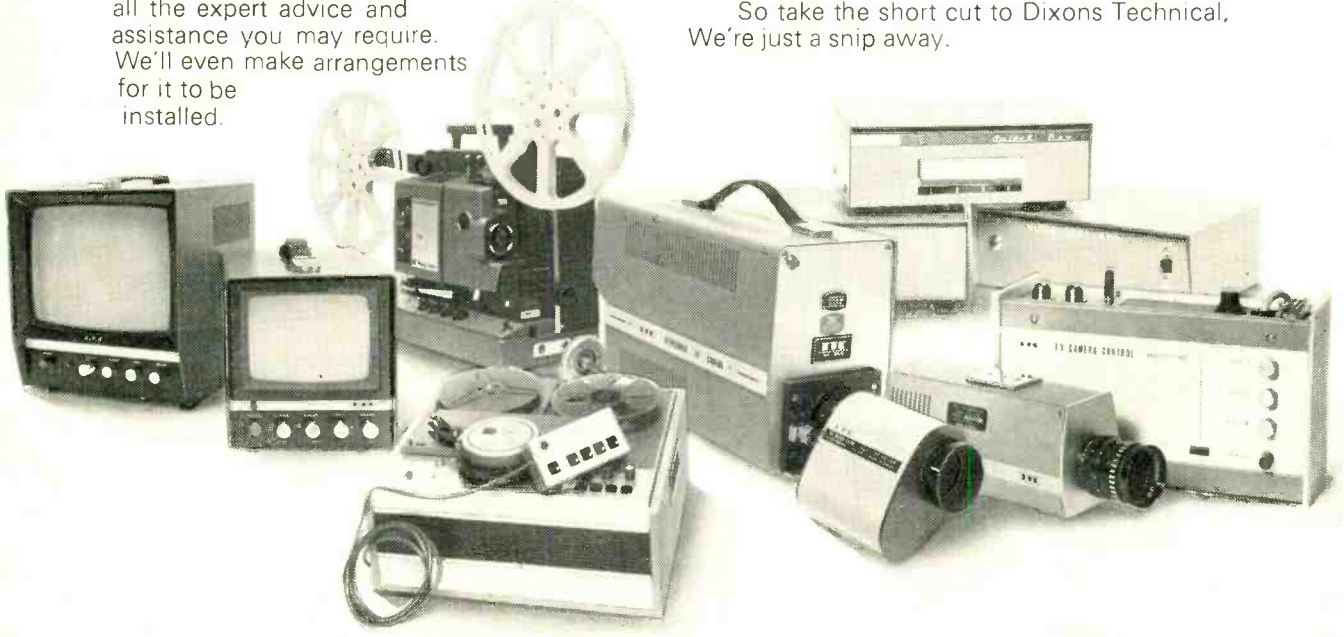
At Dixons Technical we'll see to it that wherever you live, the equipment you require reaches you quickly and safely. We'll give you all the expert advice and assistance you may require. We'll even make arrangements for it to be installed.

You'll find that we have all the famous brand names; and they're yours at the most competitive prices imaginable.

Should you not wish to touch much needed capital, we'll arrange a hire purchase agreement to suit your pocket. You can lease, or if you only require a piece of equipment for a short while – we'll rent it to you.

And wherever you are in Britain, the Dixons Technical after-sales service is ready to carry out any necessary servicing or repairs with speed and efficiency.

So take the short cut to Dixons Technical. We're just a snip away.



target tubes, it was capable of working at the high voltages used in the Link *101* camera without damage through self-induced X-rays. Although not the cheapest, it also had better resolution than some of its competitors and the prospect of a long working life.

Two Link *101* cameras were set up, one with a conventional separate mesh vidicon, the other with an Industrial grade *XQ1400*. The high impedance target bias was immobilised so that the automatic sensitivity facility was lost; like the lead-oxide photoconductive tube, this form of AGC cannot be used on a silicon target type. Making minor adjustments to match Mullards' specified working voltages exactly gave no improvement over Link Electronics' factory settings for normal tubes so the original settings were left. The silicon tube's resolution was at first slightly worse, but the pictures were so exceptionally noise-free that increasing the hf response until the resolution was as good still gave the most grain-free pictures we have seen from this camera. Although only about five times more sensitive to green light, in our tungsten-lit laboratory the silicon tube appeared over 50 times more sensitive: the reason for this can be deduced from the spectral response curves of **figs. 1 and 2.** The vidicon is panchromatic, with its sensitivity, of about 100 nA/uW centred at a wavelength of about 550 nm, which matches the response of the human eye. On the other hand, the silicon tubes response, with its greater sensitivity to infra-red, more nearly matches the spectrum of incandescent lamps and it is with these that the gain is so worthwhile. This spectral response can sometimes produce peculiar visual effects, especially outdoors in sunlight when the relative brightness of different objects is altered by their infra-red reflectivity. Even indoors, a man wearing a dark red shirt and blue tie may appear from the screen to have a light grey shirt and black tie! However, indoor shots at light levels considered comfortable for office or a sound studio give very good noise free and lag-free pictures if lit with tungsten lamps. Also the unity gamma characteristic gives an appearance of high-key lighting which is most effective for monochrome work.

The two Link cameras were pointed at the 'scene' of **figs. 3** and **4,** which was lit with a normal 40W bulb in an Anglepoise lamp. Directing the lamp away from the scene reduced the light level until the normal vidicon picture could no longer be considered usable **(fig. 3).** The light level was below the reliable range of our meter, but was in the region of 1 Lm/m^2. At this level, the silicon target tube was overloading so the lens aperture was reduced by four stops (ie 1/16 of the light) to give **fig. 4.** To give an idea of the difference in lag between the two tubes, the white square visible above the glass egg was attached to a steel piano wire spring and made to bob up and down. As most cctv cameras (including the *101* Links used in our tests) get their auto-sensitivity feature by biasing the target through a resistor of 1000M/ohms or more, this system cannot be used with silicon tube so an iris control, neutral density filters, or some video agc system must be used. We found that two neutral density filters plus the normal lens iris adjustment was sufficient wherever the *changes* in illumination were not too great.

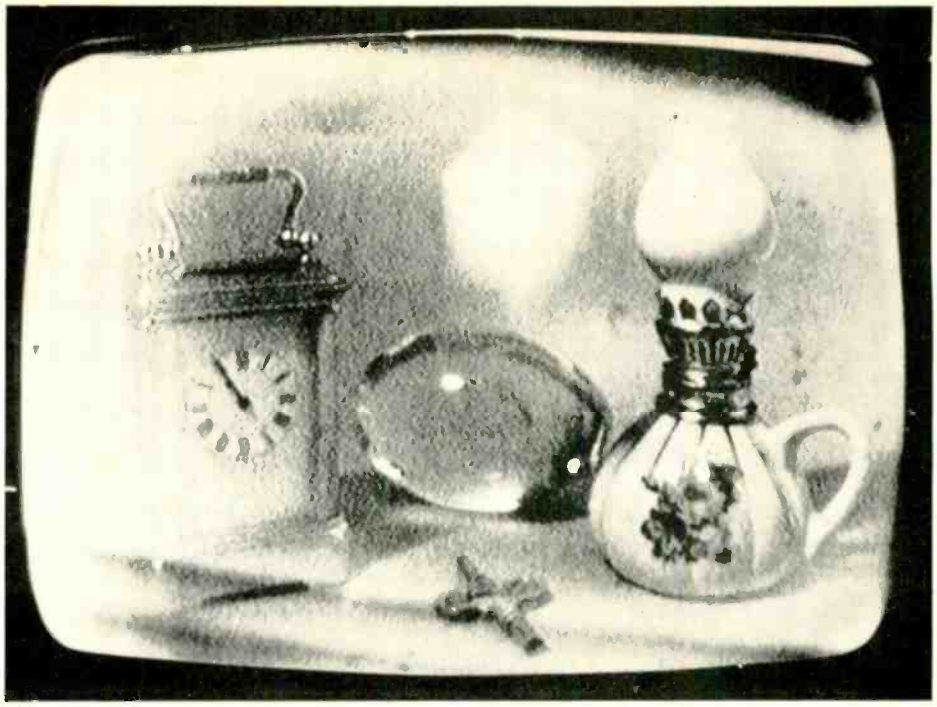


FIG. 4

Conclusions

Where a few stops more sensitivity are needed, particularly in tungsten light, silicon diode tubes are worth investigating. They can usually be fitted to existing cameras with very little modification and, providing the light level changes are not too wide, are satisfactory with the lens iris adjustment of sensitivity. The higher initial cost of the tube is partially offset by its long life expectancy and immunity from damage by over illumination. The Mullard *XQ1400* tested here would not take long to fit to most cctv cameras and gives comparable resolution to a normal separate mesh vidicon tube but with greatly increased sensitivity and reduced lag.

Where greater sensitivity is required, *both* types of tube are available with image intensifiers which amplify an 'electronic image' of the scene, giving an increase in optical sensitivity of between 50 and 100,000 times. Although mechanically compatible as far as scan and focus coils are concerned, the intensifier section itself increases the length of the tube so either a mechanical change or a new camera is required. An additional eht supply of several kilo volts is also needed, which is available in the form of a potted transistor invertor of only a few cubic centimetres volume. But this supply gives a convenient form of gain control, lacking in the straight silicon diode tube. Intensifier tube cameras cost more and should be given careful consideration so a list of manufacturers together with some further reading is given below.

Manufacturers of low light television cameras

Pye Business Communications.
Link Electronics.
J. D. Jackson Electronics.
Studio 99 Video.

Further reading

English Electric Valve Co: 'Silicon diode tubes' and 'Low light television tubes' (reprints).

J. D. Jackson Electronics: 'Low light television' (reprints from US journals).

Studio 99 Video: 'Development and use of a silicon target tube and camera' (factsheet no. 2).

Be Ready for Holidays & Europe!

On EMI cassettes & reels direct from manufacturer learn

FRENCH SPANISH GERMAN ITALIAN

...its so simple, just slip cassette into machine, or reel onto recorder. Each pre-recorded language course comes complete with manual. Ideal for beginners or as a brush up course!

Why pay £5 per course!

ONE COMPLETE COURSE OF 24-26 LESSONS **£1.49**

OR ALL FOUR LANGUAGES **£5.50** p&p 20p per order

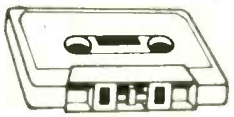
GIGANTIC OFFER Most at less than **HALF PRICE**

MANUFACTURED UNDER CONTRACT BY EMI LOW NOISE 5 SCREW TYPE CASSETTES

with index cards at less than half list branded prices all in plastic presentation cases.

C60 32p, 10 for £3; C90 45p 10 for £4.20

HEAD CLEANERS 30p; C120 58p, 10 for £5.50; EMPTY PLASTIC CASES 10p. P/P 20p



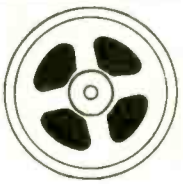
CHEAPER GRADES OF CASSETTES BY AUDIO CERTRON & OTHERS

5 SCREW TYPE INDEX CARDS AND CASES.

C60 25p, 10 for £2.35; C90 35p, 10 for £3.25; C120 45p, 10 for £4.25. P/P 20p

INDEX CARDS 3p PER DOZEN

RECORDING TAPES



SUPERB QUALITY WITH LEADERS & BOXED · POLY-ESTER · PVC · & MYLAR BASED. MANUFACTURED BY LEADING ELECTRONICS FIRMS

Why not try one and cut your recording costs?

	Standard Play		Long Play		Double Play	
5″	600′	35p	900′	42p	1200′	60p
5¾″	900′	40p	1200′	55p	1800′	80p
7″	1200′	48p	1800′	70p	2400′	98p

EMPTY SPOOLS 5″ 10p, 5¾″ 11p, 7″ 12p. P/P 20p.

WALKERS (S) 16 Woodthorpe Road, Ashford, Mdx. 52136

FROM THIS

TO THIS

The complete IVC range is available from Action Video.

IVC are fast becoming accepted by professional and scientific users as the finest 1″ helical scan video tape recorders in the world.

Realising the vastly different applications of VTR's, and, unlike some manufacturers, not wishing to introduce new equipment with conflicting standards, IVC have developed an integrated range of units for all purposes, all employing an identical format. Every machine in the IVC family – from the lowest priced playback unit to the broadcast specification IVC-900 series – uses the same modulation standard. Tapes recorded on one IVC machine can be played on any other IVC machine.

The IVC range available from Action Video includes a machine for every application. The 700 Series features models with monochrome and/or colour playback and recording, with one or two audio channels and assembly edit; the 800 Series includes units capable of simultaneous recording and reproduction and complete insert and assembly editing; the IVC-900 Series 1″ helical scan recorders match broadcast standards. Soon to be introduced is the IVC 100 series video cassette recorder which combines full IVC interchangeability and professional quality with the convenience of cassette tape packaging. And there is a comprehensive range of IVC cameras and ancillary equipment.

To ensure a professional standard of service to match their equipment, it is IVC policy to supply only through the following accredited regional dealers:

C. W. Cameron Limited
Giffnock, Glasgow.

E.O.S. Industrial Electronics
Llantrisant, Glamorgan.

Hudson & Carter Limited
Chilwell, Notts.

T. Moland Limited
Plymouth.

Murray Swanson & Co. Ltd.
Newcastle-upon-Tyne.

Holliday Brothers
Cheshire.

Bell and Howell A-V Ltd., Wembley

ACTION VIDEO LTD

45 Great Marlborough St., London W.1.
Telephone: 01-734 7465/6/7

PRODUCTIONS · SALES · SERVICE · HIRE

Sound '73: A preview of the 1973 Association of Public Address Engineers Exhibition

FROM MARCH 13 through 15, the Bloomsbury Centre Hotel will be graced with the presence of Sound '73—an exhibition of sound reinforcement equipment organised by the Association of Public Address Engineers. The hotel is situated in Coram Street, Russell Square, London WC1 and exhibition opening times are 10.00 to 18.00 closing one hour early on the final day. Tickets are available free of charge from the APAE Secretariat, 6 Conduit Street, London W1R 9TG (phone: 493 5256).

A program of lectures and demonstrations has been prepared starting on Tuesday March 13 at 14.30 with a talk on 'Microphones'. This is followed at the same time Wednesday by 'Compressors and limiters' while 'Industrial design of public address equipment' commences at 10.30 Thursday.

A new preamplifier for the *C451* fet capacitor microphone will be seen on the **AKG** stand. A three-position switch gives flat response, 75 Hz bass roll-off, or 150 Hz bass roll-off, allowing the microphone to be optimised for boom or hand-held operation. Model *C414* is a new capacitor capsule incorporating a pattern selector for cardioid, omni, figure-of-eight or hypercardioid pickup. While this is intended for recording studios, the *D1200* and new *D2000* are described as ideal for speech reinforcement. The *D2000* is directional and incorporates a combined pattern selector and on/off switch. Made in Britain for AKG, the *LM300* microphone is designed for low budget discotheque systems.

Exhibits on the **Audix** stand will include modular power amplifiers (rated at 15, 30, 60, 120 and 200W rms continuous), limiters, equalisers, noise sensors and loudspeakers. These can be supplied to meet the needs of recording, broadcasting or theatre studios. A standard Audix audio control console is illustrated below. Equipment similar to that recently supplied for ITN outside broadcast vehicles will be shown.

Among new additions to the **Beyer** range of microphones, headphones and accessories, the *M201* dynamic microphone, *ST230* floor stand and *MTF 222/81* microphone base plate. The *M201* is a hypercardioid microphone designed to look into 1k ohms and measuring 155 mm by 24 mm diameter. *ST230* is defined as an 'extremely portable' low price lightweight floor stand with provision for mounting two microphone holders without an additional clamp. Beyer Electronics are Southern and Scottish distributors for **Calrec Audio** and will also display the Calrec range of capacitor microphones and audio mixers.

Following confusion with the Japanese 'Crown', their American namesake have adopted a new label: Amcron. **McInnes Laboratories** will display the full range of Amcron power amplifiers on stand 38. The *DC300* is being replaced by a *DC300A* operating into loads down to 1 ohm. Up to *500W* rms per channel is the specified output power; distortion is described as greatly reduced. Recently appointed agents for Dbx, Macinnes will exhibit examples of their noise reduction units including the 117 which is considered to have background music applications. It cuts out the music?

Mains and battery powered mixers and amplifiers are to be exhibited by **CTH Electronics.** Introduced last year, the *MA30* amplifier will again be displayed together with a range of transformers, cable drums and other public address accessories.

Eagle are adding a sound level meter to their wide range of audio products—the *Pro T10*. This covers 36 to 130 dBA in seven steps. The *Pro A35*, *A65*, and *A120* amplifier series will be on display and are claimed to be a new concept in public address equipment. Features include slider controls with preset markers, priority page relay and resettable safety circuits. Respective output powers are 35, 65 and 120W rms. New Eagle electret microphones will include the *Pro M5* tie-clip and *Pro M25* boom arm.

Recently developed Electro-Voice electret microphones will be seen on the **Gulton** stand together with a wide selection of loudspeakers. The latter will comprise the *SP12*, *SP12B*, *12TRXB* and *12TRX*, *30W*, *Musicaster 1A* and *Eliminator 1*.

Several newly developed items from **G. H. Garland.** *GM3200* is a battery/mains amplifier module with automatic switching from mains to a 24V dc auxiliary supply in the event of power failure. The unit is also suitable for powering mains equipment in the field and is available with (optional) internal trickle charging. *GM22*, a portable mono or stereo discotheque system, incorporates two Garrard *SP25 Mk2* turntables, bass, treble and gain controls, microphone and a headphone monitor amplifier. It is designed to feed two free standing 100W amplifier modules and comes complete with matching 100W loudspeaker units. Matching horn units are also available to improve the hf response. Other items to be exhibited by Garland include a range of remote gain controls and a family of loudspeaker units for 100V sound distribution systems.

A new series of public address amplifiers in the Toa range will be shown by the local agents of this Japanese company, **Goldring Ltd.** The *900* series can be fitted with a variety of inter-

46 ▶

Audix audio control console

changeable octal-based plug-in modules to match any likely source. The *BS-367* loudspeaker is also being introduced and takes a spherical form suitable for ceiling suspension. Two eight track cartridge background music machines, one for rack mounting, the other complete with power amplifier, are to be demonstrated. Goldring will be found on stands 41 and 42.

Prolific seems the word for **Millbank Electronics** who plan to announce over 40 completely new products at Sound '73. These will include a new family of integrated and power amplifiers for sound reinforcement applications. Cannon, DIN and CSA connections will be offered, all models conforming fully to European electrical standards. Another amplifier series has been designed for recording studios while yet another is being aimed at single applications such as paging and fire alarms. An eight track continuous playing cartridge machine is to be marketed as a background music source. This will be available in single and double transport forms.

Two electret microphones from Sennheiser should attract interest on the **Hayden Laboratories** stand. Since no high voltage polarisation is needed, the entire microphone electronics are incorporated in the unit head. *MKE201* is an omnidirectional model priced £28.50 while *MKE401* is a £33.25 supercardioid. Hayden recently obtained the agency for Isonetta loudspeakers including a miniature spherical model of some 87 mm diameter—comparable with a tennis ball. These might have applications in tetraphonic audio though no further data is available beyond a price tag of £9.50.

SNS Communications are to display their *PA12/40* six input four output mixer/amplifier. Two low impedance microphone inputs are incorporated in addition to an input switchable between microphones, grams or tape. Separate gain controls are fitted to the three main channels with master bass and treble tone controls giving 15 dB cut of boost. Also on show will be the *Strauss* range of public address loudspeakers. Models from this range are illustrated below together with the *Chorale* entertainment mixer/amplifier. The latter features six inputs with individual slide faders. Each input channel has bass, treble and reverberation controls. Price is from £455.

Illustrated above, a largely self-contained public address system to be shown by **Trusound Manufacturing.** Model TPA20 operates from either mains or internal batteries and has inputs for 30/50 ohms (100 uV for full output) or 500 mV at 250k ohms microphone. Output power is specified as 10W rms with an additional 10W rms available from an extension loudspeaker feed. Retail price is £85.67.

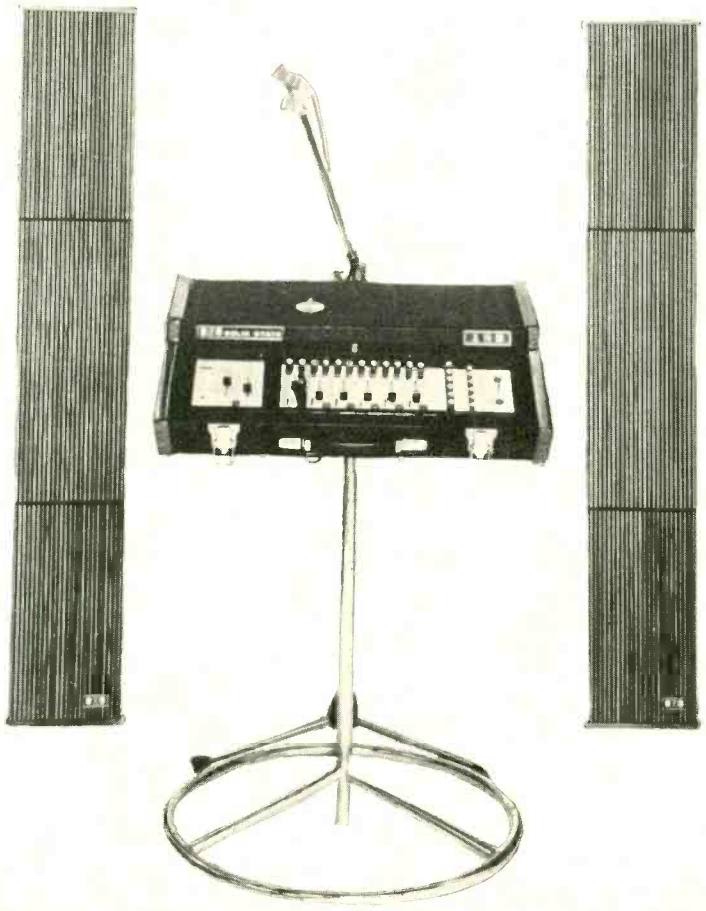
PSP Electronics, based in Wembley, plan to show a comprehensive range of connectors and accessories including Cannon XLR and—perhaps better known in the air than on the ground—Hellerman-Deutsch. Also a new range of aerosol packed cleaning and lubricating products.

On the **Celestion** stand, speakers from the Ditton range, of which the largest is the *66 Studio Monitor*. Frequency response is described as 'substantially level' from 25 Hz to 30 kHz, power capacity being 80W into 8 ohms.

From **Chymes Audio,** a claimed 'first': their £117 audio mixer with integrated lighting drive unit. Chymes recently supplied a quadraphonic discotheque system to the Sindlesham Mill country club, Berkshire, and examples of their dj console systems will be on display. Power amplifiers are available from £79 (2 x 100W) and £147 (2 x 200W). These, Chymes consider, offer the best performance/price ratio at the high quality end of the discotheque market.

Among microphones and accessories on the **Keith Monks** stand, a wide selection of floor and table stands including the *MSPA/B* floor and versatile *SC/1* side clamp.

Last but not least, the staff of STUDIO SOUND will exhibit themselves on stand 43. David Kirk will attend Tuesday, John Dwyer Wednesday and Thursday.



SNS *Chorale* mixer/amplifier and *Strauss* loudspeakers

AKG EQUIPMENT LTD, Eardley House, 182 Campden Hill Road, London W8
Phone: 229 3695
Representative: P. J. Eardley
Stand: 11

ASTRONIC LTD, Dalston Gardens, Stanmore, Middlesex, HA7 1BL
Phone: 204 2125
Representative: G. H. Gray
Stand: 15

AUDAC MARKETING LTD, Trinity Works, Trinity Lane, Wareham, Dorset
Phone: 092 95 2977
Representative: W. E. Armstead
Stand: 12

AUDIX BB LTD, Bentfield End, Stansted, Essex
Phone: 027 971 3132
Representative: C. J. Billet
Stand: 26

BEYER DYNAMIC (GB) LTD, 1 Clair Road Haywards Heath, Sussex
Phone: 0444 51004
Representative: S. Duer
Stand: 16

CANADIAN INSTRUMENTS AND ELECTRONICS LTD, 35 Waverley Street, Nottingham NG7 4EB
Phone: 0602 71157
Representative: F. K. Watts
Stand: 9

CTH ELECTRONICS, Somersham Road, Industrial Estate, St Ives, Hunts, PE17 4LS
Phone: 04806 4388
Representative: C. T. Heinlein
Stand: 4

CHYMES ORGANISATION LTD, 320 Barkham Road, Wokingham, RG11 1BR
Phone: 0734 1970
Representative: C. Smith
Stand: 31

S. B. DAVENPORT LTD, 113 Graham Road, Wimbledon, London SW19
Phone: 540 2266
Representative: G. W. Aggett
Stand: 6

EAGLE INTERNATIONAL, Precision Centre, Heather Park Drive, Wembley, Middlesex, HA0 1SU
Phone: 903 0144
Representative: W. J. Morrow
Stand: 35

48 ▶

SOUND '73 PREVIEW

GARLAND G. H. & COMPANY LTD, 101-105 Nibthwaite Road, Harrow, Middlesex, HA1 1TF
Phone: 427 3536
Stand: 27

GOLDRING MANUFACTURING CO. (GB) LTD, 10 Bayford Street, London E8 3SE
Phone: 985 1152
Representative: G. Sharp
Stands: 41 & 42

GRAMPIAN REPRODUCERS LTD, Hanworth Trading Estate, Feltham, Middlesex
Phone: 894 9141
Representative: R. Denham
Stand: 21

GULTON EUROPE LTD, The Hyde, Brighton, Sussex BN2 4JU
Phone: 730 2191
Representative: Mr Smith
Stand: 13

HAYDEN LABORATORIES LTD, Hayden House, 17 Chesham Road, Amersham, Bucks
Phone: 024 03 5511
Representative: K. E. Owens
Stand: 5

JOHNSON BRODY LTD, 394 Northolt Road, South Harrow, Middlesex
Representative: Peter Walker
Stand: 28

K. F. PRODUCTS LTD, Brookfield House, Hopes Carr, Stockport, Cheshire
Representative: K. G. Faure
Stand: 17

LUSTRAPHONE LTD, St George's Works, Regents Park Road, London NW1 8XG
Phone: 722 8844
Representative: A. T. Waller
Stand: 49

MACINNES LABORATORIES LTD, Stonham, Stowmarket, IP14 5LB
Phone: 044 971 486
Representative: I. Marshall
Stand: 38

MILLBANK ELECTRONICS GROUP, Bellbrook Estate, Uckfield, Sussex
Phone: 0825 4166
Representative: A. Walker
Stands: 19, 20, 33 and 34

MONKS, KEITH (AUDIO) LTD, 26-30 Reading Road South, Fleet, Nr Aldershot, Hants
Phone: 02514 7316
Representatives: T. K. Monks, P. A. Cooper
Stand: 6

PSP ELECTRONICS LTD, 228 Preston Road, Wembley, Middlesex
Phone: 904 9521
Stand: 10

ROLA CELESTION LTD, Ditton Works, Foxhall Road, Ipswich, Suffolk, IP3 8JP
Phone: 0473 73131
Representative: E. R. Howlett
Stand: 24

SHURE ELECTRONICS LTD, 84 Blackfriars Road, London SE1 8HA
Phone: 928 3424
Representative: B. L. Denton
Stands: 2 and 3

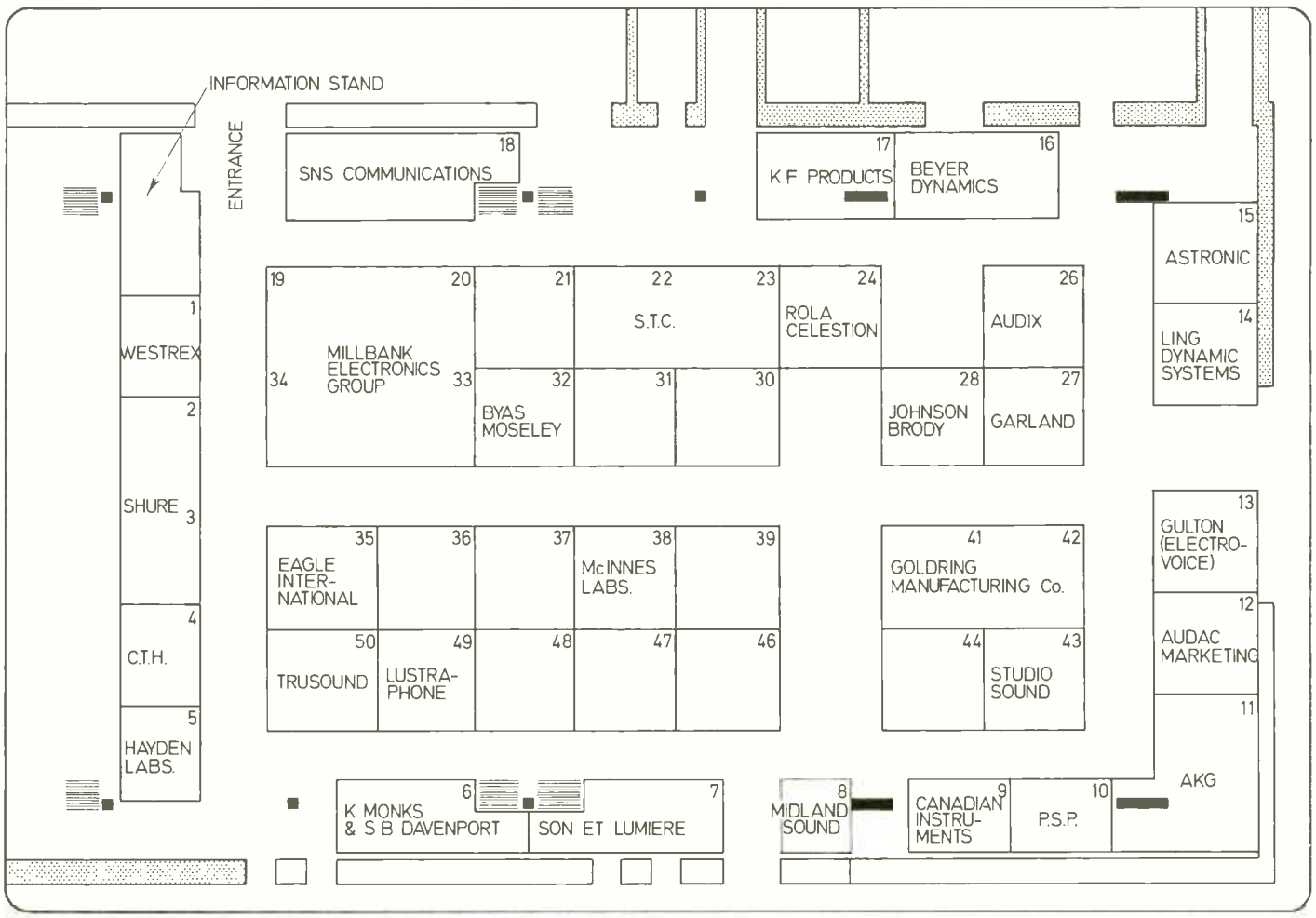
SNS COMMUNICATIONS LTD, Tropical Works, 851 Ringwood Road, West Howe, Bournemouth, Hants
Phone: 020 16 5331
Representative: D. A. Fisher
Stand: 18

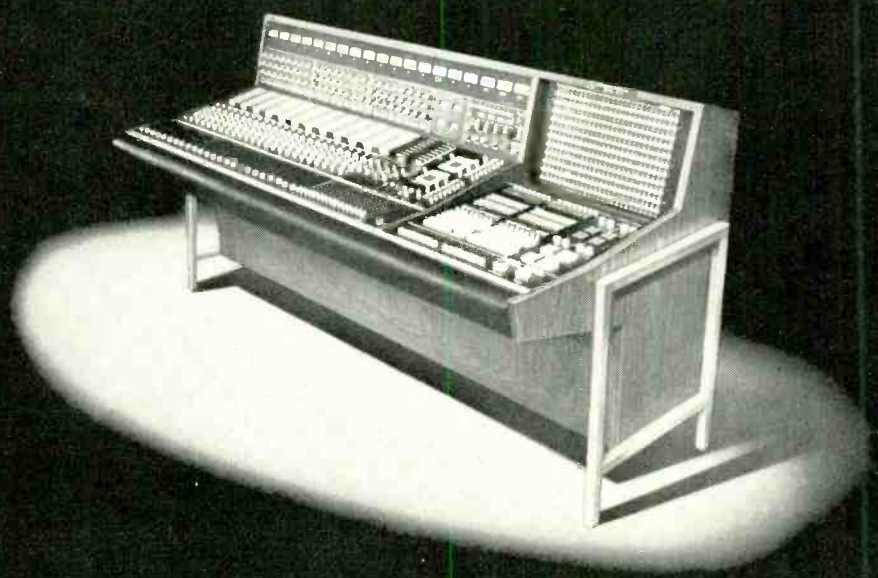
SON ET LUMIERE EQUIPMENT LTD, Ide Hill, Kent
Phone: 073 275 454
Stand: 7

STANDARD TELEPHONES & CABLES LTD, Private Communications, Foots Cray, Sidcup, Kent
Phone: 300 7788
Stands: 22 and 23

TRUSOUND MANUFACTURING LTD, Crittal Road, Industrial Estate West, Witham, Essex
Phone: Rivenhall 4101
Representative: T. I. P. Baldwin
Stand: 50

WESTREX CO LTD, 152 Coles Green Road, London NW2 7HE
Phone: 542 5401
Representative: E. A. Hawkins
Stand: 1





What makes a console great?

In aiming for creative expression, producers and musicians make great demands on a console and its operator. The key to a successful session is the ability to satisfy these demands quickly and easily.

A *great* console . . . the MODEL 2416 for example. . . . has the built-in flexibility and versatility to be responsive to the wide range of dynamic requirements encountered in studio applications. The MODEL 2416 provides up to 28 inputs, each with the Model 550 three knob equalizer, four echo sends, three position high-pass filter, channel phase reverse, switchable mike-pad and gain control, panner, two independent cue feeds and input solo. There are sixteen metered mixdown busses, simultaneous quad and stereo facilities, overdub facilities, four separate headset or cue busses with master level controls, and a complete patch bay with jacks for over three hundred separate circuits.

The exceptional quality and reliability of its components means a console that consistently delivers fine performance under the most demanding conditions.

For a look at the MODEL 2416 and a complete description of its features, contact us today.

Meanwhile, start thinking of the great things you'll be able to do with it.

AUTOMATED PROCESSES, INC.
80 MARCUS DRIVE, MELVILLE, NEW YORK 11746 · 516-694-9212

Distortion: Cause and Effect

TONY EDEN

In the second of two articles, the author attempts an objective answer to the question 'How much distortion is tolerable?'. The usefulness of an oscilloscope in evaluating distortion is emphasised and several methods of measuring amplifier distortion outlined.

LAST MONTH, consideration was given to the methods of measuring the harmonic distortion content of a sinusoidal waveform. Ultimately these methods of measurement are the only ones which are consistent enough to be used in comparing one tape system, amplifier or loudspeaker with another. However, such methods leave a number of questions unanswered, the most important of which is: What figure is good enough for the distortion of a piece of equipment? Without an objective function, there is no way of determining whether a total harmonic distortion content of, say, 0.5 per cent is good enough. The only objective function as yet developed for evaluating the performance of an amplifier or loudspeaker is an aural test and this inevitably introduces a subjective evaluation. While subjective measurements are disliked by many engineers, a vast amount of work has been performed in acoustic measurements and some consistent results have emerged.

Firstly, a trained listener finds higher order harmonic distortion more objectionable than lower order harmonics. This may in part account for the observation that a Class A power amplifier sometimes sounds better than a Class B amplifier of comparable total distortion content. Class A amplifiers generate second and fourth order harmonics whereas Class B amplifiers generate third and fifth order harmonics. Wigan, in an article in *Electronic Technology* (April 1961) proposed using a weighted measurement to take account of higher order harmonics being more objectionable than lower order harmonics.

Tolerable distortion

Secondly, based on a single 1 kHz sinusoidal waveform input, a trained listener can tolerate a second harmonic distortion level of about 1 per cent before detection and the figure for the third harmonic is about 0.4 per cent.

Thirdly, the trained listener can detect what has been called the 'acoustic roughness' of complex waveforms. This appears to have a far lower distortion content than the minimum detectable on a single sine wave.

The last point has led to the development of methods which attempt to evaluate complex waveform distortion. Fundamentally the problem is this: a sinusoidal waveform of one frequency, when passed through an amplifier, will at the output contain harmonics. Another frequency will be similarly affected and, when both frequencies are introduced, one frequency will amplitude modulate the other. This is of no consequence as far as the fundamental frequencies are concerned since normal complex waveforms occur in this manner. However, modulation also occurs to the harmonics producing in effect sidebands of the fundamental frequency. These sideband frequencies occur as the sum and differences of the fundamentals as well as other more complex relationships. It is the occurrence of these sideband frequencies which produces what is known as acoustic roughness and the magnitude of the roughness is determined by the depth of modulation of the carrier signal. In turn, the depth of modulation is a function of the harmonic distortion content of each of the frequencies being considered. Thus, while harmonic distortion gives one measure of roughness produced by an amplifier or loudspeaker, what it does not do is give any indication of how much harmonic distortion can be permitted before acoustic roughness becomes apparent. Von Bekesy, in a large number of tests on the relative roughness measures of one frequency beating with another, showed that roughness is at a maximum when one frequency is about 50 Hz away from the other (see **fig. 1**). Furthermore, the roughness increases to a maximum when the frequencies are around 3 Hz, and appears to be smaller at lower frequencies—which is in accord with general experience. When the difference between the two frequencies increases or decreases from 50 Hz, the roughness appears to diminish.

Measuring 'roughness'

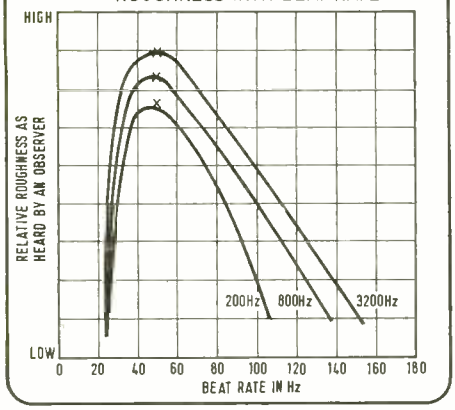
The work of Von Bekesy in the mid 1950s summarised many other workers' efforts, particularly those who tried to measure roughness by two frequency methods.

Hilliard described a method of measuring roughness or 'intermodulation distortion' in an article in *Electronics* (July 1946) which was subsequently adopted by the Society of Motion Picture and Television Engineers and is now usually known as the SMPTE method. The two frequencies used are a low frequency signal (Q) of about 60 Hz and a high frequency signal (P) of about 3 kHz. Q is arranged to have four times the amplitude of P. The two signals are combined and passed through the amplifier. A high pass filter follows the amplifier which rejects signal Q. The modulated high frequency signal consists of P, plus the products (P+Q), (P–Q), (P+2Q), etc. These signals are now fed through a detector and low pass filter so that P is removed leaving only the modulation products (**fig. 2**) which are then read on a millivoltmeter.

It can be seen from the work of Von Bekesy that this measurement is not evaluating what the ear detects as roughness since the frequency difference between the two signals is too great. Therefore the method does not measure the subjective impression of roughness though it does have its uses in loudspeaker testing. One of the most difficult aspects of loudspeaker design is to reproduce bass cleanly and it is here that most 'tricks' are employed to give a reasonable bass output, especially in small enclosures. While the distortion of a single low frequency signal may not be immediately obvious, the distortion level may be sufficient to intermodulate higher frequencies causing a particular roughness effect.

The nature of this roughness differs from that caused by an electronic process such as amplification; instead, the distortion arises from the fact that the low frequency is modulating the higher frequency and therefore, as the cone moves forwards and backwards at a low frequency, the high frequency is carried on this cone movement. A stationary listener finds that the higher frequency is changing in frequency; an effect first observed by Doppler. A changing high frequency in the presence of a lower frequency occurs as one form of roughness and is often called Doppler distortion. This form of distortion can be minimised by using two or three speaker units each handling a different part of the frequency range. Also, a totally enclosed cabinet is often used in which the stiffness of the enclosed air at low frequencies (30 to 100 Hz) is made equal to the mechanical stiffness of the diaphragm suspension.

FIG. 1 VARIATION OF ACOUSTIC ROUGHNESS WITH BEAT RATE



Hence, under conditions where the low frequency distortion level may be high, the SMPTE method can give useful design information.

Scott, working at the General Radio Company, described another method of measuring roughness using two frequencies. This article appeared in *Electronics* in January 1945 and the method was later adopted by the International Telephonic Consultative Committee (CCIF) and is now named after that organisation. Two signals of equal amplitude (P and Q), but with a small frequency difference (usually 50 Hz), are combined and fed into the amplifier under test. The resultant signal then passes through a low pass filter to reject the P and Q signals (**fig. 3**). The even-order intermodulation products (P-Q), 2(P-Q), etc, are passed by the filter and measured on a millivoltmeter. This method does not measure the odd order harmonics 2P-Q, etc, for which a wave analyser would be required. The method represents a good measure of subjective roughness since the two frequencies are of equal amplitude and both frequencies close together. Typically the frequencies used are 3 kHz and 3.05 kHz.

As a guide, the ear would detect roughness as being apparent using the SMPTE method when the lower frequency has a distortion content of about 5 per cent. However, the ear can detect roughness using the CCIF method when the frequencies have distortion levels of about 0.2 per cent. The latter test has probably given rise to the general acceptance that the harmonic distortion level in an amplifier should lie below 0.1 per cent throughout the major portion of the audio range (100 Hz to 10 kHz).

It was mentioned last month, and is worth reiterating, that an oscilloscope can be extremely useful in evaluating many forms of distortion. Intermodulation is a good example. If the SMPTE method is used to measure distortion, the oscilloscope trace may well appear as shown in **fig. 4.** By making use of the graticule on the oscilloscope, a quantitative value can be placed on the distortion level. Alternatively, if one frequency is put directly on the vertical plate of an oscilloscope and the other frequency on the horizontal plate, then the various waveforms that result are shown in **fig. 5.**

Two other methods are used for testing the roughness of amplifier responses. If white noise is applied to the input of an amplifier in which a band of the noise is suppressed, then the output from the amplifier can be measured to ascertain if there is any signal present in the suppressed region. If this is the case, then intermodulation distortion is present in the amplifier. This test is particularly useful to show the distortion content of the high frequency end of the amplifier. For example, if noise is applied above (say) 15 kHz and the amplifier output measurement is tuned to the 1 to 4 kHz region (the most sensitive part of aural spectrum) then the level of output gives a good indication of the intermodulation that has occurred above 15 kHz.

The final method to be described for measuring distortion of amplifiers is very simple in concept. A signal (single or complex) is applied to the input of an amplifier and the amplifier output is attenuated and compared with the input signal. The object is to balance, as far as possible, the input with the output signals thereby (in an ideal case) resulting in zero output after the balancing network. Since phase

FIG. 2 SMPTE METHOD OF MEASURING INTERMODULATION DISTORTION

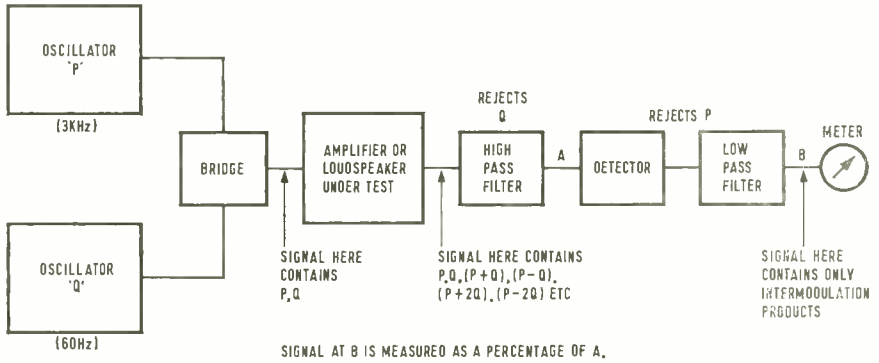


FIG. 3 CCIF METHOD OF MEASURING INTERMODULATION DISTORTION

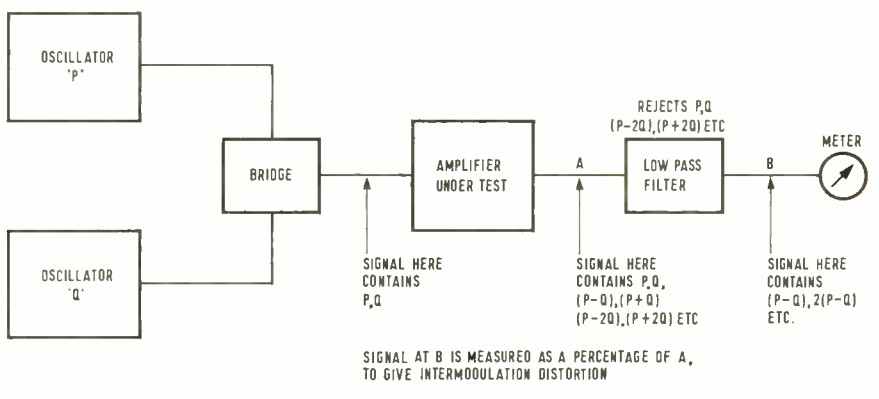
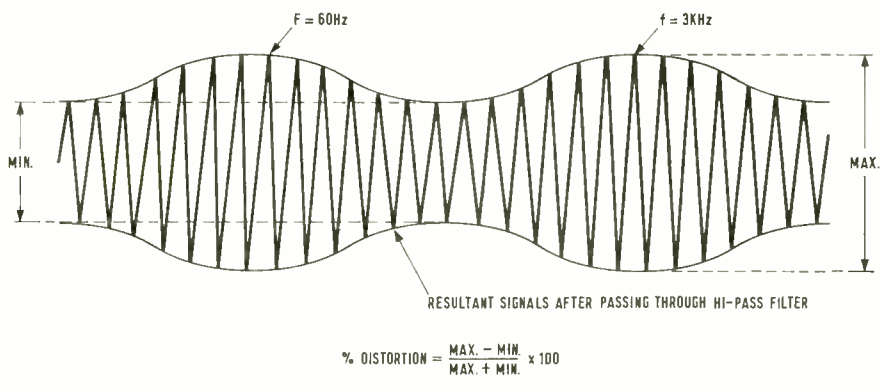


FIG. 4 USE OF OSCILLOSCOPE TO ESTIMATE DISTORTION BY THE SMPTE METHOD



$$\% \text{ DISTORTION} = \frac{\text{MAX.} - \text{MIN.}}{\text{MAX.} + \text{MIN.}} \times 100$$

52 ▶

shifting occurs in the amplifier, some form of compensating network is required (fig. 6). By making a phase shift network that compensates for the amplifier signal throughout the audio range, the dynamic distortion present in any musical item after amplification can be tested.

Transient distortion

Another form of distortion which arises in a rather different manner but results in the same acoustic roughness is transient distortion. Transient distortion is present in amplifiers to a small extent but is a much more important consideration in loudspeaker design. The problem here is that a large quantity of energy is required to make the loudspeaker cone move. Thus there is a delay in making the cone move, due to its inertia, when a pulse is applied.

FIG. 5 GAIN DEVIATION METHOD FOR ASSESSING DISTORTION

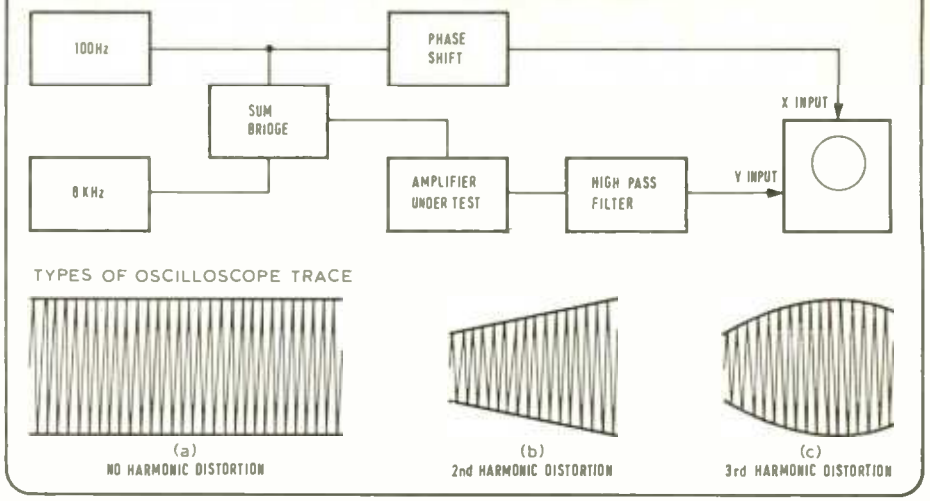
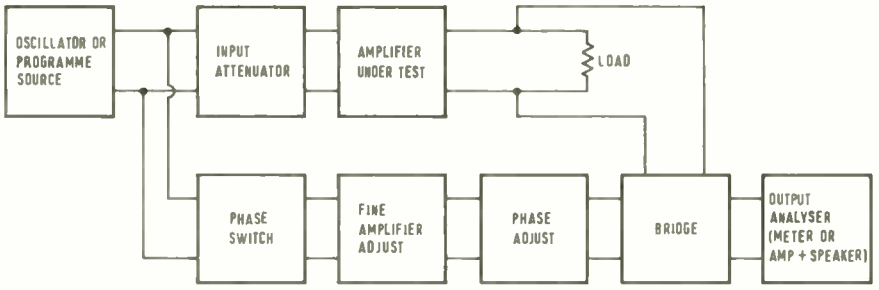


FIG. 6 DYNAMIC METHOD OF TESTING AMPLIFIERS



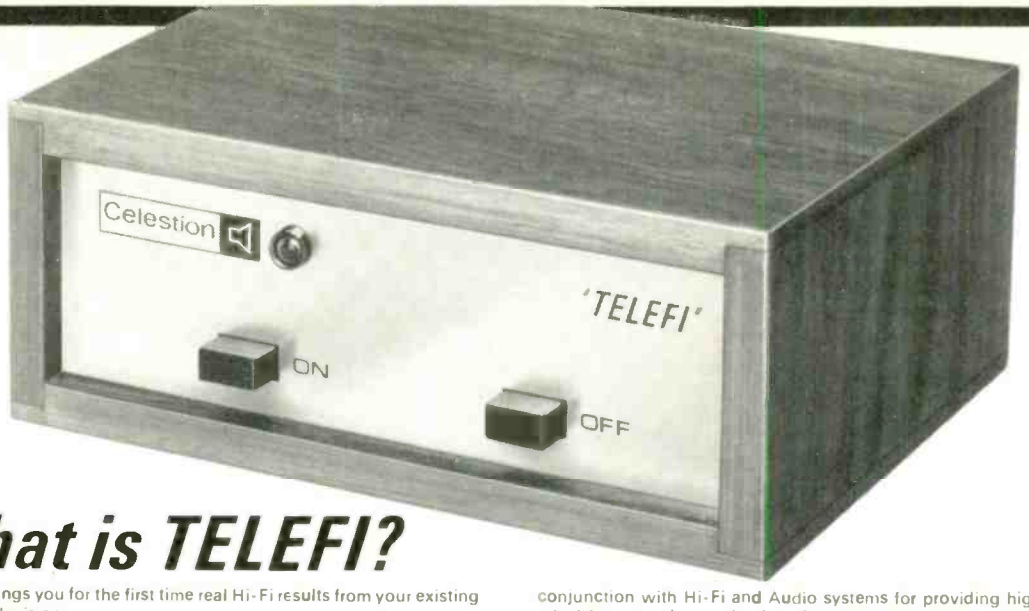
Similarly, when that pulse stops the cone continues vibrating. This can give rise to many forms of 'hangover' resulting in roughness. One method of testing loudspeakers has been to apply bursts of tone to the loudspeaker and observe the results on an oscilloscope. The loudspeaker with low transient distortion will commence vibration very quickly and likewise will cease very quickly when the tone burst ceases. This is a very useful method of testing at the development stage of a loudspeaker but does not of course give any quantitative information about the loudspeaker performance.

Considerable research has been undertaken over the last two decades (much of it by the BBC) to produce loudspeakers with reliably low distortion at all power levels. It is a tribute to the BBC Research Department that the results of their development work are incorporated into so many loudspeakers used for monitoring purposes. In nearly every publication on loudspeakers, the final evaluation of the quality of a speaker is dependent upon aural tests. The reason for this is that the single frequency test will yield some information on the distortion level of a speaker, a two-frequency test will yield rather more information, but speech and music contain very much more complex waveforms than the first two tests can possibly evaluate. Hence the final assessment of the quality of a loudspeaker is usually made by listening critically to different types of program material.

Speech (especially male) is a good test of the low/middle frequency range, an area where distortion (or coloration) is usually most objectionable. An instrument such as a harpsichord provides a very good test for the transient response of a loudspeaker as the attack and decay times can be extremely fast. A full choir provides a very useful test for the power handling capabilities of the loudspeaker, as well as a very good test for the 'cleanness' of soprano voices. Finally, certain pieces of organ music provide a very good test on the quality of deep bass and this test will usually reveal objectionable intermodulation distortion. In a few more years it should be possible to analyse the quality of a loudspeaker as it relates to the human brain.

Distortion measurements on tape recorders can be complicated by the effects of wow and flutter on the figures. Wow and flutter are, of course, a source of distortion giving an effect on a single frequency similar to Doppler distortion in loudspeakers. The simplest single frequency method of measuring distortion on tape systems is to use a distortion factor meter. It is difficult to make accurate measurements to much below 0.5 per cent because the frequency is being modulated (fm) by the wow. Hence accurate tuning of the 'notch' becomes impossible. The problem is usually not too bad because the notch is sufficiently wide to allow for small variations in the fundamental. The problem is much worse if a wave analyser is to be used for tape distortion measurements. Here the response can be 3 dB down for a bandwidth deviation of 6 Hz (which is independent of frequency) and therefore measurements become extremely difficult at frequencies above about 5 kHz. One method of overcoming this problem is to use a tuned amplifier but tuned over a fairly wide frequency spectrum such as one-third octave. In this way frequency variations of the fundamental can be catered for and such a facility is fitted to the B & K spectrum analysers. Intermodulation distortion measurements are possible on tape systems but are infrequently made and even less frequently quoted. Any such tests are usually restricted to the amplifiers only. More rigorous distortion tests on tape machines would quickly differentiate between machines which apparently have the same frequency response and noise level. The most widely quoted measurement is the maximum single frequency signal that can be put on tape for a 2 per cent distortion level. What happens below this level is rarely disclosed. The signal can be distorted by the tape mechanics, the bias oscillator, the tape medium itself, and the electronics.

It is hoped that this rather brief survey of the methods of measuring distortion will help to put into perspective the advantages, disadvantages and limitations of the various techniques, as well as to indicate the necessary interpretation if meaningful figures are to be obtained.



What is TELEFI?

Telefi brings you for the first time real Hi-Fi results from your existing 625 line television.

T.V. Studios transmit superb quality but skimping in the sound section of the receiver means low-fi sound.

Celestion Telefi changes all this – simply coupled to most T.V. receivers – the first T.V. music you hear through Telefi will convince you the dramatic improvement is what you have been waiting for.

Telefi a remarkable innovation exclusive to Celestion for use in conjunction with Hi-Fi and Audio systems for providing high quality television sound reproduction. No direct connection to the T.V. is required, the coupling being effected by an inductive pick-up.

Telefi is complete in a handsome natural teak veneered case 7½" x 5⅛" x 2⅞" approx.

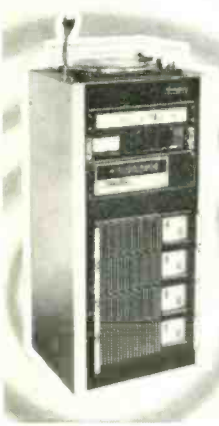
"The Telefi is a very worth while device and will give greater overall enjoyment than the T.V. manufacturers normally provide." *John Gilbert 'The Gramophone'.*

Celestion

Also send for details of the complete range of Celestion Loudspeakers

ROLA CELESTION LTD.

DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP



Grampian

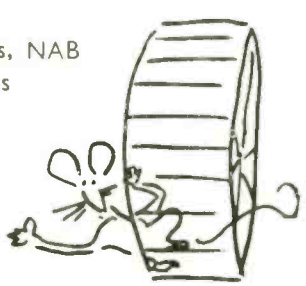
Series 7
Modular Sound Systems

GRAMPIAN REPRODUCERS LTD
HANWORTH TRADING ESTATE,
FELTHAM, MIDDLESEX.
TELEPHONE: 01-894 9141.
GRAMS: REAMP FELTHAM

THE PROFESSIONALS

Prime mover for jingles, NAB and Q8 cartridges, machines instant start solenoid operated.

5 models at **£75, £95, £145, £230, £270.**



SOUND

1 Oldershaw Mews, Maidenhead
STD **0628-33011** *24 hours Answerphone*

MINIFLUX

MEG 260 Peak Recording Meter responsive to both positive and negative waveforms: Sensitivity 90mV-2V to indicate 0dB: Exclusive automatic LED overload indicator. Price **£33.50** + VAT.

MEG 120 Constant Current Recording Amplifier.
MEG 130 Master Bias Oscillator and Buffer Amplifier.
MEG 140 Slave Bias Amplifier for multi-channel recorders.
MEG 150 Erase Power amplifier.
Modular electronics for multi-channel recorders and Studio equipment.

MINIFLUX electronics limited
8 HALE LANE, LONDON NW7 3NX England
Telephone 01 959 2991

The dBm or the dB(V)?

ANGUS McKENZIE

The decibel is arguably the most frequently misused and the least understood 'unit' in electronic engineering, despite hard competition from the Watt. Responding to H. A. O. Wilms' and J. M. Bowsher's theoretical article published in our December issue, the author suggests practical definitions of the dBm.

IN AN EXCELLENT article in the December STUDIO SOUND, John Bowsher and H. A. O. Wilms gave a most interesting history of the use of the dBm and made some suggestions for clarification in the use of the various dB reference standards. While in general agreeing with the various points raised, I feel that further clarification might be of interest. I would also like to propose some new standards myself.

Though agreeing that the 0 dBm reference point was originally designed to represent a power level of 1 mW dissipated in a 600 ohm resistance or impedance, and that dB relative to this originally referred to variations in power level, I have always regarded the unit as a convenient voltage reference of 0.775V. I would suggest that 99 per cent of engineers involved directly in the sound recording industry nowadays also regard the unit in the same way, although line communication engineers and some film audio engineers may well continue to use the unit as a power reference. Provided that the output source impedance of equipment was always 600 ohms and the input load impedance was also 600 ohms, the unit could perfectly easily be used for voltage references without any misunderstanding. I use the word 'was' because almost all studio audio equipment is now normally supplied with a low output impedance and a high bridging input impedance, although 600 ohm impedances can usually be supplied for the diehards. Many manufacturers, however, still completely misunderstand the 600 ohm line theory. While supplying input termination resistors to make up the input impedance to 600 ohms, they then frequently terminate the output with a parallel 600 ohm resistor, rather than building out the output source impedance to 600 ohms by adding a series resistor allowing a 600 ohm source.

My own experience of confusion in relation to dB as power gain or voltage gain was in 1958 when I purchased two STC microphone amplifiers which were normally supplied with 600 ohm input and output impedances floating balanced. The amplifiers had switched gains with positions labelled 40, 50, 60 and 70 dB gain. Since at the time all my mics were of 30 or 50 ohms impedance, the units were ordered from STC to work with such mics and to feed equipment with 600 ohm input termination resistors. I remember being baffled for a while because I had measured the voltage gain of the equipment on each switched position some 8 dB higher than stated by STC. Since 8 dB change of voltage corresponds to an impedance change of approximately six times, the input impedance of the STC amplifier would therefore have been approximately 100 ohms, which would have tied in with the specification. The necessity of loading the output with 600 ohms in order to achieve correct working levels, however, brought considerable complications. The most serious of these was the necessity of using either trap valve amplifiers to feed various pieces of equipment, or hybrid transformers which split the output power to different loads. It was not always economic to allow valve equipment to give both a high voltage clipping level and a low source impedance since this amounted to an ability to give considerable power. With modern transistor equipment, however, it is easily possible to design all equipment to give levels of above 7V from source impedances as low as a few ohms, plus the dc resistance of a transformer's secondary where applicable.

With most equipment using 1:1 ratio line output transformers, the output impedance of a few tens of ohms is in my experience almost entirely due to the dc resistance of the transformer windings. The input impedance of almost all industrial equipment is now 10k ohms or over, although frequently the manufacturers specify that the equipment should be driven from a source of 600 ohms or less in order to avoid input transformer reactance components having a detrimental effect on performance. It therefore seems quite pointless to consider power gain of amplifiers used in modern recording studios and it would therefore be reasonable to consider the adoption of not only a new unit but a new voltage reference. I therefore propose the adoption of the dB(V) as such a reference, 0 dB(V) representing a 1V voltage level anywhere in the system. Most studios work to a nominal peak line level referred to as +8 dBm which, in old terminology, should perhaps more correctly be referred to as 1.97V. If this same level were referred to as 2V, i.e. +6 dB(V), the error would only be 0.2 dB which is of no real significance.

After considerable research I have ascertained that some studios peak approximately 6 dB above 320 nWb/m on their tapes even when Dolby noise reduction systems are used. For interchange purposes, therefore, it would be extremely convenient if 0 dB(V) could be standardised as a level equivalent to a recorded flux of 320 nWb/m. This would in particular tie in precisely with current BBC practice where a peak of six on their ppms corresponds not only to an output voltage of 1.97V but also a recording level on BASF *LR56* tape (used frequently by them for stereo recording) of 640 nWb/m (6 dB above DIN reference level). A standard line-up level of four on a ppm would therefore correspond to −2 dB(V). In such a system a ppm reading of 4.5 would correspond to a tape flux level of 320 nWb/m and 3.25 would then correspond to Ampex operating level, also referred to as 'Dolby level'. Once again it is convenient that 3.25 on a ppm happens to coincide with BBC stereo line-up tone.

The eventual adoption of these proposed levels would necessitate changes of gain in many units but, under almost all circumstances, preset gain controls will be found to have more than enough gain in hand.

There are obviously a number of snags in such a change, the main one being the necessity of replacing scales on test equipment having references to 0 dBm equalling 0.775V. Much test equipment, however, including that made by B & K, is scaled in dB(V). In any case, instruments such as the Level microvoltmeter series are, by the die-hards' standards, incorrectly scaled in dBm, since their input impedances are usually at least 1M ohm. Also, they measure voltage rather than power. A change of scale to dB(V) would put right this error for all, and bring the instruments up to the same, scaling standard as B & K.

Alternatively, as John Bowsher points out the scale should be referred to in dB(V.7), a unit which I strongly object to as nobody would remember to add the '.7'. New scales would not be expensive to produce and would be very much easier to correlate. Amplifier input

sensitivities are often given in mV which can be quickly referred to in dB(V), whereas rapid mental calculations translating mV into dBm or vice versa can easily result in 2.2 dB being absentmindedly added or subtracted in the wrong direction.

I discussed all the above suggestions with John Bowsher and he agrees in principle with them. The matter was also raised at a recent AES meeting held at the IEE where most people who contributed to the discussion also agreed in principle. One member of the audience, however, insisted that the dBm should always be used for power level references and further stated that he preferred to see all amplifier gains as power gains. I replied that this seemed unnecessary since very few engineers now were concerned with matching amplifier impedances. I quoted the absurdity of specifying the power gain of an fet capacitor mic amplifier having an input impedance of several hundred megohms and an output impedance of 200 ohms or so, and having a voltage gain of unity. To avoid loading effects I also pointed out that it would be most convenient to agree upon an international standard that all output source impedances of studio equipment shall be less than 100 ohms, and all input impedances greater than 10 k ohms with the sole exception of microphone preamplifier inputs. For the latter it would be reasonable to specify internationally 1k ohms, and for microphones to be designed to work into this impedance. In practice, normally all professional microphones are designed for optimum performance into 1k ohms. All equipment could also have performances specified with 1k ohms input and output terminations. Under these circumstances, we would therefore have a situation where 0 dB(V) would equal 0 dBm as originally used, a power dissipation of 1 mW, but into 1k ohms. This nominal impedance is of course geometrically half way between 100 and 10k ohms in terms of loading. Input and output transformers could be designed to work at all appropriate impedances below or above 1k ohms respectively, with no undue problems. Many manufacturers find it necessary to load a balanced output transformer in order to obviate high frequency ringing or peaking. The addition of a reasonable number of 10k ohms input impedance amplifiers would not materially affect output levels since the output impedance would be less than one-tenth of 1k ohm. This would end the 600 ohm legend. It is incidentally worth noting that, whereas 600 ohms is not a standard value of resistance, 100 ohms, 1k ohm and 10k ohms are.

The VU meter unfortunately presents a problem. Not only is a 0 VU reference an awkward one but it has been normally regarded as indicating Ampex operating level or Dolby level. Most industrial machines have VU meter amplifiers of variable sensitivity. It would probably be best to consider increasing their gain by approximately 7 dB so that 0 VU could correspond to a voltage level of −4.8 dB(V), having established 0 VU as 320 nWb/m. With older equipment in which VU meters are switched across 600 ohm source impedance lines, most VU meters will be found to introduce distortion on to the line because of the diodes used in the meter rectification. In such circumstances, would it perhaps be better to consider a metering system not having such failings and giving a truer indication of peak line levels?

It is fair to add the VU meters used across lines driven from low source impedances (i.e. 100 ohms or less) do not add significant distortion. The advantages of effectively lowering the absolute peak voltages in systems also include the possibility of using considerably lower ht rail voltages in equipment, with the subsequent saving in cost of components. Lower power levels would be involved and emergency battery supplies such as two *PP9* in series (18V) would be ample for many purposes.

I realise that all the above suggestions are rather controversial but feel that such standards would be very convenient for many users. I realise that referring a tape flux level to a line voltage may be impracticable, partly because of the VU meter, but I think that at least the use of the dB(V) rather than the dBm can be most seriously considered, leaving the dBm where it originally belonged—to the line communications engineers.

The VU meter design is now well over 30 years old and, while in its early days it was remarkably sensitive (having approximately 1.8V ac fsd with an impedance of 7.5k ohms), it could be greatly improved with current technology. It might be fairly simple to design a meter of the same input impedance, but using more efficient diodes, and a better magnetic system which could allow a sensitivity of 580 mV for 0 VU (which is also incidentally the voltage level proportionate to most *B* system Dolby levels, as well as Dolby level on my new suggested standard of 1V = 320 nWb/m. If the new standard reference impedance of 1k ohm could be used, this might be referred to internationally as 0 dB(kΩ), in which case the already suggested IEC standard of dB(mA) representing a reference of 1 mA would tally most conveniently. If most of these recommendations could be adopted, they would finally realise Dick Swettenham's slogan '600 ohms is dead'.

Late news item

SHORTLY BEFORE going to press, we were informed by Mr Ira Gale (Gale Electronics & Design Ltd, 39 Upper Brook Street, London W1Y 1PE) that he is organising an exhibition of industrial audio equipment to run concurrently with Sonex '73 at the end of March. A bus will take visitors from the Excelsior Hotel to *Proson '73* at the Sheraton Hotel, Heathrow, and back again. Admission will be free but by ticket only (available from Gale). It is understood that AKG, Amcron, Ampex and Audio Applications equipment will be on show in addition to a Gale loudspeaker. Contrary to rumour, STUDIO SOUND is in no way involved with this event though we will be represented at Sonex.

Survey: Disc cutting equipment

COUNTY

County Recording Service, London Road, Hinfield, Bracknell, Berkshire.

Tel: 0344 4935.

Disc-cutting equipment and all ancillary units and services. A complete system could be supplied costing from £500 upwards, depending on requirements. Individual items are priced as follows:

Disc recording heads rebuilt, repaired and serviced —from £15 upwards. Stylus heater units—£25. Swarf extraction systems—about £100. Disc cutting equalisers with or without a monitor section—from £100 upwards.

County make and supply styli for all types of cutter head from £3 each. Heater windings are fitted to the styli for an extra 25p each. Disc cutting styli are relapped at from £1.75 each. County Recording Services say they have nearly finished experiments on a new stereo disc recording head. It is a moving coil device which they hope to sell for about £750, with the electronics, power amplifier, equaliser and so on costing a further £750. They hope to be able to convert suitable disc recorders to cut stereo for under £2000, which will include mechanical overhaul, delivery and setting up in the client's cutting room. In the near future they also hope to offer 18 cm recording blanks for 40p each.

MSR

MSR Electronics Ltd, Meeting House Lane, Balsall Common, Near Coventry, Warwickshire.

Tel: 0676 32468.

MSR series 1000 and 2000 disc cutting lathe

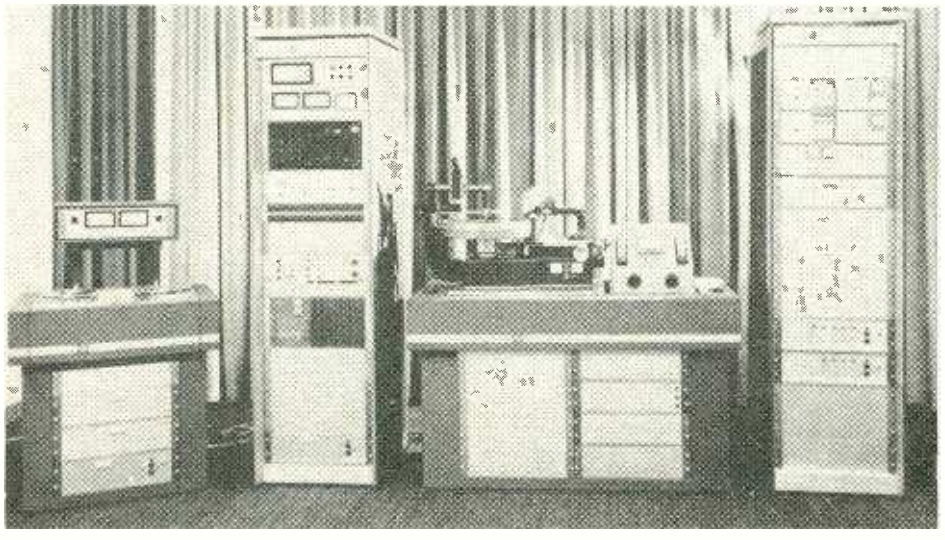
The MSR series *2000* and MSR series *1000* disc cutting lathes are designed to cut stereo and mono records respectively. The system is intended to accommodate all standard record sizes and a range of four turntable speeds.

A control system which has the following functions is used to achieve semi-automatic cutting: lowering and lifting the cutter head; scrolling in and out at predetermined diameters; adjustable timed marker groove; start stop of the tape replay machine and so on.

The cutting system incorporates the Ortofon stereo cutting amplifier type *G0701/GE 701* and the complete unit is housed in a floor standing console accommodating recording amplifiers and control logic circuitry.

Technical specifications

Cutter head mounting: intended for the Ortofon stereo cutter head type *DSS661*.



Left: Neumann cutting system.

Cutter head suspension: automatic lower and lift stylus heater current switching depth of cut electrically controlled and adjustable.
Turntable speed: 16⅔, 45, 33⅓, 78 rpm.
Turntable diameter: 40 cm.
Turntable weight: 18 kg.
Turntable vacuum: vacuum indexing for 18 cm/s 25 cm/s and 30 cm/s recording blanks.
Leadscrew: servo controlled with varigroove.

All functions are actuated by push buttons which are illuminated to indicate the function in operation. Switching operations are carried out by solid state circuitry mounted on plug-in printed circuit boards, thus avoiding the need for unreliable relay switching. All pushbuttons and controls required for the operation of the lathe are grouped together on a control panel. Separate instruments on this panel indicate groove pitch, stylus current, depth of cut and peak programme groove modulation.

The 406 mm diameter turntable is driven direct from a dc motor, servo controlled using a crystal controlled clock achieving a high degree of speed stability over a long period. The system is independent of mains frequency.

The leadscrew is driven from a servo-controlled motor which may be adjusted manually to give a wide range of grooves per centimetre. Varigroove is also incorporated in the same circuitry and its signal is derived from an advance head on the tape replay machine. The vari-groove signal is analysed for programme level and frequency spectrum before overriding the groove pitch set manually for the leadscrew motor. The vacuum line serves two purposes, namely collect swarf from a point directly behind the cutting stylus and as a turntable vacuum for retaining the recording blank.

The cutter head mounting and suspension is intended for the Ortofon stereo cutterhead type *DSS661*. The mounting also contains the stylus heating coil, which is cut off when the cutter head is lifted, and electronically controlled depth of cut.

Groove pitch: continuously variable from 40 gpc to 160 gpc for each turntable speed.
Stylus heating: variable dc current up to 1A.
Microscope: Nikon microscope 150 times magnification with calibrated graticule.
Metering: independent meters are used to monitor groove pitch, depth of stylus cut and stylus current.
Programme Input: balanced floating 10k ohms. Presettable in one dB steps from —6 dBm to ±6 dBm.
Monitor output: 100W rms per channel into 8 ohms impedance.
Programme metering: one ppm per channel switchable to read programme input and other functions.
Recorded velocity: peak cutting velocity 30 cm/s
Frequency response: measured on disc. ±3 dB 10 Hz to 36 kHZ. ±1 dB 20 Hz to 18 kHz.
Harmonic distortion on disc:
1 kHz recorded at 25 cm/s peak. 2nd harmonic 0.4%, 3rd harmonic 0.2%,
30 Hz recorded at 1 cm/s peak. 2nd harmonic 0.6%, 3rd harmonic 0.2%.
Intermodulation: different tones
6.6 kHz and 7 kHz 8 cm/s peak. 40 Hz = 0.07%.
12 2 kHz and 12.6 kHz 2.8 cm/s peak. 400 Hz = 0.1%.

NEUMANN

Georg Neumann & Co, 71 Heilbronn/ Neckar Fleinerstr. 29, Postfach 2120, West Germany.

Tel: 8 22 75.

Agents: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire.

Tel: 01-953 0091.

Disc recording lathe system VMS70

Components: Computer programmed automatic groove spacing (pitch) and depth control, as a

function of program material provides optimum utilisation of the record surface.
Relay-less control system.
Plug-in programmer; one for each record rotational speed and diameter, all other functions such as lead-in and end groove diameters, basic-pitch, automatic pitch control, lead-in, spiralling and lead-out pitch, concentric end groove, cutter lift delay and so on are programmed automatically. Re-calibration is not required.

Amplifier rack

This rack houses all of the electronics required for operation of the *SX68* stereo cutterhead.

Components:

RIAA recording characteristic equaliser (switchable).
Cutterhead drive power amplifiers.
Circuit breaker: to protect the cutterhead against thermic overload.
Feedback amplifiers.
RIAA playback amplifiers (pick-up/feed-back).
Monitor power amplifiers.
Cutterhead alignment module.
Automatic high frequency limiters.
Mounting space and all connections provided for the tracing simulator *TS 66* for reduction of tracing distortion.

Programme controller SP 172 (48 cm version)

Programme controller SP 272 (console desk version)

The programme controller is the heart of the tape-to-disc transfer system. It is here that the program coming from the tape playback machine is processed, metered and monitored. All important program parameters such as disc level, equalisation pitch/depth control and automatic banding may be reproducibly influenced here. Tapes of greatly varying level and quality parameters can be brought into line to produce optimum results. The *VMS 70* lathe may be remote controlled from the program controller.

Complement:

Metering and indicating unit comprising dual light beam peak indicator, two VU meters and stereo correlation meter and phase monitor scope.
Relative disc level attenuator for selection of the recorded disc velocity without influence on meter indication (automatic range switching).
Preview offset control: for changing control channels separately from modulation channels to influence record fill-factor. Both above are 0.5 dB/step amplifier/attenuators.
Four active equalisers: for low/high/mid range boost and droop control.
Four high/low cut-off filters for limiting of frequency band width.
Two elliptical equalisers for reduction of low frequency vertical component to provide compatibility improvement.
Linear board-fade attenuator.
Output for tape recorder for simultaneous tape copy.
Five-frequency precision test oscillator with push-button injection into programme circuits.
Complete jack field (tip/ring/sleeve) provides access to all essential circuits for rapid fault diagnosis, insertion of external components etc.
Monitor selector buttons give access to all vital points for both metering and listening.
Flashing push buttons as reminders of certain vital non-standard functions. Prevent false starts and lacquer spoilage.
Automatic banding unit provides spirals, selection counting and lead-out from optical sensor on tape recorder. Relay-less.
Mounting space and signal and power connections provided for two Dolby Model *360/361* and EMT-*156* PDM compressor.
Push button controls provided for: phase reverse, channel reverse, Dolby insertion, equaliser insertion, mono/stereo, 150/300 Hz compatibility turn-over frequency, cutter on/off, 14 dB test record gain increase, monitor mono control and A/B comparison.

Preview/playback tape console MT72

Tapes are played on the tape deck of the special *MT72* console, which is equipped with special idlers and two stereo playback heads which provide both the control signals for automatic pitch/depth control and the modulation outputs for the cutterhead.

Complement:

Speckal AEG Telefunken *M-15* magnetophon with switchable 19/38 cm/s tape speeds.
Four playback amplifiers.
Four switchable NAB/IEC (CCIR) playback equalisers.
Preview head continuously variable preview distance to suit all tape and disc speeds.
Optical sensor sends pulses on seeing leader between selections and at the end of the tape to provide fully automatic spiralling and lead-out grooves.
Four VU meters with range switch.

Stereo disc cutterhead SX68

In combination with the amplifier rack the dynamic feedback cutterhead *SX68* cuts stereo and mono records.

Technical specification

Turntable rotation: 16⅔, 22½, 33⅓, 45 rpm switchable.
Pressing diameters: 178, 254, 305 mm switchable.
Lacquer blank diameters: 178, 254, 305, 337, 356, 406 mm switchable.
Tape speeds: 19 and 38 cm/s, others available.
Recorded velocity capability: 33 cm/s lateral.
Playing time at 33⅓ rpm: programme dependent but 33 minutes not uncommon.
Frequency response:
disc section: 40 Hz-16 kHz ±1 dB.
tape section: 40 Hz-16 kHz ± 1.5 dB.
Channel separation: at least 35 dB.
Weighted signal-to-rumble ratio: at least 70 dB (measured according to DIN 45539).
Weighted peak flutter: ±0.03% max (measured according to IEC, DIN 45507 and ANSI S 4 3 1971).
Programme dependent automatic low-pass (30 kHz to 7 kHz): *HK66* automatic high frequency limiters (two off).
Compatible cutting through reduction of vertical signal: switchable 150/300 Hz, 6 dB/oct: *EE70* compatilising cards (two off).
Reduction in second harmonic (tracing distortion): *TS66* tracing simulator at least 18 dB at groove excursion limit.
Automatic pitch/depth control information: every ¼ turntable revolution.
Nominal line level: 0 VU corresponding to ±4 dbm.
Switchable for under modulated tapes: to —10 VU corresponding to —6 dBm in 0.5 dB steps.
Switchable for high output tapes: to ±10 VU corresponding to + 14 dBm in 0.5 dB steps.
Tape playback equalisation: NAB/CCIR switchable.
Nominal disc level (peak recorded velocity): settable in 1 dB steps between —4 dB and ±8 dB: producing 5 cm/s per channel corresponding to 7 cm/s lateral at 1 kHz.
Preview offset: ±6 dB switchable in 0.5 dB and 1 dB steps.
Programme equalisation, high/low equalisation: 60 or 100 Hz and 10 kHz: ±15 dB reproducible in 11 steps.
Presence/absence: 0.7, 1, 1.4, 2, 2.8, 4, 5.6 kHz ±8 dB reproducible in nine steps.
High/low cut off filters: 60, 125, 250, 500 Hz, 8, 10, 12, 14 kHz; about 12 dB/oct
Other equalisers available on request.
Automatic banding unit: max eight spirals; relay less.
Timing of spirals: 0.25, 0.5, 0.7, 1, 1.2, 1.5, 2 s (time function).
Metering section: two light beam peak indicators (—70 to ±5 dB);
Two ANSI standard VU meters; one stereo correlation meter; one stereo monitor oscilloscope.
Expansion of metering section: 14 dB for standard alignment records.
Power consumption (dimensions (wth x dpth x hght)): *VMS* 500 VA 1400 x 620 x 1370 mm.
VG 400 VA 540 x 630 x 1950 mm.
SP172 100 VA 540 x 630 x 1950 mm.
SP272 100 VA 1400 x 620 x 1080 mm.
MT 160 VA 810 x 670 x 890 mm.
Weight: *VMS* 350 kg; *VG* 130 kg: *SP172* 125 kg; *SP272* 150 kg; *MT* 150 kg.

Disc cutting lathe system VMS70—mono/stereo.

With disc cutting lathe *AM66*, microscope Leitz *ZA36a*, cutter head suspension *SA66*, depth of cut control unit *TE66*, pick-up arm *TA70* with magnetic stereo-pick-up, lead screw drive-unit *VA66* with echo device for elimination of echoes, drive control *AS66*, power supply *NG70* and three program plugs (30 cm/33⅓ rpm; 25 cm/33⅓ rpm; 18 cm/45 rpm), vacuum chuck turntable *ZA3*, turntable drive motor *SM8/3-A*, lathe console *ZT70* with wiring and suction installation, vacuum pump *VP1* and control amplifier *SV66*.
Price: £11,530.

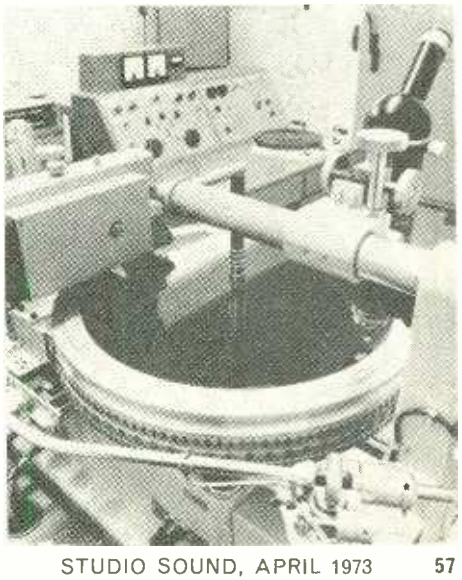
Amplifier system VG66S—mono/stereo

The *VG66S* contains one 48 cm rack *SG66*, one amplifier component assembly *VB66S*, two monitor pre-amplifiers *WV661C*, two recording equalisers *SE661C*, two cutter adjustment modules *CE66*, two feedback amplifiers *GV66*, four drive amplifiers *LV66*, two circuit breakers *SI66*, one monitor control *AR66*, two monitor amplifiers *AV66*, two power supply assemblies *NB66* and one dummy cutterhead *EW68A*.
Price: £3,575.

Control console SP272—mono/stereo

The control console SP272 contains one peak meter unit with one double light beam instrument *M±W*, two peak level indicator amplifiers *PTMV* and one power supply *NS66*; one VU meter unit with two VU meters (Weston), one correlation coefficient meter *U79t* with instrument and two amplifiers *VU70*; one cassette field with two active level controls *RV72*, four equaliser amplifiers *PEVb*, two two-channel high-low-pass filters *HT66* and one stereo monitor oscilloscope; one automatic spiralling device *KS70* (the light barrier *LS70* is to be mounted on the 'Magnetophon' *M15* in *MT72*), one stereo flat-track fader; one switchfield with one test oscillator *PG70*; one amplifier unit with six amplifiers *PV26b*, two elliptical equalisers *EE70*; one power supply unit *NESP* with three power supplies *NS66*, one power supply *2TN15-01A* and one impulse switch *1G*.
Price: £8,600.
One stereo cutterhead *SX68*.
Price: £2,440.
One set interconnecting cables.
Price: £56.
Ten *Cutting sapphires 74 kMH at £10.60.
Price: £106.
Two treble limiters *HK 66* at £272.
Price: £544.

58 ▶



Right: Neumann turntable and microscope

One helium reduction valve.
Price: £20.
One helium cooling system *BA4*.
Price: £60.
One Buchmann-Meyer light *ZA21*.
Price: £98.
One Strobotron *ZA42*.
Price: £58.
One microscope for stylus adjustment *ZA12/68*.
Price: £114.
Total price: £27,201

Tape replay machine
Either Telefunken *M15* special complete in console.
Price: £4,000.
or Studer *A80*/VU-pre-listening.
Price: £2,140.
*cutting rubies are available as alternatives to sapphires at £12.00 each.

ORTOFON

Ortofon, 5 Trommesalen, DK 1614, Copenhagen V, Denmark.

Tel: (01) 31 08 83.

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

Tel: 01-580 4314.

DSS 661 cutter head.
Principle
Each moving coil system is connected to a separate recording amplifier, the moving coil system being part of the negative feedback loop. So the two channels are electrically isolated from each other. The two moving coil systems in the cutter head are mechanically coupled to a common stylus holder in such a way that one moving coil system will move the stylus tip in a direction of 45° to the vertical and the other moves the stylus tip in a direction perpendicular thereto (—45°).

This coupling arrangement, for which Ortofon has taken out a patent, allows the two moving coil systems to drive the cutting stylus in the respective directions without mutually affecting each other.
Negative feedback reduces distortion and damps the cutter, resulting in low crosstalk, flat frequency response and wide frequency range.

Features
The *DSS 661* has a new shape which allows a working position with a tilt of 30° maximum to the vertical. Due to the so called 'spring-back' effect it is necessary to tilt the cutterhead about 25° in order to obtain an effective 'vertical' angle of 15° in the groove. In accordance with another Ortofon patent the *DSS 661* has been prepared for gas cooling to reduce the temperature rise of the driving coils at heavy loads. This is particularly important when cutting frequency test records and so on where a high driving current must be applied for a considerable time interval. The gas-cooling protects the driving coils from damage due to overheating. It is not necessary to employ gas-cooling when cutting normal music records, but if the facility is at hand, it may as well be used in all cases; it will never hurt and it may save the cutter head from damage due to errors or accidents. The cooling gas must be either hydrogen or helium.
Price: Stereo cutter head: £1,600. Cutting sapphire, 'superior quality': £11.70. Cutting sapphire, 'first quality': £8.75.

GO701/GE701 stereo cutting amplifier set
The Ortofon cutting amplifier, *GO701*, has been designed with careful consideration for high power output and minimum intermodulation distortion and harmonic distortion. The amplifier is constructed for a sine wave output of 500W (peak power of 1 kW) which makes it possible to cut peak velocities of more than 30 cm/s even at 20 kHz. The transfer of such high power, particularly in the treble region is normally prevented by the rising impedance of the cutter head. However, in this amplifier a four pole impedance matching network is inserted between the output stage and the cutting head. This network converts the complex impedance at the output into a real load, essentially resistive, throughout the entire audible frequency range.
Since the feedback is a motional feedback sampled in the moving parts of the cutter, it reduces non-linearity in the cutting action at lower frequencies, while throughout the operating range, it reduces system distortion and damps the cutter. In the *GP701* amplifier the entire frequency range is covered by the feedback loop. In the low region at 40 Hz, for example, a feedback ratio of 12 dB is typical.
When the temperature of the cutter coil exceeds a preset value, the programme is electronically switched off and the head is disconnected. Average temperature is displayed on a front plate meter additional to the conventional cutter current meter. The equalisation in the monitor section is adjusted according to IEC/98 playback response.
The pickup playback preamplifier allows the use of either dynamic or magnetic pickups.
All switching in the amplifier is made electronically with analogue switches. The only relay in the amplifier is the cutter connecting relay which is of the mercury wetted contact type.
The amplifier is provided with push buttons for manual switching cutter on/off and monitor feedback/pickup.
The power supply GE*701* contains two identical supply systems. They supply each amplifier with two symmetrical voltages referred to zero.

Technical specification

Power supply GE701
Mains supply: ac 50 to 60 Hz, 220V or 110V, +10%.
Output voltage per system (idle run): +40V, 0—40V.
Maximum continuous supply current per system: approx. 6A.
Dimensions: plug-in unit for 480 mm frame insertion (three height units).
Frontplate: 438 x 132.5 mm, cabinet depth: 337 mm.
Weight: 20 kg.
Delivery: ready for rack-mounting frame included. By special order mounted in steel casing: 505 x 155 x 400mm.

Cutting amplifier GO701
Programme input arrangement and impedance: balanced, floating 5k ohms. Feedback input arrangement and impedance (at 1 kHz): unbalanced, approximately 10k ohms.
Pickup input arrangement: 1 to 3 ohms dyn. pickups balanced or unbalanced.
1 to 3 k ohms magn. pickups, unbalanced.
Drive coil output arrangement, assumed coil impedance: symmetrical to zero, 9 ohms.
Monitor output arrangement, recommended load: balanced, floating: 1 to 10 k ohms.
Programme input sensitivity: (presettable) —6 dBm, 0 dBm, +6 dBm.
Feedback input sensitivity: approx 6 mV/cm/s.
Pickup input sensitivity: (1 kHz): Dyn. approx 20μV/cm/s. Magn. approx 0.6 mV/cm/s.
Monitor output level (adjustable): programme input level.
Maximum monitor output level (into approx 1k ohms) approx: +20 dBm.
Power available at all frequencies direct from power unit into external ohmic resistor (using ±40V as supply voltage): 500W.
Output connected to cutting head *(DSS661)*: Available power raising with frequency to 500W at 20 kHz.
Peak output current: 16 kHz, approximately 8A.
Peak output voltage: 16 kHz, approximately 150V. Corresponding to cutting velocity peak: 30 cm/s.
Typical data with DSS661. Measured on monitor output terminal:
Frequency response: ±1 dB 20 Hz to 18 kHz.
Harmonic distortion:
1 kHz (0.4A, 25 cm/s peak), 2nd harmonic 0.4%; 3rd harmonic 0.2%; higher harmonic 0.05%.
30 Hz (0.65A, 1 cm/s peak), 2nd harmonic 0.6%; 3rd harmonic 0.5%; higher harmonic 0.1%.
Difference tones:
6.6 kHz +7 kHz (0.4A, 8 cm/s peak), 400 Hz = 0.07%
12.2 kHz +12.6 kHz (0.32A, 2.8 cm/s peak) 400 Hz = 0.1%.
Dimensions: plug in unit for 480 mm frame insertion (four height units).
Frontplate: 438 x 177 mm, cabinet depth: 337 mm.
Weight: 8 kg.
Delivery: ready for rack mounting, frame included. By special order mounted in steel casing: 505 x 195 x 400 mm.
Price: *GO701* two channel cutting amplifier, complete with *GE701* dual power supply: £3,880.

Four channel cutter
The Ortofon cutter head *DSS661* and the drive amplifier have been on the market for some years. The cutter head has now been modified to cut four channel records, the carrier wave system, at half speed. A head for regular speed recording is in preparation.

LPS 691 four channel equaliser
Ortofon also produce a four channel equaliser, *LPS 691*, equipped with logic circuitry for manoeuvring of the master tape machine and the monitoring circuitry. The normal version is designed for two programme channels plus two preview channels. A special version for regular programme channels is however also available.
Price: £1,095.

New filter
A regulated low pass filter of a new design will be available from the spring of 1973. The filter is designed for protection against the cutting of non-trackable treble signals as well as against overheating of the cutter head. Its operation is based on pulse width modulated mos-fet's in an active filter configuration.

WESTREX

Westrex Company Ltd, 152 Coles Green Road, London NW2 7HE.

Tel: 01-452 5401.

3D11 Stereodisc recorder
Dynamic, negative feedback stabilised stereophonic recorder compatible with all Westrex stereo disc systems. Makers say 'it retains the original advantages of a quick-change positive self-aligning stylus holder with large diameter stylus, low spurious resonances and high sensitivity, and special high temperature coil wire and insulation with quick change stylus heater wire clips . . . [It has] greater mid and high frequency sensitivity, higher recording level capability and a new stylus mounting holder. 'Cooling is not required to consistently record very high levels without fear of distortion or recorder damage. Long term stability is assured with the use of 29 dB of negative feedback. Negative feedback is adjusted for an ample margin of safety from the tendency to self-resonate. Negative feedback monitoring over the entire frequency range provides a metered and audible confirmation of performance'.

Technical specification

Type: 45°-45° stereodisc.
Damping: stabilised negative feedback (29 dB at resonance).
Coils: two drive, two feedback, one each per coil form.
Drive coil impedance: 10 ohms nominal.
Recording frequency range: 30 Hz to 20 kHz.
Feedback voltage: 27 dBm (.035V) at resonance (approximately 1 kHz) at 3.5 cm/s recording velocity.
Crosstalk: approximately 35 dB, 50 Hz to 10 kHz.
Stylus: *P98438* red sapphire, self-aligning.
Stylus heater wire: quick-change, spring-loaded, wire clip terminals.
Vertical stabilisation: advance ball.
Weight: 2.5 kg.
Dimensions: 8.3 x 10.8 x 24 cm.

Survey: tape duplicating systems

AEG TELEFUNKEN
AEG Telefunken, AEG House, Chichester Rents, Chancery Lane, London WC2.
Tel: 01-242 9944.

M1528 tape duplicator

1. A master console including:
Two professional-type M15 tape reproducers modified for tape speeds of 304/152 cm/s. One program panel subdivided into a crossbar distributor, eight attenuators of ±12 dB, eight push-button controls for automatic operations and one switch for the choice of either the musicassette or sterec-eight cartridge system. Four or eight VU meters for measuring program levels on each channel can be furnished on request. Eight *V797* plug-in replay amplifiers with their respective interchangeable plug-in adjustment boards (eight boards for the musicassette system, eight for the stereo-8 system and four for the preparing of master tapes). Eight *V696* recording amplifiers with their respective *E696* basic equaliser. One logical modular device for the automatic control of the duplicator. One power pack.
2. Slave consoles, each of which contains:
Three professional *M28* tape recorders adapted to 76/38 cm/s speeds and to 3.81 mm tape. Interchangeable plug-in AE 696 adjustment boards (three boards for the musicassette system, six for the stereo eight system, one for preparing master tapes.) The first slave console contains the central oscillator, the separator amplifiers, and the power amplifiers for the premagnetisation of the relative slave recorders, while the other slaves contain only the power amplifier. A master console can drive up to four slave consoles for a total of 12 slave recorders

Technical specification

Master tape reproducer M15
Speed of master reproducer: 304/152 cm/s.
Wow and flutter: approx 0.6%.
Starting time: approx. 0.8s.
Slave tape recorders M28
Speed of slave recorders: 76/38 cm/s.
Wow and flutter: approx 0.8%.
Starting time: 1s.
Speed of first slave recorder if set up for the preparation of master tapes: 152/76 cm/s.
Frequency response—playback:
In preparing master tapes, 30 Hz to 15 kHz ±3 dB.
In duplicating musicassette tapes: 30 Hz to 10 kHz ±3 dB.
In duplicating stereo eight tapes: 30 Hz to 15 kHz ±3 dB.
Frequency response—recording:
In preparing master tapes: 30 Hz to 15 kHz ±3 dB
In duplicating musicassette tapes: 30 Hz to 10 kHz ±3 dB.
In duplicating stereo eight tapes: 30 Hz to 15 kHz ±3 dB.
All frequency response figures have been measured with DIN reference tape 45513.
Signal to noise ratio: with reference to a one to one duplicating speed, signal to noise ratio loss is no greater than 1 to 1.5 dB.
Distortion: with reference to a one to one duplicating speed, the distortion factor does not increase (the percentage of distortion depends on the type of tape and on the level of signal used).
Crosstalk at 1 kHz: between the two tracks of the master tape reproducer: greater than or equal to 50 dB. Between tracks one and two of musicassette tapes: greater than or equal to 28 dB. Between tracks two and three of musicassette tapes: greater than or equal to 50 dB. Between adjacent tracks of tapes or stereo eight cartridges: greater than or equal to 50 dB.
Mains voltage: 220V, 50 Hz (60 Hz on request).
Current consumption:
Master console: 2.8A
for each slave recorder: 1.4A.
Production: (the number of musicassettes or stereo eight cartridges depends, of course, on the length of the programs). For example, musicassette with two programs lasting 20 minutes each: about 50 pieces an hour for each slave recorder.
The V797 playback amplifier:
Frequency range (depending on the multiplication factor of the speed): 120 Hz to 260 kHz.
Input: balanced, floating.
Input impedance: suitable for connexion to replay heads for high speed.
Output: unbalanced.
Output level: 1.55V (+6 dBm) across 200 ohms.
Maximum output level: 5.5V (+17 dBm).
Output impedance: 40 ohms.
Sensitivity: with a signal on 320 nWb/m tape running at 19 cm/s, the output level can be increased up to 3V (12 dBm).
Possible playback equalisations (by substituting plug-in adjustment boards): 38 DIN or NAB x 8, 38 DIN or NAB x 4, 19 DIN S or H x 16, 19 DIN S or H x 8, 9.5 DIN or NAB x 16.
Signal to noise ratio with adjustment in position for an output level of +6 dBm and with DIN 19H equalisation: unweighted at least 42 dB, weighted (1) at least 56 dB.
It should be pointed out here that when the duplicated tape is played back at its nominal speed (4.75 cm/s for musicassettes and 9.5 cm/s for stereo eight) the effective noise voltage is practically reduced to the square root of the ratio one gets between the duplicating speed and the nominal playback speed mentioned above.
Distortion: Load resistance 300 ohms output level +6 dBm: THD 0.07 per cent max. Output level +12 dBm: THD 0.05 per cent max.
Supply voltage: 20V dc.
Current consumption: 30 mA.
Attenuation of 50 Hz frequency: at least 80 dB.
Dimensions: double plug-in printed circuit 100 x 160 mm. Total depth with plug: 160 mm.
(1) The weighted noise is measured through a filter with the same curve as the filter indicated in the DIN 45405 standard (psophometric filter), the single frequencies of which, however, are multiplied 16 times (e.g. 1 kHz x 16=16 kHz).
The E696 Basic amplifier-equaliser
Frequency range (depending on the multiplication factor of the speed): 120 Hz to 260 kHz.
Inputs: two unbalanced, electronically switchable inputs.

Ampex *AD-15*

Input impedance: at least 2 k ohms.
Output: one, unbalanced.
Output impedance: at most 20 ohms.
Output load: at least 2 k ohms.
Output level: 0.5V at 16 kHz.
Maximum output level: 2V at 16 kHz.
Equalisation: Input one (corresponding to 16 times speed): low frequencies: fixed (according to standard characteristic corresponding to 1590 μs at nominal speed). High frequencies: may be regulated from +5 dB to 20 dB at 240 kHz corresponding to 15 kHz at nominal speed. Input two (corresponding to eight times nominal speed): low frequencies: fixed (according to standard characteristic corresponding to 3180 μs at nominal speed). High frequencies: may be regulated from +4 to +30 dB at 120 kHz corresponding to 15 kHz at nominal speed. Equalisation at low frequencies can be fitted by means of bridges on the connecting plugs.
Amplification: max 6 dB to 16 kHz and respectively to 8 kHz.
Distortion: load resistance 2 k ohms output level (nominal): THD 0.07 per cent max. Maximum output level: THD 0.4 per cent max.
Signal to noise ratio with 16 x set-up: unweighted at least 60 dB weighted at least 76 dB (1).
With 8 x set-up: unweighted at least 62 dB, weighted at least 76 dB (1).
Supply voltage: 20V dc.
Current consumption: 16 mA.
Dimensions: 160 x 100 x 167 mm (including plugs).
The V696 recording amplifier
Frequency range: 90 Hz to 540 kHz.
Input: one, unbalanced.
Input impedance: at least 4k ohms.
Input level: 0.5V.
Input sensitivity: 0.2V.
(1) the weighted noise is measured through a filter with the same curve as the filter indicated in the DIN 45405 standard (psophometric filter), the single frequencies of which, however, are multiplied 16 times (e g 1,000 Hz x 16=16,000 Hz).
Output: one, unbalanced.
Output impedance: 12 ohms maximum.
Output load: at least 200 ohms.
Nominal output level corresponding to maximum recording level: 4V.
Maximum output level: 10V.
Distortion: with 200 ohms load resistance, with 4V output level: THD 0.09 per cent max., with 10V output level: THD 0.9 per cent max.
Signal to noise ratio: unweighted: at least 72 dB, weighted: at least 94 dB.
Adjustment: level.
Supply voltage: 40V dc.
Current consumption: 45 mA.
Dimensions: 160 x 100 x 167 mm (including plugs).
(1) The weighted noise is measured through a filter with the same curve as the filter indicated in the DIN 45405 standard (psophometric filter), the single frequencies of which, however, are multiplied 16 times (e.g. 1,000 Hz x 16 = 16,000 Hz).
The OS 696 Bias Oscillator
Nominal frequency: 560 kHz.
Output: balanced, floating.
Output level: 6V.
Distortion: 0.06 per cent max.
Supply voltage: 20V dc.
Current consumption: 125 mA.
Dimensions: 160 x 100 x 167 mm (including plugs).
The HF 696 bias separator amplifier
Input: balanced, floating.
Amplification: 3 dB.
Distortion: 0.08 per cent max.
Outputs: two balanced, floating.
Supply voltage: 20V dc.
Current consumption: 1.1A.
Dimensions: 160 x 100 x 167 mm (including plugs).
The LHF 696 bias power amplifier
Input: balanced, floating.
Amplification: approx. 6 dB.
Outputs: two balanced outputs, floating.
Output level: 15V.
Distortion: 0.2 per cent max.
Admissible load: at least 40 ohms.
Supply voltage: 20V dc.
Current consumption: 1.8A.
Dimensions: 160 x 100 x 167 mm (including plugs).
Weight: Master console: approx. 290 kg. Each slave console: approx 195 kg.
Dimensions: master console: 1.78m wide, 0.925m high, 0.610m deep. Each slave console: 1.78 x 0.925 x 0.61m (whd).
Prices: available on application.

AMPEX
Ampex (GB) Ltd, Acre Road, Reading RG1 6HZ.

Tel: 0734 84411.

CD200 automatic cassette copier
A high speed automatic tabletop copier. Vacuum columns completely isolate tape from the cassette mechanism. Professional duplicator heads are used. The *CD200* can turn out 375 *C30* cassette copies per hour; a loader option makes it fully automatic. *CD200* also rewinds cassettes to the start before copying, and senses and ejects defective cassettes. Two-track mono and four-track stereo/two-track mono versions available. Features: Copies 375 *C30*, 225 *C60* or 120 *C120* cassettes per hour. Automatic loader option holds 100 cassettes; can be loaded in 7s. Duplicates all tracks at one pass. Automatically rewinds to start before copying; senses defective cassettes and ejects them separately. One master controls up to five slaves.

Technical specification
Tape speed: 190 (±0.2%) cm/s throughout length of *C60* cassette.
Rewind speed: internally adjustable from 254 to 760 cm/s (factory set at 380 cm/s).
Start time: with 76 cm of unrecorded tape: 0.4s at 190 cm/s from true end of tape to beginning of program. 16s at 4.75 cm/s from true end of tape (start time—time to reach 90% of spec speed).
Overall cycle time: at *C30* cassettes, approximately 40s plus load time (75 per hour per slave) *C60* cassettes, approximately 75s plus load time (45 per hour per slave).
Tape tension: constant at 93.3 (±15)g.
Frequency response: (referenced to 4.75 cm/s playback speed).
System: 30 Hz to 12 kHz, ±2 dB.
Typical copy: 50 Hz to 8 kHz, ±2 dB, using Ampex *361* cassette, biased for maximum long wavelength sensitivity.
Flutter: less than 0.05% rms NAB weighted.
Overall signal-to-noise ratio: 3 dB maximum degradation in 30 Hz to 10 kHz band.
Crosstalk rejection: 20 dB (min) at 1 kHz playback between adjacent tracks of stereo pair. 50 dB (min) between programs.
Power: 105 to 125V ac 58 to 62 Hz 6A (48 to 52 Hz operation optional).
Operating temperatures: 10 C to 35 C (—40 C to 65°C storage).
Humidity: 5% to 95% non-condensing.
Weight: 16 kg.
Dimensions: 560 x 533 x 273 mm (wdh).
Format tailoring: 76 cm of unrecorded tape (including leader). Program 76 cm of unrecorded tape at end (including leader).
Track formats: four-track stereo two-track mono.
End of tape sensing: true end of tape sensed independent of leaders, splices, sensing tape, or tones.
Automatic slave loading: 100 cassettes (may be replenished manually while *CD200* is operating).
Load time: approximately 72.
Price: Available on application.

AD15 duplicator system
The *AD15* offers a wide range of formats. Additional heads and guides permit changes from reel-to-reel formats to eight track cartridge formats to cassette formats. Each slave can be equipped with a tailoring device to deliver a completed product. All transports accept reels as small as 13 cm and reels or pancakes as large as 38 cm. Each master drives up to three slaves, with three slaves, a system produces 168 365m copies in one eight hour shift. An internal reference oscillator protects tape speed from line power shifts.
Features:
The through the reel timing accuracy for any duplicator is ±0.08 per cent. Copies all major 3.8 mm and 6.25 mm formats. Automatic system stop/master rewind. Accepts reels or pancakes from 13 to 38 cm diameter. Cassette/cartridge tailoring available. Servo-controlled tape tension. Internal reference oscillator for accurate tape speed. One master drives up to three slaves. Attractive console design; convenient control bridge.

Technical specification
Crosstalk rejection: 50 dB or better except between stereo pairs.
Bias oscillator: nominal bias frequency: 500 kHz.
Wow and flutter: 76 cm/s: 0.05%, 38 cm/s: 0.07%, 19 cm/s: 0.1%.
Signal-to-noise ratio: will not introduce more than 3 dB noise on duplicate.
Direct record input: 50 ohms unbalanced, accepts line level from 0.3V rms for recommended operating level.
Fast speed: fast speed for rewind or search functions manually adjustable. Approximately three minutes for 1,520m, 36 cm reel.
Start time: 3s to normal flutter specifications.
Stop time: 38 cm/s at 38 cm reel tape moves 76 mm.
Tape speed accuracy: within ±0.08% from beginning to end of reel. With internal bridge oscillator, tape speed unaffected by line voltage or frequency fluctuations.
Power requirements: 105 to 125V ac, 50 to 60 Hz.
Controls: system control selects number of slaves to be controlled. By main 'start' and 'stop' buttons. Local control overrides system control and does not affect other transports.
Tape formats:
Full and two track mono, full and two track stereo, quarter track stereo, four track stereo cartridge, eight track stereo cartridge: 6.25 mm tape 25 μm or 38 μm.
Four track stereo cassette, two track mono cassette, 3,800 μm tape. 12.7 μm base. Tensilised polyester.
Number of slaves: one to three slaves can be attached to a master reproducer.
Reel size: 13 cm to 38 cm reel diameter. NAB or EIA Std.
Tape speeds: 19, 38 and 76 cm/s.
Frequency response (1:1 duplication):
Master tape 19 cm/s NAB, Copies 19 cm/s NAB.
Master speed 76 cm/s, Slave speed 76 cm/s: +2 to 4 dB, 50 Hz to 15 kHz.
Master tape 9.5 cm/s NAB, Copies 9.5 cm/s NAB, Master speed: 38 cm/s, Slave speed: 38 cm/s: +2 to 4 dB 50 Hz to 12 kHz.
Master tape: 9.5 cm/s NAB, Copies 9.5 cm/s NAB, Master speed 76 cm/s, Slave speed 76 cm/s: +2 to 4 dB 50 Hz to 7.5 kHz.
Master Tape cassette, Copies cassette, Master speed 19 cm/s, Slave speed 19 cm/s: +2 to 4 dB 50 Hz to 10 kHz.
Master Tape cassette, Copies cassette, Master speed 38 cm/s, Slave speed 38 cm/s: +2 to 4 dB 50 Hz to 5 kHz.
(2:1 duplication)
Master tape 19 cm/s NAB, Copies 9.5 cm/s NAB. Master speed 76 cm/s, Slave speed 38 cm/s: +2 to 4 dB 50 Hz to 12 kHz.
(4:1 duplication)
Master tape 19 cm/s NAB, Copies cassette, Master speed 76 cm/s, Slave speed 19 cm/s: +2 to 4 dB 50 Hz to 10 kHz.
Direct recording from auxiliary source (up to three copies per run) Recording speed: 19 cm/s NAB equalisation 6.25 mm tape: +2 to 4 dB 50 Hz to 15 kHz.

62 ▶

TAPE DUPLICATORS

3.8 mm tape: ±2 to 4 dB 50 Hz to 10 kHz.
Price: available on application.

RR200 duplicator system

The system consists of an *RR200* master reproducer and up to ten *3400* slaves. The *RR2008* plays back eight-track, 25 mm masters to produce high-quality track cartridge tapes. One version of the *RR2004* uses 12.5 mm masters to duplicate four track stereo or four channel stereo formats; a change of plug-in head assemblies and turn-around tape guides, and it becomes a 6.25 mm machine in either two or four channel format, depending upon the head assembly used. The *RR200* can be concerted from 152/304 cm/s to 76/152 cm/s by a change of capstan idlers (provided) and removal of a capstan sleeve. Five different plug-in head assemblies are available for the *3400* slave, each with its own bias and record level adjustments: tape tensioning adjusts automaticaliy with each head change. Uses 6.25 mm and 3.8 mm.

Technical specification

Tape speeds: 152/304 cm/s selectable (changeable to 76/152 cm/s selectable).
Master tape formats:
RR2008: eight tracks on 25 mm wide tape.
RR2004: four tracks (staggered) on 12.5 mm wide tape, four track (in line) on 12.5 mm wide tape.
RR2004: full track two track (in line) four track (staggered) or four track (in line) on 6.25 mm wide tape.
Maximum reel size:
356 mm outside diameter: 6.25 mm and 12.5 mm tape.
266 mm outside diameter 25 mm tape.
Wow and flutter: less than 1% peak to peak from 0.5 Hz to 10 kHz (unweighted). Will not introduce more than 0.15% rms (ASA 'A' weighted) in copy.
Electronics Bandwidth: exclusive of equalisers, ±1 dB 300 Hz to 300 kHz.
Equalisation switching: independent switching is provided for both master and copy equalisation.
Frequency response of reproducer:
19 cm/s NAB master, 304 cm/s, 800 Hz to 160 kHz, ±2 dB, (50 Hz to 10 kHz at 19 cm/s).
19 cm/s NAB master, 152 cm/s, 400 Hz to 120 kHz, ±2 dB, (50 Hz to 15 kHz at 19 cm/s).
38 cm/s NAB master, 304 cm/s 400 Hz to 160 kHz, ±2 dB, (50 Hz to 20 kHz at 38 cm/s).
Typical frequency response of copies (tape limited)
4.75 cm/s cassette 50 Hz to 8 kHz ±2 dB.
9.5 cm/s cartridge or open reel: 50 Hz to 10 kHz ±2 dB.
19 cm/s open reel: 50 Hz to 15 kHz, ±2 dB.
System noise:
System set up for 19 cm/s master at 304 cm/s dB below blank, biased Ampex *404* series tape ASA 'A' weighted at least 10 dB.
2.1 kHz bandwidth, 16 kHz (1 kHz at real speed) at least 5 dB.
2.1 Hz bandwidth, 64 kHz (4 kHz at real speed) at least 12 dB.
2.1 Hz bandwidth, 160 kHz (10 kHz at real speed) at least 8 dB.
Total harmonic distortion:
System exclusive of tape, 0.2% at operating level.
Overload margin: reproducing amplifier: up to level control 20 dB above operating level, after level control 17 dB operating level.
Recording amplifier: 20 dB above operating level.
Bias supply: 1 MHz, adjustable to 60V rms at 0.5A rms.
Power requirements: 117V (±10% ac, single phase, 50 or 60 Hz; 4A approx.
Dimensions: *RR2004* 660 x 762 x 1550 mm, *RR2008* 660 x 762 x 1550 mm (wdh) Metal cabinet with all electronics mounted in overhead bridge.
Price: available on application.

BLM200 duplicator system

Automatic high speed duplication of multichannel cassette and cartridge tapes is now offered by the Ampex *BLM200* duplicator system. Rewinding, stopping, and rethreading of the tape is eliminated by use of an endless loop tape in the master transport. All solid-state electronics are used throughout. The system consists of the *BLM200* Bin Loop Master and up to 20 slave units of the *3400* series. Constructed on a building block principle to provide for future expansion, the basic *BLM200* master will drive up to ten slaves and an optional configuration is offered to drive twenty slaves.
BLM masters are available in two models, the *BLM2008* and the *BLM2004*. The *BLM2008* is an eight-channel version for cartridge duplication. However, the eight-channel *BLM2008* system will also duplicate four channel cassette tapes by rotating the slave tape guides and replacing the plug in slave head assemblies.
The *BLM2004* is a four channel version for cassette duplication. If a four channel cassette master unit is purchased first, it can be field converted to an eight-channel cartridge version by adding a bias amplifier, a power supply, and four more channels of electronics. Conversion of the slave units is possible in the field because all *3400* series slave units are already equipped with dual-width guides and use plug-in head assemblies. Installing the eight-track head assemblies automatically programs the correct tape tension.
Working master tapes for both formats are recorded on wide tape with 38 μm polyester backing, recorded at NAB equalisation. Recordings are made in four-to-eight-track formats on eight-track recorders such as Ampex Model *MM10008* or Model *AG4408*. A working master tape for the eight track duplicator system follows the same track configuration as that of the eight track cartridge format: tracks one and five, tracks two and six etc as stereo pairs, all in forward direction. For the four track duplicator system, tracks three and seven make up the stereo pair in the forward direction, and tracks six and two in the reverse direction. (When making the master tape, recording is done on tracks, three and seven in both directions.)

BLM200 Master reproducer

The *BLM200* master reproducer is a self-contained bin-loop system. It consists of a bin-loop tape transport, a reproduce head and preamplifier assembly, reproduce amplifiers, record amplifiers and a bias oscillator/amplifier. The *BLM200* drives up to ten slaves assemblies at up to 32 times the speed of the original recording. Provisions in the master assembly allow increasing the number of slaves to twenty by adding bias amplifiers.
The transport is equipped with its own loading/unloading motor assembly to transfer tape directly from a reel to the storage bin. A photocell assembly mounted in the tape path automatically counts the number of master passes and injects a 120 Hz or 320 Hz tone on the opies for cutting points.
A new head produces a higher output at mid-frequencies and greater efficiency at high frequencies. Preamplifiers are mounted on the head assembly. This arrangement avoids rf interference, and reduces signal-to-noise ratio by reducing capacitive shunting of the head cables.

3400 series slave assembly

The *3400* series slave assemblies are newly adapted versions of the Ampex Model *3200* slave assemblies. The *3400* series slave transports have turn-around guides with 3.8 and 6.25 mm guides for tape width conversion. Automatic tape tension programming is also provided to reduce the possibility of tape stretch or breakage.
Plug-in head assemblies for both four track cassette and eight track cartridge systems are ferrite core type and are equipped with their own individual bias and record level controls for each track. The controls are on top of each head assembly, insuring interchangeability without resetting controls. No wiring changes are required when changing from four track cassette to eight track cartridge head assemblies.
The *3400* series slave head assemblies for all standard open-reel formats are also available.

Technical specification

BLM200 Master assembly
Tape speeds: 152/304 cm/s or 304/608 cm/s.
Master tape format: eight tracks on 25 mm wide tape 38 μm polyester. Recorded at 19 cm/s NAB equalised.
Maximum tape capacity: 380m (about 45 minutes of playing time per program track at 19 cm/s).
Wow and flutter: less than 1% peak-to-peak from 0.5 Hz to 10 kHz (unweighted). Will not introduce more than 0.1% rms (NAB weighted) in final copy.
Frequency response:
Reproduce chain from 19 cm/s NAB equalised master: ±1 dB 500 Hz to 160 kHz at 304 cm/s, ±1 dB 1 kHz to 320 kHz at 608 cm/s (30 Hz to 10 kHz at final copy speed).
Duplicated copies: ±2 dB, 50 Hz to 10 kHz, 9.5 cm/s eight track cartridge. ±2 dB, 50 Hz to 8 kHz at 4.75, cassette.
Tailoring tone: switchable 120 Hz or 320 Hz, actuated by photocell, applied at saturation level to input of record amplifiers.
Crosstalk rejection: between the tracks or between the adjacent even or odd track pairs; greater than 50 dB from 30 Hz to 10 kHz (at final copy speed).
System noise: better than 10 dB below a blank, biased, Ampex 404 series low noise tape; 30 Hz to 5 kHz at final copy speed. Better than 6 dB up to 10 kHz.
Total harmonic distortion: system, exclusive of tape; 0.3% at Ampex operating level.
Overload margin: up to reproduce level control and record electronics: 20 dB above Ampex operating level. Reproduce electronics after the level control: 17 dB.
Environmental conditions: temperature: 16 to 41°C.
Relative humidity: 50 to 90%.
Power requirements: 115V (±10%) ac single phase, 50 or 60 Hz: 7A (BLM2004) and 9A (BLM2008) at 115V.
Dimensions: 155 x 107 x 69 cm
Weight: 225 kg.
Price: available on application.

Left: Ampex BLM 200 duplicator

64 ▶

highest attainable technical performance

quick and easy

No major repair facilities available?
This professional tape recording equipment needs none and can be used with confidence anywhere in the world. In the past a fault in sophisticated equipment could mean expensive down time, but in the E200 any fault can be quickly isolated and the part or circuit replaced.
All major mechanical components and sub-assemblies are quickly and easily changed. Many circuits simply plug-in.

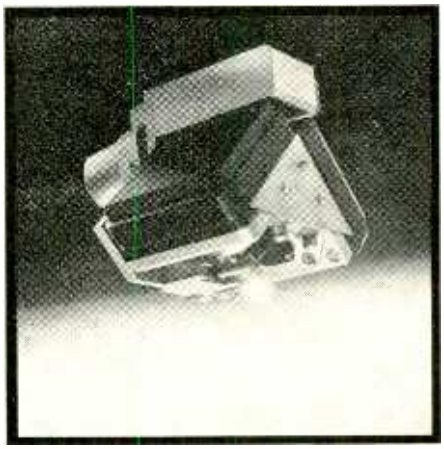
Contact **Nick Nichols** at our London office, telephone
01-874 9054

LEEVERS-RICH

EQUIPMENT LIMITED

A Member of the MCP Group

LEEVERS-RICH EQUIPMENT LIMITED
319 TRINITY ROAD, WANDSWORTH,
LONDON SW18 ENGLAND



NEUMANN SX68

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

TAPE DUPLICATORS

3400 series slave assembly
Tape speed: 76/152 cm/s or 152/304 cm/s.
Slave tape format: eight tracks on 6.25 mm tape 38 μm or 25 μm polyester or acetate (Ampex 681 tape or equivalent). Four tracks on 3.8 mm wide tape, 12.5 μm polyester (Ampex *9219* tape or equivalent). Other formats available.
Maximum reel size: 36 cm in diameter. A hub diameter smaller than 11.5 cm (NAB size) not recommended for 3.8mm wide tape.
Wow and flutter: less than 1 "„ peak-to-peak from 0.5 Hz to 10 kHz (unweighted). Will introduce less than 0.1 "„ rms (NAB weighted) in copy.
Power requirements: 115V (± 10%) ac single phase, 50 or 60 Hz 2A per slave assembly.
Dimensions: 79 x 66 x 66 cm.
Weight: 68 kg with metal cabinet.
Price: available on application.

B & A
Branch and Appleby Ltd, 42 High Street, Harrow-on-the-Hill, Middlesex.

Tel: 01-864 1577.

The B & A Systems Division of Branch and Appleby manufacture head electronics and high speed copying equipment for tape and cassettes. The equipment is variably custom built to satisfy specific requirements and is designed around modular units. Variety of 'in cassette' dubbing machines has evolved during the past three years which can satisfy most small to medium production requirements in the educational and entertainment fields. A typical technical specification follows. Complementary high speed rewind units and demagnetisers are also offered.

Master reel to cassette copier
This unit uses a reel-to-reel playback deck to transfer master recordings made at 9.5 cm/s at a speed of 3.8 cm/s on to eight cassettes running at 19 cm/s for eventual playback at the standard speed of 4.75 cm/s. The master reel-to-reel deck and the cassette decks are all electronically interlocked during the dubbing process but the system allows the stopping or removal of any cassette during dubbing without disturbing the remaining cassettes. The system run-up time is less than 2s.

Master cassette to cassette copier
This is similar to the master dubber, but with a high speed cassette playback deck substituted for the reel-to-reel deck.

Slave copier
The eight cassette slave unit is connected to the master unit by a single multicore cable and is remotely controlled via the master control panel. Any number of slave units may be added to increase output; for example with ten slave units over 5,000 dubbed cassettes can be produced in an eight hour day.

Auxiliary cassette to cassette unit
If both 6.25 mm tape and cassettes are to be used as masters, then a separate high speed cassette replay unit may be plugged into the standard master Cassette rewind unit.

Cassette to cassette copier
Up to four cassettes may be loaded independently into the fast wind unit. Half-hour-per-side (C60) cassettes are rewound in approximately 20s and are ejected automatically at the end of the process.

Operation
The machines demand little or no skill to operate and with electro-mechanical interlocks, monitor speaker and indicator lamps their operation is simple and foolproof and unskilled personnel can be trained in a few minutes.

Head and track configurations
The standard master unit contains two record and two replay channels, and standard heads are supplied to transfer any two tracks simultaneously within the normal 6.25 mm tape and 'Philips' cassette standards. Extra channels and non-standard track configurations can be supplied to order.

Durability
All tape heads in B & A systems equipment are manufactured by Branch and Appleby Limited, and are fully guaranteed subject only to fair wear and tear, for six months. Frequency response remains constant throughout head life, which is not less than 1,000 hours for the reel-to-reel deck and not less than 2,000 hours for the cassette desks.

In the event of mechanical or electronic failure:
1. the cassette decks (which are factory set for immediate use) unplug on the removal of the cover and one screw,
2. the electronic circuit boards slide into edge connectors—no technical knowledge is required to replace them.
3. the above and all other parts are available by return of post from B & A Systems on an exchange replacement basis.

Master Copier Technical specification
Standard machine frequency response: 40 Hz to 11 kHz ±2 dB.
Cassette to cassette frequency response: 50 Hz to 8 kHz ±3 dB.
Signal to noise ratio: within 2 dB of master tape.
Crosstalk rejection, standard model: better than 46 dB.
Distortion: no degradation of master tape.
Wow and flutter: less than 0.25% rms.
Equalisation, standard model: to DIN 45513.
Level indicators: true peak reading meters.
Bias supply: crystal controlled master oscillator, push-pull power stages.
Monitor speaker: switchable to either channel volume adjustable.
Master deck rewind speed: 20 minutes tape in 35s.
Auxiliary input: three pole GPO jack low impedance 1.5 k ohms for additional master deck.
Duplicating rate without slave units: up to 60 type C60 cassettes per hour.
Transfer speed: four times normal playing speed.
Power requirements: 210 to 250V 50 Hz 2A.
Console dimensions:
floor standing 1,200 x 540 x 570 mm (HWD).
desk type: 580 x 540 x 570 mm (HWD).
Weight:
floor standing: 37 kg.
desk type: 33 kg.

INFONICS
Agents: Fraser-Peacock Associates Ltd, 94 High Street, Wimbledon Village, London SW19.

Tel: 01-947 2233/1734.

Infonics fast speedwinder
The Infonics speedwinder will rewind or advance up to six cassettes at high speed. Any combination of cassettes can be loaded and unloaded while others are still rewinding. Cassettes can wind forward or backward simply by reversing the cassette position. The speedwinder has individual cassette shutoff at the end of each tape so that cassettes of any length can be wound simultaneously.
Dimensions: 356 x 212 x 121 mm.
Weight: 5 kg.
Capacity: six cassettes.
Power: model SWE 220V ac, 0.75A.
Warranty: one year.
Price: £100.

Infonics reel to reel duplicator model RR4 (stereo)
Duplication of tapes recorded at any speed from 4.75 to 38 cm/s is performed at 63.5 cm/s, with all tracks being duplicated simultaneously. The reel to reel duplicator produces three 365m reels of magnetic tape from a master reel in ten minutes. Plug-in slaves extend the duplicator's capacity by an additional four duplicate tapes so that a system consisting of a duplicator and two slaves produces 11 tapes every ten minutes.
Duplicating time (30 minute tapes): four minutes.
Master duplicating speed: 63.5 cm/s.
Copy duplicating speed: 63.5 cm/s.
Master recording speed: 4.75 to 38 cm/s.
Frequency response: 20 Hz to 15 kHz, ±3 dB.
Signal to noise ratio: 50 dB.
Wow and flutter: 0.2% rms.
Timing accuracy: 0.2%.
Dimensions: 406 x 406 x 420 mm.
Weight: 22.2 kg.
Price: £1575.

Infonics reel to cassette duplicators (Super *RC—2* or Super *RC—4*, mono or stereo available).
The Super *RC* line of reel to cassette duplicators features a 152/76 cm/s master tape transport with a dual speed hysteresis-synchronous capstan motor and two torque motors.
Duplicating time (30 minute tapes): 2.3 minutes.
Master duplicating speed: 152 or 76 cm/s.
Copy duplicating speed: 38 cm/s.
Master recording speed: 19 or 9.5 cm/s.
Frequency response: 20 Hz to 10 kHz ±3 dB.
Signal to noise ratio: 45 dB.
Wow and flutter: 0.3% rms.
Timing accuracy: 0.2%.
Dimensions: 572 x 610 x 380 mm.
Weight: 4.1 kg.
Price:
Super *RC—2* £1743.
Super *RC—4* £2415.

Infonics reel to reel duplicator model RR2 (mono)
Duplication of tapes recorded at any speed from 4.75 cm/s to 38 cm/s is performed at 63.5 cm/s with all tracks being duplicated simultaneously. The reel to reel duplicator produces three 365m reels of magnetic tape from a master reel in ten minutes. Plug-in slaves extend the duplicator's capacity by an additional four duplicate tapes so that a system consisting of a duplicator and two slaves produces 11 tapes every ten minutes.
Duplicating time (30 minute tapes): four minutes.
Master duplicating speed: 63.5 cm/s.
Copy duplicating speed: 63.5 cm/s.
Master recording speed: 4.75 to 38 cm/s.
Frequency response: 20 Hz to 15 kHz, ±3 dB.
Signal to noise ratio: 50 dB.
Wow and flutter: 0.2% rms.
Timing accuracy: 0.2%.
Dimensions: 406 x 406 x 420 mm.
Weight: 22.2 kg.
Price: £1102.

Infonics cassette copier 102
The model *102* makes two cassette copies from an original cassette at 63.5 cm/s or approximately 14

times the normal cassette playing speed. Two C30 cassette copies are produced every minute. Both tracks are duplicated in one run. Cassettes of any length can be run in the copier up to C90s.
Duplicating speed: 76 cm/s.
Duplicating time: (C30s): 1 minute.
Rewind time (C30s): 30s.
Frequency response: 40 Hz to 10 kHz ±3 dB.
Bias oscillator: 500 kHz.
Dimensions: 445 x 305 x 260 mm.
Weight: 15.9 kg.
Price: £900

Infonics reel to cassette slave duplicators (CS—2 and CS—4 mono or stereo available).
To expand the duplicating capacity of all Infonics duplicators up to three cassette slaves (CS) may be electrically connected to the duplicator. Each slave makes an additional eight cassettes in complete synchronism with the master tape.
With a system consisting of one duplicator and one slave, therefore a total of 12 C—30 cassettes can be duplicated every 23 minutes. This provides a duplicating capacity of 1,400 cassettes every eight hours.
Price: CS—2 £1575. CS—4 £2100.

BRENELL
Brenell Engineering Co Ltd, 231/235 Liverpool Road, London N1.

Tel: 607 8271.

Tape duplicating equipment made to customer's specifications.

KLARK TEKNIK
Klark Teknik Ltd, MOS Industrial site, Summerfield, Kidderminster, Worcestershire.

Tel: 0562 64027.

Teknik 2000 tape transport
A range of tape recorders and reproducers from 38 mm to 50 mm tape widths.
Type 2000S
Slow speed, multi-track for cassette and cartridge quality control.
Features: wow and flutter 0.6% at 9.5 cm/s; dc servo-controlled capstan; digital electronic tape measurement; complete logic control; all solid state relays; low s/n ratio 60 dB (weighted); can operate with pancake spools to 43 cm diameter; constant tension in all modes for storage of duplicated tape.
Type 2000N—25 mm
Variable speed 19 cm/s—38 cm/s for preparing masters. Available as reproducer only or as a complete recorder.
Features: less than 0.05% wow and flutter; extremely high audio and mechanical performance.
Available April—Cartridge/cassette winding machines—comprehensive range of automatic high-speed logic controlled winders/splicers. Klark Teknik specialise in complete installations including interface mixers, and so on.

LEEVERS-RICH
Leevers-Rich Equipment Ltd, 319 Trinity Road, Wandsworth, London SW19.

Tel: 874 9054.

Systems built to customers specific requirements based on the E200 open reel tape duplicating machine.

E200
Tracks: full, twin and stereo dimensions to BS 1568—1970.
Tape speed: 38 and 19 cm/s standard; 19 and 9.5 cm/s to order; 76 and 38 cm/s to order.
Tape speed stability: better than ±0.2% from end to end of reel with reference to absolute.
Rewind speed: 730m in 90s continuously variable.
Start time: 0.9s to rated wow and flutter condition.
Spool capacity: 29 cm European, 26.7 cm NAB, 21 cm cine.
Wow and flutter: (measured over bandwidth of 200 Hz) 0.06% rms total at 76 cm/s, 0.06% rms total at 38 cm/s, 0.08% rms total at 19 cm/s, 0.1% rms total at 9.5 cm/s.
Frequency response: (overall response within ±2 dB between) 40 Hz and 25 kHz at 76 cm/s, 40 Hz and 18 kHz at 38 cm/s, 40 Hz and 14 kHz at 19 cm/s, 40 Hz and 10 kHz at 9.5 cm/s. Noise level: measured unweighted at 38 cm/s. Full track 62 dB below peak level. Stereo 60 dB below peak level. Twin track 58 dB below peak level.
Cross talk: Twintrack 45 dB minimum at 1 kHz.
Distortion: total amplifier distortion at peak level 0.2% between 40 Hz and 15 kHz.
Input: —14 dB for peak recording level with preset sensitivity adjustment. 10 k ohms bridging.
Output: maximum output before clipping +22 dBm into 600 ohms. Source impedance approximately 50 ohms.
Metering: VU meter standard ppm to order. Switched to read 'line in' and 'line out' and 'record'.
Monitor: Switched to read 'line in' and 'line out'.
Terminations: Cannon XLR3.
Duplicating system price: from £1945.

LIBERTY/UA
Agents: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA.

Tel: 01 749 2201.

Liberty tape duplicator
The Liberty tape duplicator is designed primarily to mass reproduce cartridge and cassette tapes on a reel to reel basis, to be broken down after duplication. This method of duplication provides a more consistent and higher quality finished product than can be achieved within cartridge duplication.
The duplicator consists of one cabinet rack containing the head preamps, slave driver electronics, bias supply, master tape deck and tape bin. The master unit will drive one to ten slaves.
A special 6.25 mm tape loop bin system is available for cassette duplication where it is not desirable to go to 25 mm or 12.5 mm masters with accompanying added mastering expenses and equipment.
Necessary associated equipment would be a breakdown winder such as the Liberty Winder CW15 with 20 Hz sensing amplifier.
Liberty Tape Duplicator LT1600 series
Duplicating ratio: 16:1.
Master speed and system: real time of master is 19 cm/s recommended. Loop bin system 304 cm/s.
Slave speed: 152 or 76 cm/s.
Capstan Drive: Flywheel and belt drive to hysteresis synchronous motors. Slave capstans ceramic coated for less wear and tape slippage problems.
Wow and flutter: will not add more than 0.15% duplicates measuring components to 400 Hz.
Frequency response: 9.5 cm/s duplicates +2 dB, —3 dB 40 to 10 kHz 4.75 cm/s duplicates +2, —3 dB, 40 to 10 kHz.
Crosstalk rejection: greater than 50 dB except, between cassette stereo pairs.
Master tape and reel sizes: 25 mm or 12.5 mm for eight channel. 12.5 or 6.25 mm for four and two channel. Up 25 mm reel on master.
Slave tape and reel sizes: 6.25 mm and 3.8 mm cassette up to 36 cm reels on slaves.
Electronics: amplifiers and equalisers on plug-in cards. All solid state.
Heads: Ferrite for maximum head life and minimum maintenance on slaves. Heads on plugs for easy change of duplication formats and maintenance Mumetal on master.
Bias frequency: 1 MHz crystal controlled.
Tape guides: except in head assemblies are roller type for minimum tape stress.
Tape wipers: on all units built-in wipers to reduce head clogging and wear.
Production capabilities: Capacity based on program content is about 32 minutes total all sides, production should be approximately 640 to 840 eight track cartridges per one slave during an eight hour shift. About 320 to 420 cassettes per slave during an eight hour shift. (This of course, depends on operator skill and down time of duplicator.)
Programmed operation: manual slave start and stop at master cabinet or automatic start from master tape leader through photocell logic. Manual stop at master or predetermined stop after desired number of runs through predetermined counter in master cabinet.
Power requirements:
Master 720W; per slave: 180W
120V. 60 Hz, (220V 50 Hz operation available).
Shipping weight: about 726 kg.
Prices: from £7920 (with 6.25 mm loop bin master transport, quarter track electronics for stereo cassettes and one 'slave' position). Note: This equipment can be ordered for cassette or eight track cartridge use, with a number of slaves, and with 25, 12.5 or 6.25 mm loop bin master options, and a Mumetal or ferrite head option.

PENTAGON
Agents: Afcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA.

Tel: 01 749 2201.

Pentagon make a number of units which can be combined in a variety of ways. Systems can be reel to reel, reel to cassette, cassette to cassette or cassette to reel; two track or four track; eight or 12 times copying speed ratio; various speed and widths of tape. A few typical designs are described below.
RM1200/RM1400 reel to reel, two or four track master
Master tape deck:
Designed for high speed duplicating. Direct drive capstan from dual speed synchronous motor. Two direct drive inducation spooling motors. Failsafe differential mechanical brake system. Interlock motion control circuitry employing relay and solid state switching logic. Automatic tape lifter in fast winding modes, defeatable for cueing purposes.
Master operating speeds: 76 cm/s and 152 cm/s master.
Rewind time: approximately 45s for 18 cm reel.
Power: 115V, 60 Hz single phase.

66 ▶

operated push-buttons with defeatable tape lifter (for cueing purposes). Cassette transports have synchronous drive capstan motors. Both reel and cassette transports are designed for continuous operation. Bias readout, individual channel selector switches. 'Accutrack metering' and pull out circuit boards. Will accept NAB hubs.

C1323 Tri-Master 'Editor' duplicator
Reel to cassette, cassette to cassette, cassette to reel (for 9.5 and 19 cm/s reel masters 4.75 cm/s cassette masters).
This system permits the duplication of either reel to reel or cassette masters on to three cassette slave positions. In addition, this system can convert the reel play transport into a record deck. Through use of the cassette master position, it is then possible to transfer cassette program information on to the reel to reel transport for editing purposes. The reel to reel transport is a two speed 27 cm deck with relay operated push-buttons. The tape lifter can be released for cueing purposes. The tape deck uses direct drive dual speed synchronous capstan motor and two direct drive spooling motors. The cassette transports have synchronous drive capstan motors. Both reel and cassette transports are designed for continuous operation. Bias readout, channel selectors test switch. 'Accutrack Metering' and pull out circuit boards. Will accept NAB hubs.

C5400 Reel to cassette (for 12.5 mm, 9.5 and 19 cm/s reel masters)
A stereo duplicator system that provides four cassette copies from 12.5 mm reel tape masters. The tape transport will accept 27 cm reels and utilises a direct drive dual speed synchronous capstan drive motor and two direct drive spooling motors. The push buttons are relay operated and the tape lifter is defeatable (for cueing purposes). The cassette transports have synchronous drive capstan motors. Both reel and cassette transports are designed for heavy duty operation. All cassette positions have individual audio/bias level controls to permit precise and accurate level adjustments on all cassette record channels. Premium stereo (four track) cassette heads are included in this system. Bias read-out, individual channel selector switches, 'Accutrack Metering', mono/stereo switch and pull out circuit boards are all standard on this duplicator.

C-340 Cassette to cassette (for 4.75 cm/s cassette masters)
Duplicating system consisting of one cassette master with three cassette slave positions. Unit includes features such as 'Accutrack Metering' bias read-out, individual channel selector switches, test position switch and pull out circuit boards. Transports are driven by synchronous capstan drive motors. Each cassette position has precision capstan and slider assemblies.
Note: Models are available in both eight and 12 times normal play speeds and in two and four track formats.

C-140 Cassette copier
This model offers a cassette master and cassette slave position. One push-button starts and completes each duplicating run. Uses integrated circuits has built in rewind capabilities for both master and slave positions as well as channel selector switches. Duplicating speed is 38 cm/s and has add-on capability of recording from reel masters.

RME-2410 Reel Master (For use with most Pentagon slave models). Uses 9.5 and 19 cm/s reel masters. Two speed 27 cm reel to reel master transport complete with control electronics. VU meters and level controls. This reel master works directly into most of Pentagon's slave models. The transport has direct drive dual speed synchronous capstan motor and two direct drive spooling motors. Uses relay operated push-buttons with defeatable automatic tape lifter (for cueing purposes). Will accept NAB hubs. Bias readout, individual channel selector switches. 'Accutrack Metering' and pull-out circuit cards.

CM-1400 Cassette Master (For 4.75 cm/s cassette masters)
Plug in module adaptable to Pentagon master systems that do not already possess cassette master capabilities.

RS2410 Reel to reel slave (6.25 mm tape)
Two speed 27 cm reel to reel slave transport for reproduction of 6.25 mm reel copies of programmed materials. The transport has two direct drive spooling motors. The capstan motor is a direct drive dual speed heavy duty synchronous motor. Transport is designed for continuous operation and is housed in walnut veneer cabinet. System will accept 27 cm pancake reels with conventional NAB hubs. This reel slave can provide 38, 19 and 9.5 cm/s reel copies from 38, 19 and 9.5 cm/s reel masters.

RS-1410 Reel to reel slave (38 µm tape)
27 cm reel to reel slave transport with direct drive spooling motors. Capstan motor is a direct drive heavy duty synchronous motor. Transport is ruggedly designed for continuous duty operation and is mounted in a functional walnut veneer cabinet. System will accept 27 cm pancake reel with standard NAB hubs. Slave provides 4.75 cm/s cassette programs for loading into cassette shells.

S-140 Two station cassette slave
Two position slave module utilising synchronous capstan drive motors for greater speed accuracies. Has precision capstan and slider assemblies and channel selector switches for greater flexibility and reliability. These slave modules are designed for use with the cassette copier series of duplicators *(C120-C140)*. A total of three additional slaves modules (six slave positions) can be added to the *C120* duplicator without additional electronics. A total of two additional slave modules (four slaves) can be added to a *C140* duplicator unit without additional electronics. The slaves are housed in solid walnut cabinets to complement the *C120/C140* duplicator line. Additional electronics may be purchased to increase system size.

CS-440 Four station cassette slave
Four position slave module utilising synchronous capstan drive motors for greater efficiency and accuracy. System design enables hook-up of unlimited number of slave modules to master console due to slaves unique design. Cassette transports are ruggedly designed for continuous use application and have precision capstan and slider assemblies. Also pullout circuit boards for serviceability.

S-1400 Eight station cassette slave
Same as above CS 420/CS 440 slave system specifications except for number of slave positions. This system contains eight slave positions in one module.
Note: available in two or four track formats and in eight or 12 times copying speed.
Price: master and two slaves; either eight or 12 times copying speed ratio; for reel to reel, reel to cassette, or reel to reel with a 6.25 cm master and 38 µm cassette tape open reel slaves, for subsequent reel breakdown and cassette loading, sells for £2,100.

PHILIPS
Pye TVT Ltd, PO Box 41, Coldhams Lane, Cambridge CB1 3JU.
Tel: 0223 45115.

Philips STD
Philips STD tape duplicators consist of one master reproducer and any number of slave recorders, up to twenty. The machines are solid-state and self-contained which implies that a simple installation consisting of one master and two slaves can be extended just by adding a number of slaves. The equipment complies with the most severe demands of studio transcription services.

Master Reproducer
The master reproducer comprises a steel console, containing a tape deck and three 480 mm panel units. These units are: a container for the plug-in amplifiers, a filter unit, and a 24V dc power supply.

Tape deck
The master reproducer is equipped with a heavy-duty tape deck being specially adapted for tape duplicating. A hysteresis synchronous motor for 1500 and 3000 rpm gives tape speeds of 76 and 152 cm/s. The tape deck is provided with an automatic tape lifter which comes into operation on rewinding. Tape tension is controlled electronically and kept at 80g.

Controls
The tape deck of the master reproducer is provided with push-buttons for start, stop and fast rewind. These buttons also control the operation modes of the slave recorders. In addition, there is a continuous control to adjust the fast-winding speed.

An end-stop switch employing a light-dependent resistor (LDR) unit automatically stops the master reproducer if the tape should break, or when the end of the tape is reached, after playback or rewinding. The use of transparent leaders of sufficient length at both tape ends prevents it from running off the reels. After rewinding it stops at the beginning, ready for the next duplication run.

Head assembly
A plug-in head assembly is mounted on the tape deck. The assembly is provided with two Ferroxcube playback heads for full-track mono and twin-track stereo use. In this way the system is suitable for both mono and stereo application. The changing from one to the other is effected by simply turning a switch on the reproducer, re-plugging the connection cables underneath the slave tape decks, and adding a few electronic units. If required, a head assembly equipped with two half-track playback heads can also be supplied. Exchanging of the head assemblies is easily effected because of the plug-in type fixation.
Because of the high electrical resistance of the cores, Ferroxcube heads give only low electric losses. As a result the intrinsic head noise is very low, which favourably influences the signal-to-noise ratio. In fact the overall signal-to-noise ratio of the copy tape is better than 60 dB, with the appropriate setting of frequency response and bias. Moreover, the low losses at high frequencies means that low bias currents are required for recording. This is especially important for high-speed tape duplication where bias frequencies of 700 kHz are employed.
Ferroxcube heads are highly wear resistant, as a result of which the electrical performance during total operation life is practically constant. Consequently electronic adjustments to compensate for the head wear effect are only necessary after long intervals. The life of the heads is 5000 operation hours on an average.

Overall specification
Frequency response (with optimum bias adjustment) for 38 cm/s duplicates from 38 cm/s master tape: ±1.5 dB from 40 Hz 16 kHz [3]) 19 cm/s duplicates

70 ▶

3M announce a double-sidec in the quality of professional recording

New Scotch® 206.

1. A new oxide coating that gives a 3 db increase in signal-to-noise ratio.

mprovement

tape.

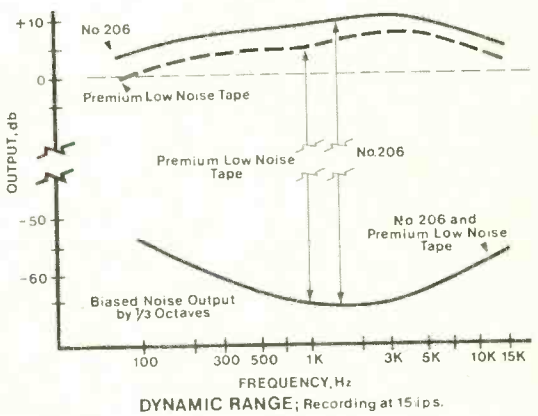
2. A new matt back coating which ensures better handling and reduces head wear.

3M have been at the forefront of recording tape development for many years. Now they offer a new dimension in recording perfection with their new Scotch 206 professional tape.

This remarkable product is the result of technological breakthroughs in the coatings on the recording and backing surfaces.

1. A new oxide recording surface

After several years of laboratory research 3M have developed a proprietary oxide which makes possible a 3 db increase in signal-to-noise ratio. This means you have the latitude to capture the extremes of frequency and output without sacrificing any pure sound quality.



DYNAMIC RANGE; Recording at 15 ips.

Scotch 206 tape also considerably reduces accumulated noise on multitrack recordings – a major problem up to now.

It is also very tough, resists scratching and prevents drop outs caused by tape debris.

2. A new matt back coating

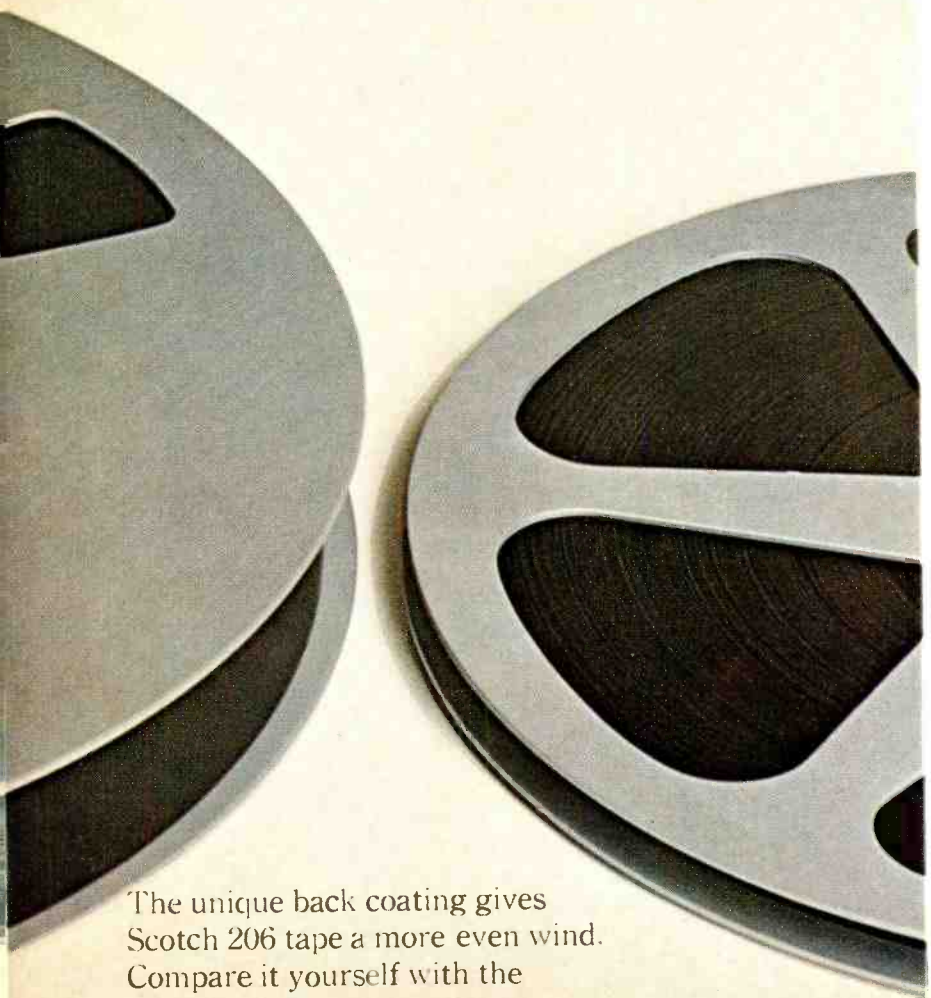
The new back coating improves the tape's handling characteristics, prevents slipping and ensures more uniform winding.

It also helps to guide the tape more accurately across the recording heads, reducing expensive head wear.

The backing is tougher, more scratch-resistant than its rivals. And since it is electrically conductive, dust and dirt are not attracted and held to it.

Scotch 206 tape is compatible with any professional recording system and is available in ¼", ½", 1" and 2" widths.

For further details fill in the coupon below.



The unique back coating gives Scotch 206 tape a more even wind. Compare it yourself with the ordinary tape on the right, above.

To: Mr. R. Haworth, Magnetic Products, SS/4/73
3M United Kingdom Limited,
3M House, Wigmore Street, London, W1A 1ET.

Please send me further details about Scotch 206 professional recording tape.

Name .....

Position .....

Address .....

.....

Tel. No. .....

3M 2040

3M

Scotch is a trademark of 3M Company

TAPE DUPLICATORS

(from 38 cm/s master tape): ±1.5 dB from 40 Hz 14 kHz[3]) 19 cm/s for 9.5 cm/s duplicates (from 19 cm/s or 38 cm/s master tape): ±2 dB from 60 Hz to 12 kHz[3]).

Signal to noise ratio: for 38 cm/s duplicates, 60 dB (full track); for 19 cm/s duplicates, 57 dB (full track); for 9.5 cm/s duplicates, 50 dB (half track).

Permissible ambient temperature: (for specified performance): up to 40°C.

Power supply: 220V, 50 Hz or 110V, 60 Hz.

Notes

(1) measured with wow and flutter meter type Gaumont Kalee *740*.

(2) measured with wow and flutter meter type *EMT 420*.

(3) measured with BASF tape *LGR* for tape speed of 38 cm/s and 19 cm/s and with BASF tape *LGS 35* for tape speed of 9.5 cm/s.

(4) output voltage with respect to a tape flux of 2 μWb.

TELEX

Agents: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA.

Tel: 01 749 2201.

Telex tape duplicating systems consist of the open-reel series *300-1* and the reel-to-cassette series *300 CS-1*.

A variety of track and channel configurations are available which may be intermixed within a system. Openreel and cassette slaves may be interfaced within a system. To expand a basic system, open reel or cassette slaves can be added for a total complement of ten slaves without additional electronics or modifications.

The systems are solenoid controlled and are operated by push-buttons from the master console. Hysteresis synchronous capstan drive motors are operative when the ac power is switched on so that tapes are always duplicated at true speed from beginning to end. All tracks of a master tape can be simultaneously copied in one pass. Automatic features stop the system at the end of a duplication run or if the master tape should break. However, should a tape on a slave unit break, only this slave becomes inoperative, allowing the duplication process to continue uninterrupted on all other slaves. A photo electric sensor allows for programming and captive tape operation on the master transport. By adding transparent windows and leaders to the master tape, this tape may be programmed for duplicating and it becomes necessary to reload the master for a repeat run.

Telex duplicating systems can be virtually custom-used with standard components. It is possible, for example, to make quarter track copies from a half track master tape. Or, tape speeds can be changed; a 4.75 cm/s master can yield 38, 19 or 9.5 cm/s open-reel copies or 4.75 cm/s cassette copies. Or a system may incorporate both cassette and open-reel slaves. All tape motions are controlled by push-buttons. The playback heads, without pressure pads, are protected by tape lifters during fast forward or rewind modes. The transport panel is standard 480 mm rack-mount size. Master transports are fitted with playback heads of the desired track and channel configuration.

The open-reel slave transport is identical to the master transport except no digital counter is provided and the unit is fitted with special duplicating record heads of the desired track and channel configuration. A hinged rear-panel match box contains individual channel audio record level adjustments, bias current adjustments and bias trap adjustments.

The cassette slave module contains three cassette transports with a common, two-speed hysteresis synchronous motor. Cassette transports operate at 19 and 9.5 cm/s. Positive braking in the stop mode prevents tape creeping during loading. Special tape guides and supply spindle torque assure accurate tape tracking and minimise tape skew. An over-sized capstan and self-aligning pressure roller provide positive, smooth tape drive. A three-cassette slave module panel is standard 480 mm rack-mount size. The module is fitted with premium duplicator record heads of the desired track and channel configurations. The hinged rear-panel match box contains the same adjustments as the open-reel slave.

Head configurations are available in half-track single-channel and two-channel, and in quarter-track two-channel and four-channel. In addition, full-track head configurations are available for open-reel duplicators. Any configuration is always duplicated in a single pass.

Open-reel slaves with 6.25 mm four-channel configurations can be used to reproduce four-channel monoaural tapes. However, due to the narrow width of cassette tape, four-channel monoaural programming on cassettes is not recommended.

Consoles

Telex duplicators come in consoles for table or bench height placement. Console panels are slanted. Louvred top panels provide air circulation for the equipment. Side panels contain ports with removable covers for connecting cables. Each console accepts two transports and one amplifier chassis. Thus, a basic system of one master and one slave transport and all associated electronics are contained within a single, table top console. When slaves are added to a system, consoles may be purchased as required.

Series 300 1 open reel duplicating system

Technical specification

Frequency response: meet or exceed ±3 dB 80 Hz to 40 kHz at 38 cm/s; ±3 dB 40 Hz to 20 kHz at 19 cm/s; 9.5 cm/s copies 40 Hz 10 kHz ±3 dB; 4.75 cm/s copies 40 Hz to 50 kHz ±3 dB.

Auxiliary input sensitivity: 500 mV, 50 k ohms impedance.

Monitor output: 1V into 25k ohms minimum load.

Crosstalk rejection: Better than 50 dB at all frequencies.

Signal to noise ratio: less than 3 dB degradation from master tapes; 55 dB peak S/N ratio at 19 or 38 cm/s.

Illuminated meters: one for bias adjustment ASA standard VU meters for each program channel.

Equalisation: front panel switching. Standard NAB and EIA.

Distortion: less than 1% THD at 1 kHz at 0 VU at 19 or 38 cm/s.

Heads: Laminated, hyperbolic ground, no pressure pads required.

Bias frequency: 300 kHz.

Long term speed regulation: 0.5%.

Capstan Drive: flutter-filter multiple belt drive.

Capstan Flywheel: dynamically balanced.

Capstan and reel bearing: oil impregnated bronze, no lubrication required.

Capstan drive motor: two speeds hysteresis synchronous.

Spooling motors: standard shaded four pole torque motors.

Wow and flutter: 0.17% rms at 38 cm/s 0.2% rms at 19 cm/s.

Brake: differential balanced braking, self energising in the event of power failure.

Control circuits: 24V dc.

Transport controls: push-button relay. Rewind, stop, play, fast forward.

Reel size: 18 cm maximum.

Fast forward rewind: 365m reel, 60s.

Counter: three digit decimal, reset-table. On master transport only.

Power requirements: 340W maximum for basic system at 105 to 130V ac 50/60 Hz. Each additional slave 150W maximum. Also available for 210 to 240V ac 50/60 Hz.

Console dimensions: 813 mm high, 533 wide, 457 mm deep at base. Front panel base 240 mm high, accepts TDC. Two transports mounted at 67° angle for operating convenience.

Finish: Stainless steel front panel. Console—black anodized aluminium, vented top and side panels, removable back.

Note: The Telex 300 series replaces an earlier series, the 235. The 300 series is identical to its predecessor but with 76 cm/s master transport speed.

Price:

Track two channel system

86476-10 three slaves £1,660.

86476-11 six slaves £2,015.

86476-12 nine slaves £2,235.

Quarter track four channel system

86835-06 three slaves £2,155.

86835-07 six slaves £2,660.

86835-08 nine slaves £3,110.

Portable rewind for three cassettes £76.

Series 300 CS-1 reel to cassette duplicating system

Frequency response: 30 Hz to 10 kHz ±3 dB at 4.75 cm/s.

Auxiliary input sensitivity: 500 mV, 50k ohms impedance.

Monitor output: 1V to 25k ohms minimum load.

Crosstalk rejection: half track, two channel, 50 dB at 1 kHz; quarter track two channel, 30 dB stereo channel separation at 1 kHz*; quarter track, four channel 30 dB stereo channel separation at 1 kHz, 45 dB adjacent stereo program crosstalk rejection at 1 kHz*.

*not recommended for individual monophonic recordings.

Signal to noise ratio: within 3 dB of master tapes.

Illuminated meters: One for bias adjustment. ASA standard VU meters for each program channel.

Equalisation: front panel switching. Standard NAB and EIA.

Distortion: less than one per cent at 1 kHz at 0 VU at 19 cm/s.

Bias frequency: 300 kHz.

Tape speed: 19, 38 and 76 cm/s (master transport), 19 and 9.5 cm/s (cassette).

Long term speed regulation: 0.5% (master), 0.8% (cassette).

Capstan and drive bearing: oil impregnated bronze, no lubrication required.

Capstan drive motor: two speed hysteresis synchronous.

Wow and flutter: 0.25% rms.

Control circuits: 24V dc.

Master fast forward/rewind: 365m reel, 60s.

Counter: three digit decimal reset-table. On master transport only.

Power requirements: 265W maximum for basic system at 105 to 130V ac 50/60 Hz. Each additional slave 75W maximum. Also available for 210 to 240V ac 50/60 Hz.

Console dimensions: 813 x 533 x 240 mm (hwd). Equipment mounted at 67° angle for operating convenience.

Finish: Stainless steel front panel. Console—black anodized aluminium, vented top and side panels, removable back.

Note: The Telex 300 series replaces an earlier series, the 235. The 300 series is identical to its predecessor but with 76 cm/s master transport speed.

Price:

Half track two channel system

86781-21 one slave £1,680.

86781-23 three slaves £2,178.

86781-25 five slaves £2,840.

86781-27 seven slaves £3,522.

86781-29 nine slaves £4,200.

Quarter track four channel system

86783-21 one slave £2,150.

86783-23 three slave £2,725.

86783-25 five slave £3,460.

86783-27 seven slave £4,180.

86783-29 nine slave £4,910.

Special head track configurations available; prices on request.

The Telex copier
This is a desk top unit designed to be operated by non-technical personnel in business, industry, education, libraries and the office. It is so simple to operate it can be used by anyone without special instructions. Small size and compact styling suit the copier to the constantly growing applications where cassettes are used for communication or information storage.
The copier is available in two configurations. The cassette copier one (master) provides all controls and makes one cassette copy from the original. It has add-on capabilities for two cassette copier two (slave) modules. Each cassette copier two makes two copies but relies on the cassette copier one for all power and control. The cassette copier two is equipped with a single emergency stop button. Both units are identical in size and styling.
The cassette copier one features two button operation. Illuminated rewind and copy buttons and a track selector provide complete control. The unit is automatically switched on when the original (master) cassette is inserted. The operator sets the track selector to copy channel one or two or both and then activates the rewind button to assure that cassettes are copied from the beginning of the tape. Indicator lights now tell the operator to push the copy button. Old material on the selected channels is automatically erased as the cassettes are copied, but existing material on other tracks is preserved. This eliminated the need for a bulk eraser. When copying is completed, cassettes are automatically erased as the cassettes are copied, but existing material on other tracks is preserved. This eliminated the need for a bulk eraser. When copying is completed, cassettes are automatically rewound to start. The unit returns to stand-by or automatically shuts-off when the original cassette is removed. A manual emergency stop, which stops all tape motion, is activated by pushing both the copy and rewind buttons simultaneously.
The cassette copier features all solid state circuitry and all electronics are on modular plug-in boards for easy serviceability. Removing the case bottom screws provides complete accessibility to all electronics and any board can be replaced in the field in minutes. The Telex copier is colour coordinated in ivory, blue and charcoal.

Technical specifications
Duplicating speed: 76 cm/s.
Rewind speed: 152 cm/s.
Frequency response: 30—10 kHz.
Automatic erase: track selectable.
S/N ratio: 45 dB below record level (3 per cent thd).
Crosstalk rejection: 50 dB minimum at 1 kHz.
Head configuration: half track two channel.
Controls: lighted amber rewind button, lighted blue copy button. Three position track selector (for duplicating just track one or track two or both). Red motion light for each transport to indicate stoppage of tape travel.
Equalisation: RIAA and DIN standard.
Weight: less than 13.5 kg.
Dimension: 40 cm x 45.5 cm x 19 cm (wdh).
Warranty: one year.

TRD
Tape Recorder Developments, Hall Lane, Walsall Wood, Staffordshire, WS9 9AU.
Tel: 054 33 5351-3

TRD have for sometime been supplying equipment for use in tape copying, especially to universities and colleges. In all cases these systems have been designed and built from standard modules and parts used in the normal production of TRD's professional tape machines.
Current enquiries are being quoted using components from the *Series 700* tape machine. A recent quote to a UK University is typical and is summarised below.
One master tape machine with half track mono record/replay facility allowing the customer to use it as a separate machine or in the copying bank.
Two slave machines with half track mono record facility only.
A remote control unit allowing simultaneous operation of all machines. A ppm and record level control to the slaves being included.
Price: Ex works for the complete unit £950.

Late entry

BIAS
Bias Electronics, Unit 8, Coombe Trading Estate, 112/120 Coombe Lane, London SW20.
Tel: 01 947 3121.

Description
Bias Electronics, the manufacturers of the *BE1000* tape recorder, also market the *BE1000* tape deck as a separate unit with high speed versions for use in tape duplicating systems available to order.

Technical specification
BE1000 6.25 mm tape transport
Power requirements: 110, 120, 200, 220, 240V, 50 Hz (60 Hz to order).
Speeds: 19/38, 38/76. 76/152 cm/s.
Speed stability: better than ±0.2%.
Wow and Flutter (peak weighted): better than 0.05% at 152, 76 and 38 cm/s, better than 0.1% at 19 cm/s.
Spool capacity: 29 cm Will accept, NAB, European and Cine centres.
Tape tension: Electronic servo tape tension system controlling the feed spool. Tension held within ±10g throughout the length of a NAB spool. Tension normally adjusted to 80g for 38 cm/s operation. Can be adjusted from 0 to 120g as required.
Rewind time: 100s for 730m of tape maximum.
Start time: to rated speed better than 0.1s to 0.1% wow and flutter better than 1s (both measured at 38 cm/s).
Mounting: standard 480 mm racks mounting or can be supplied in console if required.
Formats: 6.25 mm as above but 12.5 and 25 mm versions are also available.
Prices: from £376 for a 19/38 cm/s deck.
Available: ex works London, or from local agents abroad.

Value-added tax
Readers, particularly those not registered under VAT, are reminded that all prices in the foregoing surveys are exclusive of value-added tax.

INFONICS 102
CASSETTE COPIER

BEFORE PROCEEDING with the details of the Infonics cassette copier, it should be mentioned that the quoted specification is taken from the instruction and service manual for the copier, and is *not* a sales specification. The agents for the copier were at pains to point out that the unit is sold for the purpose of copying cassettes containing speech recordings and that it has been sold to many religious organisations and similar bodies for this purpose.

No doubt, many engineers will regard a cassette-to-cassette copier as an instrument of doubtful virtue but it does provide a quick and simple means of copying recorded cassettes for such needs as sales promotion, language laboratories, personnel training and similar applications where only speech quality is of importance. While I would have preferred to have reviewed a reel-to-cassette machine, Fraser-Peacock felt that there was little point in reviewing their current machine because it is about to be replaced by a new model. I look forward to the opportunity of reviewing the new version when a sample is available.

The Infonics *102* is a half-track copier which produces two copies per run of the 4.75 cm/s master tape at a nominal tape speed of 76 cm/s. As will be seen, the operation of the copier is extremely simple so that anyone who is capable of operating an office duplicator will have no trouble at all in producing copies of cassettes.

There are only four operational controls, all of which are in the form of pushbutton switches mounted on the top of the unit. The first control is the mains on/off switch, the correct operation of which is shown by a sensibly bright indicator light. The remaining three operational controls effect the tape movement and are the simple functions of 'stop', 'duplicate' and 'rewind'. While there is no mechanical interlock between these controls, the operator has to be really stupid to do things wrong and no disaster could result from going out of the fast rewind function into stop.

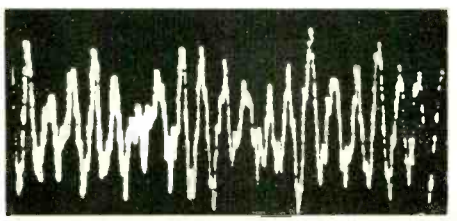
On the UK model of the copier there is one further external control in the form of a toggle switch located at the bottom rear of the copier. This switch selects the mains power for either 220 or 240V. The type of switch and its location are most unsatisfactory because it would be all too easy to operate the switch by accident when, for instance, cleaning around the copier.

In practical operation, the master cassette is loaded into the (clearly labelled) left hand transport. Rewound and bulk erased cassettes are loaded into the remaining two transports and the rewind button is pressed, which rewinds all three cassettes until the master transport stops. Finally 'stop' and 'duplicate' buttons are pressed and operation commences.

MANUFACTURER'S SPECIFICATION.
Cassette playing speed: 4.75 cm/s.
Duplicating speed: 76 cm/s.
Duplicating time (C30): 1 minute.
Rewind time: 30s.
Frequency range: 40 Hz to 10 kHz.
Wow and flutter: 0.21% rms per station (within NAB specification).
Equalisation: DIN 4.75 cm/s.
Bias frequency: 500 kHz.
Power consumption: 150W (600W surge) at 110 to 125V ac, 50 or 60 Hz. 230V ac input available on special order.
Fusing: 5A (electronics); 5A (motors); both on 230V ac.
Dimensions: 446 x 305 x 261 mm.
Weight: 15.9 kg.
Price: £900 (recommended retail).
Manufacturers: Infonics Inc, 1723 Cloverfield Boulevard, Santa Monica, California 90404, USA.
Agents: Fraser-Peacock Associates, 94 High Street, Wimbledon Village, London SW19.

The copier then continues operations until the master tape has stopped, from which point all cassettes automatically rewind. All this works well and only one possible snag was found. This was that, while the copier always rewinds the *master* fully, the *copies* were not necessarily fully rewound. This happens because the copier decides to stop the transports a short time after the right hand hub of the master cassette stops at the end of tape. Because the capstan drive is not used in the rewind function, the rewind speed depends upon internal friction in the cassettes with the result that the copies may take potentially longer to rewind than the master and therefore not be fully rewound when the master stops.

Wow and flutter across 6s



Insertion and withdrawal of the cassettes was positive and simple and the location of the cassettes in the copier was satisfactory. There was, however, no lockout facility for sensing the presence of the record interlock tabs in cassettes. It was therefore possible to record inadvertently on already recorded cassettes. While the copier is not fitted with erase heads, it would still ruin a recording.

The overall mechanical construction of the copier was to a high standard, and it should be mentioned that the unit employs one massive motor to drive each cassette transport. All the electronics are mounted on good quality printed boards and are readily accessible once the cabinet has been removed, which is a simple operation once a large number of screws have been undone. Access to the transports and heads for cleaning is really excellent as the complete top cover of the copier just pulls off.

Rather surprisingly, the quality of the tape wind was found to be good with a variety of tape makes and types, ranging from C30 to C90. While it is possible to copy C120, this is really asking rather much.

Although the duplicating speed was not measured with precision, it was certainly very close to the specified 76 cm/s, and the rewind speed was about double this, depending upon the internal friction of the cassette being rewound. Of much more importance is the difference in duplicating speed between the slaves, and this was measured by copying a cassette which was pre-recorded with an accurately known frequency. The first slave was found to run between 0.2 and 0.3 per cent fast, and the second slave between 0.15 and 0.3 per cent slow, representing a timing error of less than 6s across 30 minutes in the worst case.

Wow and flutter was determined by copying prerecorded cassettes containing 3.15 or 3 kHz tone of known low wow and flutter, and then replaying the copies on a replay machine having a well defined and low wow and flutter performance. The measured wow and flutter of the copies was virtually identical for both slaves, and in both cases was better at the beginning of the copy than at the end of the copy.

The DIN (peak weighted) wow and flutter was measured as 0.45 per cent at the start of copies, increasing to 0.55 per cent at the end of copies. As can be seen from the photograph of

74 ▶

the weighted wow and flutter waveform, by far the largest component is at about 4 Hz. By stretching the imagination a little, the rms wow and flutter could just be within the specified 0.21 per cent but none of these figures is very good. Remembering that in practice the wow and flutter from the master is added to these figures it is quite clear that any attempts to copy music will be hopeless and that copies of speech will be of marginal quality.

Uniformity of reproduction was investigated by recording a full C90 cassette with 1 kHz tone in the half track monophonic format, and then copying this entire cassette. All three cassettes were then replayed on a quarter track stereo recorder, the output of which was monitored with a Bruel & Kjaer level recorder with the pen speed set to 1 m/s. The resulting plot (**fig. 1**) shows very considerable deterioration of uniformity at the beginning of both copies, reasonable performance at the middle of the copies, but a further deterioration at the ends.

FIG. 1 INFONICS 102 REPRODUCTION UNIFORMITY (SEE TEXT)

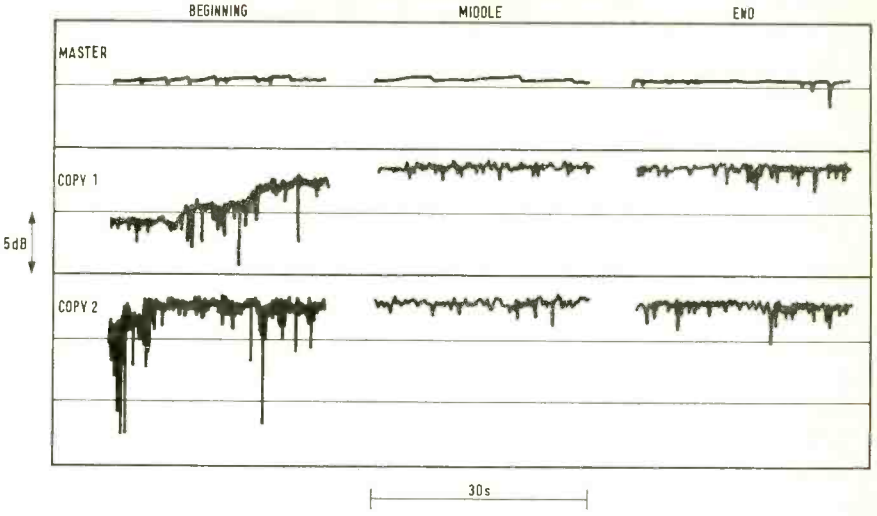
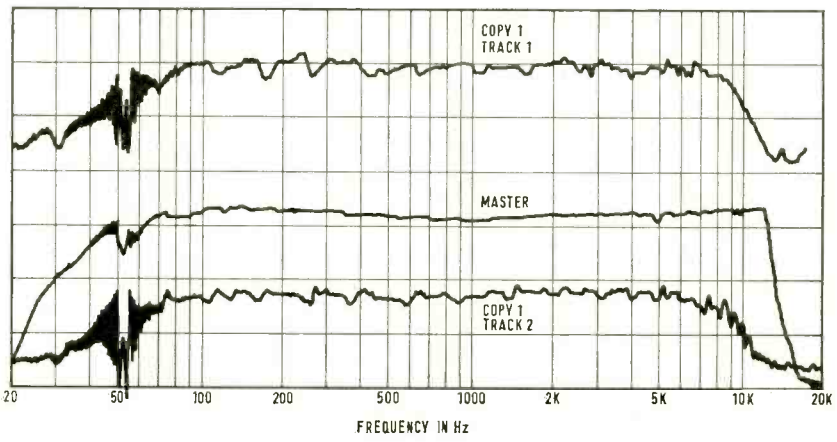


FIG. 2 INFONICS 102 FREQUENCY RESPONSE (-25dB REF. 25 pWb/mm)



The frequency response performance shown in **fig. 2** at a recorded level of –25 dB with reference to 250 pWb/mm with a pen speeds of 100 mm/s and paper speed of 3 mm/s also reveals a cyclic lack of uniformity, but the actual frequency response is quite good, with 3 dB points at 60 Hz and 9.5 kHz, compared with the master which had 3 dB points at 40 Hz and 13 kHz. The comparison between the master and copies in fact improves as the recorded level is raised, showing the biasing of the copies and the overload margins of the copier's amplifiers are satisfactory.

Reference to **fig. 3** shows the third harmonic distortion introduced by the copier at various record levels of 315 Hz tone and demonstrates the effectiveness of the internal auto gain control in the copier. It is in fact quite remarkable how little distortion is introduced by the copying process and this result was considered to be excellent.

Copied tape noise

Copied tape noise was also found to be satisfactory at a level of –53 dB(A) with respect to a 250 pWb/mm with half track (mono) replay (50 dB unweighted). However, a very serious snag was discovered during the exercise of measuring noise performance. It was found that the copies contained very serious static discharge clicks (similar to car ignition noise) when the copier was operated in low humidity conditions. This fault appeared when the relative humidity was between 40 and 50 per cent and was found to be present with C60 and C90 tape of BASF, EMI and 3M manufacture when they were used as masters. It has been suggested, and is likely, that back coated tapes may alleviate this problem but, so far as I am aware at the time of writing, only one or two makes of cassette tape are available with a back coating and they suffer from other tape problems.

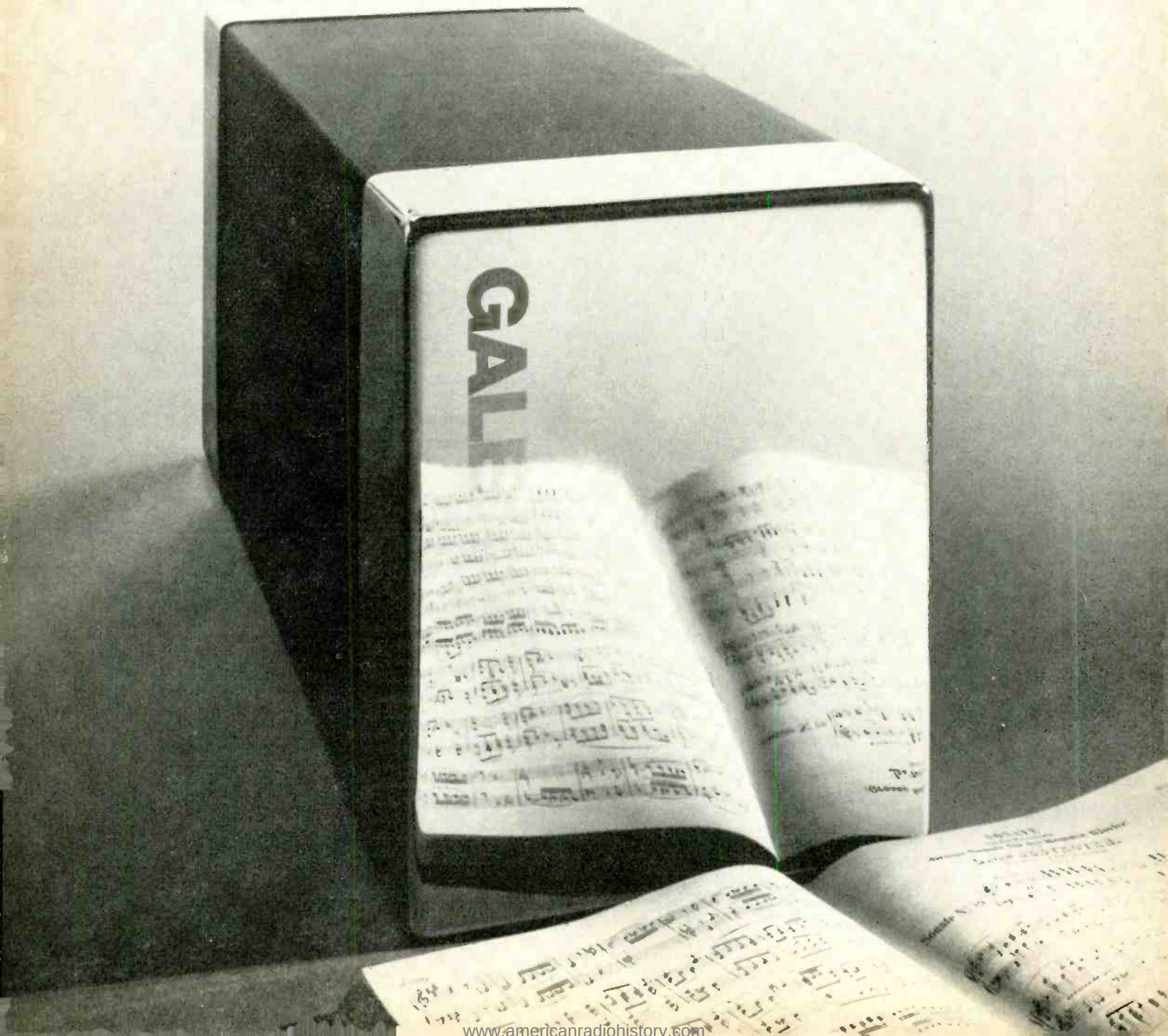
A further point also observed during the measurement of noise performance was that the copier was to a limited extent microphonic. While this problem is to no extent serious, and not in the same category as the static discharge, it is necessary to ensure that the copier is not subject to excessive vibration and is not handled during copying.

Finally, the matter of electrical safety was considered in terms of British Standard 3861: Part 1:1965 which is concerned with the electrical safety of office machines. While the stan-

76 ▶

EAR-OPENER

Power Handling: 100 Watts
Dimensions: $22\frac{1}{2}$ x $12\frac{3}{4}$ x $10\frac{1}{4}$ inches, 1·7 cubic feet
57 x 32 x 26 centimetres, 47·4 litres
Guarantee: unconditional, for 7 years
Origin: designed and made in Great Britain
Launch: Sonex 73, rooms 4029-4031
Enquiries about the Gale GS401 Loudspeaker:
I D Gale, Gale Electronics & Design Limited
39 Upper Brook Street London W1Y 1PE



dard's requirements were not investigated in any detail, one or two matters were found to require attention on the part of the manufacturers. Probably the most serious matter is that the colour coding of the mains lead is green, white and black, which is non-standard for Europe and also contrary to the UK 'Electrical Appliances (Colour Code) Regulations 1969'.

It was also noted that the previously mentioned toggle switch for changing mains voltage was mounted such that its metal dolly was not earthed to the chassis of the copier, and also that various metal ventilation panels were not earthed.

Subjective testing of the unit confirmed that its performance on music was far from good from the aspects of wow and flutter and lack of uniformity of output, also the signal-to-noise ratio left quite a bit to be desired. However, testing with speech provided perfectly adequate results and, so far as copies of speech are concerned, the performance was perfectly acceptable.

My feelings towards Infonics *102* cassette copier were to treat it in much the same terms as a regularly used office duplicator and the comments made in this review are related to this type of performance requirement. The construction of the copier is good but I doubt if the mechanics are sufficiently sound to stand up to full time use, five days a week, as a copying machine. That is without considerable degradation in performance.

Against all this one must balance the cost. At a recommended retail price of £900, this is no cheap toy. But, if one balances this against some 30 off £30 cassette recorders which would match the Infonics in copying speed and be probably not so good in performance, it becomes more realistic, particularly in view of the labour costs involved in loading and unloading cassettes. If your application is appropriate the Infonics *102* may be a best buy but it is definitely not recommended for copying any form of music recordings.

Hugh Ford

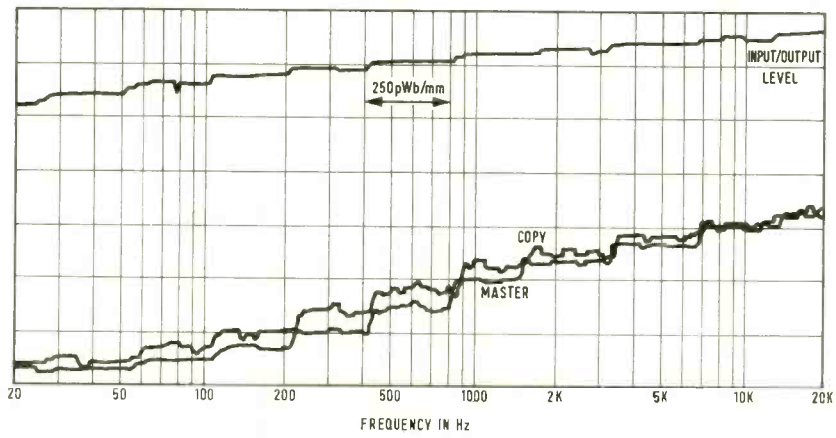
Postscript

During the course of this review, I contacted Messrs Fraser-Peacock Associates to enquire if the problem of static 'ignition noise' had been experienced with the Infonics duplicator.

It turned out that this was a known problem and, some time after writing my review, I was contacted by Messrs Fraser-Peacock Associates requesting me to examine a modified version of the Infonics cassette duplicator which had an electrically conductive strip inserted across the original plastic moulded dummy erase head on the 'master' transport.

This modification did effect a considerable improvement in the original static problem, such that the problem may not be noticed in loud speech recordings. However, the defect still exists and will without doubt remain a cause for complaint at its modified level of severity.

FIG. 3 INFONICS 102 THIRD HARMONIC DISTORTION



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 **MAY 1973** issue must reach these offices by **16th MARCH 1973** 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.

SITUATIONS VACANT

SOUND RECORDIST

Required by the Overseas Press and Radio Division of the CENTRAL OFFICE OF INFORMATION to join a small and busy group of sound engineers servicing both programme and news output. The Division produces programmes and news items for transmission by Radio stations overseas and in the United Kingdom. The successful candidate should be versatile and capable of operating all types of studio and location recording equipment. He/she will also be required to edit tapes and to operate circuit transmission equipment to overseas radio stations. The ability to work quickly and accurately under pressure is essential. Some late night and weekend working is involved. Salary according to experience and qualifications on a range £1674 to £2139 per annum. Please send postcard for application form to:

CENTRAL OFFICE OF INFORMATION
Room 53, Floor 'I', Atlantic House, Holborn Viaduct, London EC1

quoting reference number PE/290131/VY. Closing date for completed forms 30 March 1973.

★**Chateau d'Herouville**, 95-Herouville, France, tel. 466 48 26 or 28, are seeking for their studios English sound engineer—must be well qualified. Telephone or call immediately.

★**Small but rapidly expanding** company requires Audio Electronics Designer to work on development of professional recording equipment for Motion Picture and TV industry in a young and enthusiastic team. Salary by negotiation plus monthly profit sharing. Knowledge of studio and film industry techniques an advantage. Box 650.

SOUND ENGINEER

Rapidly expanding studio requires an editing/dubbing engineer. Must be experienced and able to work to high standards of quality in both music and voice recording. Knowledge of audio/visual field also an asset. Salary negotiable. Please write to:

IAN HIGHLEY
Fraser-Peacock Associates Ltd., 94 High Street, Wimbledon Village, London, SW19

★**Audio-Sales.** Technical audio sales to professional studios. FM and TV broadcasters. Several full time regional openings available in the USA and Europe. Send resume to RC Desmarais, Burwen Laboratories, 209 Middlesex Turnpike, Berlington, Mass. 01803.

★**Enthusiastic young man** (18-21) with A levels or ONC in electronics to work in recording studio. Interest in and knowledge of recording essential. Phone Jerry on 01-499 7173 for appointment.

INDIVIDUAL

To take an active part in expanding my small London based outfit. This is an excellent opportunity for a person who has a thorough technical background in audio. Must be willing to contribute in accordance with the demands of an exciting and challenging business manufacturing professional quality high power sound systems. Substantial remuneration offered to the right person.

Write giving full background to **Box No. 651.**

★**Technician** for Electronics Section concerned with medical educational television and audio tape recording. Starting salary up to £1300 depending on qualifications and experience. Day release towards ONC can be arranged. Duties include operation and maintenance of equipment and tape duplicating. Further details write or phone J. Cooper, Audio Visual Communication Dept., British Medical Association, Tavistock Square, London WC1H 9JP. Tel. 01-387 4499.

STUDIO FACILITIES

★**County Recording Service.** Stereo and Mono masters, 12″ vinyl pressings.

Roger Squire
DJ Studios

The best facilities in town for making Audition Tapes, Jingles, Programmes and Sound Commercials. For further information telephone

01-722 8111

★**County Recording Service.** 7″ vinyl discs pressed on our own plant.

★**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.

YOUR TAPES TO DISC

Records made to order—7″ from £1.50, 12″ from £4.00. 4-day postal service. Vinyl pressings, sleeves, labels. Tax-free for schools, etc. We cut records for many Recording Studios, etc, and use the same equipment for you: NEUMANN Disc Cutting Lathes—Mono and Stereo systems. Professional tape machines with Ferrite playback heads, Dolby A and B systems, 200W Amplifiers, Lockwood monitors, Teletronix/Ortofon Limiters. Send SAE for photo leaflet.

DEROY STUDIOS (1948)
Hawk Street, CARNFORTH, Lancs. Tel. 2273

★**County Recording Service.** Stereo and Mono discs from your tape.

★**Graham Clark Records.** Tape to disc pressings. 124A Station Road, Addlestone, Weybridge, Surrey. Tel. Weybridge 43367.

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

4-TRACK STUDIO
£4.50 HOUR

Free use of Hammond Organ, Fender Amps, Hayman Drums
Fender, RMI, Wurlitzer Electric Pianos
Fender, Gibson, Martin Guitars, Synthesiser also available.

T. W. STUDIOS
400 Lillie Road, Fulham, London, S.W.6
Tel. 01-385 4630/0393

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

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.

★**County Recording Service.** Top quality, reasonable price, quick delivery. Tel. Bracknell 4935. London Road, Binfield, Bracknell, Berks RG12 5BS.

★**Mobile recording** van. Live sessions. Stereo. Anywhere. Mobitrack, 01-892 9599.

HI-FI "RUMBLECURE"
(Patent 28949/69)

These Patents expose the inability of the trade, and its advisor's, to solve the complicated phenomena of vibration. WE DEAL DIRECT ONLY.
Tel. 061-330-2836 (anytime)
Black Knight, Ashton-u-Lyne, Lancs. OL6 6TA

FOR SALE—TRADE

★**Professional tape** only 45p. 1200ft. Agfa on hubs, no joins (p. and p. one box 25p, each additional box 10p). We handle 99% of all s/h professional recording equipment. Send for list. Jackson Studios, Rickmansworth, Herts.

FOR SALE

LEEVERS-RICH 1″ 8 TRACK MACHINE

PRICE £3,000 O.N.O.

Contact—
TONY LEATHER
01-499 7173

★**Sennheiser MD112 Microphone**, new/boxed. Normal price £44. **Special offer £32. AKG K50** Phones 75 ohms **£5.90. Perfectone EPGA** (Pulse) **£95. Special Microphone Offers: AKG D109 £11.00. AKG D202E1 £32.00. AKG D190C £15.00. Sennheiser MD211 £32.00. Sennheiser MD413 £25.00, p.p. 50p. Sennheiser HD414 Dynamic Headphones £8.25, p.p. 30p. J. J. Francis (Wood Green) Ltd.,123 Alexandra Road, Hornsey, London, N.8. Tel. 01-888 1662.**

FOR SALE—PRIVATE

★**Vortexion** C.B.L. 6H. Mint £118. Kibble, 232 Westrow Drive, Barking, Essex. Tel. 01-594 1749.

★**Uher 4000L** with leather case. Excellent condition. List £172. Accept £110. Runcorn 66180.

★**½in. recording tape.** Ilford brand standard play. £2 per N.A.B. roll. Phone 01-567 2746, 01-734 0072. Box No. 649.

★**Custom-built** 4 track ½in. recorder, also 8 channel stereo-mixer. Best offer secures. Further details phone Carlisle 0228 29486.

★**Brand new** ¼in. s.p. professional tape. Agfa per VO 1200ft. on 7in. spools, factory-fresh and boxed at £1 per reel. 6-10 reels at 95p each, 11 and over at 90p each (p. and p. 1 box 15p, 2 boxes 25p, each additional box 5p). Jackson Studios, Rickmansworth, Herts. Telephone Rickmansworth 72351.

★**Allen & Heath** 10 channel stereo mixer. Fold back, echo send, panning on all channels. V.U's and P.P.M's. Effects equaliser. Space for extra channels. £320 o.n.o. 2 AKG P20 £30 each. 01-437 8184 daytime.

★**All must go.** Offers invited please. Good homes required Leevers-Rich ¼in.-4 track, E.M.I. Mono Plate, Elcom 8 in 2 out mixer. Other smaller items. Inspection welcome. No reasonable offers refused. Domino Records, High Street, Albrighton, Nr. Wolverhampton. Tel. Albrighton 2384.

★**Professional system** consisting pair of I.M.F. Reference Monitors 200 watts, high speed quality Teac 7030 deck, F600-RS stereo limiter/compressor by Audio & Design, two Alice (Stancoil) crosstalk/noise suppressors with power supply, studio quality pre-amp with Graphic equalisers and Peak reading output meters, also transcriptors reference turntable, sweep arm, stylus brush, arm fitted with Empire 1000ZEX cartridge. Everything latest models. Complete system cost £1,600, must sell £1,000. Offers for separate items entertained. 01-980 7683 (evenings).

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.

★**Replay Amplifier** for E.M.I. TR52 Tape Machine. 061-436 1381.

TAPE EXCHANGES

★**32-page** illustrated booklet: "Hints for Tapetalkers, International Message Making," available to non-members: 15p. Worldwide Tapetalk, 35 The Gardens, Harrow.

MISCELLANEOUS

★**Repairs.** Our modern service department equipped with the latest test equipment including a wow and flutter meter and multiplex stereo signal generator is able to repair hi-fi and tape recording equipment to manufacturer's standards. Telesconic Ltd., 92 Tottenham Court Rd., London W.1. Tel. 01-636 8177.

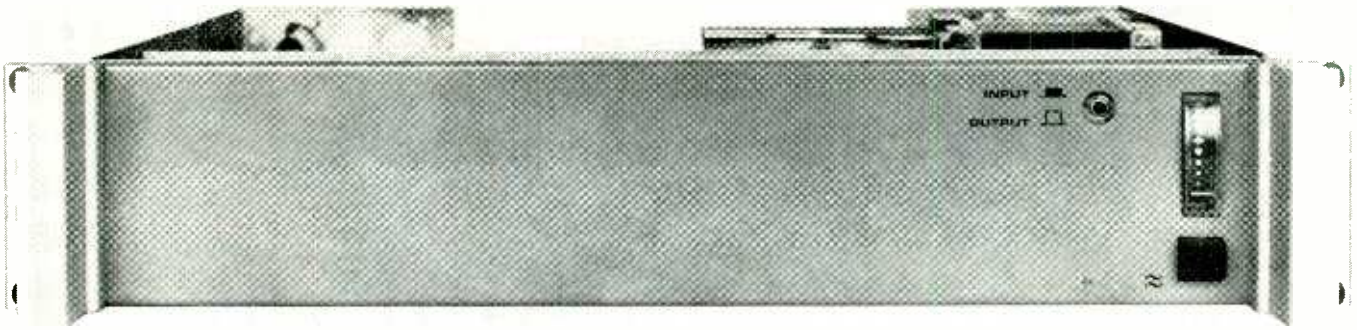
★**Tape and Cassette Recorder Repairs** by Specialists. The Tape Recorder Centre, 82 High Holborn, London W.C.1.

★**Tape-Heads reconditioned.** Guaranteed satisfaction. Send worn head enclosing £2 to Sara Electronics, Fawkham Avenue, Longfield, Kent.

INDEX TO ADVERTISERS

Acoustical Mfg Co. Ltd. 16
Acoustico Enterprises Ltd. 12
Action Video Ltd. 43
A.K.G. Equipment Ltd. 19
Alice (Stancoil Ltd.) 33
Allen & Heath Ltd. 39
Apollo Electronics Ltd. 8
A.P.R.S. 39
Audio Applications Ltd. 29
Audio Design (Recording) 12
Audix, B. B., Ltd. 18
Automated Processes Inc. 49
AV Distributors Ltd. (Schoeps microphones) 55
Baileys 67
Bauch, F. W. O., Ltd. 63
Beyer Dynamic (GB) Ltd. 31
Bias Electronics Ltd. 59
Brenell Engineering Co. Ltd. 6
Cadac (London) Ltd. 2
Calrec Audio Ltd. 45
Cintron Group 20
Communication Access. & Equipment Ltd. 20
C.T.H. Electronics 47
D.E.W. Ltd. 76
Dixons Technical Ltd. 41
Eagle International 10, 11
Electronic Music Studios (London) Ltd. .. 8
Electrosonic Ltd. 14
Feldon Audio Ltd. 67
Fraser-Peacock Associates Ltd. .. 4, 59, 67
Future Film Developments Ltd. 8
Gale Electronics & Design Ltd. .. 37, 75
Grampian Reproducers Ltd. 53
Grundig (GB) Ltd. 27
ICElectrics Ltd. 29
Industrial Tape Applications 5, 7
Lamb Electronics 15
Leevers-Rich Equipment Ltd. 63
Lennard Developments Ltd. 45
Macinnes Labs Ltd. 9
Magnegraph-Eurotel Recording Co. Ltd. 67
Magnetic Tapes Ltd. 71
Metrosound Audio Products Ltd. .. 73
Midas Amplification 14
Millbank Electronics 79
Miniflux Electronics Ltd. 53
Minnesota Mining & Mfg. Co. Ltd. 21, 68, 69
Monks, Keith, Audio Ltd. 47
MSR Electronics Ltd. 59
Neve, Rupert, & Co. Ltd. 80
PSP Electronics Ltd. 45
Quad/Eight Electronics 23
Rola Celestion Ltd. 53
Rumble, C. H., Ltd. 39
Sansui Electric Co. Ltd. 25
Shure Electronics Ltd. 17
Sonex 73 6
Sound Audio Electronic & Video Techniques 53
Spendor Audio Systems Ltd. 4
Starman Tapes 8
T.B. Technical Ltd. 39
Trident Audio Developments Ltd. .. 13
Walkers, N. 43

Published by the Proprietors, Link House Publications Limited, 10-12 South Crescent, Store Street, London WC1E 7BG, and Printed by Arthurs Press Limited, Woodchester, Stroud, Glos. GL5 5PB.



First we looked at the works. Then we worked on the looks.

It's amazing the number of good-looking amplifiers there are about these days.

But that's the easy bit.

It's what's underneath that counts.

So we decided to make sure of the works before we did anything else.

And we came up with our 'C' series.

A new range of three monitor or entertainment power amplifiers.

With the following features.

600 ohm bridging, floating, input.

8 ohm output.

Unique fully protective circuitry.

Distortion better than 0.2%.

Available in 19" rack or free standing form.

Peak reading meter is switchable between output and input.

Signal and mains inputs by XLR sockets.

MEX 301C: 30 watts, MEX 501C: 50 watts, and MEX 1001C: 100 watts.

Quite some amplifiers.

And we finished them in stylish Havana with anodised alloy handles.

After all that, they deserve to look good.

And they do.

Millbank

It's got to be good.

Millbank Electronics Group, Uckfield, Sussex, England. Tel: UCK (0825) 4166. From Europe: 892-96-4166.
Manufacturers of specialist audio equipment for industrial and entertainment applications.
Sound mixers, tuners, sound systems, loudspeakers, tuner amplifiers, audio modules and amplifiers.

ME MILLBANK

Neve at Covent Garden

Neve is wherever you find the world's finest sound – in recording studios, in radio and TV, in theatres, concert halls and film studios.

It's the performance of the consoles that makes the sound of Neve.

Look at the figures achieved on this console now in the Royal Opera House, Covent Garden.

Distortion At +20dBm

Highest recorded figure	0.058%
Median figure	0.035%
Neve specification claim	*0.075%*

Noise 20Hz to 20kHz

Output stage - maximum	–99.0 dBm
Neve specification claim	*–80.0 dBm*
One channel selected - maximum	–81.5 dBm
Neve specification claim	*–77.0 dBm*
Equivalent input noise - maximum	–125.5 dBm
Neve specification claim	*–125.0 dBm*

For the best performance figures in the world choose Neve.
Write now for further information.

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 0621 7652

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