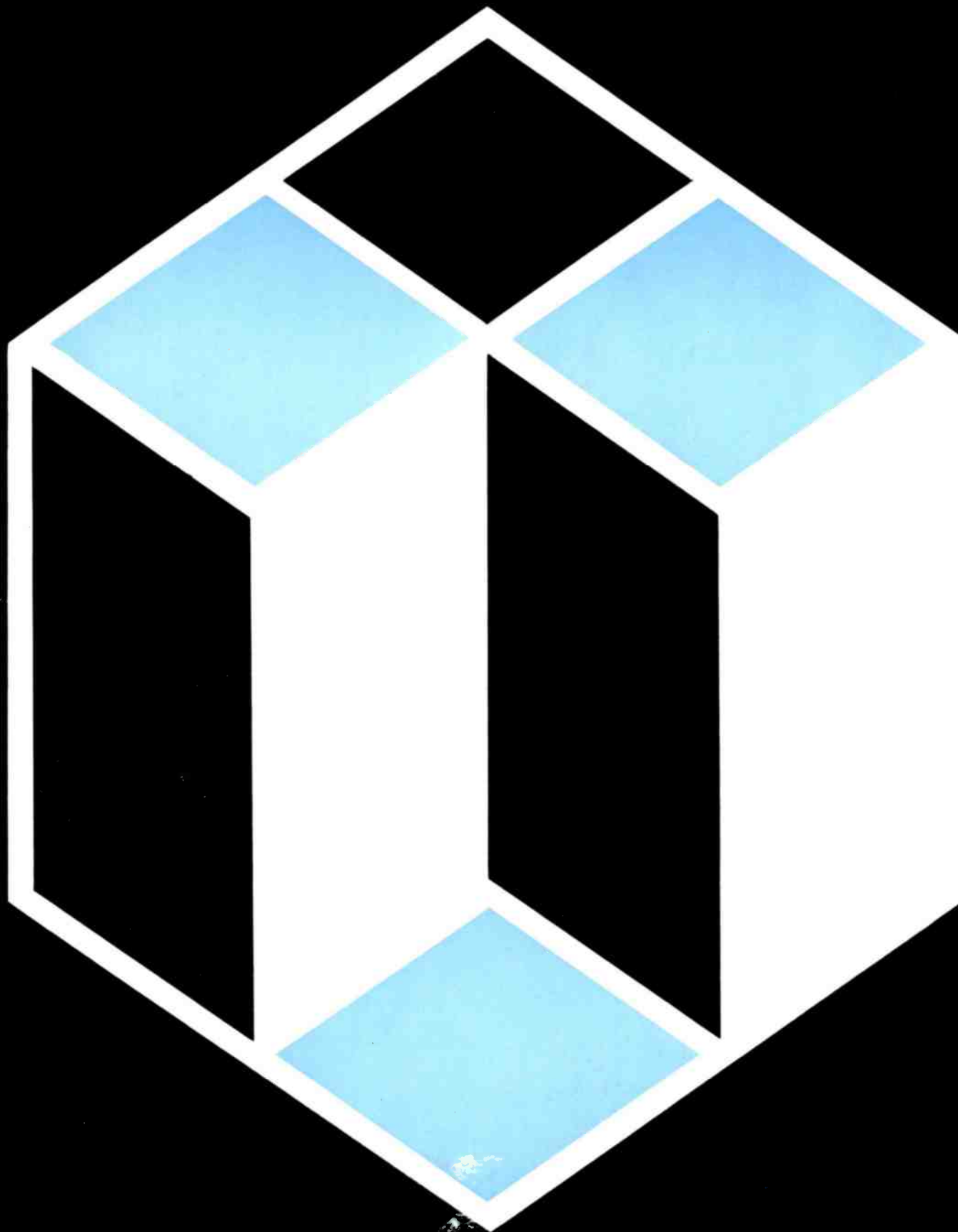


studio sound

May 1977 45p

AND BROADCAST ENGINEERING



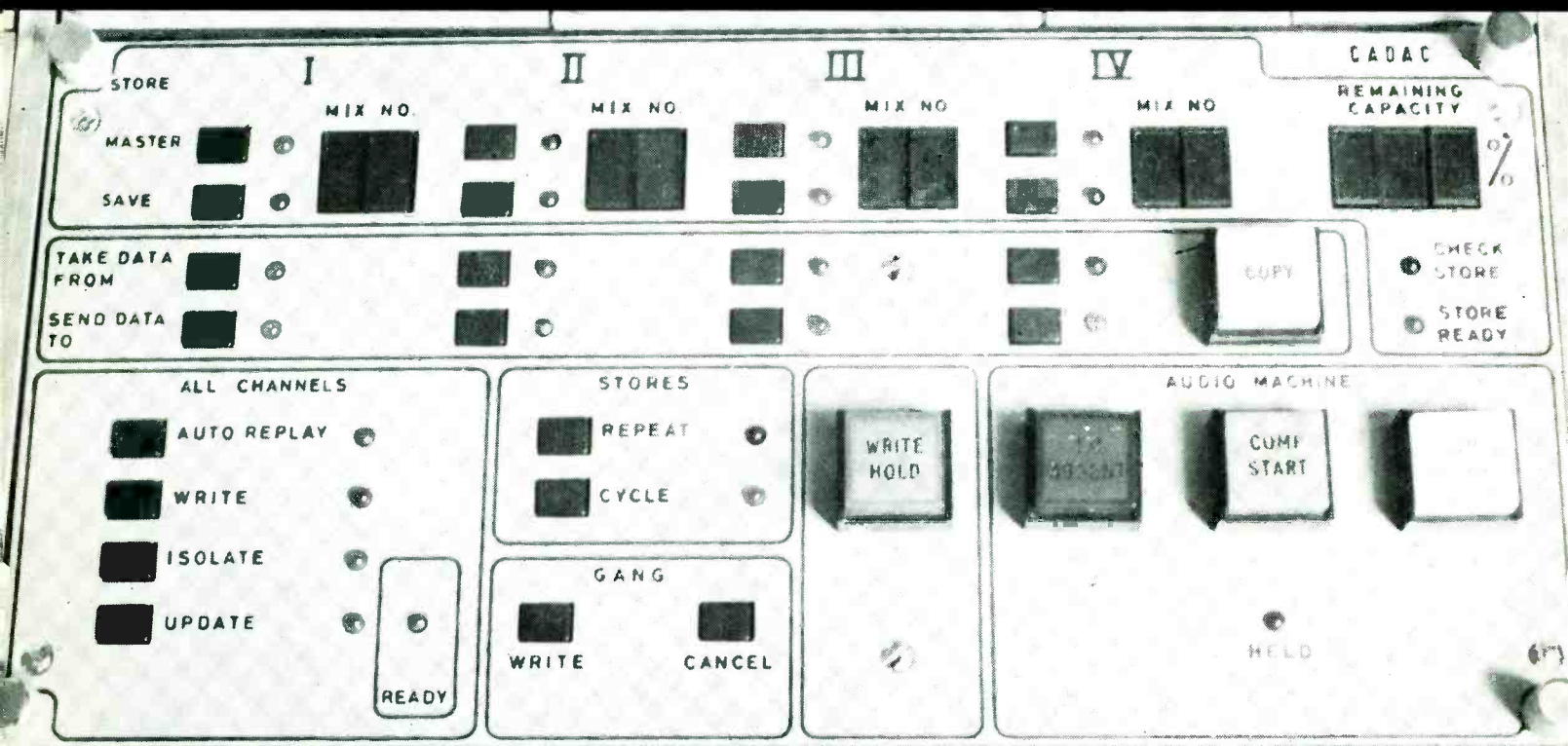
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studio sound

AND BROADCAST ENGINEERING

Monitoring opinion

This magazine doesn't indulge in technical reviews of loudspeakers. It could, but it doesn't. Not because they are large and unwieldy but rather we don't have any calibrated ears with which to make quantitative appraisals.

Most consumer magazines have leapt in with both feet producing spl measurements (probably the only one of any value), frequency response curves, impedance characteristics, Doppler distortion figures and all the rest. Others produce reviews based on 'comparative musicality'. This means a clandestine array of several models adjudicated by a panel of individuals, each of whom has fixed ideas on what constitutes a 'good' loudspeaker.

It's easier to discredit the first approach than the second. Instruments are very unappreciative of good music; in any case there is little defined correlation between a flat frequency response curve and musicality/tonality/definition/presence/coloration/brightness and any of the other abstract nouns taken at random from typical reviews.

Panel verdicts tell you about a cross-section of opinion for a given combination of music and situation—the acoustics and atmospherics of the venue contribute much to the subjective appraisal. However, it won't tell you how those same models are going to sound in your situation. And there's another problem. Panel verdicts, by necessity, are made over a very limited period. It seems more relevant to talk to recording engineers about their own preferences—this process goes on in bars and control rooms everywhere.

Most speaker reviewers have reduced their reviews to an art form—good reading but not always very helpful. We don't intend to leap on the band wagon with interesting platitudes. Until someone has invented a reasonable method of relating objective measurement and subjective comment, we will leave the whole technical issue alone.

Independence

Every so often somebody gets it wrong about the magazine. They feel that their advertising budget should pull weight with the editorial coverage. We don't work that way.

It's not that we indulge in prima donna editorship totally unsullied by nasty commercialism—the magazine wants all the ad orders it can take. We simply can't afford to trade our independence for increased revenue. Credibility carries the readership and the readership carries the advertising. Drop one and you drop the rest.

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MAY 1977 VOLUME 19 NUMBER 5

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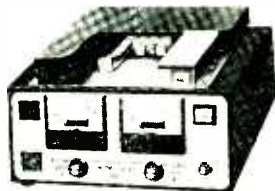
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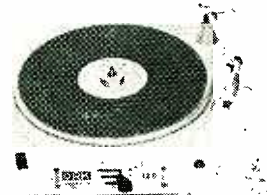
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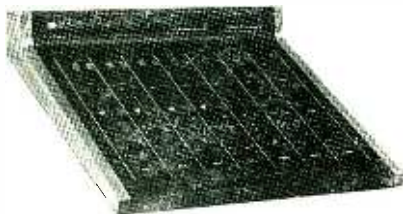


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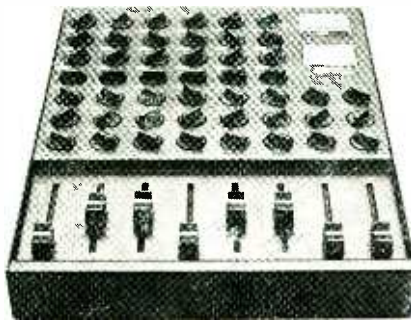
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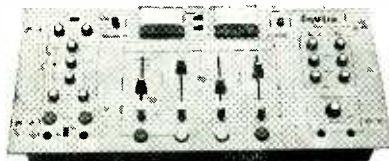
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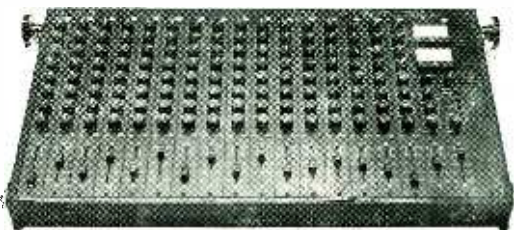


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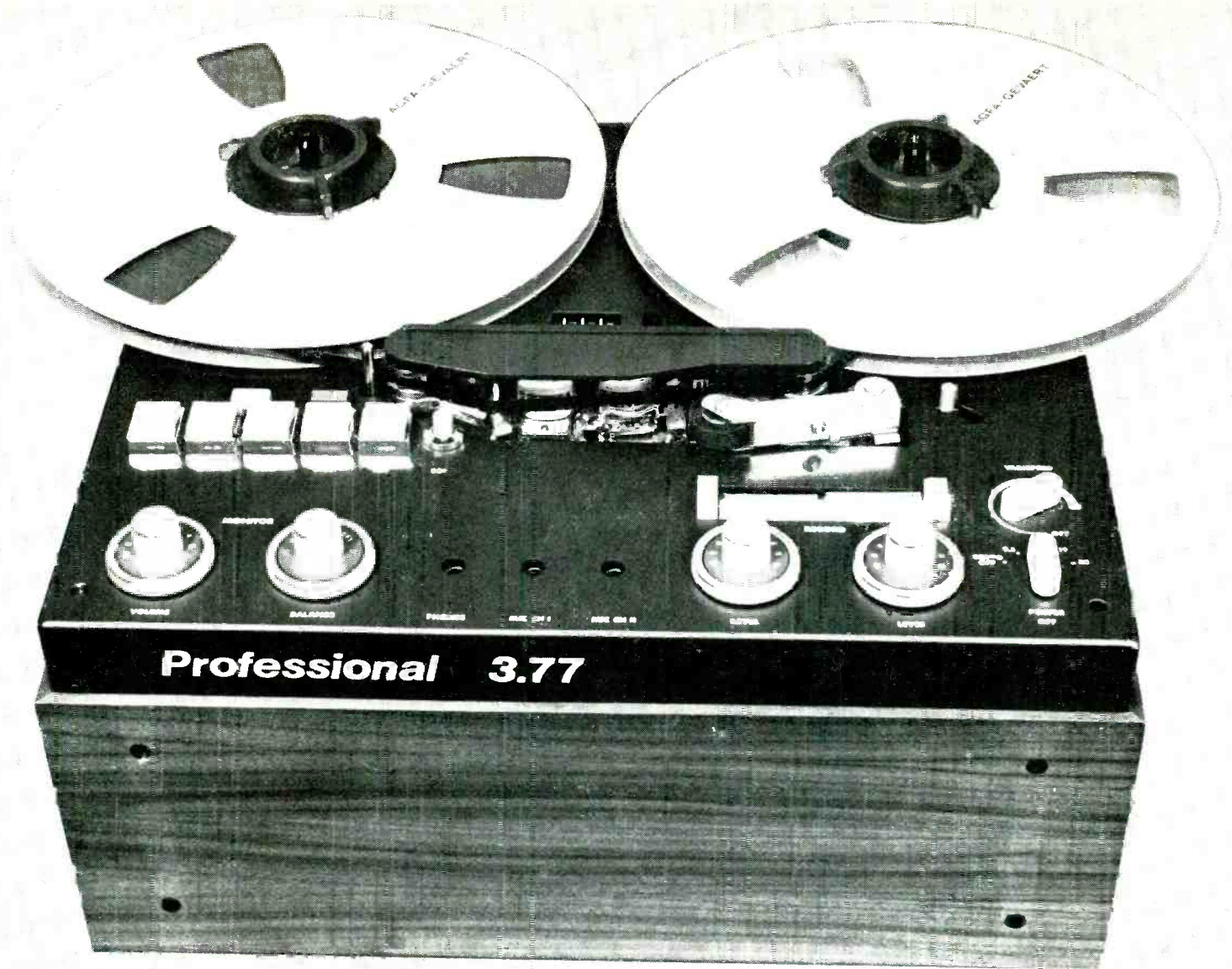
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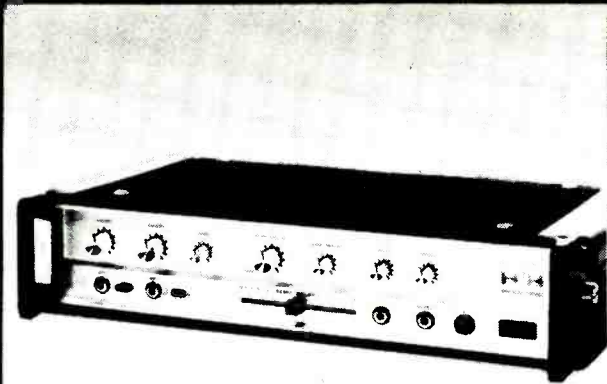
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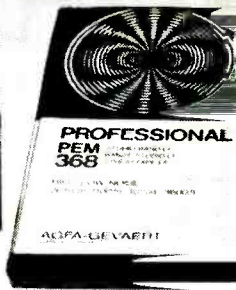
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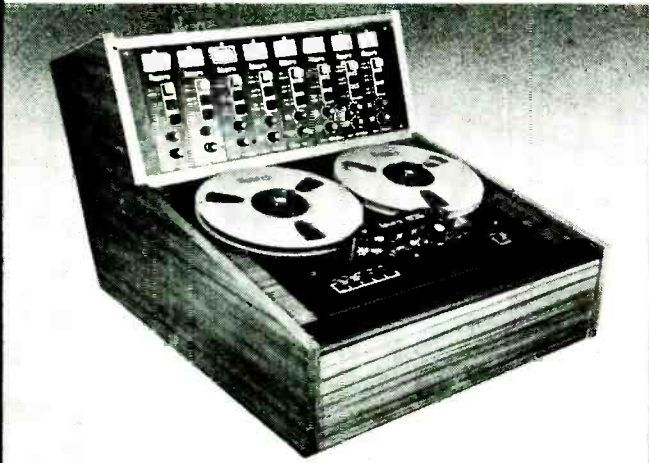
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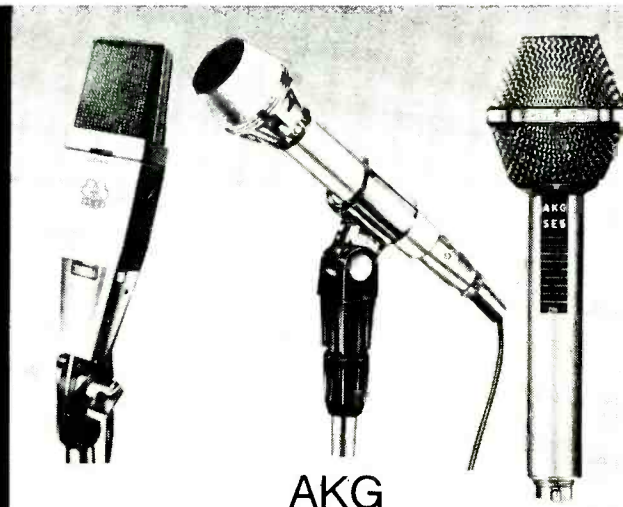
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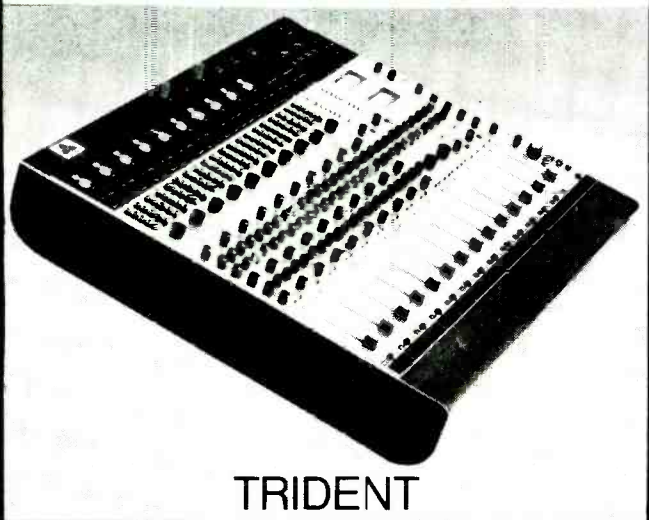
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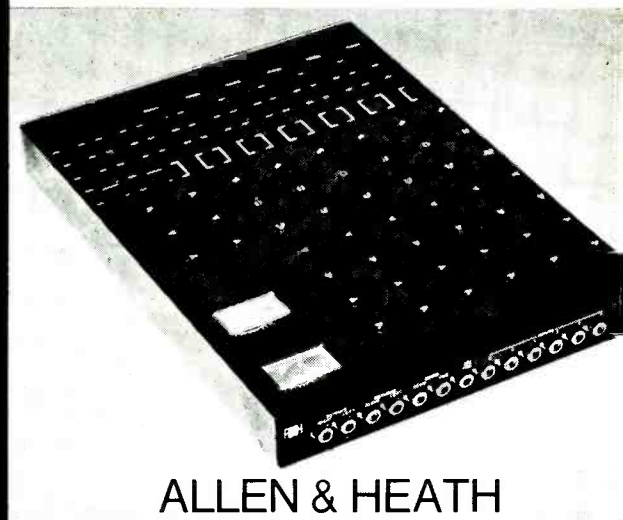
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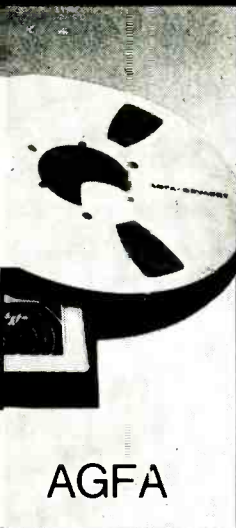
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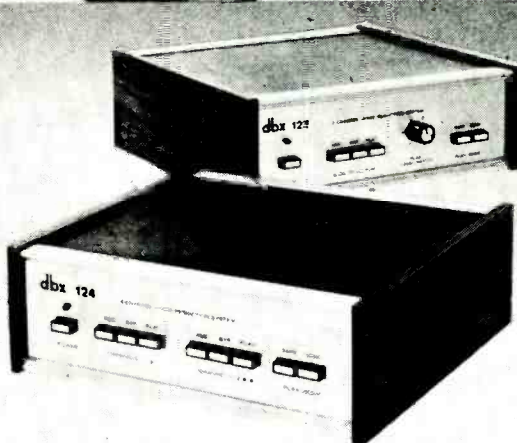
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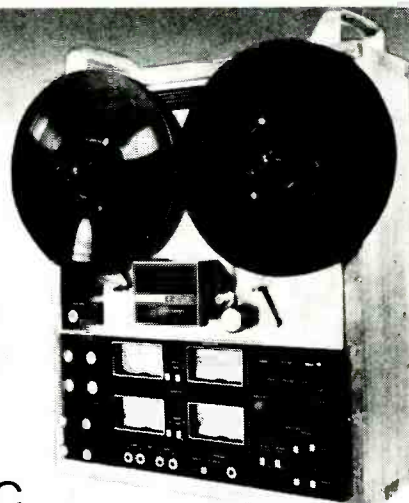
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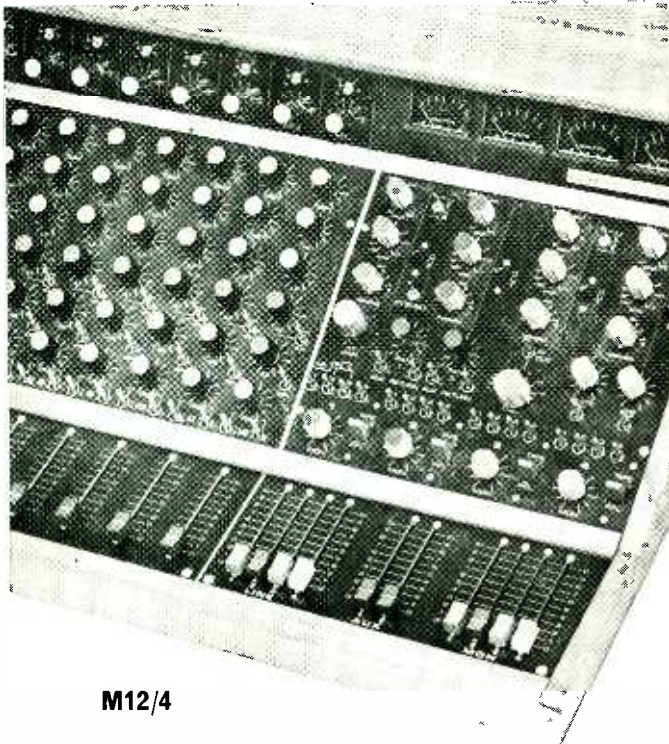
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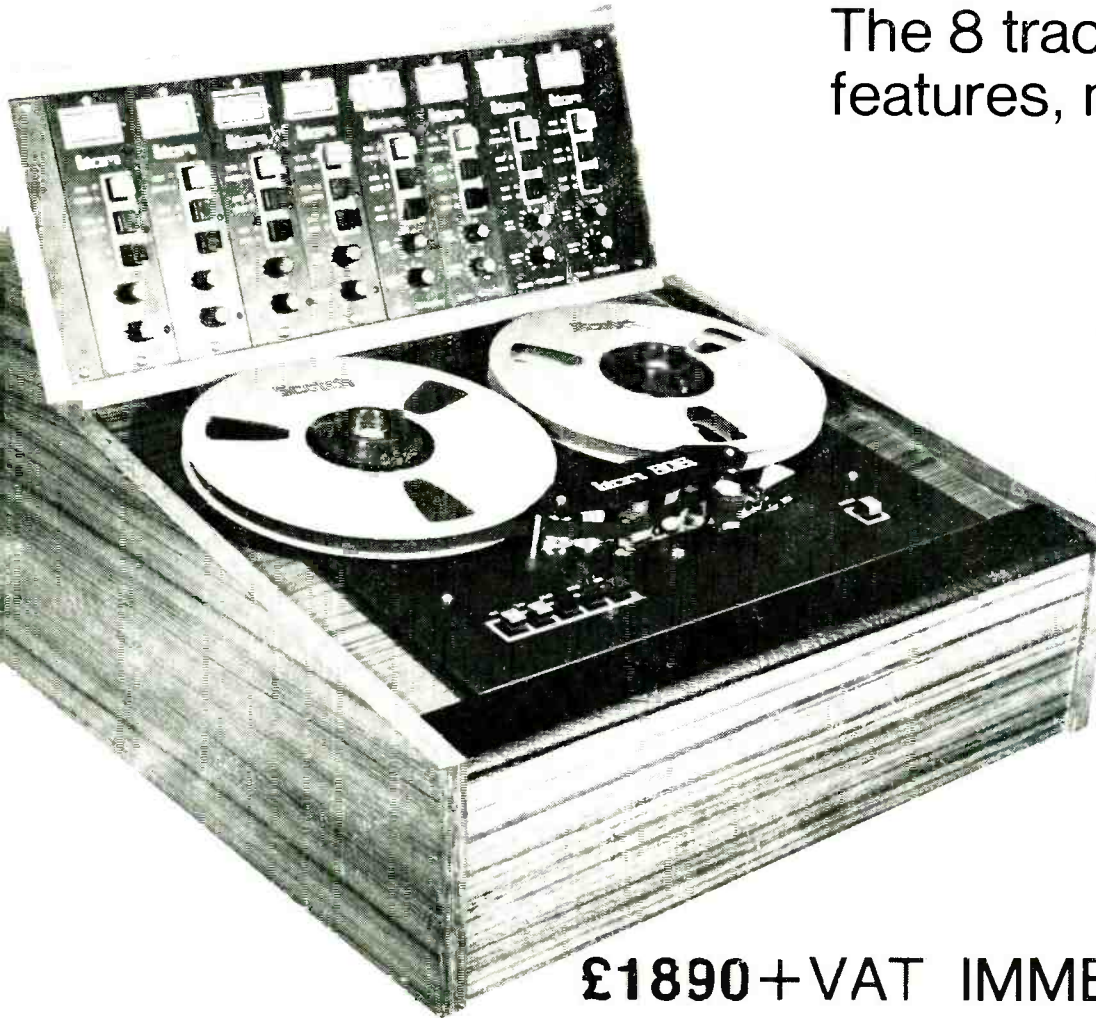
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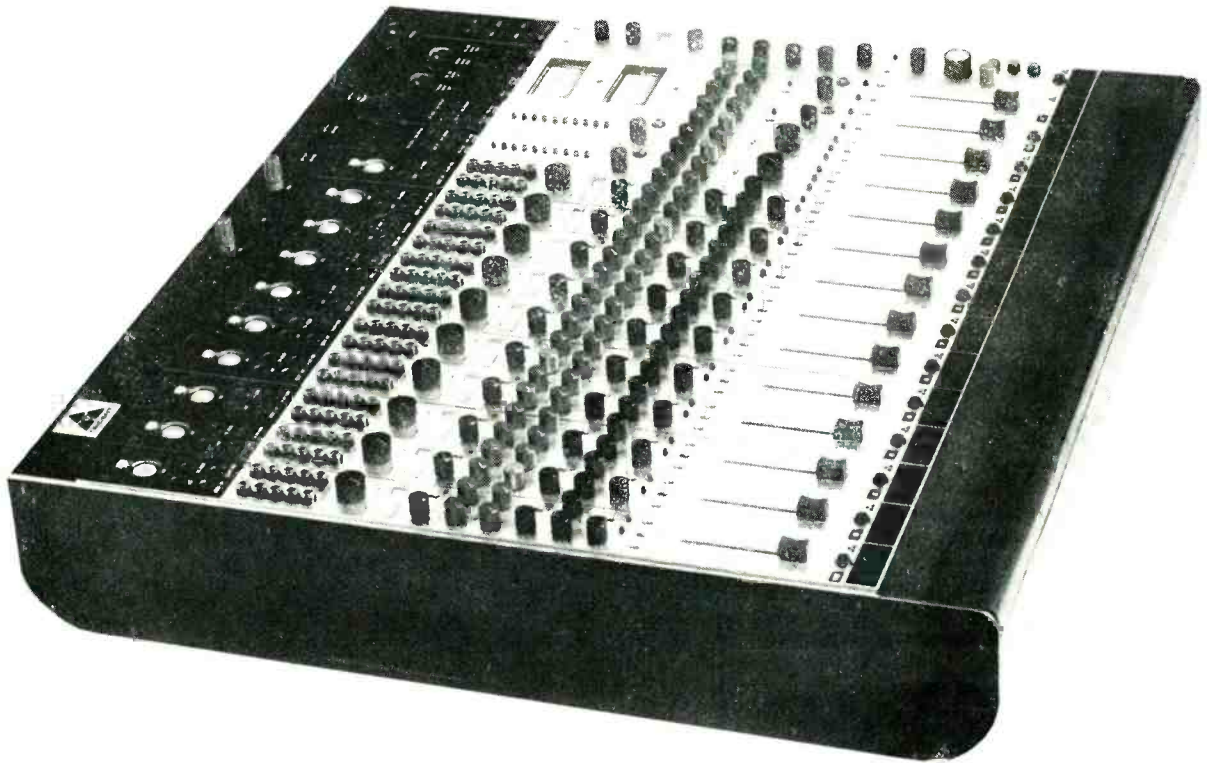
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The new MXT-1000
A unique system enabling
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8 channel, 2 group MXT-
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with compressor

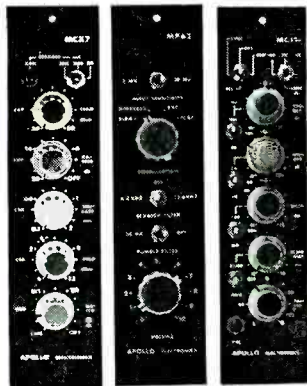
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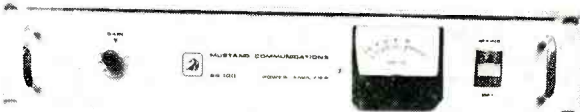
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—HM30: Compressor limiter
34 dB comp. 0.3% THD

Application data on request/AES PARIS, std B12
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Our SS.100 and SS.50 are economical amplifiers with outputs of up to 150 and 80 Watts RMS into 8-15 ohms, typical THD figures being 0.1%, slewing rate > 10v/us, noise > 90dB down, zero level input, and full electronic protection. Considering these points with their proven reliability and robust construction, plug in output transistors and driver board, optional balanced input and 100V line output, and virtually ex stock despatches we reckon we take some beating! Contact us now for the full technical specifications.

Manufacturers of mixers, integrated mixer amplifiers and slave amplifiers, studio power amplifiers, transformers, lighting control equipment and cabinets for the home and export markets. Contact us for full illustrated technical brochures.

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Telephone 0723-63298





The Tweed P104 portable

UP NORTH, PRONOUNCE IT TWEED. DOWN SOUTH JUST SAY 3M.

3M are now switched on as exclusive distributors for Tweed Audio products in Southern England and Wales.

In the North and in Scotland, Tweed Audio will continue to sell direct to professional broadcast and audio studios.

In London, Midlands and the South (and in Ulster) 3M input makes sound sense. 3M have set up a complete servicing dealership for superior Tweed equipment—from the P104 10 Channel 4 Group Portable Mixer to 24/24 multi-track recording consoles. Also all ancillary items—compressor limiters, telephone

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The output you get from Tweed and 3M stays the same: Portability and top performance at value-for-money prices. Custom-built consoles, if you want. Plus ease of servicing that's helped by modular construction, with all active amplifiers easily replaceable.

Up North, find out more from Tweed Audio, Rosewood Industrial Estate, Kelso, Roxburghshire, Scotland. Telephone 057-32 2983.

Down South, talk back to Derek Stoddart via the coupon.

To: Derek Stoddart, Technical Manager,
3M United Kingdom Limited, Witley Works,
Witley Gardens, Southall, Middlesex.
Telephone: 01-574 5929 or 574 6045

Please tell me more about Tweed Audio equipment.

Name _____

Business Address _____

Position _____

Telephone _____

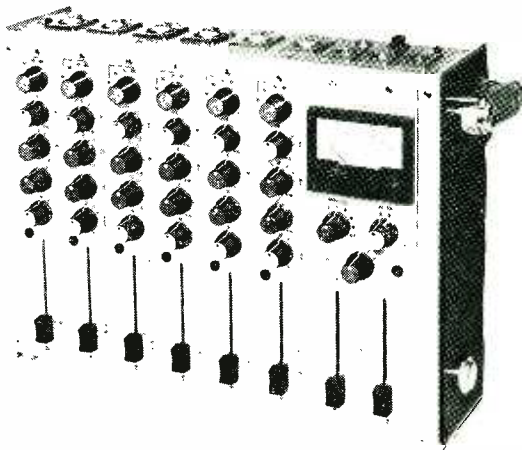


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The AD 045 PICOMixer

FOR THE BUDGET-CONSCIOUS RECORDIST WHO DOES NOT NEED ALL THE FACILITIES OFFERED BY OUR MORE ELABORATE SYSTEMS



Ideal for owners of the NAGRA IVS and similar professional portable tape recorders.

FEATURES:—

- ★ Six balanced and fully Equalised MIC/LINE INPUTS.
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- ★ Rechargeable Battery (Five Hours Capacity).
- ★ Headphone Monitoring of PFL and OUTPUT.

OPTIONS:—

- ★ DIN or XLR Connectors.
- ★ VU or PPM.
- ★ Output Transformers (to give floating line).

ACCESSORY:—

- ★ Charger Unit for battery.

Size—340 x 265 x 110mm.

Weight—6.2 KGm.

For further details write or 'phone:

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HALL LANE, WALSALL WOOD,
WALSALL, W. MIDLANDS, WS9 9AU
 Telephone: Brownhills 5351/2/3 (STD Code 05433)

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We can do anything you can dream up for the A77 within reason, and without detriment to the normal performance of the A77 such as:

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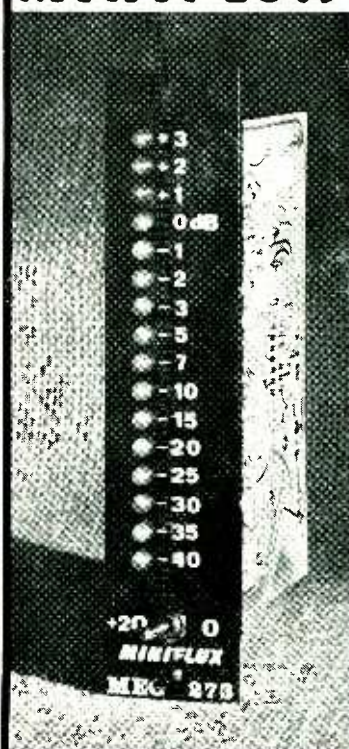
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Radio Recordings

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MINIFLUX



MEG 273 Peak Level Indicator uses a column of green and red LED lamps which ignite alongside a dB scale in accordance with input signal levels.

The indicator has no moving parts and its very high sensitivity allows it to be used at Test Tape levels and for system noise checks. The display is easily readable in multi-channel applications and its vertical orientation is ergonomically suited to the slider movement in mixers.

The circuit has been subject of long-term development and uses only five integrated circuits. The accuracy is ± 0.1 dB. Max. sensitivity: 60 mV to give 0 dB. Input Z: 100 kohm unbalanced. Supply: —32 to —50V. Integration time and Decay to IEC 268-10.

MINIFLUX electronics limited
 8 Hale Lane London NW7 3NX England Tel: 01 959 5166
 ATHENS: 815 858 PARIS: 357 16 97 STOCKHOLM: 08-83 60 00



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A NEW COMPACT, HIGH PERFORMANCE EQUIPMENT

This versatile equipment has all the features expected by the broadcasting industry.

SONIFEX LEADERS IN BRITISH CARTRIDGE EQUIPMENT
 15 COLLEGE STREET, IRTHLINGBOROUGH, NORTHANTS
 Telephone: WELLINGBOROUGH 0933-650 700



Small wonder.

One of the world's smallest dynamic-element lavalier microphones is designed to be heard, not seen. Other mini-mics may be O.K. at first, but, as you know, there have been problems with sudden failures... sometimes on the air! The new Shure SM11 lavalier solves the problem with an unusually high quality dynamic element that delivers all the reliability of a desk microphone—yet it weighs less than a third of an ounce.

Rugged, all-around durability and a

field-serviceable design keeps this new breed of lavalier on the air when you need it most. Without batteries or unnecessary wiring. And without a big price tag either.

The SM11 has everything: size, performance, durability, price. That's not just small talk!

Shure Electronics Limited
 Eccleston Road,
 Maidstone ME15 6AU
 Telephone: Maidstone (0622) 59881

TECHNICORNER

Frequency Response: 50 to 15,000 Hz

Polar Pattern: Omnidirectional

Impedance: 150 ohms (200 ohms actual) for connection to microphone inputs rated at 25 to 200 ohms

Hum Pickup: Less than 35.3 dB

equivalent SPL in a 1 millioersted field

Accessories Supplied: Specially designed lavalier assembly; clip-on clasp; tie-rack assembly; connector belt clip.





We've moved along to 'Tin Pan Alley'

REW Professional Audio have moved to much larger premises at the corner of Charing Cross Road and Denmark Street. This move has been made so we can continue to house our ever increasing range of professional audio and studio sound equipment under one roof. REW are Europe's largest suppliers of professional equipment and our trade prices to professionals are the lowest in the U.K.

REW PROFESSIONAL CATALOGUE

If you're setting up a mini recording studio,

building a P.A. system, or even just looking for a microphone or a reel of tape, this catalogue: is an absolute must! It contains the most comprehensive range of Microphones, Mixers, Multi-Channel Tape Recorders, Amplifiers, P.A. Speakers, Echo Units, Equalisers, Noise Reducers etc., from leading manufacturers. Send large SAE for your free copy now.



The following equipment on demonstration and available for immediate delivery from stock:

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REW Professional Audio, 126 Charing Cross Road and 17 Denmark Street, London WC2. Tel: 01-836 2372/7851.

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Hampstead High Fidelity—professional equipment for professional people, and distributors for the complete range of CE (formerly STC) microphones; a range of microphones covering the whole spectrum of inside and outside broadcast uses.

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We also supply the Keith Monks range of microphone stands, booms and accessories.

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Choose from our range of professional equipment. REVOX, YAMAHA, NAKAMICHI, HARMON KARDON, GALE, DAHLQUIST AND SENNHEISER

For the home market we carry in stock at our London Showrooms a comprehensive range of superb professional equipment.

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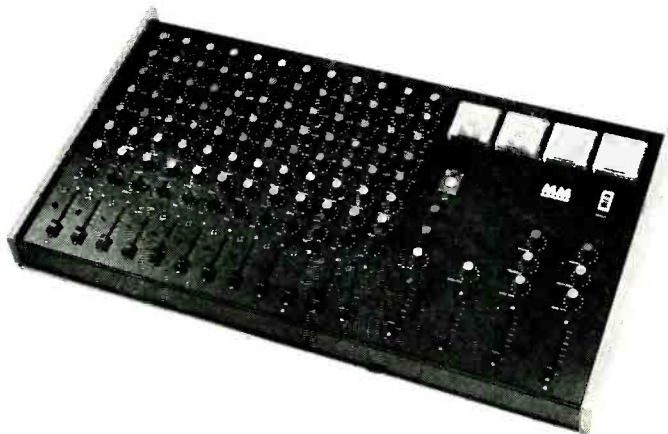
HHF

Hampstead High Fidelity Ltd
63 Hampstead High Street
London NW3 1QH, England
Tel: 01-435 0999/6377

All microphones shown are used by the major TV and radio networks worldwide.



Stereo and 4 Track Mixing Consoles



- 4-band equalisation
- Low noise circuitry—125 dBm ref inent
- Low distortion—0.01% typically
- Line level and mic level inputs
- Line level outputs up to +22 dBm
- Prefade listen and talkback optionally available

Ideal for use with Teac, Revox, etc.

Also available graphic and parametric equalisers, disc preamp units and crossovers

Further details contact

MM ELECTRONICS

Lampas House, Kneesworth St.,
Royston, Herts. 0763 45214

Wanna buy a tank?

Amongst the more conventional items of recording equipment for sale in the latest issue of Malcolm Jackson's illustrated (?) news letter is an underground German command post, comprising: two small studios, a control room and vocal booth, equipped with an EMI TR90, TEAC 2-track, TEAC 3310 4-track, ITA mixer plus other assorted goodies. Walls and roof are said to be 1m thick—almost no sound leakage problems—with full ventilation and electric central heating. Sounds cosy.

Almost mundane by comparison is another little goodie described as an 'ergonomically designed and luxuriously appointed mobile vehicle', containing a 16-track A80, Dolby noise reduction, 2-track B62, 26-input Helios console, Universal Audio 1176LN limiters, Leevers-Rich graphic equalisers, Crown and H & H amps, JBL monitors, plus all that one would need on the road (including a Sony 12.5 cm vtr and camera).

Offers, as always, to MJ, The Studio, Rickmansworth, Herts. Phone: Rickmansworth 72351.

Cut-price Nagra

A 50% price reduction has been achieved in the latest Nagra model

E by offering a single operating speed (19 cm/s) without pilot tone. The deck and transport are virtually identical to the *I* series, apart from head spacing and other minor changes.

The machine is full-track mono, and accepts a single mic input that can be switched to dynamic or a-b powered condenser mics, plus a current or voltage-fed line input that can be converted into a second mic input with an external accessory.

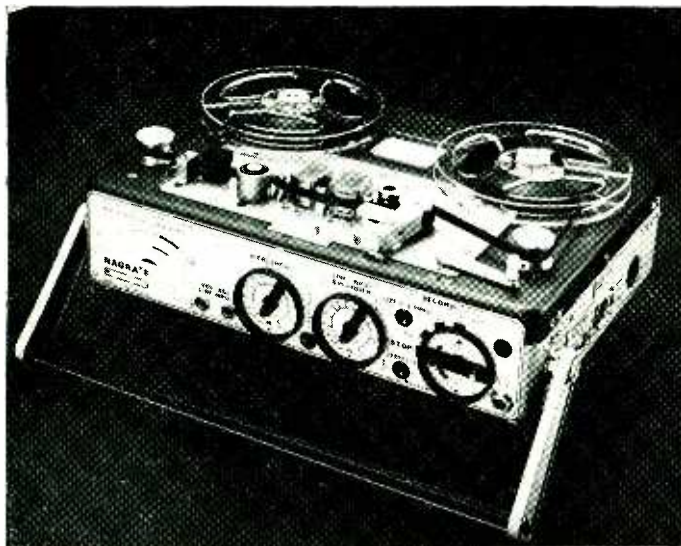
A measuring probe, circuit diagram and some spares are provided to facilitate field operation. Bias adjustment, necessitated by tape changes, can be carried out away from base by using a built-in switchable reference oscillator, which can also be used to provide the normal 1 kHz reference level (-8 dB fixed level).

12.5 mm slimmer than the Nagra *L2*, the model *E* is also 16% lighter at 5.75 kg. Price is SF 4824 (approx £1100, dependent upon exchange rate at time of order).

Kudelski SA, 1033 Cheseaux sur Lausanne, Switzerland. Phone: Lausanne 912121. Telex: 24392.

UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SI 99EW. Phone: Gerrards Cross 88447. Telex: 849469.

For the cost-conscious, the Nagra *E*



Budget Delta-T 92 delay unit from Lexicon

Low-cost delay

Lexicon has announced a new, low-cost digital delay system. Dynamic range is said to be better than 90 dB, noise and distortion less than 0.1% (whatever that means).

The *Delta-T model 92* provides two adjustable delays of up to 120 ms, each controlled by a single front-panel knob. Input and output transformers, automatic fail-safe bypass, silent power-up/power-down circuitry, and rear mounted XLR connectors are featured. A 5-position led headroom indicator, calibrated in 10 dB increments below limiting, simplifies level adjustment and verification.

Lexicon's proprietary floating-point digital encoding techniques are employed, and the unit has plug-in modules for memory and audio subsystems to simplify maintenance. Price is under \$2000.

Extract from manufacturer's specifications:

Dynamic range: 95 dB typical.

THD and noise: less than 0.1% at 1 kHz reference limit level.

Frequency response: 20 Hz to 12 kHz, ± 1 , ± 2 dB measured 14 dB below limit level.

Delay capacity: 120 ms per output, in 7.5 ms steps.

Delay accuracy: $\pm 0.1\%$ of setting plus 0.17 ms long term.

Input: balanced floating transformer coupled, 10 kohm min; adjustable from +8 to +18 dBm for reference limit level.

Output: two, independently adjustable, balanced floating transformer coupled, 100 ohms max; variable from +8 to +18 dBm for reference limit level.

Lexicon Inc, 60 Turner Street, Waltham, Mass 02154, USA. Phone: (617) 891 6790.

UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts. WD6 4RZ.

Phone: 01-953 0091. Telex: 27503.

Macinnes (France) move

Their new address is: 18 Rue Botzaris, 75019 Paris. Phone: 206 6080/8361.

It's not as long as you think

In our Work article on Konk (February 1977 issue), it was stated that the studio had to forgo the pleasure of a custom-built Neve desk, because they'd have had a wait of over a year for delivery. We are pleased to report, however, that Neve tell us their delivery time for a custom-built desk is more realistically about seven months; the exact time, of course, being dependent on the required 'degree of customisation'.

Revox price cuts

Prices of Revox equipment have been reduced substantially by sole UK distributors FWO Bauch. Reductions average about 10% and cover the *A77* and *A700* tape machines, the new *A710* 175-watt amp, and the *A78* and *A722* amps. FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.

Phone: 01-953 0091. Telex: 27503.

ITA/Scamp deal

The retail distribution of Audio and Design's *Scamp* system is now being handled by ITA. Further details from Barry Lambden or Martin Parmeter at: ITA, 1-7 Harewood Avenue, London NW1. Phone: 01-724 3768. Telex: 21879.

Wow and flutter meter

Now available in the UK from Telonic Altair, the National *V/P-7750A* wow and flutter meter utilises fm ratio detection to measure the ratio of the input signal frequency to the frequency increment and the calibration signal, based on centre frequencies of 3 kHz ± 200 Hz or 3.15 kHz ± 200 Hz.

Measurements can be made in the weighted or unweighted mode, or with wow and flutter superimposed. Peak value results based on

New from MicMix .

The Time WarpTM time delay unit and effects generator.



TIME WARP—The only delay line and effects generator offering smooth, continuously variable time delay plus POLYTONE[™], the automatic generation of harmonically related musical notes, and providing full remote control capability on all functions. Its Extended Tone Memory can hold a note smoothly for almost 30 seconds and the Saturable FM feature provides superb ring modulator effects. From guitar to synthesizer, TIME WARP is terrific.

In addition to these special features, all of the more common effects such as phasing, flanging, tunnelling, Doppler shifting, artificial (automatic) double tracking, true vibrato, true chorus, slap-back echo, pitch change and recycling reverberation are also available from TIME WARP. Complete with internal power supply and remote control connector, TIME WARP occupies only 1 3/4 inches of rack space and won't cost you the earth. Don't settle for less . . . in versatility or quality.

MIC MIX Audio Products Inc.,
Dallas, Texas 75220, U.S.A.



U.K. :
Scenic Sounds Equipment,
27-31 Bryanston Street,
London, W1H 7AB.
Tel: 01 935 0141

DENMARK :
Lake Audio,
Artillerivej 40,
DK-2300 Copenhagen S.
Tel: 01 57 06 00.

FRANCE :
3M France,
Cergy,
Paris Cedex 95000.
Tel: (1) 031 61 61.

SWEDEN :
Tal and Ton Musik & Elektronik
Kungsgatan 5,
S411-19 Gothenberg.
Tel: 031-13 02 05

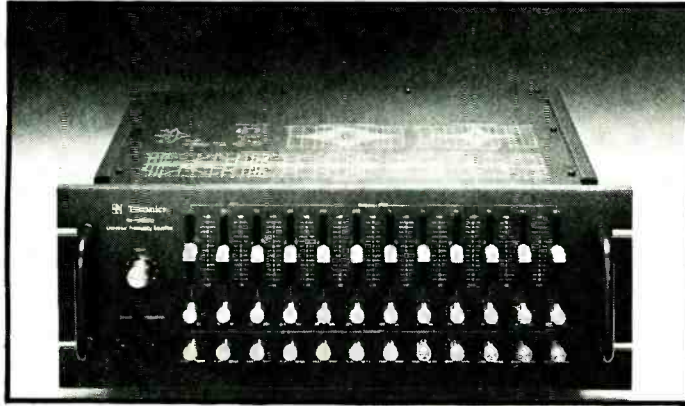
NEWS

CCIR/DIN, average value based on the NAB standard, or an rms value based on the JIS standard are available on pushbutton selection. The instrument also incorporates a frequency counter, range 10 to 9999 Hz, with led display for tape speed measurement.

Matsushita Communication Industrial Company Ltd, Electronic Measurement Department, 3-1 Tsunashima - higashi, 4 - chome, Kohoku, Yokohama 223, Japan. Phone: (045) 531 1231.

UK: Telonic Altair UK, 2 Castle Hill Terrace, Maidenhead, Berks. SL6 4JR.

Phone: Maidenhead 28057.



Technics SH-9090 graphic equaliser

Graphic Equaliser

Now available in the UK from Technics, the SH-9090 single-channel equaliser features 12 dB boost or cut for 12 centre frequencies at octave spacings (except 10 Hz) from 10 Hz to 32 kHz; each centre frequency can be individually adjusted by up to ± 1 octave. Bandwidth (Q) at each centre frequency is individually variable from 0.7 to 7.

The unit fits standard 483 mm racks, weighs 9.2 kg and costs approx £300. The following is extracted from the manufacturer's specification:

Frequency response:

10 Hz to 30 kHz, +0, -0.5 dB;
3 Hz to 80 kHz, +0, -3 dB.

Signal-to-noise (IHF, A-weighted):
90 dB at 1 V input.

Input sensitivity/impedance: 1V at
50 kohm at 1 kHz.

Output level/impedance: 1-7V at
500 ohm at 1 kHz.

Power consumption: 40W.

Matsushita Electric Trading Co Ltd, PO Box 288, Osaka Central, Japan. Phone: Osaka 204 5111.

UK: Technics, 107-109 Whitby Road, Slough, Berks. SL1 3DR. Phone: Slough 27516. Telex: 848761.

International Association of Broadcasting Manufacturers

The association's objective is to foster the interests of manufacturers of broadcasting equipment through broadcasting conventions and exhibitions. A committee formed after last year's IBC in London from representatives of 15 companies, including Ampex (GB), EMI, Neve, Philips and RCA, recently elected Tom McGann of Philips/Pye TVT as chairman, and David Bryan of Michael Cox Electronics as honorary secretary.

Companies active in the field of broadcast equipment manufacture are invited to contact the association, whose address is: International Association of Broadcasting Manufacturers, Tavistock House East, Tavistock Square, London WC1H 9HR. Phone: 01-898 6091.

Finnished Eastlake

Finnlevy Records of Finland recently opened their new recording remix and administrative complex in Helsinki. The studio and remix suite were designed by Tom Hidley of Eastlake Audio and built by Eastlake's UK based studio construction team; most of the constructional materials were prefabricated in the UK and shipped to Helsinki by container.

Both the control room and remix room are equipped with API 32/32 consoles, the remix console being fitted with API's new automation system. Monitoring is by Eastlake TM-3 quadraphonic systems, and the multitrack tape machines in both rooms are Studer 16-track at present, although 24-track machines will be installed shortly.

Finnlevy Studios, Takomontie 1, 00380 Helsinki 38, Finland (phone: 555 303), are under the direction of John-Eric Westo, with senior engineers Ronnie Kranck and Jukka Teittinen.

Eastlake/Helsinki



Pye CARE

The first Cadac automated CARE system to be installed anywhere was recently unveiled with a great deal of back-slapping at Pye's new number two studio in London. The console is equipped with 32 mic/line input channels and 32 monitor/output channels, plus four echo sends with eq, and eight echo returns with eq that also double as extra mic/line inputs if required. Multitrack recording is handled by a Studer A80 24-track machine, with a 4-track and a pair of 2-track A80's being available for quad or stereo mastering.

Studio and control room design bear the unmistakable touch of Eastlake's Tom Hidley. Walls are finished in attractive brown cork, contrasted with panels of volcanic rock imported from Hawaii.

Quadraphonic monitoring via TM-3 units recessed into the control room walls has been lined up to converge just behind the listening area.

Eastlake/London



The following new agents have been appointed by Amek:

Australia: Con Psorakis, Audio Controls, PO Box 152, Norwood, South Australia 5067.

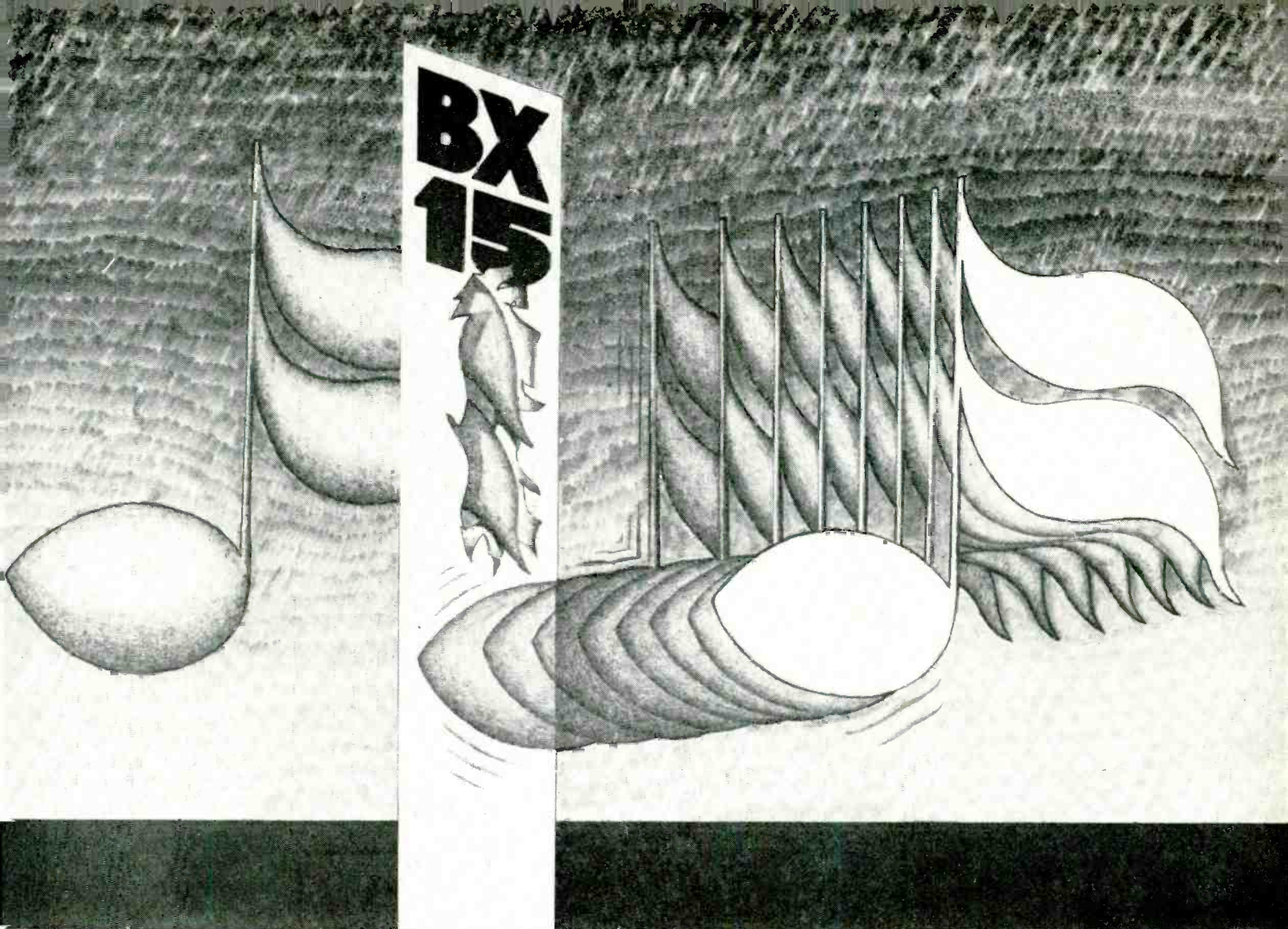
Phone: 08 267 2049.

US: Everything Audio, 7037 Laurel Canyon Boulevard, North Hollywood, Ca 91605.

Phone: (213) 982 6200.

Both companies are sole agents for their respective territories.

24 ▶



Jump into genuine reverberation



**New AKG
reverberation unit BX 15**

From the practical experience gained with the highly successful BX 20 a smaller unit has now been evolved — the handy and robust BX 15. Designed to fill the gap between the less sophisticated and the more costly and some times elaborate studio products. The BX 15 is ideal for small studios, O. B. work and professional musicians.



Brief specification:

Two independent channels with variable high and low frequency equalization. Switchable input level with additional overdriving safety factor by means of a built-in limiter. Inputs and outputs are balanced and the decay time is switchable from 1.5 to 2.0, 2.5, 3.0 and 3.5 seconds. Continuous mixing of 'reverb' and 'dry' signals with separate potentiometers. Dimensions: 17 x 19 x 12 inches (43 x 48 x 30 cm). Weight: approx. 45 lbs (20 kg).

182/4 Campden Hill Road Kensington **AKG Equipment Ltd.** London W8 7AS Telephone 01-229-3695

www.americanradiohistory.com

NEWS

Hung up with headphones?

The Sennheiser infra-red headphone system is now available in the UK from Hayden Laboratories. Although fairly expensive—around £600 for the basic stereo transmitter/radiator/headphone configuration—the system should help to alleviate some of the hassles found with conventional foldback cans.

The transmitter unit *SI 1012S* accepts audio signals in the range 30 mV to 3V into 10 kohm, and frequency modulates an rf carrier of 95 kHz (left channel) or 250 kHz (right channel). The modulated rf feeds up to eight (depending on room size) infra-red power radiators, which consist of a bank of ir diodes plus associated electronics. A receiving diode on the *HDI 134* headphones reconverts the chopped 'light' signals back into audio information. A selector switch on the headphones allows the units to operate in the stereo mode, mono/left or mono/right channel; thus two independent foldback chains (mono only, of course) can be run from one transmitter/radiator system.

It is claimed that while operating in normal background levels of ir, a single transmitter plus four

Sennheiser
infra-
red
headphone
system



power radiators will provide adequate foldback levels in an area of about 200m².

Extract from manufacturer's data:

Transmitter: Frequency response: 50 Hz to 15 kHz, ±2 dB.

THD: less than 1% at 1 kHz and nominal deviation.

Headphones: Frequency response: 20 Hz to 20 kHz, (±?)

Maximum spl: approx 108 dB.
THD: less than 1% at 1 kHz.

Signal-to-noise: approx 60 dB.
Powering: 9V, 4 mA from batteries or re-chargeable accumulators.

Operating time: approx 100h, dependent on level.

Sennheiser Electronic, 3002 Wedemark 2, West Germany.

Phone: 05130 8011.

UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks. SL99EW.

Phone: Gerrards Cross 88447.

Calibration tapes

BASF has introduced two DIN calibration cassettes—one each for ferric oxide and chromium dioxide tape—with a frequency range 31.5 Hz to 18 kHz. In addition their DIN calibration tape 76 (76 cm/s) is now available in 6.25, 12.5, 25 and 50 mm widths to DIN, Ampex and NAB equalisation standards. BASF (UK) Ltd, Haddon House, 2-4 Fitzroy Street, London W1P 5AD.

Phone: 01-637 8971.

Monitor Amplifiers

Two new monitor amplifiers are available in France from PDG. Marketed under the Linear Systems brand, the model *1830* offers 2 x 100W output into 8 ohm, a claimed distortion of 0.1% (no conditions given), signal-to-noise of -85 dB, frequency response from 10 Hz to 25 kHz ±1 dB, input sensitivity of 0.42V at 20 kohm, plus full output protection. The model *1515* is a 4 x 100W version of the *1830*, with identical specifications. Both units are designed for standard 483 mm rack mounting.

PDG and Co, 3 Cour Jasmin, 75016 Paris.

Phone: 527 7031.

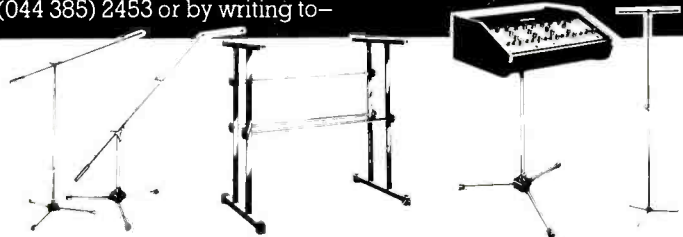


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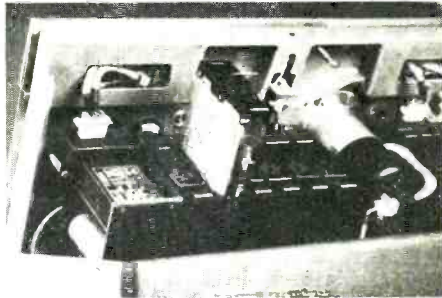
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letters

Thankfully, we have been taken to task over the March editorial. Our comments stated a seemingly widespread belief that current APRS leanings are towards the manufacturers rather than the Professional Recording Studios.

We stand corrected:

Dear Sir, I cannot understand what prompted you to write as you did about the APRS in your March issue, unless you are unaware of the activities of the Association, its aims and objects; it must be that the material and information we send to the office of STUDIO SOUND does not reach your desk.

You ask for which particular group does the APRS provide; from the context you are referring to studio and manufacturing members. The answer is 'both'—our interest extends to educational bodies, consultants and the studios of radio and television stations.

You state that the Association is preoccupied with the interests of manufacturing members. Not so; 60% of our activities for 1977 are directed to benefit studio members.

The Secretary and myself recently spent ten strenuous days at MIDEM, Cannes, distributing a thousand three-language catalogues entirely devoted to extolling the facilities of the APRS British recording studios. And next year we will be taking a much larger stand, with several studios represented 'in person'.

September this year we have arranged the 4th Engineers' Course, and in November we shall organise a weekend course on Management. Both are intended for recording studio personnel.

In the meantime we are dealing with less spectacular, but important, matters: covering, among other things, legislation on noise, the Office of Fair Trading and Terms of Business and the employment of young people in recording studios.

We always welcome constructive comment, though in this instance we cannot agree with what you propose—we do, however, have plans for forming links with organisations similar to the APRS in other countries.

We shall continue to expand by admitting to membership professional firms and groups that have an interest in the recording of sound; and we shall endeavour to serve them in different ways, as is shown by the page advertisement in the February issue of STUDIO SOUND.

Yours faithfully, Jacques Levy, Chairman, c/o 23 Chestnut Avenue, Chorleywood, Hertfordshire.

Dear Sir, I feel that you were less than fair to the APRS in your editorial that appeared in the March issue.

First, you suggested that they more actively served their manufacturing members than their studio members. This is not borne out by the

facts. They sponsored the handbook Sound Recording Practice and they organise the annual Engineers' Course each September at the University of Surrey—both emphatic demonstrations of their active pursuit of the praiseworthy objective of maintaining high standards amongst the rank and file of studio personnel. It is true that their annual exhibition each June may seem primarily to serve the manufacturers. Yet the studio people flock along to this unique show, and have nothing but praise for its smooth organisation and helpfulness to them personally. In any case the manufacturers pay the going rate to exhibit so that the show is not a drain on the APRS funds—only on the seemingly inexhaustible energies of their able Chairman, Secretary and Executive Committee.

Second, you flatteringly implied that the Engineers' Course was solely organised by me. This is not the case. Overall planning is done by the APRS Committee, and a sub-committee passes on instructions to me as the man on the spot. Two of the members remain in residence during the entire seven days of the course so that day-to-day running is a joint effort. The University of Surrey was chosen as the venue because it is a handy distance from London, has adequate residential accommodation, good catering, plenty of lecture theatre facilities and bars, and the best equipped recording studio of any teaching establishment in the UK.

It would be fair to say that the APRS serves all its members well, and a merger or transfer with the AES would not bring any obvious benefits.

Yours faithfully, John Borwick, Department of Music, University of Surrey.

We apologise for two misunderstandings apparent from these letters. Firstly, concerning the AES: we were not suggesting a merger but rather a complementary situation for the co-operative well-being of everyone; which, furthermore, would hopefully put an end to some of the 'polarised' comments so often heard. Secondly; the use of the phrase 'John Borwick's engineer refresher course' was purely intended as a term of identification, and we therefore apologise to the organisers of the course for any 'implied' non-recognition of their efforts.

Dear Sir, With reference to the review by Hugh Ford of the White Model 140 Sound Analyser, while I was pleased with the review overall, I would like to make some comments which I think are relevant.

1. Microphone pre-amp response: *I feel that the measurements made may be erroneous. Our factory manufactures to a tolerance equal to or less than 1 dB attenuation at 20 Hz and 20 kHz. The response is substantially flat in between. This is measured with a 200 ohm source—I checked the response of a production unit with a 600 ohm source and found that the 1 dB point fell at 38 Hz with no change in the high frequency response. I can only conclude that Hugh Ford's equipment was faulty, or something was grossly wrong with the unit submitted for review.*

2. Sensitivity calibration: *When the Model 140 leaves the factory the internal gain adjustment is set so that the unit will be calibrated correctly when used with a microphone of -55 dB sensitivity. The internal trim allows for a variation of ± 3 dB to accommodate other sensitivities. I would point out that the unit can be adjusted to provide calibrated measurements with almost any moving-coil microphone of known pedigree.*

3. Filter curves: *The review stated that: 'the filter curves were not, of course, to the standards used for noise analysis'. The White Model 140's curves meet the ANSI 1.11, Class 2 specifications for $\frac{1}{3}$ -octave filter sets. We would be most interested to hear which standard would be more relevant. More expensive test sets such as the B&K Labs and General Radio meet ANSI Class 3 specifications, but cost three times as much. The Class 2 specs are generally accepted as being a good compromise for field testing and economy.*

Concerning the noise output on the rear of the chassis: the problem of having to ground one side of the transformer on the front panel socket in order to obtain an output from the rear has been corrected. I know that this will not make any difference to the unit which was reviewed as this was an earlier model; however, all production units now have an extra terminal on the rear so that both sides of the noise output transformer are available. We apologise for not having corrected this oversight sooner. As far as the minimum load impedance on the output of the noise generator is concerned, we agree that 5000 ohms is too high a figure. A more realistic minimum is 600 ohms and we will make this change in the manuals sent with future units, and thank Hugh Ford for his observation.

Yours truly, Tom White, White Instruments Inc, PO Box 698, Austin, Texas 78767.

Hugh Ford comments:

Unfortunately it is now rather a long time since I did the measurements for the review and the original papers have been destroyed. However, I hope that the following comments will help to clarify the situation:

1. I do recollect being surprised by the microphone input's frequency response and it was measured more than once with the same results. It would therefore appear that the review sample may have been faulty.

2. It would not have been surprising if the review sample's sensitivity calibration was incorrectly set as this sample of the instrument was far from new.

3. Regarding the filter curves, I must apologise for being misleading as I should have stated

"ON AIR"



From the beginning the Technics SP 10 Mark II was designed as a 'no-compromise' broadcast standard turntable.

It is already installed in many broadcasting stations both here and abroad.

The reasons are many and varied.

In 1969, Technics were the first to introduce the DC electronically controlled direct drive principle to the world with the SP 10.

With the experience gained we've never looked back, and the SP 10 Mark II represents a considerable advance in turntable technology.

Take speed accuracy. Wow and flutter are an insignificant 0.025% WRMS. And speed drift + or - 0.002%. Rumble is also very low at -70 dB.

Through the use of a quartz locked drive system a very high torque is developed by the motor. This results in an instant start facility which takes the record from 'stop' to 33 $\frac{1}{3}$ in 0.25 secs.

And in addition you can change from one speed to another very quickly. 33 $\frac{1}{3}$ to 45 in 0.1 sec.

Another benefit is that a record can be easily cleaned 'on air' with no audible speed variation.

The three speeds (33, 45, 78) are selected by illuminated microswitches and the start/stop function can also be remotely operated. Extremely useful if you are operating a bank of turntables.

The power supply is separate and the mains supply is not directly linked to the turntable, thus avoiding any possible hum problems.

For more information about these and other benefits just write to Technics, 107/109 Whitby Road, Slough, Berkshire SL1 3DR. Tel: Slough 27516.

 **Technics**

The SP 10 Mark II Quartz-controlled Direct Drive Turntable.

LETTERS

that the filters do not meet *International Standards*. It would appear that the filters do meet the American standard specification S1.11-1966 for Class 2 $\frac{1}{3}$ -octave filters but that they do not comply with International Electro-technical Commission (IEC) recommendation 225. The American standard specifies two classes for $\frac{1}{3}$ -octave filters, the class 2 filter being a less stringent design than the class 3 filter. Filters manufactured by Bruel & Kjaer meet the American Class 3 specification and also the IEC recommendations.

I am most grateful to Tom White for pointing out my mistake and I am pleased to note the remaining points made in his letter.

Dear Sir, In the interesting debate regarding purist classical music recording and Blumlein pair techniques, it was refreshing to hear Trygg Tryggvason mentioning the absurdity of using such a purist technique at a concert of pop music or, at say, a Prom concert where the audience make more noise than the musicians.

Nevertheless I thought I might throw in my own pennyworth. I use the Blumlein pair technique frequently when I record rock music in my own studio, though I have never ever seen anyone else do so in other rock recording sessions. A good piano recorded with the lid open and a pair of coincident mics placed about three to six metres away, facing the reflecting surface of the lid, brings it to life in its environment, especially if it is being overdubbed. A group of vocalists in a semicircle around a Blumlein pair also come

to life in a similar way. Even in a fairly sterile studio the ambience proves of value and the resultant colour is not lost when reduced to mono. (Mechanical echo is quite tricky with regard to stereo/mono compatibility.)

In these days of multitrack techniques it is becoming quite common to see an engineer set up two microphones for an electric guitar, or place a very high overhead mic on a drum kit otherwise spattered with close mics. But these mics are often metres apart and any ambience is usually achieved by luck alone, and rarely holds together in mono. I feel sure that if careful experiments were made with Blumlein pairs in modern pop and rock recordings, many engineers would find their acoustic 'vocabulary' growing, and their dependence on growing numbers of close mics decreasing. Many drummers, for example, have to compromise their drum tuning to such an extent, to compensate for extremely close miking, that the flabby skins can only be beaten like boxes; drum rolls on anything other than the snare drum become out of the question for most modestly gifted players.

I could state dozens of further reasons for 'having a go' with Blumlein pairs. I am sure that there is not a musician today who would not be prepared to spend as much time presenting an acoustically correct balance within the studio itself, as they presently have to do when they fiddle around with various echo effects, synthesiser gadgets, gizmos, phasers, etc. all now found necessary in order to make dead sounding instruments live anew. Mixing down multitrack could also be simpler and less time consuming.

Mr Tryggvason's article is pointed at those

classical music engineers who have lost their aural objectivity in an obsession with purism. In rock and pop recording I think an equally valid argument may be made to engineers who have lost all sight of anything ever sounding even remotely natural. It's ironic that what all balance engineers need is a sense of 'balance' between the old and new.

Yours faithfully, Pete Townshend, Rampart Enterprises Ltd, 115 Thessaly Road, Battersea, London SW8.

Dear Sir, I couldn't help noticing Hugh Ford's review of the B&K Psophometer in the February issue of STUDIO SOUND. Mr Ford starts by asking exactly what a 'Psophometer' is. If the unit is pronounced as he suggests—I shudder to repeat it—may I suggest that it is a measuring device for ascertaining clients' credit-worthiness when booking for studio sessions.

The measurement procedure is thus: the prospective client, who intends to book studio time, presents his credentials to the psophometer, and if the reading is low, he is a good payer, and studio time can be booked in his name accordingly. If, on the other hand, the reading is high, he is therefore unlikely to pay the bill at the end of the session, so the instrument indicates that he should be told to . . . go somewhere else for his recording. Hoping this has clarified the matter.

Yours faithfully, Stephen Court, Court Acoustics, 50 Dennington Park Road, West Hampstead, London NW6.

Alice BROADCASTING – THE NEW GENERATION

During the Winter of 1976, John Lumsden (Chief Engineer, Radio Clyde) and Ted Fletcher (Managing Director, Alice) together and separately worked on accumulated experience over years of broadcasting engineering to produce a self-drive console, simple enough for the most non-technical disc jockey but versatile enough to master control election night.

The aim was to design, construct and install the systems by 31st December 1976—Alice was late. The new thinking throughout the system could not be telescoped into such a frenetic time scale and, even with wire men working throughout the Christmas holiday, completion was not until early January.

Tuesday 11th January at 4.00 p.m. was the magic moment when the new console (the first of two) went on the air with no fuss or bother—but a lot of very tired engineers.

The Alice AM 2G system is almost certainly the most advanced broadcasting mixer in the world at the time of writing. Not only does the technical performance set new standards but the facilities offered put both programming and operation into a new dimension where all things are possible.

The basic system incorporates microphone inputs with individual peak limiters pre-assigned from various studio positions. Stereo channels at line level with selectable inputs handle all other signal sources switched in such a way that any source from anywhere in the station or on line circuits to the station can be immediately switched to any stereo channel. This is achieved by a combination

of direct and audio assignment switching with a considerable amount of ingenious 'lock-out' and priority arrangements to prevent howl-round.

Monitoring systems are equally revolutionary in that any combination of P.F.L., pre-hear (any incoming signal) studio output, station output etc. etc. may be applied to headphones or loudspeakers in almost any combination. Thus, an experienced operator could listen to mono studio output in one ear while at the same time feeding completely different combinations to two other headphone systems in stereo. (An extreme case, but possible).

Plasma light column P.P.M.s monitor desk output left and right with a standard P.P.M. indicating mono output. A fourth P.P.M. allows monitoring of P.F.L. and other systems.

Time keeping is accomplished by a digital clock with count up and down facility centrally mounted in the mixer above a substantial script area.

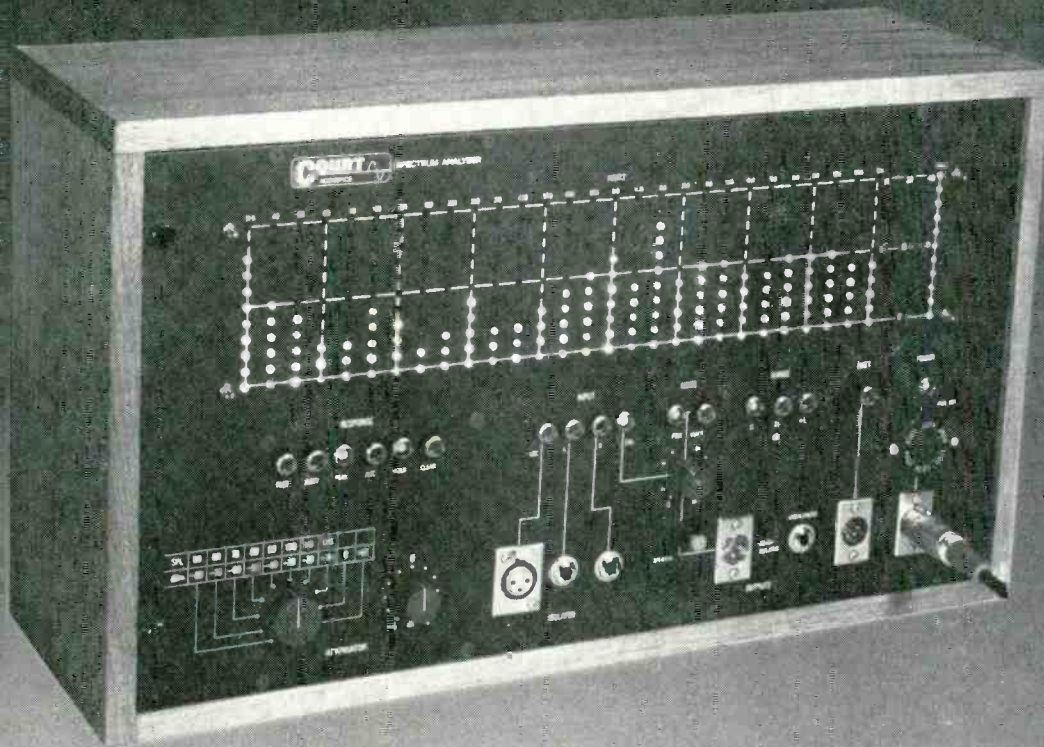
Control and monitoring of all transmission systems is achieved with a system of push buttons and status indicators on the central panel, controlling delay systems, studio to transmitter switching, transmitter status and studio status.

This new generation of broadcasting technology is now a working reality and we at Alice thank Radio Clyde for giving us the opportunity to make it so.

Alice (we've always made quiet mixers)

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- 29 x 11 led matrix giving constant plot of the audio spectrum using two pole active filters on $\frac{1}{3}$ octave ISO standard frequencies from 31.5 hz to 16 khz.
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AKG condenser mic for sound measurements.

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- Calibrate mode for injecting pink noise onto screen.
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AES 57th Convention, a preview

The 57th AES Convention will be held from May 10 to 14 at the Los Angeles Hilton, Los Angeles.

We gratefully acknowledge the assistance given by the AES in the compilation of the preview.

Measurement

Amber will be showing the new model *4400* multi-purpose audio test set. In conjunction with a triggered dc scope, the unit provides log frequency response plots over three decades and 10-60 dB amplitude scales. The set features an autoranging dBm meter and digital frequency counter, range 1 to 100k Hz. The *4550* audio spectrum analyser will also be displayed.

Ivie Electronics are to demonstrate a new version of the *IE-10A* spectrum analyser that now features selectable response time. The hand-held unit is calibrated in dB-spl and dBm.

Sound Technology will be showing their *1710A* distortion measuring system, which comprises an oscillator and analyser tuned simultaneously across a 10 to 110k Hz frequency band. Balance controls are eliminated by full automatic nulling. A balanced input measures floating or balanced sources and is said to reduce noise pick up and earth loops.

A wide selection of measurement and test

gear will be demonstrated by **Tektronix**. Products to be seen include the *FG 504* 40 MHz sine, triangle and square wave generator, and the *7L5* spectrum analyser, which has a range of 10 to 5 MHz.

The new model *150* octave band analyser will be shown by **White Instruments**. The hand-held unit features a ten-band led display, input sensitivity from 34 to 110 dB spl, with either 1 or 2 dB resolution across a 28 dB range.

Microphones

A range of new windshield and shock mounts for their shotgun condenser mics will be shown on the **AKG** stand. The new *C-41AEB* condenser mic, which features switchable omni, cardioid, figure-eight and hypercardioid patterns, three attenuations and three low-frequency roll offs, will also be displayed.

A range of **Sennheiser** cans and mics will be displayed, including the *HD224X* 200-ohm studio headset, which has a claimed 16 to 20k Hz frequency response, and the *MKE 10* electret lavalier microphone. Their infra-red headphone system (see page 24) can also be seen.

Once again, **Shure** will demonstrate their analyser system for fast room or studio eq. The system comprises an octave-band analyser, pink noise generator, measuring mic, and a ten band equaliser.

Mixers

The *Kepex*, *Gain Brain* and *Memory Plus* automated mixdown system are to be exhibited by **Allison Research**. The *Memory Plus* will be operational and available for use by interested visitors.

Audio Concepts/Dave Kelsey Sound are showing their new range of *Concept 1* consoles. Modular 16/8 and 24/16 versions are available. Subgroup selection is on

pushbutton and independent mixdown/stereo monitor buses with pan and soloing on all inputs are featured.

Audiotechniques will be showing for the first time a brand-new desk from **Allen and Heath/Brenell**. The *MOD 3* is available with up to 28 input/output modules plus vu monitoring on all functions. The new **Brenell Mini-8**, an 8-track machine using 25 mm tape can also be seen for the first time in the USA.

On show for the first time, **Auditronics** series *600* modular consoles feature two mic and one line input per channel, and are available in 16/16 formats expandable to 32/32. Designed specifically for pa and sound reinforcement use, separate foldback, paging and reinforcement feeds are available, together with multitrack recording outputs.

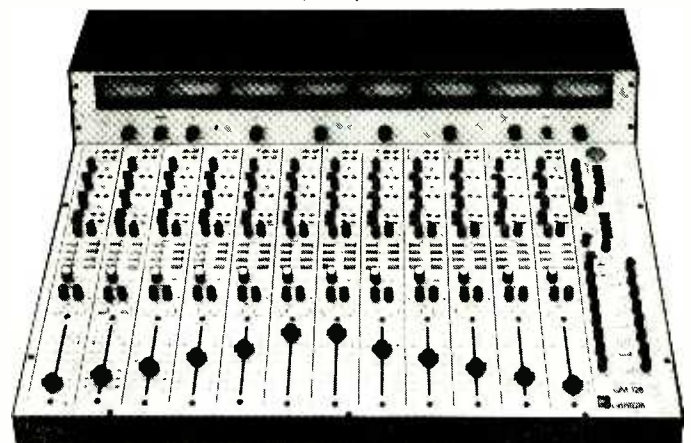
The *Minus Noise* model *8* desk being demonstrated by **ARP** features eight channels with mic or line inputs on each, inputs for reverb or other devices, built-in spring reverb, lo and hi eq, and +10 dBm output. Also on display will be their *Omni* keyboard synthesiser.

A demonstration of the **Harrison** model *2824* console has been arranged on the **Westlake** stand.

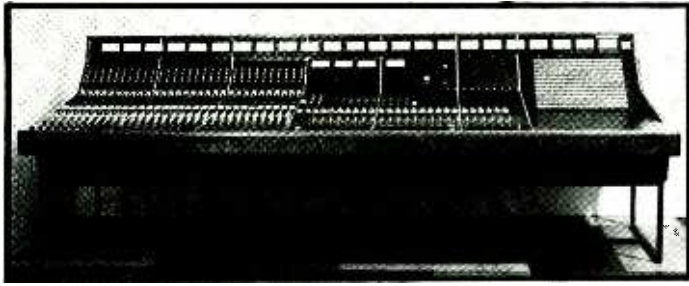
Interface Electronics will be introducing the *Series 316* 16-track mixers, which are similar to their *104/108* series apart from an added mute button and improved faders. Two newer modules from the *104* range will also be shown. Intended primarily for pa or use on stage, the *104 NS* provides pushbutton mixdown with independent output for cans, and fader-controlled output. The *104S* input module provides two stereo line plus one mono mic input, hi and lo eq for left and right, and a cue switch on the bottom of the fader. It is intended primarily for broadcast applications.



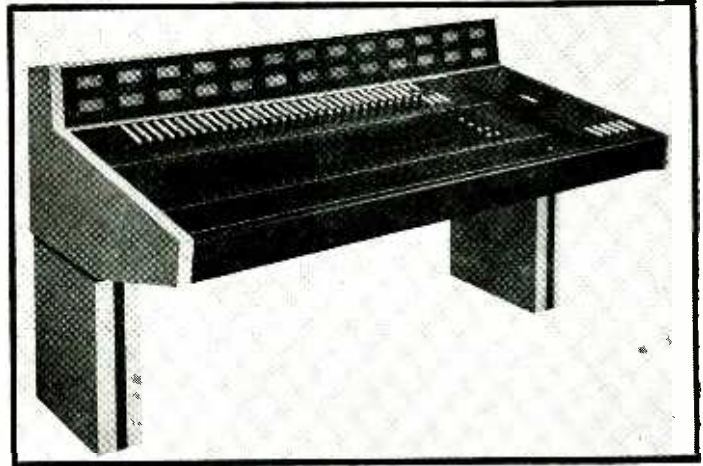
Left: Sound Technology model 1710 A distortion measurement system.



Below: QM-128 console from Quantum Audio Labs.



Above: Trident Series 'A' 32/24 console



Spectra Sonics model 1026-26 console that features 26 mic, line and tape inputs, plus a variety of outputs



Left: new model 1280 from Sound Workshop

The **Helios** series 1160 will be demonstrated by **Everything Audio**. 24 to 36-channel consoles are available with three or four-section eq plus hi and lo pass filters on every channel. Slide faders and switched insertion are featured on up to 16 submaster buses. Echo send and return modules include eq delay switching with regeneration and stereo pan returns. Standard fittings include digital clock, remotes and phase correlation meter.

Neve will once again be showing their slide and vtr presentation describing the **NECAM** automated system. Now included are details of the recent installation at **Air Studios**, London.

The 12/8 **QM-128** and 16/8 **QM-168** will be demonstrated by **Quantum Audio Labs**. Both mixers feature six eq frequencies on three controls, four separately controlled echo and cue buses, plus solo and mute on all channels.

Sound Workshop will be showing the new model 1280 12/8 desk which features comprehensive monitor and cue facilities, including an independent stereo mixdown bus. Three-band eq, pan, echo send, mute and solo are included on each channel. A 12-input expander unit for the 1280 will also be displayed.

A model 1026-26 console will be exhibited by **Spectra-Sonics**. 26 mic, line and tape inputs are provided, with 26 direct outputs, plus one mono, four control room monitor, two studio monitor, three cue, four echo send outputs also being provided. All inputs and outputs are transformer isolated.

The company will also be showing the new model 1100 mixer, which accepts six line/mic inputs into a mono output; and an improved version of the 610 **Complimixer** that now features a non-glare vu meter for easier monitoring.

Sphere will be demonstrating two new consoles **Eclipse** type A for 16, 24 and 32-track and the type B for 2, 4, 8

and 16-track operation. Comprehensive monitoring, eq and cue facilities are included.

A medium-cost 16/8 console to be shown by **Tangent** is designed for use with 4 and 8-track tape machines. Three-band parametric eq, solo, mute and overdub facilities, and mic/line mixing on each channel are available. Monitoring is by led peak indicators.

Trident will be showing a 32-input/24-output 'A' Series console, which offers 16-frequency graphic eq on each channel, four headphone circuits, six pushbutton echo groups, dual-scaled vu/ppm metering, and independent eq on echo and foldback. Interfacing for automated fader systems is featured as a standard option. The consoles can also be supplied pre-wired for future expansion.

The parametric equaliser/filter model **CB9066** will also be exhibited. The unit features hi- and lo-pass continuously variable filters with slope control up to 22 dB/octave. A three-band eq section offers up to 15 dB peak/dip with variable bandwidth and sweep frequency selection.

Uni-Sync are showing their **Trouper** series of modular pa mixers. Features include six (expandable to 16) mic inputs, monitor and main output, s/n of 70 dB, three-band eq with 10 dB cut and boost, and thd under 0.1% at outputs between -20 and +8 dB.

Power amplifiers and monitors

The model 100 being shown by **BGW** can be used as a monitor amp or as a horn or tweeter driver in bi- and tri-amplified systems. Clipping indicators and simple mono/stereo switching are featured. Also available is a professional broadcast version with XLR and octal-type connectors for plug-in matching transformers.

Electro-Voice will be showing several new monitor speaker systems, including the **Sentry V**, a two-way vented enclosure with a

sectional horn tweeter; the **Sentry III, Series II**, a three-way improved version of the existing **Series III**; and the **Sentry VI**.

A demonstration of their model **EA-412** monitor system with built-in 400W amplifier can be heard on the **Equasound** stand.

JBL will be demonstrating a range of monitors and amps, Models 4343, 4333A and 4331A speakers can be switched for passive or bi-amplified operation. The model 6233 dual-channel amp, rated at 300W per channel into 4 ohms with thd less than 0.05%, will also be on show.

The new **MCM1900** pa loudspeaker system from **Klipsch** comprises a horn-loaded bass unit with two 38 cm drivers capable of handling 1500W peak programme power (100 dB spl at 50m), a 4.8 cm straight-axis horn for midrange, and a 5-element tweeter array.

The **A68** stereo power amp, which delivers 100W per channel into 8 ohm and features a frequency response 30 to 15k Hz, +0, -0.5 dB, and thd of less than 0.1% on any level up to rated output, will be shown by **Studer (America)**. The unit was reviewed in **STUDIO SOUND**, March '77, p 68.

The new range of **Linear Phase** loudspeakers will be shown by **Technics**. A 3-way unit, **SB-7000A**, is rated at 150W peak and delivers 90.5 dB spl at 1m from 1W. Model **SB-6000A** is a 2-way system rated at 100W peak, with 91 dB spl output. The new **RS-1500**, 9.5, 19 and 38 cm/s open-reel machine will also be shown.

United Recording have arranged a demonstration of the **Time Align** monitoring system. A range of signal processing and test gear will also be displayed, including the new 539 room equaliser and 537 graphic equaliser.

The **SPEC-15L** monitor speaker being demonstrated by **US Pioneer Electronics** features a carbon-fibre bass driver and an exponential horn with acoustic lens.

The **TM-1** monitor being shown by **Westlake** features 120° horizontal/45° vertical dispersion, and produces an spl of 126 dB at 1.3m. Frequency response is claimed to be 31 to 16k Hz, ±2.5 dB in free air, measured on ½-octave centres. 32 ▶

AES 57th CONVENTION, A PREVIEW

Sound processors

Audio and Design will be exhibiting for the first time the new *E950 Paraphrastic Equaliser*, which is available as a stereo six-band per channel or a mono 12-band unit. Each band features variable centre frequencies over a four-octave range and continuously variable bandwidth ('Q'). Their range of 483 mm rack-mounting limiters, vocal stresser and sweep equaliser, plus the *Scamp* system, which includes compressor/limiter, octave sweep and parametric eq, expander/gate, dynamic noise filter and quad led ppm modules, will also be shown.

The company is now also marketing **Midnight Audio** products. The latter's equipment to be seen include the *Type 464* alignment oscillator, *MA 100* two-channel power amp rated at 100W per channel into 8 ohm, a frequency response of 20-20k Hz, and distortion less than 0.01% for any level up to 100W. Also to be shown is the *MA 2000* quick-start broadcast turntable, for which start-up times of less than 0.5s for 33 $\frac{1}{3}$ and 0.6s for 45 rpm are claimed. The unit is a direct replacement for Sparta turntables.

Amongst the items to be shown by **Audio Developments** are the model *1500* automatic graphic equaliser and model *1000* real-time spectrum analyser complete with calibrated microphone noise source and two memories.

Two low-cost digital time delay systems, featuring the *DeFreitas* a/d converter with 80 dB dynamic range, will be shown by **Audio/Pulse**. Model *1A* can synthesise a quadrasonic ambience from stereo material, while model *3* provides discrete delay.

Crown will have on show the new *EQ-2* stereo equaliser, which has 11 bands with 15 dB cut or boost per band. $\frac{1}{2}$ -octave, constant bandwidth filters set at octave centres but adjustable $\pm\frac{1}{2}$ -octave are provided.

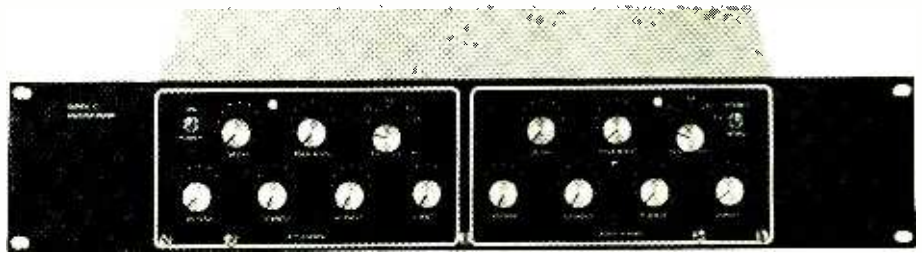
Dolby are showing the *CP 50* optical sound processor for decoding Dolbied film sound tracks.

The *Model H 910 Harmonizer* will once again be shown by **Eventide**. The unit combines a digital delay line, anti-feedback device and two-octave pitch changer in a single unit. The *Model 2830 Omnipressor*, a combined compressor/expander/noise gate/limiter unit, and *Model 1745M* digital delay unit will also be on show.

Gotham will be showing the *EMT-250* reverb unit that can produce a variety of effects. (For a review of the unit, see *STUDIO SOUND*, April, p 52).

Broadcasters should be interested in a new multiband limiter/compressor being shown by **Inovonics**. Eight frequency bands have individual adjustments for threshold and compression ratio. A limiter fitted to the model *230* has in excess of 50:1

Trident parametric eq filter



Super C reverb from MicMix

ratio, with 25 dB threshold range.

Lexicon will be demonstrating the *Delta T 102-S* stereo delay unit, model *92* low-cost digital delay unit with two outputs and model *27*, a pitch shifter with a range of ± 1 octave.

Marshall will once again be demonstrating the *Time Modulator*. This compact voltage controlled, analogue delay unit can be used to provide resonant flanging and tunnelling, automatic double and triple tracking, Doppler pan and shift, vibrato, time shift flanging or phasing, plus a variety of other effects. The sky seems to be the limit.

Three effects units can be seen on the **MicMix** stand. The *Time Warp* features up to 100 ms delay with depth, rate, mix and recycle controls combining with variable delay to give a variety of effects. The *Super C* stereo reverb units feature controls for reverb/direct gain, comprehensive eq and variable decay. The *Master Audio Meter* displays peak or rms levels on vertical led columns.

The *Compander* and *Digital Delay* will be shown by **MXR**. The second unit provides flanging, vocal-doubling, pitch alterations, echos and reverb and other effects. Delay is variable between 0.08 and 320 ms, expandable to 1280 ms with optional plug-in boards. Other units on display include a stereo graphic equaliser with up to 12 dB cut or boost at ten octave centres from 31 to 16k Hz.

The equipment being shown by **Orange County Electronics** include the *Stressor*, a combined equaliser/limiter/compressor/expander unit. Parametric equalisers, stereo and mono monitor amps will also be displayed.

Urban/Parasound will be demonstrating five of their signal processing units: the *111B* dual spring reverb; *418A* stereo limiter/compressor; *516EC* dynamic sibilance controller; *245E* stereo synthesiser; plus a new version of their *622B* parametric equaliser that now features in/out switches on each band and balanced input.

Quad/Eight will be showing for the first time a new computer-programmed reverb simulator. The *CPR-16* is a digital system capable of producing various reverb effects including mechanical plates, spinning systems, tape loops and acoustic chambers. Specifications include a dynamic range greater than 80 dB, noise

less than -80 dBm and under 0.1% thd.

Straita Head will be showing the *781* adjustable program expander gate for special effects and noise reduction purposes; a series of led meters with a range of 48 dB; a tunable eq unit with 16 dB cut or boost on the overlapping bands; and an octave band equaliser that features ± 16 dB on up to 10 bands from 30 to 20k Hz.

Tape duplication

Accurate Sound will be showing the *AS-2400* tape duplication system, which features 152.4 and 305 cm/s speeds and automatic recue of the master after a run. Plug-in head assemblies complete with playback amp eq and level controls, or bias and level controls are featured.

A demonstration of the model *1200* 32:1 tape duplicating system has been arranged by **Audio/Tek**. Up to 12 slaves can be fed from one master reproducer.

The *Gauss* 64:1 duplication system comprising a 9.5 cm/s reel-to-reel master spinning at 610 cm/s and cassette slaves at 305 cm/s will be demonstrated by **Cetec**. Owners of current systems can update to 64:1 with a conversion kit.

The *Alpha 21* 16:1 cassette copier being shown by **International Audio** comprises in one unit a master and slave, with provision for the addition of extra slaves.

The *LT-160B* high-speed duplicator will once again be shown by **Liberty/US**. Between 640 and 840 eight-track carts or 320 to 420 cassettes can be produced per slave in eight hours. Also on show will be the *CW25* cart winder and *CW15S* cassette tape winder.

A quality-control unit for standard or quadrasonic eight-track carts will be displayed by **David Lint**.

On show for the first time, a new 16:1 reel-to-reel/cassette tape duplicating system from **Pentagon**, model *1100*, can accommodate up to 11 slaves.

2-channel or 4-channel stereo modes are available running at 152.4 or 305 cm/s for reel-to-reel and 76 cm/s for cassette tape.

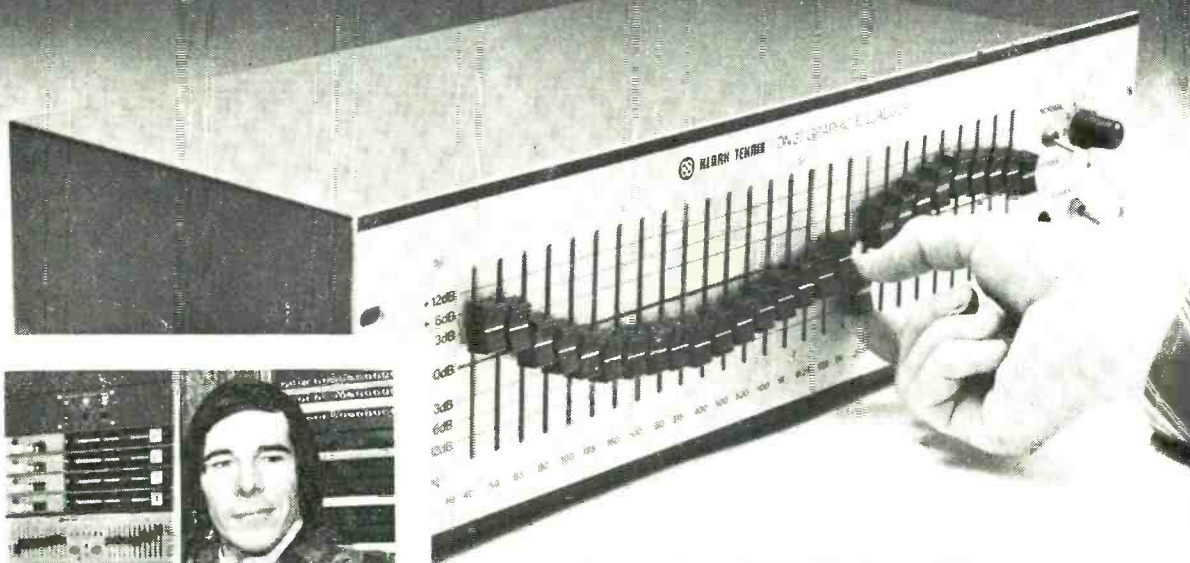
A splicing tape designed specifically for use with a wide range of automatic duplicating equipment will be demonstrated by **Pratt/Spector**.

On display on the **Recortec** stand will be examples of their cassette duplicating units. A 32:1 master machine uses 2 MHz bias is said to add less than 3 dB of noise. Speeds up to 610 cm/s are available. Slaves combining cassette loading and duplication run at speeds up to 305 cm/s.

An automatic cassette loader will be displayed by **Superscope**. The unit runs

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610 cm/s with 267 mm reel or pancakes, and will accommodate most sizes of cassette.

Tape machines and tape

PEM 468 tape displayed on the Agfa stand is rated at 0.2% thd, max output +0.5 dB at 10 kHz, +0.5 dB at 14 kHz, signal-to-noise 54 dB for 38 cm/sec and 320 nWb/m operation.

Ampex will have on display their new portable *ATR-700*, which features three-motor drive, a choice of full-, 2- or 4-track formats, capstan-servo dc motor and electronic motion sensing. Wow and flutter is said to be less than 0.08% weighted-rms. The machine has switchable eq and line and mic inputs.

Tape products being shown by Capitol Magnetic Products include the *Q-19* high-output/low-noise mastering tape, *Q-15* low-noise/low-print tape, and *Audiopak A-2* tape cartridges.

3M will be showing their new *250* mastering tape; signal-to-noise ratio is said to be 4 dB better than with *206*. Background noise of -71.5 dB below reference level (NAB weighting scale C) is also claimed.

MCI will be bringing visitors' attention to their new *JH-100A* series of 6.25 and 12.5 mm recorders. They are available in a variety of configurations, and are claimed to be especially suited for editing purposes. The automated *JH-500* consoles will also be shown.

Mitsubishi will be showing a new stereo digital recorder that features a stationary head and uses 6.25 mm tape running at 38 cm/sec. Bandwidth is said to be dc to 20 kHz, signal-to-noise ratio 85 dB (weighting curve A) and thd 0.01% at full scale. 13-bit binary coding is utilised, at 48 kHz sampling frequency.

Nagra will be showing the new model *E*, low-cost, full-track mono recorder (see News item, p 20).

The new *Mark II* machines being shown by Otari features dc capstan servo with $\pm 7\%$ pitch control. Wow and flutter is claimed to be under 0.06% at 19 cm/s, and 0.05% at 38 cm/s.

Scully will be exhibiting their improved line of *280B* and *284SB* machines that now incorporate constant tension control. The new *Varisync* digital readout speed control accessory with external sync function will also be demonstrated. Also to be seen are their



Scully 284B-8 recorder with new Varisync readout

new model *250* series of basic mono/stereo machines, plus broadcast logging recorders with digital time code reader/generators.

An automatic tape location system will be shown by Stephens Electronics that allows up to ten cue locations to be displayed and stored. Control functions entered via a keyboard unit consist of: program storage, which loads into the memory the destination and stop, play or search mode, plus the number of the next program to be processed; foot store, which enters any desired location into the current footage; program select, which will display and process any desired footage; 'dumb', which loads the tape's current location into the destination memory and returns the tape to this cue; and start, which initiates auto location control. The ability to store details of mode and next program allows the system to cycle automatically to the next program when each assignment is completed.

New all-metal heads for Scully and Ampex machines, test tapes, and the

Taber bulk eraser can be seen on the Taber stand. Details of their overhaul service for the Ampex model *350* will also be available.

The series *25-2* half-track, two-channel machines from Teac feature a direct-drive dc servo capstan motor, which with eddy current induction spool motors is said to keep wow and flutter below 0.04% rms at 38 cm/sec. Separate dbx encode and decode is fitted to each channel, enabling recording to be decoded for monitoring during takes. The *25-2* also includes a built-in 4/2 mixer.

Miscellaneous

An a/v presentation by Altec will spotlight the company's history, philosophy and present market status. Details of new products from their wide range of equipment will also be included in the presentation.

Battered pa gear may be a thing of the past with decent cases. Anvil Cases are showing a selection of custom-built units.

Audio Industries will be displaying a range of their products, including mic and tape panels, quick-connect umbilical cabling systems, and a remote 24-position stereo cue mixer. MCI's *JH-24* multitrack machine, *JH-428* console and *JH-500* automated console can also be seen on their stand.

Bobadilla Cases will be showing a wide range of rack-mountable units, plus every type of case a band on the road could require.

The model *440* gating system to be seen on the B & K stand is for calibrating and checking a wide range of equipment without the use of an anechoic chamber and outdoor free field.

Switchcraft pushbutton switches—both single, multiple and 'colour versatile'—will be shown by California Switch and Signal.

New intercom units will be demonstrated by Clear-Com. The *RS-100A* remote intercom station features call/cue signalling, mic on-off-call switch and adjustable side tone.

Two new *Slideline* faders with audio or linear taper and dual or single channel operation can be seen on the Duncan Electronics stand. Conductable plastic elements are used with built-in dust and moisture seals.

A digitally-controlled switching system to be demonstrated by Dynair packs a 400 crosspoint matrix plus power supply into just over 22 cm of standard 483 mm rack space. Crosstalk is said to be 70 dB below output level.

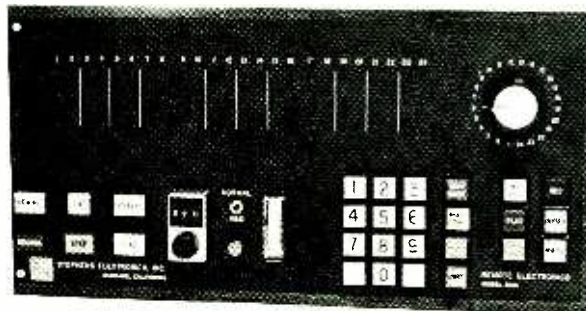
Editing tape, paper and plastic leader, and header cleaner from the Editmaster range will be shown by Coast Recording Equipment Supply.

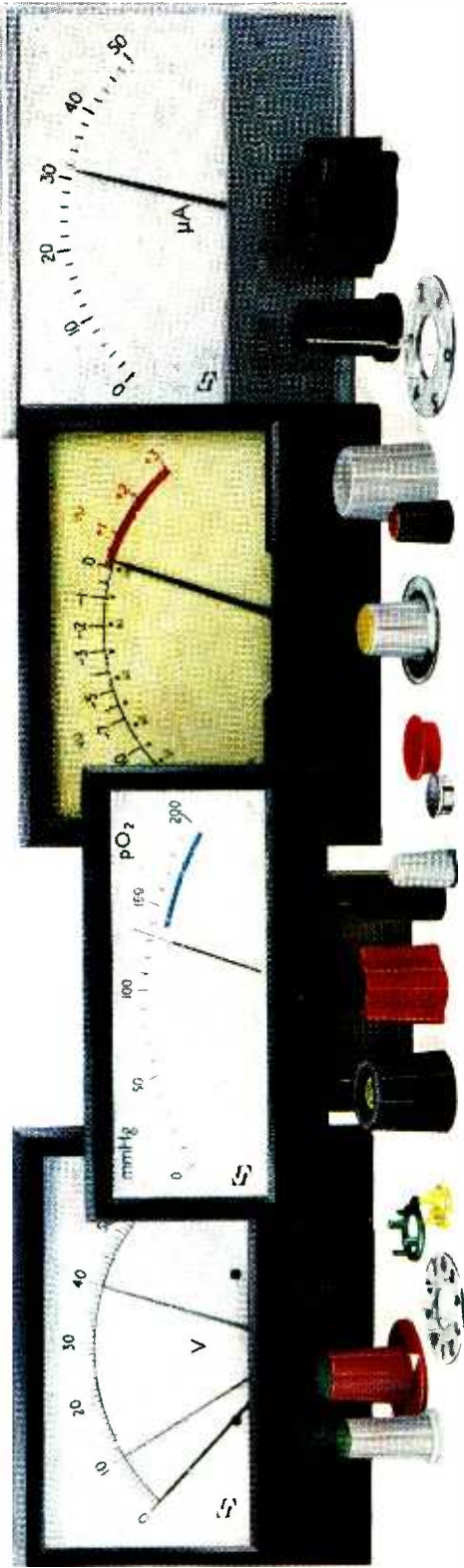
On show for the first time, the Electro Sound *Cartomatic* is an automatic device for loading 8-track cartridges.

Emilar will be showing a wide range of hf exponential horns, compression drivers, and crossovers.

Ferrofluidics will be demonstrating how their products can be used to increase power handling, prevent coil-magnet rubbing, and flatten the frequency response of loudspeakers.

Stephens Electronics automatic tape location system





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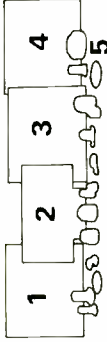
Please send for our short-form meter catalogue and the full-colour catalogue which gives complete specifications and sizes for all our knobs and accessories.



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Sifam meters and collet knobs also feature on the control panel of this portable laboratory for analysing water quality. It is made by Simac Ltd., Walton on Thames.



- 1 The Sifam Meter Relay enables any measurable parameter to be used also for alarm or control purposes.
- 2 One of the Sifam 'Monitor' range, presenting an attractively proportioned, slim appearance.
- 3 Distinctive Sifam styling and matt-black finish are combined in classical proportions in the 'Director' range.
- 4 The transparent moulded front on 'Clarity' range meters presents an appearance which appeals to many equipment designers.
- 5 A representative collection of Sifam collet knobs showing a few of the numerous combinations of accessories and colours.



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Examples of equipment distributed in the USA by **Hammond Industries** include the new *A710* power amp from Revox, a range of Beyer mics and headsets, and a selection of Meteor mixers.

The **Los Angeles Center for Electronic Music** will be providing details of their recording facilities, plus information on their synthesiser workshop. In-house equipment includes systems by Serge, Star, Polyfusion, Strider and EMS.

A tunable notch filter to control feedback in pa installations will be shown by **Rauland-Borg**. The model *7205* has five filters that can be individually set over a 100 Hz to 2.5 kHz range. Three, six or 12 dB of cut is available.

A slide show has been organised by **Sierra Audio** showing the studios they have constructed in Australia, Japan and the USA.

A new mastering console from **Sphere Electronics** featuring low-profile cabinets to prevent acoustic problems will also be shown. A physical anthropologist helped in the console design.

Sescom will be showing a wide range of their products, including a new series of mic-splitter snake systems. Transformers with isolated electrostatic shields to reduce earth-loop problems and double isolation of shield/braidshield are now featured.

A new communication system said to be compatible with most existing ground to air systems will be shown by **Soundwest**.

Light-weight headphones and a stylus wear range will be shown by **Stanton**. The cans, model *XXI-1*, feature a new design of cushions for improved isolation and bass reproduction. Frequency response 20 to 22k Hz ± 5 dB is claimed with 110 dB spl at 0.2V input. They weigh 156g.

Back-up material for the Syn-Adu-Con seminars will be available from the

Synergetic Audio Concepts stand. The book *Sound System Engineering*, recently updated by its authors, Don and Carolyn Davis, will also be shown.

A range of tape tension gauges for hand-held operation while the tape is rolling will be shown by **Tentel**.

The *Slave Driver*, a unit that allows a synthesiser to follow a guitar's pitch and other effects, is being shown and demonstrated by **360 Systems**.

A demonstration of the *Panner* stereo/quad positioning system for accurate image mixdown in the studio, or no-hands panning, positioning and special effects at live gigs has been arranged by **Video/Audio Artistry**.

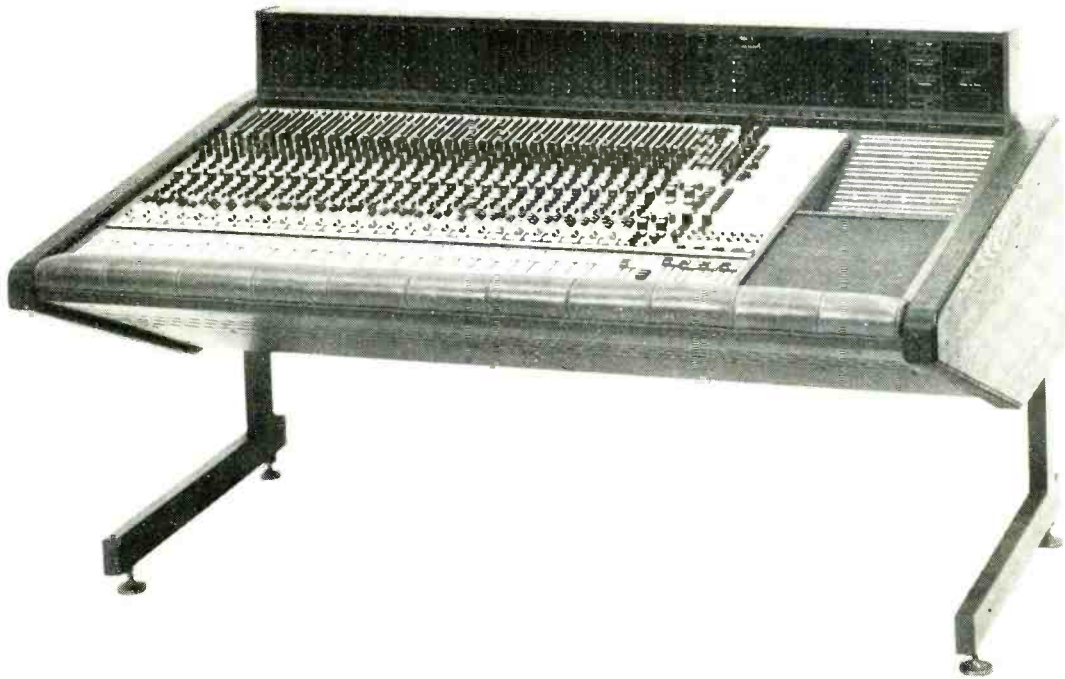
The Music Instruments Division of **Yamaha** will be showing an electronic crossover unit for bi- or tri-amplified monitor speaker systems. The *F-1030* allows crossover frequencies to be chosen between 250 Hz and 8 kHz, with 12 or 18 dB/octave slope.

LIST OF EXHIBITORS

B=Booth, D=Demo Room

Accurate Sound	B 101	Emilar	B 15	Quantum Audio	B 110 & 111
Acoustic Design	B55A		D 481	Rauland-Borg	D 480
Acoust'log	B72	Eventide	B 31	Recortec	B 102 & 103
Agfa-Gevaert	B 33	Everything Audio	B 6 & 7	SAE	B 66
AKG	B 81 & 82	Ferrofluidics	B 116	Sansui	D 574
Allison Research	B 56 & 57	Furman Sound	B 101A	Scully	B 2 & 3
Altec	Mission Room	Gal'ien Krueger	B 61	Sennheiser	D 429
Amber	B 26	Gotham Audio	B 20, 21, 22 & 23	Sescom	B 63 & 63A
Ampex	B 14A-14	Hollywood Sound Systems	B 98 & 99	Shape, Symmetry & Sun	D 465
	Madrid Suite	Holzer Audio Engineering	B 109	Shure	B 36 & 37
	(D 416)	Infonics	Pecos Suite	Sierra Audio	Stage
Anvil Cases	D 475 & 477		(D 415)	Sontec	B 19
ARP Instruments	Majorca Room	Inovonics	B 54	Sound Arts	D 463
Audico	B 119	Interface Electronics	B 95	Soundcraft	D 60
Audio Concepts	B 49, 49A & 50	International Audio	B 64	Soundstream	D 428
Audio & Design Recording	B 123	IVIE	B 88	Sound Technology	B 35
Audio Developments	B 114	Ray Jacobs Audio	B 127	Sound West	D 473
Audio Industries	B 86 & 87	JBL	St Louis & Foy	Sound Workshop	B 18
Audio Pulse	D 432		Rooms	Spectra Sonics	B 55
Audiotechniques	D 519	Jonas Miller Sound	Lapaz Suite	Sphere Electronics	Stage
Audio/Tek	D 469	JVC Cutting Centre	Washington Room	Spider/Peavey	Malaga Suite
Audiotronics	B 38 & 39	Klipsch and Associates	Dalhart Suite	SSK Enterprises	D 420
Automated Processes	B 104 & 105	LaSalle Audio Products	B 128	Stanton	B 32
BGW	B 16 & 17	Lexicon	B 46	Stephens Electronics	B 79 & 80
B & K	B 73 & 74	Lear Sigler Corp	B 115	Straita Head Sound	B 4 & 5
Bobadilla Cases	B 117 & 118	Liberty/UA Tape Duplicating	B 97	Studer (America)	B 77 & 78
Bozak	Cleveland Room	David Lint Associates	B 65	Studio Maintenance Service	B 120 & 121
California Switch & Signal	B 96	Los Angeles Center for		Superscope (Tape	
Capitol Magnetic	B 93	Electronic Music	B 100B	Duplicating)	D 461
CBS Records	El Soreno Suite	Lux Audio of America	B 112	Synergetic Audio Concepts	B 58
Cerwin-Vega	Patio Room	Marshall	B 94	Taber	B 14
Cetec	B 47, 48	MCI	B 83, 84 & 85	Tangent Systems	D 479
	Detroit Room	Micmix	B 107	Teac	Boston Room
	B 68A	3M	B 11, 12 & 13	Technics	B 59
Clear-Com		Mitsubishi Electric	D 530		D 474
Coast Recording Equipment		MXR Innovations	B 100A	Tektronix	B 113
Supply	B 90	Nagra	B 68	Tentel	B 89
Community Light & Sound	B 69, 70 & 71	Neve	Assembly Room	Uni-Sync	B 124, 125 & 126
Crown International	B 75 & 76		East	UREI	B 24 & 25
c'bx	D 482	Orange County	B 81A		Dallas Room
Diacoustic Laboratory	B 92	Orban/Parasound	B 62	US Pioneer Electronics	Hartford Room
Dolby Laboratories	B 51 & 52	Otari	B 8, 9 & 10	VIDAAC	B 100
Duncan Electronics	B 108	Pentagon	B 29 & 30	Westlake Audio	B 34, 35, 40, 41 & 42
Dynair Electronics	B 122	Pol/dax Speaker Corp	D 424	White Instruments	B 1
Electronic Technology	B 106	Pratt-Spector	B 67	Yamaha	Buffalo Room
Electro Sound	D 462	Quad/Eight	B 27 & 28		
Electro-Voice	New York Room				

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Design considerations for a pa speaker system

KEN DIBBLE *

The article discusses the design philosophy of a loudspeaker system for wideband, high-power applications at rock music concerts. It indicates that there are several pitfalls to be avoided in the 'big is beautiful' approach.

* ELECTRO-ACOUSTICS CONSULTANT

IT IS an accepted pre-condition of both musicians and concert-goers alike that modern electric music needs to be loud. A continual striving for ever increasing power levels from amplification systems has been going on since the early 1960's. Unfortunately, more power seems to go hand in hand with more distortion—even today there seems to be little understanding of the basic principles of reproducing sound in large auditoria at all, let alone at the power levels demanded by rock bands of today. It is a fact, for example, that a properly engineered system can deliver kilowatts of power in an auditorium that only yesterday caused a 50W pa system to go into feedback.

It must be realised that the concert hall platform is the market place for a band's product: its music. Apart from having paid a substantial sum of money for a seat at the concert, a good proportion of the audience are quite likely to rush out to the record store next day and buy the band's latest album to play at home. The quality and volume levels of domestic listening have increased dramatically in recent years. No longer are the secrets of properly reproduced sound confined to the living rooms of a privileged few enthusiasts. This has resulted in a far more critical listening public, and if this new-found awareness is not satisfied in the concert hall, disappointment will almost certainly result; future concerts will not sell out, and record sales will fall. Furthermore, with studio techniques at their current sophisticated level, the record-buying public have become accustomed to hearing some very complex music and imaginative production. It is of paramount importance, therefore, that the amplification system used at concerts is of high quality and power level, and offers many of the sophisticated facilities of the studio in order that production standards can be maintained under live conditions.

The equipment line-up for such an amplification system—mics, mixers and high-power amps—is not dissimilar to that found in most recording studios. However, there are four main differences. Firstly, in a studio, monitor loudspeakers do not normally come into direct audio contact with the microphones, so the old, old problem of feedback is virtually non-existent. Secondly, far more acoustic power is required to fill a large auditorium than a control room. Thirdly, control room monitors are generally feeding only a small 'listening' area—usually directly on-axis anyway—so that radiation characteristics require very different considerations. Lastly, but by no means least, the pa system must be transportable, and built to withstand a somewhat arduous life on the road. It must survive the many abuses it will receive from teams of 'roadies' and in the back of numerous trucks as it is humped up flights of stairs and moved from gig to gig. Three of the four special requirements

concern the loudspeaker system itself; it is these that will be discussed in detail here.

In the first instance, the loudspeaker system must have a wide frequency response. For reasons of stability, however, it is desirable to restrict the actual response to frequencies that will contribute in real terms to the reproduction of music, and no more. This restriction usually means that filtering is employed to gently roll off the system response at around 40 Hz and 16 kHz, since this will provide more than adequate bandwidth for reproducing music. Of equal concern is the smoothness of response right across the required range. A peak in response due to some odd resonance or peculiarity in the system will not only cause certain feedback at that frequency or its harmonics, but will also drive the power amplifier into clipping, thereby introducing distortion and more feedback problems. The need for a smooth response, free from any peaks or distortion, is much greater in pa, because the system can break into a feedback condition long before the operator has detected an audible discrepancy in the system's response.

While this response requirement may not present any problems at normal sound levels, it is not quite so simple at the levels normally required from a pa system. The simple solution of increasing the amplifier power will only help to a limited extent before ridiculous and impracticable amplifier powers are necessary. It then becomes essential to increase the conversion efficiency of the loudspeaker system itself, so that far more sound output is achieved for every watt of electrical energy fed in. Most studio monitors seem to have an efficiency of about 0.2%, while the horn-loaded, low-frequency reproducers used for cinema systems back in the 1930's were anything up to 20% efficient. Furthermore, horn-loaded compression drivers that were used to handle the mid- and upper-frequencies were over 40% efficient. By using modern high-power drive units in properly designed horn-loaded systems, it does not take a great deal of ingenuity to produce a low-frequency reproducer that has an efficiency in excess of 10%, and is capable of handling input powers of up to 300W; and mid- and high-frequency horns of 30% efficiency handling over 100W. It will be readily appreciated that with powers of this magnitude, at these efficiencies, extremely high sound pressure levels can be produced.

Most companies making pa systems use the most efficient form of housing for the low-frequency reproducer. This usually takes the form of a short straight wooden horn in front of a 30 or 38 cm cone loudspeaker mounted in an infinite baffle or ported enclosure. It is often found that this type of enclosure does not produce sufficient power at the very bottom end of the required range because of the rather high cut-off point of the horn loading. Even the larger versions of such enclosures only load the loudspeaker unit down to about 60 or 70 Hz, although a usable response at reduced efficiency is usually available down to about 50 Hz. It is sometimes worth sacrificing some of the efficiency by using the drive unit as a direct radiator over the upper part of the low frequency range, and to concentrate on loading the rear of the cone to extend the response downwards and increase the efficiency at very low frequencies by means of a horn-loaded reflex port. This will generally produce a more full-bodied bass sound, free of any resonant booming. A response down to 30 Hz can be reasonably expected of a good 38 cm drive unit loaded in this way, at the expense of a little efficiency.

One of the most important aspects of high-power amplification is the radiation characteristics of the loudspeaker system. While it is not particularly difficult to produce either the power output or the frequency response, it is not so simple to ensure that the sound produced is spread evenly over the entire seating area of a large auditorium. The theatre may possibly seat several thousand people on various levels, some probably within a few metres of the

loudspeaker stacks, and some 50 or 100m distant. There are several basic laws of physics that dictate the behaviour of sound waves radiating from a source—from observing some of the loudspeaker systems currently in use one cannot help but wonder whether these have been considered at all, or whether they are considered to be out of date. In my opinion they are by no means out of date and the likely performance of any loudspeaker stack can usually be assessed fairly accurately by an informed observer. Let us consider some of these basics and relate them to this discourse.

A point source is a sound source whose size is small compared to the wavelength of the sound being produced. If that source is a moving-coil loudspeaker, then the effective piston diameter becomes the source. A point source generates a spherical wavefront

with the source at its centre; the total energy from that source will be spread evenly over the surface area of that sphere at any distance from the source. As either the source dimensions are increased, or the wavelength diminished, propagation will become more directional, until a situation is reached where wavelength is small when compared to the source. A plane wave is then generated, and propagation takes place in an ever decreasing angle in the forward plane. At high frequencies, say when the wavelength represents about one-fifth of the effective piston diameter, all the output energy from the loudspeaker is contained in a sharp, narrow beam emanating from the centre of the loudspeaker.

To relate such discussions to a low-frequency reproducer, it will be seen that wavelengths are so long that any form of directional control by the source dimensions is rendered impracticable. As a result such loudspeakers are best allowed to radiate their spherical wavefront. Great care must be taken, however, to ensure that this is so for all frequencies handled by the loudspeaker, and to cross it over to a mid-range reproducer while the wavelength is still relatively large. (To do a few sums: the effective piston diameter of a 38 cm speaker is about 34 cm. This represents the wavelength at 1 kHz. Therefore, such a loudspeaker should be crossed over no higher than 500 Hz.) Ideally, a single point source should be used. However, since it is not possible yet to achieve the desired sound levels from a single unit, the number used should be kept to an absolute minimum; they should certainly not exceed four closely-grouped sources feeding the same section of the auditorium.

It might be of interest to examine the reasons for this single source philosophy. The most obvious is that of distortion due to phase differences brought about by differences in path length between the various sources and the listener. Even though this is less noticeable at low frequencies, there being only a fraction of a wavelength difference as compared to a difference of several wavelengths at higher frequencies, the effect will none the less be minimised if the sources are placed as close together as practicable. This point will not be dwelt on further here, as it has to some extent already been covered in an article in this magazine. 'Speaker technology for sound reinforcement' by Dave Martin (STUDIO SOUND, March '76, p50.) It is probably worth adding, however, that the path length difference from sources in the same loudspeaker cluster are really extremely small if path lengths from sources

40 ►

FIG.1 PROPOSED SYSTEM

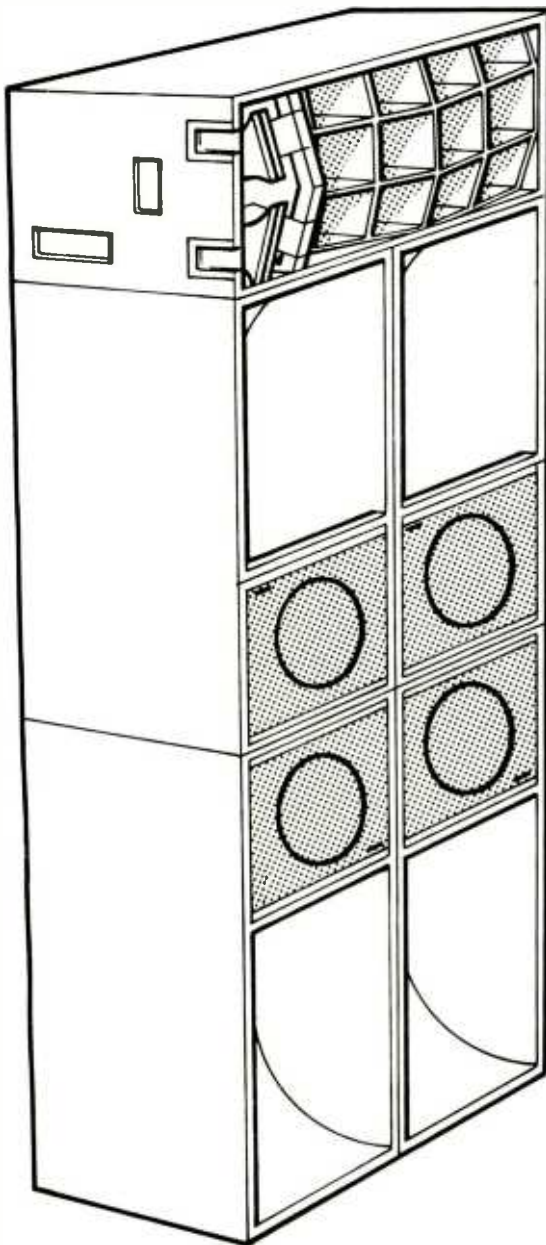
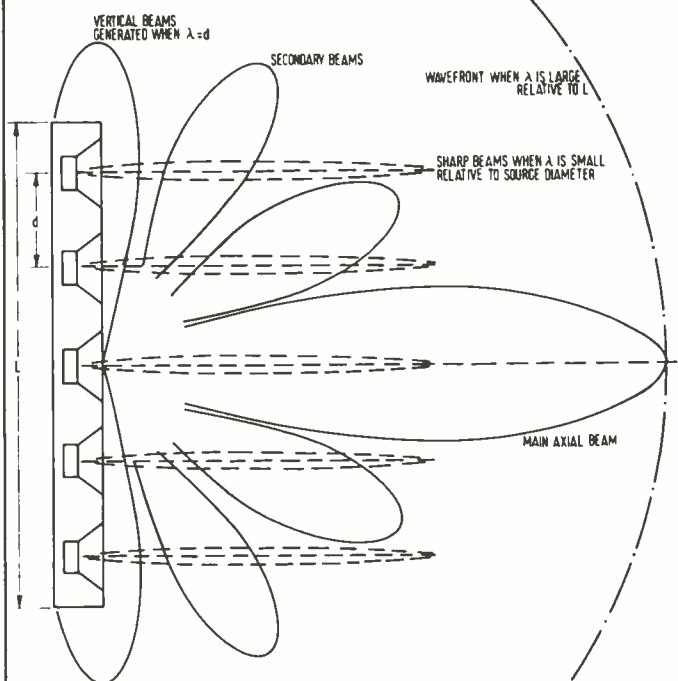
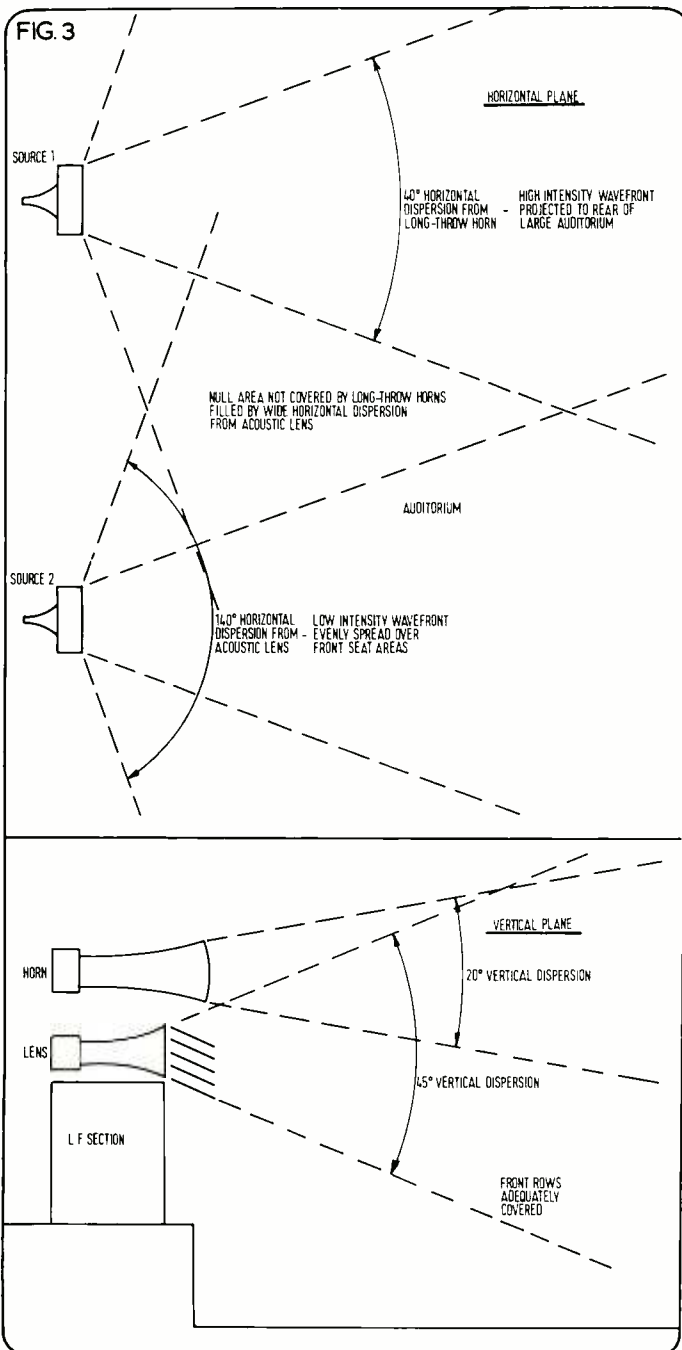


FIG.2 PROPAGATION FROM VERTICAL LOUSPEAKER ARRAY



DESIGN CONSIDERATIONS FOR A PA SPEAKER SYSTEM

on the other side of the auditorium are taken into account. Another justification for the argument, and one frequently overlooked in loudspeaker design, is that clusters of similar sources interact with each other, and the resultant radiation from a group of loudspeakers is rarely similar to that of a single unit on its own. As an example, consider a vertical column of loudspeakers used to reproduce the entire audio spectrum, as was the case in the early days of electric music, and remains so today in a large number of public address installations. Here, we have a condition when at all frequencies where wavelength is large compared to the length of the column, it will behave as a point source. As wavelength shortens, a broad flat wavefront develops at 90° to the plane of the column, the width of the beam becoming smaller with decreasing wavelength, while at the same time, a series of side lobes develop in the vertical



plane above and below the main beam. As wavelength decreases further, a point is reached where it is equal to the spacing distance between units, and at this frequency sharp beams are projected vertically upwards and downwards from the column. As wavelength diminishes still further, the main axial beam becomes increasingly narrow and eventually the system degenerates into a series of concentrated beams of high frequency sound emanating from the centre of the component loudspeaker units. This situation is shown in fig. 2, and is fully and mathematically explained in an excellent article on linesource loudspeakers by Paul Taylor in the March 1964 issue of the journal of the British Kinematograph Society as it was then known.

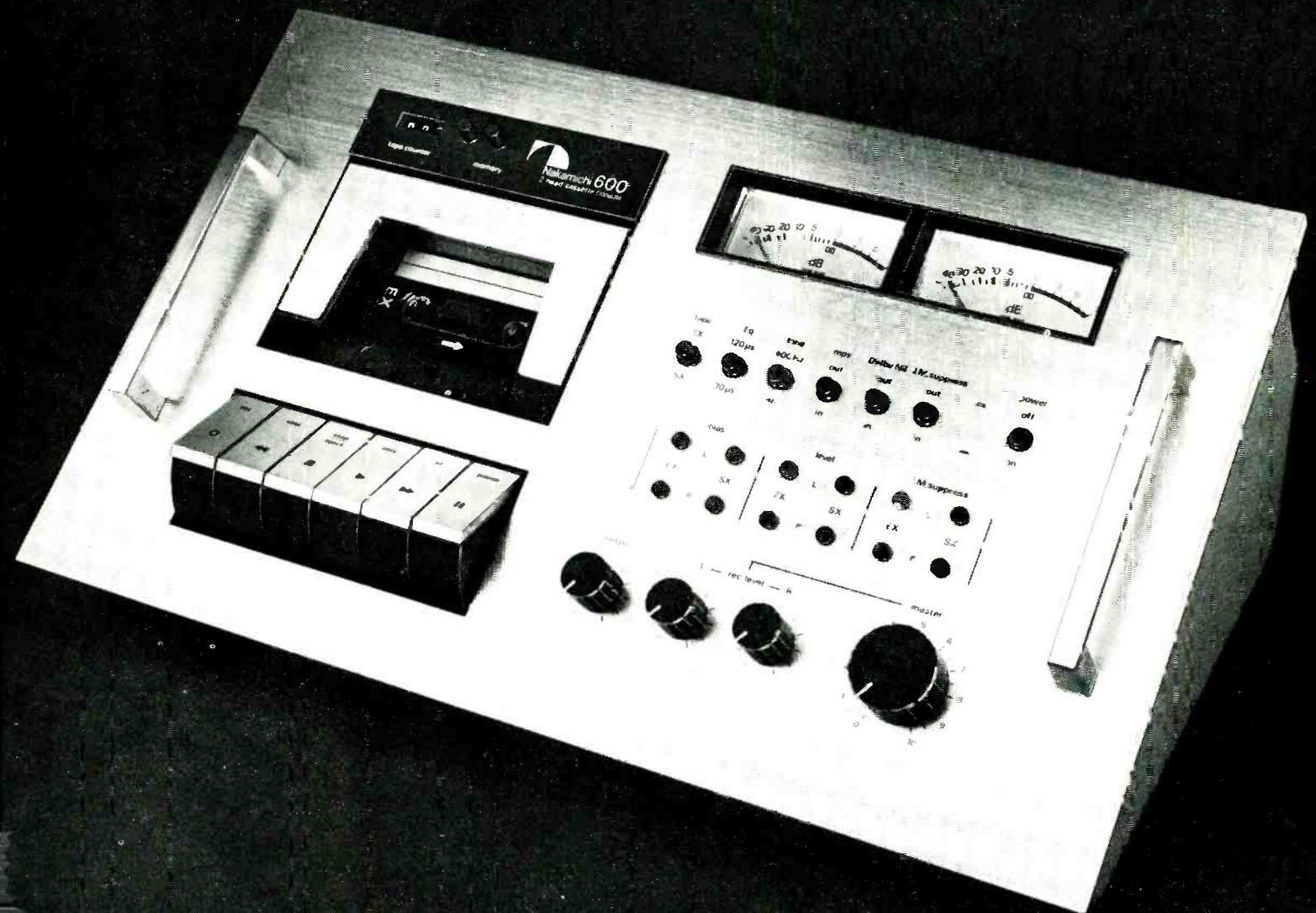
Proven technology that was good in 1964 holds good today, and when sources of sound are used in either a vertical or horizontal array, it will be seen that great attention must be paid to the dimensions of that array and to the spacing distance between sources relative to the range of frequencies to be reproduced, if serious radiation problems are to be avoided.

The loudspeaker system shown in fig. 1 suggests one possible arrangement that complies in all respects with the theoretical requirements of point source propagation, and indeed, with all the other arguments so far put forward. This end result can be similarly achieved with the use of front horn loaded enclosures, except, as already stated, the real power right at the bottom end will be somewhat lacking by comparison. However, it is not recommended that the two types be mixed, or that any two types of horn loaded enclosure be mixed in the same loudspeaker array to reproduce the same part of the frequency spectrum. Some of the reasons for this were covered in a previously mentioned article by Dave Martin, although to be fair it should be pointed out that the loudspeaker system mentioned is not a combination of units that JBL recommend. Nor is it a combination that I have ever encountered in use on the road.

Regarding the mid-range section of the system, the same basic criteria must apply. With between 800 and 1000W of low-frequency energy being pumped into the four low-frequency units, it would prove difficult to match this with a single source for the midrange. Certainly, no single cone loudspeaker can possibly handle that amount of power. Furthermore, since middle frequency wavelengths are almost bound to coincide with piston diameter and unit spacing criteria, it is probably just as well to disregard cone type units for this application. The only real alternative is to employ a mid-range horn coupled to one of the many highly efficient, high-power compression drive units now available—but there are problems. The most popular horns are the flat radial types, and the majority of these have a low-end cut-off point in the region of 400 to 500 Hz. One of the big disadvantages with any horn system is its harsh honking 'voice' over the first octave of its usable band. It is better to ignore the lower response region, and cross over into the horn an octave up, say around 800 Hz, to avoid this unpleasantness. However, from the discussion on low-frequency reproducers, it will be seen that it is not practicable to run the low-frequency section up to that point without running into radiation problems. Also, such horns usually have a horizontal radiation angle of between 90° and 120° and a vertical angle of only 30° ; this is by no means sufficient to provide even coverage of a large auditorium. It is necessary to employ two such horns, one with a narrow dispersion angle to project the midrange to the back rows, and another to radiate over a wide angle to cover the front seats. The wide-angle, or short-throw horn as it is often termed, sometimes takes the form of an acoustic lens assembly, which consists of a series of carefully shaped horizontal plates in front of a small horn. The purpose of these plates is to shape the beam of sound to provide wider horizontal and vertical dispersion than would normally be obtainable from a radial horn. Angles as great as $140^\circ \times 45^\circ$, are not uncommon, and radiation is more uniform over a wider band of frequencies. Its wide dispersion and correspondingly low wavefront energy make this unit ideal for short range purposes, and as such it works very well indeed. However, with a long-throw horn in conjunction with an acoustic lens, or with long- and short-throw horns working together, the required vertical dispersion is still lacking. The likely radiation pattern of such an arrangement is shown in fig. 3.

Fortunately, another solution exists. Again, it was in wide use by those cinematograph engineers many years ago to solve exactly the same problems in large cinemas. In those days of

Suddenly, other 2-head cassette decks look like toys.



Take a look at the new Nakamichi DT600 above. Such an astonishing cassette recorder, that it makes the competition look like no competition at all.

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Only Nakamichi could have made the DT600.

For the first time, 3-head performance in a 2-head machine.

DESIGN CONSIDERATIONS FOR A PA SPEAKER SYSTEM

craftsmanship, all types of loudspeaker were hand-made, and so one type was little more expensive than another. Today, however, the only type of horn that cannot be readily manufactured on a mass production basis, and for this reason has been largely neglected due to the high production costs, is the old multicell horn. A true multicell consists of a cluster of separate square section exponential horns coupled to a single pressure unit by an acoustically equalised throat. A 12 or 15-cell assembly would have a dispersion angle of something like 150° horizontal and 60° vertical, and would retain this over a very wide band of frequencies. Further, such horns are extremely efficient, offer very high acoustic loading to the pressure unit, and usually have much lower cut-off points than their flat radial counterparts, often more than an octave lower. Such a horn is physically rather large, but where performance is the overriding consideration over cost and convenience, this is the ideal solution to midrange reproduction in a large auditorium. The requirement of a single source is met, it can be crossed over at the required 500 Hz point and still have an octave in hand before cut-off point is reached, and by fitting a double-entry throat, two very high power drivers can be fitted. This, in conjunction with the very high efficiency of a multicell, will provide the required level of acoustic output. Such a horn then combines the functions of both long and short throw radial horns and an acoustic lens in a single unit. It should be mentioned that there are many horns on the market described as 'cellular' or 'sectorial'. Although some of these may at first glance have the outward appearance of a multicell, they are little more than a radial fitted with baffles to prevent the horn from ringing at certain frequencies—they will not perform in the manner described here.

As wavelengths shorten towards the high-frequency end of the spectrum, it becomes increasingly difficult to maintain adequate dispersion, since the radiation angle of any horn large enough to properly radiate the midrange down to 500 Hz will start to reduce after three or four octaves. It becomes necessary to cross over a second time into a high-frequency section. In this instance, the actual crossover point is less critical than with the low/mid crossover point, because there is only one midrange source, and therefore no problems with unit interaction. Instead, a convenient point can be chosen between the third and fourth octaves of the midrange horn, depending upon the requirements of available high-frequency units. At a first survey of the market, one might conclude that a proliferation of possible high-frequency units exists. However, the choice becomes somewhat restricted if single-source requirement is considered, along with radiation characteristics and the very high power handling capability necessary to match the acoustic output of the low and mid frequency sections. The current practice seems to be to use two smaller radial horns and to crossover a third time into multiple sets of dynamic or piezo-electric high-frequency radiators. This approach does not really make a great deal of sense, since without doubt the main problem areas in any speaker system lie in the crossover regions, and it is only

common sense to use the minimum number of crossover points necessary to do the job. Furthermore, we are getting still further from the single source. In fact, there was not a really suitable unit on the market until a leading British manufacturer recently introduced a new high-frequency horn. Its dispersion is 150° in the horizontal plane and 30° vertical over a band from 4 kHz to 16 kHz. Unfortunately, the 30° vertical dispersion is not sufficient for our purpose, but if two of these are mounted vertically in line and inclined at about 20°, a vertical angle of between 50° and 60° will be obtained. In other words, it will provide a similar radiation pattern to the midrange multicell. Although this involves two sources, only a very small part of the audience will be within range of both horns, and those will be on the central axis of both, where displacement will be almost non-existent anyway. If a crossover frequency of 5 to 6 kHz were selected, the multicell would be rolled off before its dispersion narrowed appreciably, and the high-frequency horn would have a little in hand at the lower end of its range to allow for the 12 or 18 dB/octave slope of the crossover, already allowed on the midrange horn by virtue of the 'honk margin'.

To summarise then, the system uses four closely-grouped 38 cm direct radiating loudspeakers in horn reflex enclosures acting as a single point source over the frequency band up to 500 Hz. This section is about 10% efficient and can be reasonably expected to handle powers of between 800 and 1000W. The system then crosses over to a single 12 or 15-cell multicell horn having a usable range between 200 Hz and about 10 kHz. This is about 30% to 40% efficient, and with careful selection of pressure units is capable of handling input powers of between 200 and 300W. At about 5 kHz, it crosses over again to an inclined vertical array of two high-frequency horns to take the system response up to a very respectable 16 kHz, again handling 200 to 300W at an efficiency of about 30%. At all frequencies between 500 Hz and the top limit of the system response, dispersion will be in the region of 150° horizontal and between 50° and 60° vertical, and omnidirectional below 500 Hz.

Such a loudspeaker system would probably be driven by power amplifiers capable of producing 50% more output power than the loudspeakers themselves are able to handle, so that the full output from the loudspeaker system can be used without the amplifiers going into clipping. A 2 x 300W amplifier would power each pair of low-frequency reproducers, and a third 2 x 300W unit would power both mid- and high-frequency sections. Crossover would certainly be active and operate at 18 dB/octave, feeding the low-frequency amplifiers direct, and the mid- and high-frequency amplifiers via limiters and/or compressors to offer some protection to the compression driver units. Almost certainly, the input to the crossover unit would come from the mixer via octave-spaced graphic equaliser to provide some compensation for the acoustics of the auditorium itself. It will be apparent that I have discussed only a single loudspeaker array. At least two such systems will be used, possibly more for a particularly large auditorium or outdoor festival system. For outdoor use, the front horn loaded low-frequency reproducers would certainly be better suited, because of the difficulties propagating low frequency in the open air. ■

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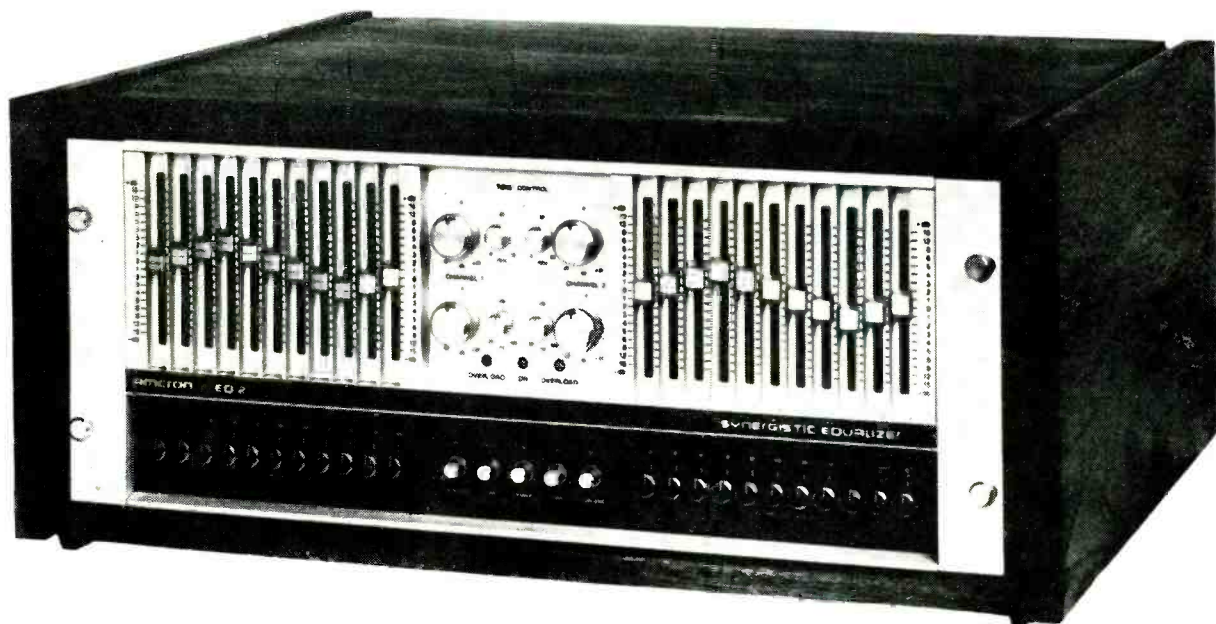
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AES 56th Convention, a report

MEL LAMBERT AND RAY CARTER

The 56th Convention of the Audio Engineering Society was held from March 1 to 4 at the Hotel Meridien in Paris.

FOR the first time the European venue for this year's series of AES conventions was Paris; and it will almost certainly be a simultaneous first and last for this location. Not only did Paris prove to be very expensive—exorbitantly so in some cases—but hassles with customs and fire officials may have proved too much for the majority of exhibitors, who would be wise to make their feelings known to the AES, if they haven't done so already.

Though the AES has had a lot of experience mounting large conventions in far-flung locations, they should at least have been aware of the tedious bureaucracy in which the French can indulge. Closer liaison with customs could have prevented many of the problems encountered by manufacturers trying to get their equipment into the country. In several cases carnets were ignored, equipment was late in arriving, or extra duty was charged at the airport or border. For one company that had driven down through Belgium without incident, their crossing into France took on pantomime proportions. Not only were they practically cleaned out paying extra duty on entry—returnable they were told—but customs officials also chased them some 20 km into France to check on the duty payable on some spare bulbs and fuses they were carrying. This involved asking a not-so-local electrical retailer how much each item was worth, the officials doing their sums accordingly.

The Hotel Meridien proved an attractive social meeting place, but the exhibition space could have been better laid out. Initially two, and later three separate areas were arranged; finding one's way from one area to another was not always a simple matter. The confusion was compounded on Monday, the day before the convention's official opening to delegates, when French fire officials decided that the demonstration rooms on the third to eighth floors would have to be closed and the exhibitors moved elsewhere. It was claimed that the rooms' electrical outlets and wiring capacity were not suitable for the equipment the exhibitors intended to plug in.

Preoccupation with fire precautions began the previous Friday when quite a few exhibition stands had to be altered before officials were finally satisfied. Concern continued for the entire duration of the convention, with hawk-eyed hotel staff wandering around with fire extinguishers at the ready. (Perhaps recent memories of the Moscow hotel fire had more to do with their high key vigilance than strict electrical considerations.)

Access to the exhibition area was gained by passing the AES registration desks, where on Monday several companies' representatives were still having to ask where their stands were, a situation that was unforeseen but quickly remedied.

The first stand to catch one's eye in area A on the lower ground floor was that occupied by **Harrison Systems**. Despite having to physically uncrate it in front of their stand on Tuesday afternoon—another delayed arrival—they were eventually able to show a 28/24 console from their 2821 series. The desk was fitted with 12-segment electronic bar vu metering, with provision for remote threshold peak detection. In a little over a year the company

has sold over 30 consoles, 14 of which are equipped with Allison automated programmers.

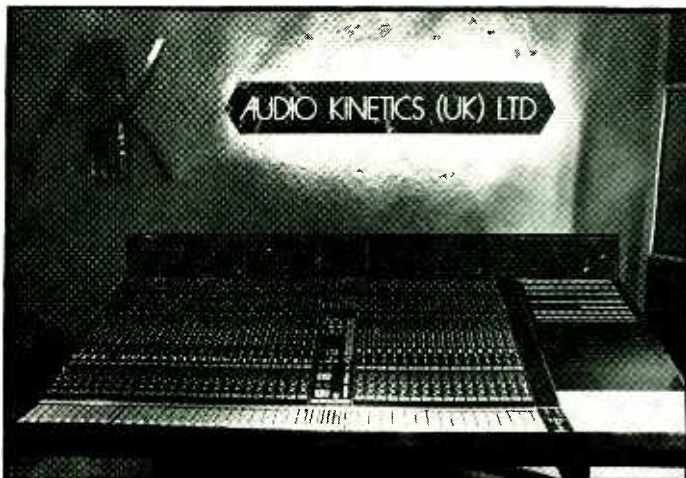
Next door **Revox** was showing the new *A740*, a domestic vu-metered version of their *A68* stereo power amplifier (reviewed in March issue p 68). Across the way, the **Studer** stand featured an example of their custom-built, turnkey broadcast systems. A stereo *O80* console forms the heart of the system, and features six inputs, two auxiliary groups for reverb or foldback and vu metering. Tape machines, turntables, power amplifiers, monitors and off-air tuners complete the package. Several self-contained Mercedes Benz ob vans fitted with these consoles were recently sold to Iran.

Klark-Teknik was showing the new *DN36* 2-channel analogue time processor, the delay section of which uses charge coupled devices operated in a balanced multiplex mode to reduce noise and distortion. Frequency response is claimed to be 20 to 15k Hz ± 1 dB. Delay time is continuously variable between 1 and 36 ms, and input levels from -18 to -8 dB can be accommodated. Signal modulation can be controlled by either internal or external signals. Price is £595 (in the UK).

Up the way the Danish firm **Lyrec** was demonstrating a new optional remote control tape position controller for their range of multitrack tape machines. The unit features four displays for 'tape position', 'A', 'B' and 'keyboard'. Search and load instructions can be activated for any display indication, and a 'store' facility allows up to 16 locations (indicating take numbers or whatever) to be memorised for later searching on playback. Based on the previous single-speed model, the 2-speed *TR 532* range of 16 and 24-track machines received their first public showing.

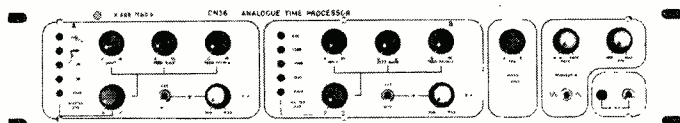
3M seemed to be emphasising video equipment that allows superimposed captions and other effects to be rolled up, down and flashed on to a tv picture. An interesting combination of video and audio equipment took the form of a programmable unit for running a multitrack machine and vtr in sync or with a predetermined delay. A keyboard controls the stop and start position and times, play/record mode and even allows the tape machine to play for a specific time, stop, search forward, or back, and then play another segment of tape in sync with a continuously running vtr. Very impressive.

Next door **Tom Hidley** of **Eastlake Audio** was laying his truth on a variety of customers who were wandering on to his stand in a steady stream. Over 600 of his control rooms have now been planned or installed, the latest being for **Abba** in Sweden; Tom was looking forward to the prospect of designing a control room in a shell almost 10m high.



Centrepiece of the **Trident** stand was a *Fleximix* console, displaying the new vu meter overbridge, which cleverly hides the input/output connectors at the 'top' of each module. Also incorporated in the desk was the new dual compressor/limiter module. Another fairly recent device being distributed by Trident is the **A&R Studio level-indicator** led meter system; comprehensive details of this 'black box' were given in a review that appeared in **STUDIO SOUND** last September. The price per module, however, is now £50 (UK).

And similar in concept to the *Fleximix* is the new *Addmix* system by **ITAM** which is modular in construction and can accommodate 40 inputs and 8 output groups. Input modules feature 80 Hz hi-pass filter; high, mid and low eq controls; echo send; foldback and pfl, plus mic/line switching. ITAM also offered for comment—constructive or otherwise—a prototype stereo compressor/limiter, to be manufactured by **Audio and Design**, costing about £250 in the UK.



The new DN36 analogue time processor from Klark-Teknik

Though it certainly didn't look that small, the new *AK 4000* series console from **Audio Kinetics** measured only 2.35 metres wide and was consequently very compact. The desk has 40 inputs, 32 outputs with vca-controlled compressor/limiter and noise gate/expander on every channel and quad compressors on main outputs. Vu, ppm and led ppm are optional. The inclusion of full multitrack controls (track number corresponding to that of the group and monitor) allows the console logic to control the master sync, replay and record conditions of the multitrack, simplifying the job of the balance engineer. Furthermore a logic controlled dropping-in system called 'Supercue' always feeds musicians' cans with personal foldback from one of six cue systems, regardless of what the engineer's drop-in sequence may be. The engineer can also pre-sync before drop-in; certainly an impressive, foolproof one-button system. UK price of a 32/32 console is approx £42 000.

Across the room **Neve** were showing a *8058 24/16/24* console destined for the Centre Georges Pompidou in Baubourg. Even though Neve were one of the casualties, courtesy of the demo room closures, their slide and vtr presentation of the **NECAM** automated mixdown system attracted more interest than could have been hoped, situated as they were at a busy intersection. The presentation has been updated since the New York AES by the addition of details of their recent installation of the **NECAM**-equipped desk at Air Studios, London.

Paris marked the first showing at an AES convention of the new **Leevers-Rich/Bias Proline 2000 TC**, (honestly, it stands for twin-capstan) a 6.25 mm machine with twin vari-speed servo capstans and servo-controlled dc spooling motors. A digital open loop servo provides constant tape tension for all reel sizes. A led counter provides real time readout in minutes and seconds at both fixed speeds. The machine's design was purchased from Klark-Teknik (who received a Technological Innovator award for it in June last year), to allow the latter to 'concentrate on research and development into new specialised professional audio products'. The *2000 TC* costs £2650 for stereo, £2750 for twin-track and £2450 for mono versions (UK prices). Also on show was a new transportable version of their *Proline 1000*. A very strong case construction should withstand even the roughest treatment during location and on use.

Centre of attention on **MCI's** stand was the *JH-528-28-LM* automated desk, complete with the *JH-50* processor that provides level, mute and grouping control for all input/output modules and echo returns. Pan and echo send controls can also be automated. A multitrack tape feeding the console allowed visitors to hear the automated effects on headphones, but the majority seemed quite content to visually appreciate the row of dancing plasma displays. The *JH-50* can also be interfaced with the smaller

400 Series consoles by a simple fader package change. Also new to the show was the *JH-110A* mastering machine (available in 6.25 and 12.5 mm formats) an updated version of their well-known *JH-110*. New features include a redesigned cabinet incorporating 'variable profile', 35.5 cm reel capacity, a minutes and seconds digital counter, and ramped time delay circuits on bias and erase for 'silent' drop-ins. What is more the colour is two-tone grey instead of the more familiar . . . yellow.

MCI's neighbour **Audio and Design** shared more than a common stand partition. Further bonhomie now exists as Audio and Design are supplying a parametric *E900-RS* sweep equaliser and *F760X-RS* complex-limiter to be 'fitted to' each of the seven **MCI 500 Series** consoles being supplied to RTV Belgrade. The standard range of Audio and Design equipment was displayed, with a further addition to the *Scamp* range in the form of the *S11* led display (four columns, 12 leds per column). News was also received that a 'paragraphic' equaliser model *E950* (designed by Barry Porter) will be launched at the Los Angeles AES exhibition in May.

Surprisingly, **Cañac's** stand contained two pairs of their monitor speakers, several modular units including the new *A505 V-Cat* compressor/limiter (details of which will be included in a forthcoming news item), and a flamboyant display of nine 'gold' discs on the rear wall. So where were the automated mixers? The fiery demon had struck here several weeks before the show opened. Fire regulations had dictated that their stand size be reduced to such an extent that, although a substantial rebate was in order, any idea of exhibiting a console faded.

As well as organising the contingent of UK manufacturers, the **APRS** had their own stand from which two well-known committee members were distributing patriotic booklets; one concerning British Recording Studios, and another dealing with British Recording Equipment. Your reporters were often seen to be chatting amicably with said committee members, discussing our mutual interests (see Letters, p 26).

The pride and joy of the **Telefunken** stand was a new multitrack machine derived from the *M15*, and suitably numbered *M15A*, available in four configurations: 8-track on 25 mm and 16, 24 or 32-track on 50 mm tape. 'It is possible to connect compander systems for all versions, or to accommodate the Telefunken *c4* compander system for up to 24 channels in the lower amplifier drawer'. All versions are available with either 19/38 or 38/76 cm/s tape speeds. (This model's little brother, the *M15A* mastering machine was reviewed in **STUDIO SOUND**, November 1976, p 66.)

Near the exit from area B, **EMI** were displaying their *152* high output, low-noise C60 cassette tape, which is proving very popular amongst users of such material, and 'making ground' in Europe against its major competitors. Behind **EMI's** stand, the room occupied by **AKG** contained several examples of their new family of semi-modular mixers. These comprise the *6100* series of mono mixers available with either six or 14 channels, and the *6200* series of 6-input stereo mixers. All models can be interconnected, and are available with or without built-in reverb. The modular approach may prove useful for updating and extending pa and sound reinforcement systems.

Alongside **AKG**, **Otari** were spotlighting their new *DP-1010* low-cost 16:1 duplicator system. Up to five slaves running at 76 or 152 cm/s on cassette or 6.25 mm tape can be linked to a single master reproducer running at 304 or 152 cm/s on 6.25 or 12.5 mm tape in a variety of track formats. For small runs, a reel-to-reel master is available, while for larger runs a modular 6.25 mm bin loop can be added. A bi-directional monitoring reproducer is also available for 6.25 mm or cassette tape.

Wandering upstairs to Hall C on the ground floor, the first stand inside the door was that of **Kajaani**, a large Finnish company whose \$100m turnover comes in the main from paper, pulp and wood products—though they do a nice line in broadcast mixers. An example of their comprehensive *10EA* series consoles was on show. Features included full eq on all 12 channels, a programme time to provide not only accurate time indication but also preset count up/down for elapsed time of recordings,

AE5 56th CONVENTION A REPORT

logic-controlled pre-fade listen facilities, and a stereo phase oscilloscope being shown in operation for the first time at an AES convention. The scope displays one channel in the X-direction and the other in the Y-direction, enabling phase differences as small as 3° to be seen at a wide range of input levels. Intended primarily for broadcast use to check stereo/mono compatibility, the unit can also be used to check and adjust head azimuth and microphone phase. An ingenious patch bay using odd-looking jacks with side prongs carrying a dc signal line in parallel with the programme signals enable over-patched and remote equipment to be activated from the desk. For example, on-air lights can be connected to come on when all components in the programme chain from microphone to transmitter are open and ready for the programme signal.

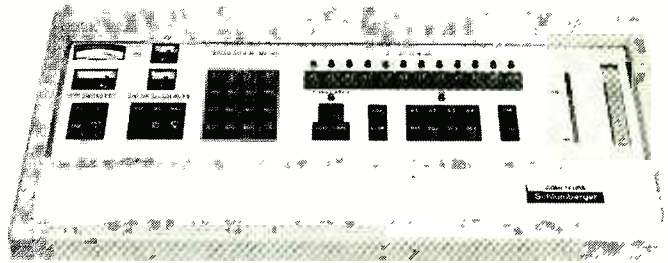
A few stands away, Nagra were demonstrating the new low cost model *E* (see page 20), and showing photographs and leaflets describing the model *T*. Not yet in production, this latest model should prove a radical departure for Nagra, so well known for their beautifully built portable machines. Unlike previous designs, the *T* will take reels up to 30 cm in diameter and will feature two capstans and full logic control. Heads and guides will be available to adapt the machine to take 3.8, 6.25 or 12.5 mm tape. Other details are rather sketchy, but watch out for further information as it becomes available.

Ampex had few surprises on their stand; newer items on show to Europe included accessories and modifications for their *ATR-100* mastering machine. A new rack-mounting version with 35.5 cm reels was being shown, as was the disc mastering preview accessory that allows the tape to be run in reverse at play speed for back-timing purposes. Disc revolution delays of 0.8, 1.08 and 2.16s can be fulfilled with numbered tape guide positions to simplify tape threading (any other required tape delay from 24 to 147 cm may be accommodated by adjustment of lockable sliding guides). A remote control and search to cue accessory for the *ATR-100* was also on show.

The largest stand in Hall C, if not the whole show, was occupied by Schlumberger. Pride of place was a demonstration of their new programmable pre-mixer linked to a *UPS4000* desk. Aimed primarily at the broadcast industry, the pre-mixer on show was being used to regulate up to 12 input channels and four output groups fed back into the master desk. Fifteen different levels for each of the inputs can be controlled by touching keys on the pre-mixer units—not a fader in sight. The resultant changes were simultaneously displayed on a video unit for visual checking, and could be logged on a digital cassette recorder for later use. Obvious applications include the preparation of complex live radio and tv programmes when the settings of many input and output channels have to be altered or changed very quickly from scene to scene or location to location. Having adjusted and 'recorded' these during rehearsals, the pre-mixer can be used to control the rapid changes needed during transmission, with the balance engineer still retaining overall sound control.

Hidden away in the corner of Hall C were to be found the unassuming gentlemen from Amek. Although traffic was fairly restricted in their direction, they were nevertheless pretty happy with the attention their new desk was attracting. They had on show a 20-input/16-output desk costing only £5000, which considering the facilities offered must be the steal of the show. Though not ready for showtime, they were showing sketches of their new *M3000* series modules, which feature 24 outputs plus direct, stereo and pan controls, four hf and four lf boost and cut, 11 peak and dip, two 'Q' positions (4 and 8 dB/octave) at two mf points, stepped high and lowpass filters, five auxiliary sends with pre- and post-select, and channel mute. A 28/24 console using these modules is expected to set you back about £14-16 000.

The companies ejected from their demonstration rooms were given space on a first-floor mezzanine level, access to which was gained through the hotel lobby, through a bar—a great temptation—and up a spiral staircase. Add to this tortuous path the fact that most visitors were not even aware that the demo rooms were closed, let alone whether their occupants had moved, resulted in only a very thin trickle of people moving past the stands during the first part of the week. Which was a shame since



Schlumberger's automation control unit

there were some interesting exhibits on this floor.

Although most visitors were probably unaware of the finer intricacies of disc cutting they could not help but be impressed by the sight of *The Lathe*, being shown for the first time in Europe by Scully. A marvel of engineering, the silver and black leviathan dominated their stand. It features everything a lathe should feature and suffice it to say that Scully will probably increase their share of the disc cutter market. (We couldn't help sympathising with the poor guys from Scully who had to move their creation down again from their hotel 'demonstration' room, having not long before carefully set it up on the third floor.)

Not far away Steve Marshall had removed the panels of his *Time Modulator*; he had found to his cost that a 110V mains transformer doesn't like to have 240 French (or otherwise) volts placed across it, and was investigating where the funny smell was coming from. His misfortune was the bystander's gain—what a serviceman's dream was laid out inside the slim chassis. Double-sided, plated-through pcb's abound, with subsections and front-panel controls interconnected with flexible flat-pack cable looms. The circuit layout is truly elegant with everything clearly labelled for easy identification. The unit is a voltage-controlled time sweepable analogue delay line with controls on the front for all mix and cancel parameters, including strapback. Marshall told us later that the potential market for his device has exceeded his expectations several times over. It appears customers are considering buying more than one unit at a time, and that certain customers will be using them as simple (?) delay lines. Furthermore, interest has been shown by those who need a special effects unit for modifying audio signals to accompany a video programme. With such a growing potential market, no wonder Marshall has spent so much time getting the design right and has had to overcome many pre-production difficulties. Potential customers will be glad to hear that production is now under way.

On show in public for the first time was Nippon Columbia's pulsed code modulation system for recording audio on an ordinary vtr (see *STUDIO SOUND* October '76 p 26). The present system offers up to 8-channel recording and playback, and has been under development since 1972. It is claimed to offer a wider dynamic range, flatter frequency response and lower distortion factor than conventional recorders, and does away with the need for noise reduction. More than 150 disc titles recorded with their system have been released on the Nippon Columbia *Denon* label, but so far other record companies and studios seem reluctant to take it up. Perhaps the present high price of the system, not to mention that of 12.5 mm vtr tape, along with the unfamiliar operation and editing techniques, are putting them off; but maybe somebody else will soon take the plunge and also go pcm.

Across the mezzanine level Soundcraft were showing a 24-input/8-output (patchable to 16) console from their *Series Two* range. They had also brought along a multitrack machine and tape for demonstration purposes but couldn't use it in the end. A metering bridge housing 16 vu's was also featured. The whole desk pivots on the mounting base for ease of servicing. Comprehensive eq with 15 dB lift or cut at 300, 3.5k and 15k Hz, plus a 50 Hz shelving equaliser and highpass filter are included. 80% of their consoles are destined for export—not surprising when one considers the £6000 price tag for the one on show.

That then was the 56th Convention. Hassles aside, and there were plenty early in the week; by the last day smiles had returned to exhibitors' faces and most felt it had all been worthwhile. Let's hope that next year's European venue of Hamburg poses less organisational problems. ■

A NEW STANDARD OF EXCELLENCE

Harrison 4032 and 3232 Master Recording Consoles

NO COMPROMISE

Harrison 

Information, sales and service are available through our selected professional audio distributors:

AUSTRIA, SWITZERLAND AND EASTERN EUROPE: Studer International AG (Switzerland)
Tel: (056) 25 87 35. Telex 53682

BENELUX: Heijnen B. V. (Netherlands)
Tel: (0885) 11 7956. Telex 48039

CANADA: Studer-Revox Canada Ltd.
Tel: (416) 423-2811 Telex 06-23310

DENMARK: Quali-fi A/S
Tel: (01) 631711. Telex 16527

FAR EAST: Studer-Revox Hong Kong Ltd.
(except Japan) Tel: 5-278571 Telex 84640

FINLAND: Into OY
Tel: (90) 17 123 Telex 121836

FRANCE: Studer France
Tel: 333 58 58. Telex 204744

GERMANY: Franz Vertriebsgesellschaft mbH
Elektronik, Mess- und Tonstudioteknik (EMT)
Tel: (07825) 512. Telex 754319

GREECE: Electronica O. E.
Tel: 3619096. Telex 214888

ITALY: Audio Products International
Tel: (02) 27 38 96. Telex 32402

JAPAN: Shindenshi Manufacturing Corp.
Tel: 03-460-6052

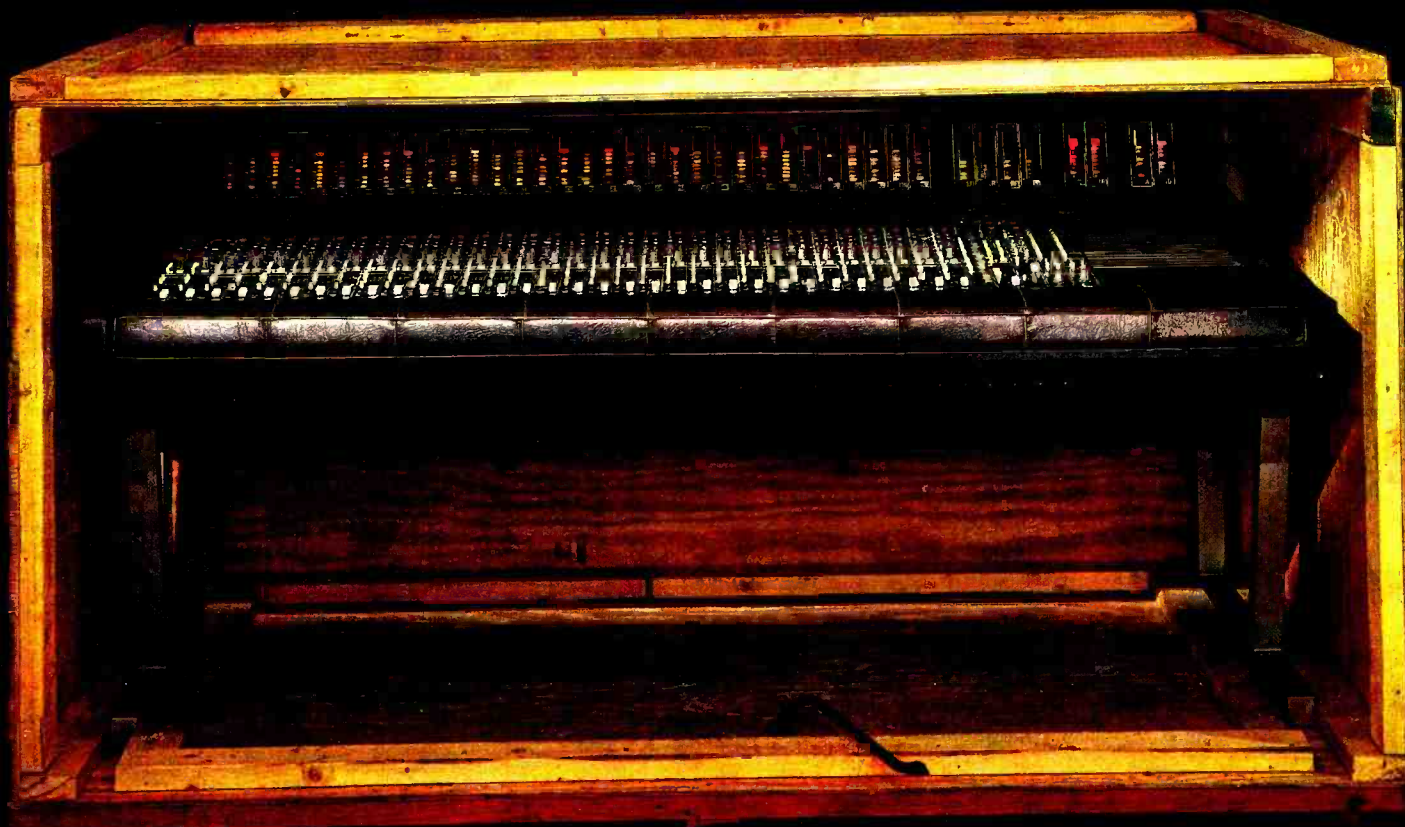
MEXICO: Ingenieros en Electronica Asociados S.A. de C.V.
Tel: 5-20-91-34 y 5-20-45-91. Telex 1775756

SPAIN: Neotécnica, s.a.e.
Tel: 242-0900. Telex 22099

UNITED KINGDOM: Scenic Sounds Equipment
Tel: (01) 935-0141. Telex 27939

FACTORY: Harrison Systems
Post Office Box 22964
Nashville, Tennessee 37202
Tel: (615) 834-1184. Telex 555133

EXPORT AGENT: Audio Systems International
146 North Orange Drive
Los Angeles, California 90036
Tel: (213) 933-2210. Telex 698645 or 555133



Survey: monitor loudspeakers

Forthcoming surveys include disc cutting and tape duplicating (August), mobile recording facilities (September) and limiters and compressors (October). Information for inclusion in the survey should reach this office (address p 3) not later than eight weeks before the issue publication date.

ALTEC

Altec Lansing, 1515 South Manchester Avenue, Anaheim, Ca 92803, USA.
UK agents: Theatre Projects Services Ltd, 10 Long Acre, London WC2E 9LN.
 Phone: 01-240 5411.

6J1-8D chassis unit

Impedance: 8 ohm.
Frequency response: 30 Hz to 20 kHz unspecified limits.
Spl: 97 dB at 1W at 1.2m.
Crossover frequency: 3000 Hz.
Max power input: 40W.
Features: two-way system with multicellular horn
Weight: 6.8 kg.
Diameter: 30.8 cm.

604-8G chassis unit

Impedance: 8 ohm.
Frequency response: 20 Hz to 20 kHz unspecified limits.
Spl: 100 dB at 1W at 1.2m.
Crossover frequency: 1500 Hz.
Max power input: 65W.
Features: two-way system with multicellular horn.
Weight: 15.4 kg.
Diameter: 40.6 cm.
Price: £300.

616-8A chassis unit

Impedance: 8 ohm.
Frequency response: 20 Hz to 15 kHz unspecified limits.

Altec
9819-8A
speaker
system



Spl: 100 dB at 1W at 1.2m.
Crossover frequency: 1000 Hz.
Max power input: 50W.
Features: two-way system.
Weight: 10.4 kg.

9846-8A speaker system

Impedance: 8 ohm.
Frequency response: 25 Hz to 20 kHz unspecified limits.
Spl: 93 dB at 1W at 1.2m.
Max power input: 100W.
Polar response: 90 h/40 v.
Dimensions: 79 x 67.5 x 60 cm.
Weight: 47.7 kg.
Price: £560.

9849-8A speaker system

Impedance: 8 ohm.
Frequency response: 40 Hz to 15 kHz unspecified limits.
Spl: 94 dB at 1W at 1.2m.
Max power input: 60W.
Polar response: 90 h/40 v.
Dimensions: 52 x 61 x 39 cm.
Weight: 27.2 kg.
Price: £425.

9346B biamplified speaker system

Input level: amp 1214 accepts line levels.
Spl: 112 dB at 1.2m, 40 Hz to 15 kHz pink noise.
Noise: 80 dB below rated output, unspecified bandwidth.
Drivers: lf/horn.
Dimensions: 67 x 79 x 60 cm.
Weight: 53.6 kg.

ALICE

Alice (Stancoil) Ltd, Alexander Road, Windsor, Berks.

Phone: Windsor 51056. Telex: 849323.

The model QM6 is now out of production. The replacement model, plus specials based on its design, is intended for broadcast monitoring. A built-in 80W power amp accepts line level signals via XLR connectors.

701

Frequency response: 32 Hz to 16 kHz 'flat'.
Spl: 105 dB max at 1m (weighted A).
Drive units: 254 mm bass, dome mf and two hf units.

Dimensions: 76.2 x 33 x 35.5 cm.
Weight: 23 kg approx.

AMCRON/CROWN

Crown International, 1718 West Mishawaka Road, Elkhart, Indiana 46514, USA.

Phone: (219) 294 5571. Telex: 810-294-2160.

UK agents: Macinnes Laboratories Ltd, Macinnes House, Carlton Park Industrial Estate, Saxmundham, Suffolk IP17 2NL.

Phone: Saxmundham 2262/2615.

ES-212

Two 25 cm bass drivers in lf unit cross to electrostatic mf/hf tweeter unit at 350 Hz.

Frequency response: 22 Hz to 30 kHz unspecified limits.

Spl: 100 to 106 dB 'in 112 m² room'.

Power requirements: 115V, 60 Hz, 3W.

Max power input: 75W.

Dimensions: 66 x 53 x 30 cm (tweeter), 66 x 53 x 40 cm (bass).

Price: £760 approx.

ATC

Acoustic Transducer Co Ltd, Pier House Laundry, Strand on the Green, Chiswick, London W4.

Phone: 01-995 3654.

ATC manufacture a range of chassis units, and this summer intend to introduce a cabinet speaker system with built-in amplifier.

Studio bass chassis unit

Impedance: 8 ohm.
Voice coil: 75 mm diameter.
Resonant frequency: 18 Hz.
Frequency response: up to 3 kHz.
Max power input: 150W rms.
Diameter: 31.4 cm.
Price: £70.

AUDIOTECHNIQUES

Audiotechniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902, USA.

Phone: (203) 359 2312.

UK agents: Keith Monks Audio, 26/30 Reading Road, Fleet, nr Aldershot, Hampshire.
Phone: Fleet 7316.

Big Red/Super Red

'The red series of monitors provide the same great Altec 604 sound with extended bass response and . . . a mid range with improved accuracy. The two mid and high frequency shelving controls of the Mastering Lab frequency divider allow fine tuning of control rooms without the additional phase distortion added by graphic equalisers.'

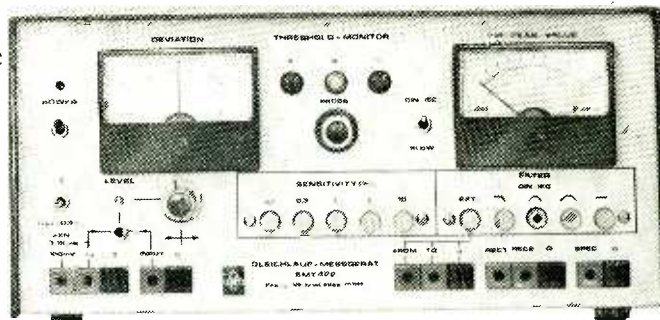
Big Reds use Altec 604E drivers, Mastering Lab dividers and a ducted port reflex enclosure. Dimensions: 76.2 x 58.5 x 45.1 cm.

Super Reds for 'super bass response' and extended sound pressure level. They are fitted with an extra 38 cm lf unit, 110 Hz crossover to a 604E and the Mastering Lab frequency divider. Enclosure volume is 12 ft³. Dimensions: 76.2 x 121 x 45.1 cm. Price: Frequency Divider \$165, Big Red \$595, Super Red \$745.

For the Flutter you can't afford

EMT have an extraordinarily versatile flutter meter at a price you can afford—the new low cost EMT 422.

Flutter and FIM (frequency inter-modulation) distortion measurement can be made in five ranges from 0.1% to 10% FSD to DIN/ANSI/IEC standards. In addition, three further filters can be selected for a rapid initial analysis of flutter frequencies. Weighted peak and slow speed deviation values are clearly displayed on separate large size meters.



A unique feature is the programmable threshold level option which provides an instant visual indication at three preset levels for simplified quality control and production line testing.

Outputs are provided for use with external filters, graphic recorders or oscilloscopes to further extend the EMT 422's unique capabilities.

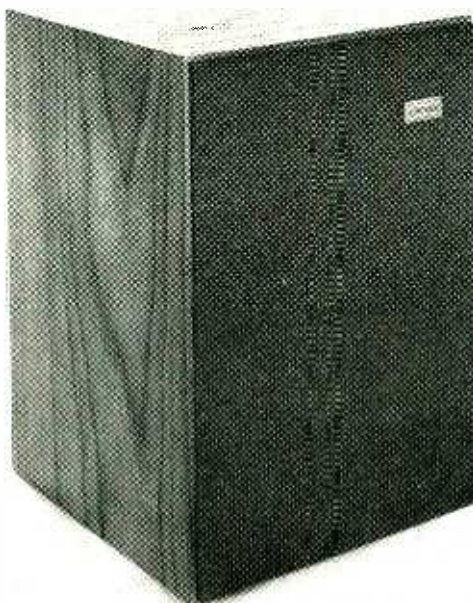
Manufactured by
E.M.T.—Franz, Vgmbh,
P.O. Box 1520, D—7630, LA HR1
West Germany.



F.W.O. Bauch Limited

49 Theobald Street, Boreham Wood
Herts. WD6 4RZ Tel: 01-953 0092 Telex: 27502

Spendor BCI, BCII and BCIII loudspeakers have been highly regarded for many years. The products of careful research, design and production quality control, they have often been used as the standard by which other loudspeakers are judged. We have every confidence that the Spendor SA1 mini monitor will achieve the same degree of success.



Size 304mm x 225mm x 216mm

Weight 7.2 kilos

H.F. Unit Son Audax HD 12.8 D25

L.F. Unit Spendor (plastic cone) 115mm

Nominal Impedance 8 ohms

Frequency Range 50 Hz to 20 kHz

Power Rating 40 watts programme

Input Connections Terminals

Cross Over Point 3000 Hz

SPENDOR AUDIO SYSTEMS LIMITED

Station Road
Industrial Estate, Hailsham
Sussex, England BN27 2ER
Tel. Hailsham 843474

spendor SA1 mini monitor

SURVEY: LOUDSPEAKERS

AURATONE

Auratone, PO Box 698, Coronado, Ca 92118, USA.
Phone: (714) 297 2820.
UK agents: Scenic Sounds Equipment, 27-31
Bryanston Street, London W1H 7AB.
Phone: 01-935 0141. Telex: 27939.

5C Super sound cube

Frequency response: 50 Hz to 15 kHz flat.
Features: compact 'mixdown-comparative monitor'.
Max power input: 30W at 150 Hz, up to 60W
'program material'.
Dimensions: 16 x 16 x 15 cm.
Weight: 2.25 kg (approx).
Price: \$49.95 a pair.

B & W

B & W Loudspeakers Ltd, Meadow Road,
Worthing, Sussex BN11 2RX.
Phone: Worthing 205611. Telex: 87342.

DM 6

Impedance: 8 ohm.
Frequency response: 50 Hz to 20 kHz ± 3 dB, 3
metres on axis.
Sensitivity: 95 dB at 1m for 7.6W pink noise.
Max power input: 350W rms.
Features: both bass and midrange units are loaded
into irregularly-shaped, totally-sealed enclosures.
'Lf contour', 'contour' and 'hf energy' controls.
Crossover at 500 Hz and 5 kHz.
Phase response: $\pm 15^\circ$ 150 Hz to 5 kHz, $\pm 30^\circ$
100 Hz to 20 kHz.
Dimensions: 93 x 41 x 38 cm.
Weight: 36 kg.
Price: £235.



Cadac Small System

CADAC

Cadac (London) Ltd, 141 Lower Luton Road,
Harpenden, Herts AL5 5EL.

Phone: Harpenden 64351. **Telex:** 826323.
Australia: Philips Electronic Systems, 14 Whiteside
Road, Clayton 3168, PO Box 550.
Belgium: Foon, Frederik Peltzerstraat 42, 2500 Lier.
Phone: 031 804661/800923.
Eastern Europe: Empexion Ltd, 233/243 Wimbledon
Park Road, London SW18 5RJ. Phone: 01-874 4362.
Telex: 928472.
Finland: Into Oy, PO Box 153, SF00101, Helsinki 10.
Phone: 11123. Telex: 121836.
France: 3M France, Boulevard D L'oise, 9500 Cergy.
Phone: 031 6161. Telex: 695185.
Holland: Cadac (Holland) BV, GV Amstelstraat 97,
Hilversum. Phone: 35 17722. Telex: 43834.
Israel: I. Bleiberg, Esq, PO Box 7119, Tel-Aviv.
Italy: Roje Telecomunicazioni spA, 20147 Milano,
Via Sant'anatalone 15. Phone: 415 4141. Telex:
39202.

Norway: Morgenstjerne & Co a/s, PB 6688, Rode-
lokka, Oslo 5. Phone: 35 6110. Telex: 11719.
Japan: Kawamura Electrical Laboratory, No 34
Yarai-cho, Shinjuku-Ku, Tokyo 162. Phone: (03)
260 0401. Telex: 22748.
Portugal: MEL (Music & Electronics), Rua do Sol
Ao Rato, No 13-A Lisbon 2. Phone: 656091.
South Africa: Tru-Fi Electronics SA (Pty) Ltd,
PO Box 31801, Braamfontein Tvl. Phone: 838 4930.
Spain: Singleton Productions, Via Augusta 59,
Desp 805, Edificio Mercurio, Barcelona 6. Phone:
228 3800/228 7602. Telex: 54015.
USA: Joel Associates, 528 River Road, Teaneck,
NJ 07666. Phone: (201) 836 8741.
Cara Pacific Sales Co, 4145 Via Marina, No 120,
Marina Del Rey, Ca 90291. Phone: (213) 821 7898.

Cadac offer two models, large and small systems,
operated in the bi-amplified mode. They are supplied
complete with crossovers but without amplifiers.

Small System

Frequency response: 20 Hz to 16 kHz, adjustable
to ± 2 dB 'under good monitoring conditions'.
Spl: 116 dB at 45W at 2m.
Max power input: 45W rms, 80W 50% duty in 10s
cycle, 120W transient power.
Distribution pattern: 90° h/40° v.
Drive units: 1 x 46 cm lf, 1 x mf compression driver,
plus 4 x 10 cm hf units.
Dimensions: 116 x 69 x 57 cm.
Weight: 136 kg.

Large System

Frequency response: 20 Hz to 16 kHz, adjustable
to ± 2 dB 'under good monitoring conditions'.
Spl: 120 dB at 80W at 2m.
Max power input: 80W rms, 100W 50% duty in 10s
cycle, 120W transient power.
Distribution pattern: 90° h/40° v.
Drive units: 2 x 46 cm lf, 1 x mf compression driver,
plus 4 x 10 cm hf units.
Dimensions: 266 x 96 x 65 cm.
Weight: 250 kg.

CELEF

Celef Audio Ltd, 130 Thirsk Road, Boreham-
wood, Herts.
Phone: 01-207 1150.

ProAc

Impedance: 8 ohm.
Frequency response: 30 Hz to 30 kHz ± 3 dB.
Spl: 110 dB at 1m max output.
Max power input: 150W (approx).
Drive units: Five including plezo tweeter.
Dimensions: 66 x 30.5 x 33 cm.
Weight: 30 kg approx.
Price: £790 per pair.

Studio professional

Impedance: 8 ohm.



Chartwell PM 450

Frequency response: 25 Hz to 20 kHz ± 3 dB.
Spl: 105 dB at 1m max output.
Max power input: 100W.
Features: reflex resistive.
Dimensions: 76 x 34.3 x 38 cm.
Weight: 30 kg approx.
Price: £510 per pair.

Mini professional SM

Impedance: 8 ohm.
Frequency response: 35 Hz to 20 kHz ± 3 dB.
Spl: 108 dB at 1m max output.
Max power input: 100W.
Dimensions: 54.5 x 28 x 30.5 cm.
Weight: 15 kg approx.
Price: £230 per pair.

CELESTION

Rola Celestion Ltd, Ditton Works, Foxall Road,
Ipswich, Suffolk IP3 8JP.
Phone: 0473-73131.

UL10

Impedance: 'to match 4 to 8 ohm amplifiers'.
Frequency response: 40 to 20k Hz ± 2 dB.
Sensitivity: 96 dB at 1m from about 40W of pink
noise.
Power handling: 50W continuous rms.
Drive units: 1 x lf, 1 x mf, 1 x hf.
Dimensions: 67.3 x 31.7 x 38 cm.
Weight: 23.5 kg.

CETEC

Cetec Corporation, 13035 Saticoy Street, North
Hollywood, Ca 91605, USA.
Phone: (213) 875 1900.

UK agents: Cetec Audio UK, 16 Uxbridge Road,
Ealing, London W5.
Phone: 01-579 9145.

The company providec hassis units mainly for oem
use, notably for Eastlake Audio and Westlake
Audio.

5831

Nominal impedance: 8 ohms.
Power handling: 200W rms.
Recommended crossover frequency: 800 Hz.
Coil diameter: 10.5 cm.
Flux density: 12 000 gauss.



Five monitors. One sound. Five JBL studio monitors. You could record with any one, play back on any other, and take your pick among the rest for mixing or mastering. The only differences are acoustic output, size and cost. No matter what size your studio is, you can cross reference with any other studio using JBL's. But reading isn't knowing for sure. Come listen to one. Or two. Or five.

CE HAMMOND & CO LTD 105 109 Oyster Lane Byfleet Surrey KT14 7LA
Telephone Byfleet 41131



SURVEY: LOUDSPEAKERS

Diameter: 38 cm.
Depth: 18.5 cm.
Weight: 11.25 kg.
Recommended enclosure volume: 156 to 184 litres.
Recommended system: bass reflex.

CHARTWELL

Chartwell Electroacoustics Ltd, 2 Commonsides East, Mitcham, Surrey CR4 1HX.
Phone: 01-648 4494.

PM 450

Available with or without a built-in Quad 405 stereo amp, bass and treble units being fed from separate channels.
Impedance: 8 ohm or 600/20k ohm into amp.
Frequency response: 45 Hz to 20 kHz ± 3 dB.
Spl: 116 dB at 1m.
Max power input: 500W or -20 dBm for amp.
Dimensions: 76 x 46 x 41 cm.
Weight: 32 kg.

DAYTON WRIGHT ASSOCIATES

Dayton Wright Associates Ltd, PO Box 419, Thornhill, Ontario, Canada.
Phone: (416) 834 3422.

UK agents: Exposure Electronics, Richardson Road, Hove, Sussex BN3 5RB.
Phone: Brighton 777912.

XG8 Mk 3

The basic building block is an electrostatic, gas-filled speaker, 1m square, that stacks with others to form an array.
Impedance: 4 ohm via ST300A drive unit.
Frequency response: 32 Hz to 24 kHz ± 4 dB.
Spl: 'up to 115 dB' at 1m on axis.
Sensitivity: 103 dB at 1m on axis from 50W.
Max power input: up to 1 kW.
Distortion: thd under 0.21% at 96 dB and 1 kHz.
Dimensions: 1m x 1m x 24 cm.
Weight: 25 kg approx.
Price: £2050 per pair including drive unit.

EASTLAKE

Eastlake Audio SA, 21 Avenue Nestle, 1820 Montreux, Switzerland.
Phone: (021) 621944. **Telex:** 25546.



A pair of Dayton Wright XG Mk 3 units, plus drive unit.

Australia, Central and South America: Sierra Audio, 621 South Glenwood Place, Burbank, Ca 91503, USA.

Phone: (213) 843 8115.
UK: Scenic Sounds Equipment, 27-31 Bryanston Street, London W1B AHB.
Phone: 01-935 0141. **Telex:** 27939.
France: 3M France, Boulevard Serrurier, 75019, Paris.
Phone: 031 6420.
Italy: Studer Italy, Audio Products Intl, Via Gaspare Spontini 3, 20131 Milan.
Phone: 273895/228120.

TM-3

Eastlake will only supply monitor systems to installations for which they have control over the mounting method. Each cabinet is powered by both channels of a Crown DC300A amp fed through a White Instruments 4001 $\frac{1}{3}$ -octave filter unit fitted with a 800 Hz, 13 dB/octave crossover network.
 Derived from the Westlake TM-1, the present unit has been updated in Europe by Tom Hidley principally by the substitution of a JBL 2405 hf radiator for the original JBL 2420 hf radiator. The choice of Gauss 5831 or JBL 2231A bass drivers, and Gauss 4000 or JBL 2440 mf drivers is often left up to the client.

EXPOSURE ELECTRONICS

Exposure Electronics, Richardson Road, Hove, Sussex BN3 5RB.
Phone: Brighton 777912.

Exposure II

Impedance: 5 to 22 ohm/8 ohm nominal.
Frequency response: 50 Hz to 20 kHz ± 4 dB (30 Hz to 35 kHz overall).
Sensitivity: 96 dB spl at 1m at 400 Hz/20W.
Max power input: 100W rms.
Features: 9 kHz and 14 kHz crossover, 12 dB/octave lo and hipass filters
Dimensions: 30 x 30 x 61 cm.
Weight: 14 kg approx.
Price: £245 per pair.

FRAZIER

Frazier Incorporated, PO Box 34216, 1930 Valley View Lane, Dallas, Texas 75234, USA.

F10W-37UA capsule monitor

Impedance: 8 ohms.
Frequency response: 30 to 15K Hz ± 5 dB.
Sensitivity: 94 dB at 1.2m from 1W.
Power handling: 30W continuous, 40W peak.
Drive units: 1 x 25 cm lf, 1 x compression mf horn, 1 x piezo hf horn.

Dimensions: 48.25 x 40.5 x 40.5 cm.

Weight: 17.7 kg.

F12-8-WHA mark 6-A

Impedance: 8 ohms.
Sensitivity: 97 dB at 1m from 1W.
Power handling: 30W continuous rms.
Drive units: 1 x 30.5 cm lf, 1 x 20 cm pressure loaded mf, 1 x hf pressure horn, 1 x piezo hf super horn.
Weight: 46.76 kg.
Dimensions: 74.3 x 65.4 x 40.6 cm.

GOODMANS

Goodmans Loudspeakers Ltd, Downley Road, Havant, Hampshire PO9 2NL.
Phone: Havant 6344. **Telex:** 86296.

Achromat 400

Impedance: 8 ohm.
Frequency response: 40 Hz to 22 kHz ± 5 dB.
Sensitivity: 96 dB at 1m for 12W.
Max power input: 75W 'music power rating'.
Enclosure volume: 39.5 litres.
Features: three-way system, crossovers at 900 Hz and 3.5 kHz.
Weight: 16.5 kg.

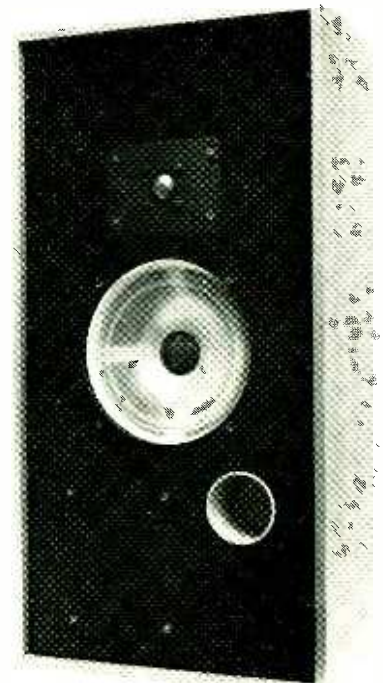
HARBETH

Harbeth Acoustics, 2a Nova Road, West Croydon CRO 2TL.
Phone: 01-681 7676.

Studio Monitor

Frequency response: 50 Hz to 25 kHz ± 3 dB.
Spl: 107 dB at 1m.
Max power input: 100W programme.
Dimensions: 61 x 33 x 30.5 cm.
Price: £270 approx per pair.

Harbeth studio monitor

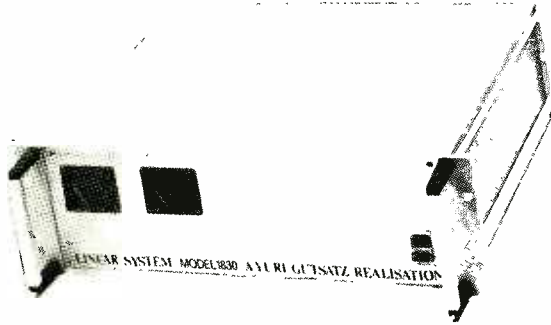


IMF

IMF Electronics, Westbourne Street, High Wycombe, Bucks HP11 2PZ.
Phone: High Wycombe 35576/7. **Telex:** 83545.
 Production of the TLS 80 has now ceased. The new unit is designed to be used on stands provided.

LINEAR SYSTEM

MODEL 1830 PROFESSIONAL



POWER: 2 x 100w RMS 18Ω
RAISING TIME: 3 μS.
SIGNAL/NOISE: -85 dB.
FREQUENCY RESPONSE: 10 Hz to 25 kHz -1 dB.
INPUT SENSIBILITY: 0.8V.
DUMPING FACTOR: ≥ 100.

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MODEL 1515 PROFESSIONAL



POWER: 1 x 100w RDS 18Ω.
RAISING TIME: 3 μS.
SIGNAL/NOISE: -85 dB.
FREQUENCY RESPONSE: 10 Hz to 25 kHz -1 dB.
INPUT SENSIBILITY: 0.8V.
DUMPING FACTOR: ≥ 100.

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50

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SURVEY: LOUDSPEAKERS

TLS 80 II

Impedance: 4 to 8 ohm.
Frequency response: 35 Hz to 20 kHz unspecified limits.
Spl: 98 dB at 40W at 1m.
Max power input: 100W.
Features: crossovers at 350 Hz, 3 and 13 kHz.
Dimensions: 98 x 41 x 46 cm.
Weight: 37 kg.

JBL

James B Lansing Sound Inc, 8500 Balboa Boulevard, Northridge, Ca 91329, USA.
Phone: (213) 893 8411.
UK agents: C. E. Hammond Ltd, 105-109 Oyster Lane, Byfleet, Surrey KT14 7LA.
Phone: Byfleet 41131.
JBL make a wide range of chassis lf drivers and hf drivers and horn/lens assemblies, plus crossovers. We list here only complete monitor systems.

4311

Impedance: 8 ohm.
Frequency response: 45 Hz to 15 kHz ± 3 dB.
Spl: 91 dB at 1W at 1m.
Enclosure volume: 42.5 litres.
Max power input: 40W 'steady state'.
Features: crossovers at 1.5 and 6 kHz.
Dimensions: 60 x 36 x 30 cm.
Weight: 19 kg.
Price: £355.

4315

Impedance: 8 ohm.
Frequency response: 35 Hz to 20 kHz ± 3 dB.
Spl: 89 dB at 1W at 1m.
Enclosure volume: 93 litres.
Max power input: 60W 'steady state'.
Features: crossovers at 400 Hz, 2 and 8 kHz.
Dimensions: 85 x 52 x 33 cm.
Weight: 43 kg.
Price: £739.

4350

Impedance: 4 ohm <250 Hz, 8 ohm >250 Hz.
Frequency response: 30 Hz to 20 kHz ± 3 dB.
Spl: 95.5 dB at 1W at 1m.
Enclosure volume: 269 litres.
Max power input: 100W to 200W, depending on impedance.
Features: crossovers at 250 Hz, 1.1 and 9 kHz, designed for bi-amplification.
Dimensions: 89 x 121 x 51 cm.
Weight: 110 kg.
Price: £1507.

4331A

Impedance: 8 ohm.
Frequency response: 35 Hz to 15 kHz ± 3 dB.
Spl: 93 dB at 1W at 1m.
Enclosure volume: 156 litres.
Max power input: 75W 'steady state'.
Features: crossover at 800 Hz, switchable for passive operation or bi-amplification.
Dimensions: 78 x 62 x 51 cm.
Weight: 57 kg.
Price: £740.

4333A

Impedance: 8 ohm.
Frequency response: 35 Hz to 20 kHz ± 3 dB.
Spl: 93 dB at 1W at 1m.
Enclosure volume: 156 litres.
Max power input: 75W 'steady state'.
Features: crossovers at 800 and 8.5k Hz, switchable for passive or bi-amplification.
Dimensions: 78 x 62 x 51 cm.
Weight: 59 kg.
Price: £838.

4343

Impedance: 8 ohm.
Frequency response: 35 Hz to 20 kHz ± 3 dB
Spl: 93 dB at 1W at 1m.

Enclosed volume: 159 litres.
Max power input: 75W 'steady state'.
Features: crossovers at 300, 1.2k and 9.5k Hz, switchable for passive or bi-amplification.
Dimensions: 105 x 63 x 43 cm.
Weight: 79 kg.

KEF

KEF Electronics Ltd, Tovil, Maidstone ME15 6QP.
Phone: Maidstone 672261.

Model 103

Impedance: 8 ohm.
Frequency response: 50 Hz to 20 kHz ± 2 dB.
Sensitivity: 25W for 96 dB at 1m and 400 Hz.
Max power input: 100W programme.
Internal volume: 25 litres.
Dimensions: 50 x 33 x 22 cm.
Weight: 16.8 kg.

Model 104 aB

Impedance: 8 ohm.
Frequency response: 50 Hz to 20 kHz ± 2 dB.
Sensitivity: 12.5W for 96 dB at 1m and 400 Hz.
Max power input: 100W programme.
Internal volume: 35.5 litres.
Dimensions: 63 x 33 x 26 cm.
Weight: 19 kg.

Model 105

The latest model from KEF will be available late 1977. A new 30 cm bass driver is featured, and 'contoured mid and high enclosures which control secondary wave-fronts and minimise off-axis coloration'.
Impedance: 8 ohm.
Frequency response: 30 Hz to 25 kHz (± 2 dB 38 Hz to 22 kHz at 2m).
Sensitivity: 86 dB spl for 1W at 1m.
Spl: 107 dB at 1m (max).
Max power input: 150W programme.
Features: 20-element crossover at 300 Hz and 2.5 kHz.
Directional characteristics: ± 2 dB of axial response up to $\pm 20^\circ$ horizontally and $\pm 5^\circ$ vertically.
Dimensions: 96 x 41 x 46 cm.
Weight: 38 kg.
Price: £330 approx.

K & H

Klein and Hummel, D-7302 Ostfildern 4, Kemnat, West Germany.
Phone: Stuttgart 455026.
UK agents: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.
Phone: 01-953 0091 Telex: 27503

OY

Bi-amplified three-way speaker. Active crossover and 2 x 30W amps built in.
Frequency response: 40 Hz to 16 kHz ± 2 dB.
Spl: 107 dB at 1m (max).
Self-generated noise: 10 dB at 1m.
Total harmonic distortion: <0.25%.
Features: >4.7 k ohm input impedance, balanced and floating, -6 dB min, plus 8 position eq.
Dimensions: 48 x 30 x 23 cm.
Weight: 20 kg.
Price: £430.

O 92

Tri-amplified three-way speaker. Active crossovers and 120W bass + 60W mid + 30W treble amps built in.
Frequency response: 27 Hz to 17 kHz ± 2 dB.
Spl: 110 dB pink noise at 1m + 6 dBm input.
Features: 4.7 k ohm input impedance, 0 or + 6 dBm, plus 4 position fixed eq and variable plugin modules.
Dimensions: 80 x 44 x 30 cm.
Weight: 36 kg.

KLH

KLH Research and Development Corp, 30 Cross Street, Cambridge, Mass 02139, USA.
Phone: (617) 491 5060. Telex: 92-1427.

UK agents: Webland International Ltd, Mirabel House, 117-121 Wandsworth Bridge Road, London SW6.
Phone: 01-736 0987. Telex: 25570.

CB8

Impedance: 8 ohm.
Frequency response: 47 Hz to 18 kHz ± 4 dB.
Max power input: 75W rms.
Dimensions: 50 x 28 x 18 cm.
Weight: 12 kg.
Price: £179 per pair.

CB10

Impedance: 8 ohm.
Frequency response: 40 Hz to 18 kHz ± 4 dB.
Max power input: 100W rms.
Dimensions: 50 x 37 x 18 cm.
Weight: 16 kg.
Price: £247 per pair.

CL4

Impedance: 8 ohm.
Frequency response: 30 Hz to 22 kHz ± 3 dB.
Max power input: 150W rms.
Dimensions: 68 x 37 x 33 cm.
Weight: 27 kg.
Price: £360 per pair.

317

Impedance: 8 ohm.
Frequency response: 45 Hz to 18 kHz unspecified limits.
Max power input: 100W short duration.
Dimensions: 58 x 30 x 25 cm.
Weight: 14 kg.
Price: £147 per pair.

363

Impedance: 8 ohm.
Frequency response: 30 Hz to 22 kHz unspecified limits.
Max power input: 50W short duration.
Dimensions: 61 x 33 x 32 cm.
Features: three-way system.
Weight: 19 kg.
Price: £220 per pair.

CL3

Impedance: 8 ohm.
Frequency response: 35 Hz to 20 kHz ± 3.5 dB.
Max power input: 100W rms.
Dimensions: 66 x 35 x 29 cm.
Features: three-way system.
Weight: 24 kg.
Price: £275 per pair.

LESLIE

Electro Music/CBS Musical Instruments, Division of CBS Inc, 56 West Del Mar Boulevard, Pasadena, Ca 91105, USA.

DVX 580

Impedance: 4 ohms.
Frequency response: 20 to 20k Hz, no tolerance given.
Sensitivity: 90 dB from 1W at 1m.
Drive units: 1 x lf, 1 x lmf, 1 x hmf, 2 x hf.
Polar pattern: adjustable.
Protection: slow blow fuse.
Power handling: 50W continuous.
Dimensions: 737 x 520 x 838 mm.
Weight: 49 kg.

LOCKWOOD

Lockwood and Company (Woodworkers) Ltd, Lowlands Road, Harrow, Middlesex HA1 3AW.
Phone: 01-422 3704/0768.
Greece: Audiolab Hellas, 8 Enianos, Athens 104.
Japan: Shiro Trading Co Ltd, CPO Box 572, Tokyo 100.91.

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For use with A-size cartridges only, our compact Beaucart Type 10 measures a trim 3½" high by 5½" wide by 15½" deep. Both mono and stereo are available in record or playback versions. Reproducers are furnished with a primary (1 kHz) cue, with secondary (150 Hz) cue, and tertiary (8 kHz) cue and fast forward capabilities available as an option.

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For use with all NAB standard A, B, and C-size cartridges, a wider, 3½" high by 10½" wide by 13½" deep Type 20 Beaucart machine is offered. These reproducers and recorders are available in mono or stereo. All Beaucart machines incorporate unique features such as our patented pancake motor and adjustable air damped solenoid for quieter overall operation than any other machine on the market.

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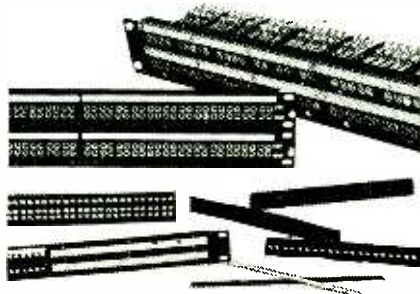


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Telephone: Maidenhead 36315 — Telex 848960.

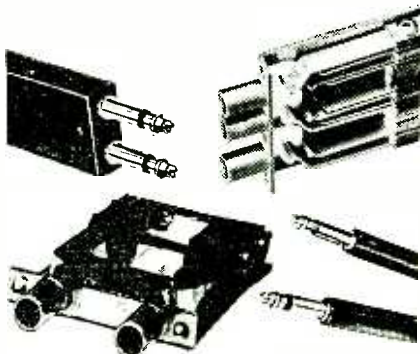
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Telex: 82362 A/B BATELCOM

SURVEY: LOUDSPEAKERS

Norway: J M Feiring, A/S, Nils Hansens, Vei 7, Oslo 6.

Spain: Mabel Sdad Ltda, Ripolles 84, Barcelona 13.
USA/Canada: Lasalle Audio Products, 2500 Bates Road, Montreal HAS 1A6, Canada.
Phone: 738 4758.

All Lockwood monitors are available with built-in power amps, mounting saddles etc, to special order.

Major

Impedance: 8 ohm.

Frequency response: 23 Hz to 20 kHz unspecified limits.

Power handling: 85W 'integrated material'.

Drive units: 38 cm Tannoy HPD dual concentric.

Features: can be supplied with built-in power amps such as Quad 50E or H/H 50D.

Dimensions: 114 x 71 x 44.5 cm.

Weight: 58 kg without optional integral amp.

Price: £395.

Universal Major

Performance spec as Major, but cabinet supplied with fixtures and fittings for wall mounting.

Dimensions: 61 x 104 x 44.5 cm.

Price: £385, mounting saddle extra.

Miniature Monitor

Impedance: 8 ohm.

Frequency response: 25 Hz to 20 kHz, unspecified limits.

Power handling: 50W 'integrated programme material'.

Drive units: 25.4 cm Tannoy HPD 295 dual concentric.

Dimensions: 56.5 x 38.5 x 32 cm.

Weight: 18.5 kg (basic model).

Price: £160.

Academy 1

Impedance: 8 ohm.

Frequency response: 23 Hz to 20 kHz, unspecified limits.

Power handling: 85W 'integrated programme material'.

Drive units: Tannoy 38.1 cm Tannoy HPD 385A dual concentric.

Dimensions: 76 x 51 x 36 cm.

Weight: 37 kg (approx).

Price: £200.

Academy II

Impedance: 8 ohm.

Frequency response: 23 Hz to 20 kHz, unspecified limits.

Power handling: 60W 'integrated programme material'.

Drive units: 30.5 cm Tannoy HPD 315A dual concentric.

Dimensions: 76 x 51 x 36 cm.

Weight: 31 kg (approx).

Price: £180.

Academy III

Impedance: 8 ohm.

Frequency response: 25 Hz to 20 kHz, unspecified limits.

Power handling: 50W 'integrated programme material'.

Drive units: 25.4 cm Tannoy HPD 295A dual concentric.

Dimensions: 56 x 38 x 33 cm.

Weight: 18.5 kg (approx).

Price: £160.

MISSION

Mission Electronics Ltd, 117 Wandsworth Bridge Road, London SW6.

Phone: 01-736 0987. Telex: 25570.

This newly-formed company make three models: 710, 720, and 730.

730

Impedance: 8 ohm.

Frequency response: 45 Hz to 30 kHz ± 3 dB.

Spl: 108 dB max at 1m.

Sensitivity: 85 dBA at 1m from 1W pink noise.

Power handling: 135W program, 200W peak.

Drive units: 25 cm bass driver, 105mm mf, 25 mm soft dome hf and 25 mm nomex hard dome tweeter.

Dimensions: 90 x 32 x 32 cm.

Weight: 21.5 kg.

Price: £299 per pair.

PHILIPS

NV Philips Gloeilampenfabrieken, Eindhoven, The Netherlands.

Phone: (040) 79333.

Distribution by company network in most countries.

RH545

Spl: 108 dB at 1m.

Enclosed volume: 70 litres.

Max power: 100W.

Features: tri-amplified motional feedback, balanced line input, both DIN and XLR connectors.

Dimensions: 65 x 44 x 32 cm.

Price: £670 approx.

For further details see March '77 issue, p 28.

QUAD

The Acoustical Manufacturing Co Ltd, Huntingdon PE18 7DB.

Phone: Huntingdon 52561.

Distribution by appointed dealer network in most countries.

ELS electrostatic loudspeaker

Impedance: 30 to 15 ohm in range 40 Hz to 8 kHz, falling above 8 kHz.

Frequency response: 45 Hz to 18 kHz (rate of attenuation asymptotic to 18 dB/octave).

Spl: 93 dB 50 Hz to 10 kHz, 100 dB 70 Hz to 7 kHz.

Polar response: 70° h/15° v.

Power unit: integral. 120/250V.

Dimensions: 79 x 88 x 27 cm.

Weight: 18 kg.

Price: £180.

REVOX

Willi Studer, CH-8105 Regensdorf-Zurich, Switzerland.

US agents: Revox Corporation, 155 Michael Drive, Syosset, NY 11791.

UK agents: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.

Phone: 01-953 0091. Telex: 27503.

AX 5-4

Impedance: 4 ohm.

Frequency response: 25 Hz to 20 kHz (DIN 45 500).

Sensitivity: 91 dB spl at 1m at 1.4W.

Total harmonic distortion: 1% (55 Hz to 20 kHz).

Max power input: 100W (nominal).

Features: 5m connecting cable supplied.

Dimensions: 39 x 65 x 34 cm.

Weight: 21.5 kg.

SCEEA

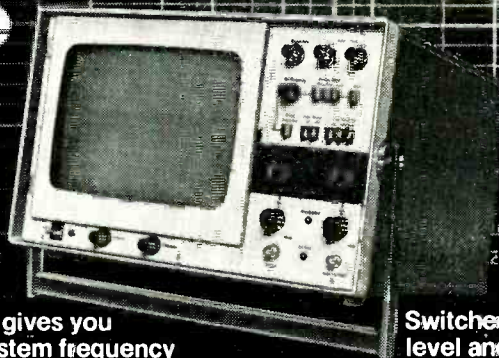
Societe de Construction d'Equipment Electronique et Acoustique, 7b Rue des Casseaux, 91190 Villebon sur Yvette, France.

Phone: 010 0090.

This recently-founded company plan to put into production two broadcast monitors later this

58 ►

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Wilmot Breeder Electronics Limited, 442 Bath Road, Slough, SL1 6BB, England.
 Telephone: Burnham (06286) 62511 Telex: 847297

SS/5/77

SURVEY: LOUDSPEAKERS

year. Both models are four-way systems with motion feedback at bass frequencies, and an active 'complimentary filter'. Quad-amplification and a limiter are incorporated. Cooling is by forced air. Balanced line input is on XLR connectors.

Estel

Frequency response: 30 Hz to 20 kHz ± 2.5 dB on axis, 30 Hz to 15 kHz ± 4 dB at 30°.

Spl: 103 dB max at 1m (ANSI spectrum), 119 dB peak at 1m.

Power handling: 30.5 cm bass driver: 120W rms, 400W for 4s; 16.5 cm mf unit: 40W rms, 90W for 1s; 51 mm hf unit: 60W rms, 90W for 1s; 20 mm tweeter: 12W rms, 90W for 0.2s.

Terastel

Frequency response: 40 Hz to 20 kHz ± 3 dB on axis.

Spl: 118 dB max at 1m (ANSI spectrum).

Power handling: bass driver: 450W rms; mf: 200W rms; hf: 200W rms; tweeter: 200W rms. (Manufacturer specs.)

Directivity: $\pm 30^\circ$ over 400 Hz.

SENNHEISER

Sennheiser Electronic, 3002 Bissendorf/Hann., West Germany.

Phone: (05130) 8011. **Telex:** 09 24623.

UK: Hayden Laboratories Ltd, Hayden House, 17 Chesham Road, Amersham, Bucks HP6 5AG. **Phone:** Amersham 5511.

The company manufactures two self powered amplifier speaker combinations operating from standard 0 dBm line.

VKL 304

Dimensions: 65 x 40 x 25 cm.

Weight: 21 kg.

VKL 305-4

Max spl: 106 dB.

Dimensions: 65 x 40 x 25 cm.

Weight: 22 kg.

SMC

SMC Loudspeakers, 76 Bedford Road, Kempston, Beds MK42 8BB.

Phone: Bedford 054133.

AS 40 studio monitor

Impedance: 8 ohm.

Frequency response: 35 Hz to 25 kHz DIN (± 3 dB 45 Hz to 20 kHz).

Spl: 103 dB max at 1m.

Sensitivity: 96 dB at 20W at 1m.

Max power input: 100W peak (50W DIN).

Features: 12-element crossover at 500 Hz and 4 kHz.

Dimensions: 32 x 63 x 36 cm.

Weight: 18 kg.

Price: £195 per pair.

AS 50 studio monitor

Impedance: 8 ohm.

Frequency response: 25 Hz to 40 kHz DIN (± 3 dB 35 Hz to 25 kHz).

Spl: 104 dB max at 1m.

Sensitivity: 96 dB at 15W at 1m.

Max power input: 100W peak (50W DIN).

Features: 13-element crossover at 500 Hz and 3.5 kHz.

Dimensions: 38 x 74 x 43 cm.

Weight: 34 kg.

Price: £422 per pair.

58 STUDIO SOUND, MAY 1977

SPENDOR

Spendor Audio Systems Ltd, Station Road Industrial Estate, Hailsham, Sussex BN27 2ER.

Phone: Hailsham 843474.

BC models are available with built-in amplifiers of 25 or 50W. XLR connectors as standard.

BC I

Impedance: 8 ohm.

Frequency response: 45 Hz to 25 kHz (± 3 dB, 60 to 14 kHz).

Maximum spl: 101 dB.

Sensitivity: 0 dB at 1 dyne/cm², 1V app.

Max power input: 40W peak programme.

Features: crossovers at 3 and 13 kHz.

Dimensions: 63 x 30 x 30 cm.

BC II

Impedance: 8 ohm.

Frequency response: 45 Hz to 25 kHz (± 3 dB, 60 to 14 kHz).

Maximum spl: 103 dB.

Sensitivity: ± 1 dB at 1 dyne/cm², 1V app.

Max power input: 50W peak programme.

Features: crossovers at 3 and 13 kHz.

Dimensions: 63 x 30 x 30 cm.

Weight: 15.5 kg.

BC III

Impedance: 8 ohm.

Frequency response: 30 Hz to 20 kHz (± 2 dB, 50 Hz to 14 kHz).

Maximum spl: 105 dB.

Sensitivity: $\pm 2\frac{1}{2}$ dB at 1 dyne/cm², 1V app.

Max power input: 70W peak programme.

Features: crossovers at 700 Hz, 3 and 13 kHz.

Dimensions: 80 x 40 x 40 cm.

Weight: 34 kg.

SA 1 mini monitor

Impedance: 8 ohm.

Frequency response: 50 Hz to 20 kHz unspecified limits.

Max power input: 40W programme.

Features: supplied in pairs matched to within ± 0.75 dB. 50 Hz to 15 kHz.

Dimensions: 30 x 22 x 22 cm.

Weight: 6.5 kg.

TANGENT

Tangent Acoustics Ltd, 3 Kesters Close, Hardwick, Cambs CB3 7QY.

Phone: Madingley 658.

TM1

Impedance: 8 ohm.

Frequency response: 40 Hz to 30 kHz ± 3 dB.

Internal volume: 42.5 litres.

Drive units: 14 cm lf/mf, 19 mm hf.

Max power input: 50W.

Dimensions: 30 x 31 x 63 cm.

Price: £123 per pair.

RS4

Impedance: 8 ohm.

Frequency response: 40 Hz to 30 kHz ± 3 dB.

Internal volume: 42.5 litres.

Drive units: 14 cm lf/mf, 19 mm hf.

Max power input: 80W.

Dimensions: 30 x 31 x 63 cm.

Price: £187 per pair.

RS6

Impedance: 8 ohm.

Frequency response: 36 Hz to 30 kHz ± 3 dB.

Drive units: 14 cm lf, 90 mm mf, 19 mm hf.

Max power input: 100W.

Dimensions: 30 x 31 x 81 cm.

Price: £252 per pair.

TANNOY

Tannoy Products Ltd, St John's Road, Tylers Green, High Wycombe, Bucks HP10 8HR.

Phone: Penn 5221. **Telex:** 837116.

Asia: Harman Asia, Sasaki Building 6F, 18-9 Roppongi 3-Chome. Minato-Ku, Tokyo 106, Japan. **Phone:** 03-583-8451. **Telex:** 22498.

Austria: Karl Gangl Kg, 1030 Wien, Gärtnerstrasse 8. **Phone:** (0222) 731289. **Telex:** 1/2353.

Canada: E S Gould Marketing Co Ltd, 109 Montee de Liesse, Montreal, Quebec H4T 1S9. **Phone:** (514) 342 4441. **Telex:** 05 826653.

France: Harman France, 21 rue de l'Alouette, 94160 St Mande. **Phone:** 374 5836. **Telex:** 680780.

Germany: Harman Deutschland, 16 Rosenbergstrasse, 7100 Heilbronn. **Phone:** (7131) 68961. **Telex:** 203 728433.

Holland: Harman Amsterdam, Kabelweg 45-47, Amsterdam. **Phone:** (20) 821656. **Telex:** 0021 16234.

Italy: Gilberto Gaudi spa, Corso di porta nuova 48, 20121 Milan. **Phone:** 655272/664981.

USA: Harman Kardon Inc, 55 Ames Court, Plainview, NY 11803. **Phone:** (516) 681 4000. **Telex:** 230961362.

The company manufacture a range of chassis units, each comprising a direct radiator bass unit and a high-frequency compression driver in a dual gap arrangement. They are supplied with adjustable crossover network.

Tannoy also market a range of enclosures fitted with their drive units.

HPD 385A chassis unit

Impedance: 8 ohm.

Sensitivity: 96 dB at 1m at 3W for 400 Hz.

Max power input: 85W continuous programme.

Features: 20 Hz bass resonance, 500 Hz horn hf cut off.

Diameter: 38.5 cm.

Weight: 14 kg.

HPD 315A chassis unit

Impedance: 8 ohm.

Sensitivity: 96 dB at 1m at 5W for 400 Hz.

Max power input: 60W continuous programme.

Features: 20 Hz bass resonance, 500 Hz horn hf cut off.

Diameter: 31.5 cm.

Weight: 8 kg.

HPD 295A chassis unit

Impedance: 8 ohm.

Sensitivity: 96 dB at 1m at 7W for 400 Hz.

Max power input: 50W continuous programme.

Features: 22 Hz bass resonance, 500 Hz horn hf cut off.

Diameter: 29.5 cm.

Weight: 7 kg.

Berkeley

Impedance: 8 ohm (HPD 385A chassis unit).

Sensitivity: 91 dB at 1m at 1W (3.1W DIN 96 dB).

Max power input: 85W.

Dimensions: 84 x 54 x 31 cm.

Arden

Impedance: 8 ohm (HPD 385A chassis unit).

Sensitivity: 91 dB at 1m at 1W (3.1W DIN 96 dB).

Max power input: 85W.

Dimensions: 99 x 66 x 37 cm.

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(See entry for Eastlake Audio.)

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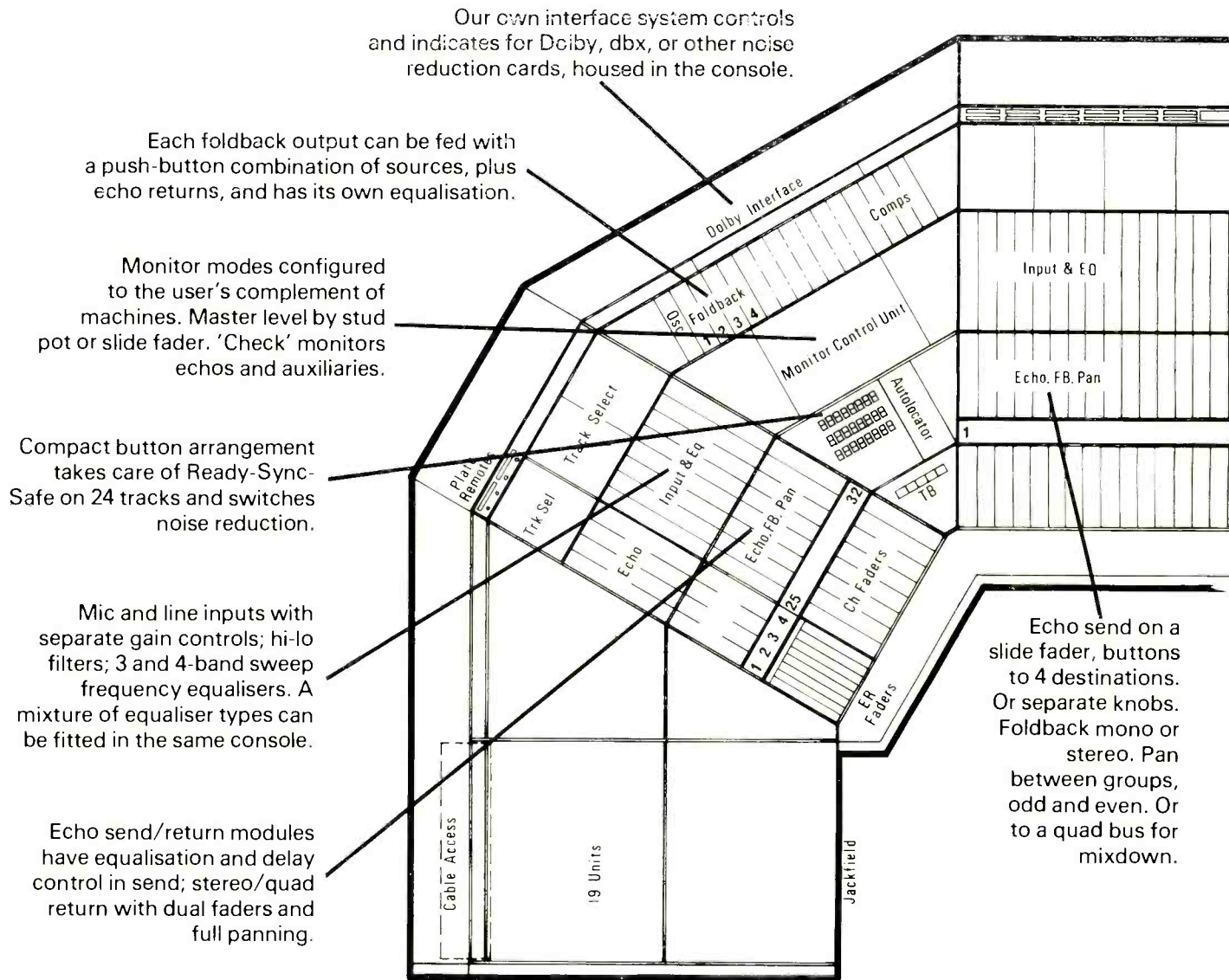
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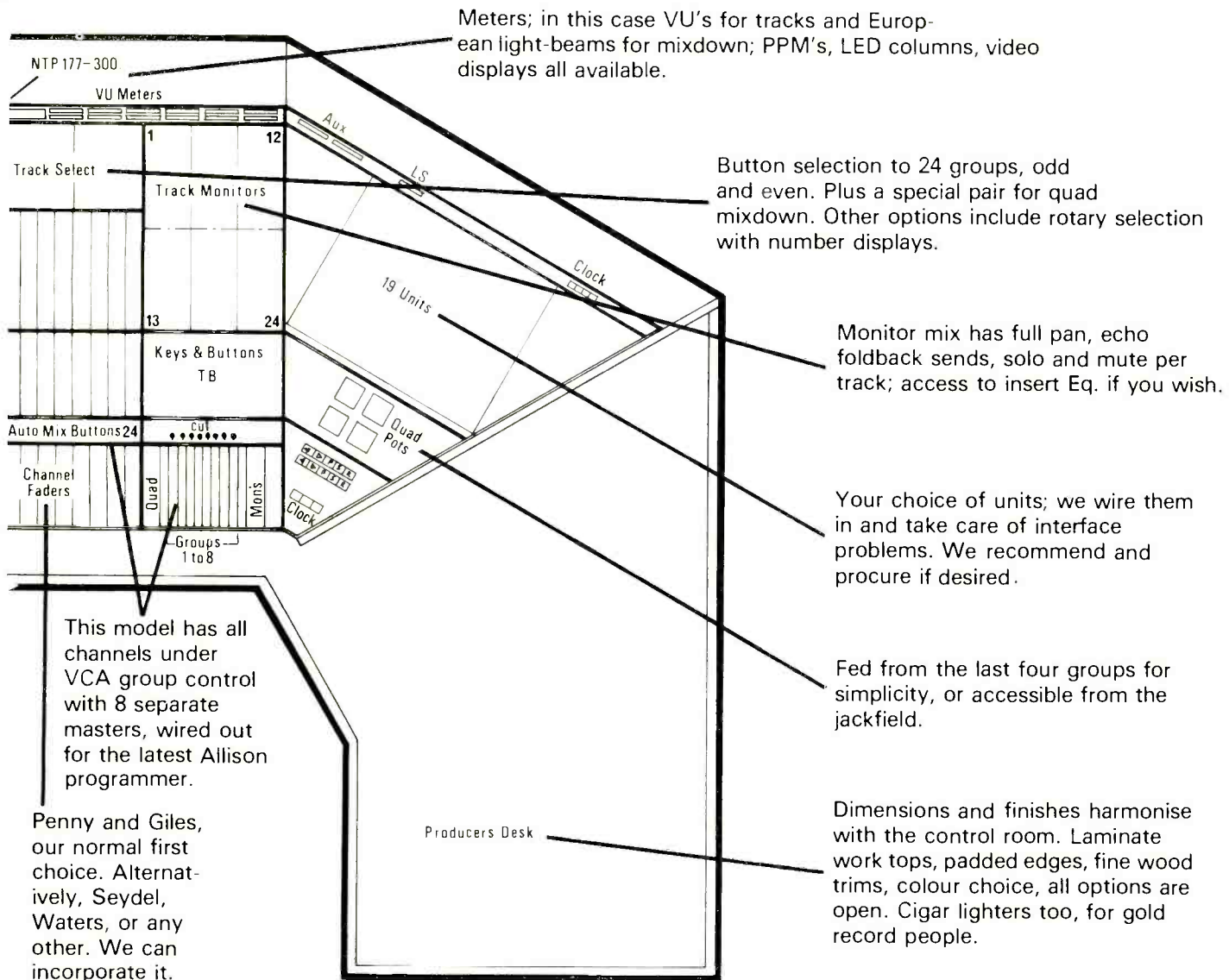
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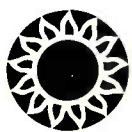
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work

Under The Redwood Tree

Covent Garden has gone through some o' dem changes, and it's a rather sad shadow of its former self these days. With the old fruit and veg market uprooted and unceremoniously dumped somewhere south of the Thames, the locality seems to have lost most of its *raison d'être*. Happily, the developers haven't had things entirely their way, and the Garden hasn't as yet been restructured into some sort of Hyams high-rise version of Utopia. Life is slowly filtering back into the area, and the old market buildings have re-emerged more or less unscathed as havens for 'The Arts'. Culture is alive and well and living in London WC2, in case you didn't know.

It isn't all that surprising then, to find the odd recording studio slotted into the motley assortment of bijou craft emporia and trendy publishing houses which is Covent Garden today. One such is Redwood Recording, a smallish unpretentious establishment, tucked well out of sight down a small side street. The location couldn't be more central, but it still affords enough privacy for visiting groups to avoid running the gauntlet of the curious. The location seems to be so unobtrusive, come to think of it, that when we paid a visit we were misdirected by newsvendors, locals and even a policeman; eventually finding the place only by a combination of guesswork and sheer good luck.

The builders were still in residence when we arrived, putting the finishing touches to a six-month £70 000 building program. The studio had only been in commission for a week or so when we saw it, and remarkably few teething problems had shown up during that time. Prior to being converted, the building which houses Redwood was a film studio specialising in commercials—which is singularly appropriate, because the bulk of Redwood's future output is likely to be voice-overs for the advertising industry. Andre Jacquemin, who runs things on a day-to-day basis, is no stranger to this somewhat specialised sector of the recording industry. He started out at Studio G, where the then chief engineer, Alan Bailey, a veteran of Radio

Luxembourg and other commercial stations, taught him the delicate art of vocal recording.

After engineering demos with Michael Palin of Monty Python fame, he was asked to produce the first Python lp. He must have survived the experience more or less intact, because he's produced three more of Python's ongoing insanities since—not to mention the latest phonographic rendering from Barry 'Housewife Superstar' Humphries. The Python connection continues, and it's a fair bet that any future lps will be made at Redwood. Mike Palin is a partner in the studio and he put up a lot of capital for the project. Keeping things in the family, so to speak, the basement is occupied by Python's resident animation whizz-kid, Terry Gilliam, who has a studio there.

The studio's an 8-track setup, although if the need arises it could go 16-track without too much tearing of hair and lost sleep. Although the rent is paid by the advertising work, Redwood has already been used for a couple of rock sessions, and there's even a house record label—Rebel Records—which has a distribution deal with EMI and a couple of commercial singles set for release soon.

The builders moved in last July after Andre, architect Tom Cox and Kevin Brown, one of the Beeb's acoustics experts, had hammered out a viable format. People who lay £70 000 on the line tend to become fanatical perfectionists.

Andre Jacquemin and gear



which is understandable because they have to live with their mistakes. That's why Redwood took six long months, rather than a couple of frantic weeks to complete. As an example of this perfectionism, the studio/control room wall didn't seem quite right when it was built. Andre felt that it made the control room too small, so the whole assembly was junked and rebuilt farther forward, at no small cost in time and materials.

The new studio spaces were built as shells within the old building—the gaps being filled with volcanic stone to a depth of 25-30 cm around the walls, and up to 122 cm above the ceilings. Both the studio and the control room are fully air-conditioned, with specially long runs of ductwork ensuring that sounds from the outside can't reach the interior. As yet, there's no reception area—you simply walk off the street into a small corridor, with doors leading off to the studio and control room—but if Redwood goes 16-track in the near future, a new reception area will be built next door with a connecting door in the adjoining wall.

As far as Andre Jacquemin was concerned, a prime consideration was that the control room should have live, natural acoustics. His reasons for this are interesting: 'I wanted to have the same sort of sound that I'd find in a normal sitting room because, after all, that's where most people are going to be listening to the end product. I've been in some control rooms which were so dead that the engineers were having to bung in loads of echo to get anything vaguely resembling a natural sound, which must be self-defeating'.

Kevin Brown's solution was to panel all the available wall surfaces with *Cedak* natural pine slats, which are specially shaped to reflect sound without colouring it.

Expensive, but effective: 'I crammed eight people in the other day, and for a small room it was uncanny; the place sounded as live as it was when I was in there on my own'. Unusually for a town-based studio, the control room has a window looking out onto the street. The view's nice, but if people can look out, other inquisitive people can look in, so some sort of curtaining was clearly a necessity. Kevin Brown vetoed Andre's original plan which was to fit long, heavy drapes, and substituted the present acoustically compatible blinds instead.

Carrying through the home-listening concept, one of the most immediately noticeable features of the control room is the presence of a pair of humble, common-or-garden domestic hi-fi speakers. They're Wharfedale *Lintons*, fed from an equally unassuming Godmans *Module 80* tuner/amp; and again, the idea is to give the closest possible equivalent to a normal domestic environment when it's required. Controlled from the desk, the system can be switched to provide anything from a horribly authentic crackly transistor radio noise, to lower/mid-market hi-fi.

More conventional monitoring is taken care of by a Crown *D150* amp, 'just to let people know we mean business', and Lockwood monitors comprising Tannoy *HPD* speakers housed in *Major* cabinets. Andre rates the new *HPDs* as having a slightly harder sound than the old *Reds* and *Goldts*, although they're still a couple of orders of magnitude softer than *JBLs* or *Altecs*. Why Lockwoods? 'I think most voice-over producers still prefer Tannoy speakers because the softer sound they give is far more sympathetic for vocal work—but the Lockwoods are still loud enough for rock sessions.'

The custom-built desk is the handiwork of Pepe Rush. It's wired at the moment for 16 input channels, with eight out and eight monitored. Conversion to 16-track operation would be straightforward; the existing inputs are wired and routed for 16 and by the simple expedient of removing a wooden panel, a further eight output groups can be added to the present ones.

Each module can be eq'd in and out and eq, channel and solo cut controls are provided. By pressing individual solo insert buttons each channel can be isolated and patched in with outside sources—and compressors can be plugged in on other inserts. To allow an individual peak channel reading to be taken while monitoring, an overall

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WORK

solo switch and vu meter are installed.

The desk has a built-in line oscillator with six frequencies from 50 Hz to 10 kHz. An AKG BX20 stereo echo, originally the property of Small Face, Stevie Marriott, and tape echo are provided. Tape returns are similar in design to MCI's with equalisation and high and low frequency controls, and echo cut.

An interesting feature is the 2-track remix control on the monitoring side, which allows the first eight faders to be coupled into two central faders connected directly to a Studer. This makes 2-minute 2-track mixes a real possibility. Foldback from tape slate and studio talkback are provided, with stereo send to headphones; and the talkback mic is discreetly hidden on the desk and equipped with a separate level control.

The desk is only the second ever complete unit to be built by Pepe Rush but, judging from Andre's complimentary comments, other orders should follow soon. In fact at the time of writing, Pepe is building a pair of graphic equalisers for Redwood; and visiting engineers have reacted very favourably to the board's layout and facilities.

A pair of Studer A80 Mk I's are used for mastering, one 8-track and one stereo; both are equipped with varispeeds and remotes with control from a position on the desk. Other recording equipment comprises a Neal cassette recorder, Lee Engineering cartridge machine, Audio and Design F700X-RS limiter, Eventide Harmoniser and two Bias Electronics playback units for copying and editing. Oh, and there was a Thorens TD125 record deck—until one of the builders dropped it from a great height with terminal consequences, that is. Surprisingly no noise reduction system was in evidence. This apparently is the norm for voice-over work where the facility is hardly ever required due to the broadcast quality of the finished item. However, Andre is currently mulling over the thought of acquiring some dbx units for music sessions in the near future.

The main studio can accommodate up to ten people, with room for another three slenderish ladies or dwarves in a separate booth. Four Sonaplan screens can be used if necessary to form a drum trap, although on recent sessions with The Tremeloes DJM's chief engineer, Mark Wallace, dispensed with them altogether and still obtained extremely impressive separation



Keyboards

and bass response. This might be due in some measure to the wall cladding in the lower part of the studio, which is of rubber-backed pegboard giving a very live sound characteristic.

Instruments *in situ* include a Fender Studio Rhodes with Hammond Rhythm Box, ARP Odyssey synthesiser, Gretsch studio drumkit, Daneman upright piano with a full grand-size scale and an EKO 6-string guitar. Studio amplification consists of a 100W Marshall top and H/H 4 x 12 cabinet, Fender Twin-Reverb and a Fender Champ. An interesting feature is that input sockets for most instruments are wired in circuits with multiple sockets sited around the studio at waist height—enabling musicians to plug in at a convenient point without lugging about 50m of tangled leads behind them.

Although Redwood's bread and butter comes from advertising work, the studio is fully capable of handling music sessions. At an attractive £14 per hour 8-track rate, bookings are beginning to come in steadily from groups who lay down their basic rhythm tracks on 8-track and then transfer them to 16 or 24 for final mixdown at another studio. Makes sense really, because there's not much logic in paying out 24-track rates for a job that can be done on 8-track at a third of the price. This is one of the main factors inhibiting Andre from going 16-track at present.

The crux of the matter is that advertising customers don't need anything above 8-track, while the music side of the business is already something of a buyer's market with

a very wide choice of 16 and 24-track studios available. By expanding therefore, Redwood might actually lose out in the long run. With the present setup, Andre Jacquemin reckons to be doing very nicely thank-you, so he'll think long and hard when the time comes to make changes.

Incidentally, Andre's talents don't begin and end at fiddling with faders and positioning microphones. Along with Dave Howman, a partner in Rebel Records and tunesmith for such, er, luminaries as Joe Dolan and aspiring Rebel superstars 'Bumper', he's blossomed into something of a high-user in the jingle writing world. Readers living within receiving distance of London's Capital Radio will need very little introduction to the raucously subliminal Barrett's Liquormart jingle, which incised its way into London's collective subconscious around last Christmas. Just for the record, Jacquemin and Howman also penned such classics of the genre as the Houndsditch Warehouse melody, and a rather memorable little tune for a Smith's Twists tv campaign. Ah well—Lennon & McCartney had to start somewhere . . .

Dave Hamill

Quivering quavers

Chappell's, the 'more, much more than a record store' record store, recently (and very commendably) ran a 2-week promotion aimed at boosting general interest in jazz—and, of course, their sales of sheet music, records

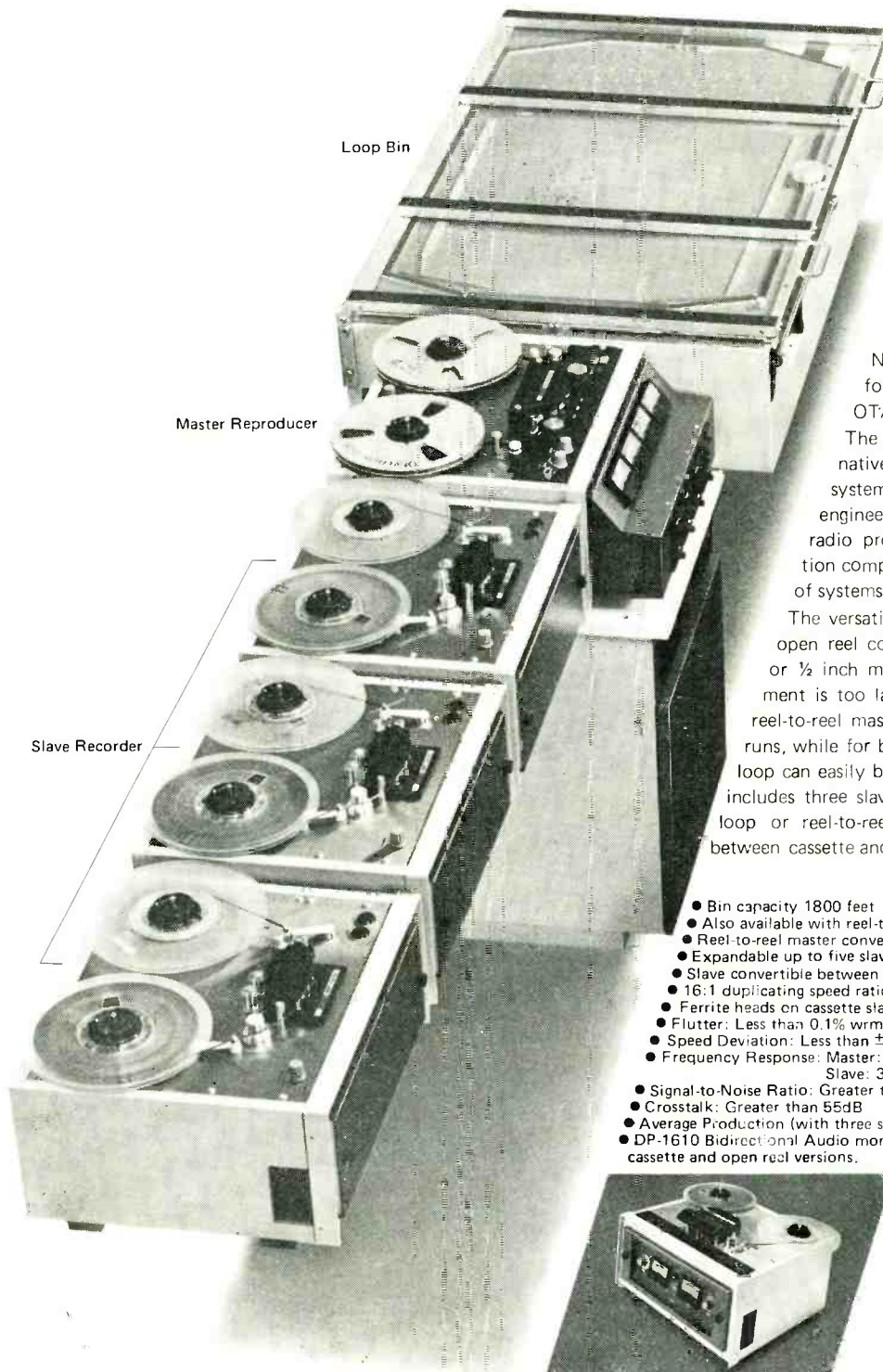
and instruments into the bargain. One of the evening events represented a few more words of the writing on the wall reported last month—namely that, as studios become ever more expensively equipped and the cost of hiring them soars, so it is inevitable that record producers with limited budgets will start looking at alternative production methods.

To set the scene, Chappell's was founded in 1811 by Samuel Chappell. Later he and his son Thomas showed remarkable foresight by purchasing the publishing rights of a wide range of musical material from Gounod's *Faust* to Gilbert and Sullivan's money-spinners. They also went into the manufacture of pianos, including one especially for Richard Strauss, and owned the copyright in so much material by the likes of Gershwin, Kern, Hammerstein, Ellington and Van Heusen that at any time, day or night, there is always enough Chappell music being publicly performed to keep the cash registers working overtime. In fact, Chappell's was one of the first businesses to be allowed into what was, in the early nineteenth century, the decidedly upper crust residential area of London's Bond Street; by concentrating mainly on selling pianos, Chappell's were rather more acceptable than your average 'shop'. Up until May 9, 1964, when the original building was completely gutted by fire, Chappell's retained the look and feeling of a Dickensian house, with chandeliers poised over a sweeping staircase, and an all-round feeling of luxurious plushness. And they not only had classy customers—there were blue-blood clients as well. When Edward VII wrote a song entitled *Gavotte*, it was a foregone conclusion that Chappell's would publish it. Although it is probably no great loss to serious music that the original manuscript of that song was lost in the fire of 1964, it was certainly a tragedy that original file copies of sheet music by Noel Coward, Irving Berlin, Cole Porter, Rogers and Hammerstein, Gilbert & Sullivan and Ivor Novello also went up in smoke. You can replace buildings, as Chappell's did in 1968, but not manuscripts like those.

As part of the recent Chappell's jazz promotion, leading jazzers, including Oscar Peterson, Acker Bilk and Ike Isaacs turned up at the Bond Street showrooms to talk or play, or both. One evening the downstairs area was left open for an extra couple of hours between six and eight pm. This

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was for a live performance by the Don Rendell Quintet, featuring saxist and flautist Barbara Thompson, whose combination of looks and talent would cause any male chauvinist to quiver. Open to the public, the session (which proved a more relaxed and better listening bet than many an expensive concert performance by bored and expensively imported jazz stars) was being recorded for possible future issue on Tony Williams's Spotlite label. Williams, who started issuing records as a hobby, now handles a catalogue of several dozen jazz titles as a full time occupation. Some are re-issues of old recordings, others of fresh material. But because Spotlite is a small label, it clearly can't afford the kind of rates currently being charged by multitrack studios and mobiles. There's no doubt, it hasn't escaped the notice of most producers that it is often easier to capture the spontaneity, atmosphere and enthusiasm of a live session, with a few mics and a mixdown straight to stereo, rather than using a plethora of close mics and tracks. But of course you can only work that way with a musically competent group, of which the Don Rendell Five is a shining example. One 4-piece suite lasting around 20 minutes went down on to tape in Chappell's show-room without retakes or audible goofs, after only five minutes' rehearsal.

To keep the recording budget to a minimum, Tony Williams had employed a classical musician, Nigel Keates, as engineer. He did the job with equipment which, at a rough estimate, must have a

total value of little more than £1000. A Revox A77 recording at 38 cm/s half-track, was used with Maxell UD35 tape. The mixer was a 6-channel Sony MX12 (now obsolete), fed by a crossed pair of AKG C451s around two metres at dead centre in front of the two solo wind players, Rendell and Thompson. An AKG D202 fixed on the music stand was spotting solos, and a Sennheiser MD121 covered the amplifier used by the



string bass player. A Beyer M500 hypercardioid ribbon covered the electric piano, and another AKG D202 was on the grand piano for the odd occasion when it was used. Monitoring was direct off the Revox using Sony DR-5A phones. And that, apart from the house pa installed by Chappell's themselves, was that. Incidentally, the C451 power feed was home-made, as were the balanced line-to-screened lead converters.

The drums were left unmiked, since Keates found that the pair of C451s was picking up sufficient from the drums and front line direct (with the aid of what was inevitably also being picked up from the house pa system being operated independently by Chappell's staff) to get a reasonable mix for the Quintet straight down into stereo. Once set, the mixer controls stayed pretty well untouched, and the only retake all evening was after a brief false start on one number—what went down on the tape is what is available for issue. There's no room for editing; and since the Sony mixer has no facilities for eq everything is as flat as a pancake, or at least as flat as the low-ceilinged room acoustics and essentially semi-pro recording equipment would allow.

Now what remains to be seen is how the finished product sounds and sells when it is released. Will the limitations of the equipment used and the short, virtually rehearsal-less session, override the feeling of informality and enthusiasm that made the live event so good? In a word, will the issued recording be 'stimulating' to listen to? Indeed, will the recording even warrant release, or will the project be abortive and written off as experience? Studios whose bread-and-butter lies in this kind of low-budget recording, but whose charges have been pushed up by inflation and capital outlay on multitrack equipment will, or at least should, be more than a little interested in the answers to these questions.

Adrian Hope

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SOUNDCRAFT
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reviews

Microphones

Calrec CM2050C/CM2051C
 Cambridge
 Peerless MBC 540
 Sennheiser MKH 415/MKH 435

Hugh Ford

ALL the microphones in this review were measured under identical conditions, the frequency response and polar diagrams being determined in open air conditions as opposed to strictly anechoic conditions. It follows that whilst errors may be present due to reflections, the identical errors were present for all microphones. Whilst I am bound to make these comments, in practice it was found that the measured performance was in all cases close to the manufacturers' specifications.



CALREC CM 2050C and CM 2051C

These microphones are described as 'Studio Transistor Capacitor Microphones' and comprise a tubular pre-amplifier equipped with an XLR plug at one end and a threaded connector for the capsule at the other end. The majority of the microphone is finished in matt black with the exception of two dull metal identification rings; thus the microphone is eminently suitable for film and television work where reflective surfaces are often undesirable.

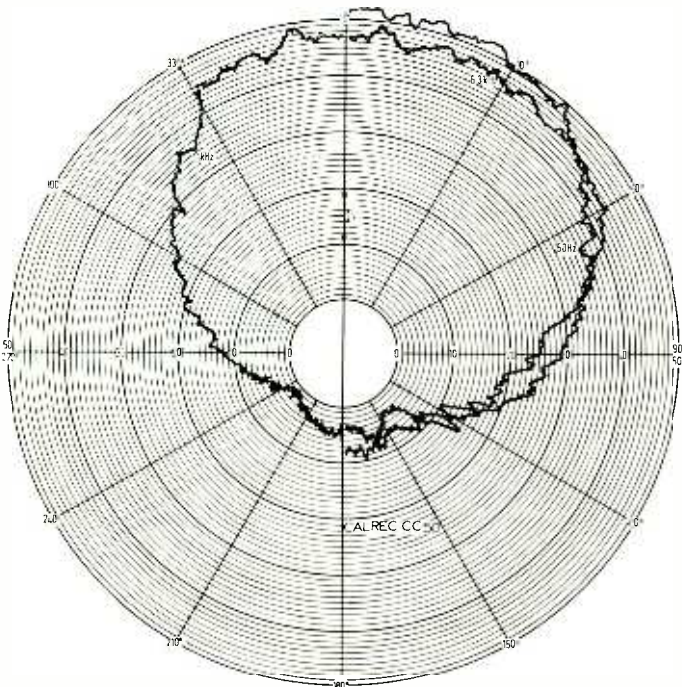
A number of alternative capsules are available to fit the pre-amplifier; the review samples were both cardioid capsules, the CM 2050 unit embodying the type CC50 full frequency range capsule and the CM 2051 having a similar capsule but with reduced bass response. The frequency response plots showed that high and mid frequency response was identical and that the specified difference in low frequency response was quite substantial.

As is to be seen from the polar diagram plots, the mid and low frequency polar response is also similar, but it appears that the high frequency front-to-back ratio of the type CC51 capsule is degraded. However, since the review the front-to-back ratio has been 'upgraded' and is similar to the CC50 on present models.

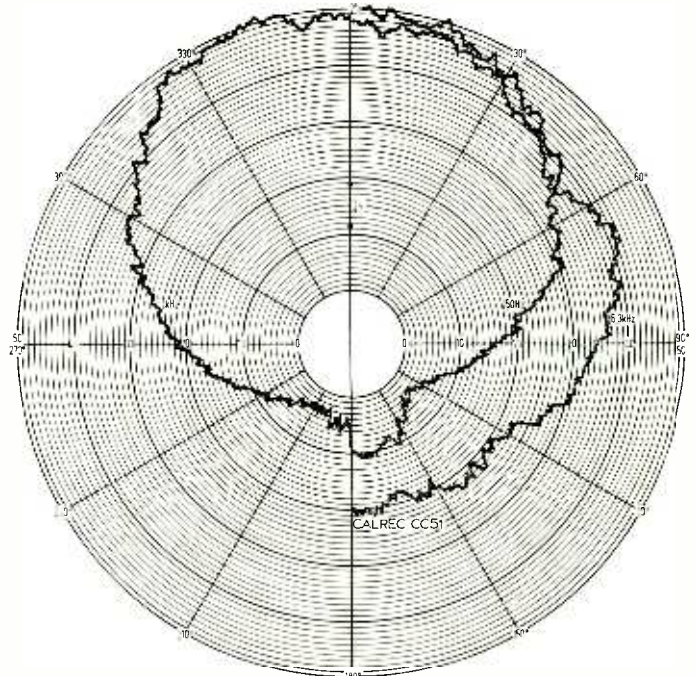
The sensitivity of the CC50 was found to be 0.84 mV/ μ bar, which is close to that of the CC51 capsule at 0.82 mV/ μ bar. The noise of both microphones was found to be identical at an equivalent sound pressure level of 23 dBA.

The output impedance was measured as 257 ohms at 1592 Hz, which is higher than the specified 100 ohms maximum, but quite low enough for most input configurations. However, perhaps the manufacturer's minimum recommended load impedance of 500 ohms is

70 ►



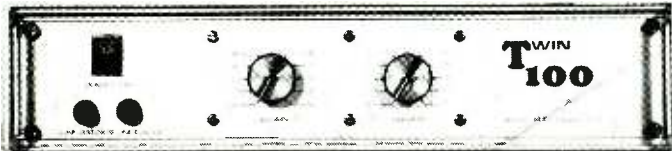
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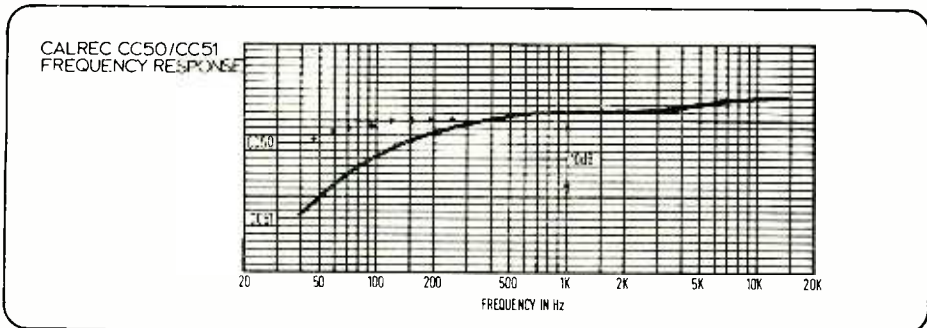
AUDIO TECHNOLOGY
EMT-FRANZ VG mbH.
P. O. B. 1520 D-7630 LAHR

**REVIEW: CALREC CM2050C
CM2051C and CAMBRIDGE**

suspect? The microphones' outputs are arranged for phantom powering to DIN standards at 40-54V which may be obtained from a Calrec power supply. The sample twin channel power supply had a zener diode stabilised 50V output to two XLR sockets, the signal being fed to XLR plugs on the power supply. No problems

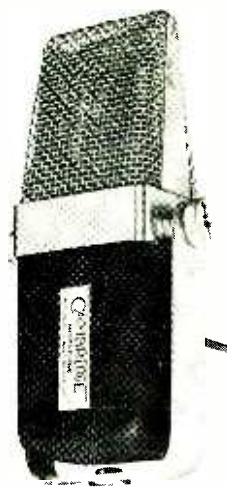
were encountered with the power unit, the standard of construction of which is fairly basic. It is felt that the mains lead was not adequately secured and also the fuse rating was not identified.

As with many capacitor microphones the Calrec is capable of delivering over 1V to the microphone input of the desk, so care must be taken to use inputs with an adequate overload margin.



CAMBRIDGE

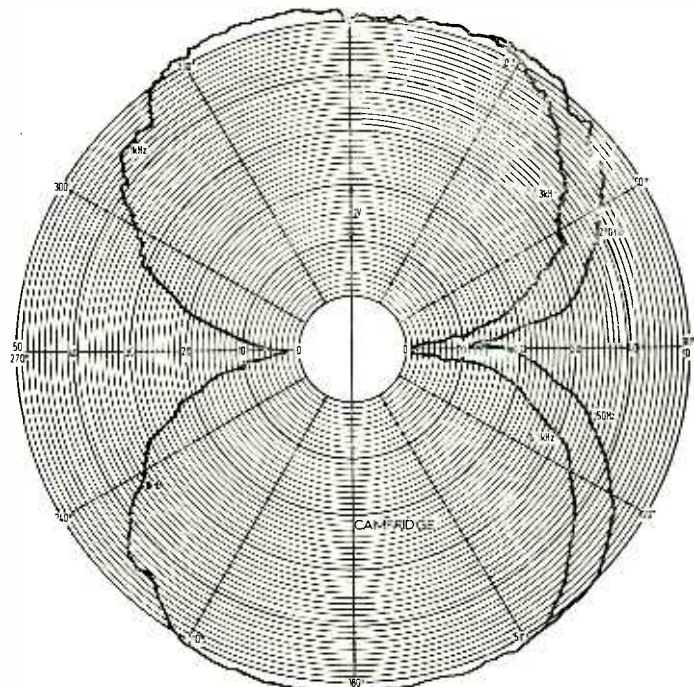
The Cambridge microphone has a figure-of-eight polar diagram derived from a ribbon transducer housed within a cubic body. This has a wedge-shaped dull chromium plated grille, the body being painted matt black. The review sample had an internal pre-amplifier, the power for which was provided by a separate power unit delivering $\pm 15V$ dc. Both the power and the audio feeds are connected between the power supply and the microphone by a single lead equipped with 5-pin DIN connectors which are unfortunately not of the locking variety!



The polar response was found to be a good figure-of-eight with relatively little sensitivity to frequency, and the overall response was generally flat, but attenuated in the bass.

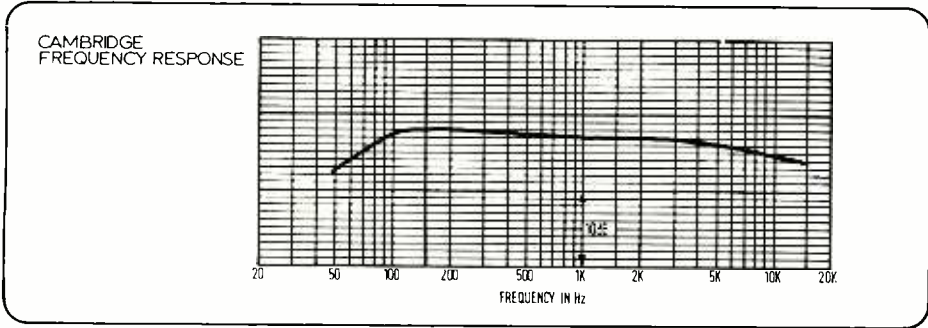
Sensitivity was measured at the power supply, which is equipped with XLR output connectors, and found to be 25 mV/ μ bar which means that the microphone, as reviewed, can deliver line level and that special precautions will be needed when using normal desk inputs.

On the other end, the noise from the microphone in terms of equivalent sound pressure level was low at 22 dB and no power supply hum components were noted. The power supply appeared to be a prototype unit, and was simply a metal box containing an encapsulated $\pm 15V$ supply and the DIN input and XLR output connectors. Since this was a 115V mains version, a very neat step-down transformer was provided for 240V operation.



THIS GRAPH REPRESENTS A LINEAR VOLTAGE FUNCTION TO DETERMINE LOGARITHMIC RELATIONSHIPS COMPUTE: $dB = 20 \log(V/V_0)$

The microphone was supplied with a rubber



suspension from which it can be hung by means of a 'U' bracket provided with swivels in the vertical and horizontal planes.

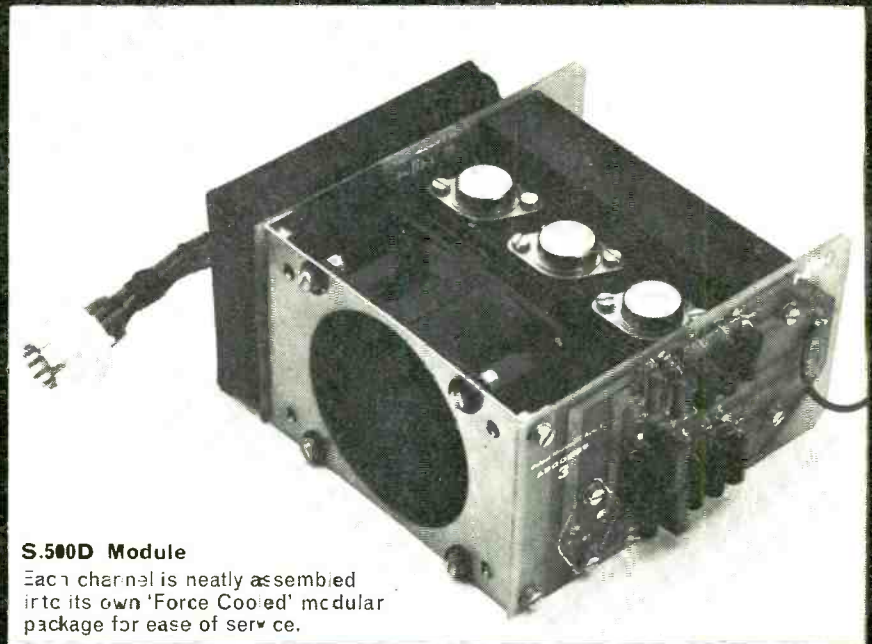
The output from the microphone or alternatively its power supply unit are identical asymmetrical outputs with a 274 ohm impedance at 1592 Hz, which is of course suitable for driving direct into most line inputs; however, if the manufacturer's power supply is not used, the microphone needs non-standard powering arrangements and non-standard connectors, thus requiring special arrangements for both power and signal connections.

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- * Bridged Mono output 300W R.M.S. into 5 ohms
640W R.M.S. into 8 ohms
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- * Power Bandwidth +0, -1dB from D.C. to 20KHz.
- * Very low Transient Intermodulation Distortion. Restricted rise time, fast slew rate.
- * Input sensitivity 0.75V for 300W into 4 ohms.
- * Noise 105dB Below 180V into 8 ohms 10Hz to 20KHz. Unweighted.
- * Elaborate system protection against short and open circuit operation
- * Small size 3 1/2" x 19" Rack mounting.
- * 1KVA Toroidal power supply providing 55 joules of energy.



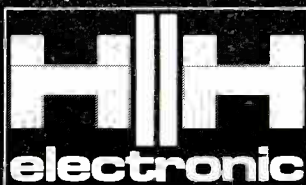
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REVIEW: PEERLESS MBC 540

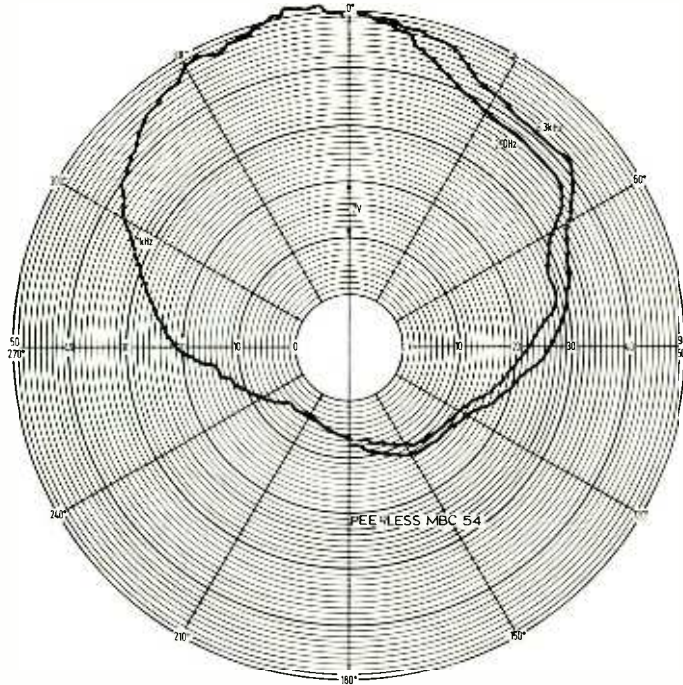
PEERLESS MBC 540

This is a condenser microphone with two alternative capsules: an omni-directional capsule or a cardioid capsule as in the review samples. Both types of capsule have fairly similar specifications in other respects.

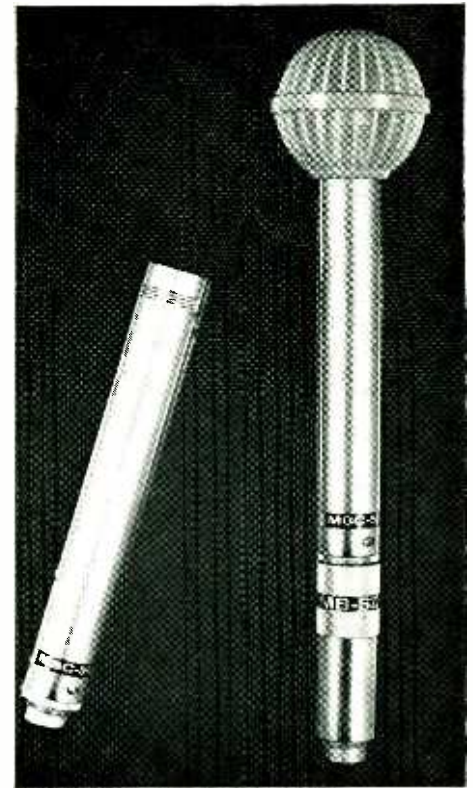
Construction of the microphone is in the

form of a tube housing a 5-pin locking DIN connector at one end and a threaded section to accommodate the capsules at the other. While the appearance is neat and the overall finish good, the rather shiny surface of the microphone could cause problems in film and television work.

An unusual feature of the microphone concerns the powering by two 15V internal bat-



THIS GRAPH REPRESENTS A LINEAR VOLTAGE FUNCTION TO DETERMINE LOGARITHMIC RELATIONSHIPS. COMPUTE: $\text{dB} = 20 \log(V_1/V_2)$

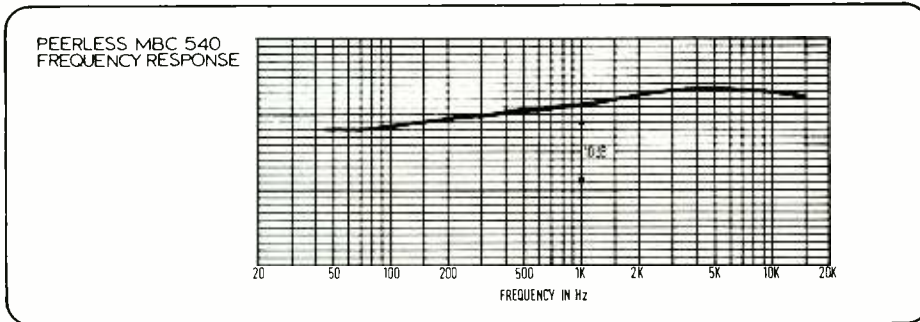


teries with a specified life of approximately 250 hours, the power to the pre-amplifier being switched via the inbuilt 5-pin DIN connector. The great advantage of this arrangement is that no external power supplies are necessary, and as the microphone is of low sensitivity it is compatible with normal dynamic microphone inputs. The microphone power can be switched at the microphone by plugging a small extension tube containing a slide switch into the microphone—this accessory has a 5-pin DIN plug and socket, the socket being locked on to the microphone by a threaded sleeve and the plug comprising a normal locking DIN connector for the microphone lead.

The measured sensitivity was found to be 0.5 mV/ μbar which, together with an internal impedance of 580 ohm at 1592 Hz and a recommended minimum load of 2000 ohms, makes the microphone generally compatible with dynamic microphone inputs if they have been properly designed for 600 ohm microphones; however, the input impedance of 200 ohm inputs is likely to be below the recommended minimum load and this factor rather restricts the use of this microphone in view of its small output level.

Because of the low sensitivity, the measurement of noise was not particularly simple. However it was confirmed that the 'A-weighted' noise was an approximate equivalent spl of 23 dB and, because of the powering system, there are no potential power supply noise problems.

Finally, as is to be seen from the plotted polar diagram and frequency response the polar pattern is a clean cardioid shape with little sensitivity to frequency. The overall on-axis response is generally flat with a small boost at high frequencies.



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Stereo Disc Amplifier 2 is a self contained mains powered unit which accepts cartridge inputs and produces balanced line level outputs. Permanent rumble filtering and switched scratch filtering is included.
FURTHER SPECIFICATIONS: (For THD, IMD etc. see March advertisement page 78.)
1 KHz at 6mV set for OdBV.7 output. Loaded 600 ohms.

- | | |
|---|---|
| FREQUENCY RESPONSE RIAA ACCURACY | Within 0.5dB |
| 30Hz-20KHz | Output + 24dBV.7 |
| CLIPPING AT 1KHz | Within 0.5dB |
| CLIPPING POINT COMPLEMENTARY TO RIAA CURVE | |
| 30Hz-20KHz | |
| Clipping determined by onset of peaky distortion products or THD exceeding - 80dB, 0.01%. | |
| CROSSTALK | 1KHz-76dB; 30Hz-20KHz -60dB |
| OUTPUTS | Electronically balanced, source impedance 50 ohms. |
| H.F. FILTER | |
| Front panel switch | 10KHz, 18dB/octave |
| Change in response at 8KHz or below | Less than 0.5dB |
| SENSITIVITY @ 1KHz | 2.8-13mV for OdBV.7 output. Presets adjustable through holes. |

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A compressor-limiter with push button ratio and automatic threshold selection; 30dB control range; and LED gain reduction indicator.

A sweep equaliser with three sweep sections: 20Hz to 1kHz (Q=3), 75Hz to 7.5kHz (Q=1.5), and 400Hz to 20kHz (Q=3), each with an amplitude control range of 40dB; overall LED overload indicator and output attenuator.

A parametric equaliser with the same three frequency sections as above plus variable bandwidth from half an octave to five octaves; and LED optimum modulation indicator.

A high pass dynamic noise filter with programme controlled variable slope filter (0 to 18dB/octave) with turnover frequencies at 100, 200 and 400Hz, to progressively attenuate low level, low frequency noise below the threshold; and a 20 or 40dB full frequency gating option.

A low pass dynamic noise filter similar to the high pass except it has turnover frequencies of 2, 4 and 6kHz to dynamically attenuate low level high frequency noise.

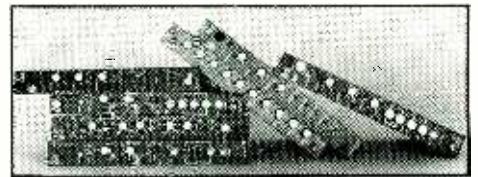
An octave equaliser providing 12dB lift or cut at the ten standard centre frequencies between 31.25Hz and 16kHz.

An LED display column with 20 LEDs per column; range of +16dBm to -40dBm; and switchable to display PPM or VU characteristics.

An expander gate with a range control to vary the maximum low level attenuation and automatically adjust the slope; a remarkably fast attack time ($>5\mu\text{S}/10\text{dB}$); a 20:1 slope gating mode; and selectable peak or rms level sensing.

The basic box is 19" by 8 $\frac{3}{4}$ " by 13 $\frac{1}{2}$ ", and is therefore standard rack mounting. It has an external power supply feeding common internal power rails. All connections are via Molex multi-way connectors.

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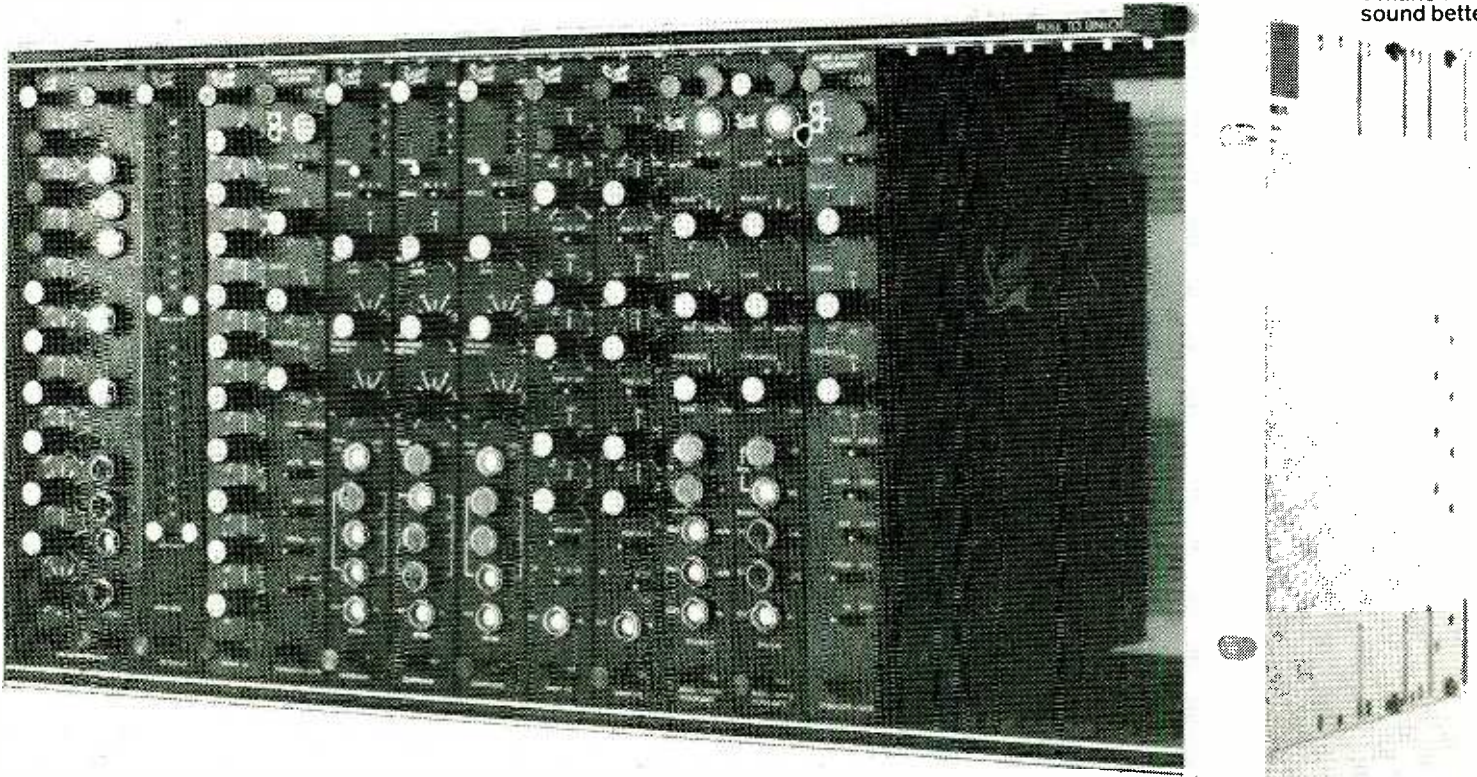
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REVIEW: SENNHEISER MKH 415 and MKH 435

SENNHEISER MKH 415 and MKH 435

Both these Sennheiser microphones are radio frequency condenser microphones using a line transducer. The principle of the radio frequency condenser system is that the variation in capacitance of the transducer is used to vary the radio frequency input to a detector. Thus there is no polarising voltage required, eliminating a number of design problems.

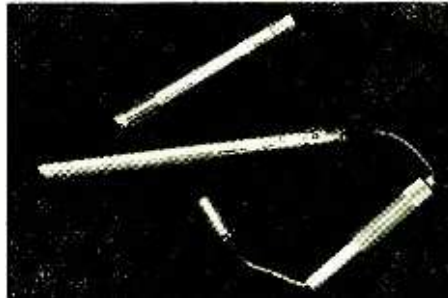
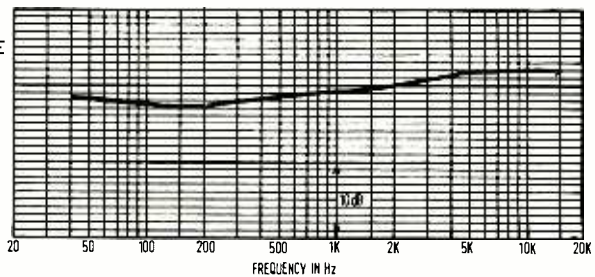
The microphones are of tubular construction with a satin nickel finish to a high standard. One end of the tube houses the connector which may be either a 3-pin *XLR* type or a locking DIN type. The transducer is at the other end of the tube which has a series of slots in its side (at the transducer end); the number of slots is greater in the more directional *MKH 435* unit.

Powering is by the DIN Standard A-B method which feeds the dc power down the audio leads and is compatible with the popular portable professional recorders. In the studio the power may be derived from a number of Sennheiser 12V power units, or alternatively battery adaptors are available which can be inserted at any convenient point in the microphone line.

The *MZA 15U* battery adaptor, which was provided with the review sample, is a tubular container with short leads at each end equipped with *XLR* connectors—this just plugs into the microphone line and is specified as giving 60 hours power from a set of nine Mallory type *RM625* cells: rather an expensive proposition! In addition to housing the power supply, the adaptor contains a battery check function and also provides the necessary isolation of the output from the dc power to the microphone.

The reason for this powering system, however, is that the mics were originally designed for location work, and since the review two

SENNHEISER MKH 415/MKH 435 FREQUENCY RESPONSE



48 volt phantom-powered mics have been introduced: the *MKH 416*, which is equivalent to the *MKH 415*; and the *MKH 106*, which is equivalent to the *MKH 435*, but physically smaller.

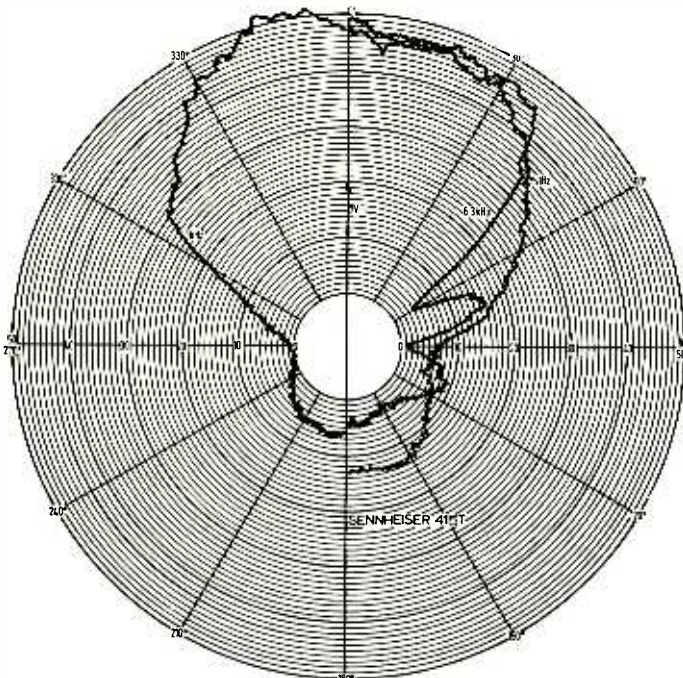
Turning to the balanced microphone output, this is a high level and low impedance output suitable for driving into any load greater than 200 ohms with a measured source impedance of about 15 ohms at 1592 Hz. Thus the output impedance will drive any normal loads, but the high microphone sensitivity measured at 2.2 mV/ μ bar in the case of the *MKH 435* and 2.7 mV/ μ bar for the *MKH 415* means that a practical output of hundreds of millivolts will be normal. Thus either input attenuators may be required, or inputs with a very high overload point must be used.

Microphone noise was similar for both types, the equivalent sound pressure level being 22 dB spl for the *MKH 415* and 24 dB spl for the *MKH 435*, compared with the manufacturer's claim of 23 dB spl.

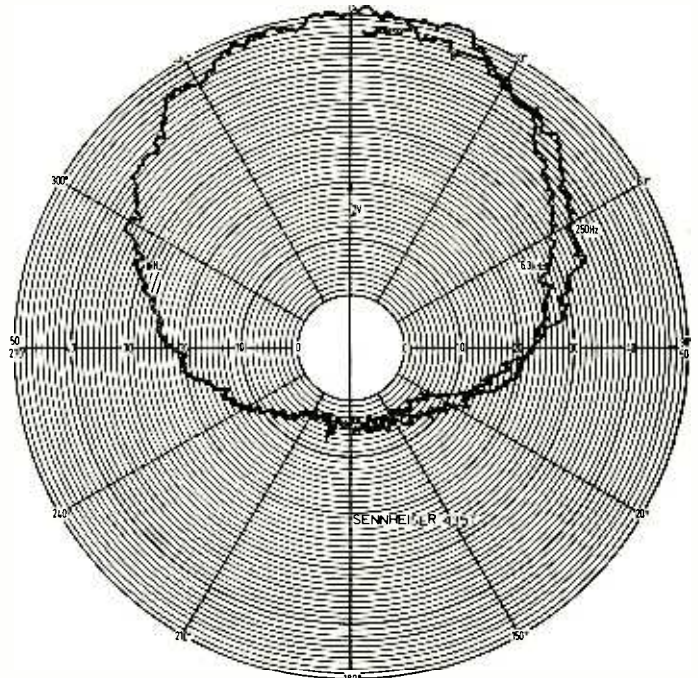
The differences between the two models lie in the polar diagram and frequency response. As is to be seen, the polar response of the *MKH 415* is cardioid at low and medium frequencies, becoming more directional at high frequencies with the normal side lobes associated with this characteristic. The polar response of the *MKH 435* is strictly cardioid and insensitive to frequency.

In the case of frequency response, the *MKH 415* is specified as having a high and low frequency boost when measured at 10 cm with the response flattening in the bass and leaving a mild high frequency boost with normal measurement—this characteristic being the standard response of the *MKH 435*. Our measurements indeed confirmed that both microphones had identical frequency responses to all intents and purposes, and for that reason, only one response curve is appended.

Originally, we had intended to publish a practical appraisal of the review microphones, written by recording engineers, to accompany the objective results obtained by Hugh Ford. Due to circumstances beyond our control, the former aspect fell through.



THIS GRAPH REPRESENTS A LINEAR VOLTAGE FUNCTION TO DETERMINE LOGARITHMIC RELATIONSHIPS COMPUTE $\text{dB} = 20 \log(V/V_0)$



THIS GRAPH REPRESENTS A LINEAR VOLTAGE FUNCTION TO DETERMINE LOGARITHMIC RELATIONSHIPS COMPUTE $\text{dB} = 20 \log(V/V_0)$

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Ferrograph ARA 1

Audio Response Analyser

Hugh Ford



25 dB or 10 dB, the latter giving a 0.1 dB resolution. As standard, the display graticule covers 20 Hz to 20 kHz and +4 dB to -6 dB, but alternative graticules are available and it only takes a few seconds to change them. For production line work it is a simple matter to trace frequency response limits on to the graticule with a wax pencil; as variable illumination is provided, it is easy to read the calibration marks.

A long persistence magnetically deflected cathode ray tube is used for the display with, in addition to a manual brightness control, a feature whereby the brightness is automatically increased at high writing speeds. In practice the display brightness was quite adequate for normal room lighting and the spot size was adequately small. However there was some parallax between the spot and the graticule calibrations with the result that care was required when reading to fine limits.

There are not, as such, any further controls for the display, as it finds its own place on the X-axis by detecting the incoming frequency, such that it can be used without any interconnection with the source. Hence the display can be used with calibration tapes, test discs or any other discrete or swept frequency source.

The second part of the Audio Response Analyser is a sinewave oscillator which can be operated in three different modes. Firstly there is a manual frequency control which can tune the oscillator to any fixed frequency between 20 Hz and 200 kHz, the frequency being read from the display by pressing a 'check frequency' button. Further, the oscillator can be operated in two swept frequency modes with either continuous sweeping or single shot sweeping between preset limits; the sweep time is variable by a front panel control.

In the swept mode there are alternate upward and downward frequency sweeps within the maximum range of either 20 Hz to 20 kHz, or 200 Hz to 200 kHz, or with a rear panel switch operated over a single decade. Further rear panel facilities include a fixed level squarewave output and the facility to drive the display's frequency axis from an external source. This facility is required when measuring such things as crosstalk or very steep filters, as, in these circumstances, the input to the display may be inadequate to drive the automatic X-axis circuits. In this case the display may be driven from the input of the oscillator or from the wanted signal as opposed to the crosstalk signal.

In addition to these rear panel facilities there is a multiway socket providing a number of useful facilities including remote control functions. A slide switch associated with this socket disconnects the crt display from its X-axis frequency detector and its Y-axis logarithmic amplifier, making the display available as a general purpose X/Y display via the multiway socket. Similarly, the outputs from the frequency detector and the logarithmic amplifier are available at the multiway socket for driving an X/Y plotter to produce hard copies of response data. In both cases the voltage at the drive input/output is $\pm 1.5V$ for the X-axis or +1, -1.5V for the Y-axis.

The remaining remote facilities include Z modulation of the display, remote frequency control together with the setting of upper and lower sweep limits, etc.

MANUFACTURER'S SPECIFICATION OPERATING CONDITIONS

Temperature range: 5° to 40°C ambient.
Supply voltage: 115/230V : 10% 50/60 Hz.

OSCILLATOR

Maximum frequency range: 20 Hz to 30 kHz or 200 Hz to 200 kHz.

Automatic sweep range: upper and lower limits independently adjustable over full range.

Continuous sweep mode: approximately exponential sweep, speed adjustable from approximately 0.1 to 1 decade/s. Remains constant when sweep limits are altered.

Single sweep mode: single upward or downward sweep between selected limits when START button is operated.

Output level: total range -80 dB to +24 dB relative to 775 mV (80 μ V to 12V rms). Attenuator -80 to +10 dB in 10 dB steps. Fine level range 0 (CAL) to +14 dB continuously variable. Level accuracy in CAL position ± 0.2 dB. Attenuator accuracy (rel to 0 dB position) ± 0.2 dB.

Output impedance: 50 ohms $\pm 2\%$ in all positions.

Distortion: total harmonic products: 20 Hz to 20 kHz <0.25%; 20 kHz to 100 kHz <1.0%; 100 kHz to 200 kHz <2.0%.

Monitor output: squarewave amplitude 1V p-p nominal, source impedance <1k.

DETECTOR

Frequency range: X1: 20 Hz to 30 kHz total; 20 kHz maximum with standard graticule. X10: 200 Hz to 200 kHz.

Frequency accuracy: with 3-decade graticule: steady frequency: $\pm 4\%$ ± 1 Hz; with 1-decade graticule, steady frequency: $\pm 2\%$ ± 1 Hz.

Horizontal response speed: with swept frequency, indication updates every cycle of input signal on X1 range and every 10 cycles on X10 range.

Input impedance: 1M Ω $\pm 2\%$ shunted by 30 pF nominal.

Input level (ref to 775 mV) total range: -80 dB to +48 dB (x5 position, minor division=1 dB); -65 dB to +40 dB (x2.5 position, minor division=0.5 dB), -56 dB to +34 dB (x1 position, minor division=0.2 dB).

Attenuator: -50 to +20 in 10 dB steps. Fine level range continuously variable 0 (CAL) to +10 dB.

Display range: X1 position -6 dB to +4 dB; X2.5 position -15 dB +10 dB; X5 position -30 dB to +20 dB.

Attenuator accuracy (rel to 0 dB position): ± 0.2 dB.

Level accuracy: in CAL position, 0 dB on screen ± 1 minor division.

Display accuracy (relative to 0 dB line): ± 1 minor division.

Maximum input level: 200V ac or dc all ranges.

Rectifier law: average reading rectifier calibrated in terms of rms value of sinusoidal input.

Frequency response: Rel to 600 Hz, 20 Hz to 50 kHz ± 1 minor division. Rel to 600 Hz, 50 kHz to 200 kHz ± 2 minor divisions.

Vertical response speed: with steady change of level, using appropriate vertical range, error does not normally exceed 0.2 dB at 20 dB/s or 1 dB at 60 dB/s.

External frequency input: minimum level 100 mV. Input impedance 100k Ω nominal.

External control voltages: all control signals normally required for remote operation are provided at a socket on the back panel.

Price: £1950.

Manufacturer: Wilmot Breeden Electronics Ltd, 422 Bath Road, Slough SL1 6BB.

THE Ferrograph Audio Response Analyser offers a cathode ray tube display of frequency response with a useful display area 280 mm wide by 152 mm high. As is conventional, the X-axis of the display comprises a logarithmic frequency scale covering three decades which can be switched to be either 20 Hz to 20 kHz or 200 Hz to 200 kHz. However, a rear panel switch can be used to change the horizontal axis to a single decade, such as is necessary for examining the characteristics of sharp filters.

The vertical axis is a linear decibel scale with switchable full scale sensitivities of 50 dB,

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TEAC 3300 SX 2T
TEAC 6300
TEAC 6100
TEAC 7300
TEAC 7300 2T
TEAC 7300 RX
FERROGRAPH (ALL MODELS)
TANDBERG 3500 X
TANDBERG 9100 X
TANDBERG 10 XD
OTARI MX 5050/2/4

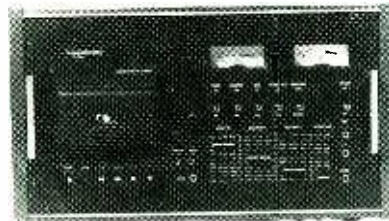


TEAC 3340 S
OTARI MX 5050 QXHD

8 CHANNEL
BRENNEL STANDARD 8
BRENNEL MINI 8
OTARI MX 5050 8SD
TASCAM 80-8

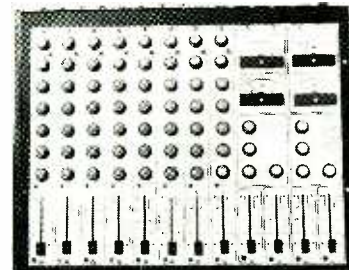
4 CHANNEL
TEAC 2340 SX

CASSETTE RECORDERS



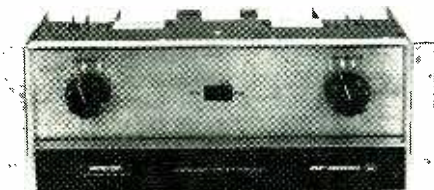
HARMAN KARDON HK 2000
YAMAHA TC 511S
YAMAHA TC 800 GL
NAKAMICHI 550
NAKAMICHI 600
NAKAMICHI 700
NAKAMICHI 1000

MIXERS



ALLEN & HEATH NON MIX
ALLEN & HEATH MINIMIXER
ALLEN & HEATH QUASI MIXER
ALLEN & HEATH PRODUCTION MIXER
ALLEN & HEATH POP MIXER
ALLEN & HEATH MODULAR
TASCAM MODEL 2 TASCAM MODEL 3
TASCAM MODEL 5 LAMB 422 ALICE AD 62
M.M. (FULL RANGE)

POWER AMPS



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T.P.A. 50
T.P.A. 100

AMCRON 1C 150
AMCRON D 60
AMCRON D 150A

HARMAN/KARDON CITATION 12
HARMAN/KARDON CITATION 16

STEREO AMPS
REVOX A78 YAMAHA CA 410 YAMAHA CA 610
YAMAHA CA 800 YAMAHA CA 1000

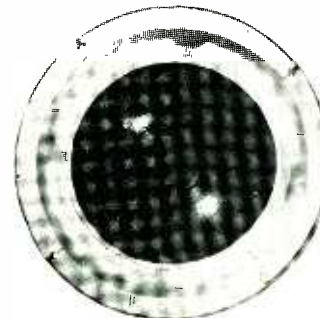
AMCRON DC 300A
AMCRON M 600
YAMAHA B1
YAMAHA B2
PHASE LINEAR 400
PHASE LINEAR 700B
REVOX A740

STUDIO MONITORS



TANNOY EATON
TANNOY DEVON
TANNOY CHEVIOT
TANNOY BERKELEY
TANNOY ARDEN
YAMAHA NS 1000 JBL 136
JBL L100 JBL L65 JBL L200B
ACOUSTIC RESEARCH (FULL RANGE)

CHASSIS SPEAKERS



TANNOY HPD 295
TANNOY HPD 315
TANNOY HPD 385
GAUSS (ALL MODELS)
ATC (ALL MODELS)
JBL (ALL MODELS)

HEADPHONES

YAMAHA HP 1 YAMAHA HP 2 REVOX RH 15
AKG K140 AKG K160 AKG K240



MICROPHONES

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FERROGRAPH ARA 1

Display

The only means of determining the frequency of the internal oscillator is by using the display, thus it is equally useful for determining the frequency of the internal oscillator or external sources. It was found that at mid-point on the X-axis, the indicated frequency was within 1.5% of the correct frequency with the errors increasing to a maximum of 2.5% at the edges of the display. This performance, well within the manufacturer's specification, is quite adequate for general frequency response measurements, but naturally will not be adequate in some circumstances: such applications as the tuning of very sharp filters and adjusting stereo decoders require greater accuracy.

On the Y-axis absolute measurement of input level is effected by the display reading together with the setting of the input attenuators—this comprises a 10 dB attenuator and a variable attenuator which has a switched 'off' position for absolute measurements. In addition the full-scale display range settings which can be 10 dB, 25 dB or 50 dB are taken into account. Using the 10 dB range the indication of 0 dBm input was read as -0.07 dB, but parallax is a problem when reading to fine limits—I consider accuracies better than ± 0.1 dB with the 10 dB range to be doubtful.

The accuracy of the step attenuator which is calibrated for +20 dB to -50 dB was within ± 0.1 dB over the entire range, and there was no significant shift of the zero point on the display when changing display ranges. The only significant indication errors arise from the linearity of the display. These errors are shown in **figs. 1 and 2** for the 10 dB and 25 dB full scale display ranges. It is to be noted that the incremental errors between major scale divisions are in the order of 1% of range, but that the cumulative errors do not show much increase above the incremental errors. This demonstrates good linearity of the display and the logarithmic converter.

The speed of response of the Y-axis level display was such that very rapid level changes produced an overshoot in either direction, and as a rough rule the practical limit on speed was found to be a maximum level change rate of full scale deflection in one second. It follows that if rapidly changing responses are being traced, a low horizontal sweep speed must be used. Overall the response speed was a good compromise, giving a steady trace down to 40 Hz with the 10 dB range, and about 0.2 dB wobble of the trace at 20 Hz.

The overall frequency response of the display was found to be flat within 0.1 dB from 35 Hz to 118 kHz, falling to -0.4 dB at 200 kHz and -0.2 dB at 20 Hz, the speed of response of the X-axis being very rapid and without any overshoot.

Tracking of the frequency axis was generally satisfactory down to 1 mV input at all frequencies (being better at high frequency), below which it was necessary to use the external frequency drive which required a minimum level of 100 mV for all frequencies. Using the normal input, the frequency axis was obviously affected by the signal-to-noise ratio of the input signal, but provided that the signal was at least 20 dB above noise, locking was perfectly satisfactory.

FIG. 1
FERROGRAPH ARA1
DISPLAY ACCURACY
IN 1dB STEPS ON
10dB RANGE

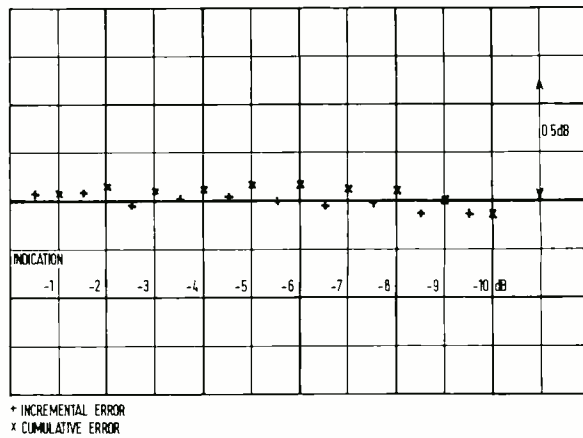
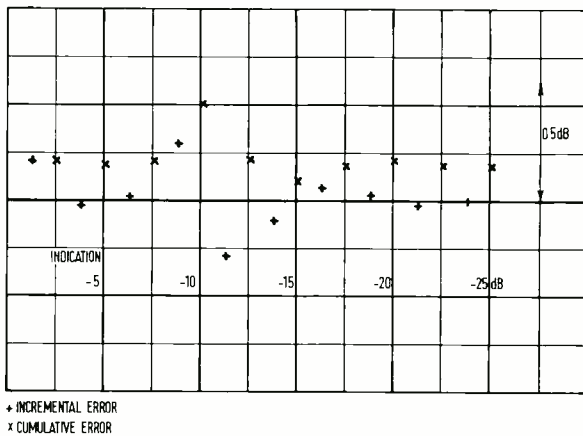


FIG. 2
FERROGRAPH ARA1
DISPLAY ACCURACY
IN 2.5dB STEPS ON
25dB RANGE



Oscillator

The oscillator output was controlled by a 10 dB step attenuator covering the range +10 dBm to -80 dBm with a measured accuracy of better than 0.1 dB over the entire range. A fine output control is also fitted and covers a 14.5 dB range above the setting of the step attenuator. At the zero dBm settings the output was found to be -0.16 dBm at 1 kHz with the flatness of the output being better than ± 0.2 dB over the nominal frequency range of 20 Hz to 200 kHz.

In practice the manual frequency range extended from 17.7 Hz to 255 kHz, and the automatic sweep modes gave a similar coverage but with selectable upper and lower limits. The actual sweep speed was controllable over a very large range without any evidence of oscillator bounce or other unwanted effects. In addition to the front panel sinewave output, there is a fixed level (1V peak to peak) squarewave output at the rear panel. This could be useful as a source of quite fast squarewaves, as the risetime was found to be 800 ns and the fall time 500 ns.

Considering that the instrument's oscillator is a swept unit, the harmonic distortion was remarkably low (see below).

Analysis of the harmonic content showed that the seventh harmonic was quite high in level at -65 dB (0.055%) at 1 kHz, but in any

terms this is a useful oscillator for purposes other than determining frequency response.

Both the available range of output level and the fact that the output impedance was constant with attenuator setting at 50 ohms make the oscillator suitable for use on high and low level inputs, thus eliminating the necessity for extra attenuators. It also provides a maximum level of +24 dBm which is sufficient for most applications.

Summary

The Ferrograph Audio Response Analyser is an extremely useful tool for production line work, and also for general maintenance purposes on all classes of audio equipment. This type of frequency response display has the particular advantage that it tracks the input signal, and can therefore be used for quick checks on pre-recorded material such as discs and tapes.

Operation is simple so that the unit can be used by unskilled personnel without difficulty, and the ability to quickly change graticules is a great asset.

In many instances the internal oscillator has the performance to eliminate the necessity for auxiliary oscillators for distortion measurement, and unlike many sweep oscillators its output does not contain extraneous non-harmonically related tones. ■

Frequency	20 Hz	200 Hz	1 kHz	10 kHz	20 kHz	100 kHz
Total harmonic dist	0.18%	0.17%	0.11%	0.18%	0.23%	1.35%

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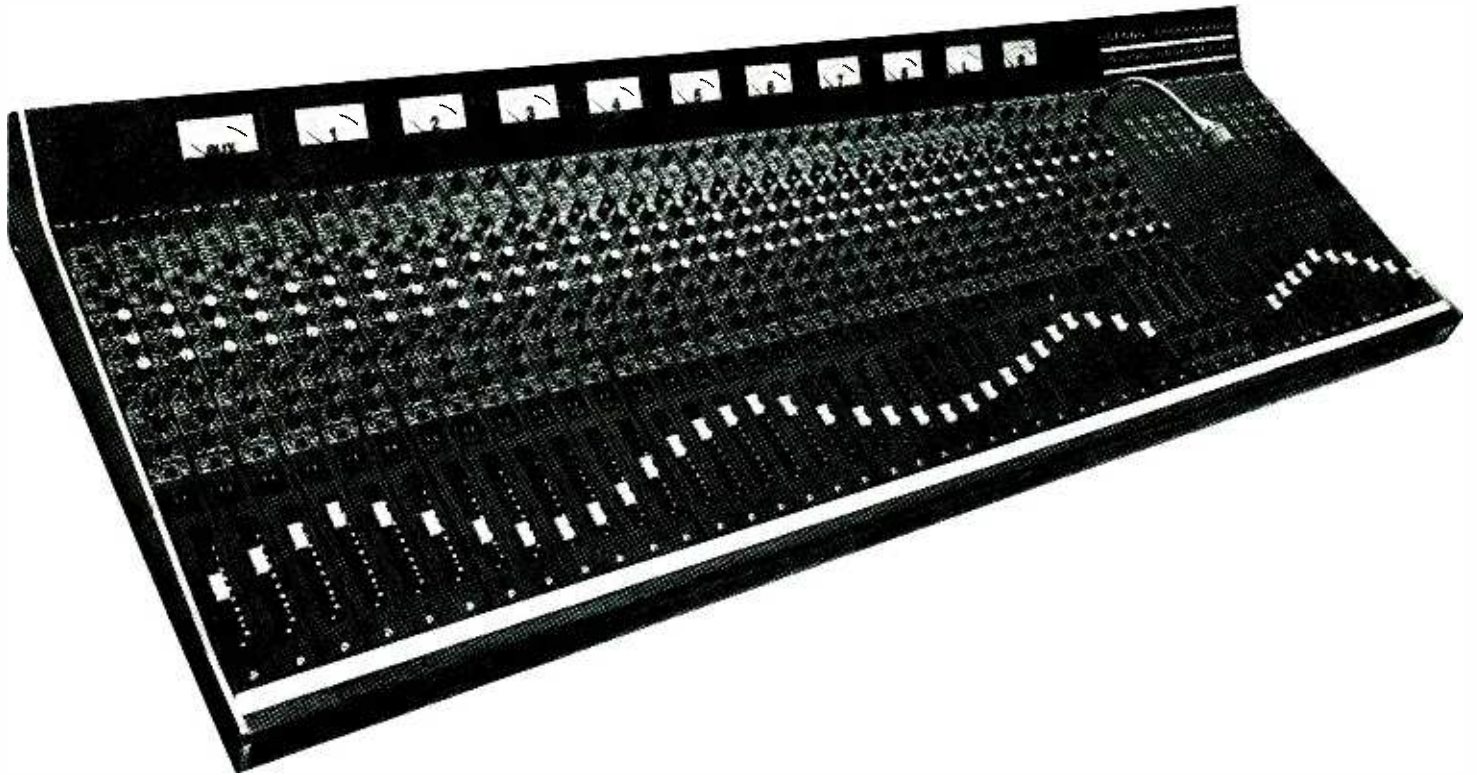
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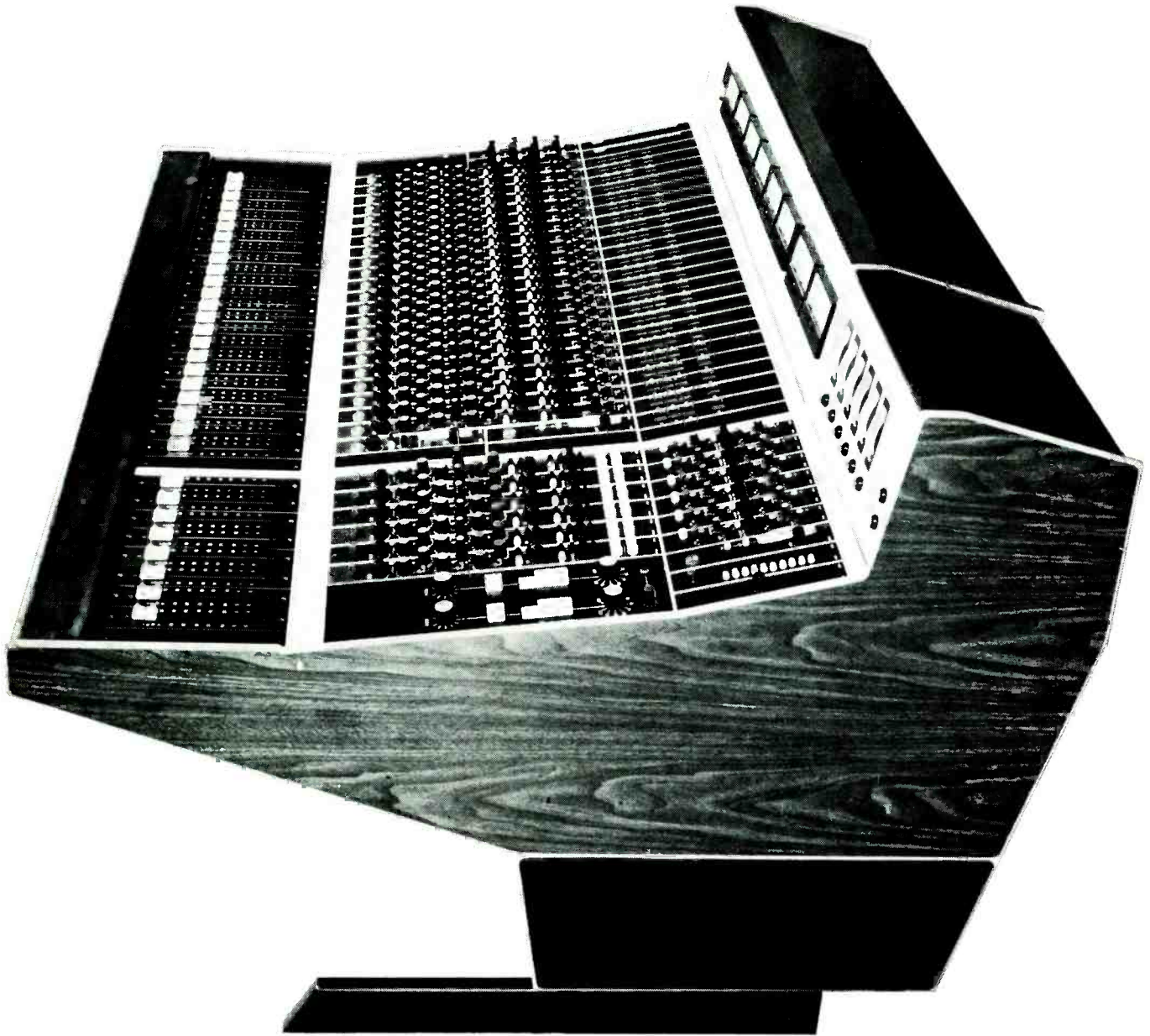
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