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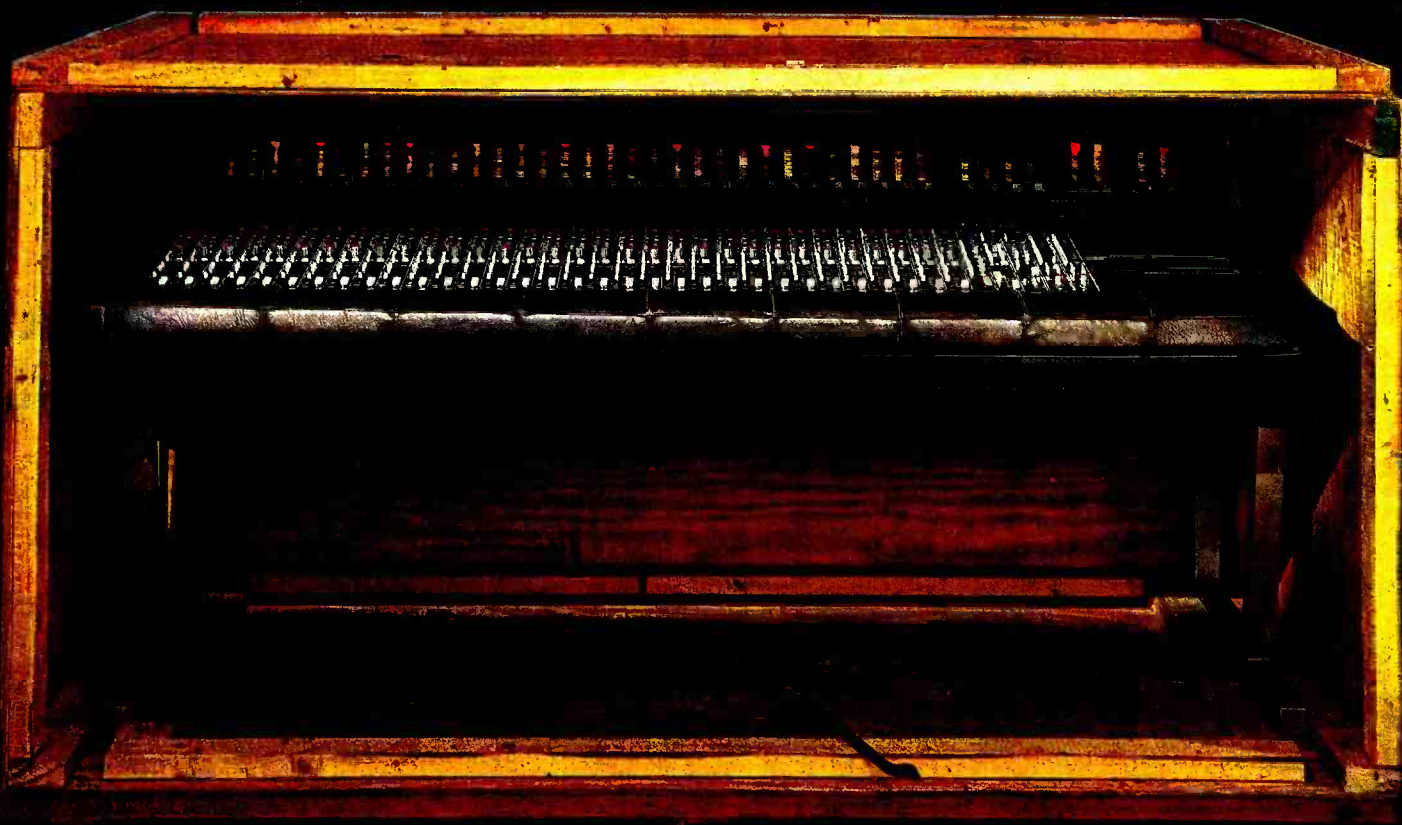
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studio sound

AND BROADCAST ENGINEERING

So what's new?

A glance at this month's contents would suggest that heavier emphasis than usual has been placed upon new equipment, rather than who is doing what, where and when (and to whom, perhaps?).

Following our extravaganza last month, it would seem timely to take an extensive look at the state of the market. While the recent NAB and AES conventions produced few surprises, there were strong indications that the emphasis of the market has radically altered—with respect to both volume and direction.

Certainly the volume of business seems to have taken an upswing—witnessed not only by the size of the Los Angeles AES, but also by the fact that this year's APRS exhibition is being held over three days instead of two. Here's to a good one.

Reviews reviewed

While technical specifications can tell us a lot about how a piece of gear will interface with present equipment, and supply electrical criteria (distortion, frequency response, noise, etc), when it comes to questions of how the unit behaves/misbehaves in real live studios, we are often left in the dark. It will come as a refreshing change, then, that this month's issue contains the first in a continuing series of 2-part (operational/technical) reviews. Both parts are intended to complement each other and provide a more useful overall assessment of a piece of equipment's 'value' in the recording environment.

Still on the subject of 2-part reviews, we had intended to give this treatment to the *Timewarp* unit from MicMix. However, both Nik Condron and Hugh Ford discovered that the unit was substantially below the quality demanded by today's exacting studios. The company is now redesigning the unit and we will be publishing a review of the 'MkII' in the near future. We'll let you know how it fares.

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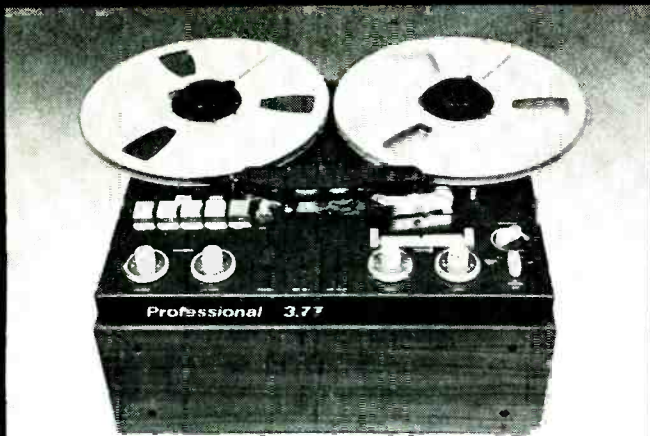
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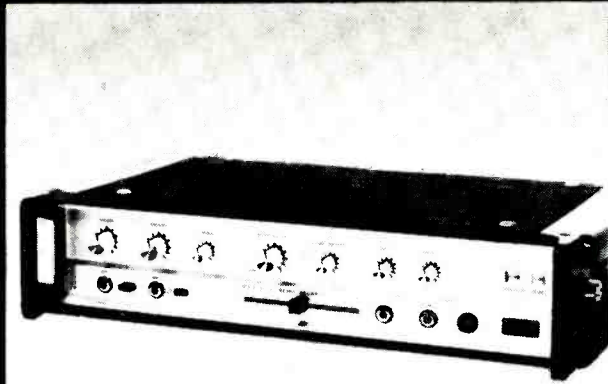
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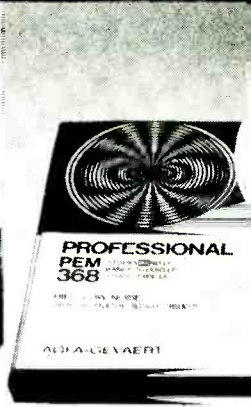
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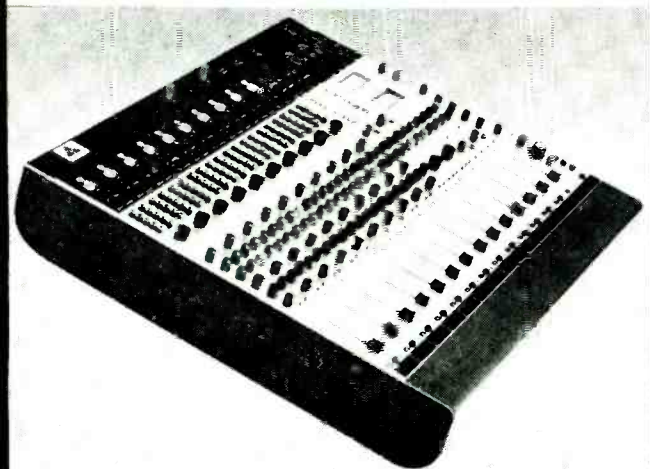
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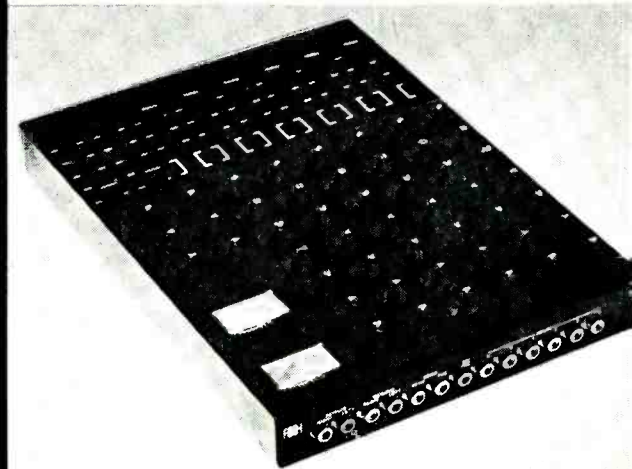
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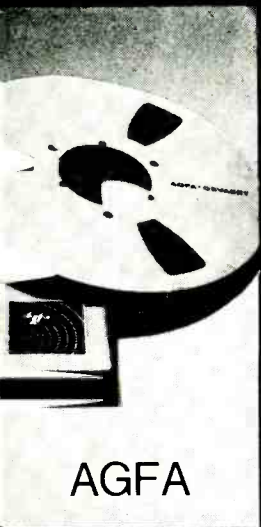
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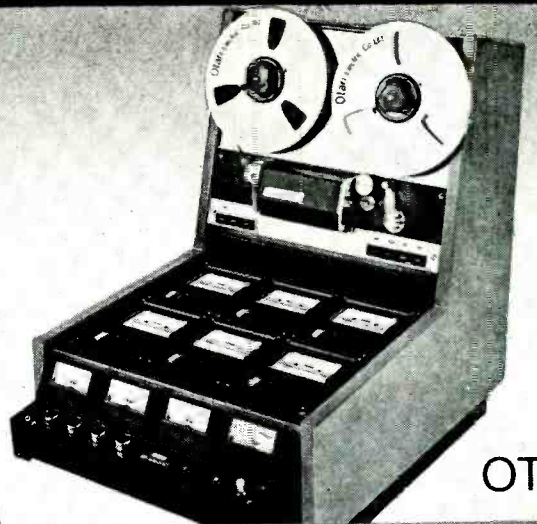
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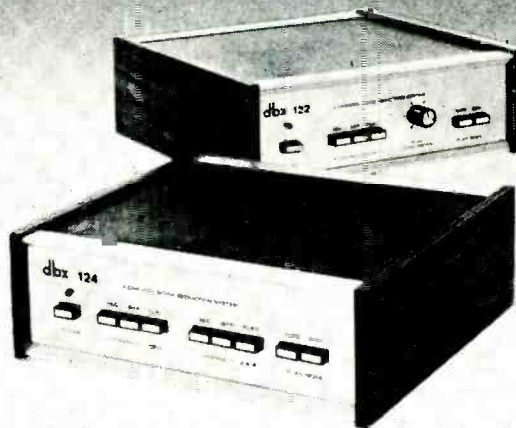
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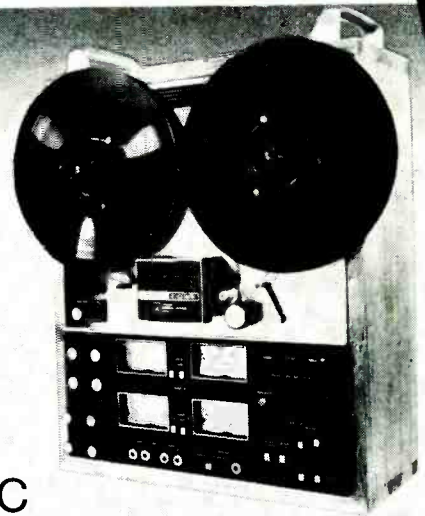
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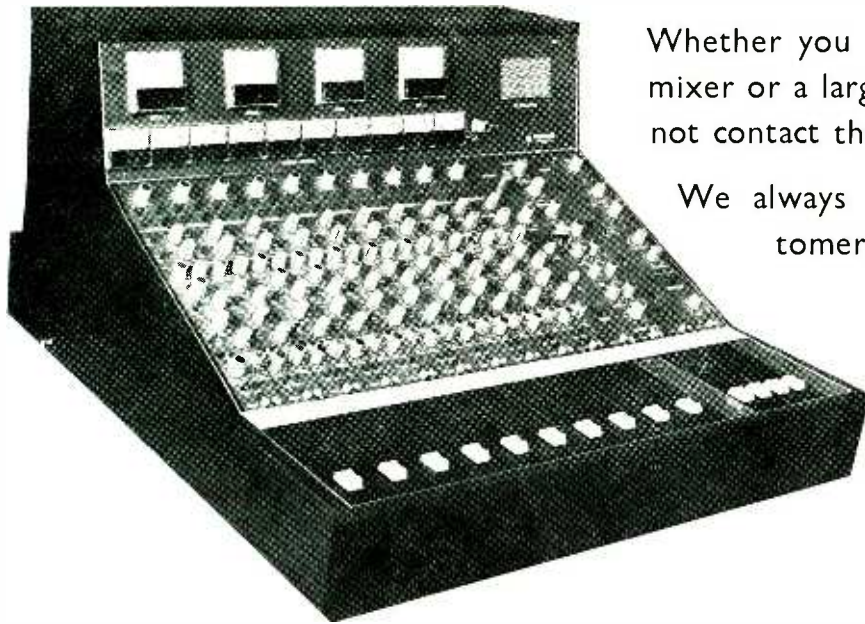
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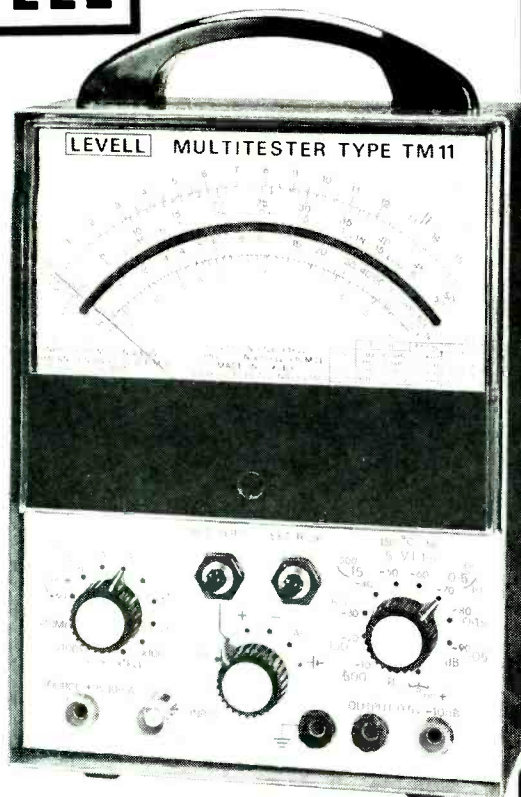
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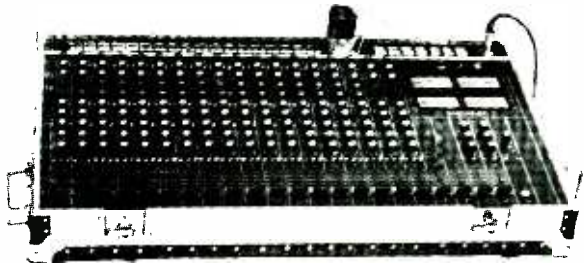
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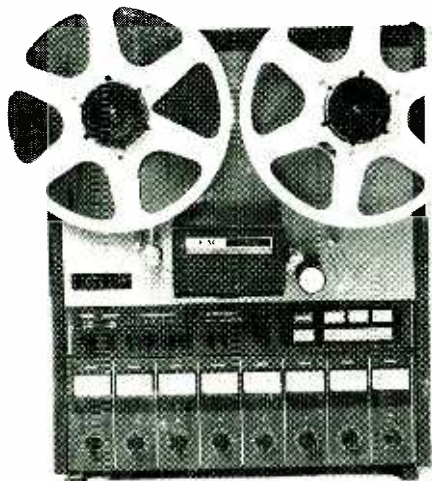
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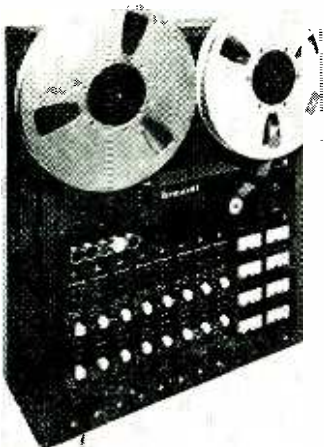
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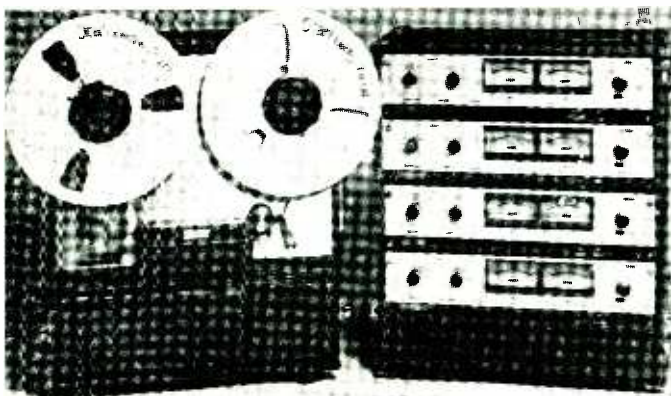
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Illustrated above are the two latest additions to the well-known range of WOELKE Wow and Flutter Meters, the ME 201 Flutter Classification Unit, and the ME 401 Automatic Distortion Meter. Fuller details on application.

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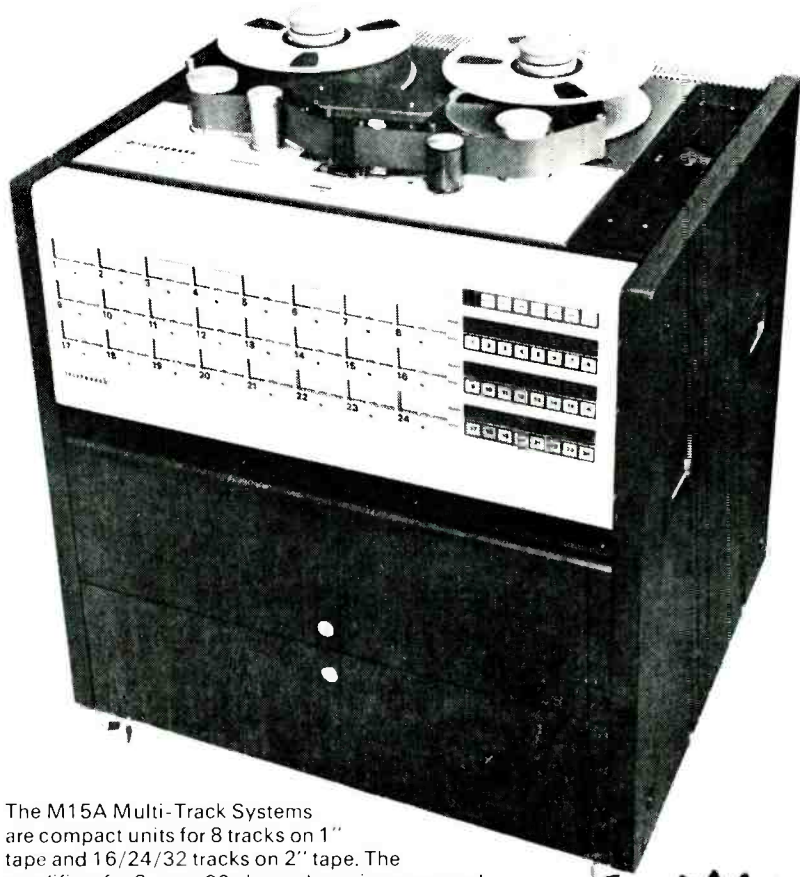
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M 1 5 A

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The M15A Multi-Track Systems are compact units for 8 tracks on 1" tape and 16/24/32 tracks on 2" tape. The amplifiers for 8 up to 32 channels are incorporated in sliding drawers in the console below the tape deck. The control metering panel is adjustable to any angle between the vertical, as illustrated, to the horizontal.

Derived from the well proven M15, the M15A Multi-Track Systems have been redesigned for easier and more versatile application, taking advantage of the most modern technologies.

The amplifiers are equipped with clickfree modulation switches, which are controlled from the tape transport function.

The M15A is designed for top quality master recording and reproduction in Radio and TV Studios, in Motion Picture and Record Industries and in professional studios in general.



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10th May 1977

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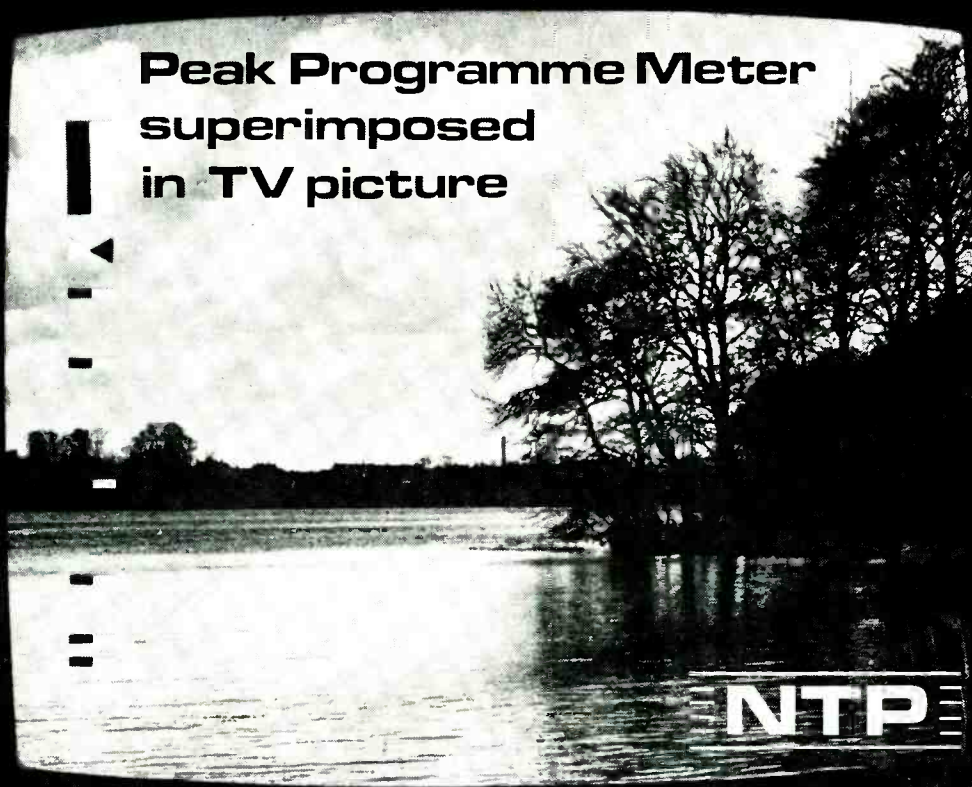
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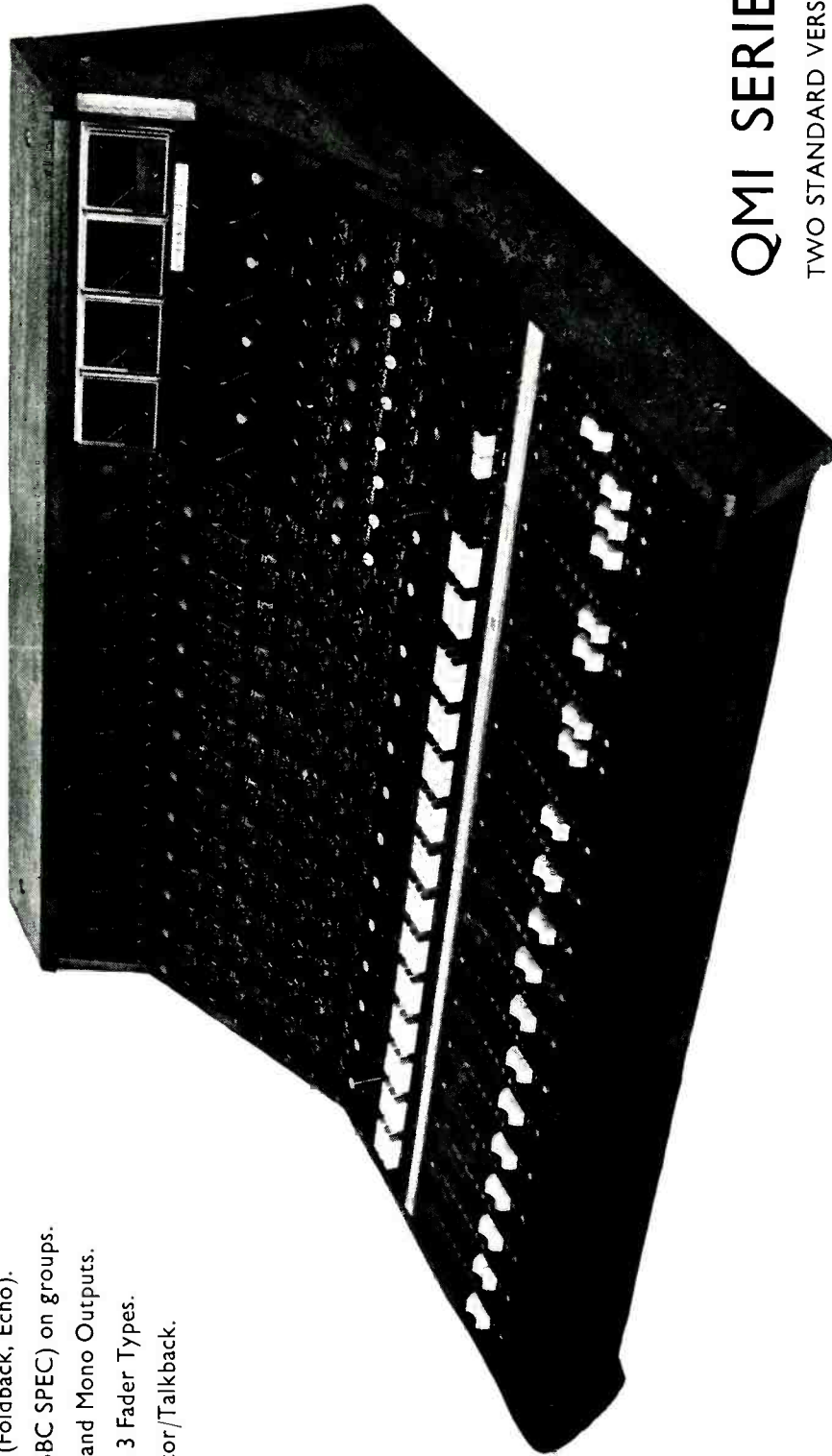
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TITLE	Artist		LABEL NO	PUBLISHER	PRODUCER	
1	SAVE YOUR KISSES FOR ME	Brotherhood of Man	✓	Pye 7N 4569	Hiller/ATV	Tony Hiller
2	DON'T GO BREAKING MY HEART	Elton John & Kiki Dee	✓	Rocket ROKN 512	Big Pig Music	Gus Dudgeon
3	MISSISSIPPI	Pussycat	✓	Sonet SON 2077	Noon/Britico	Eddie Hilberts
4	DANCING QUEEN	Abba	✓	Epic EPC 4499	Bocu Music	B. Andersson/B. Ulvaeus
5	A LITTLE BIT MORE	Dr. Hook	✓	Capitol CL 15871	Sunbury	Ron Haffkine
6	IF YOU LEAVE ME NOW	Chicago	✓	CBS 4603	Island	James William Guerico
7	FERNANDO	Abba	✓	Epic EPC 4036	Bocu Music	B. Anderson/B. Ulvaeus
8	I LOVE TO LOVE	Tina Charles	✓	CBS 3937	Mautoglade	Biddu
9	THE ROUSSOS PHENOMENON	Demis Roussos	✓	Philips DEMIS 001	Mam/Britico	Demis Roussos
10	DECEMBER '63	Four Seasons	✓	Warner Brothers K 16688	Jobete London	Bob Gaudio
11	UNDER THE MOON OF LOVE	Showaddywaddy	✓	Bell 1495	Carlin	Mike Hurst
12	YOU TO ME ARE EVERYTHING	Real Thing	✓	Pye 7N 25709	Screen Gems	Ken Gold
13	FOREVER AND EVER	Slik	✓	Bell 1464	Martin Coulter	Bill Martin/Phil Coulter
14	No noise reduction used					
15	YOUNG HEARTS RUN FREE	Candi Staton	✓	Warner Brothers K 16730	Warner Bros	Dave Crawford
16	COMBINE HARVESTER	Wurzels	✓	EMI 2450	KPM	Bob Barrett
17	WHENEVER FOREVER HAS GONE	Demis Roussos	✓	Philips 6042 186	Barry Mason Music	Peter Sullivan
18	Pre Dolby					
19	CAN'T GET BY WITHOUT YOU	Real Thing	✓	Pye 7N 45618	Screen Gems/Columbia	Ken Gold
20	No noise reduction used					

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Reproduced from Music Week Industry Year-book.

✓ Dolby system used

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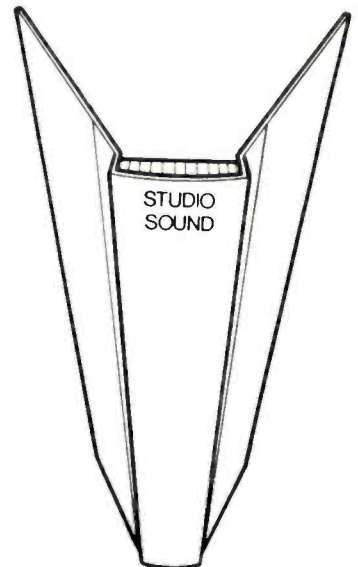
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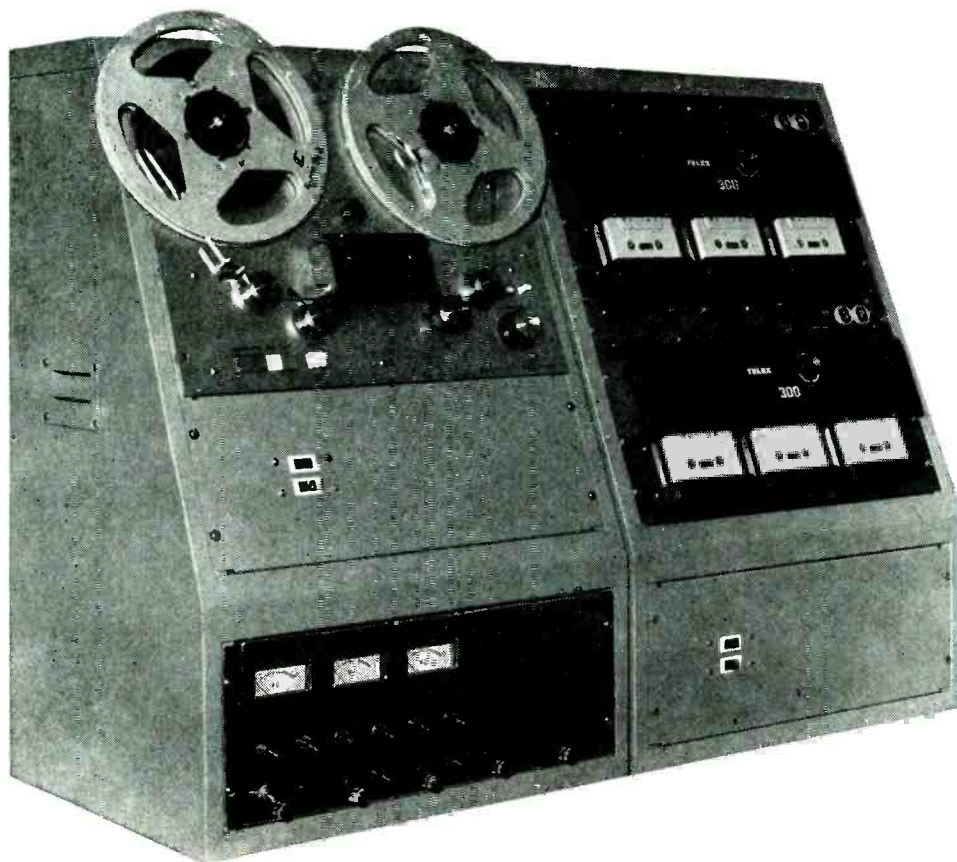
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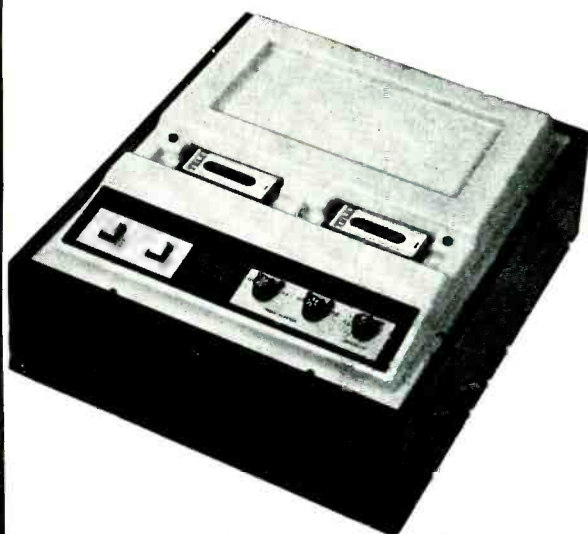
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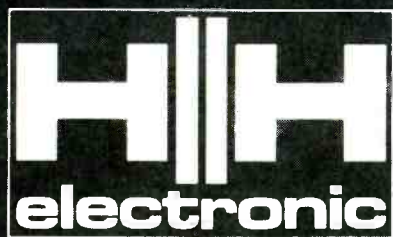
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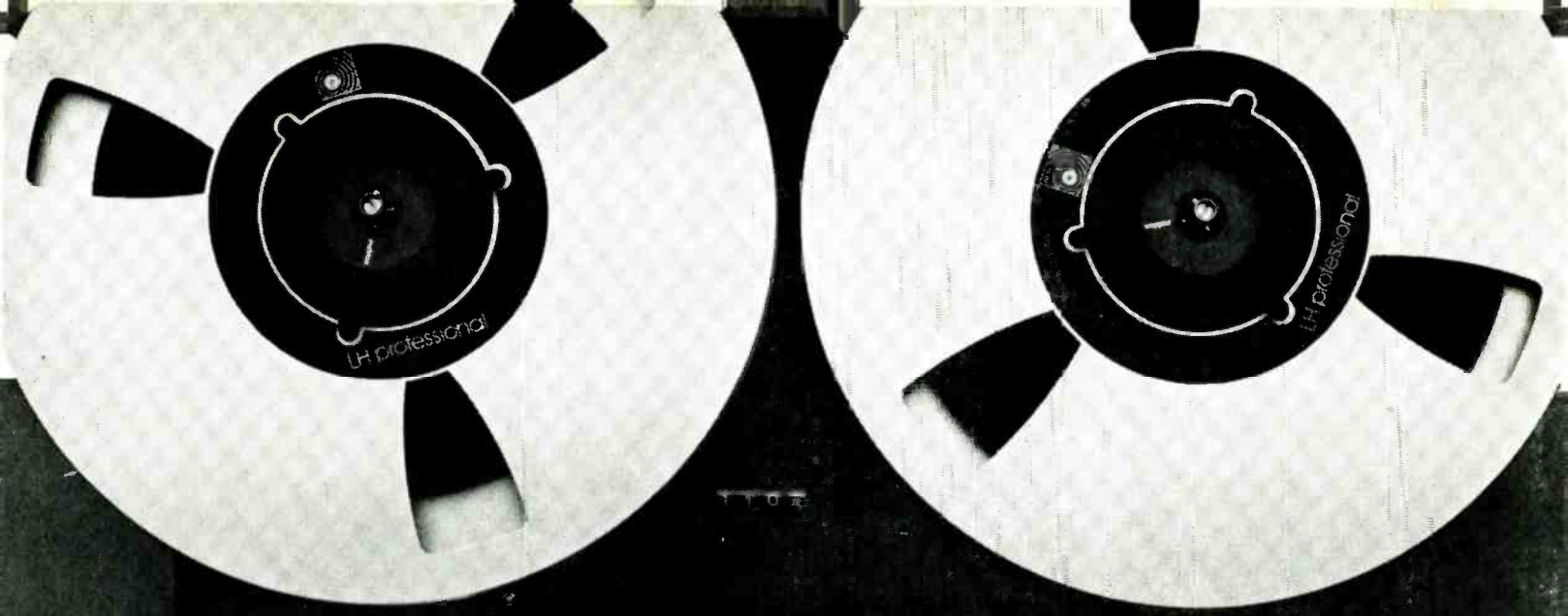
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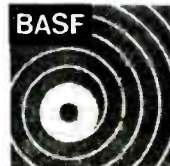
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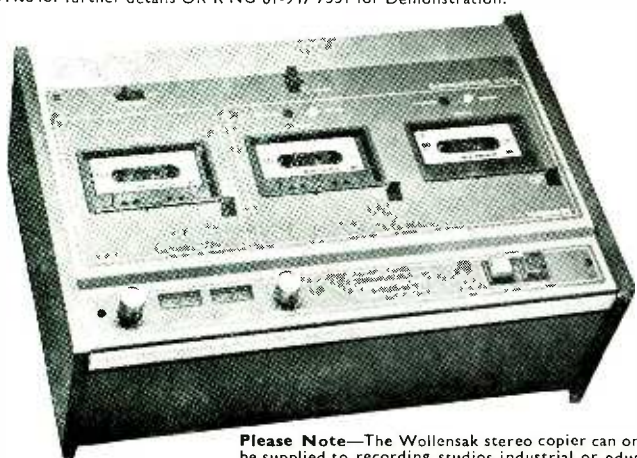
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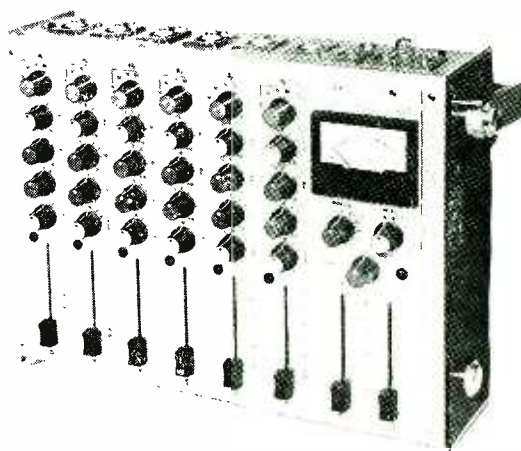
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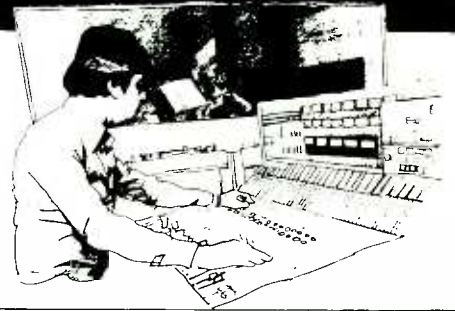
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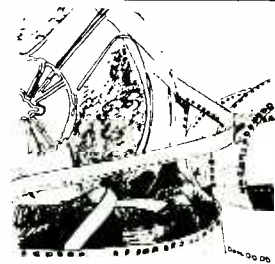
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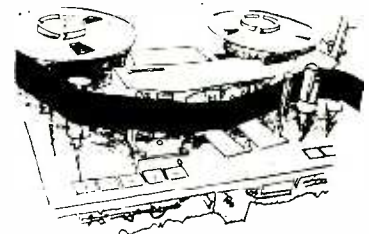
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Pyral magnetic sound track film is used by major film and T.V. Companies world-wide. The impressive list of customers during 1976 includes the BBC, Thames T.V., Southern T.V., Tyne-Tees T.V., Yorkshire T.V., Australian T.V., French T.V., West German T.V., Italian T.V. and many others throughout the world.



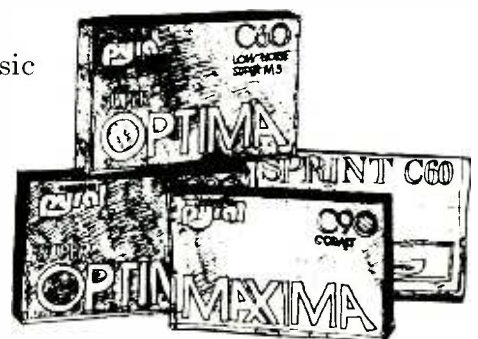
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Pyral Studio tapes are acknowledged by Studer, Nagra and broadcasting Companies throughout the world for use in Multitrack Studio recording, film sound track and stereo broadcasting recording. These products will be available to Hi-Fi enthusiasts in 1977.



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news

Neve doing well

The company has been selling quite a few desks recently:

ORF (Osterreichischer Rundfunk), the Austrian state broadcasting service, has ordered what is described as the largest and most sophisticated console yet built by the company. The 40-input desk will be designed for both 24-track music recording and direct broadcasting.

YORKSHIRE TELEVISION will soon have two 24-input consoles for music recording and TV broadcasting — simultaneously where necessary. YTV are also buying a standard *Melbourn* 12-in/2-out desk.

ANGLIA TELEVISION has placed its first order with Neve for two *Melbourn Mk 2 Model 5312* 12-input/2-output group consoles. One console is to be installed in Anglia's vtr suite, and the other in the film dubbing suite.

THAMES TELEVISION recently took delivery of a custom-built 16-input/4-output group sound dubbing console.

CITROEN (yes, the car people) has placed an order for a *Model 5305-12* stereo console, which is to be used in the preparation of audio-visual presentations for the company's dealers.

POLYVOX, a Stockholm recording studio, has ordered a *Model 8068* 32-input console for 24-track recording.

BELL STUDIOS, claimed as the first privately-owned professional-grade studio to be set up in Iran, has taken delivery of a *Model 8014* 16-input desk for 8-track recording.

SYDNEY OPERA HOUSE TRUST has placed an order for a custom-built, transportable console to be used in the concert hall, and also in the opera theatre and recording hall, when required. The console comprises 20 channels with four main and four auxiliary groups, and will be supplied with Neve equaliser units. In operation, both the desk and sound engineer will be in full view of the audience in the concert hall.

KUWAIT is the destination for a *Model 5305* 12-input/4-output desk to be delivered to what is claimed

the first private studio to use 'audio equipment of an international standard'. The sale follows an order for Neve equipment from the state-owned Kuwait Artists Association Studio.

JACQUES LOUSSIER has given Neve a free hand in equipping his new Miraval studio near Nice, and has ordered a 32-input console for 24-track music recording. The new studio is situated in the middle of a vineyard, and one of the empty wine vats has found a new lease of life—as an echo chamber.

Acoustic analyser

The *model 150* octave band analyser from White Instruments is a hand-held, battery/mains powered unit with ten led display bands, and is intended for rapid checks of monitoring and pa systems.

Provisional technical specifications indicate that the unit's filter circuits comply with ANSI type 1:11, Class II specifications. The display may be used to indicate broadband spl (range 34 to 110 dB), or switched between 14 dB or 28 dB/octave measurement ranges.

The instrument comes complete with an Electro-Voice *RE55* microphone (although any other calibrated unit may be connected to the *XLR* input), and a separate pseudo-random digital pink noise generator for system excitation.

US price is around \$1250. White Instruments Inc, PO Box 698, Austin, Texas. Phone: (512) 892 0752. UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1. Phone: (01) 734 2812/3.

UREI compressor-limiter

Now available in the UK from FWO Bauch, the *UREI LA-1* offers compression ratios from 2:1 to 20:1. Features include a led optical attenuator for extended life, input overload indication, simple stereo coupling, and a 'true standard volume indicator'.

The unit is not recommended for

overmodulation protection in broadcast transmitters, or in disc or optical recorders, unless it is followed by a peak limiter (such as the *UREI 1176LN*).

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

Phone: (01) 953 0091. Telex: 27502.

BBC order Calrec

Calrec recently signed contracts with the BBC worth £157 000 to supply several mixing desks. The most valuable contract—for Television Centre's Studio 1—will be for one of the largest and most comprehensive desks owned by the Beeb, with 50 inputs, eight main output groups, eight sub-groups and ten auxiliary sends. Furthermore, the desk will be able to operate in either mono or stereo without any compromise in facilities.

Other contracts include the first of a new range of compact stereo desks for radio use.

Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorkshire HX7 7DD.

Phone: 0422 842159.

Sound quote

Acoustikit is an organisation run by Peter Sarony and Associates offering a design service for studios and the like. They were successfully involved in the construction of the Konk Studio and Hampstead Studios. Affiliated people include acousticians, mechanical/electrical engineers, quantity surveyors, structural engineers and electronics specialists.

Acoustikit operates this way. It provides the client with a question-

naire to obtain a description of the studio and give the consultants some idea of the client's needs. Fully completed, it provides such details as room dimensions, locations, budget, and the kind of recording to be carried out.

In turn Acoustikit produces an itemised quote covering the necessary components. These might include sound seals for doors and windows, air handling plant, absorbers and traps, suspended ceilings, screens trunking, etc.

The organisation supplies the package to the customer in one go, and is prepared to work on a worldwide basis.

Acoustikit, 30 Old Bond Street, London W1X 3AD.

Phone: (01) 493 2046.

EMS move

Their new address is: Electronic Music Studios, The Priory, Great Milton, Oxford.

Phone: Great Milton (08446) 729.

Indigo 24-track

Indigo Studios now offer full 24-track facilities as part of their normal service. Of interest to those at the cheque-signing end, time costs only £24 an hour which, Indigo claims, is a 50% reduction on the rather nebulous London rates.

The basic equipment inventory reads something like this: Spectra Sonics quad desk, 24-track Ampex *MM1200*, 24 channels of A&D *Scamp* noise reduction, four channels of Tannoy monitoring, larger control room and a 10 x 15m studio floor.

Recent artists using the facilities include Sad Cafe, the Ritz band and Mike Harding. 36 ▶

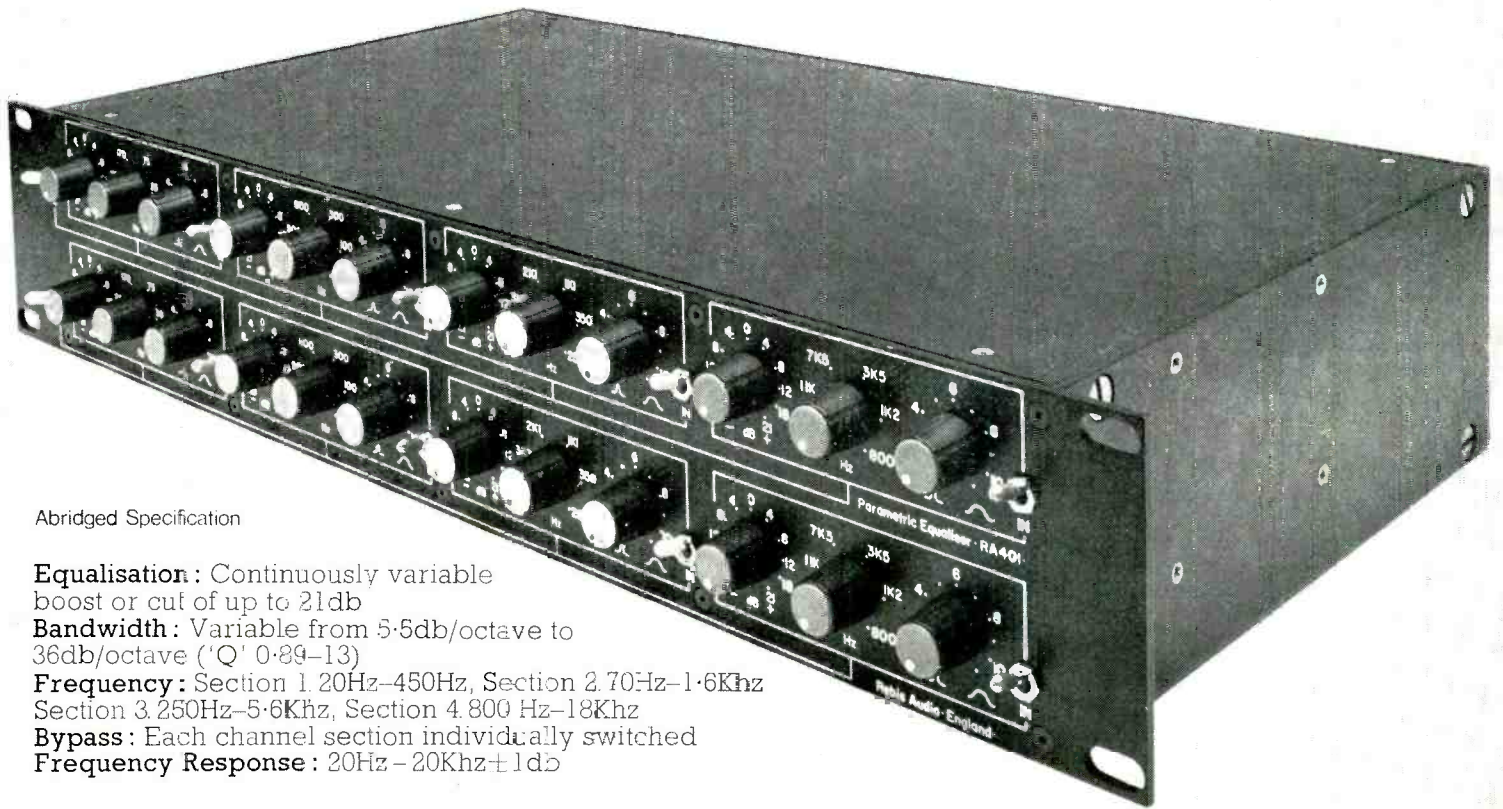


Perfectly Parametric Equalisation

Rebis RA401 Parametric Equaliser

Two independent four section equalisers in a compact 3½" mains operated rack mounting unit. Allowing extremely comprehensive parametric equalisation for musical shaping or restoration of

degraded programme, the RA401 is a versatile, effective and reasonably priced British manufactured tool for the Broadcast and Recording Industries.



Abridged Specification

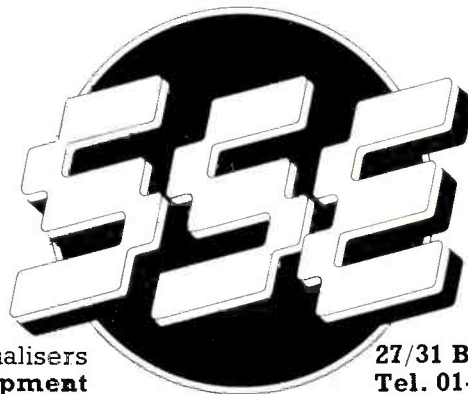
Equalisation: Continuously variable boost or cut of up to 21db

Bandwidth: Variable from 5.5db/octave to 36db/octave ('Q' 0.89-13)

Frequency: Section 1. 20Hz-450Hz, Section 2. 70Hz-1.6KHz
Section 3. 250Hz-5.6KHz, Section 4. 800 Hz-18KHz

Bypass: Each channel section individually switched

Frequency Response: 20Hz - 20KHz ±1db



Sole Distributors for Rebis Equalisers
Scenic Sounds Equipment

27/31 Bryanston Street London W1H 7AB
Tel. 01-935 0141

NEWS

Molinare expanding again

London's rapidly multiplying studio, Molinare, is expanding again. A 20-year lease has just been signed on a four storey 2200 square metre building in Foubert's Place, just off Carnaby Street and only a short stroll from Moli's existing rambling studios in Broadwick Street.

Molinare set up in business about five years ago as a very basic studio for recording simple overdubs for film sound tracks. Although the new premises were intended to replace Broadwick Street, business is so good they will probably run side-by-side, making a total of eight commercial studios and a multitrack music studio.

New facilities in Foubert's Place will include a 15m x 10.8m television studio marking Moli's first venture into television production; four commercial production studios each with three or six cartridge players for pre-recorded effect (the Moli library has over 5000 on NAB carts), two Studer stereo tape machines, and Neumann mics; a 16-track music studio; an electronic music studio; an audio/visual studio (Moli make a lot of AV production with slides); traffic and transfer departments for commercial distribution; stereo audio cassette and video cassette duplication; and an area specifically set aside for the coffee machine (Moli Mugs supplied gratis). In addition, there will be a spacious reception area with full client facilities, and incorporating the Moli Shop which hires out all types of audio/visual equipment, including video cassette recorders, slide and film projectors and audio equipment. Other facilities included are a casting agency and a club in the basement.

Meanwhile, business is as normal in Broadwick Street with only a short run between studios in the rain.

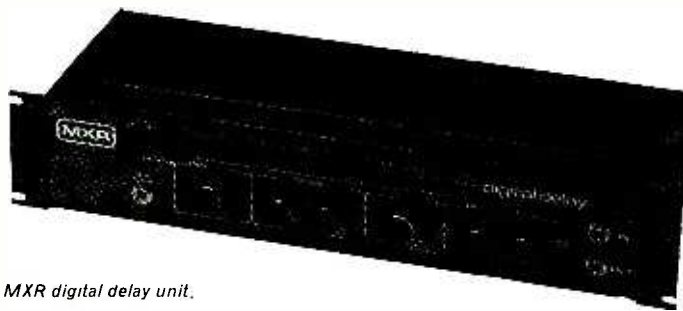
Angus Robertson

UK digital delay already

Described by the manufacturers as 'long awaited', the MXR digital delay, now available in the UK from Rose Morris, claims the following facilities:

- Controllable one-shot echo.
- Adt.
- Over-dubbing effects.
- Vibrato and time domain effects.
- Frequency modulation.
- Flanging.

Using sequential random access memory address, the unit has four clock speeds offering a frequency response upper limit between 2.5



MXR digital delay unit.

and 20 kHz, depending on clock rate chosen. Each memory board (it will house a maximum of four) offers a delay of 40 ms at the highest clock rate; the maximum delay period lies between 160 and 1280 ms, dependent on bandwidth.

Connectors and interface are designed for balanced line, 0 dBm nominal operating conditions. The company claims a thd of below 0.1% at 1 kHz, with residual noise below 80 dB referenced to overload level.

MXR Innovations Inc, 277 North Goodman Street, Rochester, NY 14607, USA.

Phone: (716) 442 5320

Rose Morris & Co Ltd, 32/34 Gordon House Road, Kentish Town, London NW5 1NE.

Phone: (01) 267 5151.

Audio/visual Teacs

Teac's UK importer, Teledyne Acoustic Research, has appointed Sound and Vision Communications as their 'main' distributors for Teac tape machines being used in direct audio-visual applications. Sound and Vision will be stocking a wide range of Teac products, with main emphasis on the model A-3340S 4-channel 38 cm/s machine with NAB hubs.

A standard discount of 10% off list price will be offered, plus further reductions depending on who is purchasing the gear, how quickly it is required, and how much is being bought. A total discount of up to 15% is said to be available to deserving customers. Full technical service facilities can also be provided.

Sound and Vision Communications, 23 Redan Place, London W2 4SA. Phone: (01) 229 4406.

Lismor—an apology

In our December issue we published an article, 'Scotland . . . the brave', about the recording scene in Scotland. It was inferred in the report that Lismor Records was only interested in ethnic music.

It has now become apparent to us that the inference was not correct. Indeed it has subsequently been brought to our attention that

Peter Hamilton, the owner of Lismor Records, has recently set up a new recording label, Neptune Records, for 'pop' music.

We would like, therefore, to take this opportunity to apologise to Peter Hamilton for any unfair impression given by the article.

Noise and level test set

The model 401 from MJS Electronics comprises a calibrated amplifier driving a dual-range (4 or 0.5 dB/division) ppm and separately-buffered headphone output via switchable highpass, lowpass, CCIR weighting or external filters. Particular applications include tape machine noise measurement in accordance with the IBA code of practice using the CCIR weighting filter.

Extract from manufacturer's specification:

Frequency response: with filters out, ± 0.05 dB 20-20k Hz; ± 0.1 dB 20-100k Hz; $+0.2, -3$ dB 100-200k Hz.

Sensitivity: for ppm '4' reading, $+30$ to -80 dBm in 10 dB steps, ± 0.1 dB of reading. An 'add dB' control increases step sensitivity from 0 to 10 dB in 1 dB steps. Accuracy ± 0.0 dB of reading.

Meter accuracy: meter and drive circuitry conform to BS4297 (1968). Indication accuracy ± 0.1 dB on normal, ± 0.05 dB on expanded scale.

The test set costs £450, with 'normal' millivoltmeter option (to replace the ppm) costing an extra £35. A 'true' rms millivoltmeter will set you back an extra £75. (All UK prices.) No price is yet avail-

able for an auto-ranging version of the model 401 to be announced in the near future.

MJS Electronics, 27 Walnut Close, Yateley, Camberley, Surrey GU17 7DA.

Phone: Yateley (0252) 871401.

Can you hear me out there?

Philip Drake Electronics has received an order from Visnews to supply a centralised talkback system for communication between ten destinations. Each destination will have a rack-mounted control panel containing microphone and loudspeaker amplifiers, and lamp signalling from the calling station. Central switching equipment will be supplied for the ten initial destinations, and is capable of expansion to cater for up to 16 destinations.

Philip Drake Electronics Ltd, 165 Lancaster Road, New Barnet, Hertfordshire EN4 8AH.

Phone: (01) 445 1144.

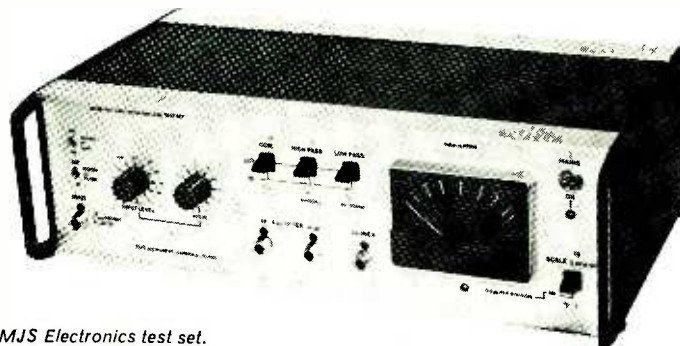
Ampex for IRCAM

The Paris-based Institute of Research and Co-ordination Acoustics-Music, which was 'set up to promote fundamental research and creation in the musical and acoustical field', has placed an order with Ampex for 16 ATR-100 series machines. Eight ATR-104 4-track and eight ATR-102 2-track machines (pre-wired for 4-track operation), complete with remote control and search-to-cue facilities, will be used by IRCAM to record and master both conventional and synthetic music.

Scenic Sounds move

SSE, UK agents for Allison, dbx, Harrison, MicMix, Urban, Eastlake Audio and ranges of other products, recently moved to larger premises at 97-99 Dean Street, London, W1.

Their new telephone numbers are: (01) 734 2812/2813. 38 ▶

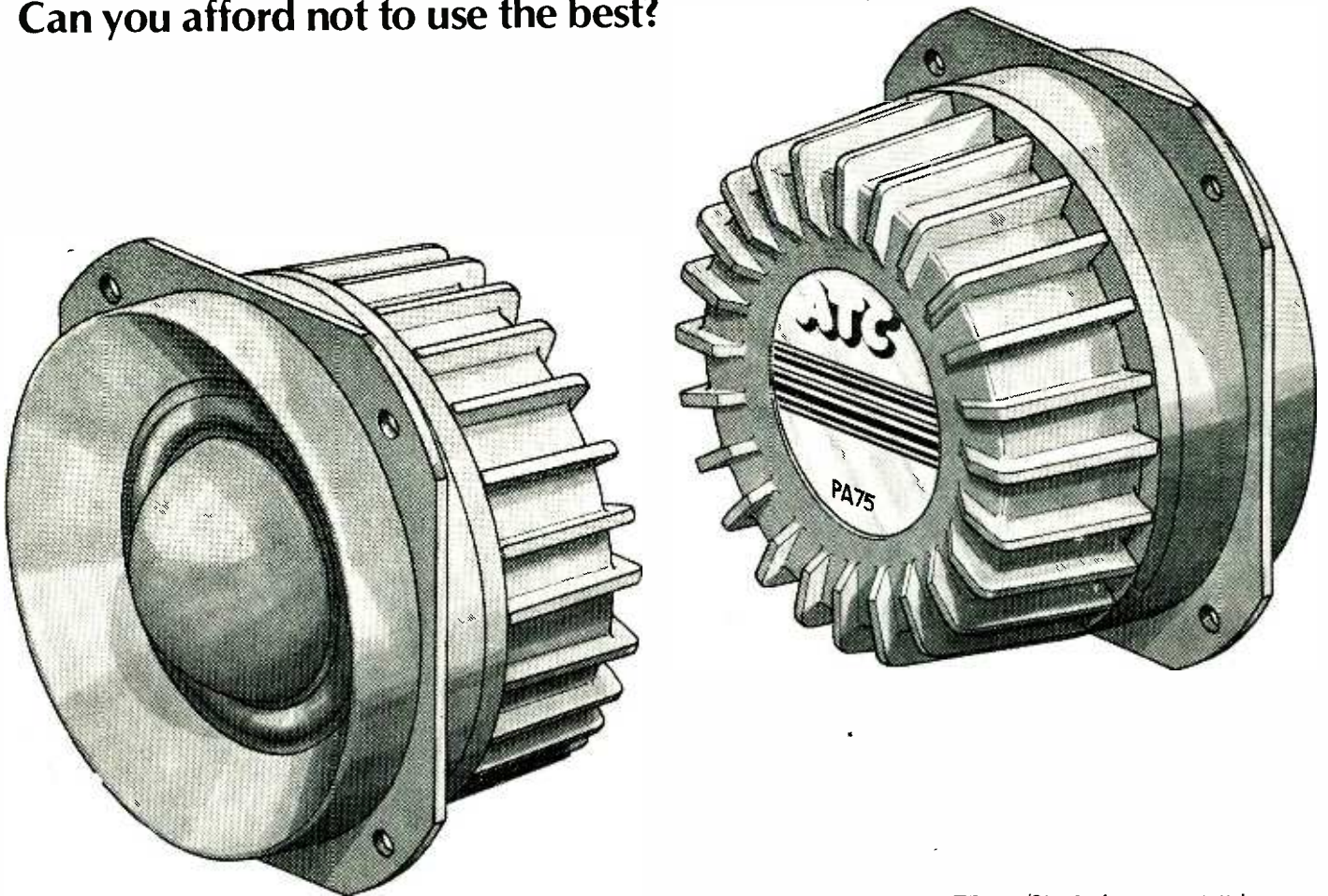


MJS Electronics test set.

ATC

Acoustic Transducer Co. Ltd.
(Acoustic engineers)

Can you afford not to use the best?



75mm/3in Soft Dome Midrange

For details of the above soft dome and our 12" and 9" studio bass units contact us at

Pier House Laundry Strand on the Green Chiswick London W4 Great Britain

Tel: 01-995 3654

NEWS

Phonogram move

Their new address is: 129 Park Street, London W1.
Phone: (01) 491 4600.

Cadac compressor-limiter

A new unit from Cadac incorporates a fast-release filter that allows it to be used on low-frequency signals, even with fast release times. Signal-to-phase and frequency distortions are said to be kept to an absolute minimum.

The *V-Cat type A505* incorporates fixed threshold, adjustable slope characteristics—the threshold knee stays in a fixed position, with various slopes originating from this starting point. Extract from manufacturer's specification:

Frequency response: 20 to 20k Hz ± 0.5 dB.

Input impedance: 10k ohm, active balanced input stage.

Sensitivity: ± 15 dB, switchable in 3 dB steps; max level $+24$ dBV.

Output impedance: 50 ohm.

Output sensitivity: same as input, max level $+24$ dBV into 600 ohm.

Threshold: with input and output controls in centre position, $+4.5$ dBV.

Ratios: 20:1, 8:1, 4:1 and 2:1, with automatic compensation for each ratio; plus external control.

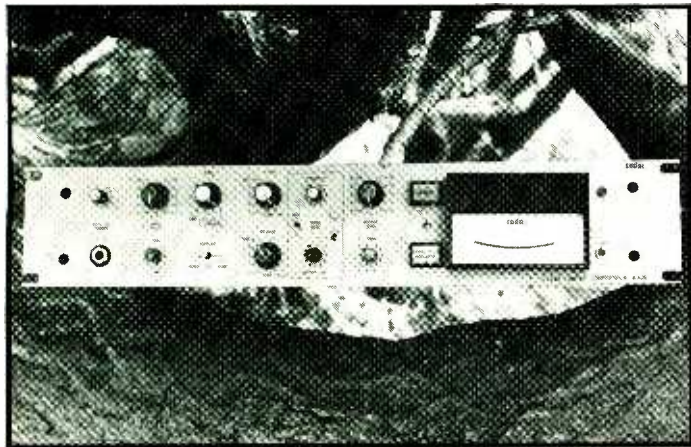
Attack time: between 600 μ s and 100 ms.

Release time: between 800 μ s and 2s.

Noise: not less than -85 dBV with input / output controls centrally positioned, and not less than -95 dBV with the noise gate operating. Cadac (London) Ltd, 141 Lower Luton Road, Harpenden, Herts AL5 5EL.

Phone: Harpenden (05827) 64351.
Telex: 826323.

If you go down to the woods today . . . the Cadac A505.



Tape cart system

Broadcast Electronics has announced a new record/playback tape cartridge system, which consists of the updated Spotmaster Model 5300A three-deck playback unit and the companion Model 5309 record amplifier. Both mono and stereo configurations are available.

The new 5300A has plug-in removable decks, and what is claimed to be an improved internal mechanical design ensuring stable deck and capstan positioning, independent of front panel reference.

Broadcast Electronics, 8810 Brookville Road, Silver Spring, Md 20904, USA.

Phone: (301) 587 1800.

UK: Broadcast Audio (Equipment) Ltd, PO Box 31, Douglas, Isle of Man.

Phone: Douglas (0624) 4701.

Telex: 627900.

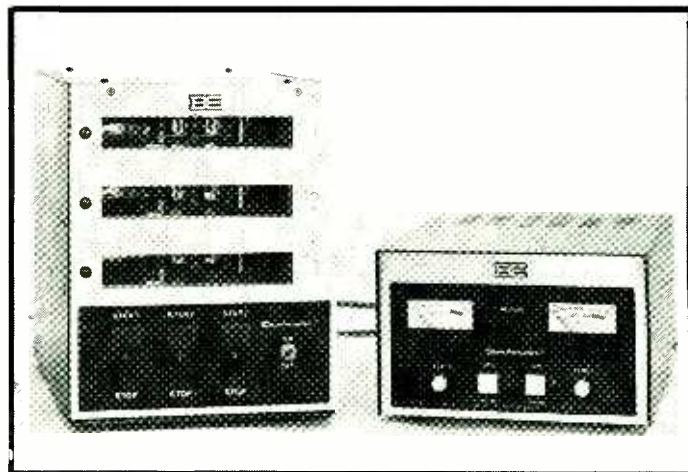
Now's your chance

Because orders have exceeded expectations (it says here) the Oxford University Press is to make a second impression of 'Sound Recording Practice', edited by John Borwick. Copies should now be available through APRS, or the publishers, Oxford University Press, or your friendly bookshop (or not so friendly bookshop).

Syn-Aud-Con Seminars

A six-page brochure from Synergetic Audio Concepts lists the full schedule of sound engineer seminars to be held this year in 17 American cities. For a free copy and further information contact: Don Davis, Synergetic Audio Concepts, PO Box 1134, Tustin, Ca 92680, USA.

Phone: (714) 838 2288.



Broadcast Electronics' playback unit and record amplifier.

Agency/distributor deals

MIDNIGHT AUDIO's products will now be marketed by AUDIO AND DESIGN's worldwide distribution network. Products include the *type 464* alignment oscillator, which is designed to simplify the routine lining-up of professional tape machines. Other units soon to follow in production are the *MA 100* power amplifier, featuring 'dc clampdown for speaker protection', and the *MA 2000* quick-start broadcast turntable (see STUDIO SOUND, April '77, p20).

Audio and Design Recording, St Michael's, Shinfield Road, Reading, Berks.

Phone: Reading (0734) 84487.

SCULLY has been appointed exclusive North American distributor for ORTOFON disc cutting equipment. In addition to using Ortofon components in their equipment, Scully will also offer these components to other original equipment manufacturers, and directly to disc cutting companies. As well as handling repairs, a Scully service centre will specialise in the rebuilding of Ortofon cutterheads, to reduce waiting time for replacements.

LJ Scully Manufacturing Company, 138 Hurd Avenue, Bridgeport, Conn 06604, USA.

Phone: (023) 368 2332.

Audio measurement

A 36-page catalogue from B & K describes a new audiometer, a new digital frequency analyser, a new waveform retriever, a new sound power source, and a new version of their electroacoustic telephone transmission measuring systems. For a copy contact, believe it or not, B & K Laboratories.

COURT ACOUSTICS has appointed the following overseas agents:

Holland: Selectronic BV, Postbus 28, Sluivdplein 3-4, Ouderkerk aan de amstel, Amsterdam.

Denmark: Quali-fi, Strandvejen 730, DK 2930, Klampenborg.

Spain: Sonex, San Marcial 31, San Sebastian.

Finland: Audiotron, Kiskontie 7, 00280 Helsinki 28.

Japan: CMC Inc, Shuwa Shoto Bldg 206, 15-5 Shoto 2-chome, Shibuya-ku, Tokyo 150.

GRACEY & ASSOCIATES have been appointed exclusive UK agents for NORTRONICS' audio analysers and noise and vibration meters.

Gracey & Associates, Threeways, Chelveston, Northants NN9 6AJ.
Phone: Raunds (09335) 2016.

MACINNES LABS are the new exclusive UK importer for the SESCOM range of transformers, pre-amps, line amps, mic splitters, mics, cables and active modules. These will be distributed in the London area by Tasco Inc, 113 Lambeth Road, SE1.

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

Phone: Saxmundham (0728) 2262/2615.

Pye CARE—correction

Our apologies to Cadac for belittling its automated console that was recently installed at Pye's number two studios in London (STUDIO SOUND May '77, p22). The desk is, in fact, equipped with 44 (36+8) input channels, and not 32 as we stated.

*Finding
the
"Missing Link"*

FEATURING
STRAWBERRY SOUTH, DORKING ENGLAND
MARQUEE STUDIOS, LONDON ENGLAND

The logo for Eastlake Audio SA is rendered in a stylized, 3D block font with a white-to-yellow gradient and a black outline. It is centered within a horizontal band of wavy, multi-colored lines in shades of blue, green, yellow, orange, and red.

**Eastlake
Audio SA**

21, Avenue Nestlé — 1820 MONTREUX (Switzerland) — Tél: (021) 62 19 44 — Telex: eastlake 25546

Finding the "Missing Link" in

WHAT DOES THE EASTLAKE ACOUSTICAL



All photographs: Strawberry South, Dorking, England.

Conception to completion with an acoustical

try be easier than you can imagine...

GUARANTEE MEAN TO YOU, THE CLIENT...?

Eric Stewart of 10cc has a few words about the “Missing Link”, his guaranteed acoustical performance.

“In successful modern studios, all the equipment, (consoles, tape-machines, auxiliary equipment, etc.) is available to everyone.

Questioning the reasons why one studio was superior to another, I came to the conclusion that the difference in quality performance had to be the capability of the engineer and the overall acoustical design of control room and studio areas.

Needing to improve the acoustic quality of the control room at Strawberry North and to create an entirely new complex, Strawberry South, I had to make a decision regarding the designer of both studios. I tried an experiment. I asked my friends to tell me which were their favorite American albums; I had chosen mine. We got them all together to compare the sleeve notes. In most cases the albums were recorded in studios which were Hidley designed Westlake Audio rooms. I figured I'd found the “missing link” in my chain and so I asked Tom Hidley to design the new control room for Strawberry North and the whole Strawberry South complex. Would you believe it? I was right! The Eastlake designed room is superb and amazingly accurate. It's an incredible relief to know that what you hear in your studio, and what you take to your mastering room is 100% correct ... Thanks Tom...”

Eric Stewart – 10cc. Owner: Strawberry South, Dorking, England.



l performance that exceeds the guarantee.



Photo: Marquee Studio

Three Weeks - Completed

“Marquee’s requirement for a rapid completion of the re-mix room resulted from earlier acoustic treatment which did not meet Marquee’s requirements. Yet the speed of the installation has not resulted in any compromise to Marquee’s or Eastlake’s high requirements. Both Hidley and Collins were able to toast a highly successful joint operation, and Producer Pip Williams’ final comment was “How soon can I get in?”

Simon White, Director. Marquee Studios. London

Here again, the “Missing Link” was found, your guarantee of excellence in acoustic performance.

EASTLAKE AUDIO DEALER/REPRESENTATIVES

Scenic Sounds David Hawkins
London (01) 935 01 41

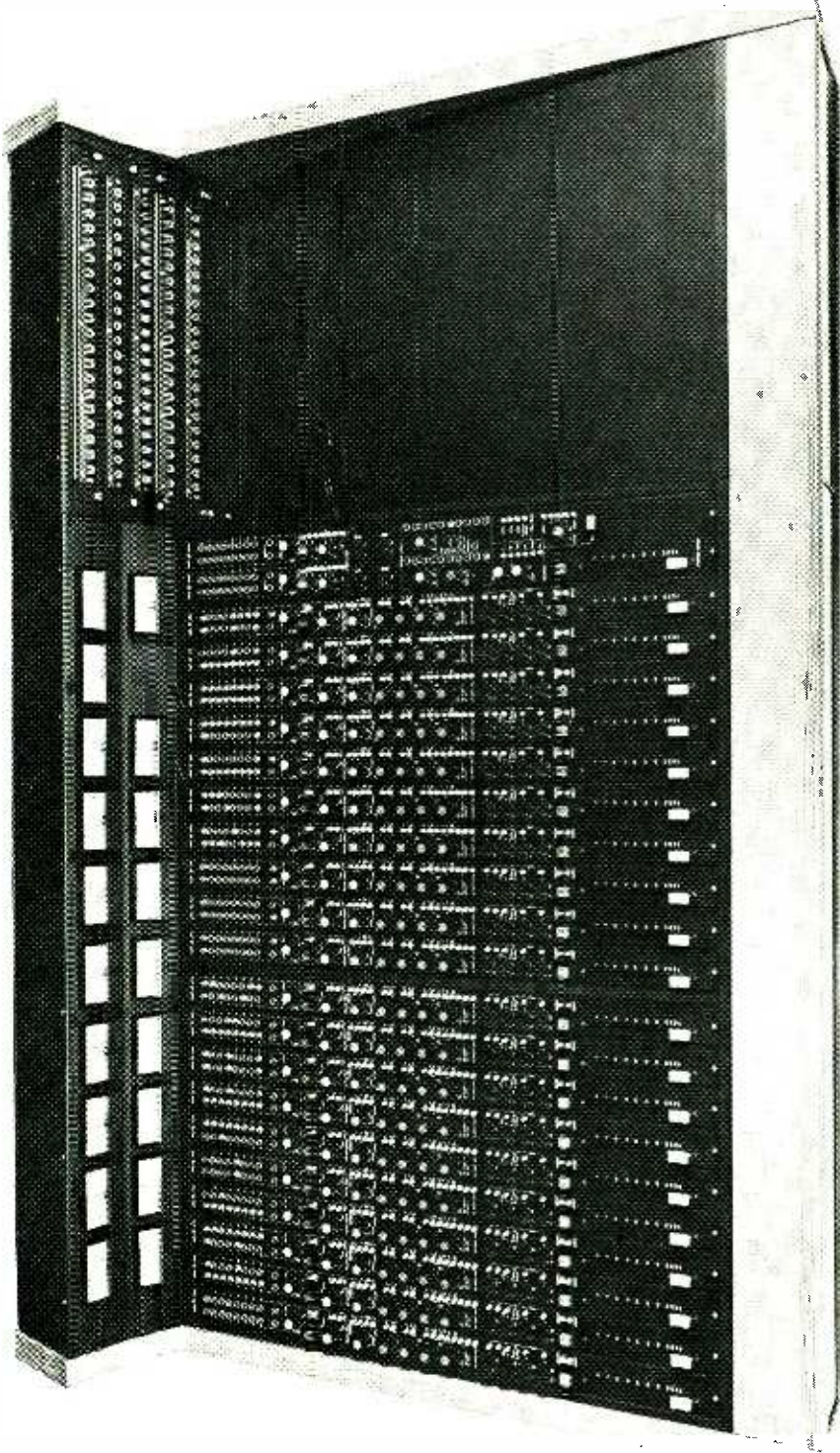
Studer International E. Spörri
Wettingen (056) 26 87 35

Sierra Audio Kent Duncan
Burbank (213) 843 8115

3 M – France Serge Lobbe
Paris (01) 031-64 20

Audio Products Int. Roberto Beppato
Milan (02) 27 38 96

Eastlake Audio S.A. Home Office: Tom Hidley 21, ave. Nestlé, 1820 Montreux, Switzerland
Telephone: (021) 62 19 44 – Telex: Eastlake 25 546



AMEK 2016 multitrack master recording console, available in various formats, standard configuration being 20-input, 16-group. Many termination options are available. Excellent construction and performance combine with keen price to make the 2016-system the prime choice for the ambitious working professional studio.

LIST OF AGENTS:

Australia: Con Psorakis, AUDIO CONTROLS, P.O. Box 152, Norwood, S.A. 5067. Tel: 08 267 2049

Benelux: Leo Maebe, I.A.T.A., Kerkstraat 16,3020 Herent, Wijgmaal. Tel: 016/44 3377

France: Francis Linon, 72 Av. Lenine, Gentilly 94250. Tel: (161) 657 0812

Germany: THUM + MAHR AUDIO, Postfach 3026, D-4018 Langenfeld (not exclusive agents). Tel: (0 21 73) 1 80 09

Greece: P. Patrikios, S.L.S. Ltd, 31-33 Dimoharous, Kolonaki, Athens

Spain: Felix Mayor, FADING, Vallehermoso 12-6°C, MADRID 15. Tel: 446 8325

USA: Brian Cornfield, EVERYTHING AUDIO, 7037 Laurel Canyon Boulevard, North Hollywood, California 91605. Tel: (213) 982 6200
Telex: 651485

UK PA Division: Ian Jones, HHB PA Hire, 16 Wallasey Crescent, Ickenham, Uxbridge, Middx. Tel: Ruislip (089 56) 73271

AMEK SYSTEMS AND CONTROLS LTD, 2nd floor ISLINGTON MILL, JAMES ST, SALFORD M3 5HW, LANCS., ENGLAND. Tel: 061-834 6747/8

(Contact Nick Franks and Graham Langley)

NEWS

BAFTA Technical Craft Award

Mike Billing, MD of Preview Two, has been jointly awarded the BAFTA Technical Craft Award as best dubbing mixer for his work on a variety of television productions, including LWT's 'Weekend World'.

Mike is probably best known for the development of the 'rock-and-roll' dubbing technique while working at a small film recording studio during the early Sixties. At the time the conventional method of mixing film sound was to work on 10-minute sequences, rehearsing as many times as necessary to iron out problems, and then attempt a take; any mistakes and all tracks had to be rewound, relaced and another take attempted. The studio in which Mike worked, however, possessed a *reversible* system that made it possible to run the film transports backwards or forwards and still maintain sync. Slight modifications to the record amp circuitry allowed noise-free record punch-ins to be made, paving the way for the rehearse-record method of mixing. The advantages were enormous: a proficient mixer could extract the best from tracks in the shortest possible time; sequences could be much longer; and tracks could be more tightly packed with

varying quality sounds. Eventually RCA, Westrex and other firms took an interest in the new techniques, and 'rock-and-roll' was specified for all new equipment.

While working for Preview Two, a company he helped to set up in 1968, Mike has worked on several previous BAFTA award winners, including BBC tv's 'Horizon' series, Ted Kotcheff's play 'Edna, the Inebriate Woman', and Mari Zetterling's 'Vincent the Dutchman'. Currently the company is working on productions for LTW, YTV, ATV and the BBC.

Roll up, roll up

The following are just a few of the items of equipment being sold off by Nova Studios through the Jackson Music Group:

24/16 Neve console with 24 monitor outputs (asking price £20k)

24/4 Neve console with four monitor outputs (£9k)

16-track 3M *M79* with varispeed (£10k)

16-track 3M *M56* with additional 8-track headblock and varispeed (£7k)

2-track *A80 VU* (£3.5k)

Two 2-track *C37s* (£900 each)

Two Cadac monitor systems with Audix amps (£1.5k each)



Orban Parasound 622 equaliser.

Two Lockwood enclosures with Tannoy units (£500 the pair)

Two Pandora *Time Lines* (£1k each)

EMT *140* reverb plate, remote controlled (£2k)

32 Dolby *A361* noise reduction units (£275 each)

Enquiries should be addressed to Malcolm Jackson, The Jackson Recording Co Ltd, The Studios, Rickmansworth, Herts.

Phone: Rickmansworth 72351; or Nova Studios Ltd, 27-31 Bryanston Street, London W1.

Phone (01) 493 7403.

Four times 24 is a lot of tracks

Sound 80 tell us that it now has three 24-track studios in full operation, with a fourth one very near completion. This gives them the 'prestige of being the first studio in America's upper midwest to go exclusively 24-track'. In addition, the company are to install a new

computerised disc mastering room; the present mastering room will be converted into an electronic music studio.

Sound 80 Inc are located at: 2709 East 25th Street, Minneapolis, Minnesota 55406, USA. Phone: (612) 721 6341.

Updated Parasound

Orban/Parasound has announced details of an updated version of the *621 series* equaliser—the *622*. The manufacturer claims that the filters in the new model are virtually immune to control wear, while allowing notches of up to -40 dB to be obtained. The thd has been reduced to below 0.025%, 20 to 20k Hz at +18 dBm (quoted).

The *622* will be offered in single and dual-channel configurations in a 9 x 48 cm rack-mount format.

Parasound Inc, 680 Beach Street, San Francisco, Ca 94109, USA. Phone: (415) 673 4544.

Probably the best cassette sound you've ever heard

Large runs for record companies and smaller runs for studios all given the same precise attention with regard to quality and speedy turnround. **Blanks wound any length.**

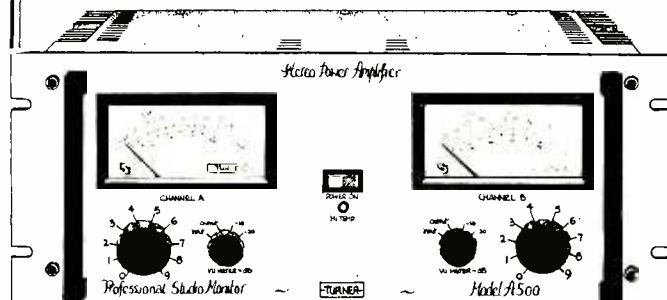
Collection and delivery service door to door for both cassette and master tape copying.

SOUND RECORDING PLANT

Contact Dave Rees at 061-795 7666 to discuss your requirements.

- TURNER -

PROFESSIONAL STEREO POWER AMPLIFIERS



TURNER is the name to be found on the Number One range of British Power Amplifiers in 1977 (and for years to come!). The technical performance achieved is now well proven, however the unique sound quality combined with reliable performance is real proof of our Power Amplifiers. Comparative tests carried out in leading recording studios (and on 20kW rigs), between our equipment and "ultimate" U.S.A. equipment, is conclusive.

Whereas in 1976 our equipment was the alternative "direct replacement" for established Brands, in 1977 those Brands are now the alternative to our equipment (for those who are prepared to spend 50% or more on foreign equipment and take a chance on service delays!).

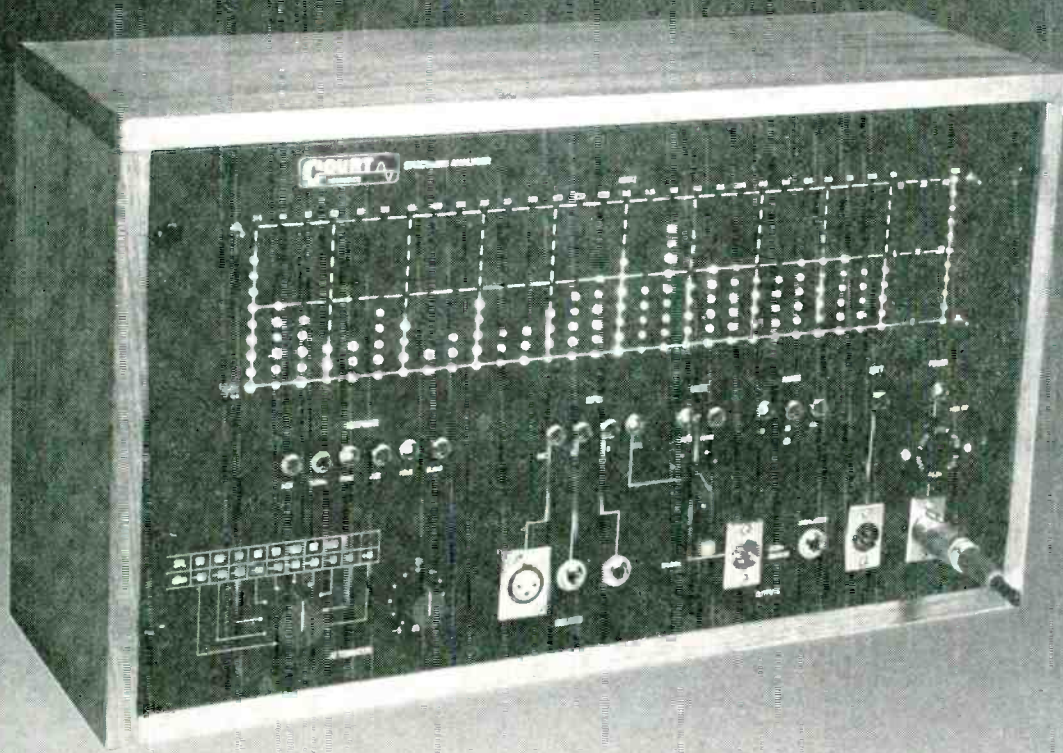
TURNER Stereo Power Amplifiers are based on 12 years of development, practical experience, and listening to all types of music—both recorded and live.

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letters

Dear Sir, With regard to the report of the AES 56th Convention, Paris (STUDIO SOUND May '77, p44), I have no comments regarding description of equipment shown, but would like to explain a few of the problems faced by the Convention Committee:

Safety regulations. Forty days before the Convention opening, a complete document giving maps of the locations, stands and demo-rooms, as well as emergency exits, expected number of attendance, etc. was placed in the hands of the local police, Paris Central Police, and fire authorities. Three days before the opening the management of the Hotel Méridien was advised by a letter received at 5 pm of an interdiction covering the whole of the exhibition. During the weekend contacts were made to avoid closure of the exhibition. After a 5-hour discussion with security authorities the day before the Convention was due to begin, the opening was 'tolerated', but an order given to close one stand in area C, to cut by half two stands in area B, and pull out all equipment in the demo-rooms. This was done during the night, and demo-room exhibitors re-installed in the mezzanine, the only possible space left.

This was the cause of a certain mess just before and at the beginning of the Convention, but the maximum effort was made to preserve the presence of the displaced exhibitors.

No exact reason was found for this last-minute action of the authorities, but a similar action was made at Hotel Nikko some days afterwards for a fishing and hunting exhibition.

The position of the Paris fire and security authorities is now that hotels, and especially hotel rooms, are not intended for exhibitions—only conferences with sufficient security measures. As a net result of these decisions, one can no longer expect to hold, in Paris, conventions in the form previously adopted by the AES, and special locations for exhibits must be used. It is quite possible that this rule will apply to all of France, and later to some other countries.

Customs. Exhibitors were well advised in

preparatory papers to sort themselves out with customs. ATA carnets were recommended, since the use of T2, T3 or T3L documents involved an accreditation with a customs agency or immediate payment of VAT and rights at entrance, this being refunded in the case of re-export.

Recommendations were also made to use Orly airport for air freight instead of Roissy, which is generally crowded with goods; an example of tariffs of an Orly customs agency was provided.

The strict customs control in France is said to be a consequence of the existing exchange control.

Area C. The devolution of stands on a first come, first served basis followed the usual AES Convention rules. This year the demands for stands and demo-rooms was up to 86, which was over our estimate, and the Méridien was the largest site possible in Paris. With new demands for stands coming after our closing deadline we decided to use area C, which did not belong to the Hotel Méridien but to Régie Renault. This extra place was hired to avoid refusing exhibitors—even late ones. We thought that the late exhibitors would want to be included, in spite of the fact that they were situated some distance from the main areas.

Advice was given regularly of the existence of area C and the mezzanine.

In conclusion, if it is quite true that the problems raised at the last minute by the security authorities gave rise to serious difficulties and some disorders, the Convention results for exhibitors were not as bad as your report suggests—written thanks were sent specially from the APRS and Nippon-Columbia.

The Convention Committee was always willing to assist, and will still investigate any problem or complaint resulting from the Convention. Displaced exhibitors were refunded in respect of their demo-room expenses.

Yours faithfully, J Remouit, Convention Chairman, AES Paris 56th, 8 rue Labie, 75017 Paris.

Dear Sir, As a journalist who has had some contact both with the recording world and the APRS, I find it a little surprising that STUDIO SOUND should be so ready to apologise for its March editorial. Surely a letter from the body you criticised is not enough to force such a quick and total retreat. Mr Levy has never, so far as I know, answered the main charge against his organisation: that it seemed able both to run with the hare and hunt with the hounds.

If there is no conflict of interests between manufacturers and those they supply (and he can't be naive enough to accept that), why does he not come clean and call the organisation the 'Association of Recording Studio Suppliers and Professional Recording Studios', or somesuch? Lucky for him that trade descriptions are only legally binding in consumer matters.

How does he explain the results of a telephone poll of fully one-fifth of his studio membership ('Music Week' a couple of years ago), which revealed less than contentment with the APRS's efforts on their behalf?

The last APRS exhibition catalogue showed that, while manufacturing membership grew from 51 to 61, the number of full or affiliated studio members actually fell by two, to 113. Manufacturers now make up 36% of what is meant to be a studio organisation. In 1974 and 1975 the figures were 28 and 31%. If just full membership is considered the manufacturers represent 40%, but over the years their representation on the APRS committee has risen even faster, from 30% in 1974 to 40% last year and 50% this year. Just think about it. Forty per cent of the members, the manufacturers, who are only 36% of the total membership, have half the seats on the APRS committee.

May I suggest that if STUDIO SOUND is to preserve its undeniable authority, it should be less willing to cave in to self-serving criticism of an honestly held and well-based view. No one doubts that the APRS does a great deal for engineers in some respects. But that is not to say that if studios and engineers had their own organisation, which currently they do not, they could not do a great deal better.

Yours faithfully, John Dwyer, Assistant Editor, Wireless World.

Phew! . . . and other such phrases of relief.

Someone has noticed, as we had hoped, that the two letters in the May issue didn't really substantiate much more than most of us in the industry already knew about the APRS—and they certainly didn't do much to answer our editorial comment. Any other takers?

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Studio synthesis

Brian Hodgson

To fully realise a synthesiser's capabilities, it is a distinct advantage to appreciate what happens 'backstage'.

ELECTROPHON MUSIC LIMITED is a small studio in Soho, London, specialising in the composition and realisation of electronic music for ballet, film, television and advertising. The standard studio facilities are fairly unexceptional, all available money having been channelled into the development of our synthesiser. It was decided that Electrophon would not purchase a large complex synthesiser like the Moog, ARP or *Synthi 100*. This decision was taken for two reasons: firstly, I felt that a modular approach would make it possible to keep abreast of the rapidly changing technology; and secondly, I wished to keep close contact with equipment designers so that we would end up with a range of modules that did what we wanted, and not what a design engineer thought we would want. In this we have been moderately successful in spite of the fact that money supply usually lags a year or so behind the birth of any idea.

All of the non-standard equipment was designed to my specification, formerly by Rodgers Studio Equipment and latterly by Ken Gale, one of the most truly creative engineers I have ever encountered.

Every synthesiser can be broken down into four main parts: *generation, modification, interconnection and control*. I shall attempt to stick to those headings in describing our studio synthesiser.

Generation

A bank of voltage-controlled oscillators provides both audio and control signals in three waveforms—sine, triangular and square. The oscillators are extremely stable and can track over five octaves around the manually set centre frequency. The manual controls are as follows:

Coarse frequency. This is switchable in octave steps from 27.5 to 3250 Hz in the audio mode, and from 1 cycle per 16 seconds (0.0625 Hz) to 4 Hz in the control mode. Of course, voltage control extends this range considerably.

Fine frequency. A 10-turn potentiometer allows fine control for

lining up the centre frequency. Tuning and tracking are checked against a switchable frequency standard using a scope to provide Lissajous figures.

Function switch. This selects waveform and 'audio' or 'control' mode.

Even harmonic. A potentiometer allows progressive addition of even harmonics to the sine and triangular waves, and alters the mark/space ratio of the square wave.

Output gain. A centre-zero potentiometer controls output level of both audio and control signals, and allows easy inversion of control voltage outputs.

Voltage control is available for frequency and squarewave mark/space ratio. A fixed level pulse output provides a signal for synchronising other oscillators.

Of all our modules this is the least satisfactory; a new design is being worked on to provide better tracking over a wide range, and voltage control of all wave forms to give us the opportunity of creating even more complex timbral changes.

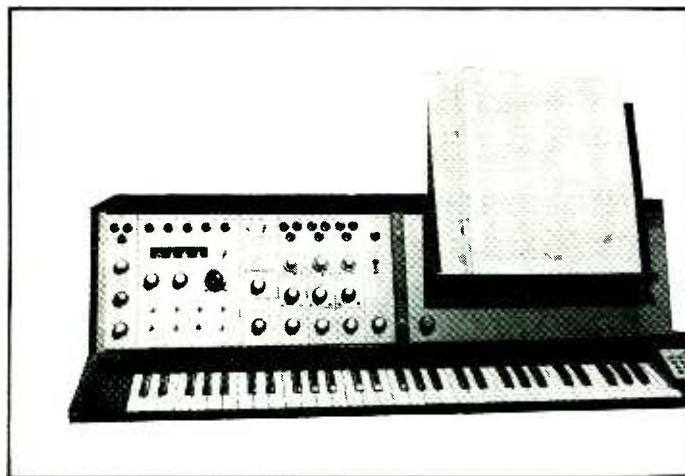
Single pulses can be derived from envelope-shaper trigger outputs, and white noise is provided from a *Synthi A* that we also use for control voltage generation.

Modification

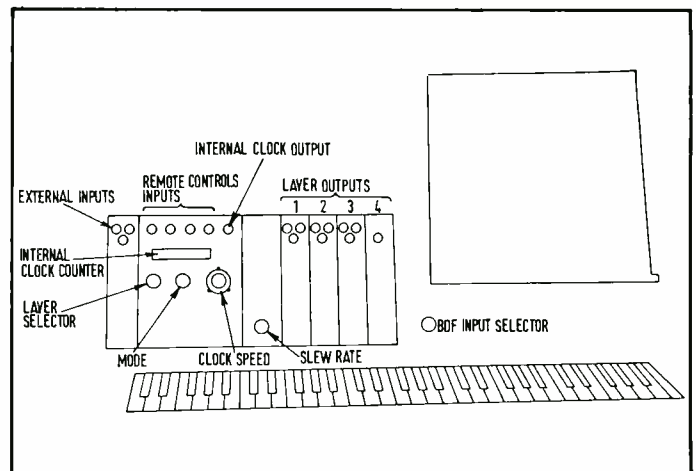
Filters. A bank of multimode filters provides all forms of filtering. Manual controls are: input gain or attenuation; mode, switchable between lowpass, highpass, band reject and bandpass; centre frequency from 30 to 20 kHz; lowpass 'Q', which alters the resonance of the filter up to the point of oscillation; bandwidth; and output level. A meter gives indication of overload within the filter.

Voltage control is available for centre frequency, bandwidth and lowpass 'Q'. This is a very successful module both for treatment of electronic sounds, where very complex changes can be produced within a single note, and in modifying pre-recorded tapes. The combination of slowly sweeping bands of sound against the original gives very complex but controllable types of phasing effects.

EMS Sequencer 256 keyboard and control.



Schematic of units in adjoining photograph.



Modulation. A multiplier gives modulation of both audio and control voltages; its ability to handle dc provides an excellent voltage-controlled amplifier for control voltages. By using envelope control voltages, one is then able to make controlled alteration to vibrato frequency and/or depth within each note. Conventional ring modulation is available from the *Synthi A*. Voltage-controlled amplifiers give level control of the signals, and a voltage-controlled panning amplifier provides stereo displacement.

Envelope Shaping. These modules are twin-channel devices with full adsr characteristic. Manual controls are featured for the time parameters: attack, decay, sustain, release, with delay controllable from 0-8s. A 4-position function switch controls: free run, by which on receiving a key voltage the shaper will attack, decay and hold in sustain until the voltage is removed, whereupon it will continue to cycle according to the settings of the time controls. (A further key voltage will hold the shaper in the sustain mode.); multicycle, which on receiving a key voltage will continue to cycle according to the time settings until the voltage is removed; one cycle, which will perform one cycle regardless of the duration of the key voltage, must be removed and re-applied to initiate a further cycle; and key on, whereby the key voltage initiates the attack and decay modes of the shaper, and will hold it in the sustain mode for as long as the voltage is present, after which the shaper will complete its cycle.

When the shaper is keyed, a dc voltage at control voltage output-level one will rise during the attack mode to the set level, hold through the decay and sustain modes, and die away during the release mode. This voltage is invertible. Control voltage output-level two (also invertible) is modified by the control voltage function, which has four settings: compound, the voltage rising during the attack mode, falling during the decay mode, holding at a voltage proportional to the sustain level during that mode, and dying away during the release mode; accent, the voltage rising during the attack mode and dying away during the decay; delay, the voltage rising during the delay mode and collapsing in all other modes; and finally sustain, the voltage rising immediately the attack mode is completed and dying away during the sustain mode.

This multiplicity of control voltages means that each aspect of the sound, its timbre, vibrato, level, harmonic content, and even stereo positioning, can be altered during the period of a single note.

The sustain level control presets the level at which the sound will hold after decaying from its attack peak. The trigger output selector controls the trigger voltage pulse produced by each shaper, which can key any other envelope shaper. This voltage can be produced at the following points: end attack, begin sustain, end decay, end sustain, end release and end delay.

The second channel of the envelope shaper, known as signal 2 function, can be switched to follow the full cycle, or the attack and decay modes only. This facility is especially useful for making the 'head' of a sound more interesting, for example, adding filtered 'chiffs' of white noise or tuned interval 'pings'.

Voltage control is available over all time parameters and the shapers can be triggered directly, ie at the start of the attack mode

or via the delay mode control. This manual trigger facilitates multiple attacks when using several shapers from a single key voltage. In combination with the trigger outputs, the delay trigger capability enables the shapers to be used in a chain as a simple sequencer.

Interconnection

We decided to employ the system used by EMS: that is a matrix board with connecting pins, since this avoids the messiness of dozens of patchcords. It also gives maximum flexibility of interconnection and, just as important, reconnection. (I tend to rewire the boards frequently as ideas change and new 'toys' arrive.) There are two 60 x 60 matrix boards—one for audio and the other for control voltages. Several lines interconnect the two, since the distinction between audio and control is often blurred. Unfortunately, we are fast outgrowing both boards so that certain inputs have had to be rerouted via selector switches. With such a large selection of interconnections possible, logging a sound for future use became a problem until a simple schematic of the synthesiser was devised which seems to function adequately. Human error is more of a problem, because here too 'Sod's Law' operates and it is always the vital control path that isn't filled in.

Control

Keyboard control is provided by the excellent EMS *Sequencer 256* keyboard. This can be used as a straight 5-octave keyboard or as a memory bank, storing up to 256 events in any distribution over three layers of memory.

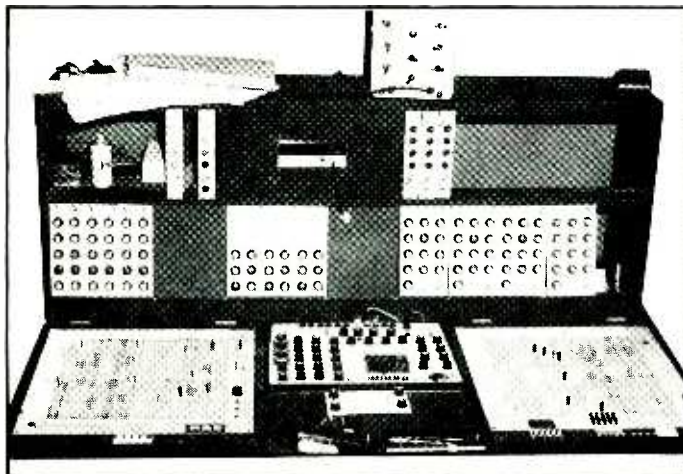
Each event consists of a key voltage, which will operate the envelope shapers, and two other voltages. The first of these is usually programmed from the keyboard and used to define pitch, while the second voltage, which may be re-written independently of the first, may be programmed by a keyboard, joystick, foot pedal or any other voltage required. It can also be used to define pitch, level, filtering, slew-rate, time parameters, and even harmonic or stereo positioning, depending on the requirement of the composer.

Although the keyboard is monophonic, a chord of up to six notes can be produced by programming them into the memory bank very closely together—for example, two or three clock pulses apart—and retrieving them whilst running the clock at 200 Hz. This is achieved by using the 'stop at event end' key and the 'start forward' button, which is 'played' in sync with the rest of the piece. The internal clock allows the memory to be run at any speed, controlling either complex fast musical figures or a long complicated effects sequence (such as the half-hour programme entitled 'Journey through Space' we did for The Geological Museum last year).

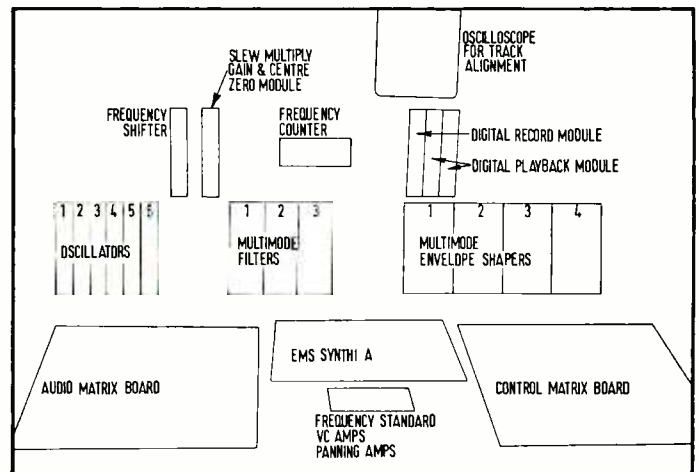
Any event can be altered and reprogrammed using electronic editing, and the sequencer can run in sync with a pre-recorded tape, by putting a pulse on one of the tracks. Pre-recorded pulses are of great use in the production of music for film, especially for complicated animation sequences. The pulse is usually set to a multiple of 24, or in the case of television 25 Hz, and the entire composition programmed to achieve sync to a fraction of a frame.

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Control console at Electrophon.



Schematic of units in adjoining photograph.



STUDIO SYNTHESIS

Indeed for a recent cinema commercial the picture was still being animated as we were producing the music, armed only with the story board and a frame count. Music and picture met for the first time on the morning of the dub, when to the editor's amazement and everyone else's relief the 39 sync points in 60 seconds matched absolutely.

The sequencer 'reset', 'stop' and 'start' pulses can also be pre-recorded and used to operate complicated pre-programmed sequences. The results are recorded either as a completed sound or a digital code, using Ken Gale's digital coding/decoding modules. At a later date the code can be used either to reprogram the memory bank, or to operate the synthesiser directly from tape. The advantage of storing the control voltages rather than the sound is that relative pitch, timbre and even speed can be altered later without destroying the original information, which may have taken hours to program or perform correctly.

The digital recording/playback modules are a new idea of Ken Gale's. They will work from any synthesiser keyboard, and will operate any make of synthesiser. The recording module will accept two voltages and 'two keys' simultaneously but independently from the keyboard, and transform them into a single digital code. This code can be recorded on one track of any studio-quality tape machine. When the tape is played back the playback module separates the voltages and keys, which can then be used to operate the synthesiser directly or even reprogram the *Sequencer 256*. Thus a complicated program or performance can be stored for future use in a voltage form, which means that relative pitch, sound quality or any other parameter can still be altered without affecting the original information. The record modules, like the sequencer inputs, are set to accept voltage changes that are the equivalent of a semitone, but both the digital and sequencer playback modules can be decoded to produce any tuning interval, for example, $\frac{1}{4}$ or even $\frac{1}{8}$ tones.

The modules we have at present only deal with two voltages and keys, but an updated version will encode four voltages and four keys on a single track. For example, four players on four separate small synthesisers could play together and the information would be stored on one track. They could repeat the process on each track of a 24-track recorder until 96 separate musical lines have been stored, each one still capable of having its sound altered at any time. Then armed with a 24-track tape, 24 decoders and 96 synthesisers the whole piece could be performed 'live' (or perhaps 'undead' is a better word) in a concert hall. The sight of 96 synthesisers playing 'untouched by human hand' would provide an awesome, if somewhat expensive, spectacle. That would of course be taking things to extreme, but the technology is no problem at all.

Our equipment has been designed to give us maximum control over each sound produced, and this to our mind is the most important requirement. A musical instrument produces a sound that contains an incredible rate of change of information; to produce interesting synthesiser sounds we must be able to produce a similar rate of change, otherwise the ear becomes bored very quickly. If you listen to any of the very early synthesiser albums, the first track sounds fascinating, the second interesting, but the third rather dull—the hand is tempted to reach for a glass of that brand of beer which refreshes the parts of the ear that the sound cannot reach. Fortunately, all of us working with synthesisers realised the problem very quickly and work never stops on developing new ways of increasing control over the sound. Nowadays the production of a 'synthesiser album' requires an incredible amount of painstaking work on the structure of each sound.

We have just completed our fourth album for Polydor. It is called *New Atlantis*, and is based on the essay by Francis Bacon. The initial spur came from reading the following quotation:

'Wee have also Sound-Houses, wher wee practise and demonstrate all sounds, and their Generation. Wee have Harmonies which you have not, of Quarter-Sounds, and lesser Slides of Sounds. Diverse Instruments of Musick likewise to you unknowne, some sweeter than any you have; Together with Bells and Rings that are dainty and sweet. Wee represent Small Sounds as Great and Deepe; Likewise Great Sounds, Extenuate and Sharpe; Wee make diverse Tremblings and Warblings of Sounds, which in their Originall are Entire. Wee represent and imitate all Articulate Sounds and Letters and the Voices and Notes of Beasts and Birds. Wee have certaine Helps,

which sett to the Eare doe further the Hearing greatly. Wee have also diverse Strange and Artificioall Echo's, Reflecting the Voice many times, and as it were Tossing it: And some that give back the Voice Lowder than it came, some Shriller, and some Deeper; Yea some rendring the Voice, Differing in the Letters or Articulate Sound, from that they receyve, Wee have also meanes to convey Sounds in Trunks and Pipes, in strange Lines, and Distances.'

Strange lines and distances . . . which must be the first description ever of an electronic music recording studio—but this was written in 1624! We then read the whole of this astonishingly prophetic essay and became fascinated. Bacon foresaw aircraft, submarines, lasers, genetic engineering and many other fantasies that have since become fact, although in his fabled society the scientists produced these wonders to further civilisation, not to destroy it.

Each track on the album is inspired by a passage in the book, my partner John Lewis composing the music to reflect the spirit rather than the literal meaning of the passages. The album took about six months to plan and record using a 16-track Studer and our new digital modules. Before even a note of music could be recorded, a pulse track was laid down so that we could run programmed lines in sync, or have access to a running memory for adjustment to the sound after the 'performance take' had been chosen. This was not just a question of recording a static pulse, as in some passages complex tempo changes were required. For example, in the passage entitled *Salomons House*, a pre-programmed phase is repeated at many times its normal speed and gradually slows down until it reaches the correct tempo for the rest of the track. In another piece, *Echoes III*, the tempo slowly increases during the second section, levelling out at a much faster rate for the third section. In these cases the external clock rates had to be carefully calculated in terms of pitch and slew rate so that these changes would occur over the correct period, starting and stopping at exactly the right point in the music. This information was programmed into the memory bank and used to control the sync-pulse oscillator. Once the pulse was recorded, metronome tracks could be programmed that would change as and where necessary, and used or ignored according to the musical requirements. Only then could work start on recording the music. Techniques varied according to the character of each passage and to describe them all would take an eternity, but several of them may prove of interest.

As far as possible 'live performance' takes were made. This improves the flow of the final result; programming each section gives an incredible degree of accuracy but has a rather inhuman feel to it. As a result this technique was only used for sections that required a high degree of exactness, or were physically impossible to perform. The digital modules proved of great value here because John Lewis was able to perform a line and then decide whether his performance was good enough before we settled down to work on the right sound. Often several lines were recorded digitally and played back together so that the interaction of the sounds could be judged, up to four lines being possible without two decoders.

After the sounds had been chosen they were then recorded conventionally, either as a mono mix or a stereo pair, and the digital tracks erased to be used again. In the chorale section of *Salomons House* John played a monophonic line, controlling pitch from the keyboard and 'swell' from a foot pedal. The voltages were recorded digitally, and a sound quality chosen and recorded. Simple retuning of the oscillator centre frequencies allowed us to record parallel reinforcements of the original line without John having to repeat his performance. When the accompaniment lines were required, the original digital information was used to control only the 'swell', with John playing in the new pitch information. In this way the 9-line passage was built up in a remarkably short time using the accuracy of the digital techniques and the 'live' quality of John's performance.

Where complicated links were required, they were first programmed into the sequencer and then added to the tape using the sync pulse and pre-recorded start pulses. The system of recording voltage pulses digitally first was also used in *The Pool*, where the 6-note phrase of the accompaniment moves in stereo patterns. In this case three digital lines covered six stereo positions and six changing pitches, the final result being recorded as a stereo pair, releasing the tracks for re-recording. The bass line was a mixture of several sounds in different stereo positioning, each with a different character in terms of attack, quality, change, etc. but produced by the same

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STUDIO SYNTHESIS

single line of digital information. Once the synthesiser lines were almost complete we laid down the percussion. Having been in constant contact during the period of electronic recording, Tony McVey (our guest percussionist) offered advice, suggestions and countless comforting cups of coffee. We don't like using synthesiser percussion except as an added effect, because we all consider that the sound and feel of a live percussionist adds so much to the excitement and impetus of the music. It was also felt that the synthesiser should be used to extend the range of available sound rather than reproduce conventional instruments.

What of the future? John Lewis has always wanted to give live synthesiser performances of his music, but both of us feel that to make a proper impact it would really have to be truly live, and not just a couple of lines played over the outputs of a bank of tape machines. The main problem up to now has been that synthesisers tend to be monophonic, or at best duophonic. Moog have recently produced the *Poly-Moog*, and we have been working for some time with Ken Gale to produce our own polyphonic keyboard. This would use an entirely different system but be capable of interfacing with any range of synthesiser equipment. The basic keyboard will be 2-manual with a 10-note polyphonic capability, but with an inbuilt capacity for '15-note polyphonic' on each keyboard—for duets or people who use their elbows! Selector switches will allow access to pre-programmable sound in any order or combination. We are now building the prototype, and hope to have it ready in time for exhaustive tests before a live commitment we have in Florida next January.

If any other of my colleagues using synthesisers want to contact me I would be delighted to hear their news, reviews and headaches. Synthesisers have come a long way since Robert Moog's original papers on voltage control in 1958, but we are still only on the threshold—so much work has still to be done. If we try to communicate more, maybe we can help each other along the way. ■

agony



... and if I ever find the guy who
chopped up my Steinway ...

"Only experienced people can produce true professional broadcasting"—Annan (BBC 2 April 28th 77)



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Alexandra Road, Windsor
Windsor 51056 Telex 849323 Aegis G

APRS Exhibition 1977, a preview

Mel Lambert

The 10th exhibition will be held at the Connaught Rooms, Great Queen Street, London, on Wednesday, June 15, Thursday, June 16 and Friday, June 17.

Opening hours are from 1000 to 1800 (15th), 0900 to 1800 (16th) and 0900 to 1700 (17th).

The equipment on display is said to be worth over £2 million.

Acousmat Apollo will be exhibiting a range of plug-in modular units, including the *MC12* channel amp with line/mic switching, echo/aux send, panpot and pfl; *MA80* mic amp with 80 dB gain and eq cut-off filter; *MP62* magnetic pickup amp with four eq curves, scratch and rumble filter; *PE16* presence equaliser with boost/flat/cut between 2.5 and 18 dB for each tone control; *CL36* compressor-limiter; *EX60* programme expander; *MCX7* compressor/limiter/expander; *TB90* talkback amp with front panel mic; *MI12* 12-input mixer; *LA26* line amp; *PA10* monitor amp; *DK32* voice-over unit; and *MI31* 3-input submixer.

Agfa-Gevaert will be showing their range of 3.81 mm bulk cassette tape, professional recording tapes and compact cassettes.

For the first time in the UK, **Allen and Heath/Brenell** will be showing *SYNCON*, described as 'a new concept in multichannel recording'. The name stands for synergetic console, by which they mean that the total capability of the desk is actually greater than the sum of the individual input/output modules. This extra capability is achieved by using 'an ingenious routing and status switching system, which allows every module to form a variety of complex functions'. Also on display and demonstration: the latest 25 mm full-logic, 8-track tape deck from **Brenell**. Of particular interest to broadcast and studio engineers will be a feed-forward delay limiter which is said to eliminate problems of transient distortion and overshoot.

AKG products on show include the new *C111EB* studio condenser mic with switchable directional characteristics; a series of multi-channel mixers, equalisers, expanders and stereo reverb systems; a range of cans, including the *K210* that has no less than 14 diaphragms; the new modular *SM2000* portable stereo mixer; and the *BX15* reverb unit.

Alice are introducing a new modular low-cost system, the *M Series*, available in 2, 4 or 8-group format with 'all usual recording studio facilities'. The version on show will be a 12-channel/4-group mixer, but the system is available in up to 24-channel format with add-on facilities. An up-dated version of the *Baby* mixer for recording and pa use can also be seen. Other equipment on display includes switching systems for radio and

television; special comparators designed for CBS Records; telephone balancing systems, distribution amps, etc.

Amek will be exhibiting a *2016-system* console as the centrepiece of their display. The desk is based on an input/output modular system; 24 modules will be fitted, routed into 16 groups. Also on view will be a 16/4-8 *X series* desk, a 'competitively-priced', smaller console offering a range of facilities. Some ancillary products, including electronic crossovers, will be also exhibited.

The **Ampex** stand will feature a new audio-visual synchronising system, to be shown for the first time in the UK, plus examples from their range of professional tape machines and high-performance mastering tape. The synchronising system, which has been developed by EECO (for whose products Ampex has world-wide distribution rights), will be demonstrated operating with a vtr, *ATR-100* and *MM-1200* multitrack machine in a 3-machine linked setup.

A wide range of rack-mounting audio processors, including the *F 760X-RS* complex limiter and *F 760X-R* vocal stresser, plus the latest *SCAMP* modules, notably the *SO1* compressor, *SO1* parametric equaliser and *S14* quad ppm led columns, will be exhibited by **Audio and Design**. Also on show is a new product, the *E950* parametric equaliser, available in 6-band/channel stereo or 12-band mono. Fader gain control of +20 dB, controls to vary centre frequency of the band over four octaves, and continuously variable 'Q' are featured. The **Midnight Audio Type 164** alignment oscillator, *MA 100* power amp, and *MA 2000* broadcast turntable can also be seen on their stand.

Audio Developments will be exhibiting a range of portable mixers, plus two new signal processing units that incorporate techniques developed for their portable models, and are now elaborated for studio use. By taking a pair of compressor-limiter modules as fitted to the *ADO07* and *ADO31* mixers, and adding transformers, switches and an attack control, the new rack-mounted *ADO55* stereo compressor-limiter has been developed. Addition of an expander and band-splitter/combiner to the *ADO55* has resulted in the *ADO60* stereo/expander/compressor-limiter, which allows adjustable frequency ranges to be selectively compressed without affecting the rest of the spectrum. The company also tells

us that they will be giving away to qualified visitors a free self-powered mixer. Just what they mean by this will be revealed at the show.

Audio Kinetics will be exhibiting a range of *Sonaplan* acoustic screens, and a new range of *Sonapanel*s. Modules of the solid-state logic *series 4000* consoles, and the *XT14* autolocator working with a 3M *M79* tape machine can also be seen.

The central feature of the **Audix** display will be an announcer-operated version of the *MXT 1000* console, introduced at last year's APRS. Built in 'wrap-around' form, and incorporating turntables, cartridge and tape machines, the console is designed for ease of operation. Also on show will be a section of a new mixer for larger studios, with eight groups and up to six auxiliary outputs. Flexibility in operation is said to be the keynote of this design, which is equally suitable for mono, stereo or multitrack working. Items from the *B100* range of mixers will include a mobile grams mixing console designed and built to the requirements of a major UK television company.

Avcom are to show the complete range of high-speed 'in-cassette' tape duplicating equipment manufactured by **Telex Communications**. These include: a compact desk-top 4-channel stereo cassette duplicator; the *series 300* open-reel to cassette duplicator; and a range of accessories. The company will also be exhibiting an unusual **Sonifex** fader that has no handle—just a recessed track. The last position that was touched on the track is stored and fed to an electronic attenuator. At the side of the track is an illuminated display that gives fader 'position'. The system may be interfaced with automatic mixing consoles.

BASF will be showing their popular *SPR50LH* low-noise/high-output tape, available in four widths on 27 cm NAB reels. Two low-noise cassette tapes will also be exhibited: *TP18* triple-play, and *QP12LH* quadruple-play. The full range of calibration and test tapes and cassettes, and three more widths of calibration tape *76* can also be seen. In conjunction with **BASF**, **Nordisk** plan to demonstrate for the first time in the UK the *Unimatic* machine developed for **BASF's Uniset** cassette system.

FWO Bauch will be showing the following equipment: **Studer A80/VU** 24-track tape

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Limp staves
Pipeless maracas
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At least you don't have to worry about the mixer.

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Each output has 2-band equalisation, (so does the monitor master) and the illuminated VJ meters show master, monitor or pfl.

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APRS PREVIEW

machine with automatic tape position locator system, *A80/RC* 6.25 mm master recorder, *B62* and new *B67* 6.25 mm tape machine, *169* portable mixer, and *A68* power amp; **Revox** *A700* and *A77* stereo tape machines, new *A710* stereo high-power amp, light-weight *RH31* headphones, and a selection of accessories; **Neumann** condenser microphones and disc-cutting equipment; the new **EMT** electronic reverberator *EMT250*, professional turntables, 4-track logging recorder, compact compressor, limiter, de-esser and noise filter modules and various items of test equipment; the new **UREI** response plotting system *200* and *Sonipulse* acoustic analyser; **Teletronix** *LA-4* compressor-limiter and *LA-5* leveller; **Universal Audio** *UA1176* limiter, *BL-40* modulimiter, *UA527-A*, *529*, *530* and *532* graphic equalisers, and *UA565T* Little Dipper filter set; **Transco** disc recording blanks; **MRL** test tapes; **Lexicon** *Delta-T 102* mono and stereo digital delay systems, and the new *Varispeech 2* time compressor/expander; **Allison Research** *Kepex* and *Gain Brain* modules; **Albrecht** magnetic film equipment; **Klein & Hummel** parametric equaliser and monitor loudspeakers; **Danner** faders and microphone stands; **ARP** synthesisers; **Seydel** faders; and **Switchcraft** audio connectors.

Beyer will exhibit a range of headphones, microphones and accessories. Their new infra-red sound distribution system, which uses ir light as a sound carrier, will also be demonstrated.

B and K will be displaying a wide range of their test equipment, including the new *1902* distortion measurement control unit, which together with their *2010* heterodyne analyser can perform swept measurements of harmonic, difference frequency and intermodulation distortion (2-200 Hz, 0.01% distortion). Other new gear to be seen: the compact *1023* sine generator; the *2429* psophometer (reviewed in *STUDIO SOUND* February '77, p64); the *4416* 2-channel response test unit for checking pick-ups; and the *2131* octave and $\frac{1}{3}$ -octave analyser.

Cadac hope to show examples from two new series of automated consoles using their *V-Cat* system for grouping and automation control. The *CCA* (Cadac Compact Automatic) consoles are fader automation ready, and feature seven dc subgroups and new isometric eq, which by electronically maintaining the LC ratio is said to retain musical 'quality' as eq is altered. All channel routing is solid-state, and the status of each channel is available on a 7-segment display. The *CCAM* (Cadac Compact Automatic Mixdown) is basically similar in design, except that only four output groups are provided instead of 32 for *CCA*, and the channel status display is simplified. Both consoles store and retrieve information through the *CARE* system using floppy disc (see *STUDIO SOUND* March '77, p32).

Calrec will be showing their complete range of condenser microphones, including the new *CM10C* phantom-powered talkback mic mounted on a 320 mm flexible stem with thief-resistant, insulated mounting. Also on display will be samples of their broadcast equipment.



4418 Calrec desk installed last year at BBC tv studios, Glasgow.

Cetec will be displaying the *Gauss 64:1* high speed tape duplication system, which allows a 9.5 cm/s master to be reproduced on slaves running at 304 cm/s. Conversion kits allow existing 32:1 systems to be updated in the field.

Philip Drake will be exhibiting communications equipment for both fixed and mobile use. An improved version of the 8 source by 8 destination rack-mounting talkback system, which allows expansion to 16 x 16, will be shown. The equipment is also capable of handling broadcast quality signals, and has been designed for use as matrix routing equipment. Uses in the studio environment include tape machine output to console input selection, and echo plate routing.

Dolby will be showing a range of cinema sound equipment, including the *364* and *E2* single channel units; the *CP100* multichannel sound processor; and the new *CP50* unit that enables existing cinema sound installations to play Dolby-encoded stereo optical sound tracks.

Electro-Voice will be showing a full range of studio, broadcast and pa equipment. As well as a selection of microphones, the *Sentry* range of studio monitors can be seen. The new *Sentry 5* and the *Interface A* will be exhibited for the first time in the UK.

Feldon Audio will be demonstrating the *Eventide Harmonizer*, which is a digital delay line plus pitch changer with a 2-octave range, and can also be used to speed up and slow down tapes without affecting the pitch; the *1745M* delay line, which features a delay range of up to 640 ms plus flanging and pitch changing facilities; the *Instant Flanger* (see review on page 90); *Omnipressor*, a combined expander/compressor/limiter/noise gate and dynamic reverser; **Ortofon** *DSS732* stereo cutting head and its associated amplifier and *STL732* high-frequency limiter.

Fitch Tape Mechanisms are to exhibit a new range of tape cartridge players and record units. On show for the first time at an APRS Exhibition will be a new professional stereo broadcast unit, *model TS 7000*, which features what is said to be a unique pinchwheel

lifting system. Also to be seen: the new *T 200* record/replay series that includes manual and automatic fast forward, three cue-tone recognition, expander gate muting and cue lock-out; and the *Audiopak* range of NAB broadcast cartridges.

Their wide range of audio products, including patch bays, cords, Nagra-goodies and other odds and ends, will be displayed by **Future Film Developments**.

For the first time **Hammond** will be showing the complete range of **Otari** compact and console-mounted tape machines. On show will be the *MX5050* range in 2-track 6.25 mm, 4 and 8-track 12.5 mm formats; *MX7308* console in 8-track 25 mm format, available for the first time in the UK in both low (9.5 and 19 cm/s) and high speed (19 and 38 cm/s) versions; the new *MX5050* mk II 2-track console, also on show for the first time in the UK; the complete line of **JBL** studio monitoring equipment; the **Sound Technology** distortion measurement system model *1710A*; and the new **Leader** *LAS5500* analyser.

Hayden Labs will have in operation the new **AEG/Telefunken** *Tachos 12* automatic cassette loading system, capable of handling up to four cassettes per minute. The new *model M15A* multitrack available in a variety of configurations and tape speeds can also be seen. Also to be exhibited for the first time: the new **Nagra** low-cost portable *model E*; the **Sennheiser** *Vocoder* special effects unit and infra-red headphone system (see *STUDIO SOUND* May '77, p24).

Helios will be showing photographic examples of their latest custom-built consoles that have been delivered recently to America, Scandinavia and the UK. Also on display will be a series of working modules that illustrate the company's policy of custom-building both the complete console and individual modules to a particular client's needs.

H/H will be displaying two new products: the *Stereo 12* transportable mixer providing 12 input channels, two main outputs and comprehensive foldback, plus a plug-in digital

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Recording Studio Design

Our new 12 into 2 mixing console



This twelve input stereo mixer was designed to provide high performance, exceptional reliability and stability at a very modest price, to suit the requirements of bands on the road and small studios.

Input Channels: Electronically balanced input and gain control 30dB input pad. Input impedance greater than 6Kohms. Minimum input for 0dBm through channel -60dBm. Maximum input for 0dBm through channel +15dB. Equivalent input noise less than -120dBm (unweighted). 20KHz bandwidth, input loaded with 200 ohms.

Tone Controls: Treble \pm 16dB at 10KHz. Mid \pm 16dB at 400Hz to 8KHz (continuously variable). Bass \pm 16dB at 30Hz to 300Hz (continuously variable). Foldback (prefade) send. Echo (post fade) send. Linear motion fader. Panpot, 3dB down at centre. PFM button allows signal level through channel to be monitored on meter. Headroom 20dB eq. flat.

Outputs:

Left and right output master faders
Foldback output master fader
Echo send master (rotary pot)
Maximum output level +20dBm
Over all frequency response
+ 0.3dB, 20Hz - 25KHz.
Residual output noise less than
-70dBm.
Output level controls at 0dB,
channel faders and sends fully
down, 20KHz bandwidth.
10dB gain after faders and echo
send
Maximum gain through mixer
equals 70dB.
Illuminated output meters Ovu
= 0dBm.
Meter select switch 1. Left and
right outputs. 2. Foldback and PFL
Echo return line level input
Echo return level control and pan-
pot, pans across left and right out-
puts
Regulated internal power supply
110/120v, 220/240

All signal inputs are Switchcraft D3F and outputs are D3M. Mains input is via an IEC mains socket, a 2 amp fuse and an on/off switch. The mixer is fully screened in a rigid steel case with wooden end cheeks, measuring only 18" x 28 $\frac{3}{4}$ " x 3". The metalbox has a very durable black stoved finish and the legends are printed with white epoxy paint.

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Gregg Audio Distributors, Chicago.
Tel: (312) 252 8144.

UK & All Other

Audio & Design Ltd., Reading.
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APRS PREVIEW

effects unit; and the *S500D* 2-channel power amplifier capable of delivering up to 500W output per channel (or 900W in bridged mono). Also on show will be the *TPA* range of monitor amps, and the *Multi Echo* and *Echo Unit*.

Zoot Horn will be exhibiting a new series of multitrack mixers. On display will be a 16-track version, which is also available in 24 and 32-track format. The console comprises 20 input/output modules with full monitoring facilities and sweep eq, two auxiliary (echo) send and return modules, two foldback (cue) modules, four master outputs for mix down, one oscillator module, service module comprising of master monitor controls, talkback facilities etc, and full patch bay.

International Musician & Recording World magazine has become the leading monthly magazine for amateur and professional contemporary musicians. The magazine is the established publication in its field due to its original approach in reviewing musical instruments and associated equipment. Each month the magazine carries news about the music business, recording studios and interviews and articles on musicians.

ITA will be showing equipment from **Revox, Teac, Itam, Otari** and **Orban**. The new **Revox 377**, based on the well-known *A77* series, features three speeds plus varispeed, full logic control with motion sensing, and improved editing facilities. The *A77* can also be seen in a variety of special versions, including a cassette pancake monitor. Also to be seen: the new **Teac 80-8** 8-channel tape machine for use with 12.5 mm tape; **Tascam model 3** and **5** mixers; the **ITAM 805** 12.5 mm tape machine, price £1890; the new **Otari DP1010** 16:1 cassette or reel-to-reel tape duplicating system; and the **Orban/Parasound 3B** reverb unit, for which **ITA** are now distributors.

Malcolm Jackson tells us that he hopes to exhibit a 'prototype of the world's first automated record producer. Although every precaution has been taken through exacting laboratory tests where the *Rec Pro Bug* has

been seated behind many types of console, for safety's sake the prototype will be lashed to a 24-track with masking tape.'

Um, but read on: 'At this point in time,' he explains, 'it is quite safe to say that the creature is not dangerous—it is not even a good record producer. However, if it should escape it would be advisable for other exhibitors to clear the hall immediately, and remove all their equipment as soon as possible. You (the hapless visitor—*Ed*) won't have any trouble in recognising him—one ear is bionic and the other normal—and his third ear is cauliflower.'

You (ditto) have been warned.

Clark-Teknik will exhibit their range of graphic equalisers, including the *DN27* mono $\frac{1}{3}$ -octave 27-band unit, the *DN22* 2-channel 11-band unit with additional highpass and lowpass filters, and the *DN15* stereo 11-band unit. Two new products will also be shown: the *DN36* analogue time processor, a dual-channel unit for flanging, phasing and adt, plus many other reverb and time-modulated effects; and the *DN11* paragraphic equaliser.

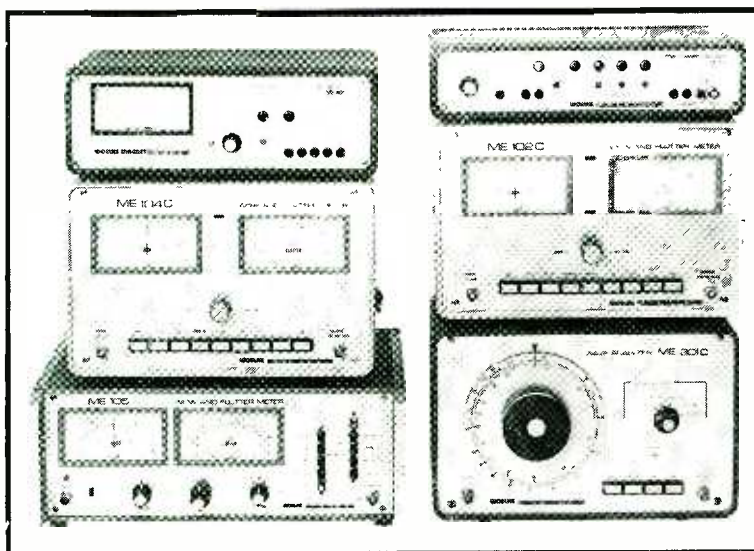
The range of products to be exhibited by **Lee Engineering** include a new bulk erase and splice finder from **International Tapetronics**, advance details of the new *Audiopack AA-3* tape cartridge from **Audio Devices**, and several tape head care products from **Nortronics**. The **International Tapetronics 3D-0001** 3-deck cartridge replay machine, which can switch any number of times in any sequence of its three carts, will also be demonstrated.

Leavers-Rich are to exhibit their range of professional 6.25 mm machines, which now comprises three models: the *E200*; the *Proline 1000* series, which made its debut at last year's APRS and is now available as a transportable version; and *Proline 2000TC*, a twin servo capstan recorder with all dc motors, ttl logic, digital servo tape tension system and the 'absolute minimum of mechanical components, thus ensuring superb performance and high reliability'. The transportable *Proline 1000*, and *Proline 2000TC* will be on show for the first time in the UK.

Lennard Developments will be showing

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Woelke
test gear
to be
shown by
Lennard
Developments
including
the new ME
401 automatic
distortion meter



The Scamp. All the signal processing you need, plugged into one box.

For example:

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.

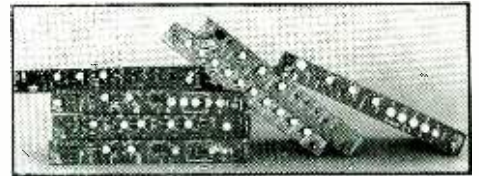
An octave equaliser providing 12dB lift or cut at the ten standard centre frequencies between 31.25Hz and 16kHz.

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 8³/₄" by 13¹/₂", 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.

You can build up a whole library of modules and quickly and easily transfer them from one installation to another (studio to mobile, for instance).



Buy what you need now, and come back for more later. We'll even buy back the blanks you've used to fill up the unused spaces. Send for full data; we're always adding new modules to the range.

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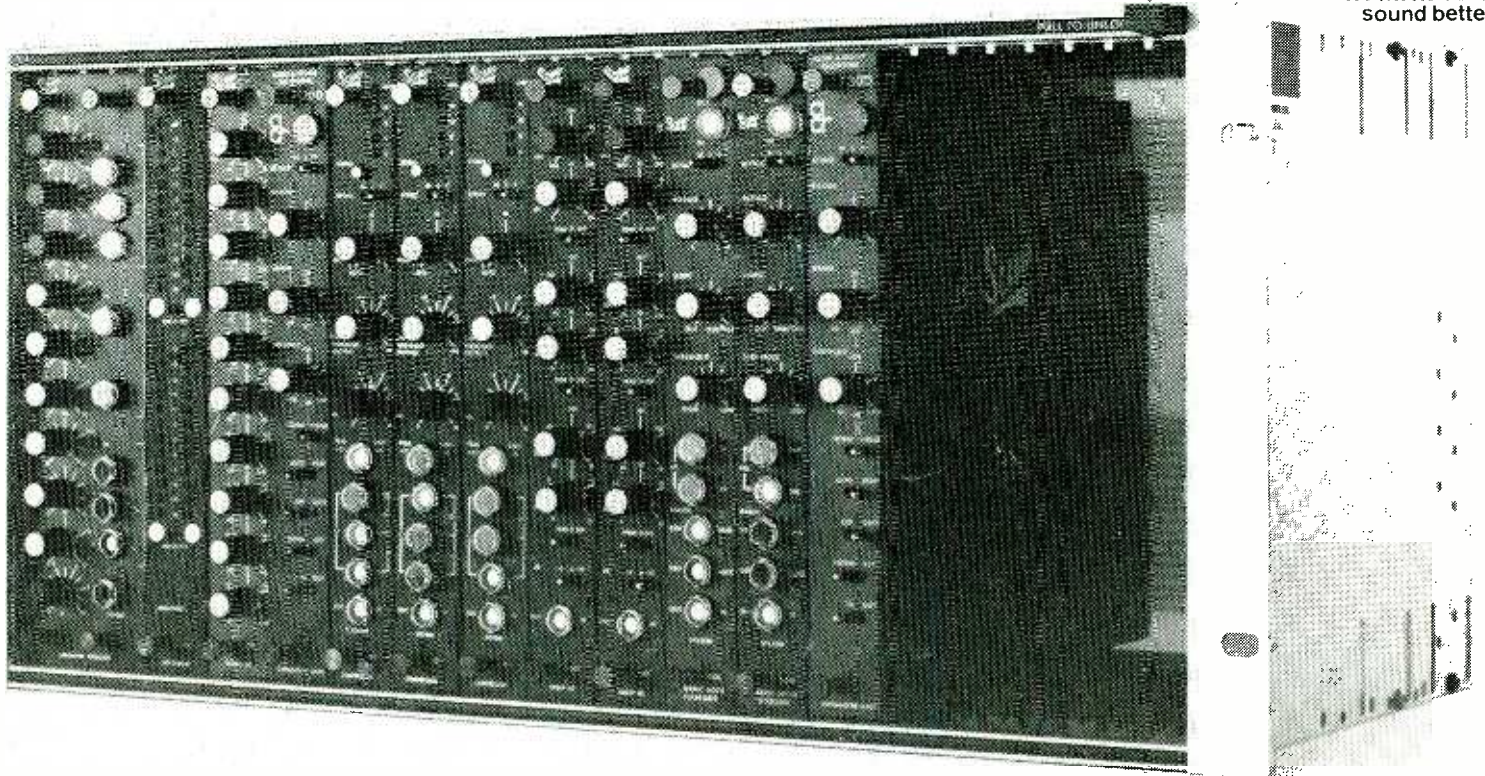
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APRS PREVIEW

for the first time the new *ME201* flutter classification unit and *ME401* automatic distortion meter, both units for use with **Woelke's** wow and flutter meters.

Jacques Levy, agents for recording blanks (mastering and playback), and mastering styli for **Neumann**, **Westrex** and **Ortofon** cutters, will be displaying the **Pultec EQP1A3** equaliser.

Lockwood will be exhibiting three new models of disc reproducing equipment, and a new portable monitor loudspeaker. Also on display will be the full range of existing monitors, available with or without power amps.

Lyrec will exhibit the multitrack *TR532*, together with a new tape position controller that enables search to three different preset locations and recycling between two positions; the unit can also store 16 different tape positions for later recall and search. Also on display will be the standard remote control unit fitted to their range of machines, and which features search function, varispeed with 4-digit readout, tape timer and controls for all amp functions. This latter facility allows selection for each track between a variety of functions including 'solo', which allows the soloed track to be monitored in the 'correct stereo image'.

Macinnes will be showing the new **Amcron EQ-2** equaliser that allows the centre frequency of up to 11 filters to be shifted by as much as half an octave. Also on display will be the

latest all-Macinnes-built mixer, which now comes complete with a low-weight glass-fibre flight case. A range of **Sescom** devices, including transformers, di boxes, mic-splitters and active modules, can also be seen.

MCI will be featuring the new *JH-110A-14-4-VP* tape machine that features 35 cm reel handling, and a tape counter displaying minutes and seconds in real time, which can be combined with the *JH-36* 'return to zero' function. New bias and erase timing generators are said to eliminate clicks, gaps and overlaps during electronic editing. The variable-profile machine (hence '-VP') is capable of handling mono or stereo formats on 6.25 mm tape, plus 4-channel on 12.5 mm tape. An example of the *JH-500 series* automated desks can also be seen.

Keith Monks Audio will be showing eight coloured mic stands and booms finished in nylon-dipped paint to make them easy to identify in the studio. Their range of cable drums, flexible goosenecks, slide clamps, stereo bars, drum booms and microphone clamps can also be seen.

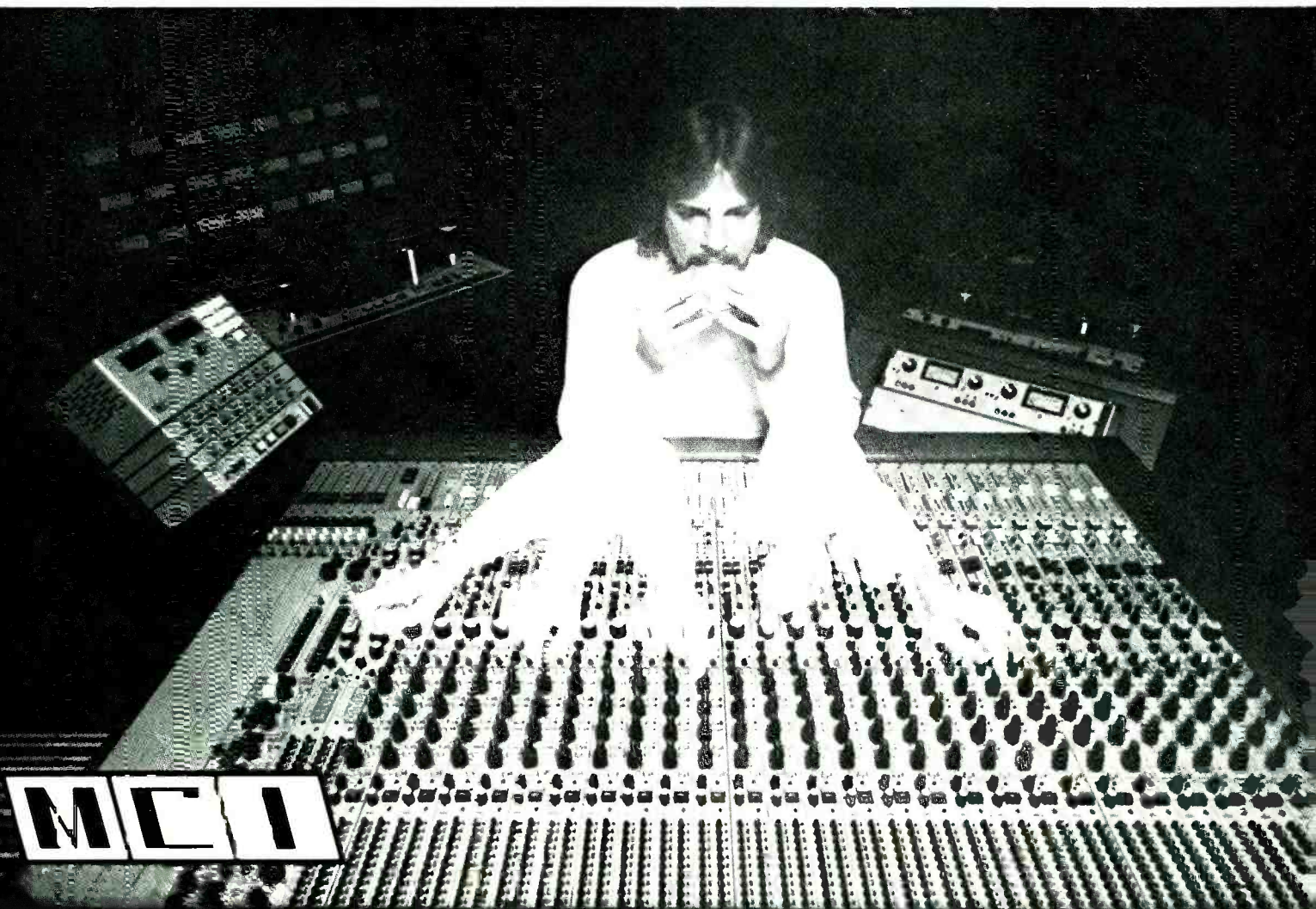
With the centenary of recorded sound in mind, the main feature of the Neve stand will be an exhibit illustrating the contribution of their 'design and craftsmanship to the art of sound recording'. Two contrasting pieces of equipment will be featured: the very first Neve console, a 10-channel/2-group design employing thermionic valves and rotary faders; and a working **NECAM** (Neve Computer Assisted Mixdown) system.

NEAL are to display their complete range of cassette recorders designed to meet all studio requirements from mono, through stereo, to 3-channel a/v and 4-channel applications.

NTP are to show a range of ppms, including type *177-400*, a compact stereo instrument with a digital peak memory and +20 dB additional gain function; type *377-500* intended for film and tv production, the reading being superimposed on to a normal tv picture; and a prototype of a filter unit to be used with type *377-100* multichannel ppm as a frequency analyser. Their display will also include a range of compressor-limiter amplifiers, stereo monitor oscilloscope, filter units and a voice-over unit.

John Page will be exhibiting a selection from the **Stellavox** range of portable recorders and mixers, including the new *SP8* machines that features a power feed for 50V phantom and 12V ab capacitor mics; separate line, mixer and mic inputs on each channel; mono or stereo operation with interchangeable head blocks and mono/stereo switch; film sync with neo-pilot or synchrotone; and a new tape counter. The last item, which is tape-driven and counts seconds at 38 cm/s, is suitable for installation on all Stellavox recorders.

Penny & Giles will be introducing two new products: a linear-motion fader that provides two separately-operating faders contained within a body width of 25 mm (thus offering separately-controlled stereo outputs from one fader); and a short-stroke fader of



MCI



A range of faders to be shown by P & G.

only 65 mm electrical travel with an overall body width of less than 12.5 mm, available with mono or stereo outputs.

The new *Contek* bulk cassette tape for high-speed duplication will be displayed by **Professional Tape Marketing**. Custom length cassette for in-cassette duplicators and 'studio quality' cassettes can also be seen. Samples of **Marathon** broadcast cartridges, for whom

PTM have been appointed European distributors, will also be on show. Still on the cart front, visitors will be able to inspect the new digital cue synthesiser developed by **Control Technology Corporation**, which is claimed to give virtually inaudible cue tones.

RAC are to show examples of their free-standing or rack-mounting, custom-built mixers, constructed from a range of 38 plug-in modules.

In addition to their established range of audio equipment and laboratory instruments, **Radford** will be showing four new items: the *TT50* and *TT100* power amps with transistor input and drive stages and valve output stages, providing 50W and 100W average power per channel respectively; the *ANM3* noisemeter, which is similar to the *ANM2* but provides 'quasi-peak' response in addition to true rms reading; and a phasemeter that provides three measuring ranges of 18, 60 and 180° fsd, and lead/lag leds.

Raindirk will be exhibiting the well-known *Mini Range*, and the recently-introduced *Series III* consoles. The latter is an all-modular system providing 16 or 24-track monitoring, comprehensive eq, a choice of wire wound or plastic conductive faders, and an integral jack bay. Also on display will be a 40-input *Quantum* console, which is also available in frames for 24, 32-input channels. The input section incorporates routing, 3-section parametric eq, hf and lf peaking and shelving and a highpass filter, plus two cues and two echo sends. The 'master status' module incorporates oscillator and talkback

facilities, four cues and echo sends, plus four status pushbuttons; the 'master monitor' module incorporates studio playback monitoring from several sources, plus monitoring of tape cues and echo sends, and control of loudspeaker circuits.

Scenic Sounds Equipment will be showing a **Harrison 40/32** console, to which will be coupled an **Allison Research** automatic programmer. Available options for the standard Harrison console now include stepped-frequency equalisers and high-resolution (36-segment) channel meters; these will be incorporated within the board on display. Smaller products from the ranges of **Amber**, **APSI**, **dbx**, **Marshall**, **MicMix** (*Master-Room* and *Time Warp*), **Mayer**, **Orban**, **Schoeps** and **White Instruments** will include the new **Amber 4400** multipurpose audio test set, **dbx 162** stereo compressor-limiter, and **Marshall** and **MicMix** analogue delay/effects units. Tom Hidley will also be on hand to discuss **Eastlake**.

Amity Shroeder are to show their range of tape cartridge equipment, and a 50 mm tape transport mounted in a console with electronics. (Further details were not available at press time.)

As well as their wide range of microphones, **Shure** will be showing the *M615AS* equalisation and analyser system and *SR107* audio equaliser for simple and fast room or studio eq. Also on display: the *SR series* of sound reinforcement equipment; and the *PE 52* anti-feedback mic that rejects sounds

58 ►

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APRS PREVIEW

from more than 25 mm from the mic, while still 'faithfully reproducing close-up vocals'.

Sifam are to exhibit examples of their vu meters and ppm indicators, plus a range of matt-finish collet knobs.

Soundcraft will be displaying examples from the *Series Two* range of 4 and 8-track studio consoles, which feature sweepable frequency eq and patch bay options. They also plan to demonstrate the new *Series Three* modular console, featuring as standard sweepable frequency eq, eight auxilliary sends on each channel, auto solo pre/post, patch bay, led vu/ppm metering, and Penny and Giles faders. The *Series Three* is designed for 16 and 24-track applications, with a standard format of 24 into 16 costing about £10 000.

The Studio Equipment Division of **Roger Squire** will be demonstrating **Tapecaster** NAB cartridge players and recorders, for which the company are sole UK importers and distributors. The company is also the sole importers for **Russco** broadcast turntables, and sole distributors for the **Anglepoise** mic arm, both of which will be shown.

Studio Republic will be supplying details of their 8-track studio that includes full facilities for producing music and speech recordings for industrial and training courses; their 8 and 16-track mobile which features an 18-channel Neve console; and cassette manufacturing facilities.

Surrey Electronics will be exhibiting the following equipment: a stereo disc amplifier for broadcast, disc monitoring and transfer; a ppm meeting the relevant BS and IEC specifications, and fulfilling IBA, EBU and BPO requirements; a 10-outlet distribution amplifier which meets IBA requirements and is available as a complete unit or in kit form excluding case and *XLRs*; a frequency shifter with a range of 1-10 Hz; a spectrum shifter/special effects unit; and a peak deviation meter for off-air or transmitter site monitoring of fm stations.

Trident will be exhibiting the well-known *Fleximix* modular mixing system, which is available with up to 40 input channels, ten mixed outputs and 24-track monitoring. Also on show: the *CB9066* parametric equaliser with three overlapping ranges and high and lowpass filters; a new low-distortion audio oscillator/frequency counter; a new low-cost compressor-limiter that provides either 2-channel mono or stereo operation, with

variable control of compression ratio, attack/release time and input/output levels; and modules of the proposed *C range* mixer.

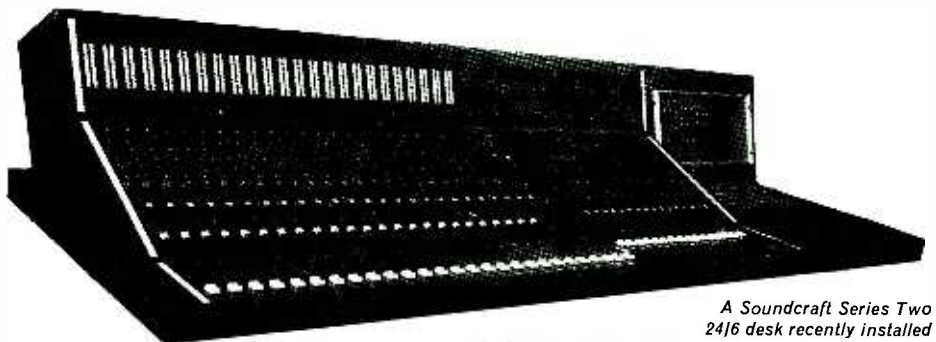
Turner will be spotlighting a selection of electrical measuring instruments, including ppm and vu-type meters. A twin ppm for stereo application, available to vu meter standard ANSI C16-5-1954 with A or B scale, or to the BBC ppm specifications BS 4297 (1968), will also be demonstrated.

Tweed will be exhibiting the *P104* portable mixer for the first time in the UK. The system is expandable to 24 inputs/outputs and offers metering and monitoring on all channels. A new high-speed limiter *CL603* that features variable attack time down to 20 μ s, recovery variable from 70 ms to 2s, and threshold switchable in 2 dB steps from 0 to 12 dB, will also be shown. Also on display: a new noise gate *CL606* designed with variable threshold of -50 to -10 dB, variable depth control and recovery; and a new broadcast mixing console type *B1403* specially designed for local radio stations.

Vitavox will be emphasising the *S-3 Pressure Driver* rated at 100W with a bandwidth from 200-15 kHz. The *4-cell* (multicellular) *Dispersive Horn*, which combines four individual horn cells to give a performance above the 330 Hz cut-off frequency, accurately bound within the 90 x 30° distribution angle, and *4 Kilo Hertz Horn*, the very narrow mouth of which is said to give an accurately bound 150 x 30° distribution, can also be seen.

Webland will be showing a new 30W per channel, rack-mounting monitor power amplifier from **BGW**. The front panel of the unit is equipped with individual gain controls and led clipping indicators for each channel. In addition, the unit is available with *XLR* inputs and octal connectors for plug-in input transformers. Other amps to be shown include the *model 250B*, which provides 90W rms per channel or 200W mono into 8 ohms; and *models 500D* and *750A*, which deliver over 200W per channel into an 8 ohm load. The *500D* is intended for use in monitor or pa systems; the *750A* shares the same mechanical construction as the *500D* but employs a massive power supply to extend the rated power bandwidth down to a claimed 5 Hz.

Racal-Zonal will display examples of tape for music mastering, broadcasting and duplicating, plus tapes designed with extremely low print-through characteristics, for applications such as location recording and archival storage. ■



A Soundcraft Series Two 24/6 desk recently installed in Canada. Upper section contains routing and ppms.

APRS LIST OF EXHIBITORS

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BD5200	FC15E £97.00

Control devices for electronic synthesisers

Nyle A Steiner

The potential of a synthesiser should only be limited by the operator's ingenuity. But even the 'front end' offers wide room for development.

ELECTRONIC MUSIC synthesisers have a unique quality that sets them apart from other musical instruments, in that their pitch, as well as other things, can be controlled by voltages, ie it can be played by means of any device capable of producing voltage changes. Most synthesisers use a standard 'black and white' keyboard simply because it is a very popular device for controlling pitch. Each key produces a certain output voltage which in turn controls the pitch of a voltage-controlled oscillator (vco).

A synthesiser basically requires two things from the player: triggers for articulation; and control voltages to control pitch and/or other things.

With a standard acoustic instrument, pitch is controlled by mechanical means; the player must vary its mechanical parameters by pressing piano keys, covering holes, pressing valves, etc. The synthesiser, however, being controlled by voltages, does not care how the voltages are varied. The player can vary them by any method that he chooses, whether it be by turning a potentiometer, playing a keyboard, pushing a joy-stick, programming a computer, etc.

Probably the most simple way to control a synthesiser is by the use of a potentiometer to vary the voltage, and a pushbutton to provide triggers. The most standard control

device consists of a standard set of black and white keys connected to a string of resistors, such that each key taps off one semitone worth of voltage-drop across the resistors to control the pitch of a vco. A trigger is also produced whenever a key is pressed (fig. 1).

Keyboards can take several forms. An unusual design involves the use of electrically touch sensitive conductors for keys, as has been done by Buchla. These pads are usually made touch sensitive by using a balanced high-frequency ac voltage, or by using the electrical conductance of the fingers. When the pads are touched, they each turn on a latching circuit to hold the pitch; each latch usually has a potentiometer to set its pitch (fig. 2).

Another form of touch-controlled keyboard is made by Putney in which the keys are electrical conductors under a layer of paint—the keyboard is merely painted over the conductors. This keyboard can be played in real time while simultaneously programming a memory for later playback as a sequencer.

Moog makes another form of control device called a 'ribbon controller'. It works much like a potentiometer, but takes the form of a ribbon which changes output voltage depending on where the finger is rubbed along the ribbon. A trigger is provided whenever a metallic strip, running parallel to the ribbon,

is touched. Another control device made by Moog takes the form of a drum, and is usually played by striking. An output voltage changes depending upon how hard the drum is struck, and triggers are provided whenever the drum is hit. The voltage is made to stay constant after each strike through the use of a sample and hold circuit (fig. 3).

The joy-stick is, of course, a well-known way of controlling voltages to a synthesiser. Although it does not usually produce triggers, the joy-stick does give the player the ability to control two or more voltages simultaneously by moving only one control. The basic joy-stick is simply a lever connected to two or more potentiometers such that a sideways motion turns one, and a forward and backward motion turns the other. Additional control can be obtained by turning another pot with a twisting motion of the stick, and another still by sliding the stick in and out.

Many instrumentalists, from guitar players to horn players, can play a synthesiser by running their instruments through a pitch-to-voltage converter, such as the one built by 360 Systems. This usually produces two output voltages: one corresponding to the pitch being played (this type of device, it must be remembered, will only act on a single note at a time, so chords cannot be played into it); and the other proportional to the loudness of the instrument. An additional output provides triggers.

Another approach to playing a synthesiser is to produce an electronic controller that works in the same way as a synthesiser keyboard, ie switching of resistors, but takes the form of a brass instrument, clarinet or what have you. This alleviates the disadvantages of using a pitch-to-voltage converter.

Steiner-Parker has developed what they call an *Electronic Valve Instrument* which is played in the manner of a brass valve instrument such as a trumpet. Three valves produce changes in voltage corresponding exactly to the pitch changes produced by pressing the valves of a trumpet. Slurring and range changes are facilitated by a special switch operated by the left hand instead of buzzing the lips at different pitches, while triggers are produced by blowing into the instrument. Thus it can be articulated in the

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Output + 20dBV.7 1KHz —86dB, 0.004%
30Hz—20KHz —80dB, 0.008%

Static intermodulation distortion 50Hz + 7KHz 4:1
Output + 10dBV.7 —88dB, 0.003%

Dynamic intermodulation distortion
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15KHz sine wave, 4:1.
Pre-emphasised input 1V pk-pk —60dB, 0.01%

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Clipping point complementary to RIAA curve

30Hz—20KHz Within 0.5dB

Clipping determined by onset of peaky distortion

products or THD exceeding —80dB, 0.01%

Differential phase shift

50Hz—20KHz Within 0.5°

Worst error, around LF and HF

filter turnovers Within 5°

Noise 20Hz—20KHz, mean reading meter

Short circuit input —70dBV.7

Cartridge source, 100mH —67dBV.7

same way as a brass instrument by tonguing. Double and triple tonguing works very well with this instrument, and since the range is controlled by a left-hand switch instead of buzzing, the player can play over a nearly 7-octave range. This instrument could be considered to be a substitute for the standard synthesiser keyboard, to be used by persons more familiar with a brass instrument than with a standard set of keys.

Computons makes another instrument called a *Lyricon*, which seems to be a voltage-controlled device that plays in the manner of a woodwind instrument such as a clarinet.

A synthesiser, being a voltage-controlled device, tends to be a 'one note at a time device' when using a standard keyboard. This is because each key represents a voltage change controlling one or more tracking vco, instead of each key representing a separate tone generator as is the case with organs. Some very complex synthesiser keyboards can play 'polyphonic' by producing several control voltages simultaneously, which can then drive several vcOs. There are many problems associated with producing triggers and envelopes for each voice, and polyphonic synthesisers are presently prohibitively expensive. Anyway, many performers use a polyphonic synthesiser to no greater extent than many organs. Both polyphonic and monophonic synthesisers have their own 'bag' but are in many cases two different animals.

Using even a single vco, such as might be found in a small synthesiser, it is possible to produce any harmonic sonority by using some kind of sequential controller to play arpeggios of the desired harmony. Very complex chord structures can be played in this manner without the limitation of only having, for example, four vcOs and a four-voice polyphonic keyboard. Sequencers though have the disadvantage of having to be reprogrammed for each set of notes.

A new type of special keyboard has been developed by Steiner-Parker which they call a 'multiphonic keyboard' (not to be confused with polyphonic). When played single note at a time it behaves like any standard one-voice synthesiser keyboard, but when many keys are pressed simultaneously the keyboard plays a sequential pattern consisting of the notes pressed—the sequential pattern changes as the pressed notes are changed. Thus this keyboard can be played as though it were a full polyphonic keyboard, but instead of hearing many voices playing in harmony, one voice produces arpeggios of the harmonies played (fig. 4)—the sequential rate is adjustable.

On many occasions, I have used a blow tube trigger generator to articulate the synthesiser while leaving both hands free to play knobs and a tiny 3-octave keyboard made by cutting a pattern of keys in a piece of printed circuit board.

Suffice it to say that there are countless ways of playing a synthesiser. All we need to do is use our imagination along with anything that can produce a voltage change: it would be impossible to cover all of the possibilities. I have written this whole article without even talking about computers that, through the use of a digital-to-analog converter, can convert its numbers into control voltages or even audio signals themselves.

FIG. 1 BASIC FORM OF SYNTHESIZER KEYBOARD

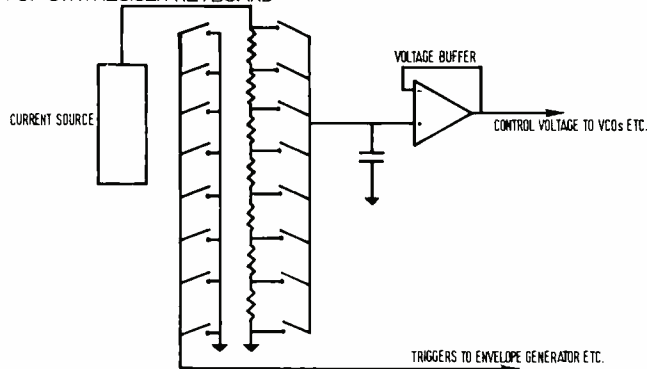


FIG. 2 TYPICAL BUCHLA TOUCH KEYBOARD

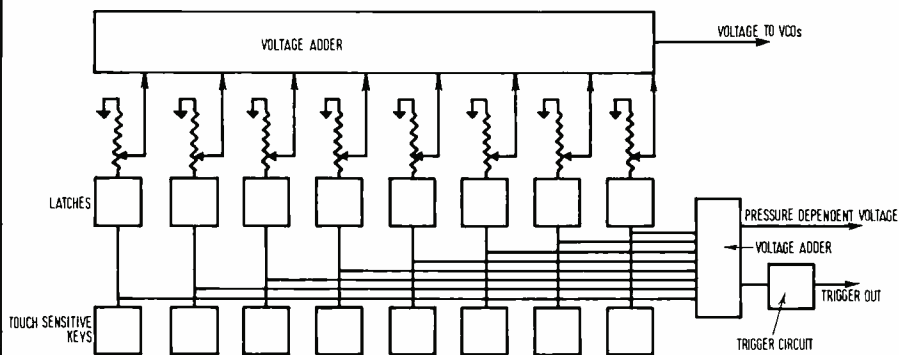


FIG. 3 BASIC SET-UP FOR DRUM CONTROLLER

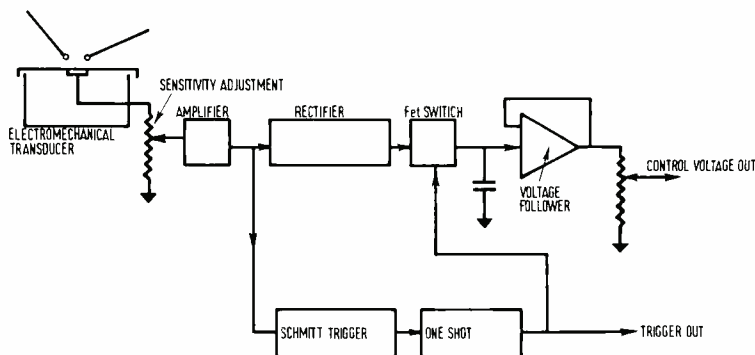
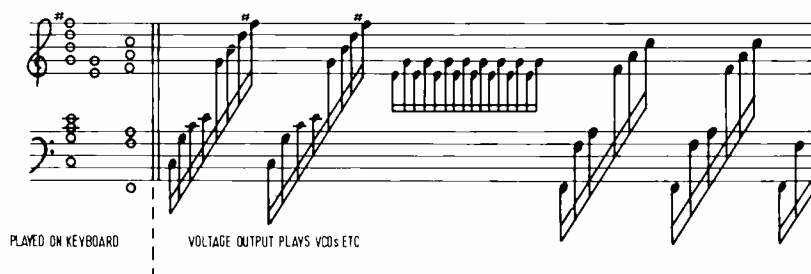


FIG. 4 BASIC OPERATION OF THE STEINER-PARKER MULTIPHONIC KEYBOARD



AES 57th Convention, a report

Gordon Skene

The 57th AES Convention was held at the Los Angeles Hilton from May 10 to 13, 1977

IF THE 57th AES Convention had been titled the 'Auto Show', or any other curious nomenclature, it would probably have held the same degree of fascination. It seems as though the number of recent entries in the console design and construction sweepstakes has reached a fevered pitch. There are probably more boards to choose from than different models of American cars, and all recent entries have their pluses and minuses.

With the recent trend toward sophisticated home-recording, a number of manufacturers have decided to capitalise and come out with their versions of the Tascam board in various configurations and prices under \$5000. Among the manufacturers exhibiting the more affordable boards were **Sound Workshop**, offering a 12-in/4-out setup for approximately \$4400, and **Allen and Heath**, with their *SD 12* 12/2 mixer for \$950. At first I found the price a bit difficult to believe, but on further inspection found it to be one of the more basic setups I've seen in some time; however, in today's state of monetary insanity, \$950 is downright cheap for audio equipment! The models *700*, *170*, *180* and *430* from **Yamaha**, which double (supposedly) as live sound reinforcement mixers, were another attractive proposition.

Aimed squarely at the sound reinforcement market—but which will almost certainly find its way into a few garage recording studios—the new *Trouper Series* of desks and accessories from **Uni-Sync** is available in a variety of formats, from a basic *Trouper I* 8-channel unit (\$749) right up to the 14-in/4-out, plus 'house' and two monitor feeds, of the *Trouper IV* system (just over \$5k). Colour-coded rocker switches for group assignment and mic/line input attenuation, plus 3-band graphic eq and echo/monitor sends on each channel are included in the top of the range models. Accessories include the *EQ-241* dual 9-band graphic equaliser, *QLM-1* quad limiter and *XO-1* dual electronic crossover for tri-amp pa monitors. Certainly a very comprehensive system. It was whispered that Uni-Sync will possibly have a studio demo at the New York AES Convention this fall, which will feature a modular console specially modified for home recording applications.

Of the considerably higher budgeted studio consoles, **MCI** was glowingly showing off their latest entry in the race for automation. As I pointed out last year, and has once again been substantiated this year, MCI is coming up with a mastering machine that accepts 75 mm tape, and comes in speeds of 38, 61 and 76 cm/s—though the sales force at the convention vehemently denied any knowledge.

The *model JH 400 B* console, which has been in use for a while now and sold to over 450 studios around the world, was still the more popular of the offerings from MCI. Two new modifications to the previous model are now available. The first is a new grouping facility, with vca-fader assemblies allowing any input/output module to be assigned to local control, or to any one of eight groups, thereby allowing *any* fader to be designated master for its group. When being used as a group master, the channel vca value is held and added to the group value. Thus if the fader is reverted to local, the group value is held while the channel value is corrected.

The other facility is 'quad-in-place solo', whereby the master

solo/mute control switches all channel mutes from normal operation to solo mode. All channels are muted *except* the ones activated as a solo. This reversal produces a quad-in-place solo function, adding to the flexibility of the console.

Sphere Electronics, a newcomer to the console manufacturing business, recently unveiled its *Eclipse C* automated setup, handled through **Sierra Audio**. Although it is in its finishing stages, with a delivery date in September of three boards, Don McLaughlin, chief engineer, explains that time was spent putting finishing touches that resulted from requests of engineers and mixers for the addition of certain features *they* felt would be unusual and extremely necessary to have. Doubtless, when comes time for final placement in a studio, the *Eclipse C* would warrant further inspection in a future issue of **STUDIO SOUND**.

On the whole though, the convention this year had less nuances unveiled than in previous years. automation and the Tascam studio setup being the highlights. Last year's emphasis seemed to be on disco sound operations, which hopelessly failed last year and wasn't repeated this year. **JBL**, who thoroughly disappointed me last year with their less than desirable sound reproduction, managed a saving grace this year. Back to clean overall reproduction and uniform response in the bass, mid-range and high-end—as opposed to last year's bass and mid-range-only obsession. A new entry, one seen as a direct backlash at the popularity of Philips' bi-amped mini-monitor, was the **JBL 4301** broadcast monitor. Small enough to be obscured, but with sound to make the room shake, the unit was not bi-amped, however, and cost only \$168. With the limited monetary resources the owners of the Tascam studios have, these monitors are practically ideal for the money.

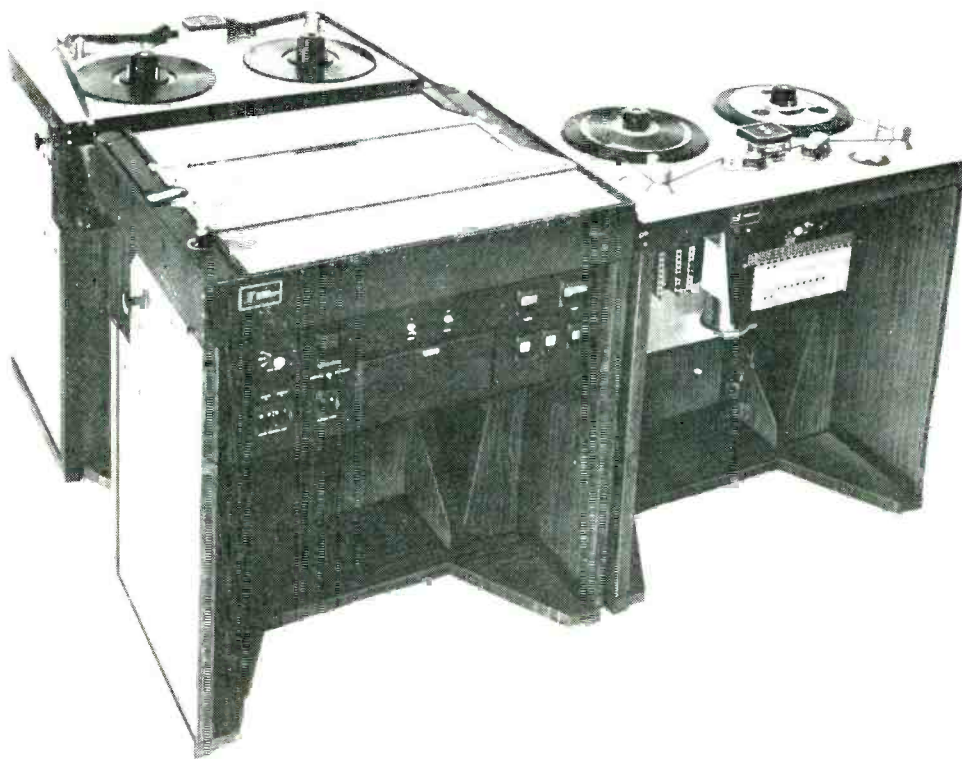
For headphone monitoring, **JVC** introduced the *Bi-Phonic* headphones which were, to put it mildly, a complete failure, with enough bass distortion and tinny response to make my skin crawl out of the room and meet me in the bar. However, the demonstration of the JVC technique of *Bi-Phonic* and *Q-Biphonic* sound over loudspeakers was more than interesting. This sort of development now makes it possible to achieve the same sort of effect as listening to binaurally-recorded sound over headphones, but with loudspeakers. Two artificial heads are used in the *Q-Biphonic* recording process: they are placed in close proximity, 30-40 cm apart (as in the usual binaural application), both facing forward with a baffle between them. The front head is clearly forward oriented, the rear head less so, each head producing a pair of binaural signals. These signals are not played back in binaural fashion; instead each pair is fed through a processing unit which incorporates equalisation and time delay to produce two pairs of signals suitable for quadrasonic loudspeaker presentation. The equalisation effectively produces a 'binaural-to-stereophonic' transformation, thus enabling the artificial head signals to be appropriately played back over loudspeakers. The technique produces phasors in space around the listener; obviously, the precise phase relationships in the original sound field must be maintained, which means that all transmission channels used in the *Q-Biphonic*

64 ►

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AES CONVENTION, A REPORT

process must be free of relative phase shift. Allpass networks, which are the heart of many matrix quadrasonic systems, cannot be used in this application because of the effect they would have on the recreated sound field around the listener.

This technique would be a challenge to the producer in the studio. However, the effects one would gain from this application would be inestimable.

Of the more consumer/semi-industrial developments, SAE recently introduced their *model 5000* impulse-noise reduction system, which is basically a simplified de-clicker. Primarily, studios would really only be concerned with such a device if there was disc re-issuing to be done, particularly if the master tape doesn't exist. But for domestic use it could mean click and pop-free disc reproduction. Useful for the home indeed, since most discs purchased in the US appear to have inherent clicks and pops built into them. But, more importantly, this system works with 78s—not totally, mind you—but considerably better than nothing at all. The ideal part of this system is the fact that it costs \$200—affordable for the neophyte 78 reissue producer, which, on the basis of all the American private-issue labels, abound. And perfect for the home user, who by and large still put their thumbs all over the grooves and spill coffee on their priceless discs.

Last year Ampex was attempting to take the bite out of Studer's overwhelming response in the US. Now they're after Teac—in fact so much so that they had their competition build a deck for them. The *ATR-700*, successor to the *model 600* of years back, and still used today by untold thousands, is in fact manufactured in Japan by Teac. *C'est la guerre*, I suppose.

Scully, on the other hand, were displaying their *model 250*, closest in looks and performance to the Ampex *700*, but not manufactured by anyone but Scully. During the course of the show, a salesman cleverly placed an American flag sticker on a demo machine letting everyone know that Mountain View, California, is not located near Kyoto—the spirit of competition and gentle back-stabbing is everywhere, even in audio.

News was also received of an interesting tie-up between a pair of American and Australian manufacturers. **International Electro-Magnetics** has recently announced that they are to manufacture under licence the *model 1000* series multichannel machines developed over the last four or five years by **Optro Pty** in Australia. Available in 4 to 24-track configurations, using 12.5, 25 or 50 mm tape, the machine features a crystal-locked servo capstan motor and interchangeable head blocks that incorporate all eq components. The deck is said to be of the same specification as a Studer of comparable complexity, but costs about one-third as much. Not surprising that it caused quite a stir.

The most popular and consistently packed of all demonstrations during the convention was the unveiling of the **Soundstream** and **Mitsubishi** digital recording systems. From the number of gasps in the audience, I knew that I was witnessing, sadly, the wave of the

future. Soundstream emphasised and over-emphasises the outstanding features of their system, which included modulation noise virtually eliminated; no generation loss while copying; wow and flutter eliminated; audio print-through eliminated; performance independent of variations in tape characteristics; total harmonic distortion and noise better than -85 dB; noise reduction totally unnecessary; 90 dB dynamic range; intermodulation distortion better than -80 dB; and crosstalk better than -85 dB. The facts from both systems are astounding. The Mitsubishi system, with a cleaner design, is still in the prototype stages, while Soundstream, with a curious collection of backup gadgets, is now ready for market purchase.

Aside from the astounding features offered by digital recording, it has the disturbing feature of offering what I felt to be almost sterile, synthetic reproduction of music—something of which there is almost too much already. In fact, the recording can be so ultra-clean that it now shows up inefficiencies in the studio: bad room acoustics, system noise, and a general amplification of all the mistakes and blemishes that would ordinarily pass through unnoticed during an ordinary session. I foresee that editing may also be a problem. As it was pointed out to me, Soundstream is planning on setting up special electronic editing centres throughout the USA (and possibly the world) for editing and assembling masters. Because the editing process is so complex (the editing being done digitally, so throw away your *Editall's*), it requires yet another set of electronics to accomplish that goal.

The system sounds and looks nice, and aside from my petty arguments about the sterility of synthetic sound produced through this system, it may prove to be yet another great step in the recording art. On the basis of this Convention there is a long way for the digital system to go before it becomes universally accepted. The initial price quoted of \$48-190k for the system appears to me to be the tip of the iceberg: I foresee a drastic restructuring of the studio in which it is housed, and the electronics to which it is fed.

I think the digital system is going to work, but something else tells me that it may be doomed to failure; the system's complexity may go far beyond the limits of the person who just wants to record something and make it right . . . pure and simple.

Ironically, in another room a display of over 100 years of recording equipment was assembled. Curious stares came from the viewers of the disc-cutting apparatus supporting a 444 mm cake of wax—the wax that became the master that became the 78. There is nothing synthetic about those 78s, and when I clear away the clicks and pops the room noise sounds just fine.

The Committee tell us that 5300 people turned up for the Convention (excluding exhibitors and press) and that the session attracting most attendance was Paul Klipsch's talk on special speakers for discotheques, which had 650 eager listeners. Some 128 companies showed their wares.

The 58th AES Convention will be held, as in recent years, at New York's Waldorf-Astoria Hotel from November 4-7, 1977.

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19in Rack Mounting, from one to six rows of 20, 24 or 26 Jacks. The jacks are mounted on a plastic block which is in turn mounted on a 19in panel. Each row is fitted with a legend (designation) strip and wire support bar. The panel is steel, cadmium plated, chromate passivated and stove enamelled hammer-tone silver.

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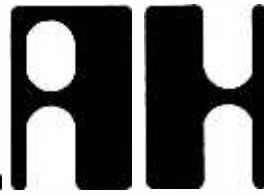
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Survey: synthesisers

Forthcoming surveys include mobile recording facilities (September), limiters and compressors (October), and microphones and ancillary equipment (November). Information for inclusion in the survey should reach this office (address p3) not later than eight weeks before the issue publication date.

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ODYSSEY 2800

Self-contained portable instrument with integral keyboard.

Noise generator: pink and white.

Transpose: normal and ± 2 octaves.

Pitch bend: about ± 1 octave frequency shift. (Exactly ± 1 octave on *Odyssey II*.)

Portamento: 0.01 ms to 1.5s/octave.

Oscillators: two; sawtooth, square, pulse and dynamic pulse on each; vco1 0.2 to 20 Hz in low-frequency mode; vco1 and vco2 20-20k Hz in audio range. Pulse width 5-50%; adsr $\pm 45\%$ and lfo $\pm 15\%$ modulation.

Filters: one vcf lowpass, 16-16k Hz, max 'Q' 30.

Ring modulator: digital working with vco1 and vco2 squarewave inputs.

Sample and hold: from keyboard or lfo trigger commands, sampling vco1 square and sawtooth, vco2 square and pink noise.

Envelope generators: two; adsr attack 5 ms to 5s, decay 10 ms to 8s, sustain 0-100% of peak, and release 15 ms to 10s; ar attack 5 ms to 5s and release 10 ms to 8s.

Outputs: two; 2.5V peak-to-peak 100k, and 0.25V peak-to-peak 10k impedance.

Interface jacks: keyboard cv in/out; gate in/out; trigger in/out, and external audio input.

Dimensions: 584 x 457 x 127 mm.

Weight: 9 kg.

Price: £798.

PRO/DGX

Similar to the old *Pro-Soloist*—DGX stands for digital switching—except that 'high-speed electronic latching devices have replaced plastic voice selection tabs, led status indicators have been added to help locate instrument sounds faster, and advanced lsi micro-circuitry has enhanced switching speed and reliability'.

Control switching: labelled as instrument—oboe, trumpet, fuzz guitar, song whistle, etc.

Additional controls: pitch, bend, wow, growl, brilliance, volume, vibrato, vibrato/repeat speed, portamento and keyboard sensitivity.

Price: \$1295.

OMNI 2300

Self-contained portable instrument with integral keyboard.

String section controls: instruments—violins, violas, cellos and bass; envelope controls—attack

ARP
2600
portable
synthesiser



and release times.

Synthesiser section controls: waveform (sawtooth and dynamic pulse), bass, vcf (frequency resonance, adsr depth, lfo depth, pedal and acc depth), lfo speed, adsr level and times.

Keyboard: four octaves, split for bass voices at $1\frac{1}{2}$ octaves from low end.

Outputs: four; main high and low level, and synthesiser line level (can be used simultaneously for discrete stereo effects), gate and trigger out, and foot switch and pedal.

Weight: 15 kg.

Price: £992.

AXXE 2400

Self-contained portable instrument with integral keyboard.

Noise generator: pink, 20-20k Hz ± 3 dB.

Transpose: down two octaves, normal, up two octaves.

Pitch bend: ± 1 octave (calibrated exactly).

Portamento: 0.01 ms to 1.5 s/octave.

Oscillator: one; sawtooth, square, pulse and dynamic pulse, range 16-16k Hz, 'tune' control range ± 1.5 semitones, vibrato depth ± 1 octave max, trill depth ± 1.2 octaves max, adsr shift ± 9 octaves max, pulse width 5-50% and adsr $\pm 45\%$ and lfo $\pm 25\%$.

Filter: one vcf, 16-16k Hz, max 'Q' approx 30, lfo modulation 1.5 octaves (max), and adsr sweep 10 octaves (max).

Sample and hold: from lfo squarewave commands, pitch deviation in vco and frequency deviation in

vcf 2.5 octaves (max).

Outputs: two; 2.5V and 0.25V peak-to-peak.

Interface jacks: keyboard cv in/out; gate in/out; trigger in/out and external audio input.

Dimensions: (l x w x h) 597 x 368 x 159 mm.

Weight: 6.8 kg.

Price: £429.

2600

Portable synthesiser with optional keyboard. Any prewired patch connection(s) can be overridden by simply inserting 'a patchcord insertion'. Easily expanded and can be used with the 2500 series.

Oscillators: three vco 0.03 to 20k Hz in two ranges. Variable-width pulse, triangle, sine, square and sawtooth waveforms.

Filter: one vcf lowpass, variable resonance, dc coupled. Doubles as a low-distortion sine oscillator.

Ring modulator: one, ac or dc coupled.

Envelope generators: two.

Envelope follower: one.

Noise generator: one, variable white to pink.

Sequencing: one electronic switch, bidirectional.

Reverberation: two uncorrelated stereo outputs.

Keyboard: 4-octave with variable tuning, portamento, tone-interval and memory circuit.

Additional facilities: general purpose mixer and panpot; one voltage processor with variable lag; two voltage processors with inverters; two built-in monitor amps and speakers, with headphone jack; one mic preamp with adjustable gain.

Dimensions: console 813 x 456 x 229 mm; keyboard 889 x 254 x 152 mm.

Weight: console 9 kg, keyboard 7.2 kg.

Price: £1797.

2500

Extensive studio synthesiser, in cabinet. May be used in conjunction with one or two keyboards.

Oscillators: three vcos; sine, triangle, rectangular, sawtooth waveforms. 1004 vco module has coarse/fine frequency, three frequency control inputs (1V per octave); rectangular wave mark/space 2", to 98%. 1023 dual vco module similar to 1004; 0.03 to 16k Hz in two ranges.

Noise sample generator: 1036 sample and hold/random voltage module contains two sample and hold circuits, two noise generators and two vc pulse generators; 1040 oscillator/noise generator module contains one white noise source, one pink noise source, one random voltage generator and vco similar to 1023 module.

Envelope generator: 1033 dual delayed exponential envelope generator module contains two identical envelope generators; attack/decay, sustain and final decay times adjustable; gate delay 1 ms to 3s delay in envelope application; times variable 1 ms to 3s, sustain from 0 to 10V; sustain pedal connected via jack socket. 1046 quad envelope generator has four generators, similar to 1033, but two without gate delay and other features.

Filters: 1006 filter/amplifier module contains 4-input mixer, vc 24 dB per octave lowpass filter, and vca; cut off external or internal vc; lowpass 20 to 20k Hz, with variable resonance; vca lin or log; 1045 voltage controlled voice module contains vco, vc filter, vca and two exponential envelope generators; sections in-line or switchable (eg as from vco) as appropriate; 1047 multimode filter/resonator module is a combination lowpass, highpass, bandpass and notch filter; $\frac{1}{2}$ to 512 variable; cut off frequency 16 to 16k Hz, coarse and fine adjustment; 12 dB per octave cut off, notch 40 dB.

Sequencer: 1027 module is 10-step counter with three variable voltages on each; repetition rate $\frac{1}{4}$ to 400 per second; 1050 mix/sequencer module has two 4-input mixers with electronically switched inputs.

Power: 110/120V or 220/240V operation.

Dimensions: console 800 x 450 x 160 mm; keyboard 870 x 250 x 150 mm.

Weight: 26.5 kg (console plus keyboard).

Price: dependent on format.

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Series of modular systems presented in standard formats or provided to customer requirements. Standard cases are available, and patchcords and filler panels are provided with systems at no extra charge. Special modules can be supplied for projection and lighting control, computer interfacing, monitoring and video synthesis; auxiliary studio equipment is readily recommended and supplied.

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MODEL 206 DUAL MIXER 3

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MODEL 227 SYSTEM INTERFACE

For equalisation, location, mixing, monitoring and routing of audio signals in 4-channel studio or performance environments. Twelve signal inputs: four primary, with associated bass, treble, echo send, pan and routing; remaining two groups of four for typical line operations. Both program and monitoring are full 4-channel outputs. Monitor function switchable, status indicated by led. Four vu meters driven from monitor buss. Internal spring reverb unit.

MODEL 230 TRIPLE ENVELOPE FOLLOWER

Three-channel follower, decay time 0.1 to 5s. Dc coupled mode provides for pulse output activation for control voltages greater than 6V. Transient coupling permits detection of attack transients over wide amplitude and background noise variations.

MODEL 248 MULTIPLE ARBITRARY FUNCTION GENERATOR

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and interval time specified for each segment. Time variation from 1 ms to 120s, with maximum 16 or 32 segments depending on mode. Individual segments may be externally voltage controlled. Programmed output pulses may accompany functions in any desired patterns. Each output section contains a time base multiplier and necessary logic for local clock start and stop functions via programme control, panel switch or applied pulses. Stage selection manually or by control voltage application. Additional outputs include voltage ref time function, reference ramp, and two programmed pulses. The unit may be described as a memory with 16 or 32 addressable storage locations and a number of output ports, each of which may give the information from any part of the memory. Operation may be asynchronous, ie different output sections may generate simultaneously identical or dissimilar functions with completely different time scales and/or phase relations. Several versions available, of varying densities.

MODEL 257 DUAL CONTROL VOLTAGE PROCESSOR

Two identical sections, each of which applies several control voltages to one signal. Algebraic manipulations possible include addition, subtraction, scaling, inversion and multiplication. Control voltage may transfer control from one applied voltage to another.

MODEL 258 DUAL OSCILLATOR

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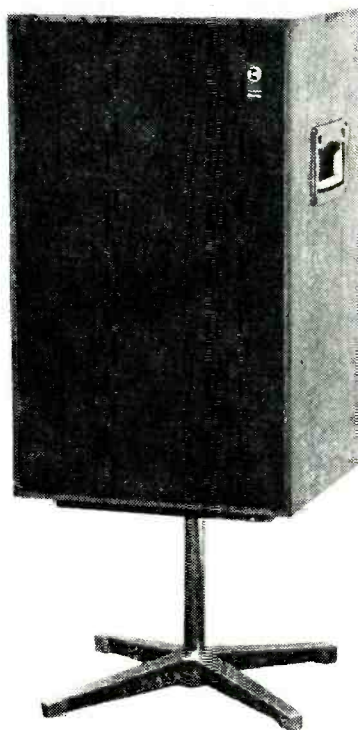
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Envelope triggering pulse can give steady level wherever input is above trigger threshold, or 20 ms (approx) pulse whenever input rises to threshold.

Input: minimum level for gate operation 10 mV peak-to-peak (low range) or 1V peak-to-peak (high range); maximum 100 mV and 100V peak-to-peak (low and high range respectively).

Output: 18V peak-to-peak maximum.

Pitch voltage: 1V ($\pm 0.15V$) per octave (invertible).

Internal oscillator: 256 Hz $\pm 24\%$. Octave function precise.

Trigger output: average +4V, maximum unloaded 12V.

Envelope voltage: 1V ($\pm 0.15V$) per 6 dB gain. Log/lin, both invertible.

Noise and hum: -60 dB ref max output.

Connectors: Jack sockets on front, multiway connector at rear.

Power: 240/115V, 50/60 Hz.

Size: available in case or rack-mounting (standard 483 x 44 mm).

Price: £450.

SYNTHI VCS 3 Mk II

Voltage-controlled unit with facility for connection to external keyboard.

Inputs: two of 1.8V ac max into 50 k Ω ; two of 2.5V dc max into 50 k Ω ; two of 5 mV ac into 600 Ω (mic).

Outputs: two of 2V peak-to-peak into 600 Ω with filters and panning; two of 10V peak-to-peak into 50 Ω (headphones, etc); two of $\pm 5V$ dc into 10 k Ω .

Oscillators: three: 1 to 10k Hz, sine and ramp; 1 to 10k Hz, rectangular and ramp; 0.025 to 500 Hz, rectangular and ramp.

Noise generator: variable white/pink noise.

Filter: adjustable Q and frequency; up to 20 and 5 to 10k Hz respectively. Cut-off rate 18 dB/octave (max).

Ring modulator: ic, transformerless; input rejection -60 dB.

Envelope shaper: attack 2 ms to 1s; decay 3 ms to 15s; variable gain with trapezoidal output.

Sequencer: 256 event storage.

Reverberation: dual spring, 25 and 35 ms (max reverb 2s); voltage control of reverb/mix ratio from 0 to 100%.

Joystick: any two parameters in x-y modes.

Meter: level or sequencer readout. (If KS keyboard is added, indicates contents of memory.)

Auxiliaries: may connect directly to KS or DK2 keyboards or other EMS modules.

Dimensions: (h x w x d) 438 x 444 x 419 mm.

Power: 240/110V, 50-60 Hz.

Price: £1025.

SYNTHI-AKS

Compact, portable voltage-controlled unit comprising *Synthi VCS3 MkII* facilities and KS touch keyboard. Older models of VCS3 or A can be updated by a works modification to operate with KS keyboard.

Price: £1225.

VOCODER 2000

'Compact, low-cost, simple to use' speech synthesiser.

Input: speech and excitation both 'line' into 500 kohm, or 'mic' into 5.6 kohm.

Output: mix of synthesiser, excitation and voice; line level, low impedance; signal/noise better than 60 dB.

Oscillator: 0-1k Hz pulse, optionally gated by 'voiced' decision.

Noise generator: white, optionally gated by 'voiced' decision.

Filters: 16; 14 sixth-order active bandpass, plus low and highpass; plus 16 envelope followers and modulators, dynamic range 55 dB.

Others: slew/freeze controls over wide range, oscillator range 1-30 Hz.

Dimensions: 506 x 105 x 335 mm.

Weight: 5 kg.

Price: £2500.

SYNTHI SEQUENCER 256

Fast access digital storage unit incorporating analogue-to-digital and complementary converters. Designed to provide convenience of sequence editing of up to three simultaneous parameter pairs (such as pitch/loudness). Sequence refers each event to one standard time, as opposed to a previous event, so that individual segments may be updated without affecting adjacent data.

Outputs: 10 signal and control voltages, at individual jack sockets or multiway connector.

Storage: maximum 256 events, each of 42 bits; total 10 752 bits.

Tracks: three, with fourth available for pulse data only.

Byte arrangement: 13 bits start time, 13 bits end time, 12 bits controlled parameters divisible between two parameters depending on resolution required.

Sequence: time resolution enables reference to common time.

Access time: maximum 0.01s.

Clock rate: 0.1 to 200 Hz; clock functions may be operated remotely.

Range: five octave (nominal) dynamic keyboard of conventional layout.

Compatibility: automatic offset control for use with equipment other than EMS.

Price: £3500.

VOCODER

See review page 95.

Self-contained portable instrument that can synthesise speech at constant and varying pitch; and modify it in numerous ways. Speech signal is analysed in frequency bands, the amplitude of which is converted into voltage that controls gain of filter bank. Can be computer monitored and controlled, and linked to *Synthi 100* and others.

Input: 10 kohm unbalanced, -20 dBm minimum level.

Output: 'low' impedance, 0 dBm unbalanced.

Oscillators: two vco; range 1 to 10k Hz; square or ramp; gating, frequency, level, pitch extraction, external voltage and keyboard input controls.

Noise generator: variable colour and gating.

Filters: bank of 22 channels each containing analysing filter, envelope follower, slew limiter, vca and synthesising filter; 20 and 7888 Hz ($\pm 3\%$); high and lowpass filters complete bank; signal/noise ratio 72 dB; all inputs and outputs available on rear multiway.

Pitch extractor: produces voltage proportional to log of speech glottal pulse frequency; range 50-1k Hz; response time for 6% accuracy 5 cycles or 20 ms; output voltage +0.5 V/octave and $\pm 1.1V$ /octave.

Patching: one 22 x 22 patchboard.

Spectrum display: real time; outputs via two BNC connectors to external 'scope (not included).

Monitoring: three ppms for speech, excitation and output levels.

Others: voiced/unvoiced detector; slew/freeze; frequency shifter, range ± 0.05 -1k Hz; keyboard controller/interfacer.

Dimensions: 900 x 240 x 550 mm.

Weight: 20 kg (approx).

Price: £10500.

SYNTHI 100

Extensive system incorporating various modules and additional facilities.

Oscillators: 12: six of sine/ramp, 1 to 10k Hz, with sync input; three of square and triangular, 1 to

10k Hz, with sync input; three of square and triangular, 0.025 to 500 Hz, with sync input.

Noise generators: two, with variable frequency envelope.

Random generator: two outputs, rectangular distribution, time variance 1:1 to 100:1; mean time 10 ms to 10s.

Envelope shapers: three; five triggering modes; each section of dual trapezoidal output variable 2 ms to 20s.

Filters: four of lowpass to resonance; four of high pass to resonance: range 5 to 20k Hz; Q up to 20; cut-off 12 dB per octave for first octave then 18 dB per octave; eight of fixed narrow bandpass filters, octaves between 62.5 and 8k Hz.

Reverberation: two spring units, vc of reverb/direct ratio.

Slew limiters: three, 1 ms to 10s.

Ring modulators: three, ic transformerless; input rejection 60 dB.

Sequencer: as for *Sequencer 256* digital storage unit (see above).

Output: eight vc amplifiers each with fader, pan, meter and variable filter.

Joysticks: two, x-y type, any parameter pair.

Keyboards: two, nominal 5-octave dynamic.

Patching: two of $\text{E}0 \times 60$ pin matrix patch, boards; one for signals, one for controls, plus interconnections.

Input: eight ac/dc input amplifiers; maximum 1.8V ac rms or $\pm 2.5V$ dc.

Frequency-voltage converter: 1V per octave.

Envelope followers: two, 1V ac rms per 6 dB.

External ties: four send and return, plus multiway plug for external connection to eg a computer.

Oscilloscope: double beam.

Others: digital frequency meter/timer/counter; plus optional digital voltmeter and sequencer free store display.

Size: 2m x 950 mm x 837 mm (without stand).

Price: £18000.

UNIVERSAL SEQUENCER

Interfaces with any other synthesiser. Self-contained with integral keyboard. Up to 256 notes and triggers can be recorded in a sequence from 30-note keyboard. Digital display of sequencer position, plus indication of mode. Transposition of sequence voltage by preset touch tabs. Random noise generator. External trigger from audio signal or pulse. Wide range of internal clockspeed.

MOOG

Norlin Music Inc, 7373 N Cicero Avenue, Lincolnwood, Ill 60466, USA.

UK: Norlin UK Ltd, Woolpack Lane, Braintree, Essex CM7 6BB.

Phone: Braintree (0376) 21911.

MICROMOOG

This is a small stage synthesiser played by either a 32-note single manual or a ribbon. The latter facility is fitted with a sample/hold circuit. There is one master oscillator, a voltage-controlled filter network, octave switching, noise generator, modulator, if oscillator, envelope generator, etc.

TAURUS PEDAL SYNTHESISER

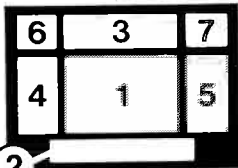
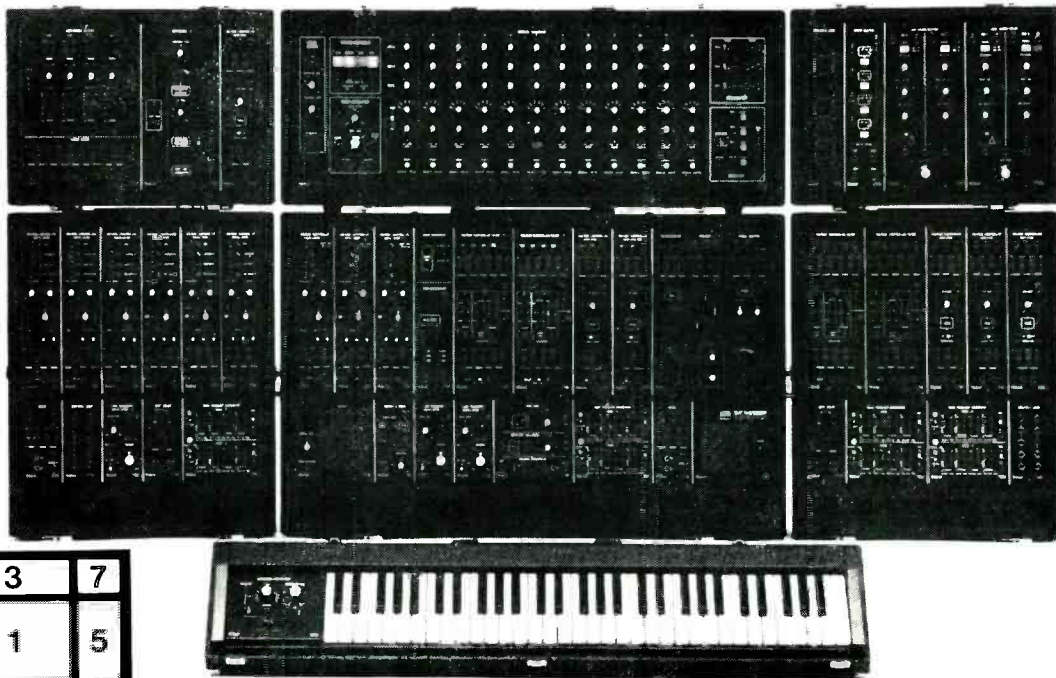
This foot pedal instrument has three factory-preset synthesiser voices plus a fourth programmable voice. Operationally, the musician selects the sound from a series of pushbuttons. Two oscillators create phasing, parallel intervals and percussive sounds. The unit also includes variable attack, glissando and decay. There is a 5-octave range with foot sliders for swell and tone colour.

SYNTHESISER 15

Portable, modular constructed synthesiser. May be

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ROLAND SYNTHESIZER SYSTEM 700



The complete system consists of the MAIN CONSOLE, the KEYBOARD CONTROLLER, and five optional blocks for a total of 7 modules.

MAIN CONSOLE:

The MAIN CONSOLE contains all the basic modules necessary in a professional system for the synthesizing of sound and can be used alone with the KEYBOARD CONTROLLER as a complete synthesizer in itself. Modules included are: VCO (3), VCF (2), VCA (2), LFO (2), S/H, ADSR (2 x 1), OUTPUT MODULE (which includes PANNING controls, REVERBERATION, and a PHASE SHIFTER), and others.

KEYBOARD CONTROLLER:

The 61 key (5 octave) two voice KEYBOARD CONTROLLER has PORTAMENTO and PITCH BEND controls.

OPTIONS:

Optional blocks can be chosen and arranged according to the particular needs of each studio. All of the modules in the optional

blocks are interchangeable, thus the numbers and types of modules can also be changed to suit the studio. The main modules of the optional blocks are: BLOCK 3 «Sequencer»: 3 channel, 12 step sequencer; BLOCK 4 «VCO bank»: VCO (6), ADSR (2 x 1); BLOCK 5 «VCF/VCA bank»: VCF (2), VCA (3), ADSR (2 x 2); BLOCK 6 «Interface/Mixer»: frequency-to-voltage converter interface, 9 channel audio mixer, fixed filter bank, VCA; BLOCK 7 «Phase Shifter/ Audio Delay»: 2 channel phase shifter, 2 channel audio delay.

MAIN FEATURES:

All modules are made from high quality parts to ensure high reliability and durability with circuit designs which give high stability for ease in recording perfect sounds.

All major modules contain both audio signal input and control voltage input mixers for better signal to noise ratios and ease in synthesizing sounds.

Input and outputs are designed for matching with other professional audio equipment for

ease of use in the studio.

On the MAIN CONSOLE, most common connections are made internally without the use of patch cords. All modules have provisions for external patch cord connections for greater freedom in patching.

External sound sources (such as other musical instruments) can be used as a source of control.

The PULSE SHAPER and the sequencer's MASTER CONTROLLER input and output jacks allow the recording of consecutive sequences on tape without a break in rhythm.

Except for the MAIN CONSOLE, all modules are completely interchangeable and can be arranged to suit individual tastes. (The MAIN CONSOLE can be special ordered direct from the factory in other arrangements).

A complete system, the System 700 contains all the elements necessary for the synthesis of sound.

Roland's 'System' Synthesizer Series are specifically engineered for professional recording studios. The top-of-the-line 700 provides full control over all synthesizer functions, extremely stable output and a frequency range from 0.1 to 100kHz. And this revolutionary new product is one of the most competitively priced, full-feature units on the market today.

Roland

Brodr Jorgensen (UK) Ltd., Unit 6, Great West Trading Estate,
Great West Road, Brentford, Middx. Phone. 01-568 4578.



SURVEY: SYNTHESISERS

operated in conjunction with 952 (included) or 951 keyboards, 1120 foot pedal controller, 1150 ribbon controller, portable sequencer or touch sensitive percussion controller. A carrying case is available. Modules available as follows:

Inputs: 4-input mixer with +ve and -ve outputs, jack multiples.

Oscillators: 921 vco, range 0.01-40k Hz; fine and coarse tuning control; sine, sawtooth, triangular and rectangular forms; six switch-selectable auxiliary waveforms; three frequency-controlled input jacks; waveforms sync at any point in the cycle. 921A vco driver, providing controls for associated 921Bs; fine and coarse tuning control; three frequency control input jacks; rectangular waveform control 5% to 95%; two rectangular width control input jacks; 921 vco, range 1 to 40k Hz; sine, sawtooth, triangular and rectangular waveforms; ac and dc coupled frequency control input jacks; phaselock sync input.

Amplifier: 902 vca, 80 dB dynamic range, linear or exponential switchable response; three control inputs.

Noise generator: 923 white and pink; low and high pass filters, cut off frequency variable from 10 to 20k Hz.

Filters: 907A fixed filter bank; separate gain control of 10 ranges; half-octave bands between 250 and 2.8k Hz; 904A vc and manual lowpass filter; frequency variable 60 to 20k Hz; three control inputs.

Alternators: 995 panel.

Envelope generator: 911; separate control of rise/decay, sustain level and final decay time.

Module complement: 2 of 902; 1 of 904A; 1 of 907A; 2 of 911; 1 of 921; 1 of 921A; 2 of 921B; 1 of 923.

Keyboard: duophonic, nominally four octaves C to C.

Power: 110-125V ac, 50-60 Hz, 130W. Conversion for 220/240V available.

Size: 450 x 630 x 240 mm (portable case).

Weight: 37 kg.

Price: on application.

SYNTHESISER 35

Modular constructed synthesiser for studio use. May be operated with auxiliary modules as *Synthesizer 15*. Includes 951 keyboard. For details of modules see above.

Filters: additional 904B vc highpass filter, vc or manual control, 60 to 20k Hz. Module complement: 3 of 902; 1 of 904A; 1 of 904B; 1 of 907A; 3 of 911; 1 of 921; 2 of 921A; 4 of 921B; 1 of 923.

Keyboard: 951, nominally five octaves C to C.

Power: 110/125V or 220/240V ac, 50/60 Hz, 180W.

Size: module housing 1.22m x 400 mm x 37 mm; keyboard 1.08m x 110 mm x 240 mm.

Weight: 59 kg.

Price: on application.

SYNTHESISER 55

Largest vc studio synthesiser of range, housed in three walnut cabinets. Includes 951 keyboard. For module details see above.

Trigger delay: 911A1 delay periods from 2 ms to 10s; alternative delay periods running sequentially or concurrently (switch selected).

Sequencer: 960 sequential controller, three independent programmable voltage sequences; vc internal clock, manual and voltage control of start/stop; voltage trigger in and out for each sequence step; indicator light for operational status and sequencer state; 961 interface; 962 sequential switch selects up to three input signals; sequence stepping by external voltage trigger.

Module complement: 5 of 902; 1 of 903A; 1 of 904A; 1 of 904B; 5 of 911; 1 of 911A; 1 of 914; 1 of 921; 2 of 921A; 6 of 921B; 1 of 960; 1 of 961; 1 of 962; plus additional interface and control modules.

Keyboard: 951, nominally five octaves C to C.

Power: 85-130V or 171-260V ac, 50-60 Hz, 350W.

Size: main cabinet 1.22m x 390 mm x 350 mm; upper cabinet 1.22m x 250 mm x 220 mm; keyboard 1.08m

x 110 mm x 240 mm.

Weight: 85 kg.

Price: on application.

SONIC SIX

Portable small synthesiser. Self-contained in high-impact case with integral keyboard and monitor amplifier/speaker. Connections are internal, operated from front-panel switches.

Oscillators: two, sawtooth, triangular and rectangular waveforms; switch calibration for fine tuning; also two 'waveform generators'.

Ring modulator: provides for modulation of signal with internal waveforms.

Noise generator: switch selects white or pink.

Envelope generator: simple in/out module shaping basic signal into final envelope patterns.

Filters: lowpass filter, resonance control lowpass to resonant.

Keyboard: nominally four octaves, C to C with high/low note priority and polyphonic capability.

Additional controls: glide rate, master loudness, pitch bend.

Outputs: two signal output jacks.

Input: one audio source input.

Power: 110-125V ac, 50-60 Hz, 40W maximum. 220-24V converter available.

Size: carrying case 850 x 310 x 150 mm.

Price: on application.

MINIMOOG

Small, portable performance instrument available with integral keyboard and collapsible into small carrying case.

Oscillators: three; range 0.1 to 20k Hz in six overlapping scales; triangular, sawtooth and rectangular with differing combinations.

Noise generator: white or pink, switchable

Input: 10 mV to 2V; 100 k Ω .

Filters: wider range lowpass with variable-height resonance at cut off, 24 dB per octave. Frequency cut off 40 to 20k Hz.

Amplifiers: two vcas, dynamic range 80 dB.

Envelope shapers: two, in-line; attack/decay 10 ms to 10s, sustain 0 to 100% of contour peak.

Outputs: high 0.5V, 3 k Ω ; low 15 mV, 1 k Ω ; headphone 0.3V maximum into 8 Ω .

Additional control inputs: pitch, filter, amplifier and trigger.

Keyboard: nominally 3 $\frac{1}{2}$ octaves, F to D. When lowest key only depressed, it controls oscillators and filter; contour generators activated whenever single key depressed.

Additional facilities: pitch bender wheel, modulation injector wheel, A440 'electronic tuning fork'; 5-input mixer combines oscillator, random and external sources.

Power: 100-135V, 50-60 Hz, 10W maximum; 220-240V converter available.

Size: 610 x 400 x 140 mm.

Weight: 12.5 kg.

Price: on application.

OBERHEIM

Oberheim Electronics Inc, 1549 9th Street, Santa Monica, Ca 90401, USA.

Phone: (213) 393 0136.

This company produces a series of synthesisers—basically either two or four voice—using synthesiser expander modules as the fundamental building block.

SYNTHESISER EXPANDER MODULE

Two vcas are arranged to operate with a 4-mode vc filter, two envelope generators, a low-frequency oscillator and a vca. The manufacturer recommends the following applications: use with a keyboard to form a small electronic music synthesiser; to expand existing synthesisers; with a sequencer (also manufactured by Oberheim) allowing the main synthesiser and the sequencer to be played simultaneously; with polyphonic keyboards to form a multivoice synthesiser, etc. The vcas produce sawtooth and pulse outputs with a variable mark/space ratio; either can be synchronised with the other or from an external source. The filter network can be programmed for either lowpass, bandpass, high-pass or notch.

TWO VOICE POLYPHONIC SYNTHESISER

Comprises a 37-note keyboard, two modules as above, a minisequencer, sample-hold and output mixer.

FOUR VOICE POLYPHONIC SYNTHESISER

Four expander modules, portamento, 47-note polyphonic keyboard and output mixer, etc.

DIGITAL SEQUENCER DS-2A

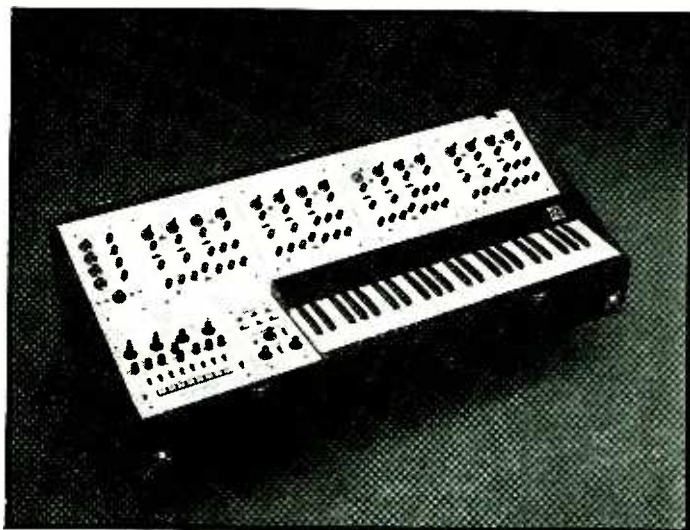
This enables up to 144 programme steps to be stored. These may be split into 96+48, or 48+48+48 steps (notes). Each note in sequence can have a duration from 8 to 0.05s. There are three basic transposition alternatives as well as a single-steploding playing feature. Transposition may be made over a four octave range. The manufacturer states that the sequencer may be used with either Moog or Arp synthesisers as well as its own products.

OMNIPHON

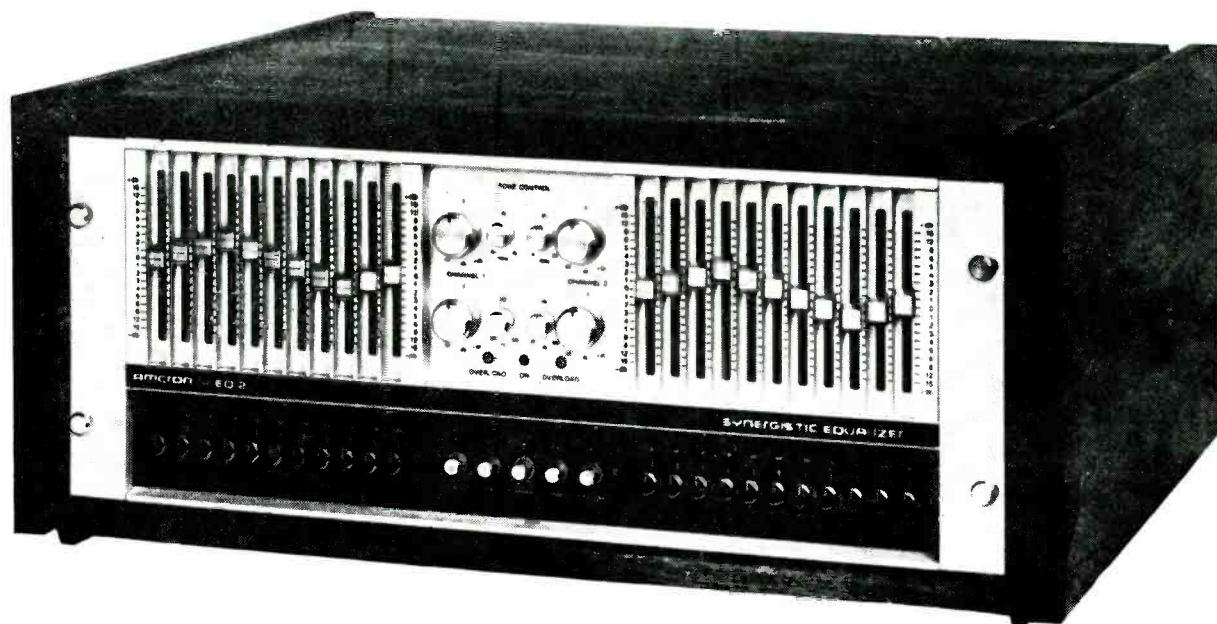
Omniphon, Box 166, Churchill Road, Mason, New Hampshire 03048, USA.

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Four
voice
polyphonic
from
Oberheim



NOW AMCRON INTRODUCE THE EQ-2 Equalizer



The AMCRON EQ-2 is a stereo equaliser designed for professional use, and offering eleven bands per channel of full equalisation from 20 Hz to 20 kHz. The filters are half octave set on octave centres, and each has a control permitting the centre frequency to be varied by ± 0.5 octave. The two channels can be cascaded to provide a full range half octave equaliser, and shelving type tone controls are provided allowing adjustment of the Bass and Treble.

The EQ-2 has been designed, and built to the usual high AMCRON standard, and is supported by the normal 3 year warranty on parts, and labour. Leaflets are available on request.



MACINNES LABORATORIES LTD.

MACINNES HOUSE, CARLTON PARK INDUSTRIAL ESTATE,
SAXMUNDHAM, SUFFOLK IP17 2NL TEL: (0728) 2262 2615

MACINNES FRANCE S.A.R.L.

18 RUE BOTZARIS,

PARIS 19

Tel. 206 60 80 et 206 83 61

SURVEY: SYNTHESISERS

The company manufactures a range of plug-in synthesiser modules, *Series 4000*, available in a number of standard studio configurations, or as custom-arranged systems. All sub-units are voltage controlled and feature 'visual feedback of all parameters through the use of led displays and meters'. Available modules include voltage-controlled attenuator, sample and hold/latch, vco, envelope generator, analog inverter, AND and OR gates, mixer, etc.

ROLAND

Roland Corporation, 7/13 Shinkitajima, 3-chome Suminoe-ku, Osaka 559, Japan.
Phone: Osaka 6815431.

Australia: Australis Instruments Pty Ltd, 18 Sydenham Road, Brookvale, NSW 2100.

South Africa: Topco National Distributors Pty Ltd, No 5 Trek Centre, Hendrik Verwoerd Drive, Randburg, Transvaal.

UK: Brodr-Jorgensen (UK) Ltd, Unit 6, Great West Trading Estate, 983 Gt West Road, Brentford, Middlesex TW8 9DN.

Phone: (01) 568 4578. Telex: c/o Chamcom/London 88941, prefixed BJ MUSIC.

Dealers in most European countries; details from Brodr-Jorgensen.

SYSTEM 700

See review page 84.

A modular console-type synthesiser with five optional sections. 47 modules are available, each with input and output jacks for patching, and a mixer.

A 'typical' system comprises the following:

Main console: three vcos, two vcs, two vcas, noise generator/ring modulator, two lfos, dual envelope generator, sample and hold, 3-channel mixer, plus output section (reverb/panning/phase-shifter/standard oscillator) and multiple jack.

Keyboard controller: 61-key (five octave) 2-voice, with vco controller plus pitch and portamento controls.

Vco bank: six vcos, sample & hold, dual envelope generator, 3-channel mixer, lfo and multiple jack.

Vcf/vca bank: two vcs, three vcas, gate delay, two dual envelope generator and multiple jack.

Interface/mixer block: multimode filters and audio mixer unit, vca and interface processor.

Phase shifter/audio delay block: 2-channel phase shifter, 2-channel audio delay, 4-input analog switch, and multiple jack.

Sequencer: 3-channel, 12-step device with numerous controls.

SH-3A

Self-contained portable synthesiser with integral keyboard.

Oscillators: one vco; slide controls for 2, 4, 8, 16 and 32 'feet' (five octaves) each available in square, pulse and sawtooth waveforms; 8 feet chorus; vibrato, pitch, transpose, glide and portamento.

Noise generator: pink or white, routing to vcf or vca.

Envelope generator: one; adsr controls.

Filters: one; controls for cut-off, resonance, envelope (adsr plus two others), and growl.

Amplifier: one; controls for level, hold, envelope (adsr plus three others) and tremolo.

Sampler: one; controls for sample time and mode, which routes output from other modules.

Others: two lfos; lfo 1 sawtooth, lfo 2 square or sine wave; manual control unit with glide, transpose, pitch and portamento.

Keyboard: 44-key, ± 1 octave via transpose control.

Power: 100/117/220/240V, 9W.

Dimensions: (w x d x h) 100 x 32 x 15cm.

Weight: 14.5 kg.

SH-5

Self-contained portable synthesiser with integral keyboard.

Oscillators: two; vco 1 has 5-octave range (2-32 'feet'), four waveforms, variable pulse width, plus controls for pitch, and sync with other vco; vco 2 range, pitch, waveforms as vco 1.

Noise generator: pink or white, routing to vcf, vca or bandpass filter.

Envelope generator: one, adsr and ar controls.

Filters: one vcf; controls for cut-off frequency, resonance, modulation, keyboard follower, envelope and mode.

Amplifier: one; controls for level, hold, modulation, envelope and panning.

Sampler: one; controls for mode and sample and lag time.

Mixer: inputs from vco 1, vco 2, ring modulator and external input.

Others: bandpass filter; lfo 1 sawtooth; lfo 2 square, sawtooth and sine wave; manual control unit with tune, transpose, bender, range-changeover and portamento.

Keyboard: 44-key.

Power: 100/240V, 20W.

Dimensions: (w x d x h) 864 x 270/335 x 257 mm.

Weight: 22 kg (including case).

SH-1000

Self-contained portable synthesiser with integral keyboard and tab key controls.

Oscillators: one vco; nine tabs for selecting preset waveforms at different octave 'lengths'; three modulation tabs; vibrato depth, pitch, transpose, glide, portamento controls.

Noise generator: pink or white.

Envelope generator: one; adsr controls.

Filters: one vcf; three tabs control growl, wow and adsr; plus cut-off frequency and resonance controls.

Amplifier: one vca, two tabs control tremolo and waveform; plus five envelope tabs.

Others: vibrato and tremolo depth controls; glide, pitch, portamento and transpose; random noise; plus 10 preset tabs for 'instrument' selection (eg piano, oboe, flute, etc).

Keyboard: 37-key, ± 1 octave via transpose control.

Power: 100/117/220/250V, 6W.

Dimensions: (h x w x d) 150 x 865 x 260 mm.

Weight: 26.5 kg.

SH-2000

Self-contained portable synthesiser with tab key controls, allowing '30 preset sounds with infinite variations'.

Touch effects: six—volume expression, wow, growl, vibrato, pitch up and pitch down.

Envelope tabs: three—hold, repeat and long sustain.

Preset tabs: 30 covering 'ordinary' (wind, string, keyboard and percussion) and 'special' sounds (wind, 'funny cat', popcorn, etc).

Others: modulation rate; portamento; pitch; transpose; random noise.

Keyboard: 37-key.

Power: 100/250V, 10W.

Dimensions: (w x d x h) 865 x 266 x 133 mm.

Weight: 11 kg.

SYSTEM 100

Modular self-contained synthesiser comprising:

Basic unit model 101: contains vco, vcf, vca, adsr, lfo, noise generator, highpass filter, audio mixer, test oscillator and 37-note keyboard.

Expander model 102: incorporates envelope generator (adsr); sample and hold; vco (sawtooth, pulse and square wave, plus pulse width adjustment); mixer (vco, ring modulator and external source); lfo; highpass filter/vcf; vca; and internal mixer (combines output from 101 and 102).

Mixer model 103: 4-channel for mic/line inputs into stereo output, with panpots, reverb, echo send/return and vu metering.

Sequencer model 104: incorporates step controller; clock oscillator; gate; series and parallel outputs; master controllers; plus 24 registers (12/channel) to control vco frequency, vcf, cut-off points vca outputs or step time interval.

Monitor speakers model 109: 16 cm 'full range', 3.5W into 8 ohms.

STEINER-PARKER

Steiner-Parker, 2258 South 2700 West, Salt Lake City, Utah 84119, USA.

Phone: (801) 972 1447.

SYNTHACON

A self-contained portable synthesiser for stage and studio, with integral keyboard.

Waveforms: sawtooth, triangle, square, pulse and sine.

Noise generator: white and pink.

Oscillators: three vcos, range 0.1-20k Hz.

Filters: three, with variable 'Q', plus lowpass, bandpass and highpass modes.

Envelope generator: controls for attack, duration decay, plus trigger source selection.

Keyboard: 4-octave, extendable to 8-octaves with range switch.

Power: 117V, 15W.

Price: one voice \$1195; two voice \$1395; 'Multi-phonics' \$1895.

SYNTHASYSTEM

A comprehensive modular system, available in a variety of configurations to customers' specifications. 'Can be expanded to any size desired'.

Price: \$3349 including 4-octave keyboard.

The company also manufacture the *Sequencer 151*, a 2-bank sequencer with internal rhythm control for use with *Synthacon* or other synthesisers (price: \$450); the *Electronic Valve Instrument*, which is said to play like a trumpet and allows horn players to control a synthesiser without the use of a keyboard (price: \$450); and the *Selective Inverter*, described as a programmable contrary motion generator capable of generating the inverse of any voltage control source, such as a keyboard, sequencer or acoustic pickup, etc (price: \$350).

UNIVOX-KORG

KEIO Electronic Laboratories Corporation, Maison Yutaka Building, No 190, Nishiohokubo 2-chome, Shinjuku-ku, Tokyo, Japan.

UK: Rose-Morris and Co Ltd, 32-34 Gordon House Road, London NW5.

Phone: (01) 267 5151. Telex: 23170.

USA: Unicord Inc, 75 Frost Street, Westbury, Long Island, NY 11590.

Phone: (516) 333 9100.

770 SYNTHESISER

The instrument incorporates a 32-note keyboard, two vcos, one vcf, an envelope generator, vco modulator, portamento and low-frequency oscillator. There is a ring modulator associated with vco 2. Vco 1 produces sine, square, triangle and chorus. There is an external vc input. Vco 2 incorporates coarse and fine tuning controls, ring modulation capability as well as pink, white and scale noise capability.

Price: £475.

SYNTH-BASS

This is a single manual 25-note bass synthesiser generating sine wave bass sounds as well as those more familiar to the standard string bass. The manufacturers recommend that the unit is used with a bass pedal and bass amp for best effect. The output can be generated over five octaves in the usual waveform shapes; there are extensive envelope shaping facilities easily accessed while playing.

Price: £337.

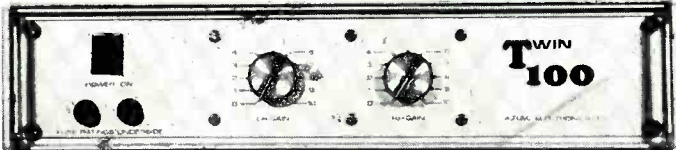
POLYPHONIC ENSEMBLE 1000

This instrument features individual tuning for each note; the sound is basically electronic piano although there is an independent waveform envelope shaper and generator section for use as a standard synthesiser. The polyphonic section and synthesiser may be coupled together to produce envelope shaped polyphonic sounds.

Price: £868.

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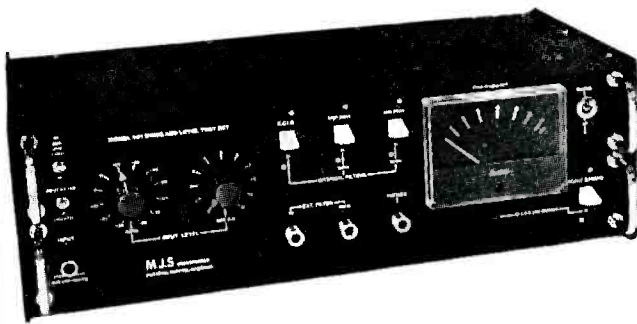
Ted Farnon 06286 3202
Redham House, Britwell Road, Burnham, Bucks.
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27 Walnut Close,
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This noise test set is proving a valuable "tool" for accurate level and noise measurements and, using the internal C.C.I.R. weighting filter, can be used to make noise measurements according to the I.B.A. code of practice requirements. Two switchable sharp (36db/octave butterworth response) filters at turnover frequencies at 100Hz and 30KHz further increase the usefulness of this instrument for making level and noise measurements in the presence of Hum, Tape machine bias, etc. A further switchable L.C. lowpass filter at the input serves to remove any R.F. present on the input.

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Telex: 262284 Ambdsr G

Sound at NAB 1977

Pat Hawker

This year's NAB Convention was held in Washington DC, its home base, from March 27 to 30, 1977.

AUDIO was by no means overwhelmed by video at the 1977 NAB Convention, held in three large hotels off Connecticut Avenue, Washington DC. Indeed the single engineering session that attracted the largest audience was an 8 am 'workshop' on am stereo—a 'dawn' meeting that soon banished any remaining thoughts of slumber with its sharp disagreements between Leonard Kahn of Kahn Communications and Harold Kassens, chairman of the National AM Stereophonic Committee.

But am stereo, important though some American broadcasters feel it will become, is still something for the future. Of more immediate interest were such matters as: processing and yet more processing of audio to make stations sound louder; satellite distribution circuits looking more and more set to take over audio (and video) long and medium-distance circuits; automatic transmission systems (ats) gradually getting ready to take control of the transmitters, which in turn are increasingly all-solid-state; quadraphony and surround-sound well off the centre of the stage; microprocessors and digital techniques of many kinds rapidly increasing their spheres of influence; and North American radio thriving financially and looking optimistically towards the future.

Audio and signal processing

At NAB it was impossible to wander very far in the crowded exhibition halls (all six of them) without encountering some form of audio processing or modulation control. The determination of every programme controller and station manager to sound louder than the guy across the street, without incurring the wrath of the Federal Communications Commission (FCC), has reached—by European standards—an almost frightening level. US engineers show some reluctance to accept more and more black boxes in the system, although they have long become estranged from the idea of a transmission chain as a linear system; the 125% positive modulation peaks on am, for instance, have long been accepted and exploited. But increasingly even the fm stations are seeking to provide ever 'louder, brighter' audio. At one discussion someone asked for a definition of fidelity; after several false starts the audience seemed willing to accept the reply 'fidelity is a ticket to the concert hall', and the advice that station engineers should at least *try* to understand the purpose of the various black boxes in the hope that 'you can process and still sound clean'.

Some engineers, it was suggested, are tending to 'listen with their eyes' by depending too much on 'scopes and meter readings; some stations, it was claimed, are adding more and more processing systems in cascade, and then complaining 'why do all my carts sound muddy?'.

The advocates of well-engineered processing point out that modern sound recording is essentially the creation of illusions—'with multitrack recordings the musicians may never have even met'—and that broadcasters are consequently justified in further 'brightening up' material by processing. What is needed, they claim, is for set-makers to agree on a standard if-response characteristic to fit the pre-emphasis being applied to am transmissions.

One of the processing systems that seems to be establishing a firm appeal is the *Optimod-FM* system of **Orban/Broadcast** with a

**This report represents the personal views of the author and not necessarily those of the IBA Engineering Division.*

claimed 2-3 dB added to average modulation levels of an fm transmitter. Then again the **Harris Corporation** (Gates) has a new *MS-15* 'maximum signal fm exciter', which incorporates a digitally synthesised modulator in its stereo generator and a lowpass filter with a dynamic transient response. The dsm stereo generator is claimed to provide a minimum separation of 45 dB from 30 to 15k Hz. In effect, the digital modulator unit replaces switching or balanced modulators, with digital logic providing appropriate phase shifts without critical adjustment. Correct phase relationships are preserved at both ends of the audio range—something not easily achieved with conventional analogue techniques. The dynamic transient response eliminates overshoot and is claimed to provide a loudness increase of 2-6 dB with 'absolutely no degradation of audio quality'.

Transmission

Similarly for am, **Delta Electronics** had a paper on a new approach to modulation control, which turned out to be another digitally-based system. It samples rf output from the transmitter, makes an assessment of the modulation characteristics, and by a digital logic process adjusts the audio level to the transmitter. Such a system can be used with other existing processing 'boxes', and when set to operate slowly is claimed to introduce no compression or asymmetry to the programme material. Front-panel counters indicate how many modulation bursts, both negative and positive, have exceeded preset threshold levels during the preceding minute. Programme control is carried out by an 8-bit multiplying digital-to-analogue converter, which forms a linear attenuator, adjustable in steps of about 0.1 dB by an 8-bit binary word coming from the up-down counter. Total range of adjustment is ± 8 dB with thresholds normally selected at 95% negative and 112% positive. Field tests show that as much as 3 dB correction may follow a change of programme source (eg by a switch from local to network announcers, or between announcer and music). The system thus forms a closed loop around the transmitter rather than processing at audio. Delta-Electronics claim that in practice the average signal level is increased by 1-2 dB.

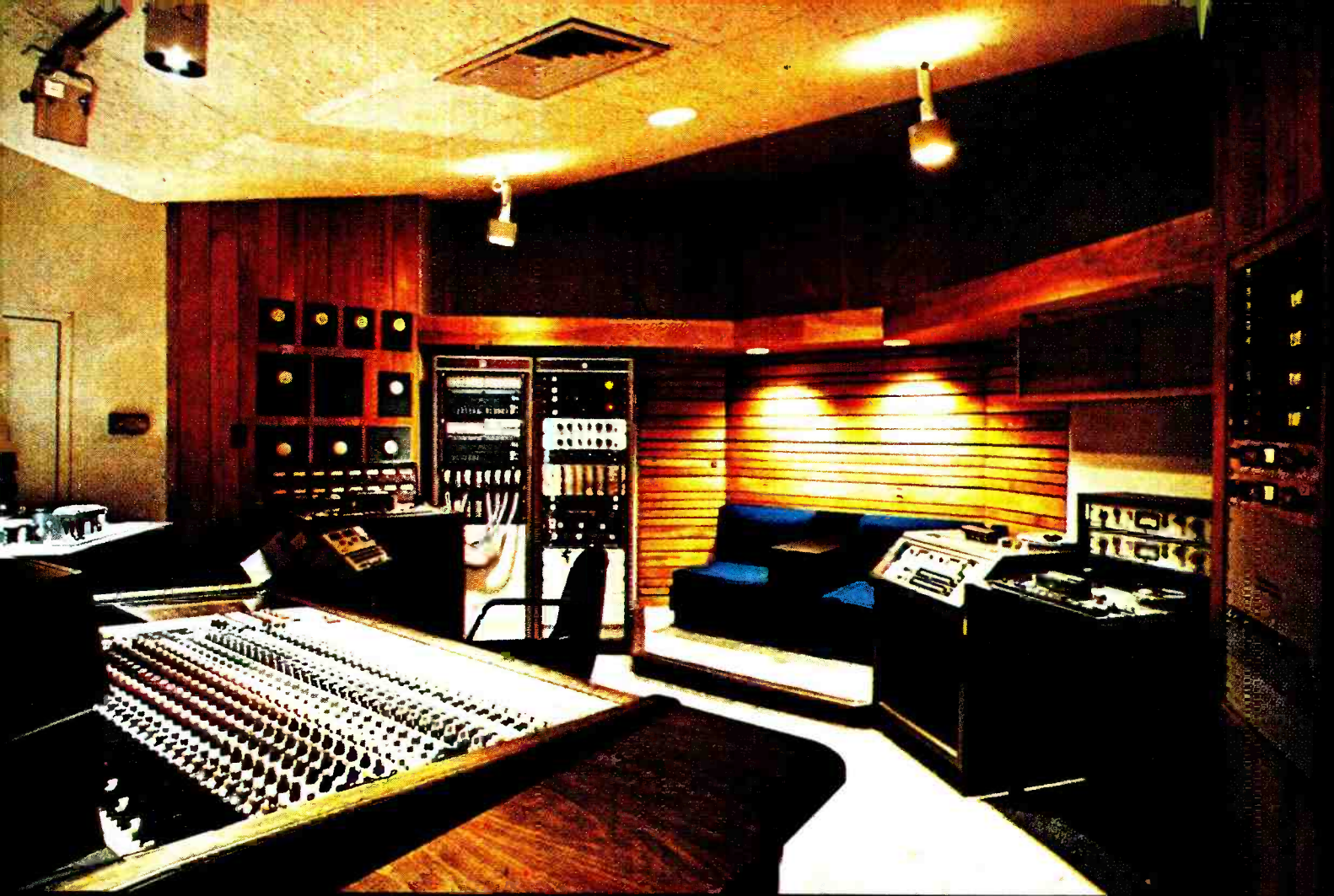
Not all the new am transmitters are solid-state: a new **Rockwell-Collins** 5 kW unit is of hybrid form using a series-switching modulator, and designed to combat the power-saving appeal of solid-state by using a power amplifier having third-harmonic resonators to increase rf power efficiency to nearly 90%. The total power consumption is between 9.3 kW (carrier) and 12.7 kW at 100% modulation.

For vhf/fm applications, all-solid-state techniques seem fairly well established up to about the 250W level, with **Cetec Sparta** planning a 500W model.

AM stereo

Three systems of am stereo are currently being investigated by the National AM Stereophonic Committee: these have been submitted by **Magnavox**, **Motorola** ('C-Quam') and **Belar Electronics**. The **Belar** system appears basically similar to the RCA system that was withdrawn when RCA pulled out of the receiver market. Several other systems have also been withdrawn, but a fourth system, developed several years ago by **Kahn Associates**, has been submitted directly to the FCC. A point of disagreement between Kahn and the

78 ►



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SOUND AT NAB 1977

Committee is the degree to which it can be claimed that his system, used at XTRA Mexico and receivable in Southern California, has been subjected to detailed measurement.

All four systems, in effect, change the traditional phase/amplitude relationships and the symmetry of the two sets of sidebands. The Magnavox system has a 5 Hz pilot that makes it possible to have a stereo indicator light in the receiver. The Kahn system alone enables a stereo effect to be achieved when using two conventional receivers, by carefully off-tuning them on the opposite sidebands.

Am stereo is seen by some North American broadcasters as a potentially important weapon in the long-standing am/fm struggle; by some others as an opportunity for American set-makers to counter the strong position of Japanese sets in the US market. But some need to be reassured that the am stereo signal will not reduce existing coverage, or reduce the 'loudness' now achieved by the many forms of audio processing.

The intention is to carry out a series of trials in Washington DC and Boston to investigate the effects on the three Committee-submitted systems of skywave propagation, selective fading, occupied bandwidth, ground-wave coverage and mono compatibility. A report will be submitted to the FCC this autumn, and an FCC ruling is being predicted by March 1978. Given a favourable decision for one or other system, it would take the industry about six months to develop and market suitable receivers.

By comparison, quadrphony was keeping a low-profile at NAB, although quite a lot of fm stations broadcast encoded material.

Satellite distribution

The use of 'domestic' communications satellites to provide broadcasters and cable-tv operators with audio and video circuits is making rapid progress in North America. FCC have recently authorised the use of small satellite receive-only terminals with dishes in the range 2-3 metres diameter, although many of the current systems are using rather larger aerials. At NAB, RCA was promoting its *Satcom* satellites and Western Union was equally vigorously promoting its *Westar Syncsats*.

Circuits with appreciably higher performance than the conventional long-haul terrestrial 5 MHz circuits are being provided; the economics—particularly for scheduled video circuits—appear highly favourable. For audio, 8 and 15 kHz circuits, including stereo pairs, are being offered with up to 65 dB signal-to-noise ratios. A prototype Western Union 3m dish terminal (manufactured by Hughes Aircraft) lists the following minimum specifications: peak programme signal-to-noise ratio better than 54 dB; frequency response ± 1 dB (50 Hz to 15 kHz); harmonic distortion nominally 1% at peak programme level; stereo pair gain difference less than 0.6 dB; and phase difference less than 15° over the range 50 Hz to 15 kHz.

Visitors to NAB were able to shuttle across the Potomac to visit the new Mutual Broadcasting System headquarters at Arlington, where an impressive computer-switched satellite system is being installed to provide a major network service for several channels of sound radio.

FM transposers

The use of low-power fm transposers, authorised by the FCC in 1970, is gradually increasing and some 250 are now operating—often installed not by the broadcasters but by various local community groups and associations, or even by property developers. Many of these are in the more mountainous areas of the mid-West, and tend to be for 'good music' and 'religious' broadcasts, both of which tend to attract very loyal and determined followers. Some of the smaller radio and tv transposers are solar powered. The 10W fm stations often provide service over and about a 16 km radius using various simple aerials such as crossed dipoles, vertical dipoles, sleeve dipoles and the like. Nobody has yet attempted to combine more than one fm transmitter on a single aerial.

Bayly Engineering of Canada showed the AEG-Telefunken pcm programme channel system which can operate in the standard North American T1 digital hierarchy—this has a telephone capacity of 24 channels and a line pulse rate of 1.544 Mb/s. Various bandwidths are being offered, including 10 and 15 kHz, mono or stereo. The 14 bits (linear) are digitally companded to 10 bits, and then transmitted in 12-bit words.

Another AEG-Telefunken system, *Telecom CAD*, turned up on the Gotham stand; this is a companding system for improving the dynamic range of tape recorders using separate processing on four sub-bands, and claimed to provide 30 dB additional dynamic range. It can be used in conjunction with existing Dolby A systems.

The 'automatic transmitter system' (ats) is now FCC-authorised for all fm radio stations and for those am stations not using directional aerials (these will probably be authorised by the time this report is published). Ats means, in effect, that transmitters can be unattended (long the practice in the UK) and monitored and controlled remotely, with a relaxation on the licensing requirements for the station operators nominally in charge of the transmitters. Transmitters must be manually activated each day—but this can be done remotely—and the ats system must, for example, be equipped to monitor power output, adjust power output, detect peak modulation, have an automatic clock to change power etc, provide various alarms, sample modulation continuously, have a method of testing itself, and so on. Type-acceptance, however, is not required of the ats system, provided that it meets all the various requirements.

Although the new ats regulations have been widely welcomed as part of a new regulatory philosophy for the FCC, it would appear that not many radio broadcasters expect that there will be a rush to convert to unattended operation, since it is felt that only the larger stations can expect to show significant cost savings.

Tape units

Scully was showing two new professional tape machines: the *Model 250*, which is available in a number of configurations; and *Model 255* designed for continuous operation in automated stations. The former can be rack-mounted in a studio or case-mounted for field recording. Both the new machines have machined, cast metal deck plates which minimise tape skew; the transports have touch-button control using ttl logic devices with protective circuits that prevent tape breaks or spills while changing from fast to play modes.

Ampex introduced to NAB a number of machines, including the *ATR-100* and the *ATR-700*. Besides being aimed at the professional music recording industry, the *ATR-100* is equally suitable for am and fm broadcasting, particularly those with automated programming. Some 500 units have already been delivered. The tape handling system originally developed by Ampex for computer tape transports eliminates the use of pinch rollers.

IGM introduced a new automation system for radio stations, based on microprocessor technology. This is known as the *Magna Carta* tape storage system; it finds, plays and returns to storage up to 1000 tape cartridges, with readout instructions, etc on a vdu.

One of the larger automation systems is the *Cetec Schafer 903E* 3-day memory system, which is a single-keyboard 8000-event control system claimed to store events for the most complex format for three days in advance.

Telex introduced a new range of *Magnecord MC-series* broadcast cartridge machines for local or remote-automated operation. The company believe that the dc servo Hall-effect motor and flutter-filter belt-drive system offers distinct advantages over direct-drive systems: for instance, the minimal temperature rise means that no ventilation is needed, even for continuous operation. The cart machines meet all NAB standards and are designed for A or B-style cartridges.

RCA was featuring 2-way portable and mobile radio systems for television and radio news operations. Their range includes *Tactec* hand-held units, which when used in the vehicle are slipped into a battery charging unit, and can be used with additional power amplifiers up to powers of 55W at vhf or 35W at uhf. Similar high-power operation is a feature of the *Veetac* range of vehicle sets, with vhf powers ranging up to 110W—considerably more than is normal in the UK. A number of new microwave link units were also introduced for electronic news gathering in the television field.

One of the less serious papers took a look at the problems of maintaining multmast medium-wave directional aerials, in which it was suggested that an important part of preventive maintenance includes cleaning up the surrounding ground before reading the base meters: 'Keep the weeds, trees, bushes and climbing vines to minimum; keep out all snakes, mice and birds; keep an eye out for bits of broken guy wire lying in the grass, as this should ring a bell that something is wrong'.

But certainly in 1977 the bells for North American broadcasting seemed to be ringing out a peal rather than tolling. ■

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COMPTEURS

Schlumberger

Survey: special effects units

As there is no hard and fast rule as to what constitutes a 'special effects' unit, readers are referred to the survey of reverb and delay units (April '77, p. 26) and the forthcoming survey of limiters and compressors (October '77).

ALLEN AND HEATH

Allen and Heath Ltd, Pembroke House, Campsbourne Road, Hornsey, London N8.

Phone: (01) 340 3291. Telex: 267727.

USA: Audiotechniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902.
Phone: (203) 359 2312.

ADT unit

This product uses an analogue bucket brigade technique to provide two channels of delay of up to 24 ms delay/channel in 6 ms increments. It incorporates XLR connectors and is designed for 0 dBm nominal line level operation. Quoted frequency response 30 to 12.5k Hz ± 3 dB with a corresponding distortion factor of less than 0.5% thd. A front-panel switch enables serialisation of delay channels.

AMS

Advanced Music Systems, 66 Ightenhill Park Lane, Burnley, Lancs BB12 0LH.
Phone: Burnley (0282) 36943.

DM 2-20 PHASE/VIBRATOR/DELAY

This unit simulates phasing and flanging, either manually by a front panel knob or by a combination of ramp and sine modulation.

A function control titled 'phase/stereo/delay' splits the signal in the stereo position producing a moving frontal image which, among other things, claims to simulate a 'Leslie cabinet' sound. Other controls include modulation depth and speed.

The unit is supplied with XLRs and will operate at normal line level; the output is unbalanced.

Price about £330 in either rack-mounting or portable format.

DATATON

Dataton AB, Box 257, S-581 02 Linköping, Sweden.

Phone: 013 10 07 11.

SYSTEM 3000

Dataton manufactures a series of 13 modules which includes a 1000 step microcomputer providing analogue voltage control through internal d to a converters of up to four vc units directly. There is also a serial addressed digital output capable of instructing 80 peripherals such as slide projectors, lighting, etc.

The other 12 modules comprise:

3001 input amplifier

Four channels of preamplification each with pad, phase reverse and limiter.

3002 vc sound generators

Four voltage controlled sound generators, each adjustable from 10 to 10.24k Hz. Control is either linear (1000 Hz/V) or exponential (1 octave/V). Each channel has variable waveform and preset level.

3004 lowpass filter

Two channels of lowpass filtering with continuously variable rollover and level.

3103 filter

Four channels of vcf networks with selectable notch, lowpass, bandpass and highpass. There are internal limiters that squash amplitude peaks created under high operating 'Q' conditions. Q variable between 0.7 and 50.

3104 envelope shaper

4-channel envelope shaper with a 'versatile' triggering system. Main functions include attack, decay, release and off time variable from 0.01 to 10s.

3101 graphic equaliser

Ganged 2-channel (stereo) operation of eight octave centres.

3102 stereo reverb unit

All-electronic 2-channel design with variable decay between 0 and 2s. There is a reverb/cleanfeed variable pot.

3105 ring modulator

Two input single ring.

3201 master mixer

Simple high-level mixer, four inputs, three outputs with 2-channel monitoring. Pan control on each channel.

3202 monitor mixer

As above without the three output groups.

3203 joystick module

Two joysticks each expanding from two to four channels. Signal paths are voltage-controlled enabling interface with other vc busses.

3321 power amplifier

2-channel, 20W each.

EVENTIDE

Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA.

Phone: (212) 581 9290.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1.

Phone: (01) 580 4314.

INSTANT FLANGER

See review page 90.

H910 HARMONIZER

This unit modifies the time domain of an input signal. Through digital processing, it enables a ± 1 octave pitch change; the actual pitch shift being shown on a 3-digit front-panel readout.

The integral delay lines which enable the pitch shift operation may be used independently of the pitch shift for straight delay effects such as slapback, flanging and reverb.

Dynamic range: greater than 90 dB.

Distortion: less than 0.2%

Frequency response: in the delay mode 20 to 12k Hz ± 1 dB.

Delay period: in pitch change 0, 30 and 60 ms. In delay mode, 0 to 112 ms in 7.5 ms steps.

KLARK-TEKNIK

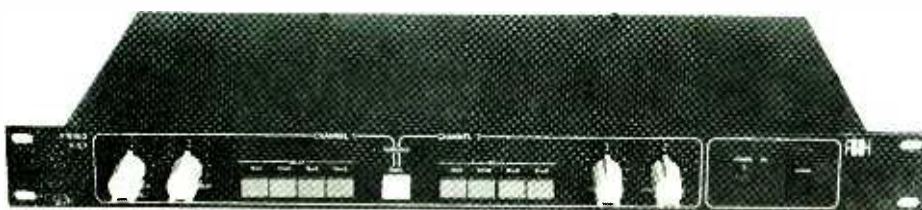
Klark-Teknik Research Ltd, Summerfield, Kidderminster, Worcestershire DY11 7RE.

Phone: Kidderminster (0562) 64027.

DN 36 ANALOGUE TIME PROCESSOR

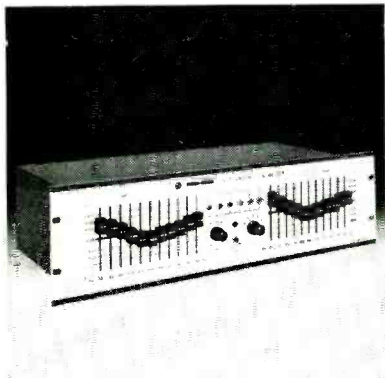
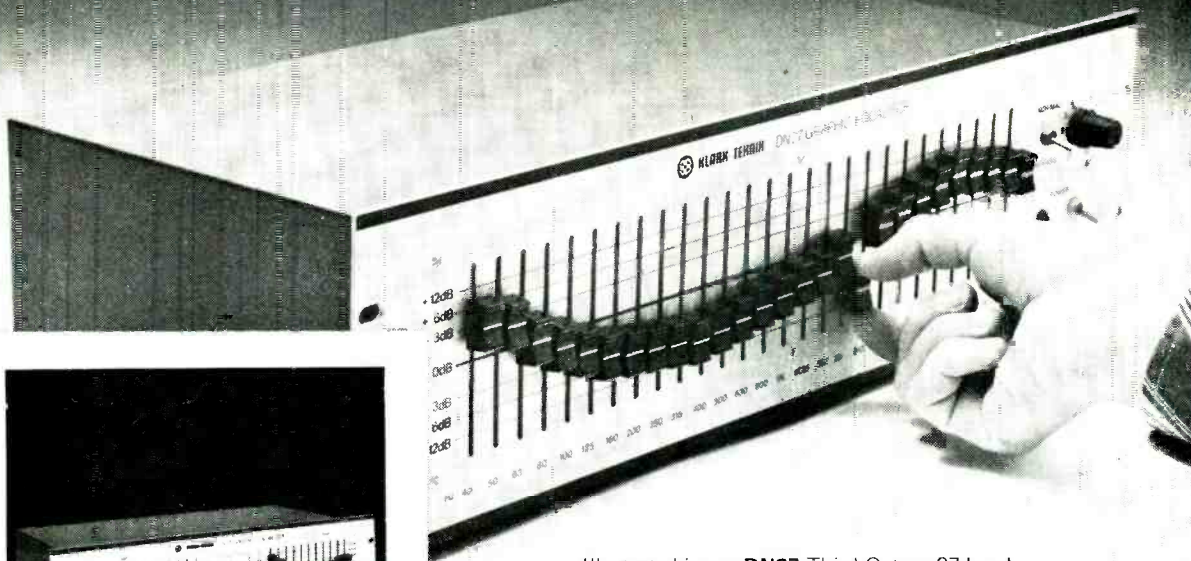
The DN 36 features two channels of continuously variable delay (1 to 36 ms) which may be used independently or serially. Delay is accomplished with

Allen & Heath stereo ADT unit



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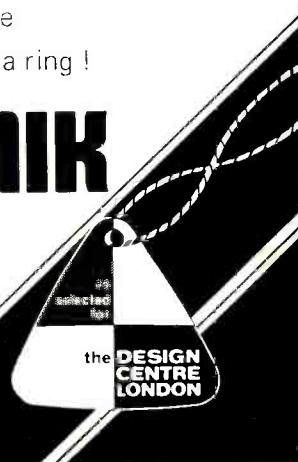
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SURVEY: SPECIAL EFFECTS UNITS

ccd analogue shift registers, each channel being controlled by independent voltage controlled clocks. An internal low-frequency oscillator may be used to modulate the delay period for special effects.

Delay time: 1 to 36 ms continuously variable.

Frequency response: 20 to 15k Hz ± 1 dB.

Interface: 0 dBm nominal unbalanced.

Signal-to-noise: better than 75 dB.

Distortion: less than 0.2% at 1 kHz.

Indication: led array from 0 to -20 dB for headroom monitoring.

LEXICON

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.

VARISPEECH MODEL 27

This unit shifts pitch in real time from two times higher than normal to 0.4 times lower. It also incorporates a recirculation feature and a front-panel mixer for mixing direct with shifted signals. The manufacturer quotes a dynamic range of 58 dB and a frequency response of 100 to 5k Hz. The signal interface is 0 dBm nominal.

Price: \$750.

LOFT

Loft Modular Devices, 91 Elm Street, Manchester, Ct 06040, USA.

Phone: (203) 646 7806.

ANALOG DELAY LINE/FLANGER

This unit will provide a variety of effects including slap-back, loudness enhancement, 'stereo synthesis', Doppler, flanging and double-tracking 'with voltage-controlled pitch error'. The manufacturer claims bandwidth is 18 kHz at 40 ms and 6 kHz at 120 ms delay. A noise-reduction system is incorporated. External control voltage available.

Input: 50 kohm unbalanced.

Outputs: two; original plus delayed signal; 'stereo' original minus delayed signal. 600 ohm impedance, ± 18 dBm max.

Frequency response: 'bandwidth' set at 18 kHz; 30-18k Hz ± 2 dB in delay mode; 20-20k Hz ± 0.5 dB 'dry only'.

Delay time: 0.5 to 160 ms.

Thd: 0.2% max.

Residual noise: less than -80 dBm.

Dimensions: (h x w x d) 51 x 483 x 178 mm.

Power: 115V ac, 60 Hz.

Price: \$750.

MARSHALL

Marshall Electronic, Box 177 Joppa, Maryland 21085, USA. Phone: (301) 679 4837.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1. Phone: (01) 734 2812/2813.

TIME MODULATOR

Time domain modifier incorporates two delay lines which may be used either serially or in conjunction with each other. Using a voltage controlled clock and an internal (0.1 to 10 Hz) sine generator enables delay control effects to be produced. In conjunction with both delay lines, the time modulation effect produces a triple track sound with or without harmonisation. Use of a common mixing buss creates the usual flanging effects between the delaylines and the cleanfeed signal. The maximum delay period is 105 ms.

Price: \$1495, £884.

MICMIX

MicMix Audio Products Inc, 9990 Monroe Drive, Suite 222, Dallas, Texas 75220, USA.

Phone: (214) 352 3811.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1.

Phone: (01) 734 2812/2813.

TIMEWARP

Modifies signals in the time domain within the range 1.5 to 100 ms. The unit features a function generator to frequency-modulate the clock oscillator producing vibrato and harmonising effects. A channel mixer enables clean feed to be mixed with delayed signal to produce the usual range of flanged signals. The basic frequency response of the delayed channel is quoted as 20 to 10k Hz with a corresponding signal-to-noise figure of 70 dB. Interface is 0 dBm nominal.

Price: \$1255, £842.

STOP PRESS:

Unit redesign - see page 3.

ORBAN/PARASOUND

Orban/Parasound, 680 Beach Street, San Francisco, Ca 94109, USA.

Phone: (415) 673 4544.

245E

The company produces a stereo synthesiser for the generation of simulated stereo from mono sources. The four front-panel controls comprise *Dimension* (high and low-frequency processing), *Separation* and *Gain*. No further information known about this model.

SURREY ELECTRONICS

Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG.

Phone: Cranleigh (04866) 5997.

Switzerland: Dr W A Gunther Ing SIA, 8702 Zollikon Zurich, Seestrasse 49-51. Phone: 01 65 5460.

Holland: Sound Techniques, Postbus 206, Alkmaar. Phone: 072 12944.

France: Studio Center RED, 3 rue du Telegraphue, 75020 Paris.

Phone: 636 73 10.

SPECTRUM SHIFTER

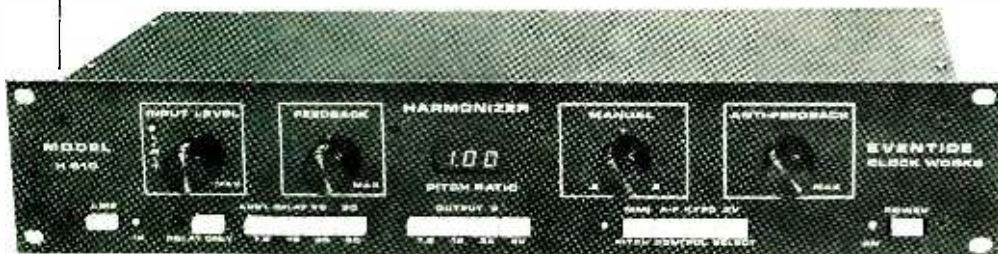
Shifts the audio spectrum up or down by any amount between 0.1 and 1000 Hz for special effects on music or speech. Over very small frequency increments, it can be used for pitch correction; however, the frequency shift is an absolute value for all input signals resulting in an atonal output.

Frequency shift range: 0.1 to 1 Hz, 1 to 10 Hz, 10 to 100 Hz and 100 to 1k Hz.

Distortion: 0.01% thd at 1 kHz.

Interface: 0 dBm nominal balanced or unbalanced.

Price: balanced version £170, \$290.



Eventide H 910 Harmonizer



Marshall Time Modulator



Orban/Parasound 245E stereo synthesiser

STUDIO TECHNOLOGY

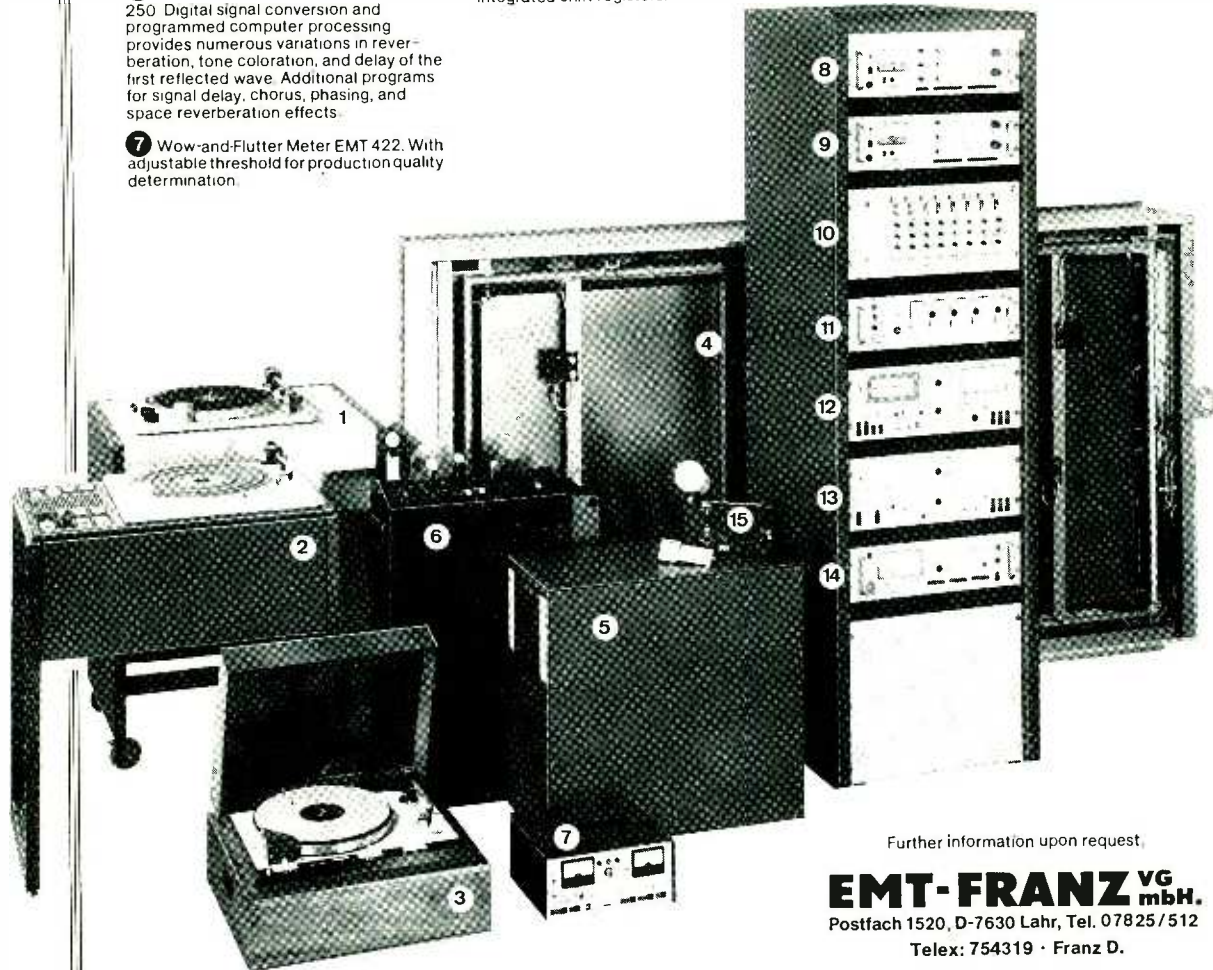


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- 3 Professional Turntable EMT 928 in wood base with protective dust cover.
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- 5 Gold Reverberation Foil EMT 240. A system in miniature format retaining all the advantages of two-dimensional reverberation.
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- 7 Wow-and-Flutter Meter EMT 422. With adjustable threshold for production quality determination.
- 8 Stereo Dynamic Compressor EMT 156. Puls-width modulation employed for gain control, enabling extensive variations in compression and limiting and expansion characteristics.
- 9 Mono Dynamic Compressor EMT 156 TV embodying the identical control flexibility; intended for AM and TV studios and transmissions.
- 10 Dynamic Signal Controllers in modular Plug-in Design: EMT 256 II Compressor with expander feature; EMT 257 Limiter with selectable pre-emphasis; EMT 258 Noise Filter with dynamic cut-off frequency and expander; EMT 260 Limiter for speech de-essing; 19" Mounting Rack EMT 259-10 including power supply.
- 11 Electronic Delay Unit EMT 440. Digital signal conversion, delay circuitry using integrated shift registers.
- 12 Wow-and-Flutter Analyzer EMT 424. Establishes new test criteria for measurements of audio signal carriers, using a new sigma circuit for retention of data.
- 13 Wow-and-Flutter Analyzer EMT 425. Specialized design employing increased test frequency for high speed tape dubbing systems.
- 14 Micro-Impedance Meter EMT 328.
- 15 Audio Frequency Polarity Tester EMT 160/161.



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reviews

Roland System 700 Synthesiser

Nik Condron and Hugh Ford

AN OPERATIONAL ASSESSMENT

For spec, see survey page 74.

THE ROLAND *System 700* is something of a departure from the norm in conventional synthesiser design. It is a large synthesiser—very large—intended exclusively for use by the serious 'synthifreak' in studios, university music departments and the like. The price tag puts it in the same league as the big Moogs, the ARP *1500* and the EMS *Synthi 100*, wherein it becomes a serious contender.

The most important feature, however, is that the system is modular: it can be expanded from a series of six separate units, so that you can begin with the first one that contains all the basics, and then add to it—thus gradually building up the complete *System 700*.

Probably the most difficult problem with any new synthesiser design is routing and ergonomics. The *700* has produced nothing new in this respect, but has taken a selection of the best existing ideas—layout for a big synthesiser has to be as concise as possible. When linking up the individual units of even quite a modest synthesiser, it must be possible for the eye to follow the logical sequence of the creation of the intended sound across the panel. Thus the conventional chain of oscillator/filter/amp should read like a book—from left to right. For the most part the *700* has been able to

keep to this formula, but being a modular system, it is obviously not possible to keep too strictly to such a concept.

In terms of routing, the layout of the system uses the basic format of the ARP *2600*. Like the big Moogs, each module has conventional in/out 6.25 mm jack sockets, but they also have input connections via faders. Each module thus has a mixer for voltage control inputs, and an additional mixer for audio inputs (except, of course, the oscillators). The vc and audio inputs are prewired for the most frequently used interconnections; for example, the vc filters have audio inputs from the oscillator bank and vc inputs from the envelope shapers and low-frequency oscillators, thus allowing all the basic synthesiser sounds to be made without the machine taking on the appearance of a telephone exchange (circa 1960)! This principle is only practicable on the main console—the interconnections of the satellite consoles have to be minimal. There are in all six blocks of modules and a keyboard unit in the complete *System 700*. These comprise the main console, an additional vco bank, a vcf/vca bank, an interface/mixer, a phase-shifter/audio delay, plus an analogue sequencer.

Main console

Along with the keyboard this is a basic integrated synthesiser. It comprises three vcocs, noise generator, ring modulator, two vcfs, two

vcas, two low-frequency oscillators, a voltage processor, sample and hold device, two envelope generators, envelope follower, integrator, audio/vc mixer and a comprehensive stereo output unit.

VC oscillators

Each oscillator has four waveforms, these being the usual lineup of sine, triangular, sawtooth and pulse/square wave—the pulse width being variable either manually, or by voltage control to give a phasing effect. The three oscillators can be sync-locked for complex vc applications. The three vcocs share a variety of prewired cv inputs, apart from the keyboard cv, which are lfo 1, adsr 1 (envelope generator) and sample and hold. There is an octave tuning control—calibrated Moog style in feet—and a pitch control calibrated in semitones; I was impressed by the stability of the oscillators, and by the accuracy of the calibrations.

VC filter

There are two of these on the main console, each unit having highpass, bandpass and low-pass capability, with variable resonance being available in each of these modes. Prewired audio inputs are from the three oscillators; white noise generator and ring modulator; control voltages from keyboard; lfo 1; and either adsr 1 or 2. The filter is really the heart of a synthesiser, and above all other modules it governs the tonal quality of the sound. This means that a great deal of effort must go into the design of these circuits, and although that has obviously been the case, the vc filters sound no better than those on the small Roland 'musicians squeakbox' synthesiser. Perhaps as the proud owner of a large Moog I've been rather spoilt, since the clarity and brilliance of the Moog vcfs have never yet, to my knowledge, been emulated by any other manufacturer, and certainly not by the Roland Corporation. Really though, these are perfectly adequate.

Envelope generators

These, once again, are based on the graphic principle of the ARP. They consist of four calibrated slider pots governing attack, decay, sustain level and release time. A switch governs the triggering and, unlike the Moog circuits, any control voltage applied to the external input will act as the trigger, without having to be interfaced with an external module.

Low frequency oscillators

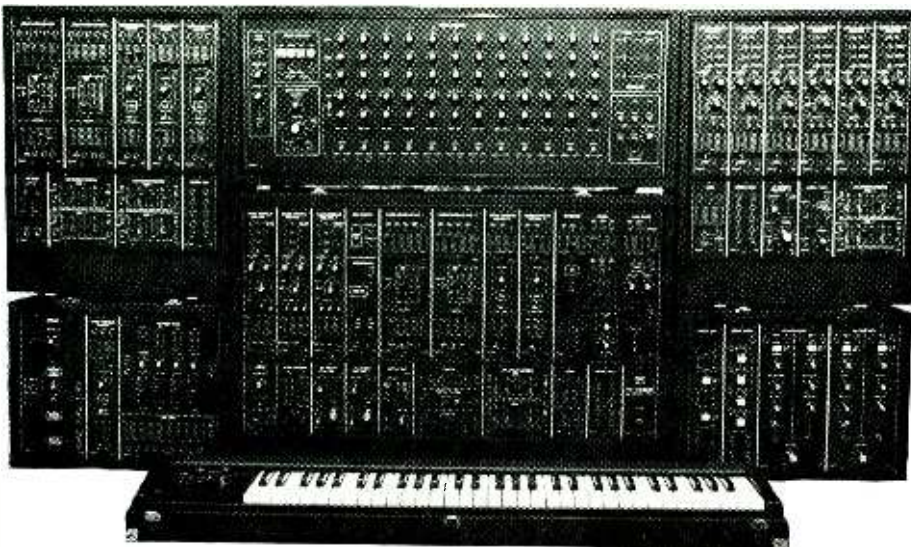
There are two of these, and a very interesting idea is used in lfo 1. This is a delay triggered from the keyboard, so that when connected to the vco inputs, variable-delay vibrato can be produced. Also, a visual indication of the lfo rate is given by a led.

VC amplifiers

Again two of these, with the audio inputs being prewired from both filter outputs. Good Moog ideas have been used, these being a gain control allowing the signal to temporarily bypass the vca, eg for tuning and setting up filter sounds; and a linear exponential switch to govern the control of either of the adsr inputs.

Ancillaries

This heading includes the voltage processor,



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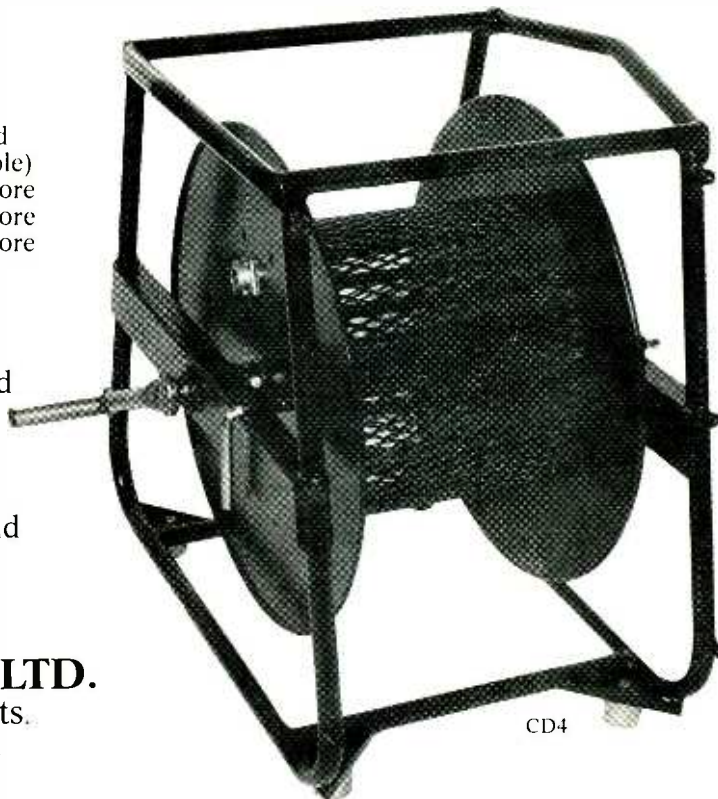
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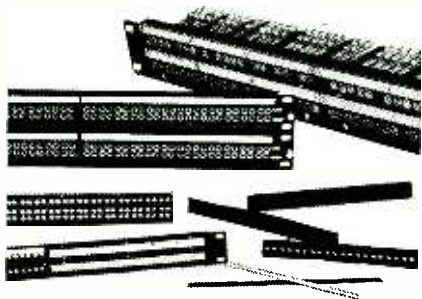


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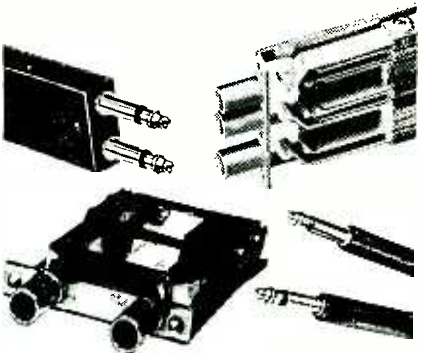
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ROLAND SYSTEM 700

sample and hold, envelope follower and integrator. The voltage processor as a cv source gives up to 10V, and as a cv inverter enables any control voltage, for example from the keyboard or adsr, to become a negative cv. There is also the keyboard cv externally available on this panel. The sample and hold device is very similar in layout to that of the ARP, the unit consisting of an internal clock which at each pulse reads the voltage of any cv input, and holds it until the next clock pulse. The clock rate is variable from 0.3 up to 30 Hz. The sample/hold inputs are internally switchable between lfo 1, white noise and, of course, external. The envelope follower gives a control voltage which follows the amplitude of the input signal. It is preconnected to an amplifier module capable of accepting a microphone or guitar, etc. The integrator is prewired from the output of the envelope follower and gives a lag time—or slew rate—to this signal; in practice this is equivalent to the glide control common to most synthesiser keyboards.

Output module

This well laid out panel consists of pre-selected inputs from the two vcas, which are then panned and sent to the output via a springline reverb unit. There is also a simple vc phase shifter on this panel, and a line-up oscillator for tuning and calibration. The output is via illuminated vu meters.

All the modules of the main console can have their internal preconnections overridden via the 6.25 mm sockets, allowing more unusual interconnections to be easily made. Another very useful facility on many of the modules is the use of leds to show visually the state of a given patch. Both vcf and vca modules have red and green leds showing 'signal present' and 'signal overload' conditions, which is a very useful idea indeed.

Keyboard controller

The keyboard for the *System 700* is a 5-octave duophonic instrument, with the usual portamento time (glide) calibrated up to ten seconds. Full marks for a pitch-bend lever giving preset movement over a semitone, octave and five octaves. All connections are duplicated on the rear panel, and with the use of these and the existing multicore connectors, several keyboards could be connected to the Roland.

As already mentioned, the main console can be extended by the use of two additional blocks, and although these come in a pre-determined layout (being modular) any combination of devices can be ordered specifically. The vco bank contains six additional vcas, two adsr units, an extra sample and hold, a third lfo and another audio/vc mixer, but none of these modules is prewired to the main console, except for the keyboard cv. The vcf/vca bank has two further vc filters, three vcas, four adsr units, and a gate delay unit which can delay a trigger signal routed, for example, to one of the adsrs to give a repeat or adt effect.

Three further units make up the *System 700*: Interface/mixer

This has, in addition to yet another vca, three very useful devices. The first is a 9-input audio mixer which can be used for mixing all

nine available vcas together to give a common signal. One of my main complaints about the ergonomics of this system is the lack of sufficient sub-mixing devices. I would like to have seen at least a couple of smaller 4 or 5-input mixers, as well as the existing 3-input cv/audio mixers. I liked the multimode filter on this panel, which is made up of four identical filters sharing a common input and output. Each filter covers the full audio spectrum, there being four controls governing frequency, resonance (bandpass) level, and lowpass/highpass/bandpass mode. This is a very efficient design for a 4-band parametric equaliser—the layout should be copied by the manufacturers of studio equalisers. The fourth device is a pitch/voltage converter interface module, and in layout and function compares very favourably with the popular EMS equivalent. Its function is to take from the input signal (eg guitar, organ, mic, etc) a control voltage governed by the frequency and amplitude of that signal. These two control voltages can be used to control functions of the *700*; for instance, a guitarist could replace the keyboard controller with his guitar. It must be said that in common with all currently available p/v converters, it takes a great deal of skill to get a clean sound from this device.

Phase shifter/audio delay

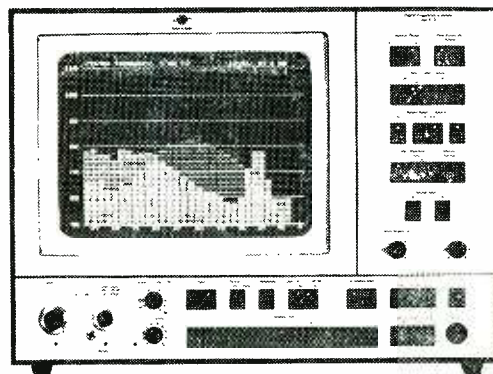
This unit comprises four modules. A switchable multiple jack and analogue switch routes up to four inputs to a single output, when a control voltage of 5V or more is applied to the four switch controls. This is very useful, especially when used in conjunction with the sequencer. The phase shift module and audio delay module have the same panel layout, each having two channels with common cv input for stereo use. The controls in the case of the phase shifter are 'resonance', 'shift frequency' and 'modulation intensity' (cv input level). In both these devices, channel 1 has an inverter switch so that the internal oscillators can give a complimentary positive and negative sine-wave vc signal. The audio delay controls are 'resonance delay time' (up to 5 ms) and 'intensity'. Each module has a bypass switch and a sweep speed to govern the internal oscillators, which in each case are external cv inputs working either as a common cv, or independently on each channel. The insertion loss of both these devices is very big—I would guess about 6 dB—and the noise is consequently so high that the outputs of these modules have to go through a vca before reaching the main console output module. Audio delay is based on a conventional analogue delay circuit; but with only 5 ms to play with, its function is almost entirely restricted to flanging. This it does very efficiently, and once again the formula should be adopted by more studio equipment designers.

Analogue sequencer

This unit is based on the very efficient Moog sequencer layout. In some respects it is an improvement, but in certain others it is not as practical as the good Doctor's design for really complex sequences. Basically the sequences comprise three rows, each with 12 discrete control voltages plus a voltage multiplier per row to give added range or sensitivity. The principle on which this kind of sequencer works is that an

THE ULTIMATE IN FREQUENCY ANALYSIS

This instrument is the first of its kind in the world. It is an integrated, all digital solution to the problem of third octave and one octave analysis in audio and sub-audio frequency ranges. It has digital filters with centre-frequencies covering the range 1.6Hz to 20kHz, true RMS digital detection, exponential and linear averaging, comprehensive digital and analogue input and output facilities and a 60dB display range with provision for instantaneous spectrum hold, plus an extra store for on-screen comparisons.

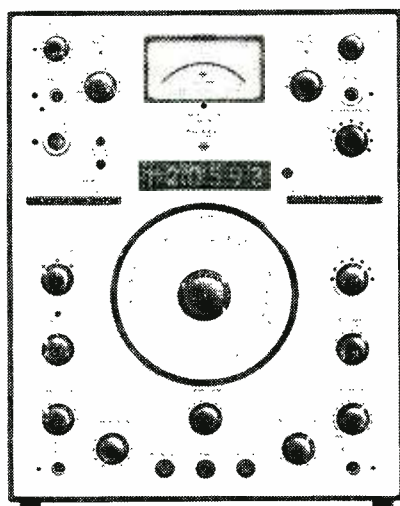


TYPE 2131 REAL TIME 1/3 & 1/1 OCTAVE ANALYSER

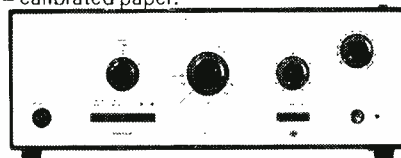
THE ULTIMATE IN DISTORTION ANALYSIS

These two instruments combine to provide swept measurement of non-linear distortion in the range 2Hz to 200kHz. Harmonic, difference frequency and inter-modulation distortion to the fifth order can be measured to DIN 45403 or IEC 268-3 standards. With the addition of a Type 2305 or 2307 level - recorder automatic swept distortion analysis can be performed and documented on preprinted frequency - calibrated paper.

By using the sweeping frequency signals of a sine generator or test record to tune this filter, it is possible to obtain instant measurements of any harmonic that falls within the 2Hz to 20kHz range, which is also the range of the fundamental input.

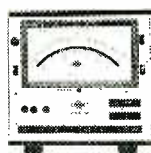


TYPES 2010 HETERODYNE ANALYSER AND 1902 DISTORTION MEASUREMENT CONTROL UNIT



TYPE 1623 TRACKING FILTER

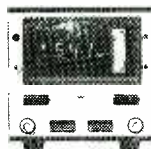
THE ULTIMATE IN CIRCUIT NOISE ANALYSIS



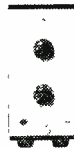
TYPE 2429 PSOPHOMETER

A small size easy to use meter for the determination of the signal-to-noise ratio in audio frequency communication channels, in accordance with the CCITT-P53 and CCIR-468-1 recommendations. It has both RMS and peak detectors and 4 different weighting networks built in. A high overload margin, assisted by an overload warning light is an important feature and a built in reference oscillator speeds up calibration. Amplification is calibrated and adjustable.

THE ULTIMATE IN PHASE CHARACTERISTICS ANALYSIS



2971



6202

TYPE 2971 DIGITAL PHASE METER & TYPE 6202 PHASE DELAY UNIT

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THE ULTIMATE IN AUDIO SYSTEM TEST ANALYSIS

TYPE 4416 RESPONSE TEST UNIT



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ROLAND SYSTEM 700

internal clock—which, of course, can have its rate externally controlled—switches the output to each of the 12 controls in turn. Thus a fixed note sequence of up to 12 equally spaced notes is available. Each row can be used individually to give a 36-note cycle, or in vertical combinations to give 12 triadic chords. The clock-rate can be delayed individually for each of the notes allowing complex rhythms to be used in cycles of up to 12—any combination in sequence can be used. There is a step selector control, governing the number of notes in a cycle, which regulates the lateral movement of the internal clock. A led above each row gives a visual indication of the position of a particular sequence; each vertical row can be externally keyed via the 'analogue in' jack, and gives an external trigger via the 'gate out' jack. A master controller governs the sequence, having four controls for 'start', 'continue', 'stop' and 'end' functions. Each of these can be externally controlled for more complex effects via 6.25 mm jacks. Thus the sequencer, if required, can be used to replace or augment the keyboard governing the vcos, or could, for instance, become three complex synchronised envelope generators—the start pulse being derived from a trigger from the keyboard controller. A pulse shaper is also available for externally derived triggers.

This device is obviously capable of an endless variety of vc applications, its limitations being governed only by the inventiveness of the operator. I'm told that the Roland Corporation is at the moment developing a digital sequencer that will be programmable (like the EMS 256) from the keyboard. I hope to be able to review this device when it becomes available.

The *System 700* has been designed to be fully compatible with most other standard synthesisers. It has kept to the IV per octave cv rule, which now appears to be standard. The keyboard is of the 'end zero' type which retains this compatibility. I tested the machine alongside my own Moog 3c, and with these two monsters working away—quite happily together—I got the feeling that I could easily have put Andre Previn and the LSO out of business! The layout of the whole machine is excellent and well conceived; a lot of time and energy has obviously been spent in developing a machine on which anyone with a modicum of intelligence could learn 'synthi-technology'. The idea of a modular system that can be built up from a basic unit is an extremely good one, since the potential customer is not immediately faced with an enormous and daunting price ticket. Obviously it is cheaper to buy the whole unit together, but even then the price hovers around the £9000 mark, so only well-heeled and well-sponsored clients will be able to save by spending.

I was disappointed that with such a good layout the front-panel components were, quite honestly, very cheap and nasty, and even for the short period I had a demonstration model a couple of small switching faults developed. I'm sure that anyone wishing to buy this machine would rather pay a little extra for reliable front-panel components. Each of the seven units is quite light and portable, which makes the 700 a very good idea for musicians who need a very easily transported complex

synthesiser rig for stage or session work. The units are housed in good-looking leathercloth cabinets, with high quality and durable fastenings and hinges; the complete system can be erected into a very impressive-looking array in a matter of minutes. Where perhaps ease of transport and erection have been a design consideration, it might be a better solution to house these expensive lumps in flight-case type boxes, which are stronger, more durable and lighter than those supplied. This is a minor point, however.

The unit comes with a very comprehensive instruction manual that includes individual breakdowns of each module, applications (ie

routing) for specific sounds, plus servicing/calibration details. Unlike EMS and Moog, however, no circuit diagrams are included. The overall sound produced by the machine was a clean one but, as I have said before, it hasn't got the 'sparkle' of the studio Moog with which I compared it. Running the two machines together in sequence and using the Roland's analogue switch, I was able to switch automatically between the two machines—each with an identical patch—and I could instantly tell 'blindfolded' which was which. Nevertheless, the *System 700* is a very fine machine, and I hope it achieves the popularity it unquestionably deserves.

Nik Condron

TECHNICAL REVIEW

CONSIDERATIONS of the electrical performance of devices such as a synthesiser presents particular problems. It would, of course, be possible to investigate fully the performance of each oscillator, filter, voltage-controlled amplifier, etc. Unfortunately, not only would a review of this nature be a very lengthy exercise, but I really doubt if such detail would be of any practical use to readers other than those who manufacture competitive products.

What really matters to the user of a synthesiser is how it sounds and how easy it is to interface with other studio equipment. Nik Condron has dealt with the sound of the Roland synthesiser in his operational assessment and has also described its many possible functional modes; it therefore only remains to deal with the interface between the synthesiser and other equipment, and to add a few other comments concerning practical operation.

The output from the Roland synthesiser is in the form of two separate 2-pole 6.25 mm jack sockets, one for the left channel and the other for the right, both of which are single-ended outputs. This immediately led to problems with my normal monitoring set-up, as a serious hum loop was formed. It would only seem to be sensible to me if the synthesiser had been provided with a balanced output, optionally floating, since not only would this be easier to interface in studio use, but it would overcome the notorious problems of hum and earthing.

The output impedance is 600 ohms genuine source impedance, which suits American practice, but could well be lower for driving into other devices. Feeding an open circuit the output clipping point was +21 dB (ref 0.775V) with the output being metered by twin vu

meters, which were aligned such that 0 vu corresponded with 0 dBm output, giving a margin of 21 dB between zero level and clipping point.

I would rather see ppms as monitors, since synthesiser output waveforms can have extremely high crest factors; the vu meter is a very poor indicator of maximum output levels.

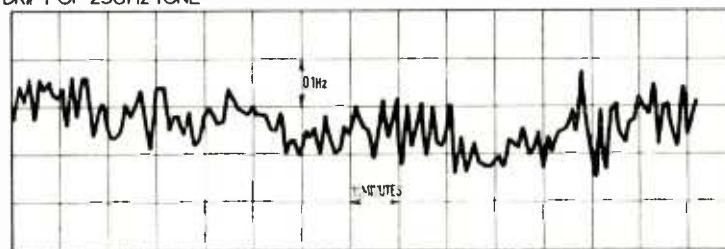
A brief investigation into the noise content of the output showed that the output module's noise was about -80 dBm over the band 20 Hz to 20 kHz as measured with a rms meter, the A-weighted noise being 5 dB lower. The addition of one of the vcas into the circuit increased the A-weighted noise by 10 dB when the gain was minimum, and 'opening' the vca gave an A-weighted noise output of -70 dBm. Taking into account the output capability of +21 dBm this provides a dynamic range of 91 dB, but is clearly the very maximum likely to be encountered. However, it is felt that in practice the noise performance should be quite adequate.

A further matter of importance in a synthesiser is the frequency stability of the oscillators. All musical instruments, of course, go out of tune in the presence of large temperature variations, so it wasn't felt that this parameter was of great importance. But what is clearly important is the long-term frequency drift at relatively constant temperature.

It was decided, therefore, to investigate the frequency stability from the switch-on from cold over a period of a few hours. The synthesiser was tuned for a 256 Hz sinewave and its output frequency plotted for both long and short-term stability, the latter proving less than ±0.05 Hz short-term. The long-term performance is shown in fig. 1 where again the peak drift is around ±0.05 Hz for the 256 Hz tone, and I really doubt if such small orders of drift give cause for much concern.

Hugh Ford

FIG.1 ROLAND SYSTEM 700
DRIFT OF 256HZ TONE



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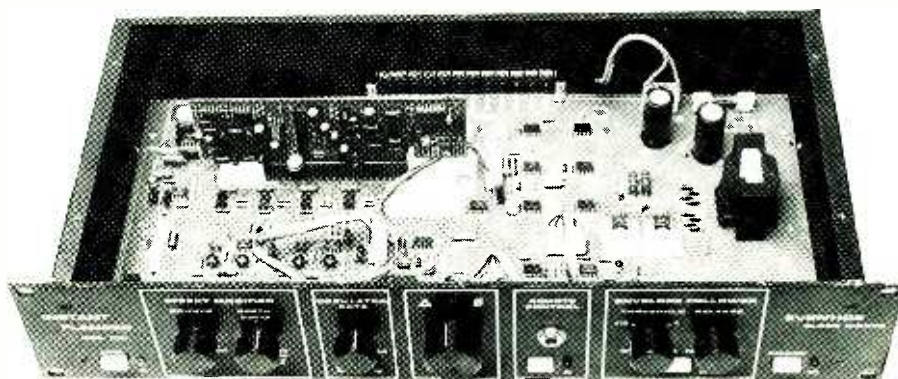
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Eventide Instant Flanger FL201

Nik Condron
and
Hugh Ford



MANUFACTURER'S SPECIFICATION

Input level: 0 to +4 dBm nominal level. Clipping occurs at +18 dBm for frequencies where the flanger gain is unity.

Input impedance: 10 kohm unbalanced. 600 ohm transformer balanced available.

Output level: 0 to +4 dBm nominal level. Maximum output level before clipping is +18 dBm. Output level may be up to 6 dB greater than input level, depending upon the nature and frequency of input.

Output impedance: 600 ohms nominal single ended. Transformer balancing option.

Frequency response: *direct channel* ± 1 dB, 50-15k Hz. May be nulled at least 30 dB (typ. 40 dB) across entire audio range. *Delayed channel* ± 1.5 dB, 50-10k Hz, down at least 3 dB at 15 kHz. Lowpass filter at input prevents aliasing.

Distortion: *direct channel:* lower than 0.05% below clipping point. *Delayed channel:* lower than 1% at nominal 0 to +8 dBm input level, increases as input frequency increases due to pre-emphasis circuit.

Typical at 1 kHz, depth at maximum in phase, 0 dBm input level: K2 down 55 dB, K3 down 80 dB, other harmonics undetectable.

Dynamic range: *direct channel:* 112 dB in 15 kHz bandwidth. *Delayed channel:* referred to 3% distortion, delay = 1 ms, 75 dB. Apparent dynamic range = 85 dB due to pre/de-emphasis.

Delay time: variable by means of front panel controls or external control voltage between limits of 200 μ s and 10 ms (as factory set). May be internally adjusted to give up to 50 ms of delay for special effects, with serious degradation of all performance parameters.

Control voltage: the voltage-controlled delay is designed to operate with an input between 0 and +6 volts. This variable voltage may be supplied externally or by any of the following controls, either singly or in any combination:

Manual

Controls delay time by manual control. C/w rotation decreases delay and increases flanging frequency.

Oscillator

Variable between 0.05 and 20 Hz, varies the flanging effect continuously and automatically.

Envelope follower

The input signal amplitude is used to control the flanging effect. Minimum input level -10 dBm required, threshold and time constant are independently adjustable.

Bounce

Control used to simulate effect of tape recorder flanging by varying delay in the same manner as a motor servo 'hunting'.

Dimensions (whd): 483 x 89 x 227 mm.

Note: all measurements are referred to main output. Auxiliary output measurements are approximately 50% better, and the delay is 50% of the main delay.

Manufacturer: Eventide Clockworks Inc, 265 West 54th Street, New York City 10019.

UK agent: Feldon Audio Ltd, 126 Great Portland Street, London W1.

AN OPERATIONAL ASSESSMENT

THE 'flange' effect is a development of electronic phasing. A simple phase technique involves the use of a spectrum filter circuit having a variable negative-frequency notch with a narrow bandpass characteristic. The resultant signal is technically the opposite to the guitarist's 'wah-wah' pedal effect—with a 'wah' pedal the narrow bandpass notch lets through the bandpass signal only, whereas the phase box cancels out the bandpass. Using different methods, this circuit achieved a greater degree of sophistication in the more elaborate studio phasers made by Audio & Design, Eventide, etc, of which Eventide's *Instant Phaser* is perhaps the best known. The circuits were analogue in such units.

The very earliest methods of phasing used mechanical systems involving at least two tape machines. The negative-going notch was produced here by direct phase cancellation over the audio spectrum, by actually varying the motor speed of one machine which was synchronised with the same sound source playing back off a second machine. Thus two identical signals were mixed together, and the inherent instability of the recorders' capstan motors—often aided by gentle pressure from the engine's little finger—produced a negative notch by phase cancellation moving up and down the audio spectrum.

When total cancellation occurred virtually all frequencies over the entire spectrum were attenuated; when slightly out of sync the bass frequencies were affected, and this notch moved to the upper frequencies because the two adjacent spectra at any given moment had very slightly differing frequencies. Flanging is simply going back to this original principle of 'tone bending' to produce the negative notch—but using sophisticated electronic circuitry instead of mechanical systems. Thus the flanger is a direct development of the digital delay line.

The *Instant Flanger* comes as a 483 mm rack-mounted unit. It will accept a single audio input, and give two antiphase outputs. The unit is comprised of three main components, and these are blocked off on the front panel under the headings:

- (1) Effect modifier
 - (2) Manual control (delta to theta)
 - (3) Envelope follower
- (Stage 2 also includes a control voltage input.)

The effect modifier has two controls which determine the degree of flanging. One is bounce—and this limits the actual frequency change of the 'shift' part of the circuit, which is later mixed with the 'direct' signal to give the

composite flange signal at the outputs. The effect control gives the percentage of direct to shifted/delayed signal.

Control of the machine is either manual or via the internal oscillator, the frequency of which is also indicated visually by a led. This oscillator can be remoted via an external input. An a-b check on the machine is provided in the form of a line button which bypasses the unit, maintaining unity gain. The third control function is provided by an envelope follower circuit, with two controls: i/p level and threshold.

The unit comes with a conventional Eventide appearance—white lettering on a black anodised panel. All connections, with the exception of the remote 6.25 mm jack socket—which is mounted on the fascia—are on a conventional tag strip. In practice this machine is capable of producing remarkable effects, but unfortunately is not so good at handling sustained sounds at a high 'effect' ratio—such as organs, or 'clean' guitars. This is due to its unnatural pitch-bending characteristic. If the effect of a smooth sinewave pattern could be achieved there would be no problem but, due to the nature of the beast, there is a regular null at all oscillator speeds, producing what sounds like a series of sharp spikes. Thus with the effect full in, a flanged organ gives the

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EVENTIDE INSTANT FLANGER FL201

impression that one's tape machine capstan is oval with a small chunk cut out of it. Another quibble is a low to mid-frequency thump at the oscillator frequency that is very audible at low level, as is the rather high noise level of

the unit. This noise level is actually so high that if the machine is left with its output routed through the desk and the gain brought up, some very good wind noises can be made—with about three layers of sound!

If the output is fed back into the input, eg through a foldback or echo line, a position just below instability can be found to enhance

the flanging effect by narrowing the bandpass characteristic. The unit seems to take this kind of misuse without grumbling.

On the mixer desk of the studio I've put a little notice in front of the producer's chair—a sign that many take very seriously: IF IN DOUBT—FLANGE IT.

Nik Condon

TECHNICAL REVIEW

FLANGING or 'phasing' have a similarity in that they involve the insertion of a variable time delay in the signal path. If the delayed signal is mixed with the undelayed signal, nulls will be produced in the overall frequency response due to cancellation effects which depend upon the delay time. Thus, variation in the delay time will vary the frequencies which are added or cancelled.

Typical phasing units achieve a small signal delay by using a voltage-controlled phase shifter, and are limited in their effect. Flanging is achieved by running two machines in the record/replay mode with the same input signals, and mixing the outputs whilst varying the tape speed on one recorder by means of a finger on the spool flange—hardly a scientific or ergonomic method, but such is the recording industry.

The Eventide *Instant Flanger* achieves both these effects and others by purely electronic means. And reference to fig. 1 will show how this is achieved, and what additional effects

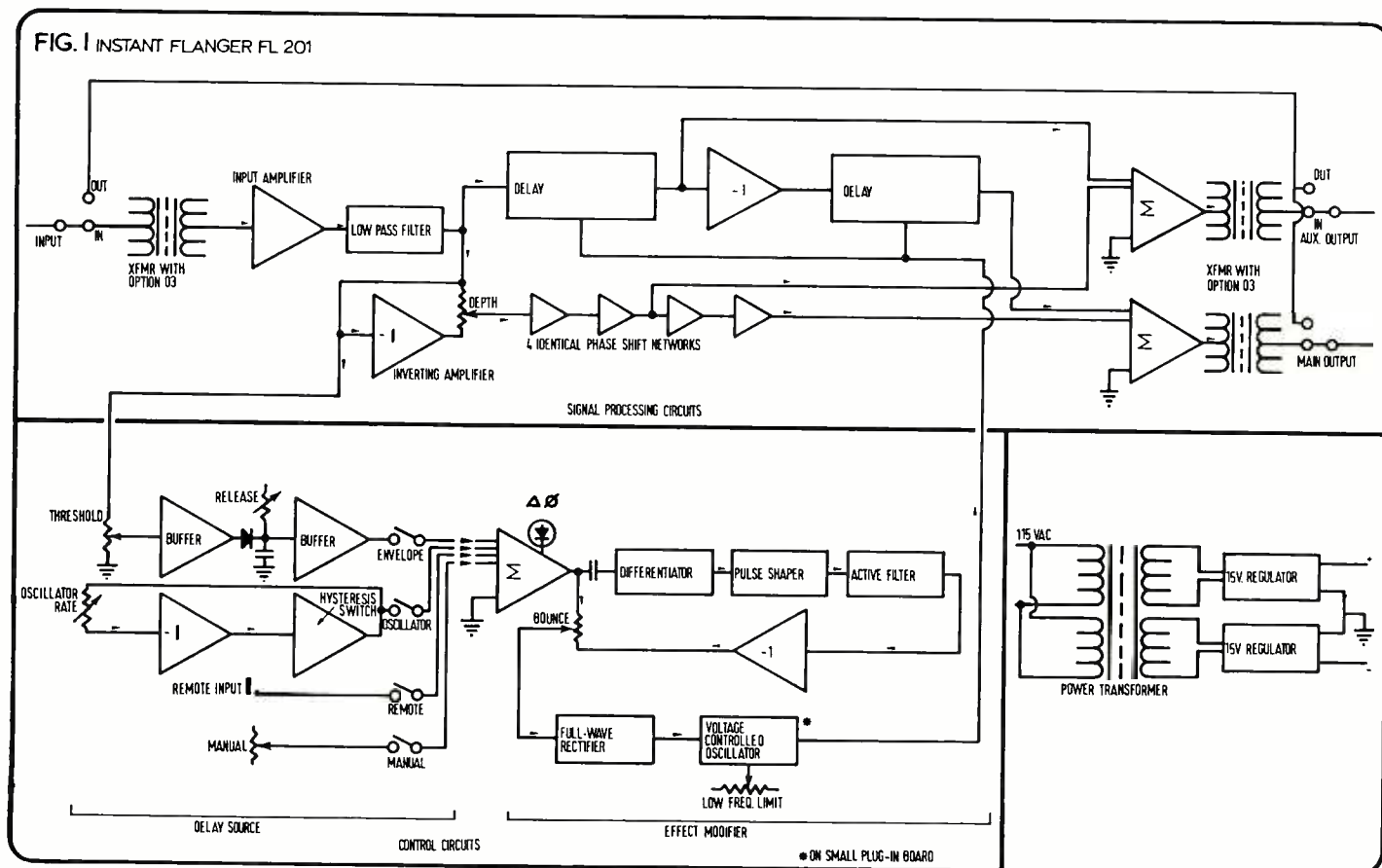
are available. The top depicts the basic signal path that starts on the left at the input, which can be switched either to the flanger or directly to the output to bypass the flanger. The audio signal is first buffered and passed through a lowpass filter to remove frequencies above 15 kHz, which would create trouble in the following digital electronics. The 'direct' signal then passes to an inverting amplifier of unity gain, the output of which feeds one end of the depth control, the other end being fed by the non-inverted signal; this adjustment of the depth control provides a 'direct' signal that can be varied from in-phase through null to full anti-phase. The output of the depth control then passes through two phase shifters to the auxiliary output, and a further two identical phase shifters to the main output; in both cases the indirect signal is added at the output stage. Turning to the indirect signal, that fed to the auxiliary output is passed through a voltage-controlled delay, and the signal fed to the main output is passed through a further voltage-controlled delay. The available delay time can be varied from 200 μ s to 10 ms, the voltage control for delay variation

being provided by the control circuits at the bottom of fig. 1.

Voltage control from a total of up to four sources can be used: manual control, remote source control, internal oscillator control or control by the incoming audio signal itself. While the internal oscillator is a fairly basic vfo with a range 0.05 to 20 Hz, delay proportional to the incoming signal is, perhaps, more interesting. The latter has a variable threshold control and a release time control, such that only signals above a preset level affect the delay. Further, the effective time constant of the detector can be varied.

The output from these four delay sources is summed at a summing amplifier. A further gimmick follows: the output of the summing amplifier may be fed directly (via a rectifier) to a voltage-controlled oscillator, or it may be fed via a 'bounce' circuit that adds damped oscillations to the control voltage, the degree of 'bounce' being controlled by a potentiometer. The vco controls the delay in the unit's signal section by providing a variable clock rate to the bucket brigade delay elements.

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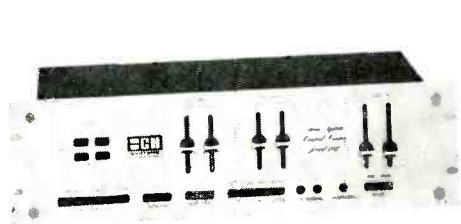
PROBLEM SOLVERS

The new BGW range offers standards of performance, reliability and safety without precedence. Whether used in the most critical studio work, the highest powered PA system, or simply driving domestic stereo, it guarantees the cleanest and most accurate sounds attainable. BGW's state-of-the-art professional line of audio amplifiers is the result of fundamental rethinking of the traditional design parameters, solving the inherent problems of conventional models.

Instability Problem — BGWs safely drive continuously into loads as low as 2 ohms. Highly reactive loads, such as electrostatic loudspeakers are no longer a factor. **Distortion Problem** — voltage and current limiting circuits often causing annoying distortion in conventional designs have been eliminated. **Safety Problem** — to protect the amplifier and loudspeakers a 'fail-safe' SCR crowbar circuit is incorporated, which discharges all energy stored in the massive power supplies and turns the unit off via magnetic circuit breakers, without relying on fuses or relays. **Thermal Problem** — exceptional thermal stability is ensured by mounting all signal carrying transistors on to massive totally enclosed heat sinks. Additionally, except for the 250B, all models have a forced air cooling system employing a thermostatically controlled dual speed fan. **Service Problem** — each channel's circuitry is on a separate 'plug-in' module enabling quick replacement. **Reliability Problem** — only industrial grade precision components are used, for example, all resistors are low-noise types, all harness wiring is Teflon insulated, all circuit boards are flame retardant epoxy glass and all signal transistors are in hermetically sealed metal cases.

Durability Problem — All units feature welded steel chassis for maximum strength and rigidity. Other features include 19" rack-notched heavy gauge front panels. A rear panel switch converts the two channel amplifier to a higher power bridge connected single channel amplifier.

Also from BGW is the model 202 preamplifier. Outstanding features include: * An advanced phono preamplifier design using two discrete component operational amplifiers per channel. The high and low frequency signals are separately equalised to the RIAA playback curve, achieving exceptional accuracy in the phono stage (within ± 0.25 dB from the RIAA curve). * A new active tone control system with ultra low distortion and precision calibrated step switches. * Active high and low pass filter systems with 18 dB per octave slope. * Special line amplifier output stage capable of driving 50 ohm lines. * High/low gain switch for optimal signal to noise ratio. * Fully stabilised dual rail power supplies. * Plug-in moving coil pre-preamplifier. * Independently switched pre and power amp power supplies. * Tape monitor and tape dubbing facilities. * Matrix input selection.



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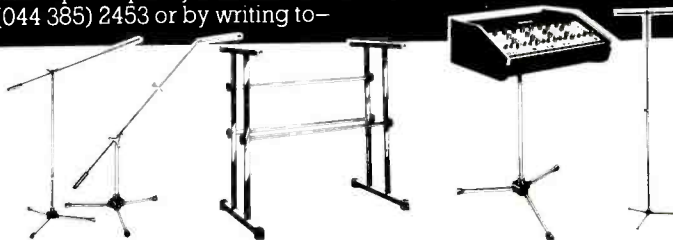


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The unit has a clearly laid out front panel divided into sections to cover the various delay control sources. There is a led associated with each source pushbutton, and a further led offering an indication of the amount of delay modulation.

Internally the guts, with the exception of the delay board, are mounted on a large good-quality printed circuit board that also has spaces for input and output transformers when these are required. Component identifications are virtually absent on the board, and no component layout diagram is provided—thus maintenance could be quite a problem with only the rough circuit supplied.

Performance

Other than saying that the *Flanger* can produce some weird and wonderful effects varying from extreme wow and flutter to others that could induce acute nausea in those of nervous disposition, I do not propose to comment further on its subjective capabilities. However, its straight audio performance is important because in use it may form part of the programme chain in circuit all the time.

The overall frequency response from the input to the main output is shown in fig. 2. Response is relatively flat up to 15 kHz, but above there is a sharp fall in output as is to be expected from the lowpass filter at the front end of the unit. When flanging in the delayed modes, the frequency response naturally takes the form of a comb filter, the characteristics of which depend upon the amount of delay in use and the setting of the depth control; figs. 3 and 4 show but a couple of the many possible responses that are available.

While it is not only difficult to measure distortion in the 'soundbending' modes of operation, it is also probably irrelevant to do so. In the 'straight' mode of operation, however, distortion is of course significant. Fig. 5 shows the second and third harmonic products in relation to frequency. It can be seen that both products take a steep dive at high frequencies, with the lower frequency performance not being beyond criticism. An opposite characteristic is shown by CCIF-type intermodulation distortion which peaks at about 3% at 15 kHz, as shown in fig. 6. But, allowing for the fall-off in frequency response at 15 kHz, this likewise is not beyond criticism.

As to noise measurements, the output was found to contain a large amount of discrete high-frequency tones, depending upon the delay time in use, which itself depends upon the clock frequency to the bucket brigade delay line. At the longest delay time the output was around ± 20 mV at 50 kHz, which is quite likely to give trouble with tape machines. By filtering the output to reduce this level, the unweighted rms noise over the band 20-20k Hz was found to be -57 dBm with an equivalent weighted measurement of 61.4 dB 'A' weighted. Taking into account the drive capability, the dynamic range is reasonable but not outstanding. Output clipping occurred at $+22$ dBm on the main output and $+21.4$ dBm on the auxiliary output, with a potential system gain of between 5 and 11.5 dB depending upon the

EVENTIDE INSTANT FLANGER

FIG. 2
OVERALL RESPONSE
IN 'DIRECT' MODE

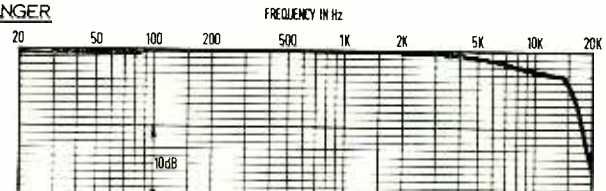


FIG. 3
TYPICAL ACHIEVABLE
FREQUENCY RESPONSE



FIG. 4
TYPICAL ACHIEVABLE
FREQUENCY RESPONSE

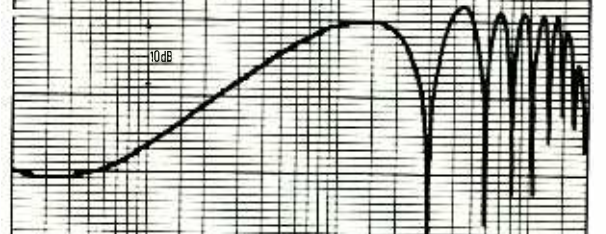


FIG. 5
HARMONIC DISTORTION
+10 dBm OUT

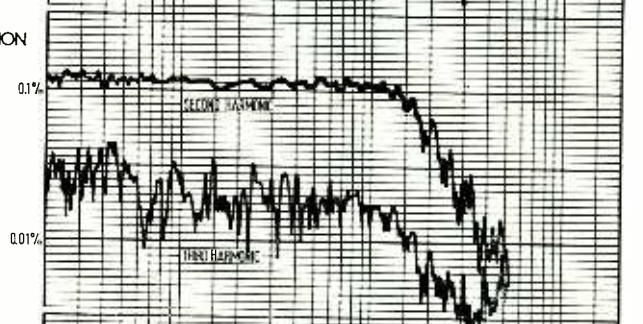
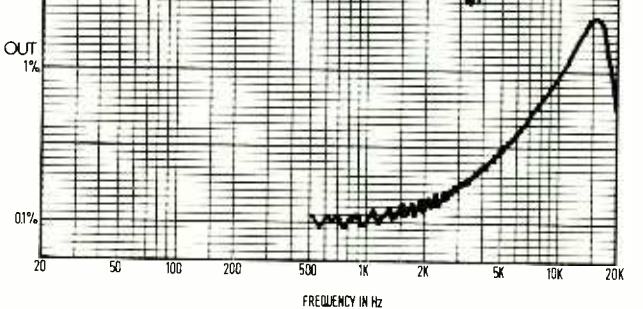


FIG. 6
DIFFERENCE TONE
INTERMODULATION
DISTORTION +10 dBm OUT



settings of the 'time bending' controls with an input clipping point of $+14$ dBm. As no overload indicators are fitted, considerable care is necessary to control the input and output levels within these bounds.

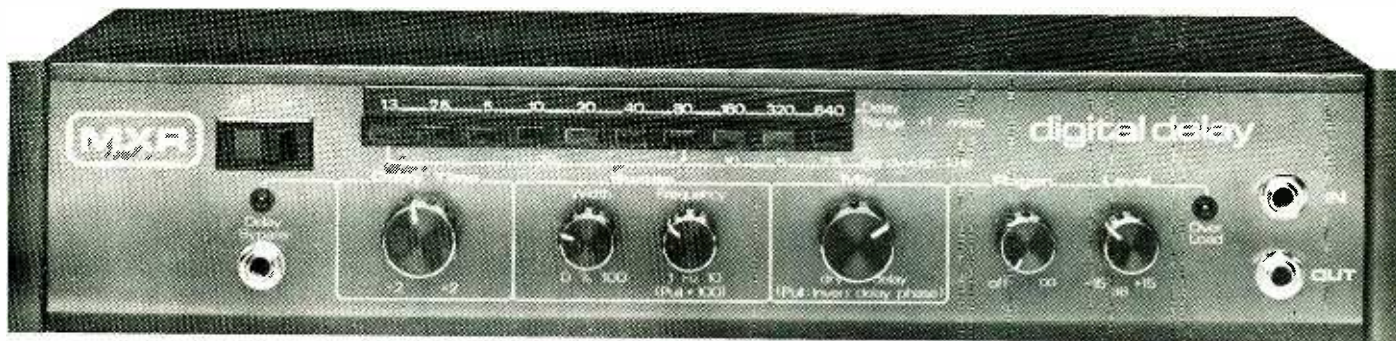
The input impedance was constant with frequency at 9850 ohms, which is generally satisfactory, and the output impedance was 613 ohms. Personally I have a dislike for 600 ohm outputs, and prefer to see lower impedance values.

The available range of overall delay time at the main output ranged from 300 μ s to 10 ms in the manual mode, with the external delay time ranging from 10 ms at zero input to 600 μ s at $+6$ V dc input.

Summary

The *Instant Flanger* is certainly a versatile 'gimmick box' capable of making a large range of new and peculiar sounds, and in this context it is difficult to treat its electrical performance too seriously. There are, however, things which matter: while the available dynamic range is reasonable, I do not like the high level of clock frequency that appears at the output. Other parameters in the straight mode are reasonable by some standards, but high-frequency intermodulation distortion, in particular, is high.

Hugh Ford



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EMS Vocoder

Nik Condron
and
Hugh Ford

AN OPERATIONAL ASSESSMENT

For spec, see survey page 70.

THERE'S nothing new about vocoders—in fact they have been around since before the last war. Their function is to analyse the human voice and recreate it electronically. The voice is basically a complex sound generating device, and consists of a frequency and amplitude-controlled oscillator known as the larynx, and set of tone filters, ie nasal cavity, mouth and throat. The first thing to do when designing a similar system is to take these individually simple devices and translate them into block schematic form. Thus a chain may be visualised whose components can be separately converted into discrete circuits—so the larynx becomes a vco coupled with a noise generator, the controlling source being (in synthesiser terms) a dc signal derived from a voicing detector. The final stage would be a multistage voltage-controlled filter bank. Gradually a new picture emerges: we now have in block form the basis for a simple voice synthesiser.

What Tim Orr of EMS has done for vocoders is rather the same that Robert A Moog did for the synthesiser. The old vocoders were enormous rambling heaps of machinery, plugged together with a nightmare profusion of cables—the analogy with the early breed of synthesisers, such as the BBC used in their Radiophonic Workshop complex, is obvious. Mr Orr has conveniently packaged all the necessary circuitry into a single ergonomically viable unit measuring about 5 x 6 x 20 cm.

Operation

The EMS *Vocoder*, in order to produce a synthesised voice, must first of all convert the input signal into readable information. The live or recorded voice to be treated is, in the first stage, routed via a filter bank. This filter-bank consists of 20 bandpass filters plus one

high and one lowpass filter. These are spaced over an average vocal spectrum of 200 to 8k Hz. The analysing filter-bank is directly coupled through a patchbay to the synthesiser filter-bank from which the final synthesised signal is derived. In order to produce the final control voltages necessary to control the synthesiser filter-bank, the input signal must be converted into a control voltage that will command the oscillators. These will, in combination with any other non-speech input (if required), produce the end 'excitation signal' that is sent to the synthesiser filter-bank.

The first voltage necessary is voice-pitch. This is produced by a device known as a 'pitch-extractor', which acts as a specialised pitch-to-voltage converter reading the glottal pulses of the speech input. It includes a 'quality' control enabling the pitch voltage to be exaggerated for special effects. The output of the pitch-extractor is fed to one or both of the two voltage-controlled oscillators available in the machine that provide a sawtooth signal. I believe there are plans to incorporate a squarewave facility into the circuit to provide different harmonic possibilities. The input signal is also sent to a voiced/unvoiced detector, which has the function of deciding whether the oscillator or noise generator should be used at a given instant in the excitation signal. Thus, the excitation signal is made up of four separate signals all of which pass through a master control unit. These four signals are as follows: the controlling signal from the voiced/unvoiced detector; oscillator output; noise generator output; and an external non-speech input. The latter facility is one of the main features of the EMS *Vocoder*. By using a speech signal and a second signal from the non-speech input, the *Vocoder* will literally encode any recorded sound with any speech sound—this is how the machine can create, for example, talking musical instruments. The *Vocoder* also incorporates other less important

but very useful effects devices. Nearly all the vc signals can be replaced with externally derived command signals, and there is a slew/freeze control that will sample at any given moment the output signal as a constant tone. There is also a frequency shifter linked to the main output mixer of the device.

Applications

I was able to use the machine in my studio for about two weeks, and this enabled me to get a pretty fair idea of what it will do in a studio situation—working not only with electronic music, but also conventional pop and spoken special effects. There is no question that it is a very fine piece of machinery, and its limitations are literally those of the operator. Like any complex piece of equipment, it takes a bit of getting used to, but the front-panel layout is straightforward and well thought out. There are meters to read input, excitation or non-speech, and output signals. Those fitted to the review machine had vu faces with ppm ballistics, which I found a bit confusing, but as this was only the prototype it's hardly important since the machine can be supplied with either. Each of the 22 filter input levels has an associated led which makes it possible to read very efficiently the signal processing. Leds are also fitted to the voiced/unvoiced detector and the mode of operation is visible at a glance.

The machine is capable of modulating any two audio signals, given that one of them is a voice or falls within the same frequency range. The possibilities in a studio situation are infinite: given a multitrack tape this machine can be hooked-up through the desk during remix, and almost any signal can be combined with a speaking or singing voice.

To get the machine to 'sing' in pitch takes a few minutes of careful tuning between pitch extractor and oscillator controls. On its own (without a non-speech processing signal) the voice quality can be changed at will. The whole quality of a lead voice can cover a range, in terms of frequency and timbre, that almost exceeds human capabilities. On its own, the voice sounds synthetic—it is not possible to create a replica that sounds absolutely authentic because, like all synthesisers, the sound is too clean, too free from natural imperfections. (A cough sounds like someone talking whilst trying to gargle!) To simply encode a voice is of little or no value in practical terms. The purpose of the machine, however, is to combine two signals, and there are many things that can be done with a single voice in this context.

Firstly, a voice can speak in a flat monotone with no sibilants—this is done by switching out the pitch extractor and noise signals. A variation of this is to use the noise generator alone, ie cutting out the oscillators, to produce a very realistic whisper. By using an external vc source such as a synthesiser keyboard, and connecting in two oscillators tuned a third or fifth apart, a very interesting plainsong sound can be achieved. A normal speaking voice reading a rather dull passage from a book can be made to swoop theatrically in an over-excited manner. Very interesting musical sounds can be produced by linking up keyboards or a fast-moving sequencer pattern and varying the degree of melody to voice.

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There are five basic models, providing a choice of mechanical configurations and electronic facilities. Specifications for all models are conservatively raised, and minimum maintenance is required to keep the machines in peak condition.

The October 1976 edition of "Studio Sound" has a 5-page evaluation of a Studio 8 recorder. Hugh Ford, summarizing his comprehensive report, commented,

"The Ferrograph Studio 8 is by many standards a very cheap studio machine, but its performance and general facilities are by no means in the 'cheap' bracket. Performance figures quoted by Ferrograph do not do justice to this recorder, which is capable of making full use of the latest low noise and high output tapes."

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EMS VOCODER

tape—or even a group of instruments—and feeding it, for example, through a foldback line into the machine, makes it possible to instantly assess the feasibility of different combinations. Depending on musical patterns, combinations such as drums, organs and especially the bass guitar, can provide totally new sound dimensions through the *Vocoder*. If the machine is linked to a complex synthesiser, such as a Moog 3c, the tonal variations are endless. If the synthesiser is confined to the frequency range of the voice, the other 'normal' instruments will actually sound as if they are being played or processed by the synthesiser. Thus a Hammond organ, in conjunction with a fast-moving sequence on the Moog, will produce a sound that is obviously a Hammond, but being played by a lunatic virtuoso.

It is possible to see from the above comments that any recordable sound can be made to talk,

whisper, sing or shout. Combined with even a modest sound effects library, thunder, trains, animals, traffic, etc can be created that sound intelligibly human. The limitations of the machine are very few to all practical intents and purposes, but the major one is the price that stands at present at £10 500. Whether this will come down if the machine catches on as a commercial proposition, no one knows. There is certainly a demand for machines of this kind, but not, I would have thought, as standard recording studio equipment. However, studios or workshops specialising in sound effects and electronic music will find the machine an exciting and challenging proposition—as would radio stations and perhaps universities who would wish to make an investment of this kind.

It is my belief that in terms of all kinds of music synthesis, this machine will be the forerunner of the final stage of musical technological development—and perhaps it is at this time that the question should be asked: Where do we go from here?
Nik Condron

Likewise, these notes on the technical features of the *Vocoder* are aimed at its studio application as an effects generator, rather than its application as a scientific instrument. Foremost in studio applications are the possible problems of interfacing the *Vocoder* with other equipment, followed by noise performance and, to a certain extent, distortion.

Out of a number of inputs there are two that are likely to be used for effects generation—the speech input and the excitation input—both of which have an associated input level control and peak level meter. The speech input and the two excitation inputs have associated input gain controls that control the input sensitivity for 'ppm 6' from a minimum of -11 dB (ref 0.775V) for the speech input and -7 dB (ref 0.775V) for the two excitation inputs, with the maximum input being effectively infinite. As is common with input gain controls that appear to be connected to the input socket, the input impedance varies with gain setting: the speech input varying from 7570 ohms at maximum gain to 10 600 ohms at minimum gain, and the excitation input from 5230 ohms to 10 560 ohms, both being an undesirably wide impedance variation.

The available output level at the onset of clipping was +19 dB (ref 0.775V) with the ppm indication 6 corresponding to +1 dB (ref 0.775V) output, thus providing a very wide margin for peaks. The output, like the inputs, was single-ended but had a very low source impedance, which is always desirable; I do feel, however, that in view of the large number of available input and output connections a floating configuration would be an advantage.

Returning to metering, for some reason the sensitivity of the excitation inputs at 1 kHz was higher than the speech input at -7 dB (ref 0.775V) for 'ppm 6', but this is of little significance; however, the frequency response of the meters was alarmingly variable, and the calibration between marks on the poor side. It was pleasing to note that the meter ballistics gave an attack time of around 10 ms and a fall time of 2.5s, which gives a good indication of level. (Provided that one can accept the poor frequency response?)

Checking the overall frequency response from the speech input to the *Vocoder* output at a level corresponding to 'ppm 6' shows that the response was satisfactorily flat, as shown in fig. 1. This also shows that the third harmonic distortion value was very low, the second harmonic being even lower. On the other hand the frequency response through the filters at the equaliser output is somewhat lumpy, as shown in fig. 2, which was made with all the filter gains at maximum. It will be noted that the response extends well above the centre frequency of the highest filter (7888 Hz); however, when this filter output is eliminated the frequency response falls very rapidly above 9 kHz.

The noise at the output with the mixer inputs closed and the mixer output open was found to be -84.5 dB(A)—ref 0.775V—increasing to -82.5 dB(A) with the speech channel open, or -76 dB(A) with the vocoder channel open; all these figures are quite adequate.

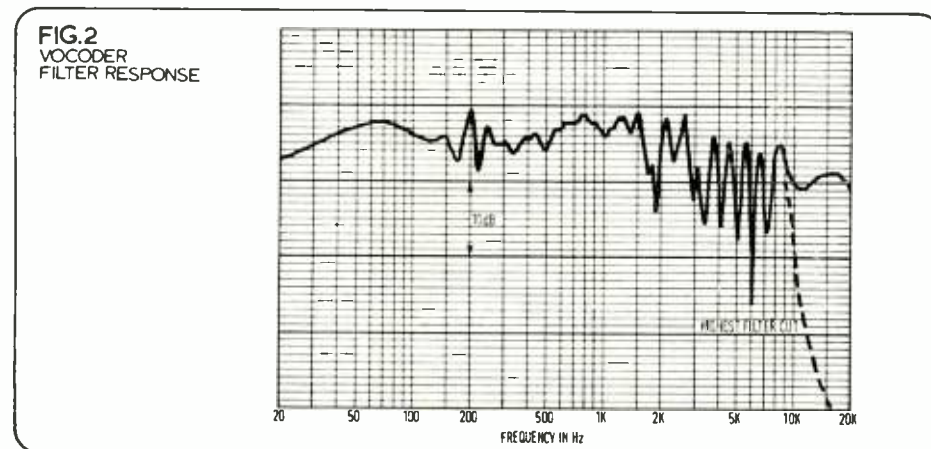
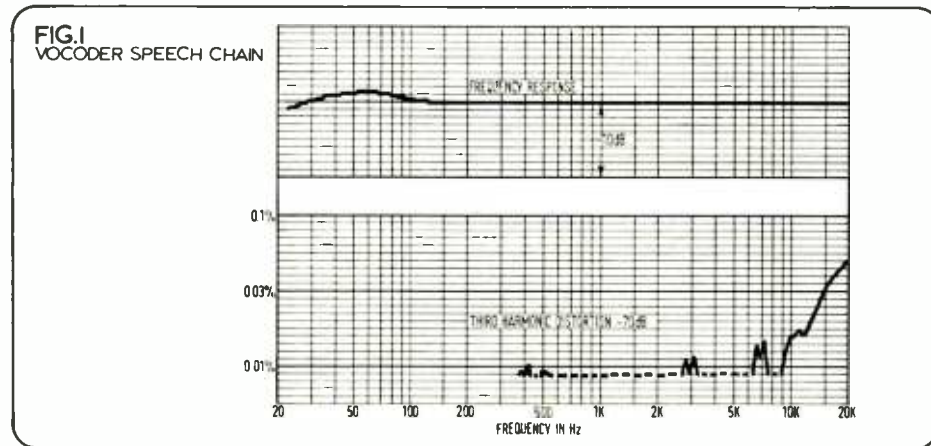
Generally it is felt that the performance as briefly reviewed here is more than adequate for studio use, but the large ripple in the filter outputs will obviously have a substantial effect upon the final sound.
Hugh Ford

TECHNICAL REVIEW

VOCODERS are generally associated with the creation of synthetic speech for specialised purposes, and with the analysis of speech. However, for the purposes of these notes there is little point in delving into the finer details of the vocoder, and STUDIO SOUND is not really an appropriate place to analyse

the scientific aspects of such a device.

As has been pointed out, the main use of a vocoder in the studio is the creation of unnatural sounds rather than the scientific analysis of sounds, be they speech or other sounds. In this context the review has not mentioned a number of special features of the EMS *Vocoder*, such as a computer interface, which may be of little immediate interest to studio engineers.



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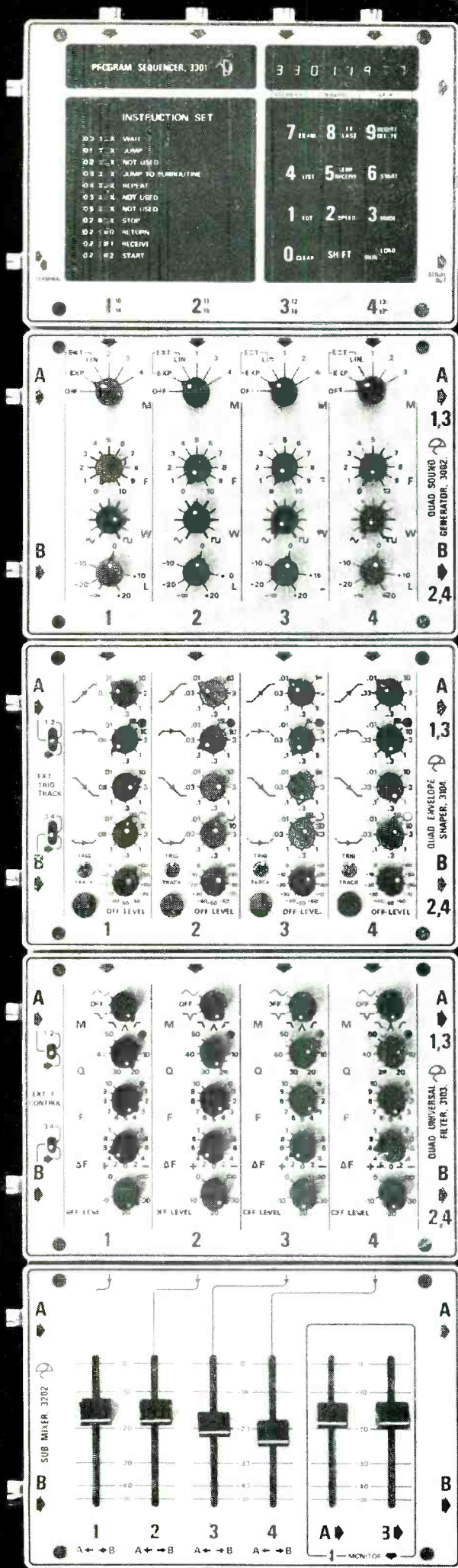
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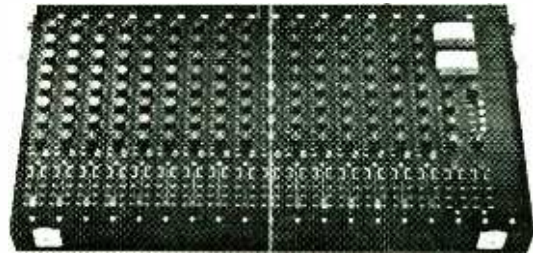
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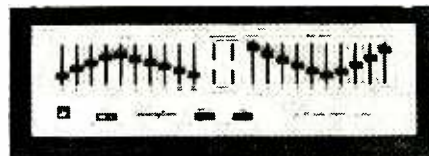
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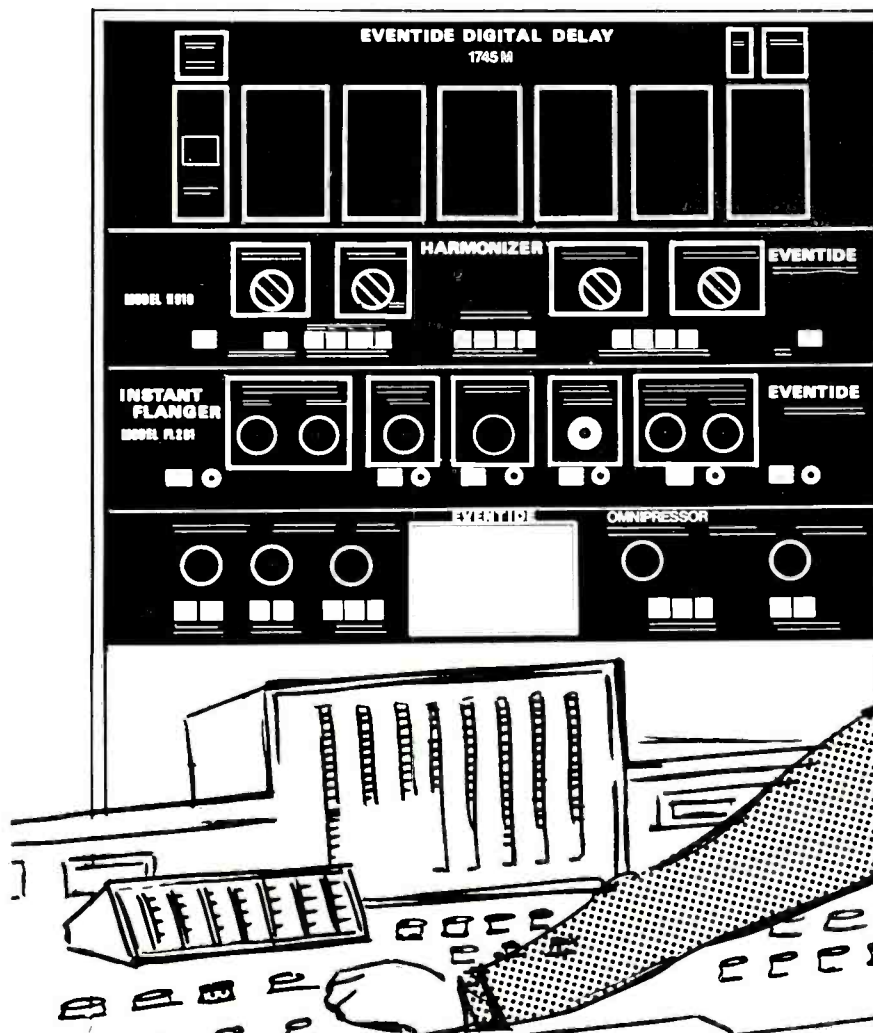
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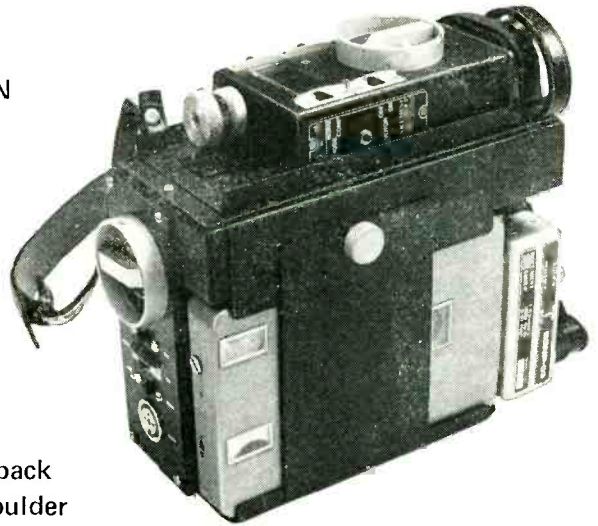
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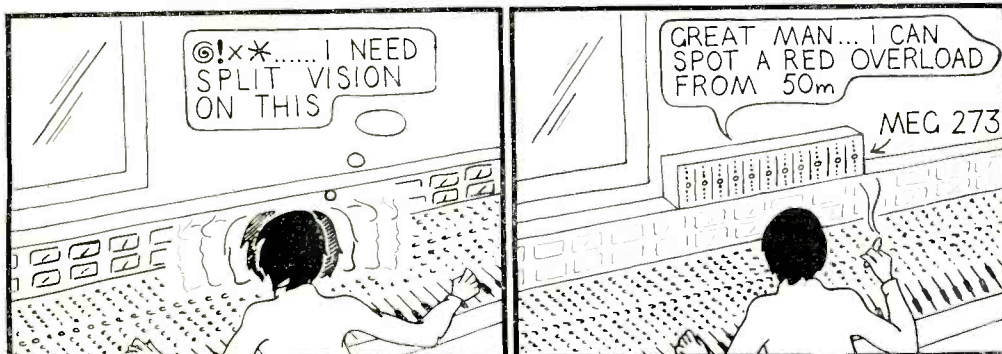
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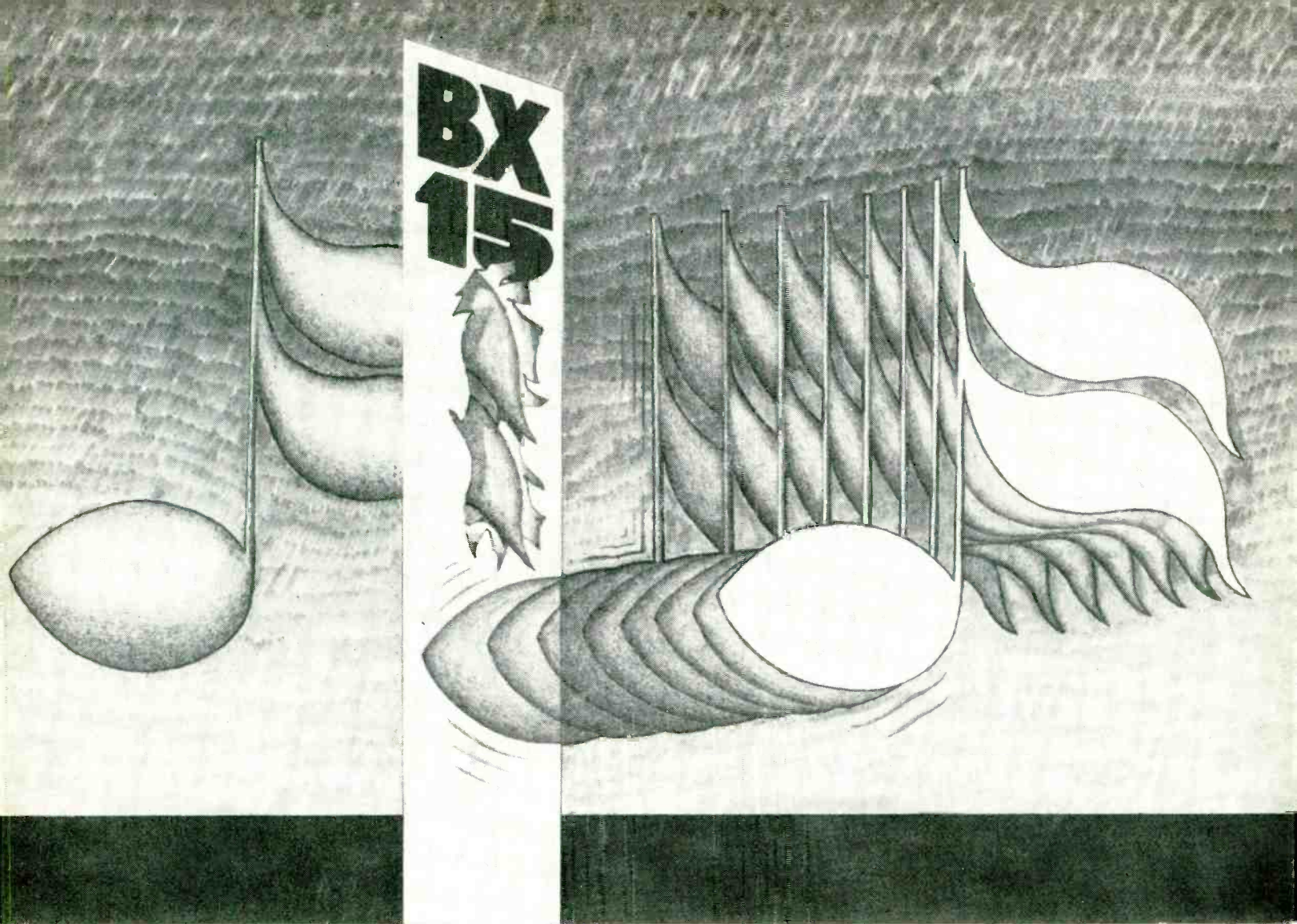
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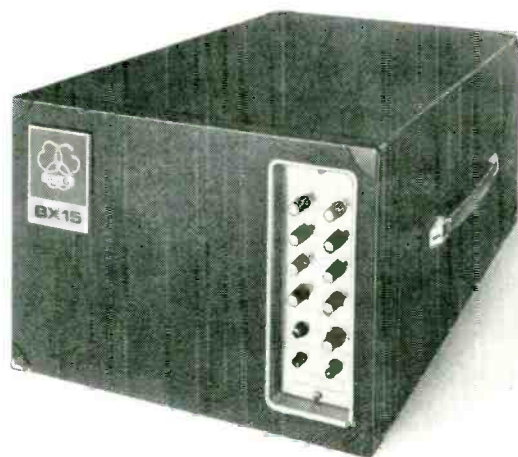
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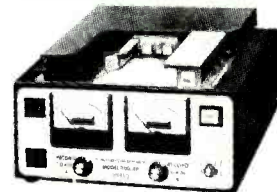


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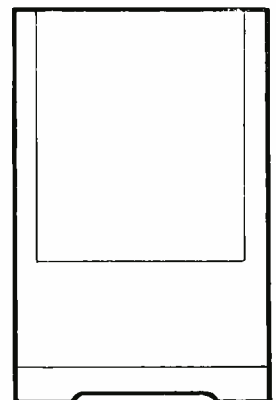
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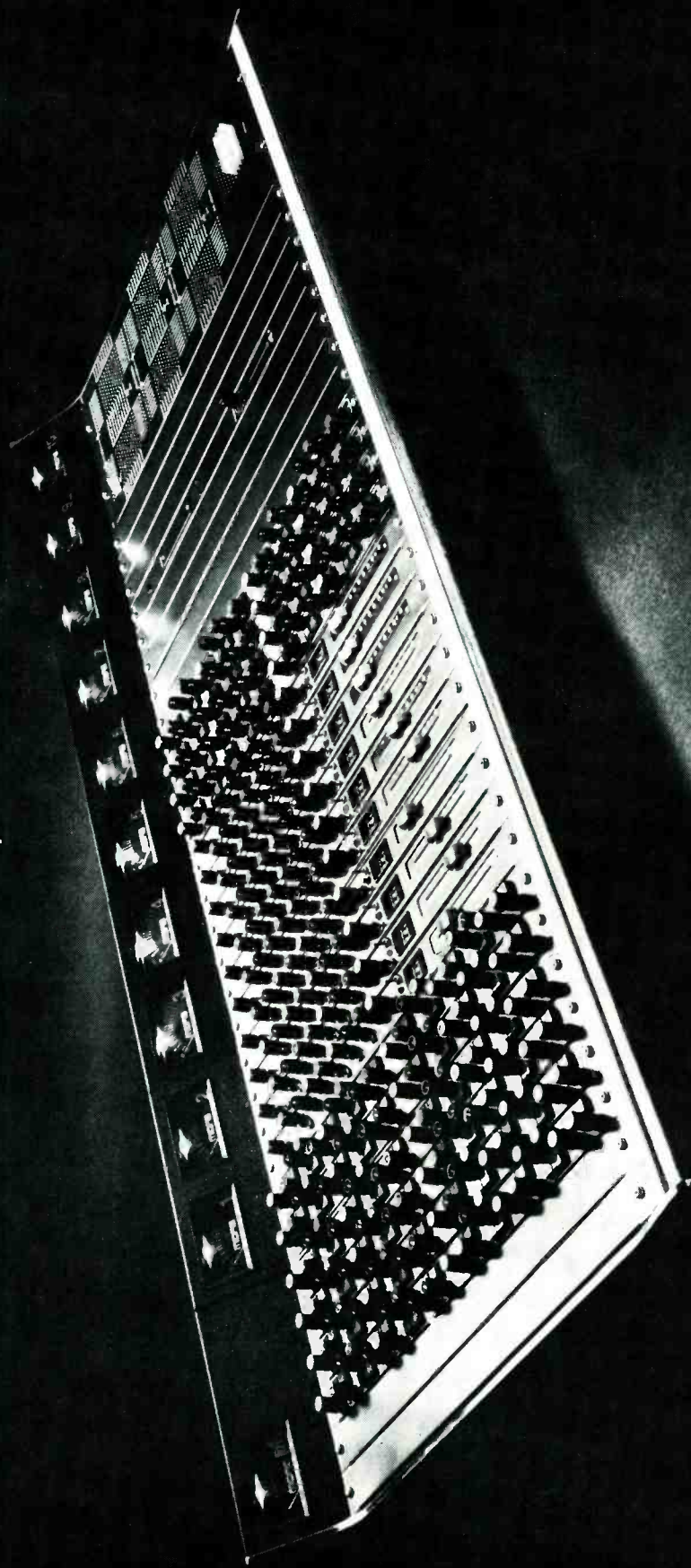
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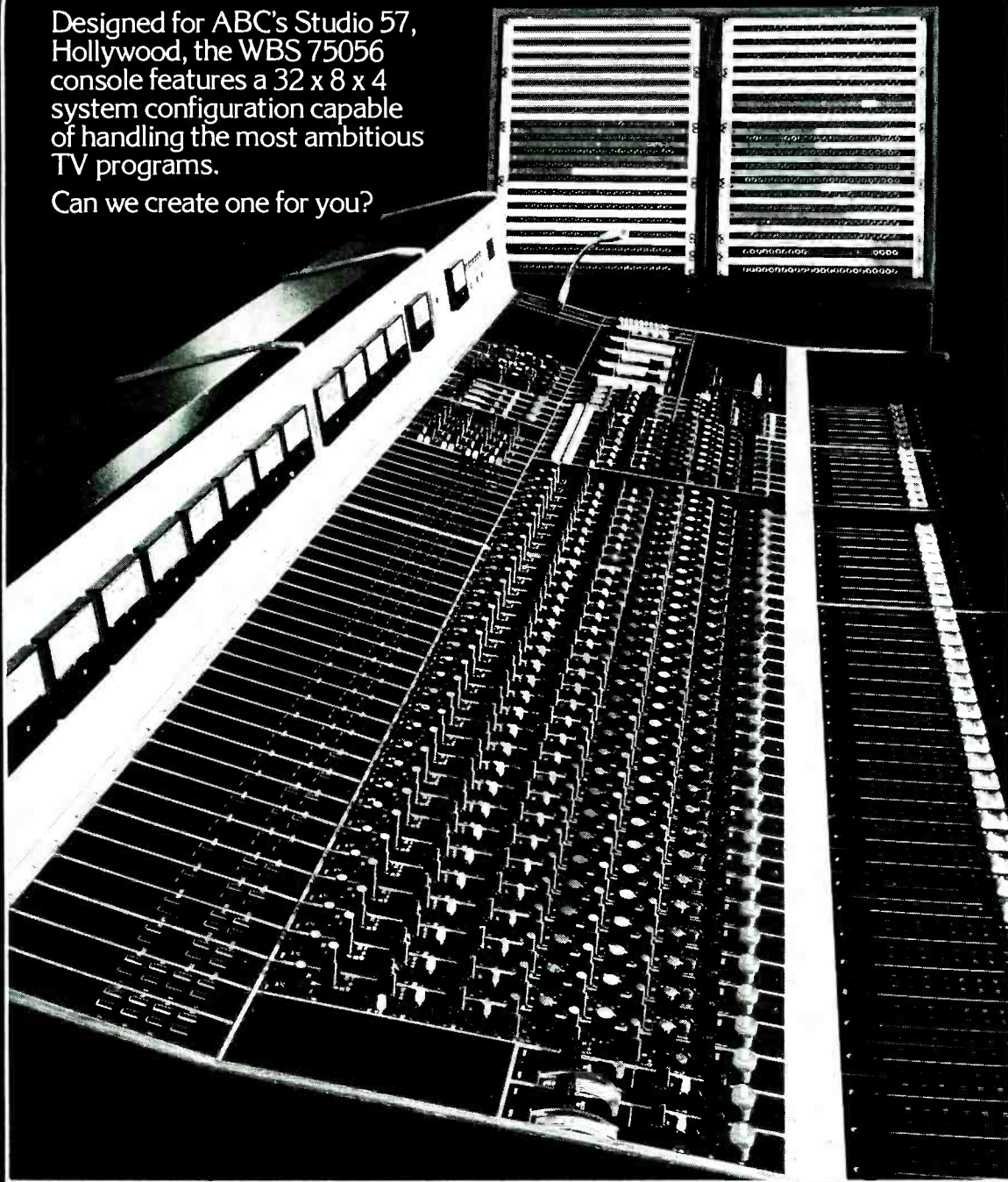


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