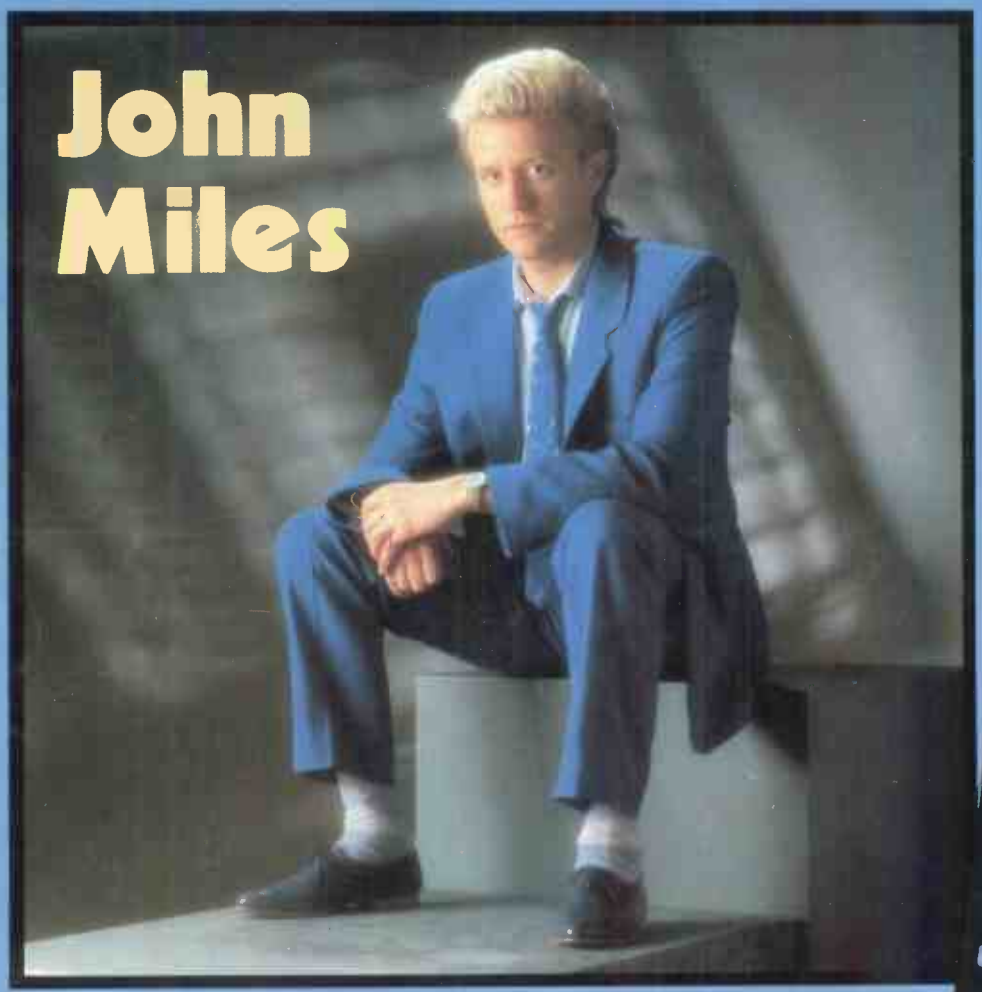
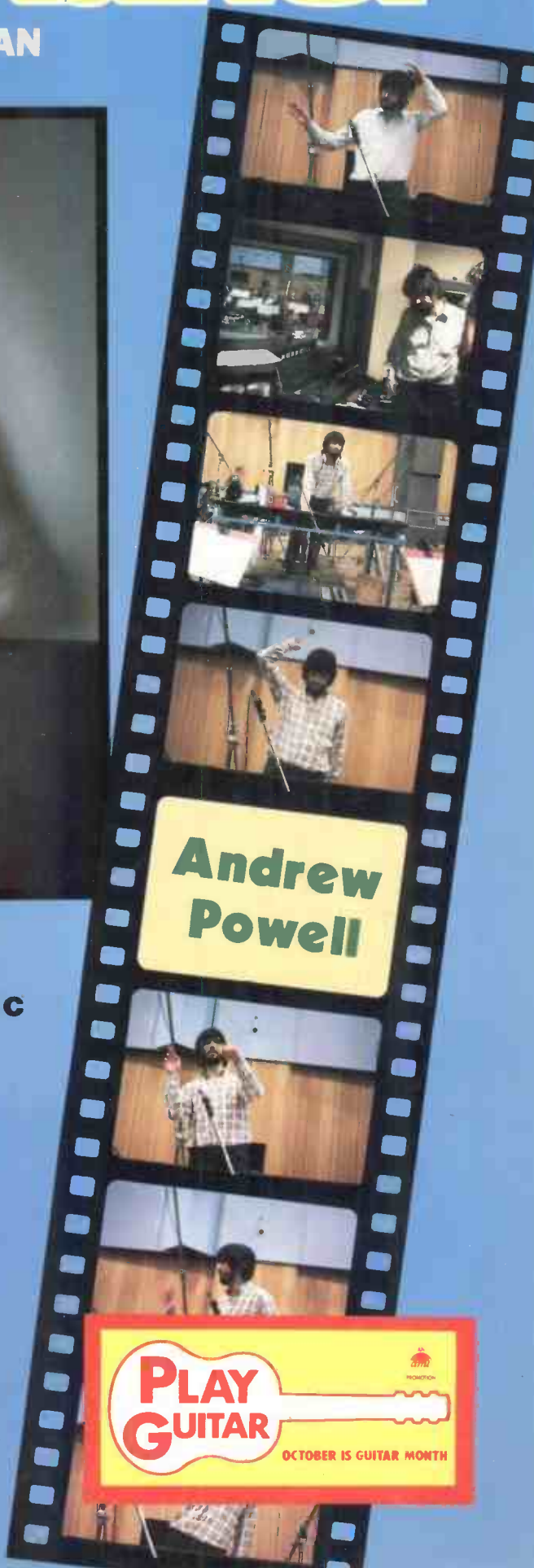
OCTOBER 1983 95p

Electronics & MUSIC Maker

INCORPORATING COMPUTER MUSICIAN





* **Apple Sound Sampling Programs**

NEW SERIES **The Psychology of Music**

* **Video Makers in action**

* **BBC Micro Music**

Reviews: Yamaha DX-1 Synth

Octave-Plateau Voyetra 8 Synth

Projects: Amdek Graphic Equaliser, EQ, Super Screened Mains Distribution Board and Sinclair Spectrum 5 Second Delay!

MC-202 MicroComposer
by Roland

"one of the hottest new products for 83!"

- Basically the MicroComposer is in two parts. MicroComposer and Monophonic Synthesizer.
- The MicroComposer has two channel sequencers which can also programme accent and portamento.
- Total memory capacity: 2,600 notes
- Playback facility through built-in synthesizer with almost same features as the SH-101.
- Tape sync facility.
- Built-in cassette interface.
- Input facility by tapping or in real time.
- Liquid crystal display.

Roland

Roland (UK) Ltd.,
Great West Trading Estate,
983 Great West Road,
Brentford, Middx. TW8 9DN.
Telephone: 01-568 4578.

The Incredible Baby Grand from Crumar

Crumar, who have always been at the front of electric piano technology, have launched a piano that is light years ahead of anything else on the market today.
This isn't just in the sounds it produces, but in the way the sensitivity of the keyboard is totally adjustable to the way you play.

A baby Baby Grand Piano, 46" wide and only 35" front to back. The Crumar Baby Grand has 16 presets of Piano, Electronic Piano and Synthesiser sounds.
The Filter control gives you a dozen variations to the presets. The keyboard touch response is adjustable to fit your hands. A built-in Tremolo and Detune feature let you make concert sounds from an elegant portable. It has a built-in amplifier (40 Watts R.M.S.) which gives enough power to play the Baby Grand on every occasion where outside amplification is not available, and it can also accomodate an external instrument, and even a microphone. It weighs about ⅛th of the weight of a large piano. The sound from this tight little package will astonish you, it's the newest technology applied to a shape that has become universally admired.
Unlike most other piano's it features complete polyphonic capability without the fear of any notes dropping out no matter how many you play at once.

If you haven't experienced the Crumar difference call into Chase today whilst you can save £550 off the recommended retail price.

R.R.P. £1799
CHASE PRICE £1249

INTEREST FREE CREDIT
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12 Monthly Payments £93
TOTAL CREDIT PRICE £1249
EQUIVALENT TO ONLY **£21.47** APPROX. PER WEEK FOR 52 WEEKS

Also available
CRUMAR DP 80

The DP 80 is a professional road Piano which offers six preset sounds and two modes that give you 12 sounds in all. Not only are the most popular Piano and Synthesiser sounds available, but the alteration of the Treble, Bass, Tremolo and Detuning let you find hundreds of possible treatments. A 7th preset selector represent a Free Mode, where you can access the two Filters and Sensitivity controls to make your own unique Piano or Synthesiser sounds. And if you want to change any of the presets, a trap door on the front panel will open to give you easy access to setting up your own bank of sounds. It is finished in a durable for the road material. A Baby Grand in a portable package.

R.R.P. £1300
CHASE PRICE £999

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Deposit £111
12 Monthly Payments £74
TOTAL CREDIT PRICE £999
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JUST ARRIVED CRUMAR DP30 PIANO
THE NEW BUDGET VERSION OF THE WORLD FAMOUS DP80
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CHASE PRICE £799

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CHASE
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MANCHESTER 58 Oldham Street, off Piccadilly, Manchester M4 1LE. Tel. 061-236 6794/5.
BIRMINGHAM 10 Priory Queensway, Birmingham, B4 6BS. Tel. 021-236 8146.
OPENING HOURS Tues-Sat (inc.) 10.00am-5.30pm. Please note our stores are closed on Sunday and Monday
All goods subject to availability

KEYBOARDS

★**ROLAND**: JUPITER 8, JUPITER 6, JUNO 60, JUNO 6, JX-3P Polyphonic synths. SH-101 mono synth with 100 note sequencer, MC-202 two-channel Micro-Composer with built-in SH-101 synth and tape sync. 100M Moduler synthesizer system, MC-4B Microcomposer, CSQ-600 digital sequencers (s/h), TB-303 Bass Line + much, much more . . . .

★**SEQUENTIAL CIRCUITS**: The amazing new PROPHET 600 6-voice polysynth with built-in real time sequencer and 100 patch memories. Prophet 5 (rev. 3.3) with FREE remote keyboard controller and Pro-One mono synth still available!

★**KORG**: POLY SIX and POLY 61 polysynths now in stock at best UK prices! MONOPOLY 4 VCO mono/poly synth — great for sequencing and fat bass/lead sounds. All Korg accessories available — we are a KORG KEY CENTRE.

★**MOOG**: The incredible MEMORYMOOG polysynth is always in stock on demo: it must surely be the most versatile poly on the market and it's got "that" sound! New model "Source" is now available from stock with Roland sync interface and new trigger/CV facilities.

★**CASIOMAGIC**: We stock a large range of CASIO keyboards right from the small, portable PT-20 and PT-30, MT-41, MT-45, MT-65 tyhrough to the CT-202, CT-1000P and the CT-7000 multi-tracking wonder keyboard.

Roland

★**LONDON'S LARGEST ROLAND STOCKIST — IF ROLAND MAKE IT, WE SELL IT!**

★We have all the latest products from Japan's leading musical instrument manufacturer: New HP-300 and HP-400 Home pianos (watch out for the new PIANO/MIDI digital recorder from Roland later this year).

★PIANO PLUS range: HP-70 (6 octave), HP-60, HP-30, EP-11 (with rhythm), EP-6060 (dual voice system).

★Understanding Synthesizers: a boxed set of 4 books that covers basic synthesis, multi-track recording techniques and modular synthesis — well worth a read!

★BOSS: The most complete and most reliable range of pedal effects and home recording units available. Please send 25p in stamps to cover costs for complete, colour catalogue.

★AMDEK: Build your own effects units — all pedals are supplied with complete parts kits and instructions. You will be able to build them even if you have never touched a soldering iron before — it's that easy! Colour catalogue available — please send 25p in stamps.

★AMDEK COMPU-MUSIC: We are London's main agents for this amazing micro-computer based music system. Our Apple II is working overtime at the moment demonstrating this latest advance in micro-music. Come and hear a demo!

★**THE LONDON ROCK SHOP WILL NOT ONLY GIVE YOU "SOUND ADVICE AT A BETTER PRICE" BUT ALSO PROFESSIONAL DEMONSTRATIONS OF THE VERY LATEST TECHNOLOGY.**

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01-267 7851

London Rock Shop

Open 7 days a week.

26, Chalk Farm Road, London N.W.1.

AMPS, CABS + COMBOS

★**TRACE ELLIOTT**: The Rolls-Royce of bass amplification. We are the sole central London agents for this great bass gear. NEW AH-150 head with 7-band graphic: £317. NEW 1004 Combo 150w 4x10" £544. NEW 4x10" and 1x15" 100w cabs to match new, lower powered AH-150 head. Plus all the original heads and combos inc. the 8x10" 1008 250w "combo"! Please ring for details of all prices and spec.

★**V-AMP**: At the other end of the price spectrum V-amp are producing some very tasty budget combos. The latest are a range of keyboard combos. VA-10k 10 watt £69. VA-30K 30watt £137. VA-60K 60watt £165.

★**SESSIONETTE**: The Boogie Man's back, relief! At last, a British-made combo that packs a real punch with soft overdrive at low volumes and wails when you wind it up. 75watt output with a Celestion 12" speaker that can handle the sting in its tail. At only £250 you have got to give it a try (price now includes footswitch and cover).

★**ROLAND**: Cube 20,40,60,100,60Bass Cube 40K, 60 Keyboard 40Ch, 60Chorus Jazz Chorus JC-50, JC-120 Spirit 10, 15B, 30, 50, 30B, 50Bass Bolt (valve) 30, 60, 100E/V, BOSS: MA-1, MA-5, MS-100 monitor.

★**PLUS**: A good range of CARLSBRO, OHM, GALLIEN-KRUEGER, BOSE and other goodies . . . . . .

Fostex

★*LONDON'S MUSICAL MULTITRACK CENTRE:*

X15: Baby multitracker, incredible at only £299!
250: Cassette multitracker with Dolby C noise reduction.
A-8: 8-track ¼" tape recorder with Dolby C.
A-2: 2-track ¼" tape recorder for master mix-down.
350: 8/4/2 multitrack mixer plus 3060 meter bridge.
3050: Digital delay (270ms) with modulation/flanging/chorus.
3030: Dual 10-band stereo graphic equaliser.
2050: 8 + 2 line mixer for sub-mix or monitor mix.
6301: 10 watt self-powered, portable mini monitors.
3180: NEW stereo reverb with 24ms pre-delay.
3070: NEW stereo compressor/limiter expander.
STOP PRESS! Fostex B-16 16-track on ½" tape machine due in September!

★ Simply turn up at our door and we will give you a full demo of how, why and what for . . . musical multitracking with Fostex may be easier than you think. FOr an outlay of around £500 (which includes Accessit accessories) the results are staggering with up to 10 sounds layered together. Why not let us show you how?

GUITARS AND BASSES

★**TOKAI REPLICAS**: You can't keep a good copy down! Mid-fifties and early sixties vintage guitars in original (Flamingo Pink, Sunburst) and new (Metallic Red and Blue) colours. Fretted and fretless jazz basses in Black, White and Metallic Red with Rosewood fingerboards. Prices start at around £200, tweed cases £59 extra. Why buy a copy when you can buy a lovingly reproduced replica?

★**ROLAND GUITAR SYNTHESISERS**: GR-300 blue floor unit features switchable pitch changing (over 1 octave +), automatic Minimoog type vibrato, filter sweeps with variable attack/decay, built-in compressor for added sumin. Choice of four guitar controllers: G-202; with humbuckers (white, blue or red). G-303: Fitted neck, humbuckers (left-handed available). G-505: U.S.A. type with trem. (Metallic Blue, Metallic red, Sunburst). G-808: Neck through body, humbucking pickups.

★**IBANEZ**: 'Musician' and 'Roadster' active basses and 'Artist' guitars.

★**ARIA**: New series SB bass and 'Cardinal' guitar.

Plus: Steinberger (when available), Fender Squier, Fender U.S.A. Gibson, Westone . . . selected models only.

RECORDING EQUIPMENT

IBANEZ: DM 1000: 900ms delay/flanger/chorus.
KORG: SDD 3000: Digital Delay-1023 MS, 9 program memories.
ROLAND: SDE 2000: Digital Delay-670 MS, delay/flanger/chorus.
CUTEC: 1024 MS, Digital Delay with extra Sub Delay — new!
MXR: Dual limiter/compressor, pitch shift doubler.
VESTA-FIRE: Rack-mount spring reverb.
ACCESSIT: Stereo spring reverb + controller.
ACCESSIT: Compressor/Noise gate/Dual sweep equaliser.
ACCESSIT: Patch bay/Headphone splitter/Dual 15w power amp.
YAMAHA: Producer Series: Stereo mixer 6/2, Headphone amp
BEYER, SENNHEISER: Range of studio headphones.
AKG: D80, D190, D310, D320, D330 microphones.
SHURE: Complete range of new PE series microphones.
SHURE: Unydyne 517, Unisphere 588, SM57, SM58 mikes.
SENNHEISER: MD421-U + **AUDIO TECHNICA**: Microphones.
AMPEX: Grand Master ¼" tape + **TDK**: cassette tapes.
D.I. BOXES: Lead testers: Whirlwind cables: Switchcraft plugs.
DRUM UNITS: Roland, 'The Kit', Mattel Synsonics.
MUSIC PERCUSSION COMPUTER (Kit 2) Now in stock!

Electronics & Music Maker

October 1983 Volume 3 Number 8

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COMPUTER MUSICIAN

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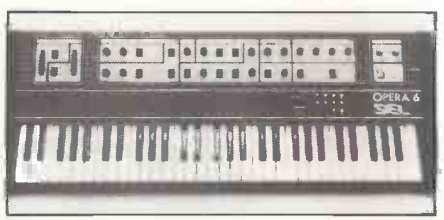

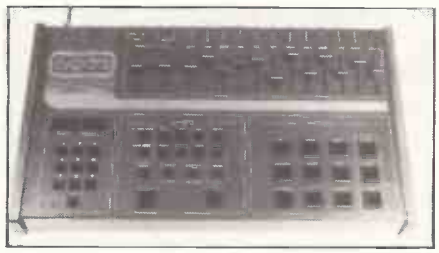

WORKSHOPS

REGULAR FEATURES

NEW SERIES

NEW SERIES

NEWS

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EDITORIAL

I often hear people say that E&MM is really a keyboard magazine and not of interest to the guitar player. But the concept of E&MM is to look at *all* aspects of electro-music and that has always meant the inclusion of guitar reviews and practical guitar workshops. The guitar is still one of the most popular instruments to learn and play at school, and the variety of instruments available today is brighter than ever.

By starting off with a low cost nylon string acoustic and moving on to semi-acoustics and solids, there are still many exciting additions for the guitar – the huge range of strings, pickups, tone controls, and virtually all the mechanical parts can have the style or finish of your choice.

My own experience of playing instruments has proved over the years that a basic skill in playing the guitar is most useful for an understanding and application of the harmonic structure of music.

So much of popular music relies on just the major, minor and seventh chords that the exploration of guitar music – jazz styles in particular – can open up new sounds for your own composing. The guitar can be used in most types of music from classical, jazz, folk, to pop and rock.

Modern music has seen the use of the guitar synthesizer with Roland making the biggest contribution in its research. The latest Roland development puts the guitar into the world of computer music – the Roland GR guitar now links to the Synclavier II from New England Digital.

Getting more down to earth pricewise, many of E&MMs projects offer useful sound processing for the guitar – The Harmony Generator, Noise Gate, Effects Link, Auto Swell, Tone Boost, Hall Effect Volume Pedal, Multireverb, Soft Distortion Pedal, Panolo, Multisplit, Guitar Buddy Practice Amp, Compressor/Limiter, Canjak, and Active Bass Guitar conversion. Two major projects that have been very popular with guitarists are the Transpozer and the Digital Delay. They can both not only create delays, but also a host of pitch changing effects.

This month the guitar player is well catered for with an exclusive interview with Ned Steinberger on his innovative guitar design, a look at the Fender Elite Precision Bass, an article on replacement pickups, and there's something for the guitar dealers to ponder over too.

Finally, the Computer Musician Supplement has been an obvious step in the development of electro-music and we welcome any comments (and programs) you may have – but don't worry about the other parts of E&MM being dropped – that will not happen. Meanwhile our sister publication Home Studio Recording will be on sale in November, for the more avid recordists amongst you – the interview with Ian Anderson of Jethro Tull is one of the most informative yet.

Next month in E&MM – Meet Dr. Click!

Mike Beecher

Roland GR Guitar – links with Synclavier II.

September 1983. Kawai SX-210 Synth. Due to circumstances beyond our control, this model was omitted from our 'Which Synth' guide. The specifications for this model, which was reviewed in the July edition of E&MM, are below.

Kawai SX-210, Keyboard 5 octaves (c-c), 8 Voice, 1 DCO per voice, triangle/square/pulse waveforms, frequency modulation (bend depth) LFO mod. depth, Osc, Sync, LFO disable/start and LFO trigger, saw/triangle/square waves on LFO (plus reverse, speed, delay time), hand controlled Pitch Bend, envelopes: VCF-EG/VCA-EG, Increment wheel, chord memory/key hold (memory patch has six character voice identifier). RRP £999.00 inc VAT. Distributor John Hornby Skewes, Salem House, Garforth, Leeds LS25. Tel: (0532) 865381.

Rose Morris. We would like to apologise to Rose Morris for the omission of pictures from their KORG advert last month.

Please Note: Electronics and Music Maker has moved. We are now based at Alexander House, 1 Milton Road, Cambridge CB4 1VY. Tel: Cambridge 313722

BOOTLEG MUSIC

5-7, SOUTH STREET, EPSOM, SURREY.
TEL: EPSOM 24528

OPEN MON-SAT 10am-5.30pm. THURSDAY 7.00pm

THIS MONTH'S AMAZING BACK DOOR DEALS!!

KEYBOARDS

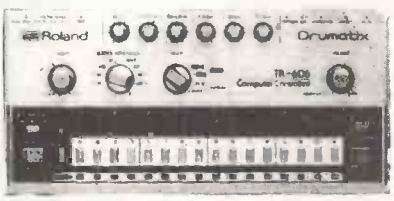
SH101 Portable model with arpegio, sequencer and optional handgrip. Grey finish. Blue and Red available.
Juno 6. The incredibly versatile polyphonic.
Juno 60. Programmable version of above.
JX-3P. New programmable polyphonic with sequencer.
PG-200. Expander for **JX-3P.**
Jupiter 6. New version of 'The Guv'.
Jupiter 8. The ultimate.
CSQ 600 Sequencer. Reduced from £599.00 To £285.00
The full new range of Roland pianos in stock.

RHYTHM UNITS

DR 55 Dr Rhythm.
TR 606 Drumatix Comprhythm.
TB 303 Bassline autobass sequencer.
CR 5000 Compurhythm.
CR 8000 Compurhythm with handclaps.
All other Roland Cube, Jazz Chorus, Spirit and bolt Amps, keyboard accessories and Echo Units in stock.

Phone for Bootleg Prices

Roland



CASH 'N' CARRY BOOTLEG TRADE DEALS *ALL NEW!!*

Guitars		
Washburn	Hawk	£139.95
	Scavenger	£89.95
Tokai	Eliet	£145.00
	CerP Bass, yellow	£184.00
	TartS	£155.00
Vantage	VS 690	£99.00
	VS 600	£77.50
Aria	PE 60	£208.00
	SB 60	£241.00
	U 60T	£168.00
	CSB 380	£99.00
Fender	Jazz Bass	£315.00
	Musicmaster	£99.00
	The 'Strat'	£488.75
Vox	Custom Bass	£211.60
	Custom 25	£211.60
Maccaferri	El plastico	£199.00
Hondo	Stick Bass	£169.00
AMPS! *ALL NEW!*		
Roland	Spirit 10	£79.00
	Spirit 30	£119.00
	Spirit 50	£153.00
	Bolt 30	£169.00
	JC 50	£199.00
	Cube 40K	£169.00
Fender	Champ	£65.00
	Champ Vibro	£79.00
	Harvard 20w	£85.00
	Twin J.B.L.	£428.00
	Bass Head, 135w	£189.00
	140 amp top graphic	£235.00
Tokai	30 watt combo	£115.00
Custom Sound	150w 2 x 12" combo	£213.00
KEYBOARDS	*ALL NEW!*	
Moog	Source	£656.80
	Controller	£285.60
Korg	Polysix	£789.00
	Mono/Poly	£495.00
Casio	VL 5	Offers pleeeeeaaaase!!
	CT 202	£195.00
	CT 101	£145.00
Yamaha	SK 30	£835.00
	CS 01	£128.00

REMEMBER! ALL THE ABOVE ARE NEW AND CARRY FULL GUARANTEES. PRICES QUOTED ARE FOR CASH 'n' CARRY

BOSS

BF 2 Flanger	89.00	54.00
CE 2 Chorus	85.00	52.00
CE 3 Stereo Chorus	92.00	59.00
PH 1R Phaser	83.00	49.00
DM 2 Delay	115.00	76.00
OC 2 Octaver	67.00	42.00
DR 55 Dr. Rhythm	118.00	69.00
BCB 6 Carrying Case	63.00	35.00
PSM 5 Power Supply	68.00	49.00

POST & POST £1.95p

LOCO by Aria

SPECIAL INTRODUCTORY OFFER . . . LIMITED PERIOD

FL 01 Flanger	£59.71	£44.95
AD 01 Delay	£89.12	64.95
CH D1 Stereo Chorus	£50.80	36.95
PH 01 Phaser	£39.21	29.95
CM 01 Compressor	£33.86	25.95
GE 06 Graphic	£46.34	32.95
DS 01 Distortion	£38.32	25.95
AD 240 Mains Adaptor	£8.90	5.95

P&P £1.50

SIMMONS

Range of Drum Synthesisers in stock now including combination pad set for overdubbing

AMDEK kits by BOSS Roland

Distortion Kit	40.00	29.95
Compressor	47.00	34.95
Phaser	54.00	39.95
Tuning amp.	47.00	19.95
Electronic metronome	47.00	31.95
Flanger	83.00	59.95
Stereo Chorus	70.00	52.95
Stereo 6 channel mixer	115.00	87.95
10 band graphic equaliser	90.00	59.95
Delay machine	165.00	112.95
Percussion synthesiser	70.00	29.95
Power Distributor	42.00	31.95
COMING SOON!		
Hand Clapper	60.00	38.95
Octaver	60.00	35.95
Delay machine	110.00	79.95

Post & Packing £1.95p

TASCAM

Complete range of Master and Multi-track recorders from the Portastudio to the 38 8-track in stock, together with accessories such as head cleaners, demagnetisers, patch leads, DBX Units, etc.

New to Multi-Tracking? Then send £5.65 and we'll send you the Tascam Guide to Multi-tracking.

KORG

Full range of Korg Polyphonic Synthesizers and Programmable Rhythm Units on display.

YAMAHA MT 44. The latest in low-budget 4-track cassette deck! With Dolby C and simulsync facilities. Phone for Bootleg Price.

We have on demonstration the range of **Yamaha Digital Synthesisers** and **Touch-Sensitive Electronic Pianos** which are great for the DI.I. multitracking nuts.
Also in stock are the **MR 10 Rhythm Units** and keyboards in the **CS** and **SK** ranges at all **BOOTLEG PRICES.**

SURREY'S LEADING STOCKIST OF

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moog MUSIC INC
TASCAM TEAC Production Products
Fender
KORG

INSTANT CREDIT ACCESS BARCLAYCARD

All Prices correct at time of going to Press.

NEWS

Videodiscs

Despite (or because of?) the fact that two videodisc systems — from **Philips** and **Pioneer** — have already been launched and made little impact in the video marketplace, **RCA** are now pressing ahead with the introduction of their own format named CED.

Like the other systems, CED has the claimed advantages of better sound and picture quality, faster track selection, and better long-term durability in comparison with video cassettes, but with the major disadvantage that the disc cannot be used for recording off-air. RCA hope to combat this problem by making both hardware and software of the new system considerably cheaper to buy than the competing video cassette formats, and at under £200 for a **Hitachi** CED player and about £70 per disc, prices are undeniably competitive.

Several music titles are amongst the list of software available at launch-time, including a disc of the Eurythmics live at London's Heaven nightclub, a selection of Duran Duran's famous video promos, plus 'The Compleat Beatles' and concerts by Neil Young, Joni Mitchell, The Tubes and Steve Miller.

For further details on RCA video software contact: Ray Hodges Associates, 5-7 Forlease Road, Maidenhead, Berks. Tel. (0628) 32839.

Readers living in or around the London area may be interested to know that September 17 sees the start of The Great Home Entertainment Spectacular at Olympia. The event which is due to run until September 25, has several items of interest to musicians among its many attractions.

To begin with, part of the display area will be cordoned off and turned into a 'Musical Lounge', where members of the public will be able to play a wide selection of computer-controlled keyboard instruments, or relax and listen to professional demonstrations of the products if they prefer.

In addition, the 'Hi-Fi Arcade' will contain displays of the latest separate components from many of the major manufacturers, and again visitors can take advantage of professional demonstrations, this time with the emphasis on taking the 'technical' element out of listening to music in the home.

Radio Luxembourg will be staging live music shows, in conjunction with tape manufacturers Agfa-Gevaert, as part of their 50th Anniversary celebrations, while a large video stand will be selling ex-rental cassettes — including some music tapes at greatly reduced prices.

With many more attractions promised, The Great Home Entertainment Spectacular should be quite an event...

Naked Eyes.

Music

British electronic duo **Naked Eyes**, featured on the cover of E&MM April, have found success in an unexpected quarter — America. Their version of the Bacharach/David classic, 'Always Something There To Remind Me', reached No. 8 in the US singles chart while their follow-up single, 'Promises Promises' is currently bubbling under the Top 10.

As a result of their transatlantic success, the band are now dividing their time between recording their second album with producer Tony Mansfield and rehearsing with a four-piece backing band for a forthcoming US tour. Meanwhile, 'Promises Promises' should be available in both seven and twelve-inch versions in the UK by the time you read this.

Britain's first cable television musichannel will be available to local franchises from the beginning of next year. London-based company **Cable Music** are offering an eleven-hour music package similar to that presented by MTV in the States, and it's already been accepted by Greenwich Cablevision for use in south-east London. Other areas should also be able to receive CableMusic once the Government has granted franchises to local companies later this year.

In the USA, MTV is the most popular cable channel after movie channels, and CableMusic are hoping that over 5 million cable homes will be receiving their programme by the end of the eighties.

Humphrey Bogart (alias Kenny Wymark) with Hitachi CED player and RCA software.

Spectro Arts Workshop in Newcastle-upon-Tyne are holding a festival of electronic music which should be of interest to many E&MM readers. The festival consists of a series of concerts and lectures and spans several weekends in October.

The festival kicks off with a solo concert by E&MM Home Electro Musician Ron Berry, while the following day sees the start of the Electronic Music Review. This is a series of lectures on electronic music techniques, and these will include a talk on American and European computer music by Tim Souster, a lecture on computer music composition by Dr. Michael Greenhough (course director at Cardiff University's electronic music studio), and a discussion by Douglas Doherty on the development of the Music II, computer music system. The lectures will be interspersed with electronic music demonstrations performed by special guest artists.

October 22 is Contemporary Music Composer's Day — a concert of electronic music pieces submitted by outside composers, while a week later (October 29) Ian Boddy will be giving a solo concert, performing tracks from his soon to be released album 'The Climb', amongst other things.

Another date for your diary is November 23, when Alan Townsend of Roland (UK) will be holding a music workshop at Spectro. This will give musicians an opportunity for gaining hands-on experience of many Roland products, with particular emphasis on the MC-202 MicroComposer.

All enquiries concerning these events should be addressed to Spectro Arts Workshop, Sound Department, Bells Court, Pilgrim Street, Newcastle-upon-Tyne. Tel. (0632) 322410.

Micros Live

Computer Musician Consultant Editor David Ellis takes part in a live programme for BBC-1 at the beginning of October. Entitled 'Micros Live', it's a follow-up to the highly successful series 'Making The Most Of The Micro'. During the programme David will be demonstrating the musical applications of several microcomputers, and afterwards he'll be available to answer telephone queries from viewers.

'Micros Live' will go out from 10 a.m. to midday on Sunday, October 2.

In Brief...

HMV Record Shops have prepared a leaflet giving a comprehensive listing of all titles currently available on Compact Disc and brief details of forthcoming releases. It's available free from all branches... Electrical retailers **Comet** celebrate their 50th anniversary this month. From humble beginnings as one small shop in Hull before the War, the company have now become one of the largest specialist retail chains in Europe. Details (0482) 20681.

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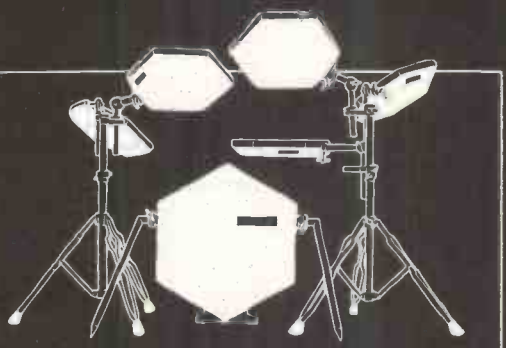

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Readers Letters

Send to: Readers' Letters, Electronics & Music Maker Alexander House, 1 Milton Road, Cambridge CB4 1UY

Keying Up

Dear Sirs,

Just a word from one of your younger readers. We have a synthesized music band, nothing special, just a straight-forward keyboard band, and, unlike some people we don't have a vast budget to buy our equipment with, that's why the cheaper range of instruments and equipment advertised in your magazine appeal to us because they are all our budget allows us to afford.

We formed our group with two Casio VL Tone's (it wasn't serious then) and we saved and saved to be able to afford bigger and better keyboards and so now we have an ARP-Axxe, Yamaha CS5, Casio 1000P, Yamaha P53, Casio MT-40 and not forgetting the VL Tones. Notice that our keyboards are not the latest or the greatest, but a rich sound can be obtained from them just as well as some largely expensive ultra modern keyboard. So the next time you review instruments how about reviewing some with some more down to earth prices, because I'm sure we are not the only people who subscribe to your magazine with a limited equipment budget.

Finally a word about computers, I've also thought computers are useful in the music world but, they can go too far. I'm sure we are not all computer mad boffins who want to attack our synths with all kinds of silly computer link ups. Of course, exceptions can be made when it comes to the legendary Fairlight.

So computers are good but I wouldn't like to see them completely take over the music world – imagine it: 'computer controlled musician, press a key to start him' anybody agree?!

S. J. Bell (aged 15)
Southsea

P.S. We hope to send up a tape when we get our drum machine, we are called 'Electro Valent'.

Axxes to Grind

Dear Sirs.

About six months ago I bought an 'ARP Axxe', secondhand, but there was no information included with it. Could you please tell me, where I could get some circuit information? ie. diagrams, layouts etc. as I intend making some modifications to the circuitry.

Kevin Jenkins
Oxford

Maybe an Axxe owner reading this could help Kevin get some information on his synth since ARP are not now in existence. The only U.K. dealers still handling ARP stock are Chase at 22 Chalton Street, London NW1.

Working

Dear Sirs,

Firstly let me praise your mag. You are doing a great job educating people in electro music, but only from the users side of it.

There is a great deal of scope in the production of equipment. Your series of Industry profiles is a step in the right direction, but how about some advice telling people how to get into this industry.

I feel this would aid a great many of your readers who, like myself aim to enter the electronic music business, as a career.

Also many schools are beginning to bring electronics into the school's musical events. Again how about an article which would be directed specifically at schools? I know this sounds limited in readers, but it could be just what was needed to bring a greater understanding of electro-music into our schools. Don't forget, the youth of today are the electro-musicians and technicians of tomorrow.

Adrian Warhurst (16)
Colby
Isle of Man

There are so many levels in the production side of the industry that it would be hard to point at any specific qualifications.

However you will obviously need an electronics grounding, and an HNC, HND or similar is well recognised. This, or a general physics/electronics background is obvious, but other studies you could add would be actual production experience, a knowledge of the construction of circuit boards and bags of patience and perseverance.

From this you can move into actual manufacture and then, perhaps, up to design. But a degree would help to get you up to the more research areas perhaps a little faster. But, it is a very competitive industry – and work is very hard to find at the best of times, best lesson is to keep trying.

Foiled Again!

Dear People.

Thanks for producing a magazine of such great interest and frustration! Being an electro-muso and technician the interest is obvious but the frustration! Please! Please! print the PCB foil patterns – we get your magazine 3 months late, read about the projects write off for a PCB copy – if there are any still stocked! Wait another eight weeks, then it's sorted by bulldozer at the post office!! So what was probably once a work of art, delicate foil board, is now a mess of cracked copper.

Regarding I. D. Collins great debate II, I agree I like to know what it sounds like, ease of operation, interface compatibility *but* that's why I want to know all the 'technical garbage' (quote) also I am very interest in knowing what's inside and I will not buy without that knowledge (we have a lot of trouble here with obsolete chips in equipment that cannot be repaired without extensive modification) and as not many music shops will let you near their equipment with a screwdriver E&MM are doing an invaluable service.

Regarding the second half of his letter – I also would love to see more quality projects (with PCB patterns!). Most muso's aren't rich and I personally would like to have lots of things that I built myself of good specifications that I could use rather than the one of two good bits of equipment that I could afford if I didn't build my own. It's enough to spend on a good tape recorder and speakers let alone having to buy the rest – so let us have quality like the Digital Delay and Alphadac and not too many toys.

Sara Dubois
Bridgewater
Australia

Studio Work

Dear Sirs,

I am interested in extending my interest in the recording side of music into a career. While I realise that this is not the sort of job you see in the local Jobcentre are there any obvious ways in?

C. Cords
Dulwich
London

Various colleges run courses on recording, including The City University at Northampton Square. London EC1 and Goldsmiths College (see E&MM September 1983). Courses like this end with your getting a dipoloma or such qualification which you can wave at people!

Alternatively, write to as many studios as you can get addresses for and ask for a tape operator/general assistant position. Almost all the engineers you can name came up by this route!

Tubby Drums

Dear Editor,

Thank you for the review of our Tubby Drum system which you published in the August issue of E&MM. A couple of points were made, which I would like to answer.

The test was carried out with the mikes over the drum heads, rather than inserted in the drum shells. This is a perfectly valid way of using Tubby Drum, and because of the speed of setting up a kit in this way, it's often used where time is short; however in our experience, there is less feedback when the mikes are inside the drums.

There is no necessity to drill the drum shells to install the Tubby Drum mikes; but an alternative, and highly professional method of permanently installing the mikes is to fit XLR sockets to each shell, and an XLR plug to each lead; as is shown on our brochure.

Immersing the heads in hot water would certainly soften the heat-shrink sufficiently for it to become malleable, but we recommend the use of an ordinary hair-dryer in our brochure, and for obvious reasons, could not guarantee any mikes which had been placed in water.

We have always supplied Tubby Drum systems with 6 mikes, but Melanie Drums, who bought Tubby Drum Mikes from us some time ago, chose to supply only 5 mikes with their 6 channel mixer.

We decided not to include equalisation in this model, as we are supplying two distinct and different markets. From our research we find that customers who buy the XLR version usually use it with a large mixing desk in the "six in/six out" mode. To duplicate the equalisation which already exists is clearly a waste of money.

The Jack systems are usually bought by drummers who are looking for the most economical way of increasing the volume of their drums, and can use the tone controls of their stage amplifier. As has been said towards the end of the review, the mikes reproduction of all drum and cymbal sounds is very accurate, and we don't wish to spend our customers' money unnecessarily.

Finally, although your article indicates that Tubby Drum systems are being marketed independently by the manufacturer, I am pleased to be able to advise you that it is my company which markets Tubby Drum systems in this country and overseas, and we will be pleased to answer any enquiries from dealers, or from drummers who wish to locate one of our stockists.

Congratulations on an excellent magazine. Keep up the good work.

Anthony V. Morris
Musimex, London
Tel. 01-368 2716

Daleks

Dear Sirs,

Do you have any boffins out there who are familiar with the Korg MS-20? If so, I would like some advice on the patching of an external microphone. I need to create a Dalek-type voice for an amateur production and have been reliably informed by the original creators (Brian Hodgson and Dick Mills of the BBC Radiophonic Workshop) that it is simply a question of putting the voice through a Ring Modulator at 30Hz oscillation.

My problem is that, not being familiar with the MS-20 patching system, I cannot get the Ring Mod. to patch into the external mic, most of my attempts have been very fuzzy, and very un-Dalek-like. I'm sure it is possible to get an intelligible vocal sound although some 'experts' swear that since it is pitch to voltage converted one can only get a series of clicks. Any suggestions on possible patching, so that I can just isolate the Ring Mod.?

David Dupont
London W9

Tremolo Time

Dear E&MM,

I have just entered (and have great hopes for!) your great Roland SH-101 Competition. The prize would make a very welcome addition to our two piece 'band', and would complement the Micro-Composer MC-202 (which we are in the process of saving up for) quite nicely. Here's hoping!

I hope to send you a cassette quite soon when we've completed our set; and we're going 'on the road' hopefully next month under the name 'Beat Technology'.

Your magazine is easily my favourite publication quite simply because every month there's so much that's relevant to the way our music is going – be it projects we can afford or tips we can use to produce better tapes.

Might I suggest, as a future project, an electronic ± one octave guitar tremolo arm which is free of tuning problems? As a modification to the Transpozer project you might substitute a hall effects arm linked to the pitch shift circuit on the Transpozer via a voltage control interface. I'm afraid I'm not technically disposed to the 'gubbins' of such a project, but perhaps your team might think it a worthwhile endeavour?

Another suggestion would be for a feature on the Mimic, which is something I'm sure a lot of people would find interesting, as any kind of sampling keyboard under half a kilo, has got to be an exciting prospect!

Your magazine seems to get better and better every month so keep up the high standards.

Hazel Bidder
Hampstead
London

John Miles

Last month saw John Miles return to the limelight with a new album 'Play On'. For the first time, he has been working in a solo capacity, backed up by some of Britain's top sesion musicians and a large orchestra.

He first shot to fame in the mid-seventies with three hit-singles 'High-Fly', 'Music', and 'Slowdown'. His popularity continued to grow with the release of three albums for Decca: 'Stranger In The City,' 'Zaragon', and 'More Miles Per Hour'.

In 1981 he signed to EMI and following the release of the LP 'Miles High' in September of that year, he embarked on a major British tour. Since then he has spent much of his time at his home in Sunderland writing, and last year he spent some time in Munich at the invitation of composer Eberhard Schoener to appear in a special live TV concert.

Ian Gilby interviewed Miles shortly after the release of 'Play On' and sets the ball rolling by asking him what equipment he's now using.

"At home I've got a Yamaha acoustic piano, a couple of guitars, the ones I use on stage, which are a Strat and a Les Paul Standard and I've just got myself a Drumulator which I'm trying to figure out. When I'm songwriting, I just use the drum machine and piano or drum machine and guitar and put the song ideas down in that kind of form.

The way I write is with my partner, Bob Marshall. I write the music and Bob writes the lyrics. Usually about 70% of the time I come up with the music first, then sing a melody line without lyrics and give it to Bob.

How do you come up with the music then? Is it simply a case of sitting at the piano and doodling until you find some chords?

Most of the time you have to because your time is often limited when it comes to writing. The best songs are always written when you're sort of sitting watching TV and you get a little idea in your head, then nip into the music room and the song's finished in half an hour.

When you've got a new album to do, do you consciously sit down and write new material for it?

Yes. When we finished recording the current 'Play On' album, Bob and I had a talk because we've always had a problem where there's been too long a gap between album releases. What we've done in the past is have an album out and go out on the road to promote it, toured for two or three months and then when we've come back everybody has been screaming for new stuff and if you haven't got any then you're in trouble!

So this time we said 'OK let's use the time that we have between albums to try and get some material together for a new album'.

We started preparing the songs for the 'Play On' album over a year ago. We were thinking about what kind of album to do and when we did get the songs together, I just went down to Whitehouse Studios in Chelsea, which my manager owns. It's a 24 track studio and there I did a better quality demo with piano, guitar, drum machine and vocals. That was the given to Terry Slater, who was head of A&R at EMI at the time; and then it came down to finding a producer. That was really where the time gap came in because Terry said 'who do you want to use?', and I said that I'd love to use Gus Dudgeon because of his previous work with Elton John and because I'd always fancied working with him, but never thinking that he would be free to do it because he's obviously a very busy man.

So Terry got the demos to him and he liked the songs and said he wanted to do the album, but then we had to wait a while because he was already committed to finishing off some other projects. I think it took about a year to get the album done from start to finish, but our actual studio time took only about seventeen weeks.

Just getting back to the writing, do you come up with an idea and approach Bob or does he supply lyrics to you?

Well occasionally he supplies lyrics, but on this album the bulk of the material was started by me and he was given very rough demos and he worked from there.

Did Gus do any pre-production work with you?

He didn't, no. We talked about it quite a lot, and we thought about the songs and how we should treat them, but we didn't actually physically do anything.

The Band

Before we always worked within a band format, and then it was easy because we were a kind of working unit and when we came off the road, we'd get some songs together and get a rehearsal room and work them out that way. But this time I decided to try and use a different format and when I first met Gus he said 'well how do you want to do it, who do you want to play on the album?' and I thought I'd try and find out who the best players are and get them in and see if they're interested in doing it. He'd already been working with the rhythm section that we used which was Graham Jarvis, Martin Jenner, Paul Westwood and Pete Wingfield.

I was confident that it was going to work because I think those people are very adaptable. They're the top session people and they do a lot of road work; I know Graham and Martin do anyway. They play with Cliff Richard all the time and Wingy, Pete Wingfield, plays with everybody: everything from TV ads to the Sugar Hill Gang. He used to be in the Olympic Runners, for instance. He's been around a long time and he's a very adaptable musician.

I didn't believe that session men would be that involved with our project. You always get the impression of session men as being the sort of people who come in, sit down, read off the score, do it note perfect, take the money and that's it. But it was like working with a real band again.

It was probably the first time that I haven't played on all the backing tracks when they were going down. I think I played acoustic piano on three of them, and the rest of them all I did was just sing guide vocals. It was so relaxing not being involved in that stage because in the past I've always been the one to have to try and get it together, and actually physically be in the studio while it's going down: if you're doing that you can't really get a feel of what's happening in the control room.

Production

How much influence did Gus have over you in the running of the session? Is he the sort of producer who sits back and lets the engineer set everything up?

Well, we used an engineer called Graham Dixon who works with Gus all the time and he's a very good engineer; he got all the sounds together. Gus was more involved with things on the artistic side than the musical side of it. He's got a great pair of ears, he really has. For someone who is not a musician to have ears as good as that is incredible, I mean he can't play anything. He can't explain something to you musically if it's wrong but he does have a knack for explaining it to you so that you know what he's trying to get at.

He tends to get the best out of everybody that works for him, and I found it very hard work. I worked much harder than I've ever worked with any producer before. Gus really is a perfectionist.

Just from my point of view when it came down to vocals. In the past when I've done the vocals on the other albums we've done maybe three shots at it just to get into it, and maybe recorded three and taken the best complete take. But with Gus he would leave something like 10 tracks over for a lead vocal, so we would do ten runs at it. And maybe after six runs there were parts that were constantly good in all of them and there were other parts which needed to be talked about and re-done. So the other four tracks we would use to re-do sections.

There were probably about two or three tracks on the album that the vocals just went straight through. It depends how hard the song is to sing and the key of the song, and as far as tuning goes, Gus is incredible. I would sing a line or something and he'd say 'come in and have a listen to this' and I would listen to it and he'd say 'well that last line was slightly flattened' and I'd say 'what?' Then he'd do it again and it was, very slightly, but those are the kind of ears he has. So a lot of the time I spent going back and repairing things like that.

Isn't that a problem because in a lot of rock music you're not singing perfect pitch all the time and a lot of it is portamento, sliding up to notes?

It is a problem, yes. I thought that by delving that far into the vocals we might lose a bit of feel and I was a bit worried about it, but we didn't in the end. In fact I think it helped the feel on some of the tracks.

Gus works very hard at trying to retain the same feel and obviously to retain the same sound which is to do with ... how far you stand away from the mic and the actual power that you have to give from the voice. That's what took the time really, but eventually he ended up with what he wanted.

Moving on to the vocals, have you actually had singing lessons of any sort?

No. I was in the school choir, the church choir and the school opera, that kind of thing. I often wonder how valuable voice training actually would be because at the moment Gus has just finished working with Stephen Bishop and he still goes to voice training lessons. When you listen to Stephen's voice, it's pretty much note perfect and the sound of it is really good. Maybe I should go to singing lessons to try it out.

Recording

What about your involvement in the songs once the backing tracks were down, what sort of time period did that take?

The backing tracks were down in three weeks, the whole lot, that was 13 songs in three weeks. In fact when we were in the studio we had 10 or 11 songs and I remember getting towards the end of the backing tracks and Gus turning around and saying 'do you fancy writing another couple, to see how it goes ...?' I don't know whether he does that all the time to people, but he threw me completely, and I didn't want to give him the impression that I didn't want to.

So I went home and stayed up all night and wrote two songs, and one of them ('I'll Never Do It Again') ended up on the album. The other one also turned out great but didn't fit the mould of the album, and anyway there was also too much music to go on the

album, so it ended on the B-side of the new single.

Were you conscious when you were writing the songs to try and aim at some sort of market, or did you write what you want?

I think we were mostly trying to aim for the American market to be totally honest with you, because that's the kind of music I enjoy playing. I find that it is much more musical than anything else, especially to sing. There's more scope for actually playing better as well. I think American players have a better feel.

Going back to the sessions, what did you put down first over the backing tracks?

We did keyboards over those first with Pete Wingfield and we also got Duncan MacKay in to do some stuff, because they're both very good players and they both have different styles. Pete is an American/funk/synth kind of player, clavinet/organ and all that kind of stuff, while Duncan is a real sound man; probably because of the people that he's worked with, 10CC and all that — he just wants a certain kind of sound and it's there straight away. He's very good at that and he's also got a great feel.

Synthesisers

Duncan was using a Yamaha CS 80 and Pete was using a Prophet, Clavinet and Hammond. I think all Duncan used was the Yamaha.

Do you ever touch synthesisers yourself?

I play them if somebody sets them up and gets the sound for me! I suppose it's easier these days with the Prophet and stuff. I had a little mess about with the Prophet ... the guy who was on the last tour with us had a Prophet and I was just messing about with that and I found that quite easy to understand. But going back to the early days, I remember trying to get sounds out of MiniMoogs and stuff ... and that was awful. With the Prophet you've got the memories so you can modify the sound. I've been thinking lately about getting a Prophet or something, mainly to write with.

I was wondering why you never really got into synthesisers. You've got them on the album but they're never really prominent.

I don't know why. I think probably I'm more in the old school of singalong than getting very heavily into the technical side of it, although the way music is moving now it's got to be worth thinking about.

Just the fact I've bought my Drumulator will open up a lot of areas. It'll depend on how much I want to explore. I think you can go with those things and still retain the style that you have. These days every record that you hear on the radio sounds pretty much the same because it's using a Simmons kit or whatever, a LinnDrum, the same hand claps. And they've all got pretty much the same kind of brassy Prophet sound. If that is going to be around for a long time, then you have to move with it.

I think it comes down to the fact that people are just not taking enough time to get something personal. It's too easy just to stick a Prophet down and get a brass sound, set your LinnDrum up and away you go. I think it will always come down to finance too. Studio costs these days are incredible. Maison Rouge (where the last LP was recorded) was something like £600 a day.

You've never actually thought about getting your own studio just to cover cost?

Well I've never really had to, because as I said before my manager's got a studio called Whitehouse Studios which I use and before that he used to have Orange Recording Studios in Old Compton Street, and that was also 24-track. So I've never really had to do anything at home. If I want to do anything I'd rather go actually into a studio environment rather than be at home because you can get totally cut off and get involved in it; you don't have the kids running in and out.

How much of the keyboards did you actually play yourself?

I just played acoustic piano on three tracks and that was it. 'The Right To Sing', 'Take Me To My Heaven' and 'I'll Never Do It Again' — I played piano on that but that was an overdub.

Time For Change

Did you drop the band for financial reasons or did you just think it was time for a change?

It was both really. At the time of disbanding the group, we were going through heavy litigation with Decca Records. We couldn't record and we couldn't gig so it was just financially impossible to keep the band going. Then when things came together again I got another deal and I thought I'd try and go for something different just to get away from it all, because I think people tend to see the same faces and think 'well, here it comes again ... there's nothing new coming out of there'. That's basically why I went for a new musical direction.

I didn't mind relinquishing control of the actual playing side, because I respected the people that I got in.

I remember talking to Bobby Columbi — he used to be the drummer with Blood Sweat and Tears and he now works with Capitol and EMI in America — and he said 'You should really get the best players that you can. You should get players that make you feel slightly inadequate because it will make you work harder'. I always kept that at the back of my mind and it does work, it really gives you a kick and makes you work harder.

Moving back to guitars, you played virtually all the guitars. Why did you feel you needed another guitarist?

Well, most guitarists have got different styles. We used two guitarists on the album, Martin Jenner and a guy called Jerry Donohue who used to play with Joan Armatrading and now plays with Steeleye Span. So he was more into the kind of picking thing, the rhythm thing, and Martin was very into the detuned stuff which I'm not. I'm basically just a sort of standard-tuning guitar player. As a guitar player I would rather just play pieces of leads, riffs and so on, and leave the really good rhythm playing to someone who can take care of it. And again if we do go out on the road I would like to use a guitar player to give me more freedom to do vocals.

When we went out as a four-piece I was having to do rhythm guitars, lead guitars and voice, and even singing a bit of backing vocals in between, so it didn't really give me any time to concentrate on any one thing. On the 'More Miles Per Hour' tour I was running about left, right and centre. I was running across doing synth lines that were necessary because we didn't have another synth player with us, so in the end I thought it was getting a bit silly. I think what people want to hear from me is good vocals and a bit of guitar and a bit of piano, but there was just too much going on and I found I didn't

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have time to relax on stage because I was constantly thinking of what was happening next.

Which songs did you actually play lead guitar on — all of them?

Yeah, all of them. I did a split solo on 'Close Eyes Count to Ten'. Martin Jenner plays the first half of the song and I play the second half, and that just came about as an accident really. He was doing little fills and rhythm stuff on it and when it came to the solo he just started to mess about and he finished up actually halfway through the solo. It was such a nice run I thought we really had to use it: it was the perfect lead in for another guitar to take over at that point.

Feel

How much work do you actually put into the guitar solos, do you plan them out beforehand or is it all feel?

No, it's all feel. It's just a case of going in really. We did all the guitar overdubs inside the control room, which I really prefer because you hear the actual sound which is going to be there. I find it really strange to have to go out in the studio with a set of headphones on and play the solo; I just feel so small.

So were you actually DI-ing your guitar, then?

No. I used the Mesa Boogie in the studio with an extension cab. We had about 10 mics on it which was unbelievable. I tried every kind of mic on it and we used combinations of each; we put a lot of ambience mics on it, very close mics, mics from the back, mics from the front, and that was all down to Graham Dixon really. He's very good with guitar sounds.

When you write the songs do you specifically leave sections where you want the guitar solo?

Yes. It might not necessarily be a guitar solo but I know where the solo should be.

I spend quite a lot of time with the guitars, but it depends really. I think the solo on 'I'll Never Do It Again' was probably the one that took a lot of time. A great deal of time was spent on the guitar sounds, but not so much on the playing.

Which guitars are you using?

On the album I used the Fender Strat which has got two DiMarzios on it. I used that basically because I love the tremolo effect. But the guitar I used mostly was the '59 Les Paul Standard which I've had for a long time now.

How much importance do you place on your guitar?

Well, I've had in my time three Les Pauls and the one I've stuck with has been the Sunburst because it feels right and it's got a lot of power as well. There's a lot of variation between Les Pauls as to the power of the pickups, and I found one that was really as powerful as I needed it to be. I used to have a '57 Switchmaster which was also a very nice guitar but it had three pickups, and I couldn't play with three pickups; I had to lower the middle pickup ... because it just used to get in the way. It's my style of playing — that is where I play.

Mixing

What sort of involvement do you have on the mixing side once the album's all recorded?

I was there all the time, I wanted to be there all the time. If there had been some reason why I had to be away from the studio, if I'd had to be away doing gigs, I would have left it to Gus and completely trusted him. But he didn't mind having me around, it didn't inhibit him in any way and I did pick up on the odd sort of little thing, mainly levels of lead vocals or levels of guitar. He was actually going for a total sound and there were maybe a couple of little things that I thought should just be slightly louder at points just because they gave something a kick or feel; I would suggest that and then take a back seat and just let him do it.

I would hate to be a producer and have the artist behind you, standing with the faders and all that, shoving them up and bringing them down. I don't think he would like that either.

You've never actually wanted to do that?

Well I have tried it. When we did 'Miles High' I was totally in command of that and I didn't really enjoy the mixing stage.

Who produced that?

I did. I enjoyed everything about that album apart from the mixing stage because mixing can be so boring, and you can get stale very easily. You can get very tired listening to the songs over and over again. Also, when Gus mixed our album he insisted on doing it on a ½" machine at 30 i.p.s. which was dead expensive. But the quality is so much better.

Getting back to instruments, what amplifier do you play the Les Paul and the Strat through?

I use the Mesa Boogie. I used one on the last tour. I haven't got one. I tried one out with the intention of maybe buying it but after the tour, I knew we couldn't gig again for a while so I didn't think it was really worth it. When it came to doing the tracks, I immediately went for a Mesa Boogie because again it is a very adaptable amp — it's great for both live work and studio work — and I went for the one with the graphic EQ so I could modify the sound.

In the past you used to have an Orange amp ...

Yeah, they used to be great amps, Orange amps, the early ones. I had one particular Orange amp for ages, until it actually physically fell apart, it just wouldn't work anymore. That was when a guy called Mac was making the amps and they were very good quality amps, everything in them was good. The components were great, but they got bigger and bigger, went into factory production and then it just wasn't as good.

What type of effects are you using?

Well, on stage I basically use the voice box, an ADT and flanger. I used an Electro-Harmonix Electric Mistress at one point. On the last tour I also used an MXR Phasing unit. There's some great new things coming out ... the new Boss stuff is great.

I've never really tried guitar synths, but one of these days I'll probably end up having a go at one.

Is that because you're going to have to set the sounds up yourself? Is that why you haven't used one so far?

Probably, I'm basically very lazy! I'm essentially an old school guitar player who likes a guitar to sound like a guitar."

Ian Gilby **E&MM**

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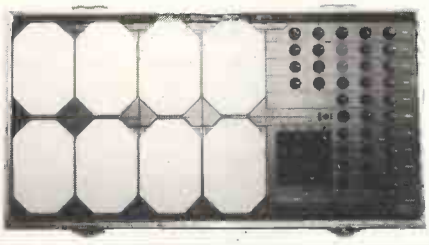

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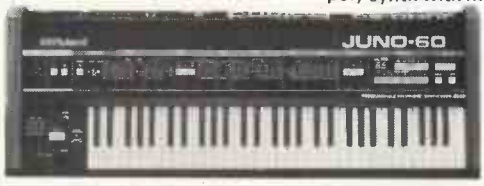

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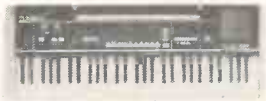

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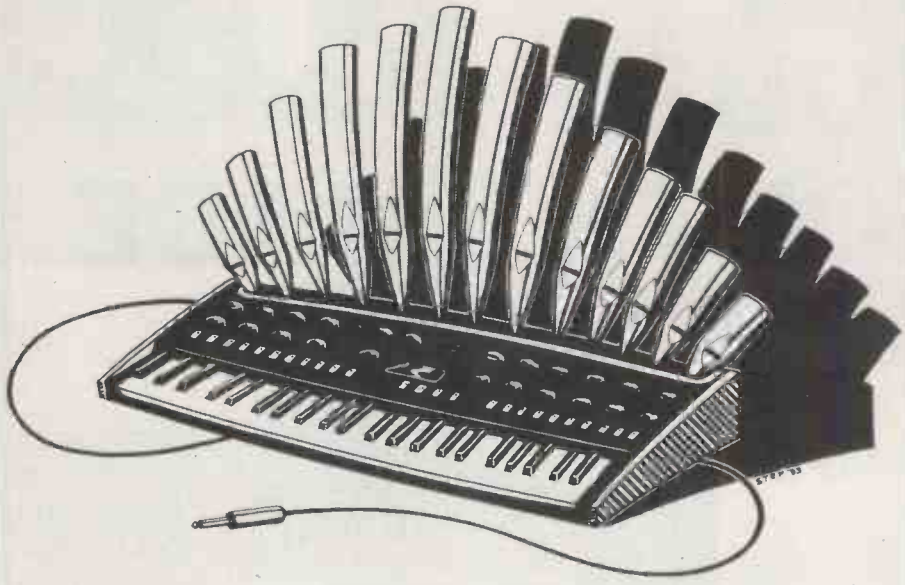


More Early Keyboard Instruments Part 4

by Alan Douglas

There is often increased activity in the electronic music field when some new or improved device is introduced. This was the case in 1927 or 28, when the gas tube reached a high state of development in Germany; anyone remember the Stabilovolt, the one and only high voltage regulator which allowed different currents and voltages to be taken simultaneously from its five outputs, without one interfering with the others?

The merits of the gas tube are that it has no heater and delivers a first-class sawtooth waveform of considerable amplitude. The gas mixtures used were very temperature-sensitive, if too cold the tube might not 'fire' at all. However, if cost was not a consideration, useful tubes could be made, and of course if a company were big enough, it could design its own eg. Philips; many Philocordas are still in use today.

Even the very cheap gas tubes like the NE2 can be made to work with enough ingenuity (USP. 1937489, 2017542, 2252184, 2403669 et al). The demerits of simple tubes are that at very low frequencies it is difficult to control the discharge and the tube may not start; this can be overcome by shining a very weak light on it; or better still, by providing a magnetic field round the tube — a few turns of wire energised from an oscillator higher up the chain will do. The other drawback is that 'splash' or random transients may occur, leading to noise and, incidentally, severe radio interference. Most of these defects are due to cathode material impurity.

Thyratron

Efforts were then directed towards better control of the discharge, resulting in the 3 electrode tube, called the Thyratron. By the introduction of a grid, as in a vacuum tube or valve, the firing potential can be controlled by a variable bias; thus a much more stable oscillator was arrived at. This delighted both Oskar Vierling and Friederich Trautwein, who were working on keyboard instruments. Vierling concentrated on organs and piano pickups, whilst Professor Trautwein conceived the idea of a stepless frequency generator, possible because the Thyratron is non-inductive. So evolved the Trautonium, the basis of all musical research for some years in Germany, and a solo instrument in its own right (USP. 2039201, 2141231).

The object of these articles is to show how forward-thinking the early investigators were, despite the lack of components or technology which, today, enable a schoolboy to achieve the same results in an evening's work. It is to these dedicated and persevering people that we owe today's electronic music.

Trautonium

To make the frequency range stepless, it is only necessary to cover a semitone interval by a gliding system. The total pitch range of the Trautonium was 3½ to 4 octaves. To cover this with a reasonably compact control element, the biasing resistor is wound spirally round an insulating elliptical former some 36" long (Figure 1). The resistor itself is of 'coiled-coil' construction, to increase the length of wire. This assembly is surrounded by a springy metal gauze cylinder which can be compressed by the finger (or a key), to contact the resistor as required. Dummy rubber keys are mounted above to indicate the normal semitone intervals. The elliptical former is pivotted as shown, so that increased pressure moves the whole assembly downwards, to com-

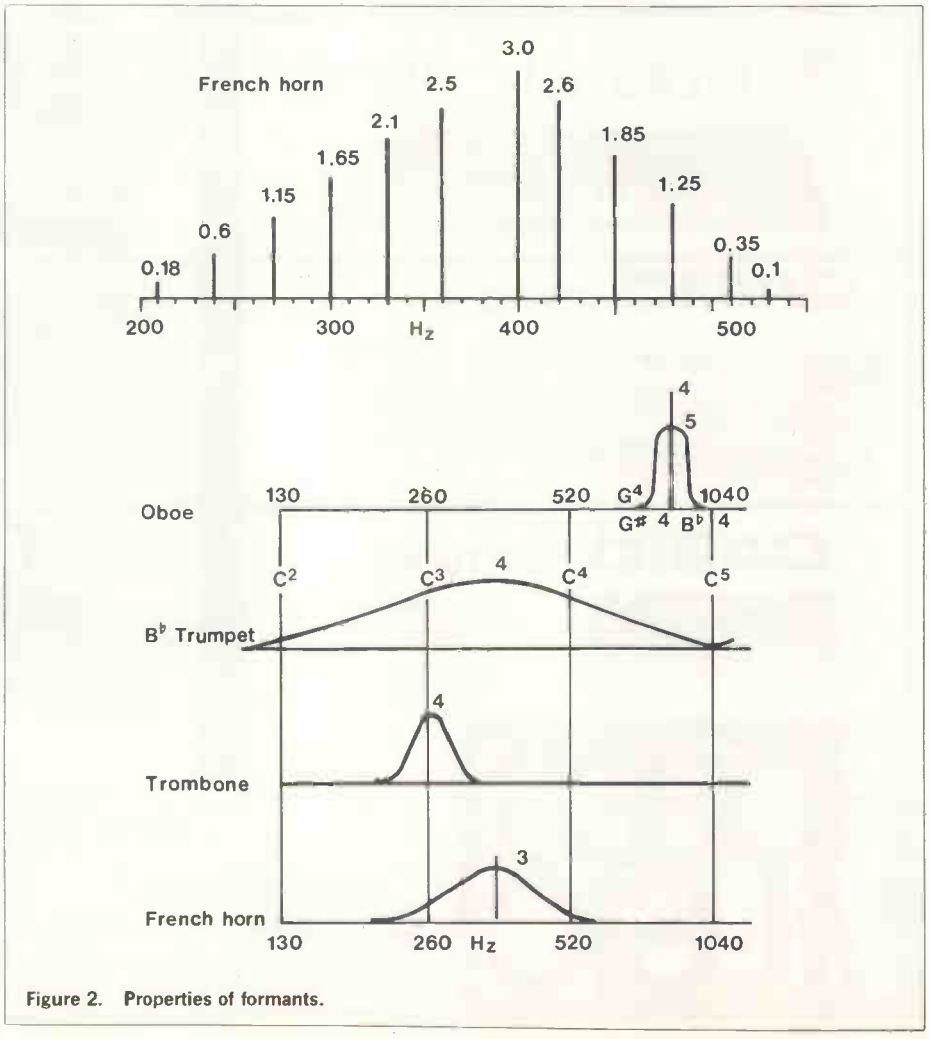


Figure 2. Properties of formants.

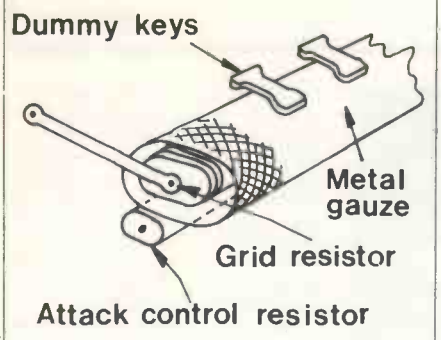


Figure 1. Keying elements of the Trautonium.

press a flexible tube containing a liquid resistance; this allows the signal to pass. It is thus a touch-sensitive instrument.

Rocking the gauze varies the point of contact with the coiled wire, and so produces gliding tones. Two keyboards were provided, mounted one above the other. A later development allowed several octaves to be played simultaneously (DRP. 917470) and this was exploited by Oskar Sala in many concerts in which the Trautonium featured as a solo instrument with orchestra.

A year or two later, when the principles of toneforming were better understood, Harald Bode devised a keyboard instrument which he called the Melochord. Two conventional keyboards, each of 3 octaves compass controlled a mass of peripherals, so that the effect of echo, attack, ring modulators, phase displacements etc. could be investigated. It was really a research instrument. The outstanding feature was the travelling formant system. It is well known that the limit for static toneforming units is about 3 octaves, so Bode arranged that these could be continuously re-tuned by extra contacts on the keys; thus, whatever characteristics were set up by a formant system could be maintained the same over the keyboard compass. A glance at formant properties (Figure 2) shows how peaky they tend to be.

About this time, the well-known firm of Matth. Hohner produced a melodic instrument using valves which was unique in that it looked like an accordion; the playing keys retuned the oscillator but the special feature was the bellows. If compressed at one end, a potentiometer altered the volume; if compressed at the other end, the harmonic content was changed by moving a coupling coil away from another iron-cored coil fixed to the instrument. An early wah-wah, as it were.

Ingenuity

Ingenuity was not limited to keyboards; a fascinating device was designed by Dr. Hugh le Caine at the National Research Council of Canada (Figure 3). A metal backing disc is cut spirally into segments, insulated from each other. A film of extremely thin mylar is laid on the disc. A similar metal disc, but not cut, is held in the hand by an insulating strap. Each segment is fed with a different waveform, but of the same pitch, as indicated; by moving the disc about over the segments, different waveforms can be mixed together by capacitive coupling. The volume can be varied by separation of the discs. The device can also be used by the right hand, whilst the left hand operates a keyboard to provide the pitch notes. Some extraordinary effects are possible, perhaps some readers may have heard it at one of my many lectures to the IEE at various centres.

E&MM

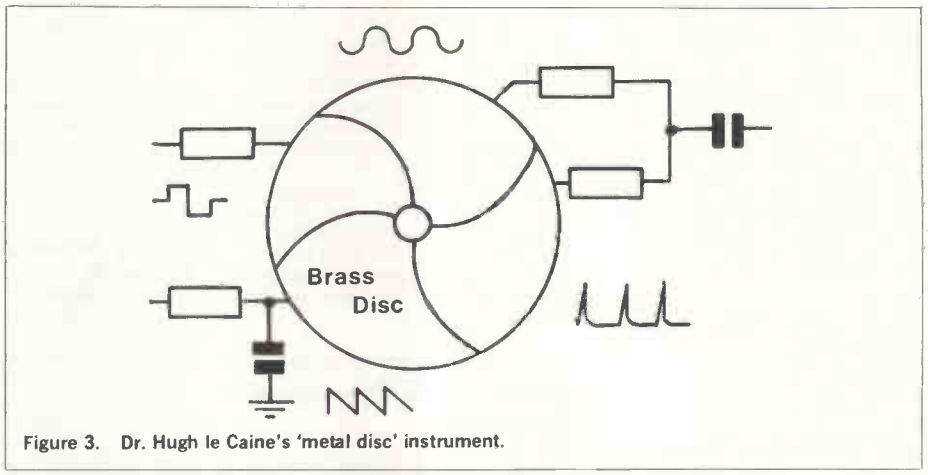


Figure 3. Dr. Hugh le Caine's 'metal disc' instrument.

RECORD REVIEWS

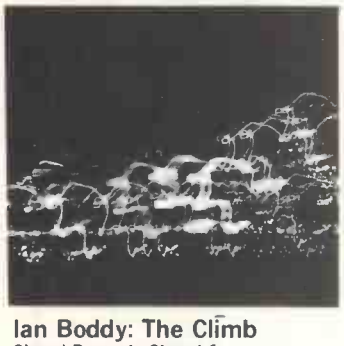
Albums

Mark Shreeve: Assassin
Uniton U021

Former Home Electro-Musician Shreeve has come a long way since 'Thoughts Of War', as this new release shows. The music is certainly derivative — there's just no escaping the Tangerine Dream/Jean Michel Jarre influences — but it's played with passion and vigour and the whole package is presented with considerable finesse. There are only four tracks, but with an average running time of 24 minutes a side — and seemingly little resultant loss of sound quality — value-for-money is high.

Of the four, 'Tyrant', with it's glowing, layered string sounds (courtesy Juno 60) and sparkling drum pattern (TR808) stands out as making the biggest emotional impact, though the title track — with a strangely familiar bass-line — isn't far behind in this respect. Nothing is perfect, however; starting one track with low, sustained Juno 60 chords being attacked by a flanger is one thing – starting all for the same way looks like overkill. And although most of the production effects are competently executed, the lead synth line bouncing around the stereo soundstage on 'Assassin' is an unwanted distraction.

You'd be right in thinking these are minor quibbles, of course, but such is the quality of the music on 'Assassin' that I can't help thinking Shreeve is coming close to spoiling the ship for a ha'porth of tar.



Ian Boddy: The Climb
Signal Records Signal 1

Already sold out of it s original pressing, Boddy's debut LP was recorded at Newcastle's Specto Arts Workshop and released by enterprising local retailers Volume Records. It's a diverse album, similar in some respects to Mark Shreeve's release (like Shreeve, Ian has also been featured in E&MM) but musically more varied and more dynamic, thanks to the rhythm machine (in this case Roland's Drumatix) being higher up in the mix.

The LP opens with 'Kinetics', a strong, almost funky track that features Glyn Bush on bass guitar, while 'The Circle' that follows has Ian's quirky vocals (processed by Roland vocoder) placed over a pounding, insistent rhythm machine pattern.

However, it's 'The Climb' itself which is the showpiece track. Over 16 minutes long, it's divided into five sections — 'Dawn', 'Procession', 'Hymn', 'Ascent' and 'Summit' — and unlike those of some composers I could mention, Ian's titles actually bear some relation to the mood of his music. The opening section is calm and reflective, with string synth to the fore, while the following three are eager, up-tempo sequencer-based tracks, conveying a tremendous sense of excitement and trepidation. 'Summit' sees a return to the tranquility of 'Dawn', and this time the mood is even more beautiful, having an almost Enoesque atmosphere to it.

Recording quality is above average for an 8-track master and the production is fine, whilst the sleeve – in addition to giving recording and equipment details – includes a superb long-exposure shot of the bright lights of Hong Kong Harbour by Paul Gilby. I wouldn't be at all surprised if Volume manage to sell out the second press run fairly quickly too . . .

Various Artists: International Friendship
Syncord RL002

This album is the culmination of a year-long project involving electronic musicians from all over the world. Each side contains six tracks, one from a different composer, making twelve pieces in all from places as far apart as Japan, West Germany, America and Italy, though oddly there are no contributions from British musicians.

The man behind the idea is Conrad Schnitzler, and his endeavours have resulted in a fascinating collection of 'new' music. With so many different artists represented, some are bound to be more interesting than others (though the overall standard is extremely high) and I particularly enjoyed the contributions of Freddy Frank (Denmark) and 'Terra de la Sera' (Italy). The sleeve notes give contact addresses for all the contributors should you want to hear more of their music, though strangely the designers have not seen fit to include any song titles.

If you're interested in 'International Friendship', write to Rudiger Lorenz at Binger Strasse 6, 6507 Ingelheim, Germany for more details.

Crozier and The Generator: Tranceformer
Fission Chips TFM 023

For those not previously aware (and I should think that's most of you), Fission Chips is one of Australia's premier electronic music studios, while the late Geoff Crozier was a magician and occult mystic who successfully blended fiery magic and hard rock during a series of remarkable concerts in the late sixties and early seventies.

An unlikely fusion of electronics and occult spells has resulted in this stunning double album, remarkable for its hypnotic tribal drum machine rhythms as much as Crozier's manic

crooning. Astonishing recording quality due to the abandonment of all compressors and limiters (major record companies please take note!) adds still further to the music's impact, but the late magician's mutterings quickly became fatiguing and the listener finds himself wishing the great man would shut up for a while and let his backing band get on with weaving their own magic spell . . .

Be-Bop Deluxe: Axe Victim Futurama
EMI EDP 1546791

Be-Bop Deluxe were one of the mid-seventies' most important bands. It was impossible to put them into any standardised rock music category because they drew on so many different influences to create a unique sound. In retrospect, they were perhaps too intelligent for a public pre-occupied with the likes of Mud, Gary Glitter and The Rubettes, and sadly the band never achieved the commercial success they deserved, eventually splitting up in 1978, four years after the release of the first album, 'Axe Victim'. This is included in the re-issue package along with their second effort, 'Futurama', which appeared in 1975.

Of the band's original members, only mentor Bill Nelson has emerged with any credibility, and if you're a fan of his more recent work, this 'two for the price of one' double album is an essential purchase as it puts his musical progression into a much clearer perspective.

Incidentally, the production credits on 'Axe Victim' make interesting reading: recording enginer Steve Nye went on to work with Japan amongst others, while mix-down engineer John Leckie was destined to produce The Human League in their formative years.

Brian Eno: Apollo — Atmospheres and Soundtracks
EG EGLP 53

Eno's soundtrack to Al Reinert's film of the Apollo space missions — composed of excerpts from the 6,000,000 feet of official NASA footgage — doesn't break any new ground, which is rare for him. However, it's still a beautifully conceived and recorded piece, if a little quirky, at times. Eno went out of his way to avoid writing 'adventure' music: music that would have been excessively grandiose and dramatic for what is not an 'adventure' film.

The result will come as no surprise to those familiar with his 'ambient' work: layers of sound — some from synthesisers some from assorted 'other sources' — lacking any conventional musical structure (sometimes even lacking any sort of melody at all), but nonetheless, creating an eerie and hypnotic background atmosphere. 'Under Stars' and 'An Ending (Ascent)' on side one are both good examples of this. This music is almost absurdly simple yet they number amongst the most beautiful pieces Eno has ever recorded.

After this, however, the first three tracks of side two come as something of a disappointment, with Dan Lanois (at whose studio the album was recorded) providing some none-too-subtle Hawaiian and steel guitar riffs, underpinned by some rather tinny home organ rhythm machine patterns. However, all is not lost as 'Always Returning' and 'Stars', the album's closing track, are both magnificent examples of ambient engineering; the former with its haunting repeating lead guitar melody, the latter with layered semi-orchestral synth sounds and a structure which is strangely reminiscent of 'Neptune', the last movement of Gustav Holst's suite 'The Planets'. Perhaps this was a deliberate allusion on Eno's part?

To sum up 'Apollo' is an essential album for anyone who believes (or might want to believe) that music does not have to be loud to be powerful. Buy it.

Philip Glass: The Photographer
Epic EPC 25480

'The Photographer' is a music/theatre piece on the life of Eadweard Muybridge, a nineteenth century inventor best known for his work photographing horses to prove that at one time during their stride they lift all four feet off the ground. As performed for the first time in Rotterdam in May 1982, the work consists of three acts: a play (with Glass' incidental music), a concert and a dance.

Musically, the album is typical Glass fare: continual repetition of one basic theme with a note or two being modified at long, almost random intervals. It's not as satisfying as 'Glassworks' (his previous release) — the melodies are less powerful and the structure less ordered — and surprisingly, the digital recording is not as clear as some of the composer's earlier analogue efforts (the opera 'Einstein On The Beach' springs to mind), lacking space, depth and ambience. It's still a rewarding album, however, and although 'Glassworks' remains the definitive introduction to Glass' music, 'The Photographer' is a vital investment for those already converted.

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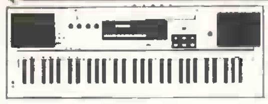

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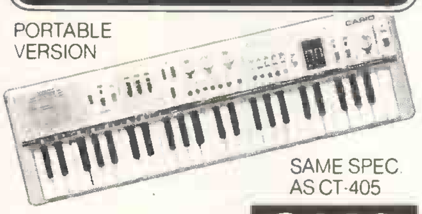

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Rockman IIB & Ultralight

Portable Amp designed by Tom Scholz

The original Rockman amp, which has been available for some time now, has been used by many reputable artists, such as Jan Hammer, Carlos Santana, Al DiMeola and Allan Holdsworth as well as by the designer Tom Scholz (guitarist in and leader of Boston). The idea behind the unit was to provide the performer (be it guitarist or keyboard player) with the sort of sound normally only available in the studio of from a collection of signal processors and amplification special features. However, the original unit, whilst producing a great sound, had certain problems with noise and unwanted distortion. In the Rockman IIB and the Ultralight models particular attention has been paid to these problems.

For those of you who are not already familiar with the Rockman, it is a black plastic box 6.2" high, 4.2" wide and 1.4" deep — about the size of a Walkman — and can be worn on the belt in a similar manner. It also comes with a pair of collapsible headphones of extremely high quality. It runs on eight AA size batteries (which is no mean investment) which give a useful working life of around 35 hours. All the controls but one are located on the top where they can be accessed easily whilst playing. The sole exception to this is an overall gain preset, which is located on the back where it cannot be knocked out of position. This should be set at the best level for the equipment through which the output is going (be it headphones, amp, mixing desk or record player).

Features

On the top there are 4 small slider switches, two inputs and two outputs. First we have an on/off switch, with an LED which flashes to let you know that the unit is on (presumably the flashing is designed to minimize battery wastage). Above this is the volume switch, with three positions, maximum, -5dB and -10dB. This is particularly handy for fast changes of level in a 'live' situation as a rotary control in this position (at the hip) would be less manageable. To the right of this is a mono ¼" jack socket labelled 'Guit Kybrd Input' and it is here that you plug in the instrument whose sound you want to treat. Clearly the unit is primarily designed for guitarists but the keyboards we put through it sounded interesting and different, the effects working best on aggressive lead synth sounds (no wonder Jan Hammer likes this little box).

So what effects do you actually get? There are two more switches, one marked 'Echo Off', 'Normal' and 'Chorus Off' and one marked 'Dist', 'Edge' and 'Clean 1' & '2'. Unlike most effects boxes, the 'Normal' position doesn't mean that the signal is untreated. As the idea behind the box is to get that 'stage' sound, this is exactly what this position gives you. This sound is achieved by a subtle chorus effect combined with a moderate amount of echo. Neither of these effects are in anyway adjustable, but this is not the aim of this unit. The idea is to create an ambient sound, such as one might achieve by careful adjusting of a series of signal processors or by use of a 'live' room in a studio, and to have this instantly and permanently available. It is this big sound which is the beauty of the Rockman, and it seems impossible to get this from such a small box. You can turn one or the other effect off — it is vital to be able to turn the chorus off to tune up for example, but if you want a clean signal you should use the other input.

The last switch changes the actual sound. Firstly, there are two 'clean' settings. Clean 1 is a sharp sound, ideal for clean, fast rhythm playing, whilst Clean 2 is a more full, more rounded sound, typical of the sound a jazz guitarist might use, and is particularly effective with the chorus on.

Now we move on to the 'meatier' sounds. 'Edge' (which is a new setting not on the original Rockman) is an extremely handy one. Tickle the strings and you get a lovely clear sound, ideal for arpeggios and spread chords, but hit the strings harder, for chords or lead lines, and it pushes the Rockman into a soft, rounded distortion, giving a nice chunky chord sound or a cutting lead 'edge' (hence the name of this setting). But the last setting is the real triumph 'Dist(ortion)' brings in an extra circuit which turns the 'edge' distortion into the hard clipped variety, giving a rich harmonic content to the sound. Add in the echo to this and you get the sort of guitar sound you normally only hear on record or from a big stage using a stack of amplification and processing. This setting really makes your guitar sing. The sustain just seems to go on and on.

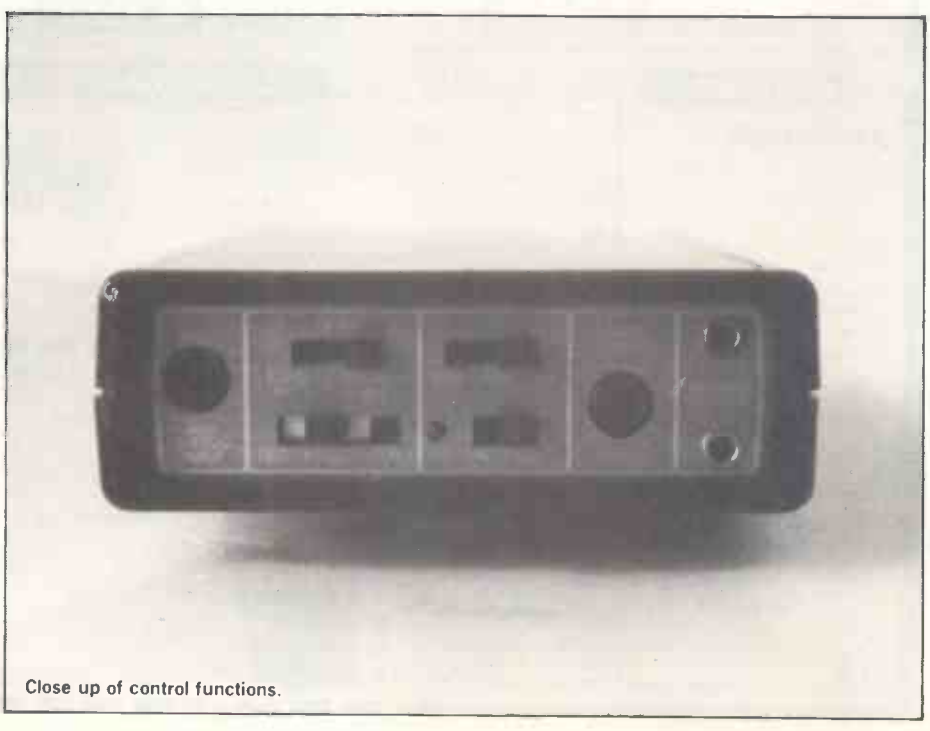
Surreal

Using the Rockman on headphones is almost a surreal experience. The sense of space is almost disturbing — it is difficult to believe that you are not in a huge acoustic chamber, or that the other people in the room are not sharing the experience. This, of course, comes from the fact that the 'normal' setting contains a specially regulated amount of echo and chorus. The reason that these are not variable is that they have been fixed at the optimum levels to obtain this 'ambient' feel. It is, of course, most convenient to use the Rockman on headphones, but with a lead terminating in a stereo minijack, the output can be taken to an amplifier, a mixing desk or your home stereo, making the Rockman useful for anything from the live 'gig', through studio sessions to the amateur home player, all with that 'big' professional sound.

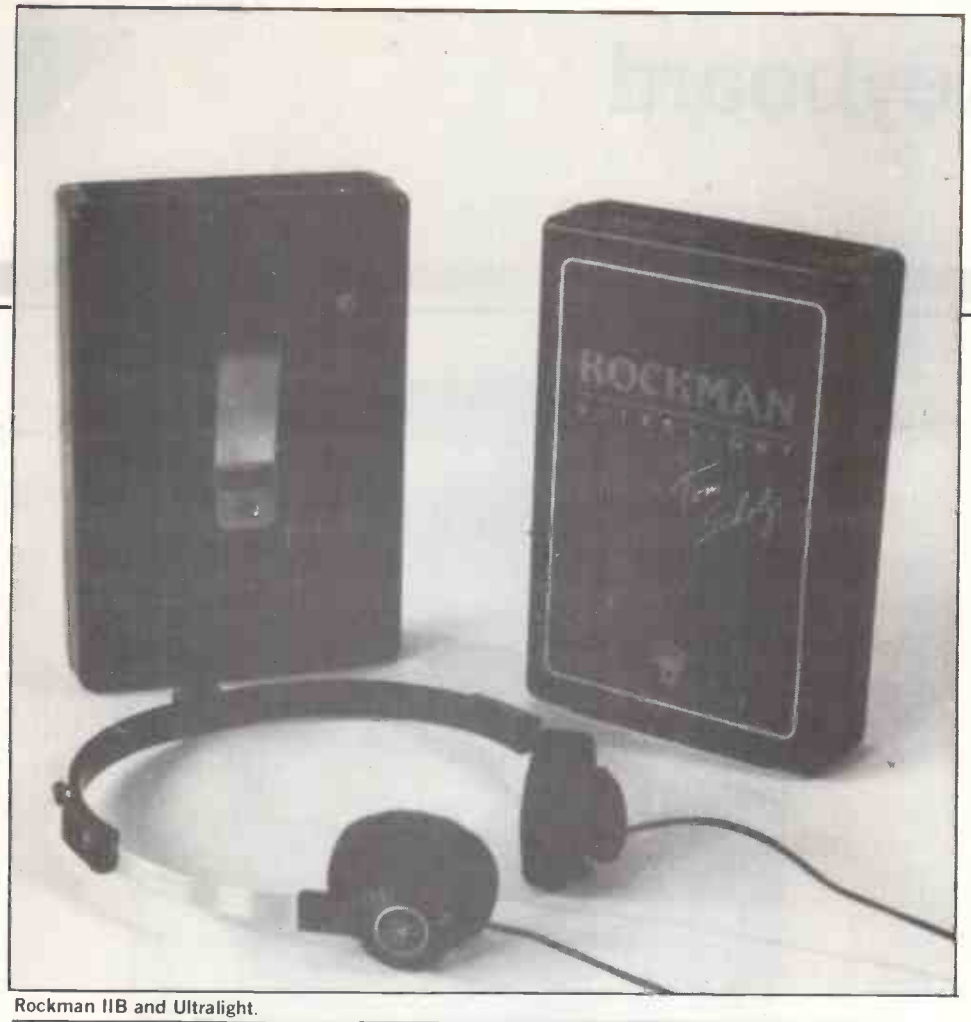
The other clean input (which we have hardly mentioned yet) is also a big bonus for the home user. It enables them to play their radio, record or cassette player through the Rockman and monitor both the music and the guitar accompaniment, all without disturbing the people sharing the same room or house. For the amateur user this must be one of the major advantages of the unit.

The internal configuration of the Rockman is well thought out, and neatly laid out on 2 fibreglass PCBs. The system utilises TL072 op amps which is one of the main reasons why these models are so much quieter than the original Rockman. The echo and chorus are based around MN3011 and MN3007 bucket brigade delay lines.

The principle difference between the IIB and the Ultralight is that the latter has no echo available. However, the space is empty on an identical circuit board, and Dixie's Music assure us that all Rockmans (the original or the Ultralight) can be upgraded to the IIB specification for the difference in price between the original unit and the cost



Close up of control functions.



Rockman IIB and Ultralight.

of a IIB, so you can go for the lower price model and upgrade when the extra money becomes available. The Ultralight, for example, is £66 cheaper than the IIB.

Conclusions

The price of the IIB is £245 (RRP inc. VAT) which may seem expensive for a unit with four basic sounds on it. The publicity material says "you would need 10,000 dollars worth of studio gear to duplicate the Rockman sound", which may well be true (although you could do a lot more with such gear). What is certainly true is that you would need to spend a lot on amplification and processors and what is perhaps more important, a lot longer setting it all up, to have the sound which is available at the flick of a switch on the Rockman. All you have to do is sort out the right leads and connections and you can have that 'big' sound virtually anywhere.

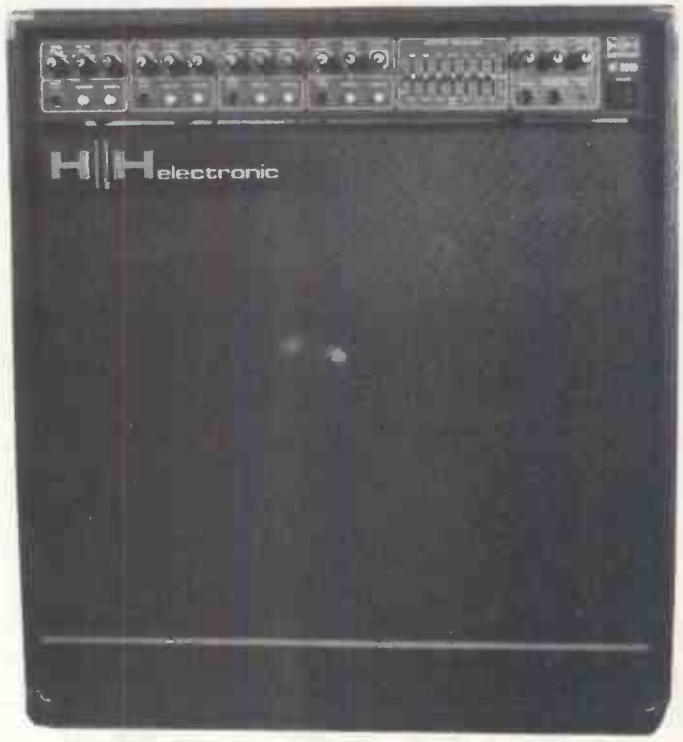
Paul Wiffen **E&MM**

The Rockman is distributed in the UK by Dixie's Music, 2 Stocks Walk, Almondbury, Huddersfield. Tel. (0484) 51260 or 25920.

HH K150 Keyboard Combo

Despite their wide range of stage equipment, HH haven't, up to now, had much to offer the keyboards player. This has changed with the recent introduction of the K80 and K150 which are available both as discrete mixer-amplifiers ('heads') and as combos.

For this review, though, we'll be concentrating on the larger and higher powered K150 combo.



Features

This model has 4 input channels, the first of these being the 'bright' input (with a slight peak around 1.5kHz) favoured for certain electric pianos. Each channel features switched routing to a common FX send-return socket and a shared 7-band graphic EQ, no dedicated equalisation (ie. for individual inputs) being provided. There's also an internal spring-reverb, and each channel sports a couple of pots to control the FX send and reverb levels. The other control on each channel is, of course, the input gain, but it differs from most in being *active*. This means that rather than attenuate away excess level from an amplifier stage with a (fixed) gain of x30, say, the pot directly adjusts the gain of the front-end circuitry. The overall effect is to make it easier to set the controls so as to avoid distortion when injecting high level signals.

Moving across the front panel to the other side of the graphics, there are reverb and FX returns, an output peak (clipping) LED, plus two jacks; one for headphones, the other for reverb and FX footswitching. The connection here is with a stereo socket, so you can use a dual footswitch with a single plug, and three core lead. Returning to the headphone socket, this disconnects the speaker outlets when in use, and is ideal for tuning up or practice.

Compared to some HH instrument amps in the past, this one is generally sparse and devoid of Sci-Fi controls – the immediate impression is of a musicians' workhorse yet without looking unattractive. Instead of gimmicks then, we find a couple of sensible extras on the rear panel. First, a balanced output for DI purposes – not exactly a new idea, but a facility that should be seen more often in view of the cost of a good DI box. Second, a Bi-amp socket. This is a line level, 'low frequencies only' feed to a separate bass power amp ('slave'). The clever bit is that inserting a jack plug here also removes all the LF content from the K150's speaker output socket – so this unit becomes the mid/treble amplifier. You then hook up appropriate drivers, ending up with a 2-way active (or Bi-amplified) keyboards stack.

In addition to these novel features, there's a pair of send/return jacks, a line level (slave) output, and two speaker outlets, one being used up by the jack plug from the combo's speaker enclosure. The 18" bass driver is loaded with a large vent, which suggests that it's tuned to augment the lowest bass notes, rather than higher up. This unit is partnered with HH's well known ring-radiator horn tweeter, or 'bullet', as it's more conveniently known. With the two drivers excelling at their respective ends of the spectrum, output in the midrange deserves attention, and accordingly, a silvered centre-dome on the 18" speaker offers some balance in this region.

Evaluation

Whether using a keyboard or a rhythm box, it was easy to set up a range of tasty sounds with the graphic EQ and a touch of reverb; even with the EQ switched out, the sound was acceptable, indicating an essentially smooth response. (The rhythm box was particularly revealing – in general any system that sounds correct on percussion will also excel on keyboards, and the K150 falls into this category). However, in some instances, there was a definite lack of *bite* on keyboards, and as one would expect from the combination of drivers employed, the high midrange is slightly recessed. This is a pleasant departure from the usual state of affairs, and is readily rectified by a slight adjustment to the EQ's 2kHz slider.

Whilst on the topic of EQ, it's good to see that the instruction manual advises against ragged settings like 60Hz @ +12dB and 150Hz @ –12dB. Instead, it sensibly advises that you set up gentle curves. On the other hand, it's suggested that the graphic could be useful for room equalisation, which is really not on with only 7 bands – even assuming room EQ to be a valid technique in the typical live environment.

Alas, the graphic controls don't have centre click-stops, so it's hard to quickly set all the knobs to 0dB, especially when you're adjusting from above, on a dark stage. Of course, you can hit the 'graphic send' pushbuttons, always assuming you can *see* them, but that's not quite the same thing as zeroing the graphic's sliders. Fortunately, there's little audible effect when the knobs are slightly askew about the central position, but HH should consider fitting sliders with centre click-stops in future.

The reverb had a relatively small range of useful adjustment, especially with percussive sounds, where over most of the higher gain settings, it became too 'twangy'. This is a common problem with combos, being due in part to high level bass vibrations reaching the springline, but some judicious damping and improved shock relief would be advantageous. The headphone output scores well on sound quality, and it was also easy to drive high impedance headphones at high SPLs. Although this can be a danger to one's hearing, it's an improvement over insufficient level – many headphone outputs only offer sensible power into low impedance cans.

On the other hand, at low listening levels, there was excessive hiss (measured at less than 60dB, it could be 10 or 20dB lower), even with the gain controls set for optimum signal-to-noise ratio. Although to be fair, the hiss would probably not be overprominent in view of the noisiness of some keyboards! Before purchase, then, it'd be a good idea to test out the headphones

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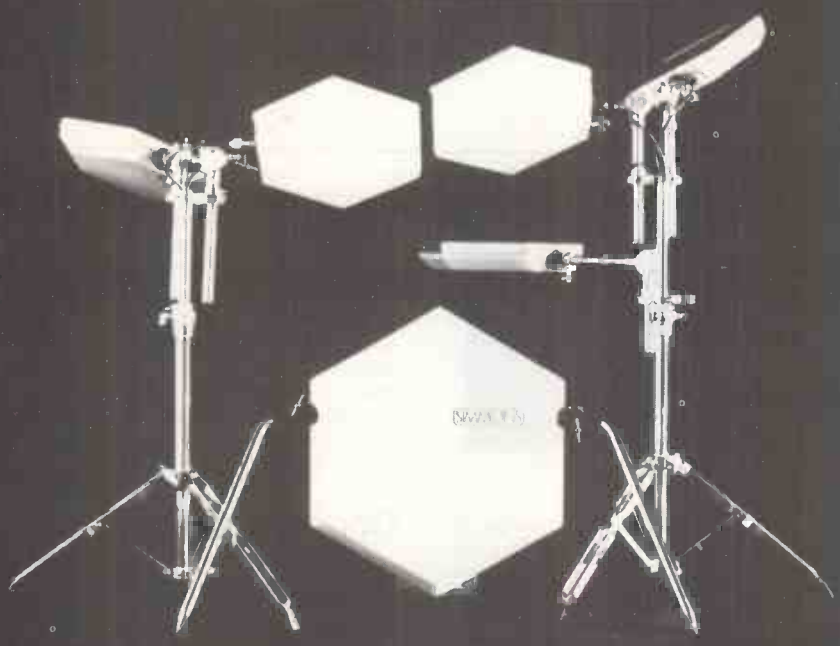

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HH Keyboard Combo

(Continued)

Front panel features.

facility and assess the degree of aggravation if you anticipate doing a lot of quiet headphone work.

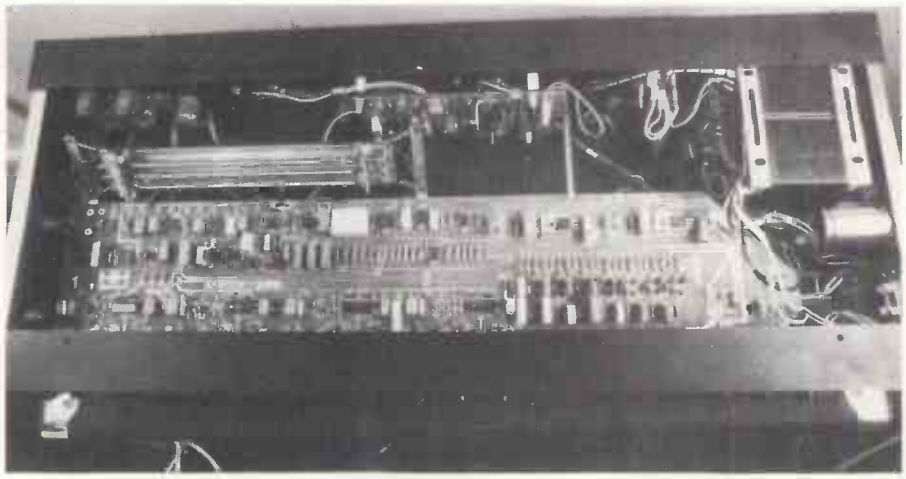
Packaging and Mechanics

Musicians and sound engineers have always had strong feelings (both positive and negative) towards HH stage gear. To some extent, this is a reaction to their brash, 'forward', macho image. In recent times, this has mellowed, and along with Japanese competitors, the styling has gravitated towards that of UK professional audio. The K150 is a development in this direction, and put simply, it's a lot more pleasant to live with on an aesthetic level than some of HH's earlier creations.

Of course, HH's ideas as to who uses their gear has ramifications on the styling, so perhaps the recognition that most users are involved in Electronic/Funk/Jazz/Pop fusion rather than Heavy Metal mayhem has led to the welcome aesthetic refinements – Aswad, Fun Boy Three and A.C.R. being some typical professional HH users. But I digress: apart from the absence of click-stops on the graphics, the front panel layout is superlative. Moving onto the cabinet, both drivers are front mounted, and as the grille is easily removed, replacing blown drivers in a hurry should prove no problem.

On the rear of the combo, the flying jack lead from the speaker cabinet is long enough to reach a power amp laid on top of the combo – this is often handy for quickly checking the speakers if the combo goes dead for no apparent reason.

Like the external packaging, the internal layout is a major improvement – the infamous and unreliable HH wiring looms are largely vanquished; instead, money has been wisely spent on a well designed double-sided circuit board. For the musician, this should mean greater reliability, and if repairs are needed, it should also help to keep costs down, as access to the circuitry is so much easier.



Internal layout.

Electronics

The input stages of the K150 use the NE5533 op amp, which is a dual version of the NE5534 low noise 'superchip', widely used in high grade UK pro audio equipment. Unfortunately, sections of the reverb and output circuitry incorporate 741s, an earlier and much noisier chip. This is okay so far as it goes, but doesn't help the poor noise performance on the headphones output, although to an extent, the noise problem appears to stem from a less-than-ideal gain structure. It's just a pity, that having used a good, low noise op amp for the front-end, the hiss is more prominent than it need be. The power amplifier is of the Bi-polar variety, which is odd in view of HH's commitment to MOSFET amplification. Nevertheless, the sound is devoid of any obvious shortcomings, and the power stages in HH instrument amplifiers do have an excellent record for reliability.

Rear panel connections.

Conclusions

HH have clearly pulled their socks up: the K150 combo has been thoughtfully executed, and incorporates welcome improvements and elegant refinements from many angles. The main reservation relates to the graphic EQ. If you're simply equalising the speaker, that's fine, but given that many keyboards – even expensive ones – often lack EQ on their outputs, with a *multi-keyboard* set up, you've no control over EQ for each instrument – not even the most elementary bass and treble controls. Of course, it's not an insoluble problem. You can easily patch in a set of low cost EQ units (from, say, Turnkey's 'Accessit' range) between each keyboard and the K150's respective input. Or you could use a cardboard template to quickly reset the graphics for each instrument, assuming you're using them in a long sequence.

To finish on a more positive note, the K150's ability to make a cheap keyboard sound good was ample verification of the excellence of the speaker design, and with this in mind, the K150 is also well suited for use as a small and accurate PA.

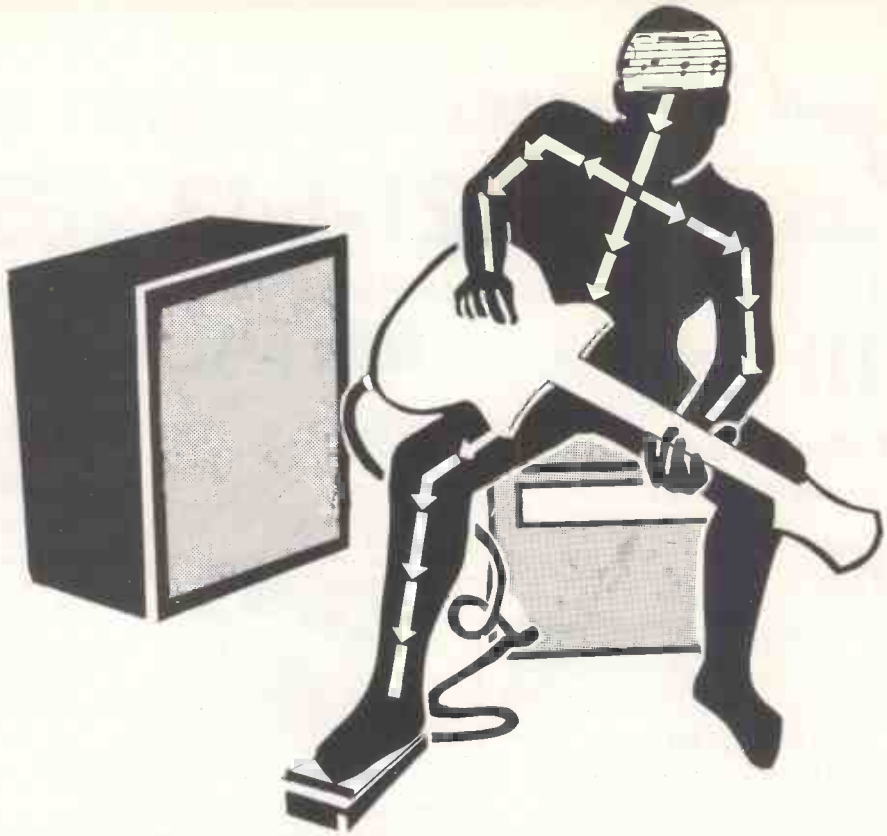
So musicians who are looking for compact amplification with good low bass performance and near Hi-Fi characteristics should give the K150 serious consideration.

Ben Duncan **E&MM**

Shortform data

Power: 150 watts into 4 ohms
(Note: because the combo speaker is rated at 8 ohms, you will only attain full power with an additional 8 ohm cabinet)
Input sensitivity: 190mV (– 12 dBU)
Input impedance: 50K
Graphic EQ: +/– 12dB @ 65, 150, 350, 800, 2kHz, 4kHz and 8kHz.
FX send/return levels: – 10dBU

Recommended retail price of the K150 is £441.45 including VAT. Further information available from HH Electronic, Viking Way, Bar Hill, Cambridge CB3 8EL. Tel. (0954) 81140.



the PSYCHOLOGY of music

"The chasm between music theorizing and music making has not narrowed at all since Plato."

Sloboda (1982) Exeter University

by Andrew Morris

In fact, it has probably widened as a result of the so-called 'prescriptive' view of music theory. The purpose of a proper music theory should be to enable people to think coherently about musical problems. An important sphere of research centres around the intersection between the *physical* world of music and our perception, cognitive processing, and mental organising of ordered sounds. This sort of research leads us to a music theory which can help to explain musical phenomena without dictating what must be done to obtain them.

The last decade, in particular, has witnessed a sudden interest in the empirical study of music on the part of both scientists and musicians. Along with recent advances in computer technology there has been a flourish of research into auditory shape analysis, attention in music, the organisation of memory for musical information, and the skills used in an actual performance, and so on. As a result of these sparks of interest on the part of psychologists and musicians, there has been a spontaneous expansion of study in the broad area of information processing in music.

Music can simply be understood at all its levels of complexity in terms of grouping: grouping of sound frequencies to form specific notes and textures, grouping of these notes to produce chords of clustered sound, grouping of individual tones or chords along the length of music to form phrases and rhythmic clusters. From the micro to the macro-level, music is based upon this fundamental principle. The complexities which arise in music are not from other strategies but from interactions between pitch, rhythm, timbre, texture and so on. A music theory that *does not* account for these, and the perceptual processes which are required to analyse them, cannot possibly claim validity in real-world music making. And, after all, isn't this what we as practical musicians are interested in?

Over the last decade, many studies have been done in several of the levels from which musical processing can be approached. Recent advances (relatively speaking) in computer technology have enabled scientists to generate and analyse complex sound stimuli with versatility and precision. Thus, it has become possible to explore such issues as auditory shape analysis, attention in music, the organisation of memory for musical information, to mention just a few. This same technological development has led composers to experiment with the computer as a compositional tool. By so doing, they have raised many questions in perceptual and cognitive psychology that are of both practical interest to composers and theoretical interest to psychologists. As a result of this flourish of interest on both the part of scientists and musicians, there is currently a rapid expansion of work in the area of musical processing, and perhaps more importantly, symbiosis between scientists and musicians is a rapidly growing phenomenon.

Although the fundamental question of perception is essential to the full understanding of music theory, what is most important to the skilled instrumentalist is the knowledge of how music is actually performed in the real world, as opposed to the laboratory. It is because of the lack of technology, specialised measurement techniques, and experimental control that the study of music performance has lagged many years behind the study of more basic questions.

Our purpose here is to draw together all the diverse and scattered knowledge that has accumulated, specifically over the last decade, on musical processing. We will be looking not only at music itself, but also how it is processed by the listener and the performer, the effects of different types of music on our moods and behaviour; musical preference and appreciation; the neuroanatomy of musical function, and brain disorders which result in musical abnomalities; mental plans for action and performance; the role of feedback in performance; musical ability; illusions in music; rhythm; and psychoacoustics.

The overall aim is to produce a 'new theory of music' which overcomes the double barrier that currently exists between musical practice and music theory, and between music theory and those other fields, such as computing, which touch music at some point or other. There has always been a problem of communication; the chasm between thinking about it and doing it. It is one thing to know when and how and where to pass the thumb in fingering, say, the C-major scale on a keyboard, and altogether another thing to do it smoothly at moderate and fast tempos.

The 'traditional' theory of music has been going on for so long, 2000 or 3000 years, that it is no surprise that it is a very confusing body of knowledge. The history of music theory can be seen as a special pleading for

this or that musical style. That must be changed. What is needed is a music theory that is bound by style, that is valid for *world* music, not just its European, Chinese or Indonesian varieties.

Music Performance

Let's first look at four central aspects of music performance which relate to the skilled musician. How do we best characterise what it is that someone knows when he or she performs a piece of music? How does that person acquire that knowledge? How does the performer use perceptual feedback to control his or her performance? And, lastly, how is music performance affected by social and situational factors?

Whenever someone performs a piece of music, he or she is induced in a process of translating a mental plan or representation into action. Everyone has those plans to a certain degree! They allow us to hum tunes as we go about our daily routines. But what kinds of plans are required to execute these actions? A simple possibility would be a list of actions in a specific sequence and of specific durations. However, this simplistic approach cannot account for the differences in performance which are found on different occasions using the same equipment. Human beings do not perform music in exactly the same way on each occasion. In fact, the variation which can be heard can be classified as unsystematic and uncontrolled, or systematic and controlled variations, the latter, of course, being effected by the performer. For instance, many people are perfectly able to sing a song from any starting point (within their vocal range) and comply with requests to sing louder or faster. Furthermore, some people who know a tune very well through singing it, can, if they are competent enough, transfer the tone successfully to an instrument, or if literate, write it down in notation.

These observations suggest that the 'musical' plan must be somewhat more abstract than a list of defined actions, and must be capable of varying infinitely in many dimensions. It has been suggested that a performer's plan may be a listing of items in which the duration, pitch, and intensity of each note is specified *relative* to other notes. Before the plan can be executed as action, absolute values for each pitch, duration and intensity would have to be specified, and the appropriate motor actions would subsequently be determined.

In a literal kind of transcription (for that is what playing from music, or a mental representation of it is all about), a fluent response sequence may be derived from a representation that contains programs with knowledge about how to translate notation into physical response. Motor programs are mechanisms 'within the nervous system' that enable co-ordination of a movement sequence, and these may become more complex and extensive with experience and practice. The programming can be thought of as becoming rather complex as more lines are added in modular fashion to accommodate further skill acquisition.

There is a further distinction between 'planning' and action, and 'programming' it: *plans* can be carried around in the head of particular pieces or anything else for that matter, whereas *programs* can be thought of as mechanisms for interpreting plans and executing them in a particular mode. If the expressive mode is the voice, then the plan is executed via the motor programs which organise the movements of the vocal chords. If the mode is the keyboard, then the motor programs direct the placing of the fingers and make the ballistic movements required to 'land' on the correct notes. Because the plans themselves may be extensive, the programs may intepret them in a succession of fragments, moving along the plan as if on a conveyor belt. However, in sight-reading music from a score, it is the score which is the basic plan, and decisions of expression and dynamics must be improvised during performance. Such a performance may lack the refinement of expression that develops with practice, but it can be reasonably fluent so long as the player can look ahead of the notes he is playing. We will discuss this particular point later as it has been well studied using electronic keyboards and computers. Lastly, in a freely improvised performance there is little or no distinction between planning and programming as the plan is spontaneously created and there is a continuous translation between conception and motor response.

The performance variations which we have so far talked about share a common property, that of 'context-free' application. In other words, each variation applies in the same way to each note. For instance, when a tune is played faster, each note is shortened by the same proportion. Or if it is played in a different key, each note is raised or lowered by the same proportion. However, not all variations in music are like this, some are called 'context-sensitive'. They are often called 'expressive' and include such techniques as rubato, variations in attack and decay, fluctuations in pitch and timbre. These are the variations which prevent performances from appearing 'dead-pan', and are applied at the discretion of the performer in the light of the current situation. It is these that we will turn to in the next article.

E&MM

RECORD REVIEWS

Hubert Bognermayr Harald Zuschrader: Bergpredigt

Erdenklang 6.25590

'Bergpredigt' ('The Sermon On The Mount') is a bold and immensely ambitious attempt to fuse religion, politics, computer technology and music. The album's creators assert that Christ's two thousand year-old message is the foundation on which our society should be based, and that only through the common language of music can this message be broadcast and heard throughout the world.

This presents something of a dilemma to the reviewer in that for many people the spiritual motivation and the finished product as heard on the LP are inseparable, while at the same time it is well-nigh impossible to come to any sort of objective conclusion regarding the album's musical content without putting the purely religious elements to one side.

Opting for the latter course, I can only say that 'Bergpredigt' is an extraordinary achievement in what is becoming an increasingly ordinary world. Musically it is totally, unlike almost anything previously committed to vinyl, and the sheer unstinting commitment displayed by the musicians involved is almost sufficient to send a shiver of inadequacy down the spine of the listener.

There is little or nothing on this record that has not been 'treated' by a computer somewhere along the line, yet some of the sounds Bognermayr and Zuschrader have created are among the most beautiful yet produced electronically. Melodically, the album is both interesting and varied, the whole being constructed from a musical network of some complexity. Production has clearly been undertaken with considerable care, as almost every sound on the record is reproduced with crystal clarity, though perhaps some of the credit for this should go to Teldec's superlative Direct Metal Mastering.

Yet for all this, 'Bergpredigt' is far from perfect. Indeed, it has two serious faults which conspire to reduce the album's listenability (and hence its significance) considerably.

First of these is the gaudy, almost gimmicky use of electronics which pervades much of the album and at times reduces it to a kind of upmarket demonstration record for the Fairlight Computer Musical Instrument and the Quantec Room Simulator. It's difficult to take seriously music which is so obviously 'manufactured' and so hideously contrived. It's almost as if the composers have gone out of their way to ruin all the natural beauty that is in music and replace it with an ugly, sugary muzak.

Worse still, however, are the vocal additions which appear with frightening regularity throughout the LP, under the direction of Walter Karlberger. These consist of excerpts from the original New Testament text, interspersed with slices of contemporary life: headlines, clichés, cries for help and so on. While there's nothing wrong with this in principle, in practice the vocals disturb the tranquil atmosphere of some of the music, and the Fairlight processing only serves to make matters worse in this respect.

Given that to most people 'Bergpredigt' will be little more than an amusing technological aside (and it is my belief that it will be), the authors' message of peace and tolerance is unlikely to get the fair hearing it deserves.

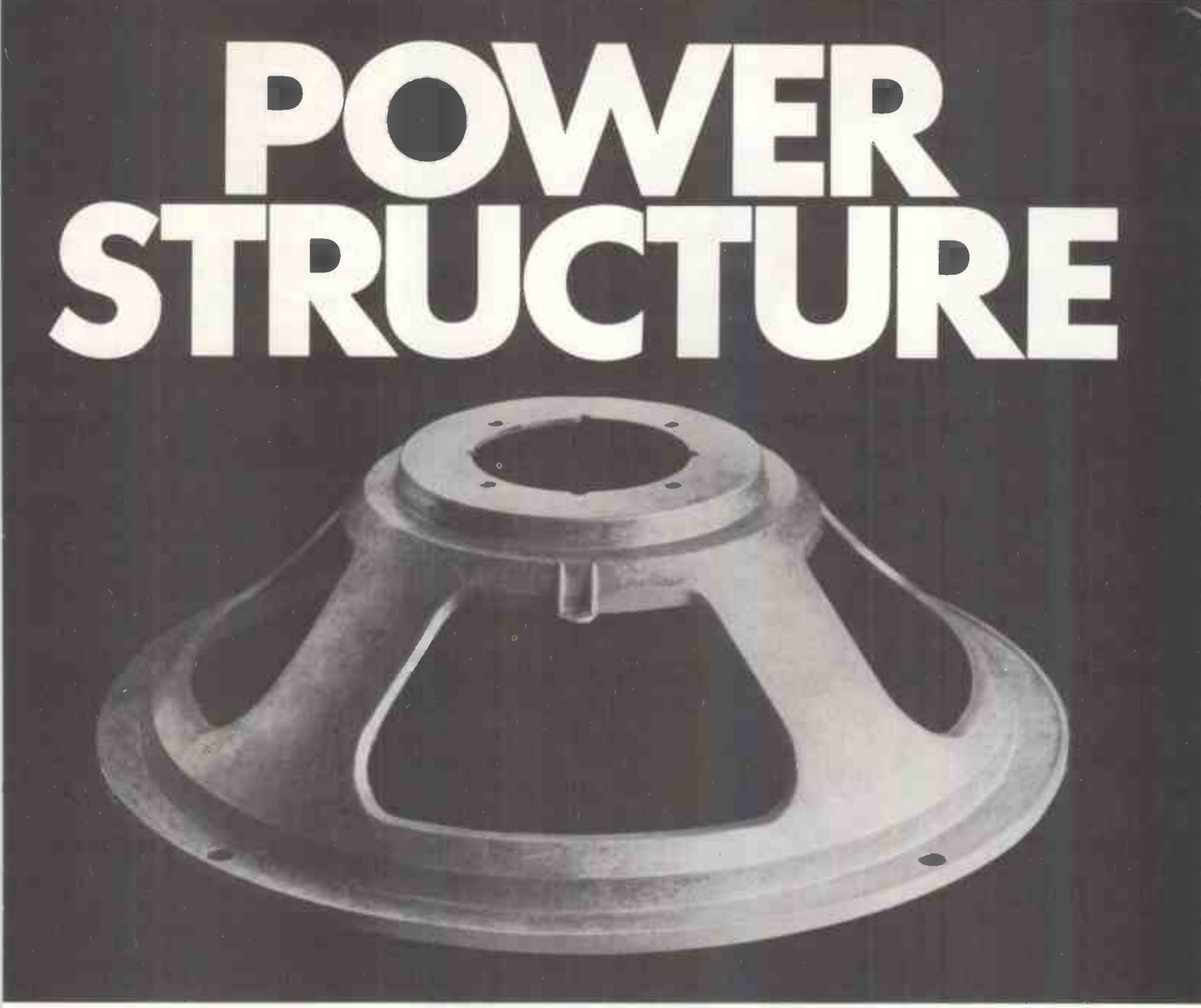
The biggest sufferer of all, however, is the music. For if this is all that can be done with the latest and best of what computer technology has to offer the composer, (and admittedly there is already plenty of evidence to suggest that this is not the case) then I'd rather stick to a grand piano and a Juno 60. There are passages on this album which are so far divorced from the peacefulness of the original message that you begin to wonder whether or not the sleeve belongs to the record.

'Bergpredigt' is an album which promises the world and delivers considerably less, and the only rewards for the (determined) listener are in the fine recording quality and in the knowledge that if it weren't for the sugar-candy sound effects and persistent vocal interruptions, it would perhaps be the best concept album ever made. As it stands, it is not more than the sum of its constituent parts: religion, politics, computer technology and music. In that order.

Dan Goldstein **E&MM**

This LP is available in the UK from Making Waves, 6-8 Alie Street, London E1 8DE (Tel: 01-481 9917).

POWER STRUCTURE



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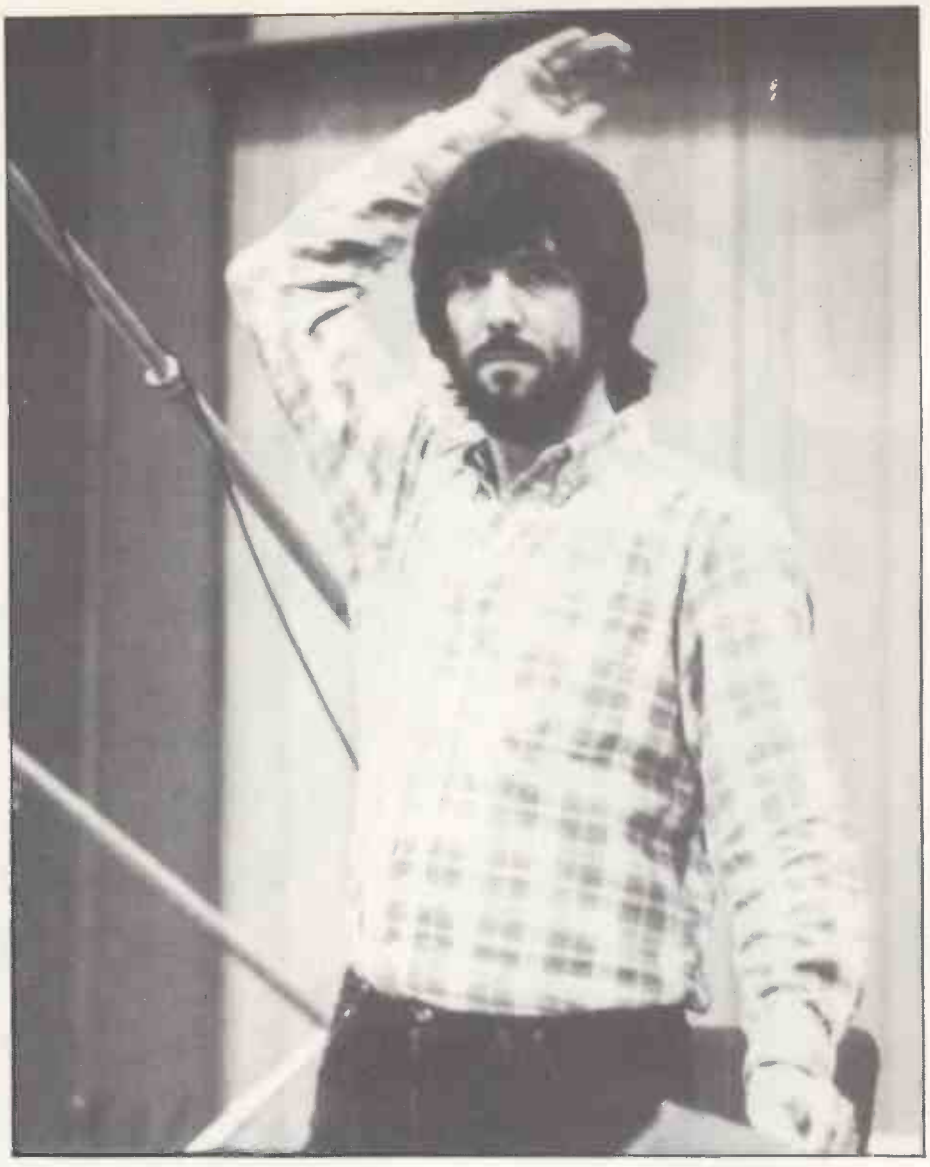


Conducting the Philharmonia.

Andrew Powell

Andrew Powell is one of the UK's foremost arrangers and producers. His list of credits is long and impressive, including as it does such names as Steve Harley, Kate Bush, Cliff Richard, The Alan Parsons Project, Al Stewart, Mari Wilson and Nick Heyward. Most recently, he has been devoting his attention to 'The Best Of The Alan Parsons Project', his album of orchestral arrangements of Project pieces. In this exclusive interview he gives an insight into what makes an arranger tick, beginning with his early days studying under Stockhausen and reading Music at Cambridge University.

"While I was still at school I became interested in the music of Stockhausen. I was playing piano and I met him for the first time at a concert of his. Then as soon as I left school I went on a course at his summer school in Germany. What I learnt from him is extremely difficult to describe. He used to discuss formal justifications for the music he was writing at the time, and a lot of it was extremely technical. I remember he'd just written a piece called 'Procession', which was a live electronic thing with a lot of plus and minus signs and the players all having to react to each other and that sort of thing. It was always fascinating to watch him rehearse with his own band, but I did find some of it confusing: he's a very, very high-powered man.

After that I went to Cambridge University to study Music, and in retrospect I think I got more out of simply being at Cambridge than I did out of the curriculum itself. What you often find at these places is that the best musicians are reading Physics, French or German or something, and I think the main reason for that is that the actual Music courses themselves really aren't all that interesting. At Oxford at the moment, for instance, the Fairlight is used for purely orchestral sounds and nothing else, which is completely wasting the instrument in my opinion. There's no way you can re-create the sound of a conventional instrument without, say, making 50 samples for the first four bars of a cello concerto, and you might as well just hire a cellist to do it. It's easier, cheaper, and sounds far far better.

Intermodulation

While I was at Cambridge I joined an electronic ensemble called Intermodulation. The other members were Roger Smalley, Tim Souster and Robin Thompson. We were using very early, prototype VCS3 synths, and we formed specifically to play some of the Stockhausen stuff like 'Procession'. Then when we left Cambridge, Robin and I formed a rock band, using the same sort of instruments but playing a slightly different sort of music; something more in the Soft Machine vein, you might say. We were joined by Morris Pert on drums, and he played a demo-tape of ours to Stomu Yamashta.

Yamashta was quite impressed with it and before we knew where we were, we were playing a concert with him in Paris, using lots of strange instruments like the Baschet Brothers' sound sculptures, which sound amazing and look absolutely incredible, of course. We also made an album with Stomu called 'Floating Music', but after that and a few more (highly enjoyable) concerts, I decided to branch out into arranging, although I suppose that's not being totally accurate because the whole thing seemed to happen more by accident than design.

Arranging

At the time I was doing quite a bit of session work on bass guitar – which was, and still is, very much a secondary instrument for me – and suddenly an old friend of mine from college offered me the work on the first Cockney Rebel album which he said he couldn't handle.

It was a very refreshing experience working with Steve Harley, because there's no doubt he had a very original approach to songwriting, and his material reflected that. On the arrangement side, he wanted the orchestra to play just as significant a part in shaping the sound, as the band did: that was especially true of the two big songs, 'Sebastian' and 'Death Trip', and it was tremendous fun working with so many people.

Steve was very pleased with the results on the first Rebel album, but for the follow-up he felt he wanted more say in the finished product, so EMI got Alan Parsons in to produce it and I did the arranging as before. That was the first time I actually met Alan although naturally I'd heard of him before from his work with Pink Floyd and so on.

Partnership

When we'd done the second Cockney Rebel album, Alan and I formed a loose sort of partnership and went on to do quite a number of things together before the Project itself actually got off the ground. Among these were the three Al Stewart albums (including 'Year Of The Cat') plus some other, less well-known stuff. Then of course there was the John Miles album which included 'Music', which I did on my own without Alan.

'Music' was very similar to the Cockney Rebel material in some ways: the orchestra became almost as important as the song itself. That record gave me more public acceptance than ever before, and of course it's become something of a classic – it's still played all over the place. It's a shame in a way that John has drifted away from that sort of thing and veered more towards trad-

itional rock, because he's an incredible musician – very fast and astute.

After the John Miles thing I found myself doing the orchestration on Cliff Richard's 'Miss You Nights' which is what a lot of people remember me best for, I suppose. I'd never worked with Cliff before, but two years previously I'd done an album with a guy called Dave Townshend (which was never, in fact, released) and among the songs we recorded was 'Miss You Nights'. Someone at EMI liked it and we decided to record it pretty much the same way as before except with Cliff, instead of Dave, on vocals.

Kate Bush

It was about this time that I was introduced to Kate Bush. I remember Dave Gilmour (of Pink Floyd) playing me a demo of 'The Man With A Child In His Eyes', and my only reaction was 'when do we start?' As it turned out, we recorded that song and 'Berlin' soon afterwards, when Kate was still only about 16. The same recordings were used on 'The Kick Inside', although the rest of the album was recorded some time later when Kate had finally signed to EMI.

Kate used the time between making those first recordings and signing up to very good effect. I think a lot of artists would have begun to despair or maybe thrown in the towel altogether, but she remained calm and during that time her writing matured a good deal: she wrote some brilliant songs.

Production

'The Kick Inside' represented my first venture into production, and oddly enough I didn't feel the need to do orchestral arrangements for every song. Some of the tracks on side two are more or less just piano and vocals, which is the way Kate writes them, of course. I kept them sparse because it was something of a change for me, and I think they worked very well on the whole.

From the beginning, Kate was very interested in the mixing and production side of things, and by the time we came to do 'Lionheart', she was assisting me to quite a large degree. I'm very proud of some of the things on that album, expecially the arrangements on 'Wow' – a lot of people reckon that to be one of the best things I've done.

I always thought Kate was one of those people who wanted to do everything herself, and it came as no surprise to me to see that she'd done the last album entirely on her own. She's very much a perfectionist, and a very talented one at that; working with her was a real pleasure, and I learnt a lot from it.

The Project

It was around the same time as the first Kate Bush recordings that the idea of the Alan Parsons Project was first mooted. I remember being very excited by it, because it was a completely novel concept: a group of musicians that was neither a rock band nor a classical ensemble in the conventional sense. It was a fusion of the two, and that was the most interesting aspect of it from my point of view.

There were problems, on the other hand. The Project was a very nebulous concept that the record company had a lot of trouble promoting. Unlike an ordinary rock band, it was practically impossible for us to take our act on tour because it was so complicated. Of course, we had a lot of offers – especially from places like Germany where our album sales are very high – but in the end the sheer complexity of the thing made it impossible. The problem wasn't just one of scale – although obviously carting an orchestra and a choir around on tour with you is never going to be easy – there were also problems with our own instruments.

For instance, we had an 88-note Fender keyboard connected up to trigger a 24-track tape-machine. the idea was to create a sort of 'mega-Mellotron', the difference being that because we were using two-inch tape, the sound quality was far, far better. However, the machinery was simply impossible to transport and it was problems of that nature that prevented us ever from going on tour, though there's an outside chance we might play live at some stage in the future.

EMI weren't very happy with all this, of course, and tried out some bizarre ideas to try and promote the Project. I remember that for 'Pyramid', they filled cinemas with strange, pyramid-shaped objects while the audience watched a film of the band and listened to the music for the album.

Looking back, though, you could say that it didn't matter how they marketed us, because our records have sold millions worldwide and that speaks for itself, really.

Recording was something of a problem with the Project, too. It would have been nice to record orchestra and rhythm section together but the practical problems are just insurmountable, particularly at Studio 1 at Abbey Road (where a lot of our stuff was recorded) where the desk has only got about 16 inputs. In the end we recorded the rhythm section first and laid the orchestra down afterwards, because on many of our faster, rockier pieces it's the band that carry most of the weight whereas the orchestra is just there to add colour, really.

Solo Album

My own album is something that I've wanted to do for a long time. I chose the Project material for several reasons. First of all, I'm very close to it and, having written it myself, I felt that if anyone should muck around with my arrangements it should be me. Second of all, I think the structures of the pieces themselves are very well suited to orchestration. For example, a lot of Eric's songs have things like parallel triads in the intros, and that sort of thing works extremely well with, say, 3-part strings, brass or whatever.

It's been very interesting working solely with an orchestra. I've tried to keep the number of electronic instruments down to a minimum, and in fact there's only about 40 bars worth of synthesizer on there; mainly Synergy, Emulator and my trusty old Prophet 5. What is interesting from my point of view is that some of these transcriptions are taken from Project pieces that were originally written on a Fairlight, for example, so in a sense I've reversed the current trend of synthesizing orchestral pieces. It's something that I feel could be done more often, because there's no doubt some people are writing the orchestra off already, which is a big mistake in my opinion.

On the other hand, some of the recent orchestrations of popular material have proved absolutely disastrous, because to my mind, something like Queen's 'Bohemian Rhapsody' really needs the sound of electronic instruments to carry it off. The orchestral version just sounds flat.

Imitation

What it all comes back to is the fact that you simply can't imitate orchestra sounds with electronic instruments. If you sample a viola and one note has a bow noise on it, when you play the keyboard all the notes have the same bow noise, which is obviously ridiculous. There are still so many synthesizer sounds that haven't been discovered or explored properly, it seems a waste to just spend your time trying to copy conventional sounds.

Similarly, even though the orchestra is a very powerful and versatile 'instrument' in its own right, it's folly to assume you can replace electronic instruments with traditional ones simply because you've got

Andrew Powell – in the studio.

Andrew Powell – arranger.

more people playing, because it just doesn't work that way.

I do think though that orchestras should be given more of a chance to work on rock records, because there's no doubt the Philharmonia enjoyed working with us immensely, and they were great fun to work with from my point of view, too. I think classically-trained musicians enjoy the opportunity to 'let their hair down' a bit, and of course they're very easy to record with because you simply present them with the manuscript and they play it – just like that.

Mixing the album presented me with something of a dilemma because I find that it's very important to get the balance between orchestra and rhythm section just right. If you sink the rhythm section too low in the mix they tend to start sounding like a cabaret outfit: you lose all the power and dynamics. Similarly, if you bring the band too far up, you lose all the power of the orchestra and it just becomes a sort of background texture, a bit like wallpaper, if you like.

One difference between this album and the original Project stuff is that it should be possible to take it out on the road. We've already got the agreement of the Philharmonia and the English Chorale (who appear on a couple of pieces) to tour England in the near future, and when we go abroad we'll either use the Philharmonia or, if they're not available, local orchestras. Performing live represents a very exciting prospect for me because it's something that I've done only rarely in the past, and I'm hoping it all comes together this time.

In The Studio

When I'm in the studio I like to keep things as simple as possible. That may sound like a contradiction in terms for someone who's earned his living as an orchestral arranger but it's true. I like to record everything as 'live' as possible. That's why I don't make a big thing of demos. I've just got a Fostex A-8 and matching mixer, a Great British Spring reverb and a pair of Auratones. Now and again I've been tempted to enlarge on it but I don't think I really want to.

Personally, I don't see any point in setting up a 24-track studio in my home and trying to compete with Air Studios and the like. For one thing, if you do install such a set-up you can be sure it'll probably break down at 3am with nobody available to come and fix it, and in any case, if I had that sort of facility at home I think I'd get swamped in all the recording technology and forget about the music, and that really is fatal in my opinion.

So I stick to professional studios for serious recording and use my home set-up purely for demos. I've got an old ARP

Odyssey, the Prophet, a Fender Rhodes and a grand piano at home, plus a Fender Stratocaster bass I use now and again. I never use synths to take the place of an orchestra in demos of arrangements, and a lot of the time all I put on tape is piano and vocals. I use a Linn drum computer for more up-tempo songs, but from my own point of view I find the sound it makes rather fatiguing, and I'd never use it on a record. I think it was a novel sound at one stage, but nowadays I find myself just waiting for it to make a mistake – a real mistake, not just a 3 per cent variation in hi-hat level.

The most important thing when making a demo – or any other recording, for that matter – is to get the simple things right first. It's much more important to get, say, a convincing vocal delivery down on tape than to spend ages messing around trying to get a digital delay line to do what you want it to do. Unless you know exactly what you're doing, complex electronic devices can be an awful lot more trouble than they're worth.

The Future

As for the future, I'd like to do another album similar to the last one, only this time using my own compositions as the basis instead of other people's. Writing is something I've neglected for some time – mainly because of having too many arrangement and production commitments – and apart from one or two Alan Parsons Project tracks, very little of my work has actually appeared on record. I've also got some TV sound track work in Germany coming up, plus on the production side, a new LP with Al Stewart and the soon-to-be-released Nick Heyward album."

E&MM

Yamaha DX1
Programmable Polyphonic FM Synthesizer
E&MM takes a first look at the latest prototype from the Yamaha factory

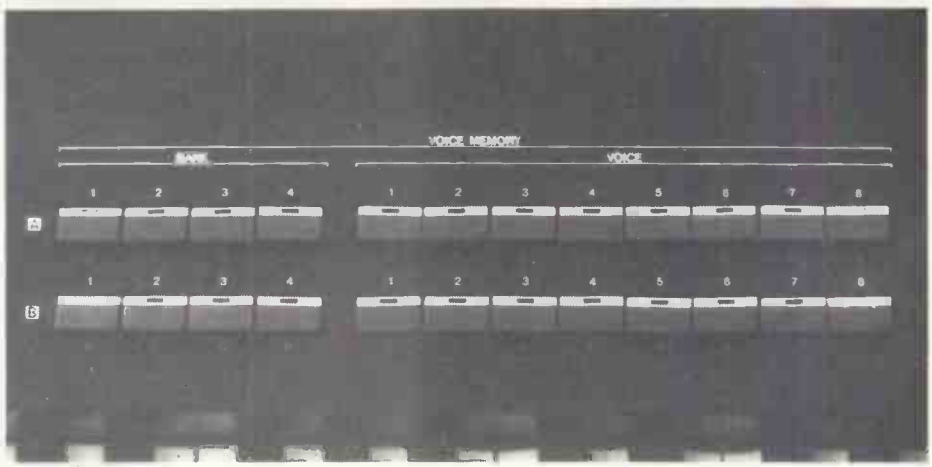
The DX1 is a 6-octave 73-note programmable instrument, with touch sensitive weighted action keyboard like the Yamaha GS1 or an acoustic piano. In terms of memories and voice, it's like the CS80, with two channels where you can select one instrument voice from each channel. In Single mode you choose one voice; in Dual mode one voice will go to the left output and the other to the right; in Split mode you select one voice for upper and lower parts of the keyboard, depending where you set the split point.

There are a total of 64 voice memories on board, but in practice, when you select a voice you are really choosing a 'Performance Program' memory which is a combination of two voices in whatever mode you've pre-programmed.

The voice instrument memory system and the way in which voices are produced are identical to the DX7. So you could easily go from the DX7 to a DX1 — in fact, it would be a good deal simpler because you've got a large display panel across the instrument indicating what is going on, as well as the central liquid crystal display (LCD) that is larger (40 characters x 2 rows) than the DX7. The Performance Program memory directly under the LCD is very important — for example, if you're in Dual mode, you're not just choosing two voices, you're also bringing in things like programmed vibrato speed for each voice, output levels, individual touch response on each of the keys, whether one voice is monophonic and possibly the other polyphonic, whether one's got portamento or not — these extra performance characteristics are all coming up in the 'Performance Program' (PM) section. So all 64 PMs could be set for totally different response in performance from the way the instrument is played. Even the Pitch Bend wheel can have its range programmed.

Performance & Voice Memories

Each PM is called up by pressing one of the 8 momentary switches in an upper 'Bank' row and one of the switches in a parallel lower row labelled 'Performance & Voices'. All the switchbuttons in these 2 rows



Voice Memory section.

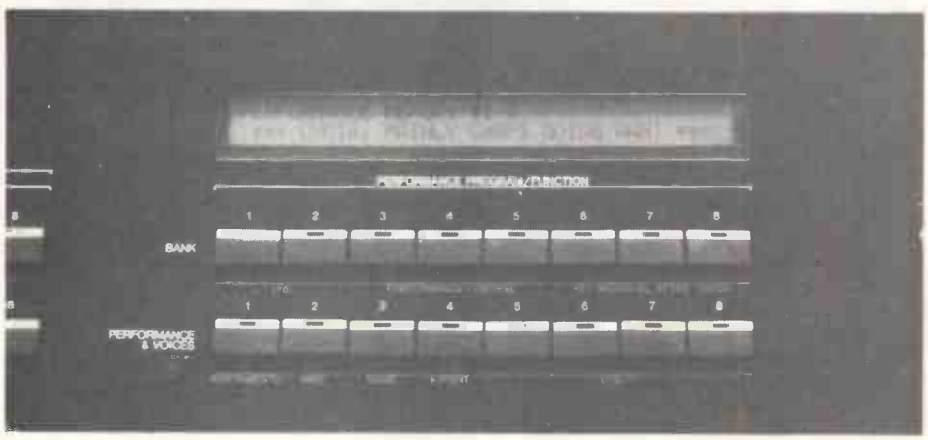
just above the keyboard, including the 'Voice Memory' group to the left and the 'Key Assign Mode' to the right, have built-in LED 'on' indication. The PM group also acts as Function select buttons for defining the performance parameters.

Some examples might be: take Bank 1, Performance memory 1 — the LCD shows a long title "ROCK PIANO WITH BREATH CONTROLLED BRASS"; or Bank 1, PM 5 with "CHOIR, MAINLY CHAPS GOING AHH!" A "ROCK PIANO" could be with 'TOUCH BRASS', the latter coming on with extra pressure. "ROCK ORGAN WITH OLD LESLIE" contains all the wheezes and thumps like the real thing! Putting together a string orchestra sound with different vibrato and timbres on each voice was particularly impressive and hardly needed the usual chorus effect in addition.

The 'Voice Memory' section is divided into two channels called Voice A (upper row switches) and Voice B (lower row). Using a similar means of selection as the Program Memory section, 4 Bank and 8 Voice switches call up any one of 32 stored sounds in Voice A and also for Voice B. Each of the stored voices can be your own created sounds or a set of 32 loaded into the appropriate voice via Cartridges A or B. These are inserted in the slots on the right of the control panel. A ROM cartridge contains 64 factory preset sounds in 2 groups of 32 that are selected by a small switch on the cartridge case. A flap on the slot closes the hole and nicely stops dust getting inside, while the cartridge is labelled so that it's obvious which way round to insert it. A RAM cartridge is used to store your own sounds — either in Voice or Program Performance form. All the voice-type cartridges you prepare are usable on the DX7.

When the Bank button in use is pressed again, the LCD reads a voice's chief features such as Internal Voice A1-8. B1-7, both polyphonic. etc. As well as stereo left and right outputs on the DX1, there is a third mono output for routing through effects.

Performance Program/Function buttons and LCD.



Performance Functions

Since two voices can be used to make the final sounds, one of these is examined at a time by simply pressing an A or B Voice button plus Function in the Key Assign Mode group to assign it to the LCD. Then the two rows of Performance Program buttons under the LCD become Function buttons.

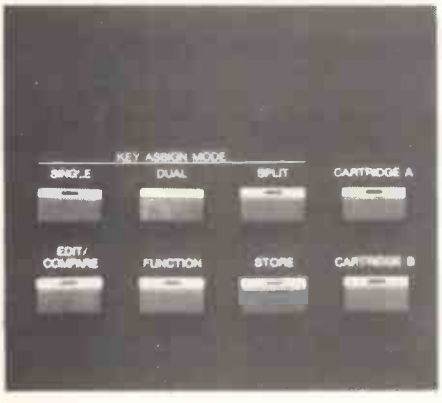
First, the LFO can be set with pitch modulation depth, amplitude depth, sensor (ie. velocity, pressure or breath) on pressing Bank button 1. Moving along the row, button 2 calls up LFO Speed, Delay Time, Waveform Select, Key Synchronizers on or off; No.3 looks at Performance Controls — Poly or Mono, Source Select (0 = internal, 1-15 = external MIDI channels allowing specific communication between chosen MIDI instruments and/or home computers). Also Pitch Bend Range, Step; Modulation Wheel Sensitivity, Assign to Amplitude and/or Pitch Modulation Depth or EG Bias; Foot Controller Sensitivity. Assign (as Pitch Bend); the same for After Touch sensitivity, and Breath Controller.

Key Individual After Touch sensitivity buttons follow — that means you can have pressure 'bringing out' the note or notes you press harder, with adjustable decay rate and overall key pressure. It is then assigned as 'Response' to one or more of the 6 'Operators'. (The DX Operators are the main building blocks for an FM Algorithm. The latter simply means a specific routing arrangement of the 6 operators that will construct

a particular range of sounds).

Extreme effects can be called up by increasing the output of a particular operator — say it's the lowest part of an algorithm routing (this is similar to the VCA in an analogue synth), then it could turn a 'timpani' into a 'side drum roll' and so on. This After Touch control is not on the DX7.

The lower row of buttons in the PM section allow examination and modification of Portamento, Glissando, Sustain, Portamento Pedal control on or off, and Time; 'Miscellaneous' is an audio output level attenuator to match up levels of each voice in a Performance Program; Oscillator Key Synchronize as on the DX7 makes all the 'oscillators' start from the same place in the waveform. Since this instrument is 16-note polyphonic, with sync off a smooth transition is made back to the first note. Otherwise a noticeable click would be heard, especially with sustain on. But there are advantages for using sync on with certain sounds and effects.



Key Assign Mode section.

Continuing, there is Program Output (the third mono output) on or off; Sustain Pedal on or off — that's useful for example, in Split mode, where you might be using a bass on the left and piano on the right, with the latter only requiring sustain.

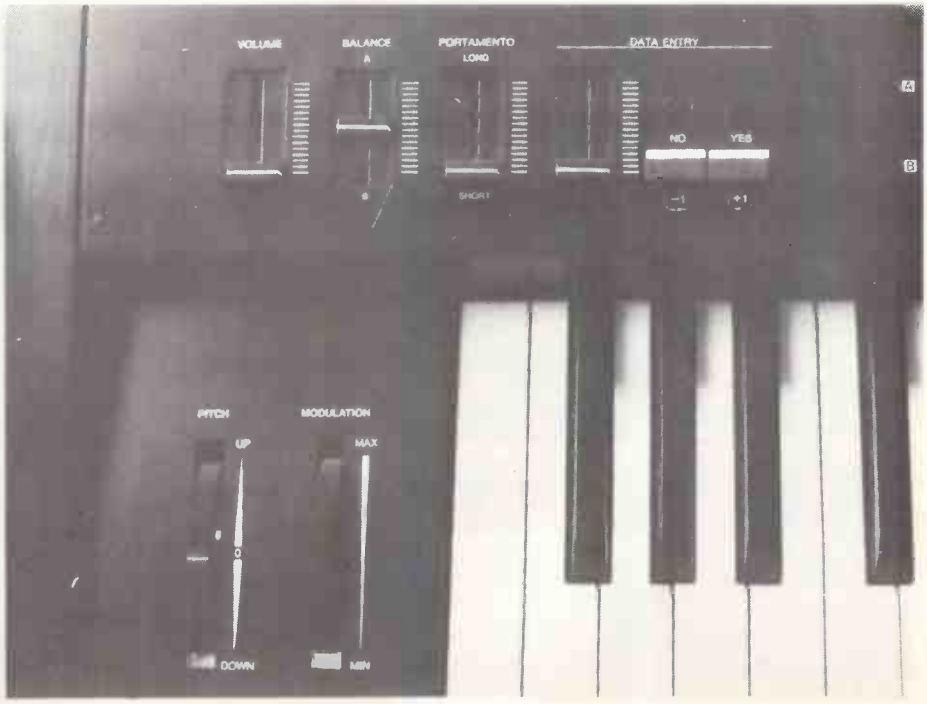
Next comes the voice Name button, which pressed once allows naming of each Voice using the upper buttons on the panel, and then a further press allows naming of the Performance Programs; Voice 'K Point' for Key Transpose, Split Point select, Performance Key Shift — this leaves the Voice Memory intact but lets the PM have a transposed setting of it.

Several 'Utilities' are then provided on the remaining buttons in the lower row for copying Envelope data from one operator to another, pushing Operator data into the memory, initialising a Voice Memory, scratching (deleting) all Voice Memories, Master Tune, Internal Memory Protect, Change Battery indication, and Recall Previous Edit data.

If you use the Save utility, it has a first option to 'Save all voices from Internal memory A into External RAM cartridge A'. If you punch in the 'No' Data Entry button, it tries again with 'B' into External B', then 'Performance Memories into External A', and finally 'Performance Memories into External B'.

A 'Load' utility has the same options in reverse. The cartridge can be formatted for receiving data and given an ID number. There are also a few extra assignments that

Performance controls.



Yamaha DX1 (Continued)

are only explained in the only currently existing manual for the DX1 in Japanese!

Each button actually has 3 or 4 of the functions accessed on further presses. A cursor moves along the LCD display to indicate the function selected.

General Functions

These are the controls located at the left end of the keyboard for Volume, Balance between Voices A & B, and an improvement over the DX7 is that Portamento is readily available with long to short adjustment rather than fixed on or off within the voice memory. Here, too, are the Data Entry controls: on/off, yes/no, or count up/down 1 step buttons, plus a slider that gives variable change over the whole numeric range of 0-99 quickly as well as up/down setting for on/off, yes/no.

Two wheels are provided for Pitch Bend +/-12 semitones range and adjustable pitch step (spring-loaded return-to-centre), and Modulation Amount (free movement).

You can also change any of the Key Assign modes at any time to Single, Dual or Split and you can select one of the voices directly from an external RAM cartridge, so a total of 128 voices are always available from the two cartridges.

The weighted action of the keys is, of course, a major performance characteristic of the DX1. Total weight of the instrument is not quoted, but anyone who has moved around a CS80 or GS1 will know there's a lot of kilograms involved to test the most athletic roadie!

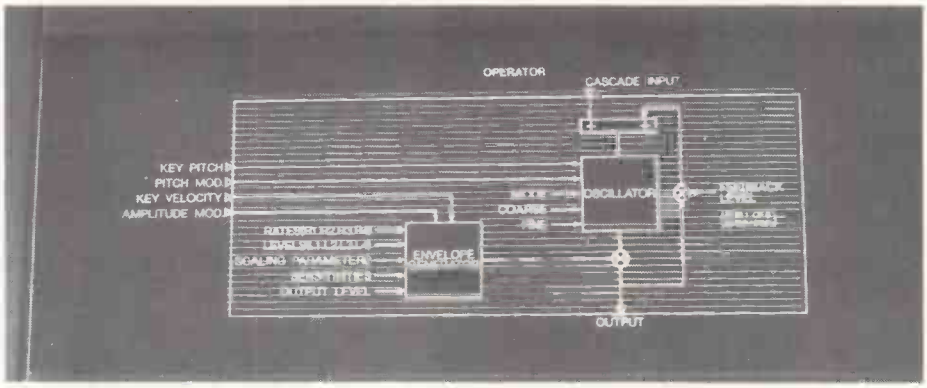
Voice Editing

The lower right group of control buttons called 'Key Assign Mode' set keyboard modes, allow storing of sounds, selection of cartridges A or B, and two main operations: 'Edit/Compare' and 'Function'.

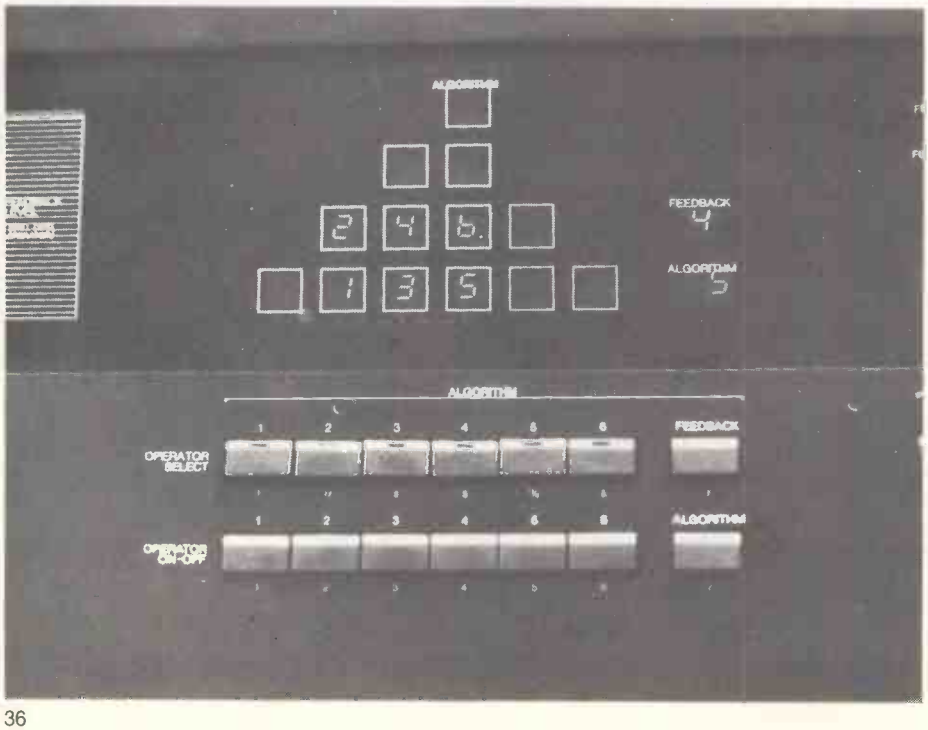
The Edit/Compare button lets you edit or create a sound, then a further press will recall the original sound you worked on for comparing and checking. Creating a sound in this mode shows another big difference between this and the DX7 — across the panel is a large plastic panel with screened writing within blocks that illuminate appropriately to show, from left to right: Operator make-up (this is actually a 'static' drawing for reference only), Algorithm indication (1-32) — square blocks show Operator numbers in the selected format linked by illuminated lines, plus Feedback setting (operators with feedback have a dot by their number), then Oscillator, Envelope Generator, Keyboard Scaling and Sensitivity settings.

Beneath the display panel are the relevant control buttons for changing these settings — here's the next big difference from the DX7, in that one button is provided for each parameter. Changes are therefore very easily made and do not require to be 'dialled up' on the LCD display. In fact, on this instrument, the LCD plays no part in the construction of a voice, and it's much more like working with a standard synth control panel. Only the Operator Select buttons have built-in LED indication because the other Edit buttons have settings shown on the main display.

Data entry buttons need not be used to change settings. For example, holding the 'Feedback' button down will show its value changing continuously from minimum to maximum in a cycling action. Each operator will have its own set of values as if it's a complete synthesizer in itself (although that is not really true in the analogue sense), and the whole display shows these values.



Operator display panel.



Algorithm display and controls.

Envelope Generator

So the Envelope Generator display gives information on either the Pitch Envelope or the Amplitude Envelope. Rates 1-4 and Levels 1-4 are shown as numbers (0-99) and the peaks of the envelopes as illuminated vertical lines between. Pitch is scaled by horizontal lines over +/- 4000 cents (100 cents = 1 semitone), and Amplitude is from - 96.0 to 0dB.

The point here is that parameters which are *not* shared, ie. are specific to a particular operator, are all shown; whereas parameters which *are* shared are in the Performance Program section already described.

Oscillator

The Oscillator section of the display shows the following: Frequency Ratio mode — a red dot here means that the pitch is related to keyboard pitch. Otherwise it will be a Fixed Frequency in 1, 10, 100 or 1,000 Hertz ranges that turns an Operator into a sort of LFO element.

Oscillator pitch is set by Coarse and Fine buttons and displayed as a decimal, with a Detune button for displacing pitch 7 steps up or down from the basic frequency.

Keyboard Scaling

This section has another unique display — it's a 'Level' graph with linear and exponential +/- curves drawn on it. A single LED then lights on the selected curves for left and right parts of the keyboard. The 'Break-

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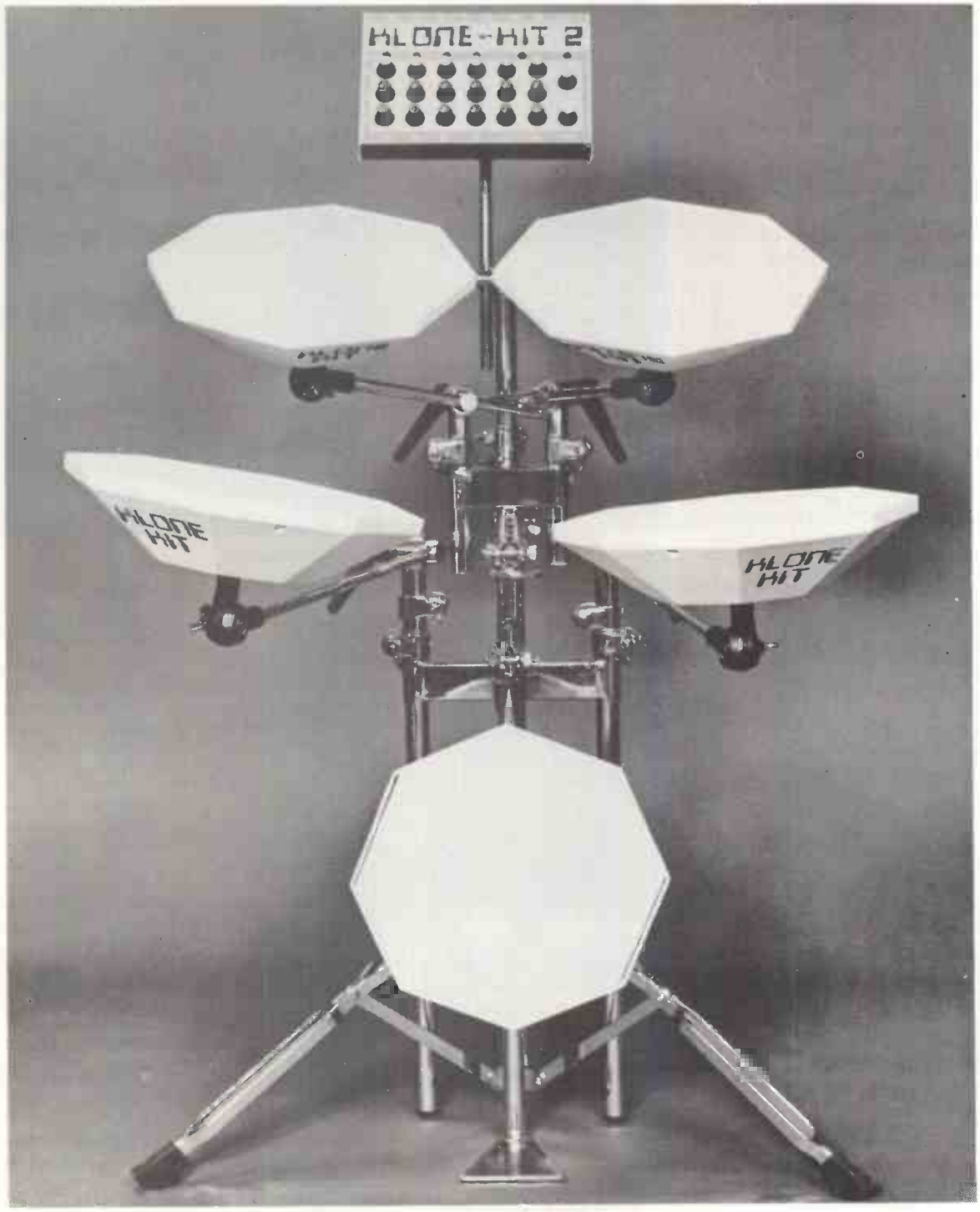

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Yamaha DX1 (Continued)

point' between left and right is also assignable as a keyboard note number. Value can be 0-99 for all 3 settings (even though the keyboard has only 73 notes!). Left and right curves are given as a Depth value to indicate the amount of change you want the keyboard to make (linearly or exponentially) as you play up and down its range.

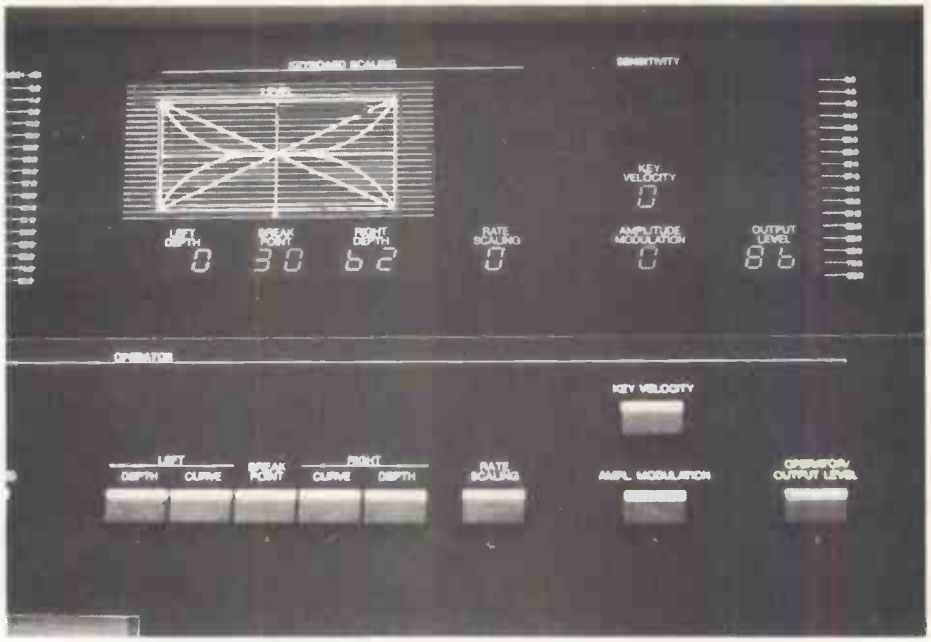
Rate Scaling

This is an important function as it 'tightens' up the envelope. It increases the Rate values (from 0-7), thus decreasing the time between the envelope peaks, always towards the top of the keyboard (as on a traditional piano).

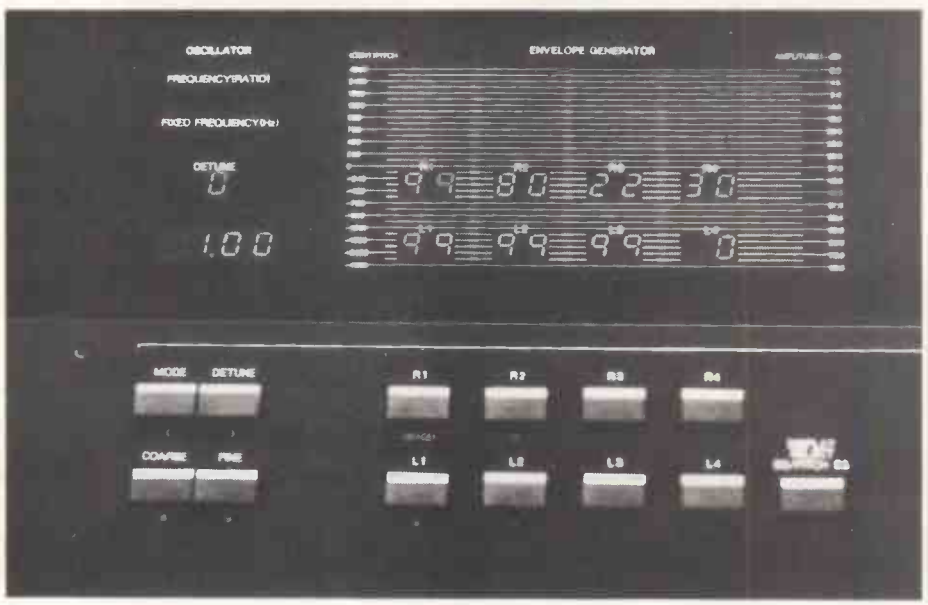
Sensitivity

Overall key sensitivity is adjustable (0-7). Incidentally, the highest number here is not necessarily the biggest key velocity *effect*, so you really have to work aurally to find the required control — unlike analogue synthesis, which is much more predictable.

Amplitude Modulation sensitivity (0-3) can also be set. At maximum on all operators, the sound will only come on when one or more of the assigned modulation sources are activated – the breath controller, foot control, modulation wheel and after touch.



Keyboard Scaling, Sensitivity and Output display and controls.



Oscillator and Envelope Generator display and controls.

Finally, the Operator/Output Level (0-99) is defined and also shown as a vertical LED display from -96.0 to 0dB.

DX Practice

The full display across the board is rarely used in performance — its prime use is for constructing a sound precisely with full visual confirmation by numbers and LED 'pointers'. The only exception would be when you had pre-planned some specific change in a Voice.

Most of the time in editing, the Amplitude Envelope will be used and the Pitch Envelope is for creating special effects.

When playing the instrument, the range of instrument voices that you can construct has to be heard to be believed and the DX1 can bring two of these together in unique performance formats.

Here lies the strength of the machine — but of course, you have to take the trouble to exploit all this potential — will you bother with breath control, will you explore the individual pressure action of the weighted keys, will you create new sounds when such a variety of good stuff is accessible from the ROM cartridges? Certainly the sound making can be like analogue synthesizers, but the scaling and FM synthesis in general brings us much closer towards producing sounds of the 'lasting' quality of traditional instruments.

It's very useful to have the LCD illuminated because this is where you'll be glancing during playing. Ordinary LCD's tend to require a limited viewing angle.

What this overview has not tried to do is explain how to program. We'll save that for another article!

Put the DX1 under MIDI control from a home micro and you're nearer to getting a picture of the tremendous possibilities. Price is to be somewhere between £7,000 and £10,000 – does that make it a dream machine for most of us? We shall have to wait and see. Still, it's encouraging to see that Syco Systems have taken on this exciting instrument – their expertise in the large scale computer/synthesizer field should put the DX1 into the right perspective.

I'll leave the final comment to Dave Bristow, Yamaha's chief demonstrator: "With the DX7 you've got the fundamental FM synthesis, with the DX9 you've got a smaller, simpler version of the DX7, and with the DX1 you've got a DX synthesizer that's a programmable GS1 with no expense spared!"

Mike Beecher **E&MM**

For further information on the Yamaha DX1, contact Syco Systems Ltd., Conduit Place, London W2 (tel. 01-724 2451), or Kemble/ Yamaha Ltd., Mount Avenue, Milton Keynes, Bucks MK1 1JE (tel. 0908 71771).

VIDEOTEK

VIDEO MAKERS IN ACTION

Top: Tripod camera, Mike Brennan operating recorder and monitor, with Gary Horton checking monitor.

Right: Three people with camera and mic, with Mike Brennan (hand on chin) directing.

Composing a VTR today has become a tougher project in some respects, due to the easy public access to the final product (from in-house training to musical promo tapes). Each video tape that is made, sold, and broadcast means a greater dictionary of terms to the viewer, in visual terms anyway. Is it an educated eye that savours the multiple super-impositions and the digitised effects or a merely 'entertained' eye of the masses?

There are management, production and engineering people in the world of straight television broadcasting who certainly place some distance between their product and the VTR. (Well, nearly anyone could hire or purchase a VHS camera and recorder then go out and shoot for a day, a gig, or a session, but to make a proper television broadcast one needs the resources and talents of at least six fully staffed departments: costume, graphics, make-up, scenic services, TV design and visual effects — just to DESIGN and PREPARE the thing).

There are obviously independent video production units who have the equipment that is up to broadcast specification; that is cameras, recorders, and editing equipment that are capable of producing a VTR that is 'good enough' to be broadcast on TV. For instance, the Watershed Arts and Communication Centre in Bristol houses the Watershed Arts Trust Video Workshop and production unit. These video makers have the equipment and human (ACTT members) capabilities and are aided by the British Film Institute (amongst other backers).

Mike Brennan is director of the video unit and Gary Horton is his production assistant. At the moment they use two cameras, a Hitachi SK 91 Hi band which is up to broadcast standard and a Sony XC 6000 which is something like £12,000 worth of camera. At the Watershed it is possible to study and use the video equipment in four day workshops at a cost of £175. More workshops are being planned for ethnic minorities and for women (presumably these fees will come aided or granted from somewhere!)

There is no studio at the Watershed but Mike and Gary's equipment may be hired for a basic fee of £150 per day for location work. This would include the camera, recorder, monitor, tripod, leads, microphone (Sennheiser 416) and batteries.

The hire cost does not include the fees of a technician (camera operator, sound recordist, etc. whose payment could be from £48 to £80 per day) though Gary does give plenty of help when required. Also important to the hiring of their equipment is some demonstrated knowledge for the proper use of it. Gary says that VHS camera and recorder experience can be helpful to give just the basic idea of handling the camera, but these people do regard themselves as specialists and the equipment they use takes some skill to operate in a professional manner!

Lighting for the VTR becomes as anything else a question of budget as well as aesthetics. The most simple lighting could be 800W 'redheads' with barn-doors and stands, and of course any video production could make use of dimmers, mixers and other stage lighting gear. Any lighting effect can be checked with the TV monitor and suitably readjusted or amended.

Work is being done at the Watershed right now to build a three-machine editing suite using JVC 8250s, plus an ABR 1 edit controller built by Paltex. There will be two IVC 8000 digital field stores and they will use a Crosspoint Latch 6112 vision switcher.

The techniques for recording a video tape can use pure electronic sources for the input or treat a camera recorded tape (or mix of several camera recorded tapes) with a large number of digital, computer effects. The list of effects and post production techniques is steadily growing but with the implementation of these effects it seems the importance of the basic performance arts might become neglected or placed in a lesser position.

Mike Brennan as a director sees and indeed stresses the importance of pre-planning in any video production: "One should have an actual mental picture of the final tape before beginning to edit any of it. So, from the end product back to the initial inspiration each location, scene, set, lighting effect, face, or costume produces a myriad of detail. And then, if it's a song that is being produced, it is important to discover the narrative quality of the song, as well as writing a script and story-board."

The number of cameras and camera operators available will be an obvious control on design limitations, but careful thought for the use, angle, filter, lens type of even a single camera position can be mapped out.

Ideas and planning cost no more than time and it might be helpful to fill notebooks with a lot of ideas and images, from colour scheme to character movement. The post production mixing and adding of effects should also be planned.

Film makers have long been concerned with attempting to translate dream into an audio visual public reality. Jean Cocteau's early film, "Blood of the Poet" may be the ideal as it seems to be able to synchronise imagination, and then design, into a complicated and technically manipulated reality. It doesn't matter if that reality lasts for three minutes or three hours of real time as long as the final mix is the one intended.

Amanda Stanley **E&MM**

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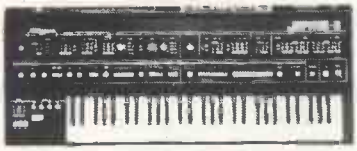

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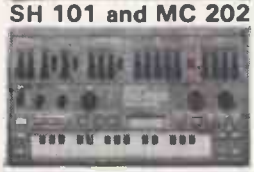

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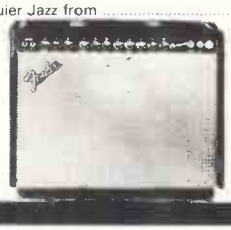

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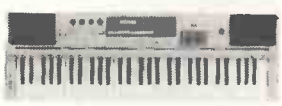

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Octave-plateau Voyetra Eight

Programmable 8-voice Synthesizer

From the seventh floor of a New York building, Octave-plateau Electronics Inc have conceived the Voyetra series as the 'next step in the evolution of electronic portable keyboards'. The basic idea is simply that the synthesizer comes as two separate units — a keyboard controller and a rack-mounted package that generates your sounds. That's not really something new, as EMS, ARP, Korg and Roland have all produced systems with separate keyboards in the past.

Nevertheless, the Voyetra Eight does have one very big advantage over these earlier machines in that it is designed to be *non-obsolescent.* The sound generating system comes in a very strong, portable 19" rack-mounting case and contains a micro computer that controls eight synthesizer circuits, all on removable cards closely stacked vertically inside. This allows up-grading of the system as OEI introduce new circuits, controllers for other instruments such as guitar and home computer links. The current keyboard controller, the VPK-5 is cleverly connected to the Voyetra module by a standard microphone cable (up to 20ft long) that lets you get on with the playing and still control the whole range of different programmable effects in performance from its four-way joystick and velocity and pressure-sensitive keys.

The other important feature of the Voyetra Eight module is that you get much more than what you see. The front control panel consists of 42 switch buttons (including numerical keypad) and 18 small pear-shaped rotary control knobs, many of which have multi-functions accessed in complete panel groups called 'Pages'. Three large pairs of red LED alpha-numerical displays and numerous red LEDs serve as indicators to Pages and functions in use, for complete editing and complex programming of sounds, arpeggiation, as well as real time polyphonic sequencing.

Surprisingly, the synthesizer VCOs, VCFs and VCAs are all analogue, although the reason for this is to keep the sound quality free from digital quantisation effects. The rest of the module is digital, including the ADSRs, LFOs and Sample & Hold, and the built-in micro has almost total control of the calibrated monitoring of the instrument, enabling storage of 100 sound programs. In addition, a 100-stage program 'Stepper' allows panel settings to be stored and recalled in any order with virtually all the performance parameters you require for each sound. These and other functions can also be dumped onto standard cassette tape.

Construction

The Voyetra Eight module is of sturdy construction employing 3 mm fixing plates for a 19" rack, being quite heavy at 16.8 kg, and measuring 483W x 133H x305D mm. It has open grilled top and sides for ventilation since it dissipates a fair amount of heat from its tightly packed boards. Each PCB card fits onto a mother board across the base and can be removed for servicing. All sockets are standard jack except for the remote keyboard and MIDI sockets which are XLR types. The latter posed a small problem since it's the only MIDI instrument we've used without 5-pin DIN sockets! But they obviously keep the professional quality in terms of on-the-road usage. Actually, the review model had no MIDI interface built in — this presumably plugs into the multiway socket at the rear.

The case is finished in light grey with black/grey plastic/mylar front panel and windows for the large ¾" LED displays. Switches are all small micro types, colour-coded blue, white, grey or red. A stereo headphone monitor socket is provided and the main on/off switches are also brought to the front.

Keyboard

The VPK-5 keyboard is very well made, with strong light metal case and hardwood end pieces. The 4-direction joystick is finished in chrome with 'left', 'right' selected assignment buttons (according to the Page you are using) situated above. A pressure sensitivity pot control is an unusual but useful extra (no — we haven't lost its control knob!).

The key action is quite firm and springy and did make the velocity sensitivity to be a little variable for dynamic control. Velocity can also programmed for various modulation effects and different keyboard 'tapers'. Pressure control can be varied to be immediately on with each key depression up to requiring hard key pressure. The joystick is a spring-loaded return-to-centre type, with left/right directions programmable for specific modulation effects (through what is called the Poly-Mod Bank System) and forward/backward pitch bend up or down a fifth.

Programming

There are two stages in Programming. First, you shape your sound using internal 'Edit Pages' and then store it in a Left Program memory or Right Program memory — holding up to 100 different programs in all if required. (In other words, Left and Right Program memories may hold the same sound or any dual combination of 100 memories).

Second, you use the 'Stepper' (termed a 'Program Programmer' by OEI) which allows you to set and memorise 100 combinations of the following controls:

Program No, Octave, Volume, left/right
Keyboard Modes
All Trimmer settings
Arpeggiator settings, left/right including speed etc
Pitchbend and pressure defeats, left/right
LFO1 and 2 sync
Velocity controlled Volume, left/right

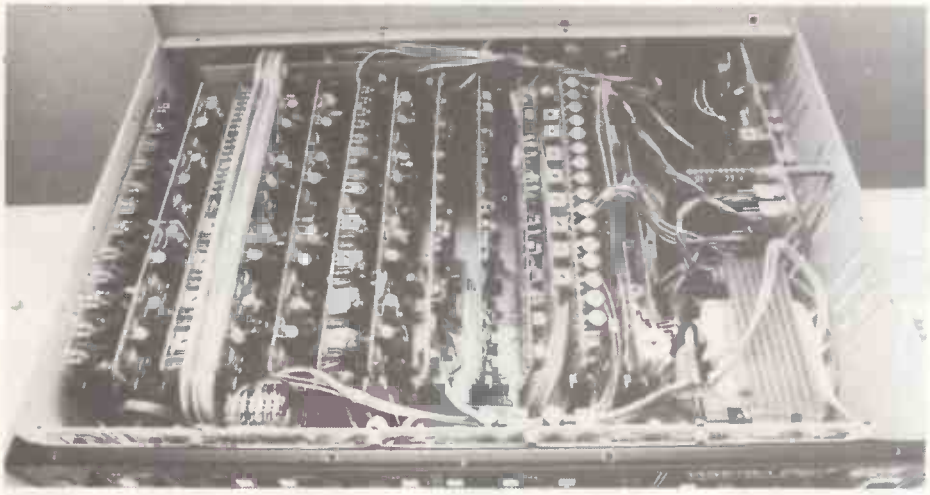
A most useful feature is that the Step programs can call up programs in any order, although in performance you'll be stepping through these 100 locations forward or backward (using the two keyboard switches or optional footswitches). Step memories can also be saved on cassette. An added bonus that provides on-board capacity for 300 sounds comes when you edit a Program and store this within a step. From a studio point of view, an external clock can be used and, in conjunction with a click track on your multitrack recorder, will allow complex layering of sound in sync.

Voicing

Each of the Voyetra's eight voices has two VCOs and a white noise generator that feed into a 4-pole, -24dB/oct low pass VCF and then into the VCA. Both VCF and VCA each have their own ADSRs and VCO1 may bypass the VCF to get a wider range of timbres.

Both VCOs have four waveforms than can be added together: sawtooth, triangle, variable width pulse, and suboctave square. The VCOs can be synchronized for dramatic harmonic effects and independent volume controls are provided for each enabling audio outputs to be switched right off when using a VCO as a modulation source. Ring modulation effects are easily obtained by sending the summed waveform output of VCO2 to the linear FM input of VCO1.

VCO keyboard tracking can be switched off to use it as a polyphonic LFO and both VCO pulsewidths may be modulated by either of the two LFOs and ADSRs. As modulation depth is variable, it's possible to make modulation increase with keyboard pitch. No combination of routing seem to have been left out and both VCOs can be



Internal circuitry of Voyetra module.

independently modulated from all four Poly-Mod banks.

Further refinements of control let the ADSR 'decay' and 'release' track the keyboard to give shorter times on higher keys, similar to acoustic piano and other traditional instruments. Key velocity can also control the attack rates. Unconditional and Normal modes for ADSR triggering give control of individual note decay and sustain can be switched out to give percussive ADR envelopes. Release times can also be switched out using panel or footswitch 'defeat'.

There are two LFOs, each having sine, sawtooth, triangle and sample and hold outputs that can be sent as modulation sources for all four Poly-Mod banks. LFO outputs can control VCO pulse widths and arpeggiator (Left Program) speed. LFO 1 has a variable delay and an additional square modulation output. Both waveform 'starts' from the keyboard can be sync'd, as well as left and right LFOs in Split Keyboard mode.

Poly-Mod Banks

Very comprehensive modulation is made possible on the Voyetra by the Poly-Mod banks, as they are called. The first important point to grasp with them is that its 8 modulation 'sources' are monophonic or polyphonic. 'Mono' sources are applied to all, eight voices simultaneously and are DC (for bending and sweeping effects), LFO1, LFO2 and LFO1 square. 'Polyphonic' sources are ones generated individually for each of the eight voices in the system, and include VCO1 and VCO2 summed wave outputs, ADSR1 and ADSR2. Any source can be inverted for reversed sweeps and so on.

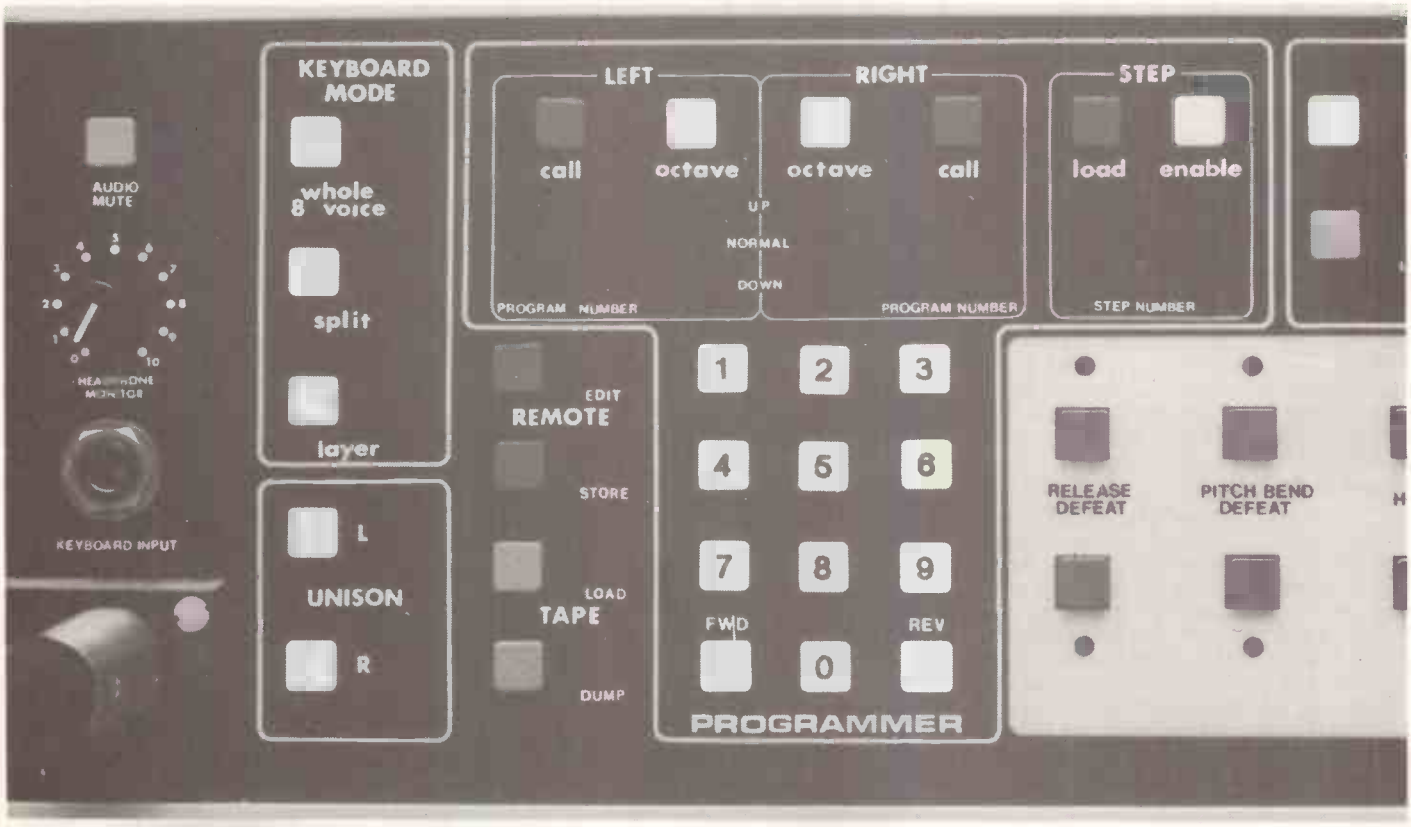
Each of the Poly-Mod banks 'sources' go to a 'controller' and then to any combination of 'destinations': VCO1 & 2 pitch control, VCF Cutoff and VCF Resonance. Mod depth can be set numerically from 0 to 255.

Performance Power

The real strength of all those modulation possibilities lies in the 'controllers': key velocity, key note control voltage, key pressure, joystick control, programmable foot pedal, ADSR1 and low frequency noise. Four distinctive modulation control situations can be created — not just a single complex one! With the Voyetra module's storage capability, you can call up the most spectacular mod arrangements in performance using the keyboard and a number of footpedals. You'll not be short on output volume either, as the Voyetra puts out a massive signal up to 20V!

Panel Pages

With Octave-plateau's claim that the front panel would need to be 17ft long to provide a separate control for every function, it's no wonder that they devised the *Paged Panel*



Left hand side of control panel.

Right hand side of control panel.

concept. Ten pages are currently available and more are likely to be provided in the future. The only snag with this arrangement is that the front panel legends only refer to the first 'Normal' page functions, so you have to keep checking the panel schematics for each page in the comprehensive instruction manual. But with continued use you certainly pick up the individual page controls as you go along.

Normal Page

This is the power-up page with functions as labelled and incorporates most performance controls for calling up programs and varying main parameters and arpeggiator settings using the buttons and rotary controls. The latter do not necessarily indicate the actual setting until individually operated to make an instant change to a parameter. Normally these temporary changes are lost once a new program (a sound 'patch') is called up on the LED displays in the Programmer section. Although the small pear-shaped knobs feels rather inadequate, there appears to be plenty of control available - for example, Release and Decay times extend to more than 1 min 45 sec.

Alternate Page

Entering this and the other pages is by means of 'hidden' functions. For this page for example, you press 'A440' and 'Step Enable' buttons together. This page transfers programs within the Voyetra's memory banks. (A rear panel memory protect switch is provided and memory is stored on switch-off by battery back-up). It's not just a swapping process, as you are able to edit a sound (jumping to other pages to do so if neccessary), store it in a new location, and leave the original intact.

Other functions control the Arpeggiator, as well as VCA velocity, key pressure and VCO1 detune 'defeat' (left and right programs).

The Arpeggiator has the accepted Up, Down, Up and Down and Random effects. More interesting is that speed can be remembered in a program 'Step' and left and right programs can have different arpeggio speeds, plus keyboard retriggering of both clocks — and even auto octave shift! External clock in and out is available too.

The VCF is unusual in that not only can the Frequency Cutoff be modulated by the ADSR and Poly-Mod banks, but also the Resonance (Q) control. In effect, the latter will allow sweeping changes of harmonic emphasis to the point of self-oscillation — some pretty original stuff can be made in this way. Keyboard tracking of the filter is also variable.

ADSR1 goes to the VCF and ADSR2 controls the VCA — this VCA also receives velocity sensitivity voltages for playing loud and soft on the keyboard. Both ADSRs can be assigned to the four Poly-Mod banks.

Velocity Taper Page

The 14 Program Parameter trimmers let you tailor the velocity control in a variety of ways. By striking a key yourself in this mode, a value of 0 to F (hexadecimal scale) will indicate the strength (or velocity) of your 'strike'. This can then be a guide for setting the trimmers (assigned 0, 1, 2 to A, B, C, D, E) so that a strike of 'A' intensity with trimmer A turned fully on will give full modulation of whatever your're controlling — dynamics, vibrato and so on. In this way, loud and soft playing can be reversed, or vibrato (or some other modulation) can be made to come on at only the loudest strikes.

This is an unusual facility and requires you to pre-plan all your programs carefully — if you don't write it down your're bound to forget what you set for one of your 100 program steps!

Poly Sequencer Page

This page will have a lot of appeal to real time players (as opposed to 'enter by music' musos). Rather than provide the individual 'tracks' to build up your piece, you can record sequences (poly or mono) on top of sequences onto two separate channels (rather like doing sound-on-sound taping).

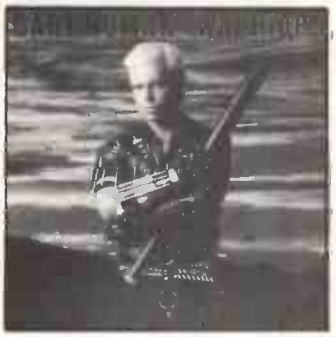
Once again, it is worth considering carefully whether the poly sequencer offers enough note storage for the kind of music you compose. For example, the two channels allow two separate sequences of 850 'events' but that actually means 425 notes each. It's also possible to record up to 1700 events (850 notes) in one Record sequence and footswitch control of start/stop is provided. The displays show the number of events left and on playback you can still play the keyboard along with your recorded sequence.

The sequencer will operate in the various keyboard modes available. These are Whole 8 mode, playing Program Right sounds; Split Mode, playing Program Left and Program Right sounds on opposite sides of the split point (normally split two octaves/three octaves over the five octave C to C keyboard, but redefinable in performance). Unfortunately the split point is not programmable and will default as just stated. Only four notes are available on each side of the split. Similarly, in the next Layer mode four notes each have two voices — giving the most variety of sound. Despite the limitations of four notes, I preferred to use this mode most of the time.

Unison mode is another very useful assignment because it can be used in Split as a powerful four voice mono lead with a chord accompaniment. With Layer and

RECORD REVIEWS

Singles



Gary Numan: Warriors
Beggars Banquet BEG 95

After what has been — by Numan's standards — a lengthy absence from recording 'Warriors' comes as a mild disappointment. With bassist Joe Hubbard sounding more like Mick Karn than Mick Karn does, the return of Cedric Sharpley on drums, and a swirling, atmospheric synth intro, it's not a very original single, though it's still unmistakably Numan. Fortunately, Bill Nelson saves the day with some splendid guitar playing, while the B-side, 'My Car Slides' is one of the most emotional songs Gary has recorded since 'Please Push No More' on 'Telekon'. The twelve-inch single features a double-length version of this track, so it could be well worth checking out.

New Order: Confusion
Factory FAC93

Since discovering the wonders of drum machines and sequencers, New Order have blossomed into a powerful and exciting dancefloor combo. This 'experimental release' (their words) sees studio mixing and editing techniques again to the fore, this time in the hands of respected New York craftsman Arthur Baker. The synth and vocal lines are simple but instantly memorable and eventually addictive, and one can't help but admire the panache with which the band seem able to make even the most straightforward melody come to life. Don't bother looking for a seven-inch version of this because, as with 'Blue Monday', there isn't one available; not that you'd want it anyway because some of Baker's extended re-mixes are sheer arithmetical architecture.

Midge Ure/Mick Karn: After A Fashion
Chrysalis FEST X1

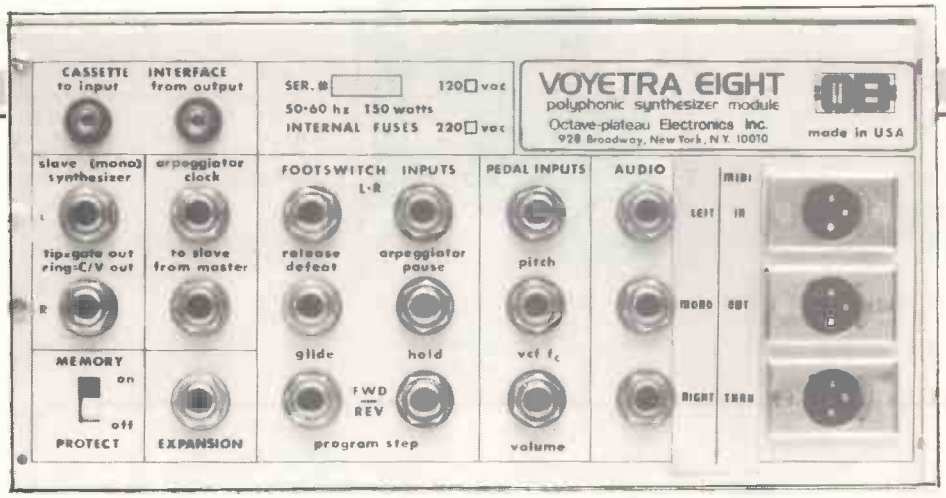
This isn't an 'immediate' song; you have to sit down and listen to it a few times before the blend of Karn's weaving fretless bass and the Ultravox vocalist's Fairlight violins begins to take its hold. Again, the melodies themselves are far from sophisticated, leaving it to studio editing and Ure's forceful vocal delivery to bring the track out from the sea of electronic mediocrity. Oddly the rhythm machine patterns and general production have much in common with Sylvian and Sakomoto's excellent 'Bamboo Music', and should this duet remain together, further fruits of their collaboration should be rich indeed.

Cabaret Voltaire: Crackdown/Just Fascination
Some Bizarre CVS1-12

'Crackdown' is the title track from their much-awaited debut album for Some Bizarre, fast and furious with haunting vocals, anarchic synth

playing and some beautiful string sounds towards the end, but it's the other side that's of most interest here. An immensely powerful Movement Drum Computer rhythm runs the length of the song (it lasts over eight minutes on the twelve-inch) and provides a backdrop to an assortment of lead synth, sequencer and string machine melodies and some suitably chilling vocals. Lyrically, Cabaret Voltaire remain angry, obscure and unapproachable, but their music — though still far from commercial — has become a good deal more listenable in recent months. If you've never liked their sound before give this one a whirl; you may be in for a bit of a shock.

E&MM



Rear connection panel.

Whole 8 you get 4 or 8 voices per note for thick cutting lead lines.

Glide (Portamento) and chromatic Glissando can also be used between notes and chords.

Back to the Sequencer! While you're playing away your sequence, you can be editing the sound and changing programs to vary the timbre, and looping is also possible, but relies on accurate use of the 'stop' switch at the end of the sequence — rather hit and miss in practice. Playback speed can be doubled, halved (from the keyboard buttons above the joystick if you want) or continuously varied.

Some very useful control routines are implemented: Auto goes straight into play after record; Overdubbing — bouncing from Channel 1 to 2 and back until the memory is full; Continuous Overdubbing — does all the switch over of both channels from record to play automatically; Auto-Continuous Overdubbing — will keep going through the overdubbing process while you get on with the playing; Stevenson Mode — this is perhaps the most powerful function as it lets you record a passage, play it back, record another passage, playback, and so on, all from one footswitch.

Sequences can then be stored on cassette tape using Load and Dump functions.

Edit Pages

There are six Edit Pages which you can cycle through using forward/reverse switches on the module or keyboard. Here you can create your Program sound patch by setting VCO tuning, volume, waveforms, VCF and ADSR parameters, and Poly-Mod banks A, B, C and D. The latter have slight differences in order to accommodate extra modulation controllers.

Editing and Expansion

Quick editing is provided by the Normal page, including one octave up or down for left or right programs. A Master Tune control sets overall pitch and, besides the internal edit pages, it's possible to go into external edit through the MIDI to display and edit programs and probably do more extended sequencing. OEI intend to provide soft and hard interfaces for Apple II, IBM PC and Commodore 64 (what — no BBC B or Spectrum?).

Tape storage can be for programs, steps, user tapers for velocity, and sequencer notes. Individual programs can be dumped too. Tape Dump takes 1 min 20 secs and disables the keyboard.

And if you're worried about tuning you just press the Auto Tune button, which goes through a visual diagnostic check as well.

There's also an Auto Mute button for cancelling main audio output while you monitor on headphones.

Rear Panel

This final audio output is sent to stereo left or right, and mono output sockets, the latter being a mix of left/right programs. In Whole 8 mode, voices are panned across the stereo field — set by means of a row of presets inside the Voyetra Module.

There are footpedal inputs for Pitch Bend, Volume and Filter sweep. Stereo footswitch inputs for Program forward/reverse, release defeat, hold, glide, arpeggiator pause, and there's an expansion socket for another Voyetra Module to be controlled from the same keyboard for 16 voice operation. There's also CV and Gate left and right outputs to drive two slave mono synths (1V/oct types), plus sockets for cassette interface and arpeggiator clock.

Conclusions

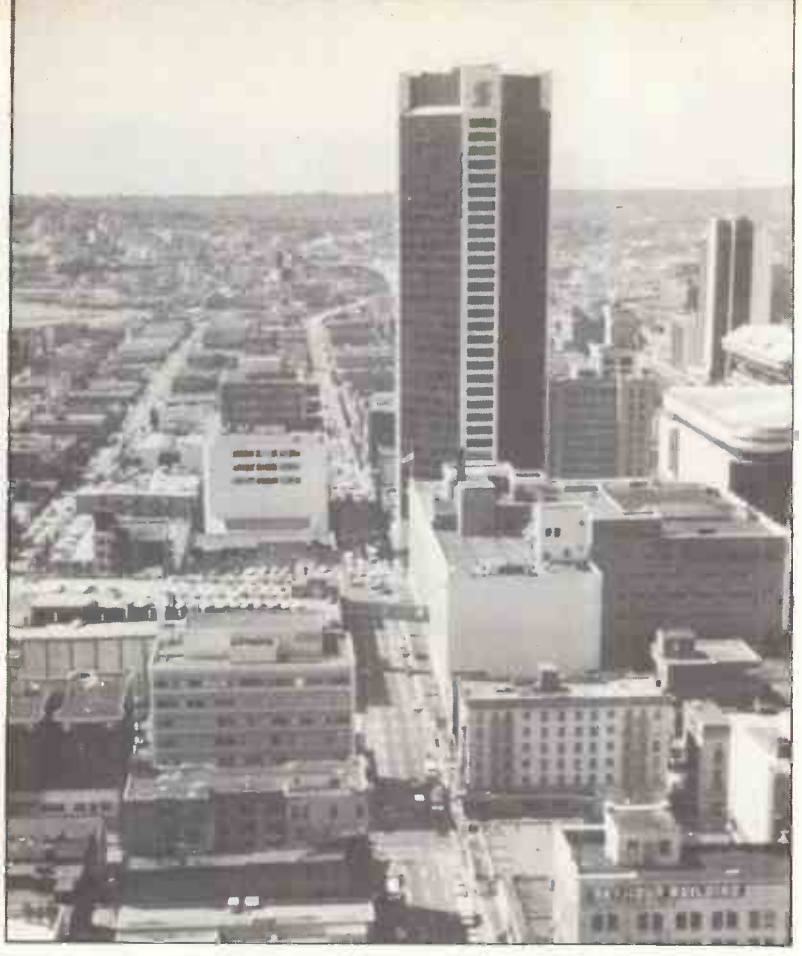
There's no doubt that this is a very desirable instrument by virtue of its extensive synthesizing capabilities. The sounds are still very much 'analogue' and retain the traditional warm, fat and punchy qualities we've come to expect from the analogue synths. Background noise is very low and the instrument is ideal for studio recording. The MIDI interface and software for Apple II is now available (an IBM version will arrive in late October), and is claimed to work on all other MIDI instruments!

The system is professionally built from beginning to end — but it is in the expensive class at £3,750 including VAT. If that doesn't deter you, then you'll enjoy an instrument that is very playable and highly orientated towards sophisticated performances.

Mike Beecher **E&MM**

The Voyetra Eight is available from Computer Music Studios, 62 Blenheim Crescent, London W11. For further info or demonstration telephone 01-221 0192.

Voyetra Eight.



Downtown Vancouver.

The Institute of Communications Arts Vancouver Canada

With the plans for cable and possibly satellite TV well under way in this country, much attention is being focused on the USA and Canada where a typical viewer has the choice of over forty different stations. The resulting demand for personnel in all branches of the broadcasting industry has inspired many schools and colleges to start courses for young people seeking a career in the booming entertainment business, be it music, TV or video.

Such a programme is run by the Institute of Communications Arts in Canada, which operates a one year course entitled 'Modern Communications Media'. Situated next door to a garage selling English sports cars in downtown Vancouver, thirty-two aspiring young Canadians take classes in a variety of subjects from video and audio engineering to photography and synthesiser techniques. The emphasis has always been on hands-on experience rather than formal teaching as Neils Hartvig-Nielsen, a director of the institute, explained:

"The whole thing started a few years ago when a group of us owning an 8-track recording studio came to the conclusion that we knew very little about the finer points of engineering and production. So we hired one of Canada's best sound engineers. Keith Stein, booked a band in for a session and simply sat back and watched. The idea worked very well and generated a great deal of interest so we formed the Buttertree School of Sound to run similar teach-ins for other local musicians."

And how was the ICA formed?

"Well, after a while it became difficult to enlist the help of various companies and expand the school unless we became a non-profit making educational establishment, so we sold the studio and became the ICA. Our training facilities are now, for the most part, actual operating commercial establishments, which means students practice on relevant up-to-date equipment and are often walking in as a major act walks out. Local session musicians are used for the classes as they help keep things running smoothly and are always glad of a bit of free studio time."

What are the courses available?

"Every student must complete classes in Music Business, Audio Engineering, Sound Reinforcement, Video and Record Production. The music business course deals extensively with everything from basic book-keeping to graphics, promotions and contract law through a series of lectures from guest speakers in the industry. In addition to these courses, two options must be chosen from Photography, Synthesiser Techniques, Marketing, Journalism and general Communications."

Anyone is eligible for the programme although Neilsen is quick to point out that initiative and an outgoing attitude are more important than any technical or musical background.

"In a field which in the past has always been rather closed-shop, presentability and flexibility are valuable attributes. We are looking for the artist/producer type who is aiming to freelance in TV, radio or music and will therefore benefit from having as diverse a background as possible. That's the aim of the courses."

How do you see the future of video developing?

"Well the quality of most of our TV stations leaves a lot to be desired. As the number of channels increases with satellite TV then stations are going to aim at highly select audiences — for instance one channel may show only heavy rock videos, another electronic music. This will create a market for both low budget recordings and very high quality productions using all the latest techniques. You must remember that the combination of 'Sound and Vision' in modern music is still in its infancy, and although the home video market hasn't taken off as wildly as expected, the course puts a lot of emphasis on this area. In the next few months we hope to start work on a microprocessor system linking a video recorder and a synthesiser in real time to enable soundtracks to be dubbed more easily."

So you think synthesisers are going to play a major role in the entertainment industry?

"Absolutely. One only has to consider the increasing number of film soundtracks (the success of Vangelis springs to mind), TV ads and of course recording artists that are using them. I

try to acquaint students with polyphonic instruments as soon as possible because once the development costs have been paid then they should drop in price in the same way that small synthesisers did. Fortunately a number of synthesiser manufacturers are very interested in sponsoring educational schemes — even at High School level — so we have access to some pretty expensive instruments."

And do you feel that you can teach someone to be a useful keyboardist in under a year?

"Yes, because modern music is depending more and more on skills in production and sound engineering than on instrumental techniques. It's quite likely that the virtuoso of the future may have spent three years studying electronics rather than practising chromatic scales, and his/her instrument may be a microprocessor."

But is this real art or just computer programming?

"Well, some might say that if engineering doesn't become an art in itself then society's got problems! More to the point, almost everyone in entertainment has to make a distinction between art and business at some point — it's a very personal decision and I certainly wouldn't prod anyone in either direction."

Subject to passing the odd exam and attending all their chosen options, students are awarded a diploma at the end of the year and then have to look for their first job. Neils and his fellow directors have been responsible for compiling and publishing a 'Who's Who in Music' in Western Canada, presumably gaining them a vast number of contacts in the business and thus helping their young proteges off to a good start. Opportunities in independent sound recording are much the same in Vancouver as in any English city; it is in TV and associated video industries where the vacancies exist, and in this area we can expect rapid developments on our side of the Atlantic.

ICA studio control room.

Unfortunately the timing of our visit did not enable us to watch any classes in action, but Neils showed us round the local studio complex, conveniently only a block away, where the sound recording course is run. "All the best desks come from England", he said playing with the Trident mixer, so I assured him that all the best videos would too. Certainly whatever the Government's final decisions, the advent of cable TV in this country should open up many interesting possibilities for anyone considering electronic music and video as a profession. Roll on Channel 40...

Paul Carnell **E&MM**

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Fender Elite Precision Bass 1

In an attempt to prove to the world that although the names get longer, the product gets better, and at the same time explain why they'd dropped their ordinary standby lines ie. the Stratocaster, Telecaster and Precision, Fender invited me along to their recent Hilton Hotel launch to find out what the fuss was all about.

Aside from myself, other luminaries seen checking out the goods included, Andy Summers, John Entwistle and none other than Jimmy Page himself. As Pagey is not exactly noted for visiting Trade Events, I assumed something was up.

My suspicions were confirmed when I learned that some weeks later a gold Rolls Royce belonging to John Entwistle, who incidentally does not drive, turned up at Fender's Enfield HQ to borrow a clutch of their new Elite series basses for further inspection.

It seems that in a moment of madness, all of the standard models I've mentioned, have been replaced by the more expensive active EQ Elite series along with an improved passive range, called the Standard series, that cost less than the models they've replaced. In the Elite Precision alone, there are no less than 10 models which include variations in maple, rosewood and walnut necks, gold parts, fancy finishes, fancy cases, one or two pickups etc.

The bad news is that it's no longer possible to buy a Precision bass with a rosewood neck unless you're prepared to fork out for an Elite.

Innovations

Elite Stratocasters incorporate many innovations along with active electronics, such as 4 bolt microtilt neck adjustment, a 2 way concave – convex truss rod system Fender call the Biflex, TBX and MDX tone controls and a new Freflyte tremolo system that works on a knife edge principle. Their new Torq Master tremolo arm snaps in and out so you no longer have to unscrew the arm or put pressure on it when you close the case. Further items include the top loading of strings, straplocks, and a carrying case Fender call the 'Voyagair' which looks a lot more comfortable to sleep in than the bath ever did.

And everything but everything bearing a fancy name has 'patent pending' slapped after it. Remember Fender have been caught out in the past. This time they're taking no chances.

The Elite Telecaster has many improvements and one major fault. It no longer sounds like a Telecaster even though it looks like one. Single body edge binding has been added, and the pickups on the Elite are a pair of Fender's own new humbuckers. The guitar plays and sounds like a bitch and if I ran the show I'd have changed the body shape and launched what I believe could have been a totally brand new model for the catalogue. I have a slight reservation here, I'm not too sure if I like the optional stick-on adhesive scratchplate. Do be sure to call Fender for their advice on what to do when you've removed large chunks of finish after trying out this piece of new technology.

Broadly speaking, I've covered the range above and now I'd like to select the Fender Gold Elite Precision Bass 1 (pause for breath) and review it for you.

Elite Precision

With a 34" scale it's exactly the same length as a standard 'P' bass. It has one split pickup in the regular position, although Fender do offer another version with an extra pickup situated near the bridge, called the II, for the sake of brevity.

The maple neck with black dot inlays is extremely cambered, though the width of it has been returned to the same size as was used on vintage 'P' basses. It's a very thin comfortable neck, without the sharp edges that plagued their Bullet range.

Now the real focal point of interest with this neck is a new truss rod, called the Biflex system. This offers not only convex neck adjustment but concave too, should you require very light gauge strings on the instrument, and a very close action, which incidentally on this instrument is rather good. A central pivot on the Biflex truss rod is the piece of technology that allows you to bend the neck in either direction. This is achieved by inserting an Allen key into the headstock, directly above the unit.

Micro tilt adjustment is there to offer adjustment to the angle of the neck without the need to add shims (slivers of wood). The difference between this new 4 bolt and the older 3 bolt system, is added stability, an extremely sore point with owners of the infamous 3 bolt action.

The neck sports 20 medium size, conical frets and the neck fit is good – not always the case I'm afraid. Machine heads are of a new type produced for Fender by Schaller, finished in gold, and very responsive if my test sample was anything to go by. The headstock is topped off by a single gold circular string guide and a serial number, which I'd prefer to see on the neck plate, but only because I'm a traditionalist.

Features

When it comes to finishes on the Elite range, it's Xmas. There are just so many choices. For example try Natural, Arctic White, Black, Sienna Sunburst, Brown Sunburst and Pewter. More expensive custom colours include Candy Apple Red (which is the colour of my Precision 1 here), Lake Placid Blue, Candy Apple Green which is a genuinely successful attempt at a new colour and Aztec Gold – not forgetting transparent Emerald Green and Wild Cherry. If that's not enough for you, how about an Elite Precision 1 in American black walnut, or one of the exciting (according to Fender) new Stratoburst finishes in Black, Blue and Bronze. These latter hand airbrushed colours fade from black or blue to metallic silver, or from bronze to gold. Fender are obviously trying to please and I'd suggest there must be something there for everyone.

Body weight of the Elite Precision 1 is about medium for a 'P' bass, helping it balance perfectly. The contours are in the usual places and access to the uppermost frets is as good as it used to be ie. very good.

A new feature here is a different type of recessed jack socket that basically look a little smarter than the older type. Strap-buttons have been replaced with straplocks mainly because £774.92 is a lot of bass to

drop on the floor. The battery plate at the rear of the Elite Precision 1 is recessed, making it in one breath a visual treat, and a pain for overworked roadies who may have to waste valuable seconds trying to dislodge the thing, in order to replace a dead battery (9 volt of course) that should last you six months.

The scratchplate is triple laminate white/black/white, and it's affixed by 13 gold, Phillips head screws. Like an ordinary Precision, this one owns single volume and tone controls, the difference being that the Elite Precision has a central detent position between treble boost and bass boost. By the way, if you're into rubber, and some of us definitely are, each of these knobs carries a black (very important that) knurled rubber edge to it.

The bridge on this bass is an extremely chunky-looking affair, gold in colour, and actually holds the six separate bridge saddles offering two-way adjustment for action and intonation between its jaws, therefore preventing the saddles swaying from side to side. Each saddle carries a fine tuner now which permits slight alteration to the pitch of the string without removing your left hand from the neck. Just like the Steinberger tuning system, this one is affected by using the right hand.

Sounds

The pickup on the Elite Precision 1 is shielded in white plastic and described as the "new, noise cancelling, split single coil pickup" with "less hum and noise interference": a claim that needs substantiating.

On plugging in and playing this Fender Bass 1, the previous claim proves to be partially true, and it's a very difficult claim to verify in the circumstances, since active electronics have never been renowned for their quietness.

With the tone control in the centre detent or flat position, there is a small amount of hum and hiss. With the tone control in the full bass boost position there's none whatsoever, and very little of anything else I might add. However, on rotating the pot a fraction back towards the central position we have a very attenuable sound that continues past the flat position towards the full treble boost mark. I say 'towards' because the usable tone spectrum finishes some time before the full treble boost position, due to an inordinate amount of hiss and hum caused by lack of earthing, and active electronics.

Conclusions

What the bass lacks from my point of view is hardness at the bottom end. Instead we're greeted by wooliness which won't do. Also, I'd like to hear a little more warmth in the whole of the tone spectrum, something that is available on the ordinary 'P' bass. Although it's very difficult to provide on a bass with active electronics, it's not an impossible feat to accomplish either.

Don't get me wrong, I do like the tone on offer, I only wish it could be expanded upon to encompass a little more sound which I've come to expect from a bass that costs £774.92 including VAT.

Max Kay **E&MM**

Test amplifier: Fender Sidekick Bass 50.

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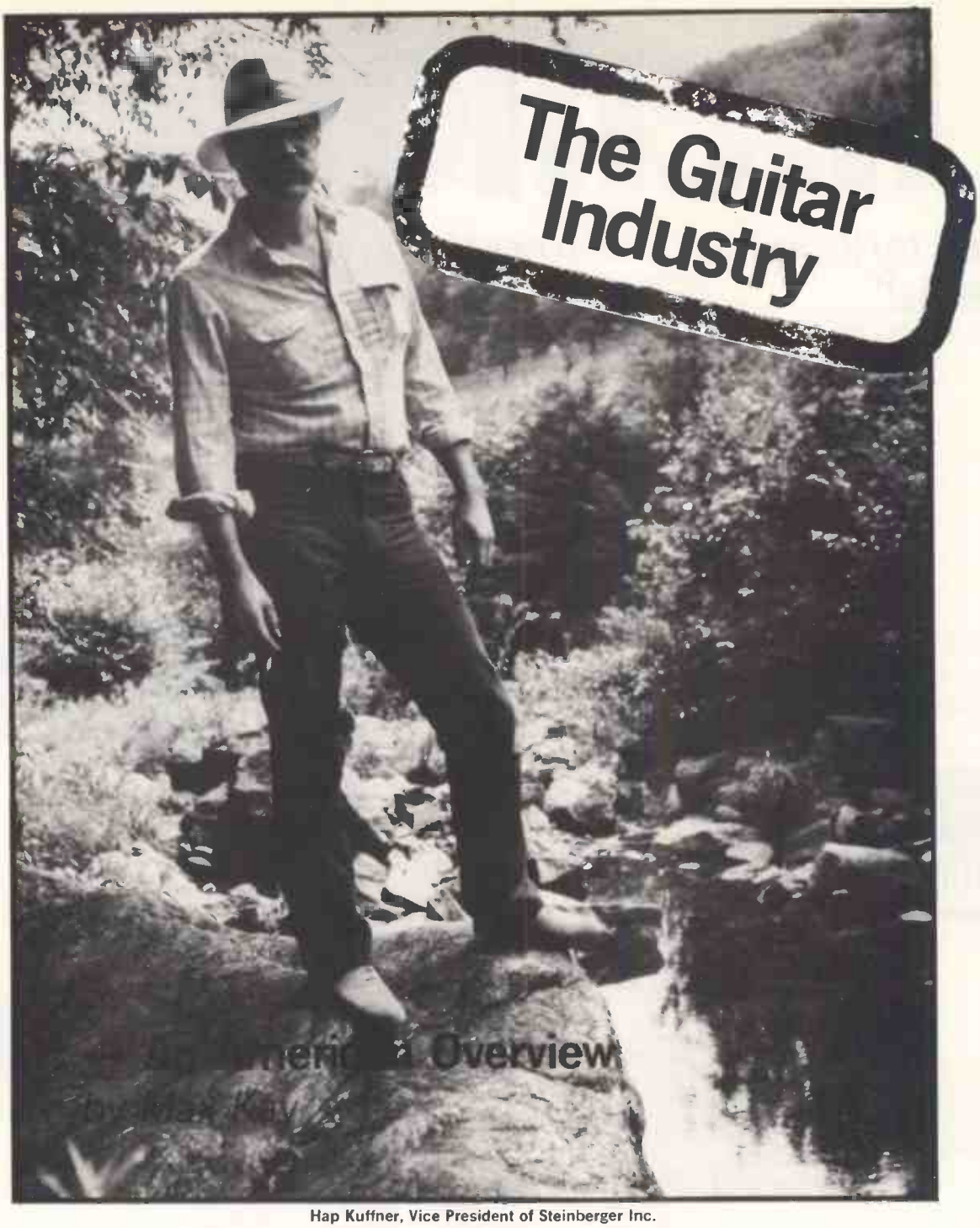


Hap Kuffner, Vice President of Steinberger Inc.

How many more times do we suffer in silence as we hear yet another musical instrument manufacturer/wholesaler/dealer, wheel out the by now, well worn phrase, 'The market is dead'? Who are these people, what have they got to offer, and yet more to the point, why are they still in business?

To find out more about the supposed decline and fall of a business that's receiving far too much lip service of late, Max Kay spent several hours in the company of Hap Kuffner, Vice President of Steinberger Inc., to get an American viewpoint on a situation that is not only affecting the British way of life, but many other nations also.

Kuffner, who's 36 years old, started up in the music business in 1968, packing boxes for Fender. In 1971 he and his partner Stanley Jay formed Mandolin Bros, a musical retail outlet specialising in acoustic instruments on New York's Staten Island. With typical nerve they began by pooling $212, bought two bags of banjo parts and they were in business.

Hap Kuffner made his exit from that company in 1980 to form Steinberger and later sold out his interest in Mandolin Bros. At this point in time he owns a company called Kuffner International which carries out the marketing and all the international sales for brand names, such as Spector, Steinberger, EMG and is just about to begin work as a consultant to Trace Elliot with a view to breaking that product in the U.S. marketplace.

His work involves travelling the world extensively which has meant that visiting music stores and trade shows has become a way of life for him. Kuffner, who is instantly recognisable at any of these events, is possibly the easiest person to spot at the Frankfurt and NAMM shows due to his flamboyant style which manifests itself in a three piece white suit, white hat and handlebar moustache.

After many visits to England in the past, he's come to the following conclusions, which as he's quick to point out are not aimed strictly at the English but anybody to whom this stream of consciousness is relevant!

Problems

"Most wholesalers, manufacturers and retailers fail to be successful through sitting around worrying about problems, through being afraid to take a chance, through indecision — that's how businesses and markets fail, not by going all the way out there and reaching for it.

"It seems to me that a lot of people are at the end of the period I call 'phenomena time', which was created by the Beatles and a lot of the groups that came after them during the height of the teen years of the baby boom.

"You can sell a refrigerator, a car and food, to any human being that has the wherewithal and money to buy them, but the musical instrument is not a necessity for a human being in order to live. Without music on this planet I don't wanna be here, forget it, because this planet's in bad enough shape as it is. Music must continue to exist and therefore it must be sold.

"In 1962 or '63 at the height of the baby boom teen years, the Beatles broke on the scene and every kid decided, 'I don't wanna be a cop, or a fireman or a truckdriver, I WANNA BE A BEATLE. I wanna have Rolls Royces, cash, jets, guitars, drums, basses and keyboards and be famous!' And so all the teenagers decided to become musicians. So you'd open a store, stock it with 3 or 4 instruments and the world rushed in to buy an instrument.

"That was a phenomena, now it's OVER! At that time Ludwig was making the Ringo Starr drum set, I think they were working double shift, six days a week in their factory and couldn't fill their orders. Hofner solid body basses? They couldn't make enough. Rickenbacker guitars? They changed from a very little known Californian company into a huge name at that time... because of the Beatles. Rock music became very important and rock 'n' roll instruments sold very easily, and these instrument companies had enormous growth, people were rushing and flocking to buy instruments and it interrupted the previous cycle of 'cradle to grave' selling. In the past when children were born, and went to school, they became involved with music, music was taught in the home and music became a part of their education so that they'd continue with music, not to become famous or rich, but to be a better person, or a more enlightened person.

"So what happened was, the typical selling of music, selling of instruments was interrupted by a phenomena which by 1976 had crested and died, and here we are 8 years later and everybody's moaning and groaning 'instruments don't sell!' You have TO SELL THEM, you have to find a way to sell them, you have to look at your customer.

"Why play an instrument? It makes you deep, it'll make you mystical, it'll make you an open book, it'll make you spend more time alone in a room with an instrument by yourself, it'll make you spend time in a crowd, it'll make you sexy, it'll make you a degenerate!! You have to find the persons, identify and use a way to get that person to buy an instrument, because without instrument sales, there's no music, and without music, this planet is totally in the toilet. If you can't sell musical instruments, and you're sick and tired that nobody rushes in to buy instruments, sell fish, they'll buy it. Don't sell instruments, pack it in, change your store to a fish store, you'll probably do quite well if you have some chips and wrap it in newspaper.

"Number one, make your decision. Are you in the musical instrument business for the long haul, or has it just been a fad? If it's a fad, get out, believe me you won't be missed, there's a bunch of people who will take your places, who believe in music. Only people who believe in music will survive in this business. You can't become filthy rich in this business, you can have a good living selling instruments and it's a great thing to do with your life. If you're in it just for the money, and there's no money, get out, go sell shoes, or fish or motor cars, or gold or anything else and start beating it to death. If you believe in music, and you've dedicated your life to sales, then number one, if people won't come to you, go to them.

What To Do

"When is the last time you went out to a concert? When is the last time you went out to see Joe Blow's band playing the garage or a pub? When was the last time you went out there to find out what musicians really needed? You know, you walk into a bands' rehearsal and you look at their equipment and tell them that they may need this, that, some fixups, some repairs, some patch cords, or an amp's maybe broken. Show them the new technology. They may be very interested in coming into your store to see that, but don't expect them to walk into your store and ask for it. If you don't educate them, nobody else will.

"Number two, go to concerts. If you don't attend 2 or 3 concerts a month, then maybe you don't care about music, and it doesn't have to be rock concerts. Go to pop concerts, go to folk concerts, go to classical concerts, whatever type of music interests you, get more involved in the music, and it will reflect in your attitude to selling instruments.

"Number three — nothing sells on price. There are now retail stores in America who're going out of business and yet they are some of the biggest discounters. Why has this happened? Because they've taken the sex out of selling an instrument, it's no longer a sexy sale, it's 'okay line up, grab your instrument, and get it outta here, put it in a box yourself'. You're selling a musical instrument not a pair of shoes. You have to sell it!

"Make sure that the merchandise in your store is good merchandise, it doesn't have to be the biggest brand names; make sure it's good quality merchandise. Will it hold up? Will the manufacturer back it up? Can you sell it? Make sure that you're involved in music and make sure that the products that you sell out of your store, you believe in. If you put a product on your wall that you and your sales people don't believe in — it won't sell.

"Number four — don't go after the top rock stars, they've already got their equipment, although maybe they're interested in one or two new updated things. What you have to go after is the beginner — the word I detest is 'punter'. You're the punter because he is the one who's got you. If he doesn't buy your goods, you may as well punch your way out of the football field until Kingdom Come — because you're the punter.

Customers

"Let's get it straight, he's the guy you need, without a customer you don't have a business. He's not the punter, he's smart and maybe the punter, by not walking into your store, what he's trying to tell you is, 'I don't need you, you need me.' Maybe you should re-examine it. Instead of being angry at the punter maybe you should be angry at yourself. Get off your rear end and GO SELL!!

"Print advertising in the music press, so that the concerned musician who reads that magazine, can get your address and telephone number and find out what you're up to this week. So put some of your money there, but if you put it all there, you've left out the other vehicles.

"Namely — in-store advertising. What you may wanna do is have a sale of the month, a certain instrument of the month, or have a group come in and do a demonstration. Pay a group to come in and demonstrate your instruments if the people in your store are not technically up to it, or get your salesmen to work out once a week and have a show, and each week the salesmen will take new instruments in your store and demonstrate them in a live performance situation. You're paying for that because these men are not on the floor selling, and you've got a crowded store full of people listening to a concert at a loud volume, but you are spending money for that, and that is a way of selling and that is advertising.

"Again, have business cards printed up for every single individual in your store and make sure they go to concerts, nightclubs, group rehearsals, etc. And when they go to the gigs, make sure they single out a musician, write his name on the back of the card, put the date and what they were talking about, and when that musician walks in with his card, you'll know that your man is working. That's advertising! If he gets a sale on his off hours, he should be reimbursed for that extra hours time, or that extra labour, even at a point of purchase.

"Advertise manufacturers products in your retail store, and most importantly, make it exciting. If it's not exciting, nobody cares. If somebody's buying a musical instrument, they've saved up money, and they're gonna be back next week to buy another one. Make that sale memorable. For example, you're very lucky to be buying a musical instrument, you're a very talented individual to have been given the gift of playing music. I am very thankful that you are buying a musical instrument from me. Let me write down your name and telephone number, and once a month give you a call or send you a postcard on new developments with the line or a new special on sale, or a new type of string, or updated product — SELL IT...

Steinberger

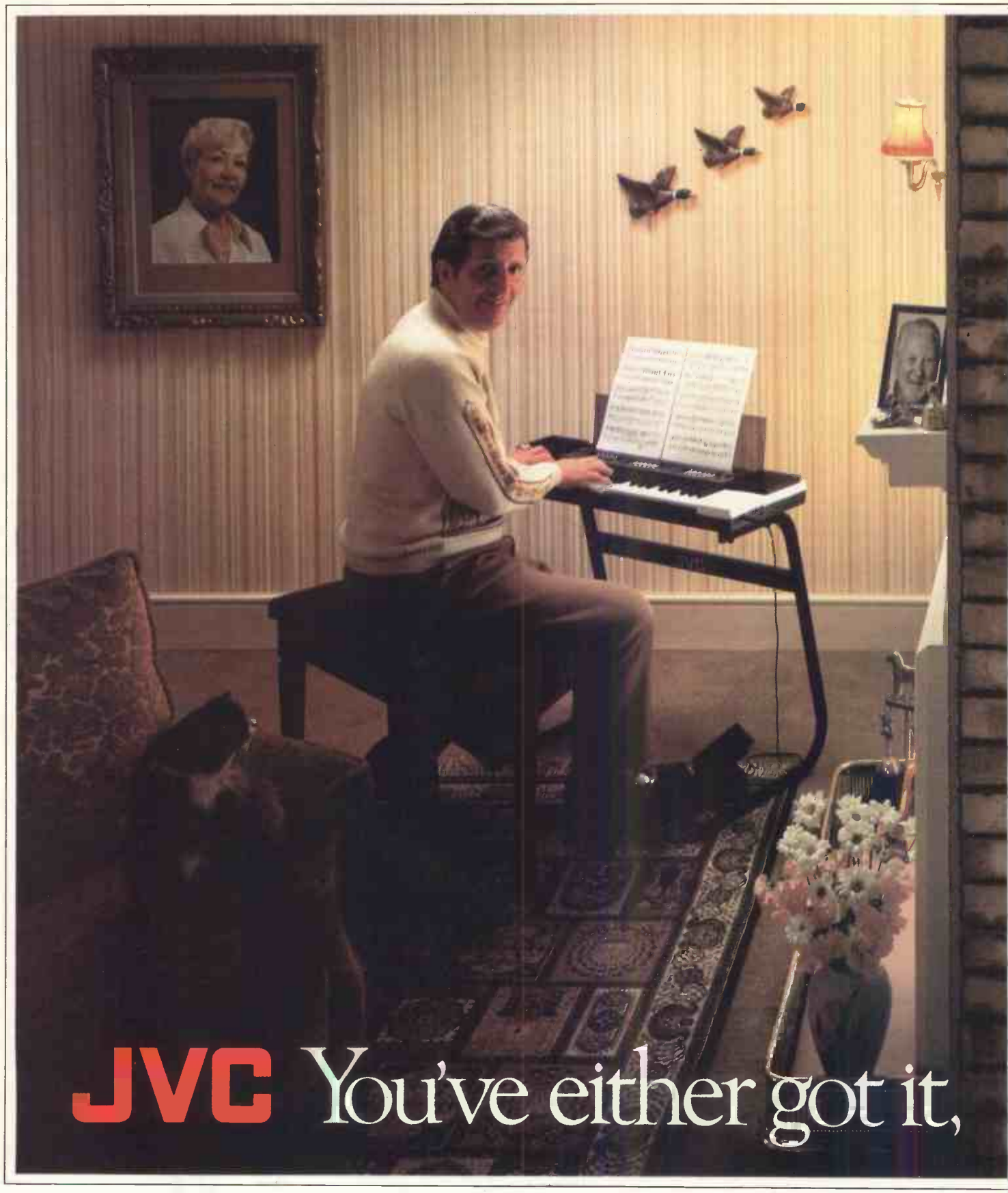
"I've never told anybody to do something without first being able to do it myself. Three years ago when I started promoting Steinberger and setting up the national and international distribution system on Steinberger, everybody laughed at me as though I was totally insane. Everybody looked at the instrument and said, 'that'll never sell, it's too much money, it's plastic, it has no headstock, and forget it, it'll never sell.'

"Now everybody says 'it's easy for him, he sells Steinberger.' That's right — I SOLD Steinberger. Spector basses were around 7 years, and nobody picked up on them until I did. EMG pickups were around for 7 years; put a battery in my guitar? That'll never sell! Right now EMG is the number two pickup company in America and threatening in the next year to become the largest pickup company in the business. Their sales have quintupled this year. Why? Because you have to go out and sell it. If you believe in what you're selling, you don't have to worry about competition, you don't have to worry about what the other guy is doing, and you don't have to worry about who's going to rip you off. All you have to do is pretend you're a long distance runner and that you're going to win the race. Pace yourself and run the best race.

"You must want to succeed, to succeed. If you're lazy and you really don't care about what you're selling, or you feel that there's no sense in selling something, or you adopt a nihilistic attitude, like 'what does it matter?' then you're not gonna do OK. If you believe totally in what you're doing, you'll do well at it. If you're waiting for the money to roll in to you, you're nothing special, none of us are. Everybody who's gone into business for themselves must make that business work.

"There's no easy business, and selling instruments is one of the hardest."

E&MM



It's really quite amazing the lengths some people will go to try and recreate the sound possibilities of the KB range of stereo keyboards from JVC.

Unfortunately, there's simply no way to even come close to the creative potential available to the JVC player.

The KB-300, 500, and 700 are all virtually unlimited in their musical scope, yet so straightforward to use even beginners can sound professional with them.

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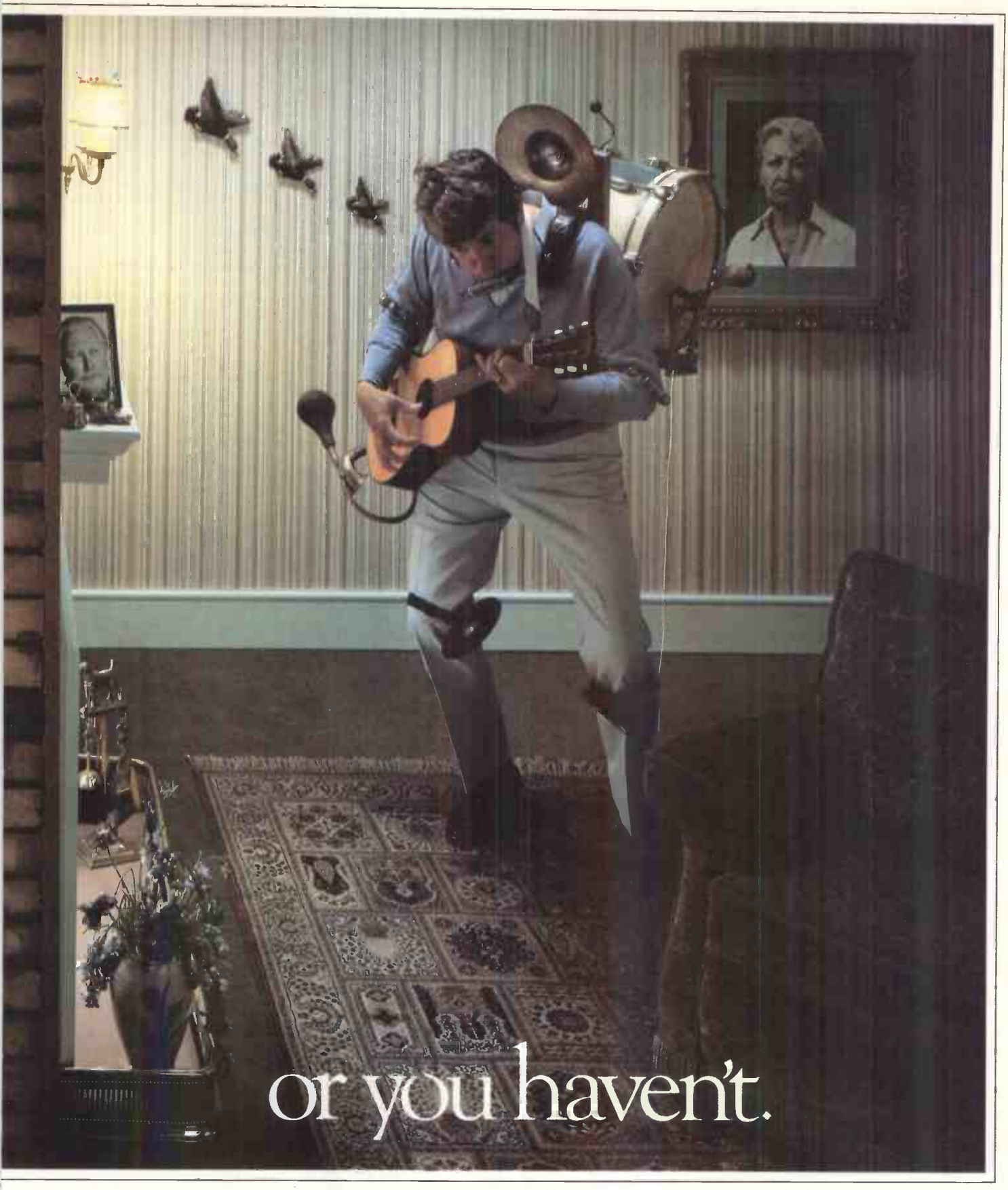


still using all the notes on the keyboard.

There's great ensemble settings too, like Brass and Strings as well as Rhythm sections that include such styles as Reggae, Rock 'N' Roll, Shuffle and Rhumba all with great drum intro fill-in on each rhythm selected.

While if you feel like musical accompaniment out of doors, the KBs can all run off normal-sized batteries and are light enough to be easily carried about.

Perhaps you're now thinking there must be a price to be paid for all this versatility? Well there is, but it's less than you think.

So why not pay a visit to your local JVC keyboards dealer soon, and try out the exciting KB range for yourself.

The KB-300, 500, and 700. The keyboards to beat the band.

New pickups for old

Hints on replacement pickups for electric guitars

by Peter Cropley

Sometimes a guitarist will find that a pickup has gone 'open circuit' (it's happened to me a few times). Then again you may be dissatisfied with the sound you're getting. Often solid guitar owners are distressed that the clean, tangy unamplified sound of their instrument doesn't get as far as their speaker. Again jazz players with big body acoustic electrics can find that while the bass strings are deep and mellow, the high notes are muffled and lacking in character. Perhaps the pickups, or the way they're wired are giving too much roll-off on the treble frequencies. So, what's to be done?

If you like the unamplified sound of your instrument (perhaps resonant and mellow for an acoustic electric, clean brassy and sustained for a solid, with a semi-acoustic somewhere in between) but don't like what you hear through the amplifier, then ten to one your pickups are not right for you. So, why not do something about them?

To digress, I rewired my 1960 Hofner V3 out of necessity, not desire. Quite early in its life, the middle pickup died but I didn't replace it, as I still had the other two, even though the sound of the deceased was my favourite, being clear and mellow. I gave up playing for several years to concentrate on an Open University degree (in Electronics and Relativity, among other subjects) and having got the B.A. I went in for an OU theoretical music course.

No way was I going to learn to play the recorder as specified, or use the reed organ that the Open University lend music students. So for the first time in three years I got out my trusty axe to practice the various cadences and harmonies we were expected to become familiar with, and discovered the bridge pickup had also died, probably in disgust at its long neglect. Yes, the very pickup I used to use for screaming lead breaks in my mis-spent youth!

This I replaced with a Gibson Super Humbucker (£35). A few weeks later I again disinterred the instrument, only to find the fingerboard pickup had expired. Provoked beyond endurance I then attacked my (former) friend with chisel, drill and smouldering iron, with the end results shown in the accompanying photo. For me at least, the twenty year old Hofner is now quite simply the best, most versatile electric guitar I've ever played. When I began the rewiring process I adopted a 'money no object' policy, but soon found that the most expensive pickups aren't necessarily the best.

Wiring

I wired the guitar so that the pickups can be used in any combination of series or parallel, either 'in' or 'out of phase' by using double pole, double throw 'centre off' switches throughout.

At the fingerboard end I've fitted an Ibanez 2351-62 humbucker, (£8.25). This is a low inductance pickup with a fairly low output level for a humbucker and an extremely clean sound, ideal for the fingerboard position. In fact it gives the cleanest sound of any dipole flux linkage pickup I've ever tested. This type includes all the 'standard' humbucker types. Other types sometimes encountered are stud humbuckers, coaxial humbuckers, and 'drone' humbuckers, where one coil is just for hum cancelling and doesn't contribute to the output from the strings.

As the Ibanez came in a two-wire series connected version, I dismantled it and rewired it for 4-wire output. The two coils connected in series and in phase (factory setting) give a deep, clean, mellow sound when fitted in the fingerboard position. 'In phase' parallel gives a lighter sound with the higher strings sounding about the same, but the lower strings a lot less bassy. Series 'out of phase' switching gives a twang on the bass strings with the high notes still fairly mellow. 'Out of phase' parallel gives a very sharp, clean sound not unlike a harpsichord with a very sharp rhythm sound; 'melodic sharp' rather than harsh. There's a lot of volume loss for antiphase parallel on this pickup and turning your amp up for loud solo passages can give noise and hum problems in this mode. I'd definitely recommend this pickup as a replacement for a one pickup guitar which has the pickup at the fingerboard end, as it will give a superb crisp rhythm sound if rewired for phasing, and clean, mellow highs when the coils are 'in phase'.

The Gibson Super Humbucker I've fitted in the bridge position has one live output only, with braided screen, and can't be wired for coil tap or phasing with itself as the coil assembly is set in epoxy resin and there's no way you can get at the coils without wrecking the pickup. As it gives such a good sound in this position I'd not dream of changing it.

It produces a very coloured rich treble tone in this position, possibly because of the large wide magnets used without excessive coil winding (the inductance is fairly low, no higher than a standard humbucker). This helps emphasise the dissonant harmonics, particularly on the bottom strings, giving a rich, slightly raucous edge to the sound which is far more pleasing to my ears than the chopped up hamonics of a high inductance distortion pickup.

In the middle position I orginally intended to fit a Mighty Mite 'Motherbucker', costing around £39 at the time. This is a three coil pickup similar to that now fitted to the Hamer Prototype, which presented several problems and in the end I mounted three single coil 'Strat' pickups on a brass plate instead. I also made a quarter inch thick mounting ring out of brass, above which the pickups protrude only a fraction of an inch. This, together with the brass backing plate, provides very effective shielding for the noise prone single coil pickups.

The assembly consists of two SSP Gotoh pickups (£5.35 each) facing the fingerboard, and a Fender Strat pickup (£25) at the bridge end. All three pickups give the clean melodic singing tone characteristic of a good single coil pickup, rich in undistorted harmonics with a clear, deep uncoloured bass. In my view the SSP Gotohs are of comparable sound quality to the CBS Fender pickups, and better than most American single coil pickups selling at five or six times the price. The DC resistance and inductance, and electrical output are very similar to the Fender which has a slightly colder tone together with a little more 'presence', due I suspect to a less symmetrical coil winding. The SSP Gotohs, like the Ibanez, are Japanese.

Tone

With these three pickups, parallel 'in phase' switching gives a clean melodic tone on the high notes and a very rich and deep gutsy bass. This effect is accentuated with just the two outside pickups on together (SSP and Fender). All three together in series and 'in phase' give a deep mellow effect, as deep and mellow in fact as the Ibanez in the fingerboard position, together with a high electrical output. Though the DC resistance of this combination is about 24 kilohms, the sound is still clean and harmonically pure due to the very low inductance and symmetrical magnetic field inherent in this kind of pickup.

Parallel switching with the Fender and SSP 'out of phase' gives a very sharp sound with a hard metallic twang on the bass strings. All three pickups in parallel with one 'out of phase' gives a boost to the treble strings while still allowing a fairly deep sound on the bass. In series 'out of phase' gives a sharp treble string with a rich, sonourous twang on the bass strings. Resonance effects can often generate subharmonics in the pickup coils. Note also that single coil pickups used together in this way are in a humbucking mode when switched 'out of phase'.

Blending pickups of different waveform parameters gives many interesting and musical tones. One of my favourite combinations is using the fingerboard facing SSP

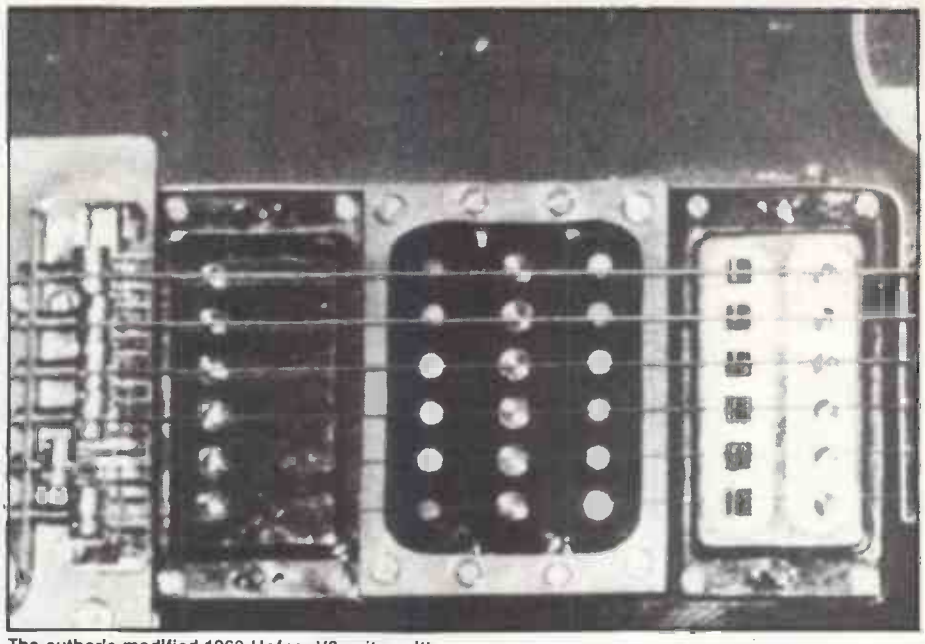
pickup 'out of phase' with the Gibson. This gives a thin, clear sound similar in some respects to a treble boosted Telecaster, whilst the Fender 'out of phase' with the Gibson sounds extremely harsh and piercing even through my old Bird valve amp's rather soggy 15 inch Wharfedale speaker, so this is a combination I don't particularly like or use. The Fender and Gibson pickups together 'in phase' gives a rich warm sound, with a melodic lilt.

Obviously, I can't describe all possible combinations (and who can describe sound in words anyway?). Suffice it to say that combining pickups with greatly different tonal characteristics can give an amazing richness and variety of tone colour, and in my view is preferable to having 2 or 3 identical pickups on your guitar.

Also, I'd seriously suggest that anyone replacing a humbucker consider mounting two single coil (Strat type) pickups side by side. They'll give clean, mellow or sharp sound depending on how you wire them, and if you have a single pickup guitar then using them 'out of phase' will give a crisp, clear sound. Some humbuckers used with their coils 'out of phase' sound really nasty and unmusical, particularly high inductance, high impedance designs. This is partly because of flux linkage between the two sets of pole pieces, which in most designs share the same magnet. Two Strat pickups mounted together will fit quite easily into a standard humbucker mounting ring, so there should be no problems on that score.

Recommendations

What pickups would I recommend you to try? This is largely a matter of taste. Bear in mind that although I wouldn't change the



The author's modified 1960 Hofner V3 guitar with replacement pickups added.

Fender or Gibson pickups on my own guitar (since they're both superb pickups and perhaps more important, I've got used to them) price is no guide to quality. The Japanese (ESP, SSP Gotoh, Ibanez etc.) and German (Schaller, Hofner etc.) pickups may or may not sound exactly the same as their high priced American counterparts but they're just as good. The workmanship on the Schallers is probably superior to the American pickups and at less than half the price. Anyway here are a few possibilities for you to consider when choosing your own replacement pickups.

Humbucker (Clean and Bright)	
Ibanez 2351-62	£8.25
Schaller Golden 50	£11.85
ESP 59 (PAF type)	£15.50
Humbucker (High output, rough edge)	
Schaller Hot Stuff (Bar magnet type)	£16.95
ESP Hot Pickup	£15.50
Single Coil (Strat replacement type)	
SSP Gotoh	£5.25
ESP V1 Vintage Strat	£11.75
Schaller S6 (Large magnet, high output)	£10.55
Schaller SX (adjustable pole pieces)	£10.55

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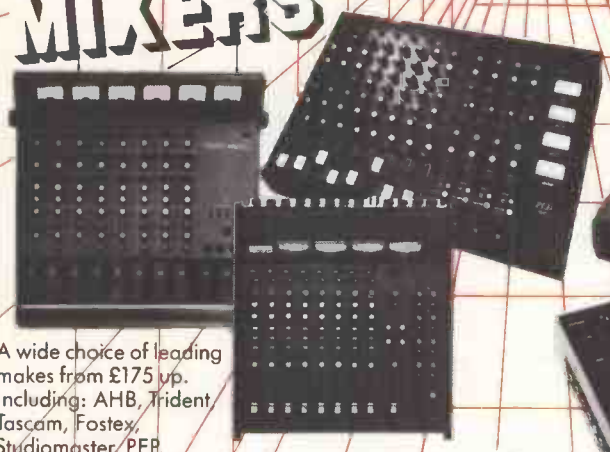

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Steinberger 6-String Guitar

In an exclusive special report, Ned Steinberger takes you through the features of his latest design – the Steinberger guitar

"We've been working on a guitar for two years now, ever since we saw the initial success of our bass. We realised that the guitar was also going to be a great application of the basic system that we developed, and so we began working immediately to develop this guitar. We wanted to make sure we did it right and I have no regrets about taking the time we did to make sure that we really could develop this thing correctly. We've had a reception here at the NAMM show that's nothing short of phenomenal – they're lined up most of the time with those little Rockman amps that are doing such a wonderful job of showing people just how much fun these guitars are to play. They're having a ball and everyone just wants to know when they're going to be able to get them."

In an attempt to discover more about this 'phenomena', we began by discussion the new Steinberger guitar in relation to both conventional guitars and their own bass.

"First of all it has much more in common with our bass than with a conventional guitar. It utilises the double ball end Steinberger tuning system which is something that will be increasingly available in the future and of course it's headless. It has a small body made from a blend of fibre-reinforced epoxy, coated with an impact resistant polyester gel finish. It's wide enough to rest right up against your own body, remain stable and give you support for your right hand. Yet on the other hand, it's as small as possible to still accomplish that, because there's an over-riding belief in everything that I do that the more minimal you can make something, the more highly functional it automatically is. Anything that you add that's extra – that is unnecessary – is going to be counter-productive and the purpose of this guitar is to hone everything down so that there's the minimum baggage to carry around with you."

"It's lighter than the bass but it cannot be lightweight and still perform the way that it performs. Remember the guitar sound is still the most important thing and the sound of this instrument is 'sustained' and 'brilliant' in a way that a conventional wooden instrument simply cannot be. When people are first confronted with this tiny little guitar they tend to react very sceptically and if we had an average sound they'd panic. We can't get away with an average sound, they simply wouldn't accept it because some guy is just ready to say 'well, it's neat but it's not a real guitar'."

Trademark

"Our trademark is defined by this body shape and we'd like this to be well understood. The fact that an instrument is 'headless' is something which predates our design. On the one hand, we've undoubtedly popularised the headless concept and it's become very much identified with us, but nevertheless, there were precedent in the past. After all, Les Paul actually built the first headless guitar back in 1944 so the headless guitar by itself is not our true trademark. This body shape – this is original, this is our identity and this of course is very important to us."

"The controls are kept as simple as possible, and these are a volume control, three-way pickup selector and a tone control in this case. There are two EMG/Overlend low impedance active pickups which have a tremendously wide frequency response. The front pickup has a low midrange resonance that brings out a really warm sound because that location on the strings is also the area where you get most of the fundamental. In the rear position, hard up against the bridge, is a high resonance pickup that really emphasises the string harmonics and all that high end material. It's a wonderful sound from the rear pickup and very different from the front pickup and that's something that we stress."

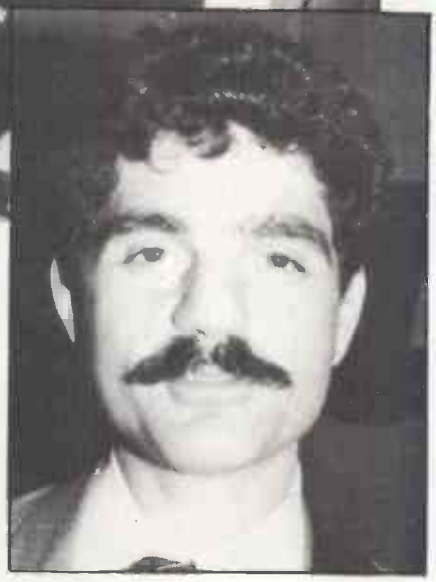
"That big difference between the pickups, gives the instrument a wide tonal range and you can combine the pickup sounds or you can have them separate. You can hear that warm front pickup and then you hear them both together and then you get in that back position and it just kills!"

Action

"The overall length of the guitar is just 29½ inches but there's a full scale 25½ inch fingerboard just exactly the same as Leo Fender so correctly made his instruments over thirty years ago. The actual playability

The many faces of Steinberger.

Bridge. pickup and body details.



Ned Steinberger. designer.

of the guitar is very conventional. except we are currently developing a way of grinding the frets that I'm very excited about. I can't go into detail yet but I think that when we have this system resolved. we'll have the lowest possible action both in theory and in fact. The action and the neck are very important and of course on this instrument the neck is highly rigid. as it's unaffected by changes in moisture or temperature."

"There is no truss rod in the guitar neck because the material it is constructed of is so rigid that it's difficult to actually make a truss rod work. I don't need a truss rod because I could put the heaviest guage strings on here one time and the lightest guage on the other. and the neck would cope with the change in stress quite easily."

Because of the guitar's unusual styling, we wondered if this would restrict its popularity to the rock player. Ned, however. did not see this as a problem.

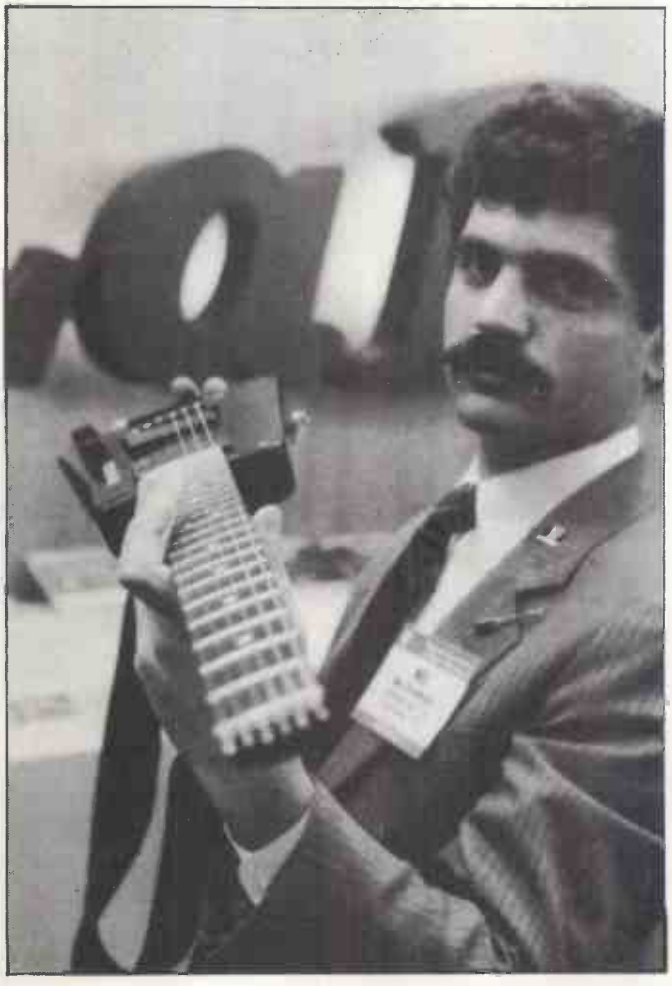
"I'm very pleased to say that, while I know that rock'n'roll is the big market for guitars, and that's where we're going to enjoy our greatest success without a doubt, I've still had quite a few jazz players try out the instrument and they've had the warmest things to say about it. Of course they mainly use the front pickup which has a very warm sound to it and that's why I'm interested in that tonal range because I don't want to make an instrument that's designed for one guy or for one kind of music. To me a really fine instrument is capable of a good range and it is able to play in any kind of style."

"The controls themselves are not active, but the pickups are. The pickups have a preamplifier in them, which is powered by a battery that fits neatly into the back of the instrument and this is what gives them the kind of frequency response that they have. You can't get this kind of sound from a conventional high impedance pickup."

One interesting fact came to light in our discussion with Ned Steinberger – namely that he does not actually play guitar! Was this ever a problem?

"No. not really. I feel that those of us who are unable to make music are just naturally the best admirers of those people who have that talent. I think that I have more regard for musicians than they have for themselves and I just admire them more than I could say. It is difficult for me to accept sometimes that I can't play and I often question in my own mind how it is that I design these instruments and yet I don't play them!"

"I get feedback from a lot of people about guitars. That's very important, because you could take the greatest musician in the world and just sit down and design a guitar specially for him. That's no good though, because guitar design goes beyond any one person's idiosyncratic demands, no matter how talented or how great they are."



Future Plans

"Steinberger Inc. is, first and foremost, a development company and my interest in industrial design has a big impact on the kind of things that this company is going to be able to do. We're interested in quite a few new projects at present, and you will be seeing some exciting new products from Steinberger in the future. However, don't be in too big a hurry because we plan to take the time to perfect all of the products that we bring to the market place."

A commendable attitude we believe, and one that manifests itself quite openly in the Steinberger 6-string guitar.

E&MM

A touch of magic

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● Voltage Control Amplifier	12
● Envelope Generator ADSDR	6
● Envelope Generator ADR	6
● Low-Frequency Sweep Generator	6
● Memories	132
● Interactive Poly. Sequencer (max. note storage)	1000
● Cassette Interface	YES
● Triad Interface	YES
● Midi Interface	YES
● Velocity Sensitive Keyboard	YES
● Programmable Keyboard Split	YES

Peter John Vettese

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computer MUSICIAN

Rumblings

ZX81 with EDP synths and E&MM drum generator.

Rumour has it that there's a pile of dead ZX81s beneath a certain window in NW5. Apparently, Sinclair ULAs have a habit of going to the Great Uncommitted Logic Array In The Sky when downloaded via the cassette port from an Apple. The message is don't try pretending you're a cheapo cassette machine! Such noble euthanasia of the Sir Clive kind has been for the cause of us computer musicians in the shape of AMICS and a couple of Fireflies. Er. what? AMICS stand for 'A Music Interpretative Compiler and Sequencer' — composing software, in other words. The Firefly, on the other hand, is a couple of de-keyboarded Gnats in a tasteful wooden case. AMICS is likely to reside in ROM in place of the ZX81's Operating System (or whatever it calls itself), thereby turning the elegant door stop into a dedicated music processor. Between the ZX81 and Fireflies there's an interface box (ZXIF) that includes its own cassette interface with data verify. Preliminary specs suggest that the package will provide for 4,000 notes sequencing with 4 voices and that it'll come with a drum sync and keyboard interface. Provisional prices are £250 for the two-voice version and £450 for four voices. That doesn't include the ZX81! We'll have a full report on this as soon as there are signs that ZX81s have ceased trying to turn themselves into garden gnomes . . . Meanwhile, you may like to dig out E&MM issues for Dec. '81, Feb. '82 to find circuits for a 7-voice EDP synth system and stereo drum generator for the ZX81.

The Grand Poobar of Casio Mods, Robin Whittle, sent me his fascinating bulletin on getting-more-out-of-these-keyboards-than-you'd-ever-imagine-possible. If you've got an M-10 or MT-30 lurking behind your bookshelf/bed/keyboard stack, then dig it out and add all the goodies that Robin talks about in this press release:

"An 18 page booklet, 'Modifying the Casiotone instruments', gives details of extra features which may be added to the Casiotone M-10, MT-30, MT-31, MT-40, CT-101, CT-202. These instruments can have their musical range greatly increased by new controls such as filter bypass, octave drops, half speed octave drop, hold, and hard/soft or fast/slow vibrato. An external circuit facilitates computer interfacing and coupling two instruments as master and slave. This technical bulletin is available for £4 (cash or bank cheque) from Robin Whittle, 42 Yeneda Street, North Balwyn 3104, Australia."

Robin talks about the MT-65 in glowing terms — particularly abut the special sound LSI in this unit which actually puts out 16 bits of data to the DAC. In fact, the model you or I can buy in shops only use 14 of the 16 bits, so Casio are actually under-selling themselves. One of the nice things about this LSI (called the uPd 931) is that the sum of all the notes is put out with a sampling rate of 600 kHz (phew!). By my reckoning that translates into a 75 kHz sample rate per channel, so it's basically bye-bye to all that aliasing hassle! More than that, the data going to the 931 from the main processor includes waveform and envelope specs, which should mean that home micro interfacing is a definite possibility. As Robin says, "the 931 is clearly like Aladdin's Cave — a small entrance leads to many corridors and treasure chests, some of which have never been fully explored." He's now working on loading voices directly from his CP/M system into some 931s he's acquired. We'll keep you posted on future Whittlings at the Casio stick . . .

Continuing the Casio connection, Serge Modular Music Systems have recently announced their 'N Voice Controller', a "microprocessor-based digital-to-analogue converter that converts most inexpensive Casio keyboards to a monophonic/polyphonic keyboard with voltages, gates and triggers for controlling analogue synthesisers." Serge suggest that the interface will work with models MT-10, MT-30, MT-31, MT-40, CT-201, and CT-202. The idea behind this is that the Casio's own internal waveforms can be further processed using a few voltage-controlled modules in an analogue synth. Serge claim that "the combination of a Serge voice with a processed Casio sound is an extremely versatile voice. 'fatter' than the fattest synthesiser sounds from a monophonic instrument." The only dampener on what sounds a really good idea is the price — $650. Serge can be reached at 572 Haight Street, San Francisco, CA 94117 (Tel: 415-621-6898).

Well on the way are a couple of really smooth British (about time too . . .) programmable digital sound generator add-ons for home micros. Specs are elusive at present, but one would appear to have 12 channels each with a 64 kHz sampling rate and offering all sorts of yummy modulation options, whilst the other goes for more channels (32) with a lower sampling rate of 32 kHz. The former is expected to appear initially for the BBC Micro and, not surprisingly, Acorn are showing a lot of interest. With expected price tags of under £200. these look just like what the doctor ordered . . .

Jen (the Italian synth manufacturer) exhibited their version of the alpha-Syntauri/Soundchaser keyboard-type add-on at the British Music Fair at the beginning of August. Offering 4-track soft recording facilities and three-oscillator digital voices, it sounded fairly impressive. The price tag of around £1.200 seems a bit steep. though, bearing in mind what the competition is up to these days. The system runs on either the inevitable Apple II or IIe or their own Apple lookalike. The trouble with Apple lookalikes is that you have to contend with Apple's wizzo team of injunction-seeking solicitors. Apple don't like people copying their ROMs, so they do their darndest to boot you into hyperspace. It must be really hard work being a Pineapple or an AMI II or an Apollo II or a Franklin Ace or a Basis 108 or a . . .

CM

Jen Computer Music System.

Sounding Out The Micro

Part 2

A sound sampling Dodolator and Kaleidosound picture machine for the Apple

This month, we're going to get wrapped up in the sound sampling side of the micro, but, firstly, it might be sensible to have a brief recap of some of last month's ideas.

Since music is all about notes of particular frequencies for particular durations, the first thing any program aimed at music synthesis must be able to do is to act as an accurate timekeeper. So, in the simple examples we looked at for toggling cassette relays, output port bits, or whatever, there were two timed loops involved in generating the less than dulcet musical tones, which we can illustrate with the diagram in Figure 1.

```
-------[ (↓-----delay 1-----↑-----delay 2-----)  ]-------

        toggle              toggle                f  d

         low                 high
```

Figure 1.

The round brackets enclose the instructions required to perform the off/on toggle and set up an inner frequency-controlling loop. The two delays will determine the frequency of the toggling and can also be used to alter the mark/space ratio so that variable pulse-width waveforms can be outputted. The square brackets set up an outer loop that determines the number of circuits around the inner loop and, therefore, the duration of the note.

That's basically where we got to last time. The other thing that might also have sunk in is that there's a multiplicity of ways by which one can get sounds out of a micro to the outside world, and, so far, we've touched on methods involving radio interference, hammering printers, clattering cassette relays, speaker toggling, output port bits, and cassette interfaces. Whoever said that micros were silent creatures?

The main aim of this month's shindig is to introduce a further technique into the micro's repertoire, namely digital-to-analogue conversion, since this is ultimately the only means to a quality end. We could approach this from the waveform table angle, but it's probably more interesting to start off with another way of filling up memory with the numerical representation of sounds, i.e., by using analogue-to-digital conversion. Also, this practical implementation of the digitisation principle is what everyone inside and outside the media seems to be fascinated by. and. given that it's the only way you could stuff Mrs Slocombe's pussy inside a micro, who's arguing with that!

There's also a good deal of satisfaction to be had from making a lot out of a little (like the aforesaid feline), and so, for the moment, we're going to stick with the simplicity of the cassette interface in the Apple (sorry. all you BBC Micro/Spectrum/Commodore/etc. owners. but the Apple makes life rather easier than you lot in that respect!) and see what more we can get out of (and put into) it. There's another factor behind my backing of cassette port techniques, and that's the simple fact that cassette ports are cheaper than additional hardware for analogue-to-digital and digital-to-analogue conversion. In these times of financial stringency and cut-backs (yawn), that's not to be sneezed at. Mind you, the results are somewhat far removed from the DIN or any other Hi-Fi standard.

Sampling with the Apple

For good or worse, sound sampling seems to have become the '80s catchword, but the current exploitation of the technique prompts me to proffer a new version of an old adage, namely, "it's not what you do, it's how you use it." Sound sampling tends to be synonymous with sound regurgitation at present, and we've still got a long way to go as far as using natural (or whatever) sounds creatively is concerned. However, diatribes apart, let's have a go at some sound sampling on ye venerable olde Apple.

Kaleidosound

For starters, Listing 1 is a machine code program that turns the Apple into a sort of frequency analyzer, given some suitable audio directed into the cassette input. However, rather than just being content to display a stream of frequencies on the screen, Kaleidosound goes one step further, in terms of amusement value, by producing a kaleidoscopic display of LORES coloured blocks pulsating symmetrically out from the centre (high frequency) to edge (low frequency).

```
0800-4C C1 08 18 A9 14 6D 10 00 A8 A9 14 6D 11 00 20
0810-00 F8 38 A9 14 ED 10 00 A8 20 0E F8 18 A9 14 6D
0820-11 00 A8 A9 14 6D 10 00 20 00 F8 38 A9 14 ED 11
0830-00 A8 20 0E F8 18 A9 14 6D 10 00 A8 38 A9 14 ED
0840-11 00 20 00 F8 38 A9 14 ED 10 00 A8 20 0E F8 18
0850-A9 14 6D 11 00 A8 38 A9 14 ED 10 00 20 00 F8 38
0860-A9 14 ED 11 00 A8 20 0E F8 60 A0 00 84 1E A2 04
0870-86 1F 98 8D 50 C0 8D 52 C0 91 1E C8 D0 FB E6 1F
0880-CA D0 F6 60 20 A9 08 F0 1B 20 A9 08 F0 16 85 00
0890-20 A9 08 F0 0F 85 01 C5 00 B0 08 48 A5 00 85 01
08A0-68 85 00 60 85 00 85 01 60 A2 00 AD 60 C0 85 02
08B0-E8 F0 07 AD 60 C0 45 02 10 F6 8A 60 4A 4A 4A 4A
08C0-60 A9 00 AA 9D 00 0F E8 D0 FA 85 03 86 04 20 6A
08D0-08 A9 10 85 05 20 84 08 A5 00 20 BC 08 85 11 A5
08E0-01 20 BC 08 85 10 F0 08 A5 03 20 64 F8 20 03 08
08F0-A6 04 A5 10 9D 00 0F E8 A5 11 9D 00 0F E8 8A 29
0900-3F AA 8E 04 00 BD 00 0F 85 10 E8 BD 00 0F 85 11
0910-A9 00 20 64 F8 20 03 08 C6 05 D0 B9 E6 03 A5 03
0920-29 0F D0 AD E6 03 4C D1 08

                                        (297 bytes)
```

Listing 1. Kaleidosound Program.

Patience is required in entering this wadge of code — so take it slowly! Once that has been done, the program can be saved onto disk from the monitor with the command:

BSAVE KALEIDO,A$800,L297

BRUNning this file will then run the program automatically. Note that nothing will happen on-screen until some audio is plugged into the appropriate orifice. The level required isn't particularly critical, but a headphones output from an amplifier or tape deck seems to work well. Avoid excessively high input levels as this may lead to overloading of the input stage of the cassette circuitry.

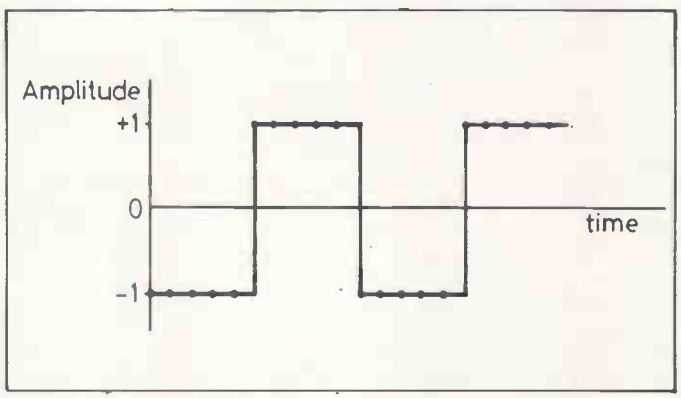


Figure 2.

So, what's going on here? Well, sound sampling works on the principle of making a continuous series of measurements of the amplitude of a waveform at any given instant. If the sampled sound happened to be a square wave, then the series of measurements might look something like Figure 2 and read as follows:

-1 -1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 -1 -1 -1 -1 -1 -1 +1 +1 +1 +1 +1

The values indicate that the waveform switches between just two amplitude states, positive and negative or high and low, and that the two states occur for the same amount of time. It's also apparent that a new cycle of the state switching occurs every 10 samples. So, if these samples were being taken 10,000 times a second, this would imply that the input waveform had a frequency of 10,000/10 cycles per second, or 1000 Hz.

On the other hand, the sampled values might instead appear like Figure 3 with measurements along these lines:

-1 -1 -1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 +1 +1 +1 +1 +1 +1 +1

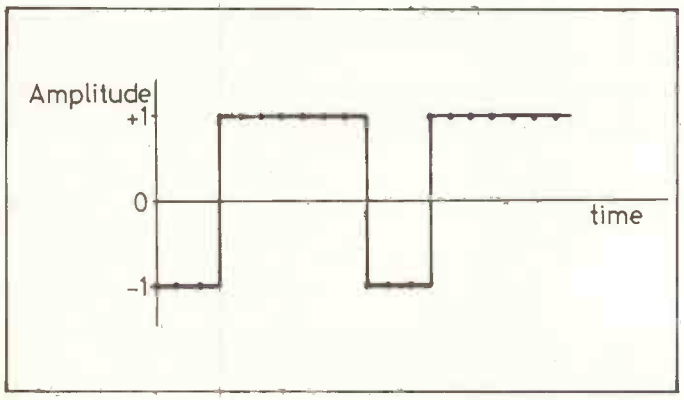


Figure 3.

Even though there are still the same 10 samples for each cycle of the waveform, the equality between the times spent in each state is now no longer apparent. In fact, the sampled waveform now represents a pulse wave with 70% of its period spent in the high state, rather than the 50% in the case of the previous square wave.

Let's take one further example:

0 .7 1 .7 0 -.7 -1 -.7 0 .7 1 .7 0 -.7 -1 -.7 0

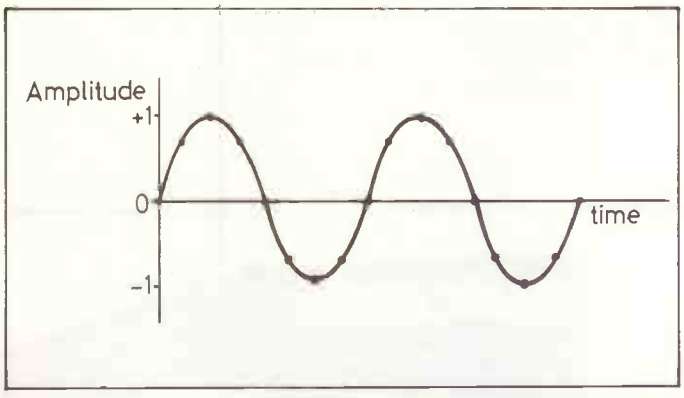


Figure 4.

Here, we've got a rather different situation, but all makes sense when you plot the values out on a graph as in Figure 4. This time, the period between repeats of the waveform cycle is 8 samples, which translates to a frequency of 10,000/8 cycles per second, or 1250 Hz. What we've done here, then, is to sample a sine wave by converting the continually changing amplitude of the waveform into a series of discrete values that can be plotted on graph paper, drooled over, or, more constructively, stored in memory for processing at a later date.

However, the cassette input is designed for sampling waveforms like those in Figures 2 and 3, rather than registering all the amplitude subtleties of the sine wave of Figure 4 or any other complex waveform.

The Kaleidosound 'frequency analysis' program therefore works on a very basic level, in that it merely uses the cassette input circuitry to sample the audio input and ascertain its frequency. Each time the signal applied to the input circuit swings from positive to negative, or vice versa, the input circuitry changes state, e.g. if it was sending ones, it'll change to sending zeros — the action of a bi-stable comparator. The Kaleidosound program is able to inspect the state of the cassette input circuit by looking at location $C060, and, by doing this repeatedly (thereby establishing the sampling rate), it is able to get a reasonably accurate idea of the number of peaks in the stream of waveforms being fed into the Apple by this route. As a frequency detection method, this is a bit on the dubious side, since high amplitude high harmonics will create a lot of peaks within a single cycle of the fundamental and therefore fool the cassette sampling into thinking that it's receiving a high frequency input. Still, it's the principle of the thing that counts, and, apart from being fun, it serves as a useful introduction to at least one aspect of sound digitisation.

The other side of the sampling business is the measurement of all the amplitude values that fall in between the highs and the lows. The 1-bit resolution of the average cassette input circuit is a bit stuck at this point, but the quirks of the Apple's circuitry enables a cunning way around this limitation to be pursued. As we'll see shortly, it's possible to put this into practice in the context of a program that both digitizes and regurgitates sound via the cassette port. In general, though, the more bits of resolution the better the sampling accuracy is likely to be. The other vital component of the sampling equation is the sampling rate, since the faster a wave is changing (ie., the higher the frequency or the more high harmonics are present) the more often it's necessary to take a sample to check that the waveform hasn't done the dirty on you and changed its amplitude level since the last sample. What this boils down to is the all-important Nyquist sampling theorem, which states that the maximum sampling bandwidth is half the sampling rate. So, a 10 kHz sampling rate would be fine for waveforms of up to 5 kHz in frequency.

If life was full of square waves merrily switching away between zero and 255, one probably could cope with just 1 bit of resolution, but, with more musical waveforms with rather less in the way of rough edges, even 8 bits pose something of a problem. The point is that if a waveform presented itself with an amplitude value of 122.42 for sampling, then the only solution for 8-bit conversion is to take the nearest integer value, ie., 122. This is known as 'rounding down' or 'rounding up', and the long and the short of it is that the continuous stream of samples includes a similarly continuous stream of small sampling, or 'quantisation', errors. Unfortunately, such errors make themselves felt as noise throughout the audio spectrum, and no so-called anti-aliasing filter is going to do anything about that. So, next time you're listening to an Emulator, Fairlight, alphaSyntauri, or just about any other system on the market, enjoy that quantisation noise!

As we mentioned back at the beginning of the *Macro Music* series, the man behind all these digitisation techniques was Max Mathews at Bell Telephone Labs. The first practical implementation of these ideas was a program that subjected digitised speech to all manner of deliberately unpleasant processing, such that, when it finally emerged from the Bell Labs digital-to-analogue converter, it was replete with the grunge, noise, distortion, and treble cut typical of the modern telephone system. Funnily enough, the Apple sound-sampling program coming up next does roughly the same, though here it's a limitation of the sampling/regurgitation achieveable with the basic Apple, rather than a deliberate ploy to assault the average reader's shell-likes.

The Dodolator

In fact, it could be said that the 'Dodolator' is something of a dead duck as far as music's concerned, but that's to be expected from the low sampling rate (around 2.7 kHz) that's used. In compensation, the fair whack of memory (100 pages, or 25K) set aside for storage means that just over 9 seconds can be sampled. As you may have surmised, sampling is all about swings and roundabouts!

The reason why sampling is possible with the basic Apple lies in some extra components built into the cassette circuitry that make analogue life more susceptible to sampling than you might otherwise imagine from a straightforward DC comparator. In fact, there's a series capacitor and shunt resistor in the cassette input that acts as a high-pass filter, or, in mathematical terms, as a differentiator. Then, on the output side of things, there's a series resistor and shunt capacitor which acts as an integrator. Put the two together and you have a means of forcing the change of state comparator circuitry to sense some of the subtleties of amplitude variation and impart this information to the output circuitry on playback. That explanation is the bare bones of the situation, and, for more on that subject, I'd refer you to the original article describing the technique in Call-A.P.P.L.E., September '81.

In contrast to the lengthy whack of machine code used in the Kaleidosound program, the machine-code routines that do the sampling and regurgitation for the Dodolator are pretty straightforward. The one factor that's crucial with this unusual sampling technique is that timing in the taking and sending of samples must be closely matched, or otherwise you'll end up with a glorified buzz. So, there are five NOP instructions built into the sampling routine that delay the proceedings slightly to match the playback. As the routines stand, the maximum sampling time is around 9 seconds. This can be extended with the loss of fidelity (fidelity? What fidelity!) to just over 12 seconds by adding in a monitor WAIT routine by changing the byte at $0317 and $0377 to A8 rather than the present B3. In addition to the two routines, there's also a short Applesoft BASIC program that runs the whole shishkaboodle.

Firstly, here's the sampling routine to enter from the monitor (CALL-151):

```
0300: 18 58 B8 D8 A0 00 A2 08 AD 60 C0 2A 26 09 EA EA
0310: EA EA EA EA A9 01 20 B3 FC CA D0 EC A5 09 91 08
0320: C8 D0 E3 E6 0C C6 0A D0 DD 60          (42 bytes)
```

Secondly, the regurgitation routine:

```
0352: 18 58 B8 D8 A9 00 85 08 A0 00 A2 08 B1 0B 85 09
0362: A5 09 45 08 10 06 AD 20 C0 AD 30 C0 A5 09 85 08
0372: 06 09 A9 01 20 B3 FC CA D0 E6 C8 D0 DD E6 0C C6
0382: 0A D0 D7 60                              (52 bytes)
```

Everything that comes in between the two routines is garbage, so don't worry about whatever else you see after the RTSs that end the two routines. Whilst still in the monitor, save the machine code on disk with the following command:

BSAVE DIGITIZER,A$300,L134

When the BASIC program is run, it'll BLOAD this particular file into the right place in memory. Running the program will display a menu from which you can make various choices as to your interaction with the Dodolator.

The ONERR at the beginning of the program will provide some degree of anti-idiot-trapping against premature crashes, but pushing your luck is inadvisable! Input to the Apple's 'cassette in' socket is probably best taken from the headphones socket of an amplifier or mixer, and, in practice, it seems to like being driven quite hard (give me more...). It's also worth fiddling about with treble EQ levels so as to optimise the differentiation process. Playback is both via the Apple speaker and the 'cassette out' socket. The program allows you to both select into how many pages you want the sample to go when recording, and also to set up a repeating loop out of those pages on playback.

When you're using the Dodolator, bear in mind that it's not designed for music (whoever heard of sampling music at 2.7 kHz and getting decent results?!). However, if you're careful, it will sample a monophonic synth input quite effectively, adding a generous helping of fuzz and dirt in the process. The thing to remember is that polyphonic input = complex input = complex waveforms = lousy sampling = horrible sound!

We'll probably return to the Dodolator in the future if and when there are any improvements to be incorporated. Any suggestions will be gratefully received!

Next month, we go slightly higher up the quality scale with a digital-to-analogue converter plus some intriguing programs for producing music with the minimum of input hassle.

David Ellis **CM**

```
 10 REM APPLE DODOLATOR
 20 REM (C) 1983 DAVID ELLIS, BRUCE DETTERICH
 30 REM & CALL-A.P.P.L.E.
 40 HIMEM: 4352: TEXT: HOME
 50 AD = 4352: D$ = CHR$ (4)
 60 PRINT D$;"BLOAD DIGITIZER"
 70 HTAB 12: VTAB 4: INVERSE: PRINT "SAMPLING OPTIONS": NORMAL
 80 HTAB 14: VTAB 9: PRINT "1 - RECORD"
 90 HTAB 14: VTAB 11: PRINT "2 - PLAYBACK"
100 HTAB 14: VTAB 13: PRINT "3 - SAVE TO DISK"
110 HTAB 14: VTAB 15: PRINT "4 - LOAD FROM DISK"
120 HTAB 14: VTAB 17: PRINT "5 - QUIT PROGRAM"
130 CALL -958
140 HTAB 11: VTAB 22: PRINT "MAKE YOUR SELECTION:"
150 HTAB 32: VTAB 22: GET A$: PRINT A$
160 FOR I=1 TO 100: I = I + 1: NEXT I: AX = VAL (A$)
170 ON AX GOTO 200,310,570,600,700
180 IF AX > 5 GOTO 140
190 IF AX < 1 GOTO 140
200 TEXT: HOME: HTAB 14: VTAB 4: INVERSE: PRINT "RECORD MODE"
210 NORMAL: GOSUB 620
220 HTAB 5: VTAB 10: CALL -958: PRINT "GET READY TO START THE AUDIO INPUT"
230 HTAB 5: VTAB 11: PRINT "WHEN YOU SEE THE FLASHING 'RECORDING"
240 HTAB 5: VTAB 12: PRINT "IN PROGRESS' SIGN."
250 HTAB 5: VTAB 14: PRINT "PRESS ANY KEY TO START:"
260 HTAB 30: VTAB 14: GET G$
270 INVERSE: HTAB 10: VTAB 20: FLASH: PRINT "RECORDING IN PROGRESS"
280 CALL 768
290 NORMAL: HTAB 5: VTAB 20: PRINT "HIT ANY KEY TO STOP RECORDING:"
300 HTAB 36: VTAB 20: GET G$
310 TEXT: HOME: HTAB 13: VTAB 4: INVERSE: PRINT "PLAYBACK MODE"
320 NORMAL
330 HTAB 5: VTAB 8: PRINT "ENTER START PAGE (01 TO 99):"
340 HTAB 34: VTAB 8: GET S$: PRINT S$;: SS$ = S$: GET S$
350 PRINT S$;: SS$ = SS$ + S$: SS% = VAL (SS$)
360 IF SS% > 99 GOTO 330
370 IF SS% < 1 GOTO 330
380 HTAB 5: VTAB 10: PRINT "ENTER END PAGE (";SS% + 1;: PRINT" TO 99):"
390 HTAB 32: VTAB 10: GET E$: PRINT E$;: EE$ = E$: GET E$
400 PRINT E$;: EE$ = EE$ + E$: EE% = VAL (EE$)
410 IF EE% > 99 GOTO 380
420 IF EE% < SS% GOTO 380
430 HTAB 5: VTAB 12: CALL -958: PRINT "TIMES AROUND LOOP (01 TO 99):"
440 HTAB 35: VTAB 12: GET N$: PRINT N$;: NN$ = N$: GET N$
450 PRINT N$;: NN$ = NN$ + N$: NN% = VAL (NN$)
460 IF NN% > 99 GOTO 430
470 IF NN% < 1 GOTO 430
480 MS% = 17 + SS%: LS% = 4352 + 256 * (SS% - MS%)
490 FOR P = 1 TO NN%
500 POKE 10,EE% - SS%: POKE 11,LS%: POKE 12,MS%
510 CALL 850
520 NEXT P
530 HTAB 5: VTAB 16: CALL -958: PRINT "REPEAT PLAYBACK? (Y/N):"
540 HTAB 29: VTAB 16: GET R$
550 ON R$ = "Y" GOTO 310: ON R$ = "N" GOTO 560: GOTO 530
560 TEXT: HOME: GOTO 70
570 HTAB 11: VTAB 22: INPUT "NAME OF FILE TO SAVE: ";F$
580 PRINT D$;"BSAVE ";F$;",A";MS% * 256;",L";(EE% - SS%) * 256
590 TEXT: HOME: GOTO 70
600 HTAB 11: VTAB 22: INPUT "NAME OF FILE TO LOAD: ";F$
610 PRINT D$;"BLOAD ";F$: GOTO 590
620 MS% = AD / 256: LS% = AD - 256 * MS%
630 HTAB 5: VTAB 10: PRINT "ENTER NUMBER OF PAGES (01 TO 99):"
640 HTAB 39: VTAB 10: GET C$: PRINT C$;: CC$ = C$: GET C$
650 PRINT C$: CC$ = CC$ + C$: CC% = VAL (CC$)
660 IF CC% > 99 GOTO 630
670 IF CC% < 1 GOTO 630
680 POKE 10,CC%: POKE 11,LS%: POKE 12,MS%
690 RETURN
700 HOME: HIMEM: 38400: END
```

Listing 2. Dodolator Program.

COMPUTER MUSICIANS...

£60 *for your program!*

E&MM is interested in buying software written by computer musicians for popular microcomputers. If you have a software program for any type of music making – or simply of use to other computer musicians, with or without a hardware add-on project (including MIDI), we would like to see it – even if you are new to software writing.

We are offering £60 for each accepted program as well as the opportunity to earn royalties if used for our Softmuse cassettes.

Program tapes carrying your name and address and, if possible, a listing, should be sent to E&MM, Alexander House, 1 Milton Road, Cambridge CB4 1VY. Please complete the declaration below and include this with your program:

.....

The enclosed program entitled..... is my own work and has not been published/offered to any other company. It is designed for a

..... machine (state make and model)

and it requires .....K memory.

Name..... Address.....

.....

Signature.....

If under 16 please get parent/guardian to countersign.....
All tapes will be returned.

BBC Micro Music

The past few months has seen an explosion of music programmes for the BBC Micro, so we thought it'd be fun to take a number of these beasties and put them under the dissection microscope in this month's 'Round-Up'.

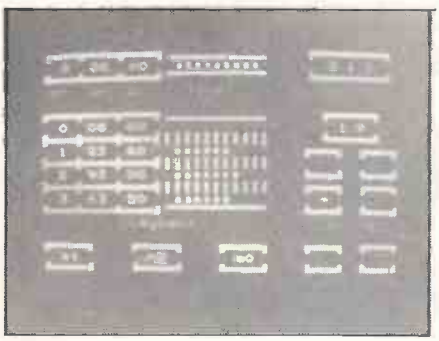
On the face of it, the BBC Micro should be no better than any other micro with a sound chip on the motherboard that's doing its darndest to be a kazoo. But the beauty of the music side of this machine is that the operating system designers used their noggins when it came to constructing the interface between us users and the sound chip itself. Those SOUND and ENVELOPE statements might appear a cunning means of persuading computer journalists to right screeds about the machine, by way of explaining what all those parameters actually do, but there's rhyme and reason in them there numbers, and it all comes down to making the sound chip more musical than you might otherwise imagine. On to the programs...

QUICKSILVA MUSIC PROCESSOR

(Model A/B, cassette, £14.95)

Quicksilva have a high reputation for quality software, and, looking at their BBC Music Processor *(MuProc)*, it's not hard to see why.

Basically, *MuProc* sets out to simulate the operation of a synthesiser, 4-track recorder, and mixing desk, by providing over 30 single-key functions for envelope selection and modification, sound effects, tape controls, mixing editing, and so on.



MuProc's ingenious display.

A single MODE 7 display is used which packs a lot of information into a tight space. Tape controls are on the right, with a 3-position digital counter for tape position and drive indicators for playback, record, reverse, fast forwards, and single-stepping (both ways!).

Music can only be entered from the qwerty keyboards, using one row from '1' to '£' as the first just-under-two-octaves and another from 'A' to 'X' as the top end of the keyboard. Personally, I think it's a bit obtuse putting the lower part of the keyboard on top of the higher part, but I suppose you get used to it. Bearing in mind that *MuProc* doesn't provide any visual assistance to avoid getting fingers in a twist, an alternative coded, or MCL, form of music entry would have been useful.

Where *MuProc* scores is in the ability to add expression to a piece of recorded music. Because envelope details are stored and displayed independently for each and every note, any number of envelope changes can be entered at the editing stage. To make life simpler, *MuProc* simplifies the 14 ENVELOPE statement parameters down to just 5, for a) pre-defining the amplitude part of the envelope, b) altering the sustain, c) pre-defining the pitch offset, d) modifying the pitch offset, and e) adjusting the overall volume. What's more, these envelope changes are displayed for each part as it's playing back (from the left to the centre of the display).

When music is entered into memory from the keyboards, 10 bytes are required for each note, which translates into around 1,950 notes for a 32K machine. Using the 'long-play' feature, this bytes/note requirement is reduced to 6 by putting notes into playing order and eliminating pointers, thereby increasing the note storage up to 3,250.

All of *MuProc's* ingenious envelope-changing features are demonstrated by one of the examples provided on tape — the first movement of Bach's 2nd Brandenberg Concerto. In other hands, this might have been yet another bit of sewing machine counterpoint, but, here, it really becomes something else. In fact, there's well over 100 envelope changes during the course of the piece, and, judging by an infamous 'plopping' sound that appears towards the end, it'd appear that someone's trying to beat Wendy Carlos at her own game! Mind you, I wonder whether all those notes were entered from the Beeb's qwerty keyboard? Somehow, I doubt it!

Conclusions: Music entry difficulties aside, this software has real class and I'd strongly recommend it.

Availability: Most shops selling BBC software, or direct from Quicksilva, Palmerston Park House, 13, Palmerston Road, Southampton SO1 1LL.

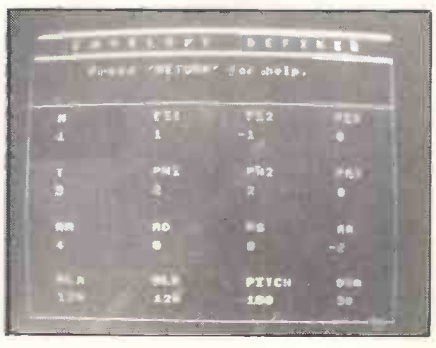
Rating:

Musical quality	♩♩♩♩♩
Ease of music entry	♩♩
Display quality	♩♩♩♩♩
Facilities	♩♩♩♩♩
Ease of use	♩♩♩♩
Documentation	♩♩♩♩♩
Value for money	♩♩♩♩♩

CLARES BEEBSYNTH

(Model B, cassette (£7.95) or disk (£10.95)

Clare's Beebsynth is much less ambitious than *MuProc*, but it's also half the cost. Its angle is also somewhat different to *MuProc* in that it concentrates its attention on making the best of a bad job, ie., using the qwerty keyboard as a live music input device. And, whilst *MuProc* certainly falls flat on its face as far as that's concerned, *Beebsynth* makes a reasonable stab at it.



Clare's envelope definer.

Basically, there are two sides to using it: firstly, the envelope definitions — filling in the parameters of the ENVELOPE statement — which is accomplished fairly painlessly with cursor keys and a rather basic display (no graphics to show the shape of the envelope); and secondly, the keyboard input itself which uses a different and more useful display.

Clare's keyboard display.

Rather than doing a *MuProc* double manual act, Clare's have managed to get 2 octaves out of the middle two rows of keys from 'CTRL' to 'RTN', with visual feedback provided by a set of displayed piano keys. The trouble with both this display and the similar one in Musicsoft's *Synth* is that they just sit there looking (fairly) pretty, passive as a, er, pork pie. I think keyboard displays should be made to work for their share of the screen, and some form of registering of finger activity (blobs appearing inside relevant keys, for instance) wouldn't go amiss in the pursuit of micro music excellence.

Various types of keyboard scanning (last note priority, etc.) can be put into effect with three of the function keys. All this works pretty well, and one ends up with a fairly playable keyboard with 3-voice polyphony. Mind you, both this program and all the others in this review would benefit greatly if some bright spark could come up with some sort of overlay that made the keyboard look a bit more like the real thing. Wishful thinking, I guess...

One drawback is that all 3 voices are assigned the same envelope — some sort of keyboard split would be a useful feature — but, more annoyingly, it's not possible to switch to a different envelope without going to a different display. That needs changing, I think.

A rather nice touch is the pitch bend facility provided by using the up and down cursor keys. Using these is actually quite like a pitch bend wheel, though not quite as fast as one might like, but it's still a useful feature.

Conclusions: A fair program, but the user interface needs a bit more work.

Availability: direct from Clares, 222 Townfields Road, Winsford, Cheshire CW7 4AX.

Rating:

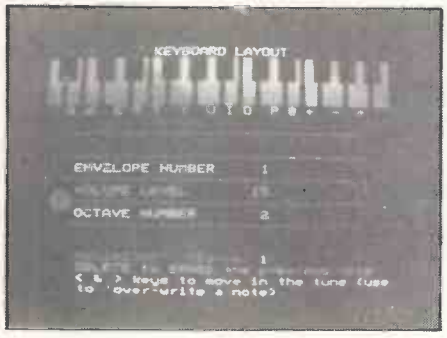
Musical quality	♩♩♩
Ease of music entry	♩♩♩♩
Display quality	♩♩♩
Facilities	♩♩
Ease of use	♩♩♩
Documentation	♩
Value for money	♩♩♩

MUSICSOFT SYNTH
(Model B, cassette, £8.50)

Musicsoft's *Synth* is the most recent of the music programmes in this review. In fact, the author very kindly rushed us a pre-production copy specifically for the review, so certain features may change by the time it sees the commercial light of day.

As far as comparisons with *MuProc* and *Beebsynth* are concerned, *Synth* would seem to offer the best of both worlds, in that it provides reasonably efficient input from the qwerty keyboard and a number of rather ingenious recording and editing features.

This time, the rows of playable keys stretches from 'TAB' on the left to the ' ' cursor key on the right — a stretch of 2 octaves-and-a-tone. Selecting the 'record' option from the main menu allows one to lay down a track for one of the four sound channels. Unlike some other real-time input programs, recording with *Synth* also provides most of the benefits of 'event' recording. So, for instance, as you're recording, you an change the volume setting (actually, the ALD parameter in the ENVELOPE statement), add pitch bend up or down, switch between envelopes, or even change any of the ENVELOPE parameters, and all this will be stored in memory. You're also able to stop recording at any point to back track to an incorrect event, change it, and then continue from where you left off.



Recording with Microsoft's Synth.

Playback can either be with the original timing or using the 'alter rhythm' feature. This is rather like the 'one-key play' mode of certain Casio keyboards and allows one to correct timing discrepancies, or change them completely, simply by trotting out recorded events with key taps. This 'adjusted' real-time performance can then be used for putting more tracks on top or it can be trotted out all over again if you still haven't got it right!

Another rather ingenious facility is the 'bring in line' feature that automatically lines up channels 2, 3 and 0 with channel 1 if they are within about 15/100 of a second when using 'alter rhythm'. If this is done with the speed slowed down, then the timing latitude is greater because the bringing-in-line is tempo related. Of course, it could be argued that it's the timing inconsistencies that add human feel to micro music, but, given the limitations of the keyboard input situation with the BBC Micro, this seems a sensible idea in this instance.

Finally, there's a 'repeat' facility which allows you to specify repeats for ranges of stored events. In effect, this means you can put any section of notes anywhere — even putting a beginning section at the end — and then reassemble things later on. Also, this extends to apparent event storage from around 3,000 notes to something a good deal less limited. These repeats can also be stored on tape along with the events themselves.

Conclusions: the display and interactive side needs a bit of working on to bring it up to the standards of *MuProc*, but it's basically a very flexible and inventive program that's highly recommendable.

Musicsoft also produce an excellent 'Musictools 1' cassette (for £5.75) which is aimed more at the educational market and general user. This includes a monophonic recording keyboard with speed, pitch and rhythm alteration on playback, a simple auto-tune generator, a symbol writer to generate chunky musical graphics (very useful for classroom teaching), and a program for cursor-editing of ENVELOPE statement parameters. All these programs are based on easily listable and movable PROCs, and the author suggests using them in different contexts on a mix 'n' match basis. All in all, rather good value!

Availability: direct from Musicsoft, 12, Fallowfield, Ampthill, Beds.

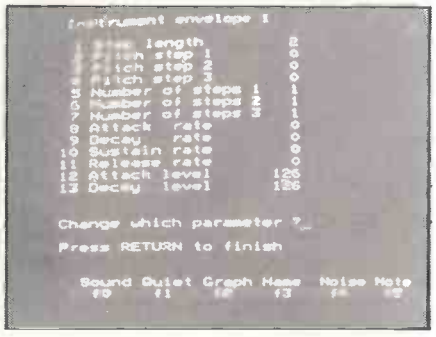
Rating:

Musical quality	♩♩♩♩♩
Ease of music entry	♩♩♩♩
Display quality	♩♩♩
Facilities	♩♩♩♩♩
Ease of use	♩♩♩♩
Documentation	N/A
Value for money	♩♩♩♩♩

BUG-BYTE
BBC MUSIC SYNTHESISER
(Model A/B, cassette, £9.50)

Bug-Byte's *Music Synthesiser* is definitely of the non-real-time sort — not a keyboard display in sight! The two main sections of the program are 'edit' and 'play'. Edit works for setting up both ENVELOPE statement parameters (extremely slow and tedious with no help from the cursor keys to scrollup and down or from one parameter to another) and inputting notes into each channel.

The major drawback of the note input is that there's no facility provided to alter the duration of one note relative to another. It's really right back to the old analogue sequencer territory, here. There are, however, some useful features, such as 'repeat' (a sort of in-part subroutine) and 'transposition' (which applies to all the notes in a part). One can also make up 'sections' of notes which can then be assembled, on playback, into verse/chorus-type structures.



Bug-Byte's version of envelope defining.

In comparison to *MuProc* and *Synth*, this program looks pretty pathetic. Those programs actually turn the BBC Micro into a decent sort of musical tool, which by virtue of the sophisticated editing and per-note parameter changing that they encourage, make the micro work hard for its share of the National Grid. With Bug-Byte's offering, one can imagine the Beeb's 6502 sitting back on its multiple pins counting silicon sheep jumping over logic gates for all the processing it's forced to do.

Also on the cassette is an 'Auto-Composer' program. This works on the basis of using your entered weightings for all the major and minor chords to ring simple rock-like progressions. It's quite fun, really (for a wet afternoon), but that's about as far as it's going to get as a model of transition rules

Auto-composition (of spelling mistakes . . .).

theory. Where this program really enters the realms of mind-bogglingness is in the spelling department. I mean, it's sort of understandable to mis-spell syncopation as 'syncapation' in the instructions on the cassette liner, but when the same word is mis-spelt in a different way ('sincapation') in the displayed text, sync spelt as 'sink', and chord as 'cord', it really makes you wonder . . .

Conclusions: needs starting again from scratch, and this time the picture on the cassette liner (rock keyboardist and concerto-playing pianist) might be made more representative of the program's contents.

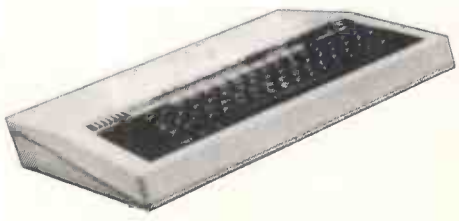
Availability: most shops selling BBC software, or direct from Bug-Byte Software, Mulberry House, Canning Place, Liverpool L1 8JB.

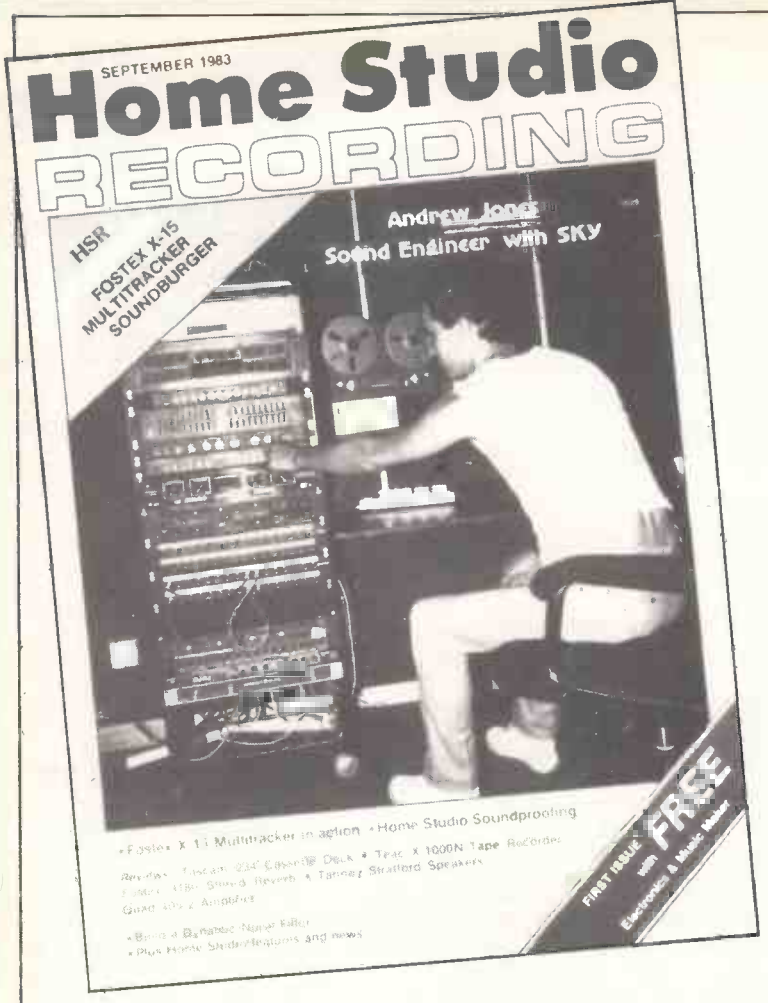
Rating:

Musical quality	♩♩♩
Ease of music entry	♩♩
Display quality	♩♩
Facilities	.
Ease of use	♩♩
Documentation	♩♩
Value for money	♩♩

So, what does this selection of programs hold for the BBC Micro user who's more serious in his musical inclinations than the average consumer? Well, to be honest, no one stands a bat's chance in hell of cutting an LP on a basic BBC Micro, but, what can help a lot is to get the sound chip talking directly to a mixing desk (if you're feeling grand) or your Hi-Fi (if you're being more realistic). One possible externalising add-on for the BBC Micro is 'Microvoc', a couple of speakers in Airbal-type spheres that are advertised as 'The Sound System for the BBC Micro'. Frankly, I can think of better ways to spend £22.50, but I guess it might suit some users. A much better ploy is to dig inside the BBC Micro and find a couple of solder pads marked 'PL16'. This is a couple of resistors away to the left of the 76489 sound chip (IC18) on the left side (or 'west', according to Acorn terminology!) of the motherboard underneath the keyboard. Taking an output from this gives a really clean 50 mV signal direct from the sound chip which can then be treated with chorus. echo, or whatever. In fact, this is the route that the BBC used for DI-ing sound on 'Making the Most of the Micro', and you can't get a better recommendation than that!

David Ellis **CM**





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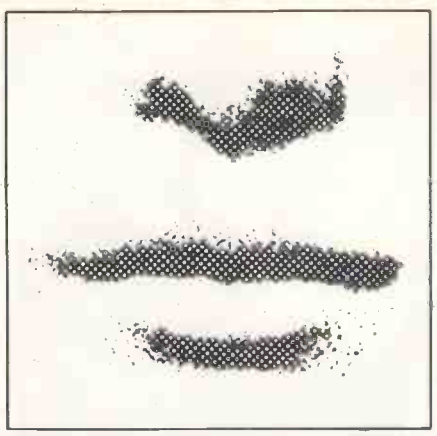
SPEECH SYNTHESIS



The desire to make inanimate objects spout forth more-or-less human utterances may possibly have something to do with Man's insistence upon anthropomorphizing everything he gets his grubby paws onto (viz. boats, cars, planes and family pets). The successful transplant of the refined tones of Kenneth Kendall from BBC TV news studio to a slice of silicon in the BBC Microcomputer must therefore represent a near ultimate example of the humanisation process, although, in essence, the transposition is nothing more than a technological update of good, old-fashioned ventriloquism. However, before we pat ourselves on the back for making such a tasteful transition from Detroit Dalek to Hereford Human, it's worth remembering that the origin of synthetic speech goes back a good deal further than even the first 'pocket calculator' of Charles Babbage. What's also rather interesting is that the two principal techniques for producing speech — recording/reproduction and synthesis through modelling of the vocal tract — have followed roughly parallel paths of development over the last century or so.

Confining our historical explorations to the last 200 years, one of the first well-documented accounts of a talking machine lies in the work of Johann Maelzel. Apart from inventing a speaking doll in 1823, Maelzel was the first person to attempt to simulate the vocal tract by using bellows ('lungs') to force air through a small diameter tube ('windpipe') with a moving flap ('tongue') to alter the resonant characteristics. Modelling of the vocal tract took a quite literal turn in the early part of the present century in the shape of Sir Richard Paget's Plasticene Resonators Producing Artificial Vowel Sounds. Paget's work stems from Helmholtz's observation in the 1860s that certain vowel sounds depended upon two resonances being set up simultaneously in the mouth. The Plasticene Resonators were constructed to demonstrate that all vowels stemmed from two such resonances. In a paper presented to the Musical Association of London in 1924, Paget proved his point by driving his vocal models from bellows, thereby simulating the eight basic vowel sounds. The reader can demonstrate some of Paget's observations for him/herself by speaking the words in Figure 1 and listening to the change in pitch on going from one to another. The actual resonant frequencies generated by the vocal tract will obviously vary from one individual to another, but it should be easy enough to hear the rising scale of the upper notes and the change in pitch that also occurs down below.

Modelling of the vocal tract took a more technological turn in the late 1930s at Bell Telephone Laboratories in the States. The voice synthesis system that emerged, the VODER (Voice Operation DEmonstratoR), consisted of a signal generator producing a buzz to simulate the vocal cords, a noise generator to simulate the rush of expired air, and a series of filters to imitate the resonant characteristics of the vocal tract. In the meantime, the other side of the speech synthesis fence was also being explored, in the shape of extensions of the 1936 speaking clock, using miniature glass records and transport mechanisms. Such synthesis by reproduction found its way into countless Barbie-like talking dolls, but also achieved some commercial success in elevators, information booths, and the like. The advent of cheap microprocessor technology hasn't actually changed the essential principles of speech synthesis, but it has made both techniques more efficient and more flexible.

Speaking Your (Computer's) Mind

The modern-day equivalent of recording and reproduction with a glass record is the digital implementation of the analogue tape recorder. Spoken words are digitized at a sample rate that's commensurate with the bandwidth of the voice and stored directly in memory. Speech is produced when the contents of the memory are accessed and fed to the input of a digital-to-analogue converter (DAC), then smoothed by a low-pass filter and amplified (Figure 2). This direct-storage method was widely used in the first talking calculators and by a number of microcomputer peripherals, including the Mountain Computer 'Supertalker' for the Apple II.

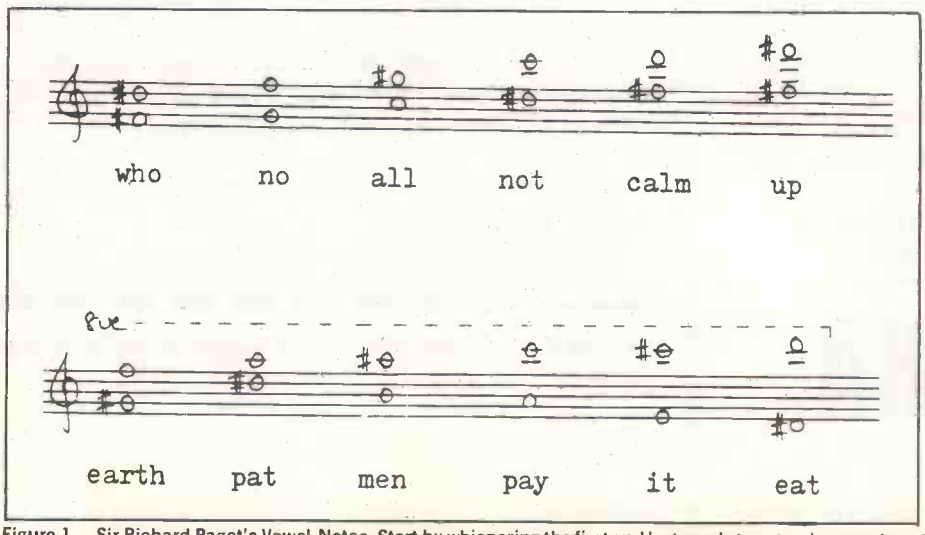


Figure 1. Sir Richard Paget's Vowel-Notes. Start by whispering the first and last words to get an impression of the range of the upper resonant frequency and then try the words, but still whispering, in the order shown.

The main disadvantage of the direct-storage method is the large amount of memory space needed for even small amounts of speech. For example, the Supertalker operates with a maximum sampling rate of 4kHz, meaning that 4K of RAM will be used up for every second of speech, and the resultant 1.6 kHz bandwidth for the final speech output means that a lot of high frequency detail is lost in the wash. The only way of improving the quality of speech is to increase the sampling rate, but that automatically reduces the number of words digitizable in a given memory space. So, a measure of commonsense and compromise is rather important in putting the digitisation principle into effect!

Commonsense also applies to which words one actually elects to store in memory. If, for example, one wanted the computer to speak a number that was the result of a calculation, a phrase for every possilbe answer could be digitized — provided one had infinite RAM and infinite patience. A much more sensible approach is to store the words, 'thousand', 'hundred', 'ninety', ... 'twenty' and 'nineteen', ... 'zero', a more manageable total of just 30 phrases, in an appropriate 'phrase table', with an address pointer for each entry, and then concatenate them together to produce whatever number is required to vocalise the calculation. The other thing that can be done to improve the vocal lot of the direct-storage method is to subject the speech to some form of data compression. An obvious starting-point is to remove the 'dead time' at the beginning and end of words, but special compression techniques can go as far as reducing the number of bits required for each digitized value to a quarter of the number used by straight digitization, though the quality of speech invariably suffers.

For all the difficulties encountered in applying digitization to speech synthesis, there are two major advantages to the direct-storage method: firstly, the speech is your own voice and, therefore, is as natural as that normally is; and secondly, adding a new word or phrase to the computer's vocabulary is simply a matter of digitizing it and storing it in memory.

Phonemes

Using the direct-storage method as a starting-point for further discussion, it's pretty clear that economic speech synthesis needs some means of reducing the storage requirements and data output rate from memory while still retaining intelligibility. One technique that emerged in the mid-1970s was synthesis based on stringing together the basic speech sounds or 'phonemes' common to any language. Examples are the "ouuu" sound in 'zoo' or the "tch" sound in 'touch'. When any of the 64 English phonemes are strung together, words are created. The word 'pin', for example, would consist of the phoneme for "phh", followed by the phoneme for "ihh" and that for "nnn".

The results for phoneme synthesis are the classic examples of talking computers — the IBM computer reciting a Shakespeare sonnet, for example — and this is because of the lack of inflections at the ends of words or sentences and an over-regular cadence (ie., monotonous intonation) to the sound. This method of speech synthesis produces speech that is the least understandable and most robotic of any technique, but it does have the considerable advantage of using minimal memory to store the parameters required to construct a word. Speech can be

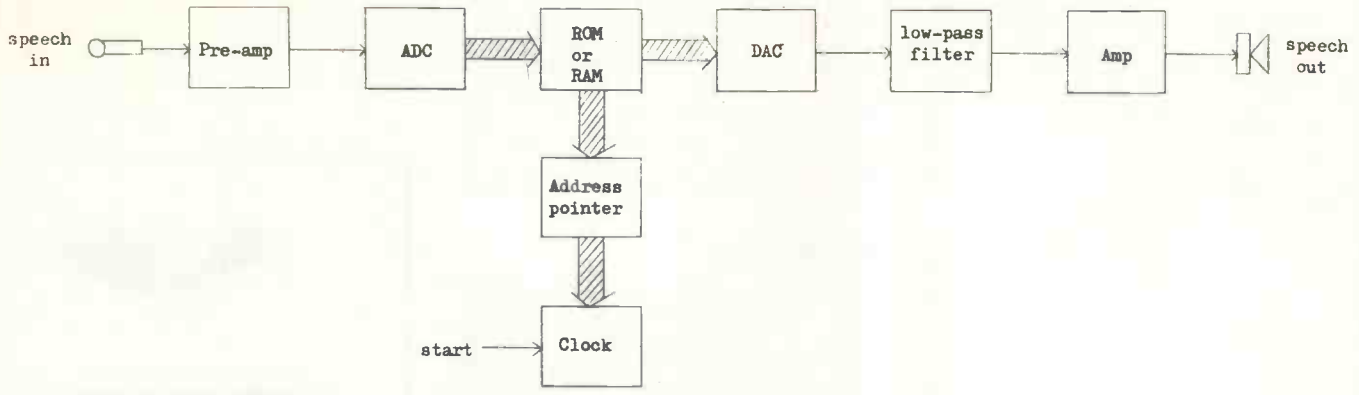


Figure 2. Direct storage method of speech synthesis.

stored at data rates of 10 bytes per second of speech — a dramatic contrast with the thousands of bytes per second required by digitization techniques. Furthermore, unlike the direct storage of entire words, the phoneme storage and reconstruction method enables true speech synthesis to be carried out, though the large amount of concatenation needed to assemble text makes for a fairly bumpy ride.

LPC

The third and most recent type of speech synthesis, linear predictive coding (LPC), offers a happy compromise as regards the amount of memory required for encoding speech, but it is also the first modern technique to return to the basic principles of vocal tract modelling. As LPC is the technique used by a number of new speech chips (including the TMS 5220 that is used in the BBC Micro and to be examined in 'Chip Chat' shortly, it's worthwhile taking a break from discussing technology to have a look at what one's actually attempting to model — the human vocal tract (Figure 3) — and how it produces the sounds we call speech.

Speech is composed of two main components:

1. Voiced sounds

These are produced when air from the lungs is forced between the vocal cords, thereby forcing them to vibrate or buzz, making a pulsating column of air enter the mouth and nasal cavities. The fundamental pitch of the resultant sound is determined by the length, thickness, and tension of the vocal cords. During the production of voiced sounds, the vocal tract receives pulses whose harmonic spectrum is very complicated — not least because it's changing from one moment to the next. However, a crude approximation of the vocal cord buzz is a pulse wave of very narrow width, ie., that generated by the vocal cords opening and closing very rapidly as air passes through.

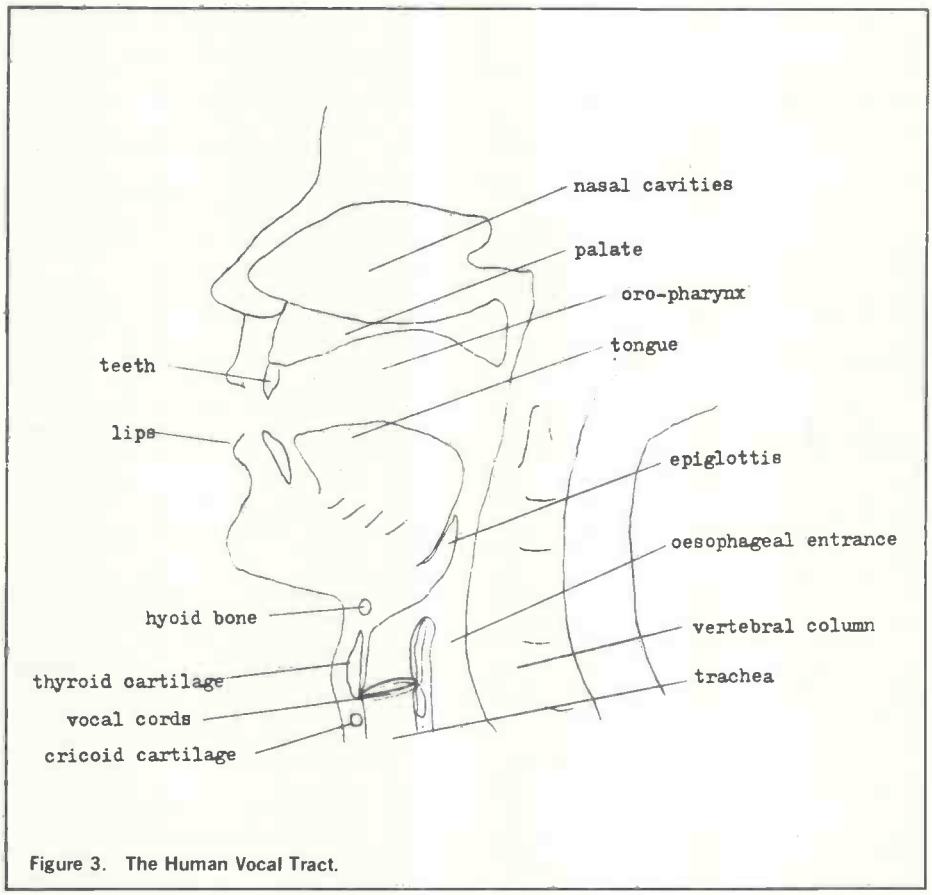


Figure 3. The Human Vocal Tract.

The harmonic spectrum of such a pulse wave gives equal weight to all the harmonics (Figure 4a), which isn't exactly like the real thing, but it turns out that passing this approximation through a series of filters does enable a reasonably convincing simulation of vowel sounds.

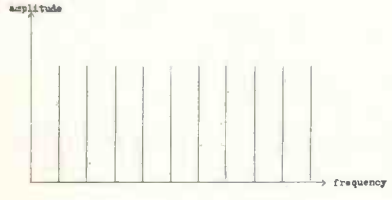
2. Unvoiced sounds

If the air from the lungs is allowed to pass between the vocal cords more or less unchecked, then unvoiced sounds such as "f" or "h" are produced. Fortunately, for merry modellers of the vocal tract, these are very similar in nature to the sounds produced by filtering a white noise source that has a rather broad and flat spectrum (Figure 4b).

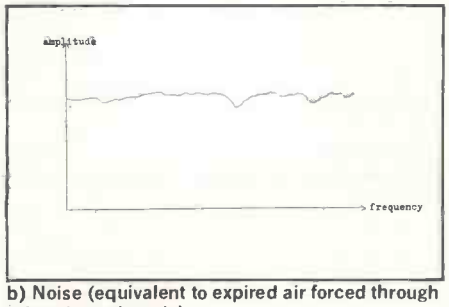
These raw sounds then have to be twisted and turned into shapes more closely corresponding to speech, and that's where the rest of the vocal tract comes into play. The upper vocal tract acts as a complex filtering system that determines the tonal character of both voiced and unvoiced sounds. Important filtering elements are the shape of the mouth, the position of the tongue against the teeth or palate, and the characteristics of the nasal cavities. Sounding "ah" and slowly altering the shape of the mouth demonstrates the effect of changing the shape of the upper part of the vocal tract on the spectrum of these voiced sounds.

In the case of vowel production, the jaw and tongue positions uniquely determine the voicing of the vowels, a, e, i, o, and u (see Figure 5). Also, their production isn't pitch-dependent, ie., any vowel can be produced at any rate of vocal cord buzzing. In general, precise variations of tone quality are obtained by movements of the tongue and lips altering the resonant characteristics of the filter system, thereby creating areas in which

Figure 4. Sound sources for modelling the vocal tract.



a) Narrow pulse wave (very roughly equivalent to the buzz of the vocal cords).



b) Noise (equivalent to expired air forced through relaxed vocal cords).

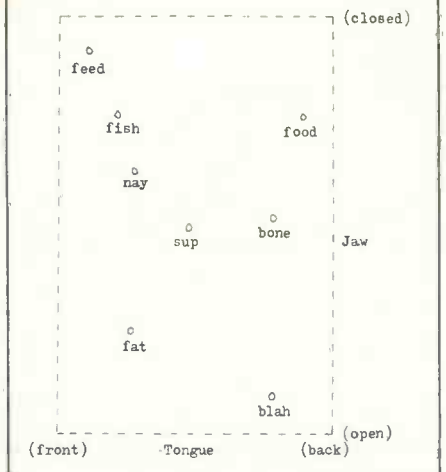


Figure 5. American vowel chart.

certain frequencies are boosted and others cut. The ranges in which certain frequencies are boosted and others cut. The ranges in which frequencies are boosted are known as *formant bands* and, for a given sound, produce the sort of spectrum shown in Figure 6. In addition to the filtering characteristics of the vocal tract, the lips and epiglottis also impose dynamic amplitude characteristics on the emerging air column to produce the percussive attack transients common to explosive sounds such as 'p' and fricative consonants like 't' and 'k'.

Overall, then, the vocal tract may be regarded as a complex sound generator consisting of an ampltitude — and frequency-controlled oscillator (vocal cords and lungs), a noise generator (lungs), and a set of formant filters (mouth and nasal cavities). These basic ingredients are available on commercial synthesisers, but the real problem in transposing them to speech synthesis lies in making the extremely complicated filter changes necessary to simulate speech. To synthesise speech by duplicating these filter changes, one has to be able to analyse these changes, and that's where linear-predictive coding steps in.

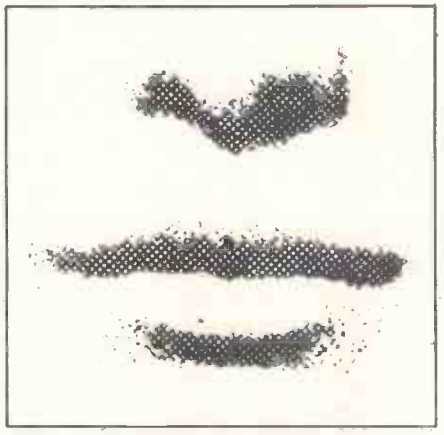
In the case of LPC, speech is gathered by the usual ADC sampling technique and then encoded and compressed, but, rather than being compressed in the time domain (at the waveform level), an algorithm first transforms the data to the frequency domain, ie., sorting out the formant bands, the speech equivalents to the harmonics of the average musical waveform. The results of this analysis are essentially the data needed to describe the filtering characteristics of the upper vocal tract and, given a suitable vocal tract synthesiser and raw voiced and unvoiced sounds, would enable speech to be shaped. The data collected by linearly predicting the characteristic formants of a particular word are stored in RAM or ROM. Retrieval of the compressed speech data is then used to control a digital *lattice filter* being fed the digital version of white noise (raw unvoiced sound) and pulse waves (raw voiced sound), with the digitally-filtered output being sent to the usual combination of DAC, low-pass filter, and amplifier (Figure 7).

Allophones

The important point about LPC is that it mirrors the way the vocal tract goes about speech synthesis remarkably accurately. However, the fact that each word or phrase requires an exclusive area of memory means that a large vocabulary requires an extensive library of ROMs (typically, 16 x 16K to store 3000 words). Fortunately, a compromise between the low quality, infinite word number of the phoneme method and the high quality, limited word number of the LPC method has been developed, and that's by using the magical ingredient of *allophones*. Like phonemes, allophones are basic speech components, but, in contrast to the 64 phonemes needed to build up words in the English language, 302 allophones are required, meaning that a single allophone is, in effect, a rather more basic component of speech than a single phoneme.

In fact, allophones are best viewed as modifiers of phonemes, and analysis of English speech suggests that 40 or so allophones can provide most of the phoneme modifications necessary for realistic speech. For example, the phoneme for "phh" is rounded and aspirated in 'poke'; rounded and unaspirated in 'spoke'; aspirated in 'pie'; unaspirated in 'spy'; slightly aspirated in 'taper'; released in 'appetite'; and unreleased in 'apt'. These acoustically different versions of 'p' — the so-called voiceless *bilabial stops* — are allophonic variations of the phoneme 'phhh". So, allophonic speech synthesis includes the majority of the subtle variations each phoneme can encompass and, therefore, provides much better quality than standard phonemic speech synthesis.

The cost saving of the allophone approach over an all-LPC method of synthesis reflects the very modest memory requirements of the former: just 3K to store the library of 128 allophones and 7K to hold a set of rules (such as Texas Instruments' 'Text-20 Speech') for translating text into allophonic equivalents, and for contouring inflections with the help of pitch modifiers to make the speech sound more natural. A key element in constructing speech with allophones is to make the transition from one to the other as smooth as possible whilst including enough *prosody* (tonal or syllabic accents) to make everything sound reasonably natural. Apart from what happens at the level of a given



word, good speech quality also needs a smooth energy contour over the length of concatenated phrases, and that's no easy task! We'll see how well that's actually achieved in practice when we come to look at the speech facilities now available for most micros.

Finally, to show that it's not just computers, dolls, clocks, and Plasticene Resonators that can be made to speak, here's another historical perspective on speech synthesis:

"(Alexander Graham) Bell's youthful interest in speech production also led him to experiment with his pet Skye terrier. He taught the dog to sit up on his hind legs and growl continuously. At the same time, Bell manipulated the dog's vocal tract by hand. The dog's repertoire of sounds finally consisted of the vowels 'a' and 'u', the dipthong 'ou', and the syllables 'ma' and 'ga'. His greatest linguistic accomplishment consisted of the sentence, "How are you, Grandmama?" which must have actually sounded like "ou a u ga ma ma". This, according to Bell, is the only foundation to the rumour that he once taught a dog to speak."

David Ellis **CM**

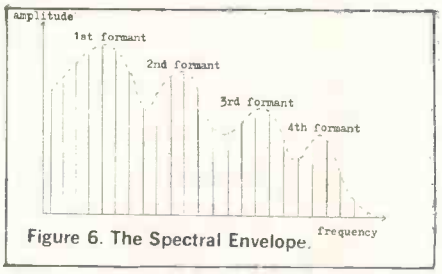


Figure 6. The Spectral Envelope.

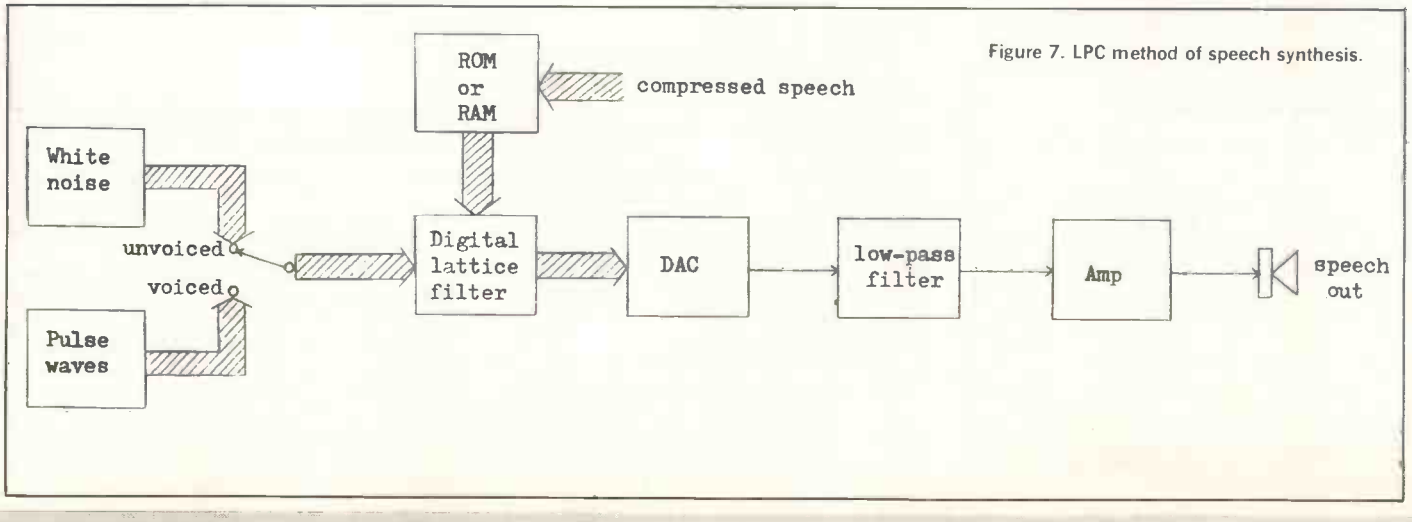
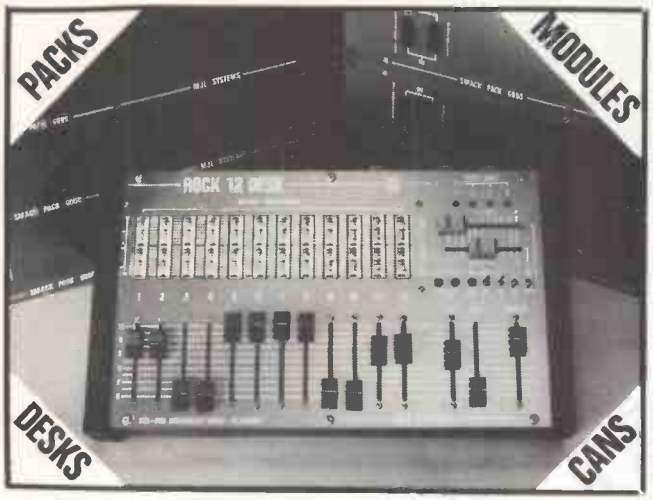


Figure 7. LPC method of speech synthesis.

LONG LIVE ROCK



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CAMI — Some Educational Music Programs

'CAMI' stands for Computer-Assisted Musical Instruction and is really all about making life easier for teachers trying to teach music or for those attempting to teach themselves.

The use of computers in music education in the USA is big business these days, and more and more companies are getting in on the act. Two companies that have made strong moves in this direction are Passport Designs (who make the Soundchaser) and Syntauri (of alphaSyntauri fame). Another firm that has been around longer, and has therefore accumulated a more sizeable array of educational software, is Micro Music (now under the aegis of a Washington company called Temporal Acuity Products). Not surprisingly, all three base their software around the evergreen Apple. This month, we're taking a look at what Passport Designs and Temporal Acuity Products have to offer.

Music Tutor

Music Tutor is the name of the CAI software from Passport Designs, written by Dr. Charles Boody of the University of Minnesota. The software is designed to be used in conjunction with the Soundchaser keyboard (Figure 1) and Mountain Computer MusicSystem digital synthesiser boards. As the latter two add up to just under £1,000, and Music Tutor costs £180 (both prices VAT inclusive), the system is by no means cheap (possibly more than many schools and education authorities would be comfortable parting with), but it does add up to a pretty impressive aid for teaching composition, orchestration, and that perennial bugbear of musical education — ear training.

Basically, Music Tutor incorporates four 'training units' — intervals, matching & tuning, chords and melodic games — that are designed to develop a number of aural skills and introduce general music concepts and principles. An important factor is that students can elect either to follow drills at their own speed or engage in ones that set some sort of goal by virtue of response times. There's also plenty of flexibility when it comes to how you enter your responses. For instance, when you're engaged in 'Matching a growing tune' (a sort of 'Simon' game without the distraction of flashing lights), you can opt to play the notes on either the Apple keyboard (using an overlay to show which keys correspond to what notes) or the Soundchaser keyboard itself. Furthermore, you can also choose whether or not you want visual feedback help (displayed solfege or notes on stave). All in all, there's lots of potential for ringing the sort of changes that one's likely to encounter in actual musical practice.

A set of displays associated with each training unit provides instruction, encouragement, progressive feedback, scores and selection of drill parameters (see Figures 2 and 3 for examples). The only real criticism I have of the way in which information is presented to the student lies with the complexity of some of the displays, which might prove off-putting to the newcomer. Whatever difficulties may be encountered in understanding the displays is adequately made up for by the helpful and friendly manual. I really like the laid-back style of humour typified by the following excerpt!

> ***The Intervals software will sharpen your aural (listening) skills and help you to learn to identify the interval between any given notes. These skills are more difficult to learn than the skills of playing Space Invaders, and for two good reasons:***
>
> ***1. It is more difficult to train your ear bones.***
>
> ***2. It requires more patience than saving the Earth from an alien invasion.***
>
> ***Most people feel a deeper sense of satisfaction with finely-tuned aural skills than with 2-D video game skills. As you keep reading, you should feel the first waves of satisfaction rolling in shortly.***
>
> *"The hurrier I go, the behinder you get."*
> Grandpa Verny

Well, I don't know who 'Grandpa Verny' is (the Californian equivalent of Confucius, I guess), but one thing that's certain is that Music Tutor makes ear training really enjoyable, and that's no small achievement.

As the software stands at present, it's very much designed for the individual student wanting to apply a bit of self-help to improve his or her musical skills. For the rigours of classroom use, some sort of unerasable report and statistical analysis of each student's performance is needed, and this is to be added to the next version of the software.

Micro Music

Micro Music programs are rather more reasonable in terms of their hardware requirements in addition to the Apple itself. This time, all one needs is a simple digital-to-analogue converter (DAC) board (costing $175) that slots into the back of the Apple. The quality of sound from this bit of hardware is way below that of the MusicSystem boards used by Passport's software, but it certainly suffices for teaching purposes. The range of Micro Music CAI programs is impressive to put it mildly, so I've listed them below:

COMPOSITION/SYNTHESIS
Music Composer
Envelope Shaper
Envelope Construction

MELODIC DICTATION
Melodious Dictator
Arnold
Doremi
Name that tune

HARMONIC DICTATION
Harmonious Dictator
Harmony Drills
Interval Mania
Chord Mania

RHYTHMIC DICTATION
Rhythmic Dictator
Rhythm Drills

ERROR DETECTION
Sir William Wrong Note
Sebastian

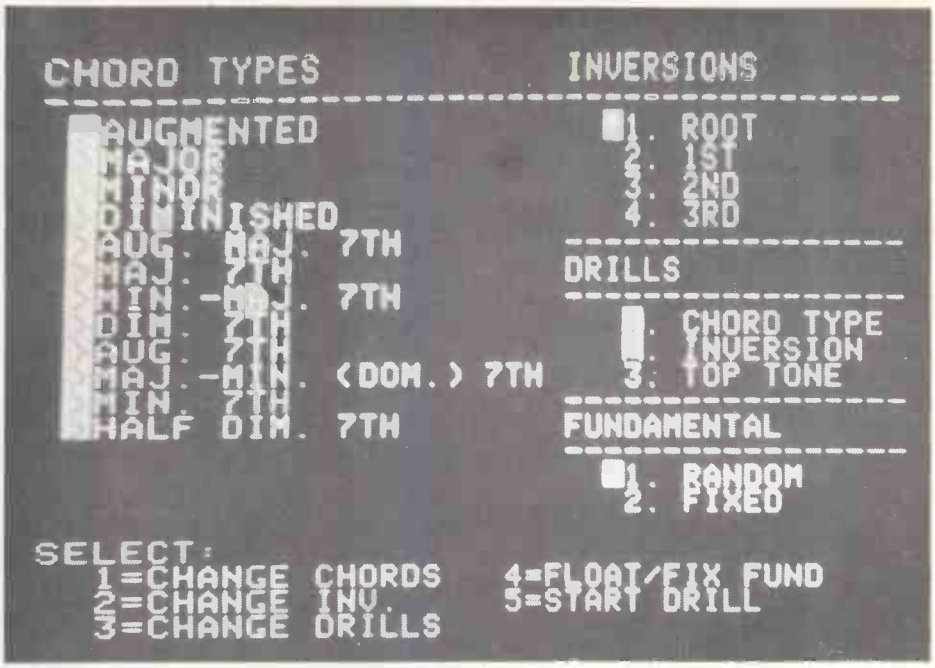
THEORY
Key Signatures
Pitch Drills w/o accidentals
Pitch Drills with accidentals
Mode Drills

VOCABULARY/SYMBOLS
Musical Symbols
Musical Terms
Musical Instruments
Italian Terms
Foreign Instrument Names

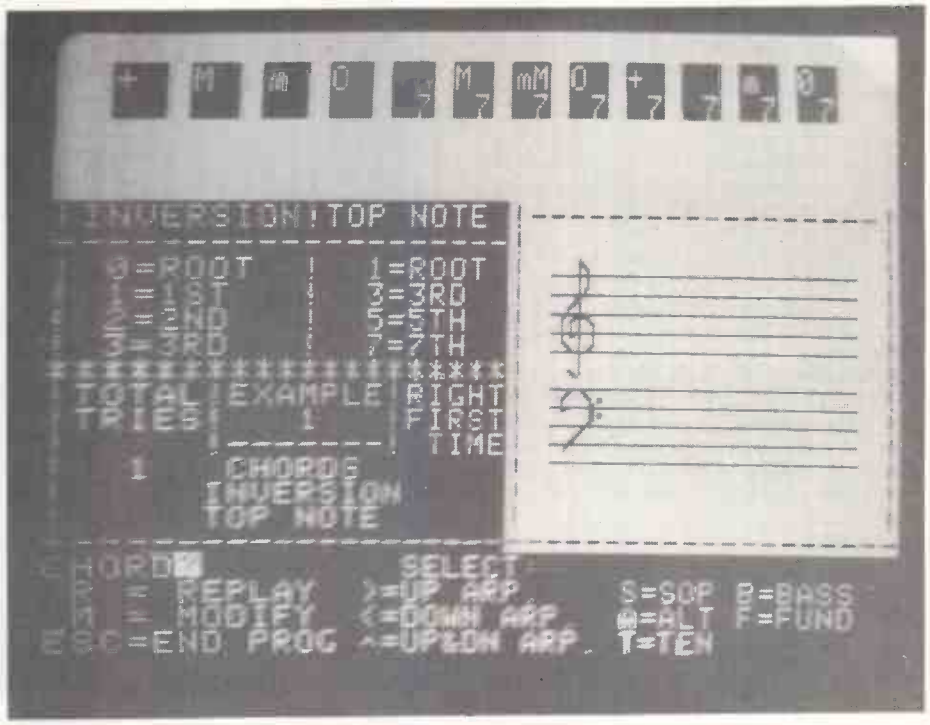
HISTORY
Composers and their works

INSTRUMENT TUTORS
Microtrumpet

MANAGEMENT
Uniform Master



Music Tutor display.



Music Tutor display.

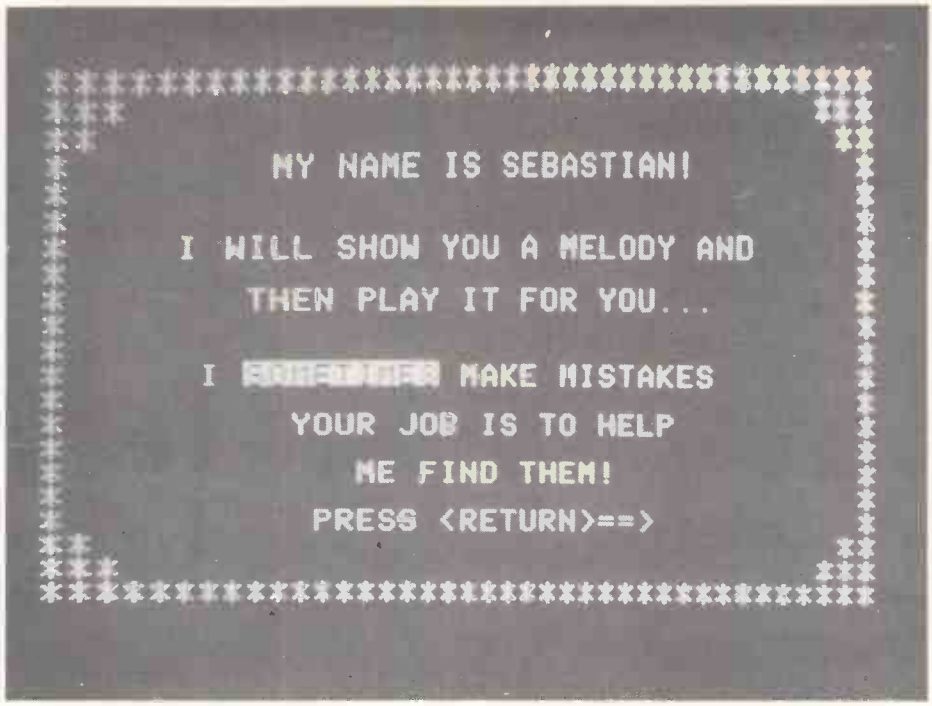
Temporal Acuity Products were actually kind enough to send me all these programs for review, but, faced with 28 disks, you need several bottles of plonk and a lot of stamina to wade through the contents of all of them, and, to be honest, my patience started waning after the first ten. Mind you, that's no reflection on the quality of the software; it's just amazingly tedious to have to boot up disk after disk in order to move from melodic (Melodious Dictator) to harmonic (Harmonious Dictator) and then to free (Interval Mania) interval presentation. And therein lies the big problem with the Micro Music software: lots of separate disks means lots of money. Taking the three intervals-training disks as examples, the purchase of those as well as the compulsory DAC board would set one back $745 (around £650), which seems one helluva lot to pay for just one corner of musical CAI.

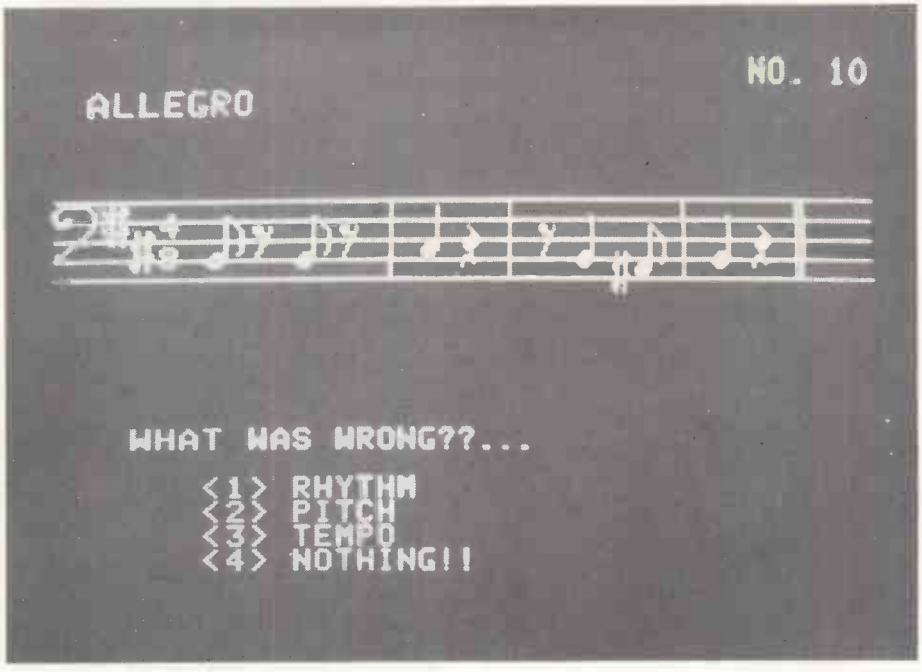
Going even further to consider the cost of all 28 disks, the sum would be a cool $3,355 (leaving you little change from £3,000, I'd imagine). That might buy you a really amazing CAI set-up, but at what a cost! Surely educational software should be cheap rather than in the business software bracket? The annoying fact about all this is that Micro Music's software is excellent, especially their 'error detection' programs which have no competition on the market. A program like 'Sebastian' (no relationship to teddy bears, I hasten to add) would surely be valuable in a huge number of educational situations, since it displays a line of music (Figure 4), either pre-programmed or entered by the teacher, plays it with an error of tempo, rhythm, or pitch, and then asks (and cajoles) the student into saying what mistake has been perpetrated and where it lies. This is, quite simply, a superb program, but even this, at $190, is too expensive for the cost-conscious educational market.

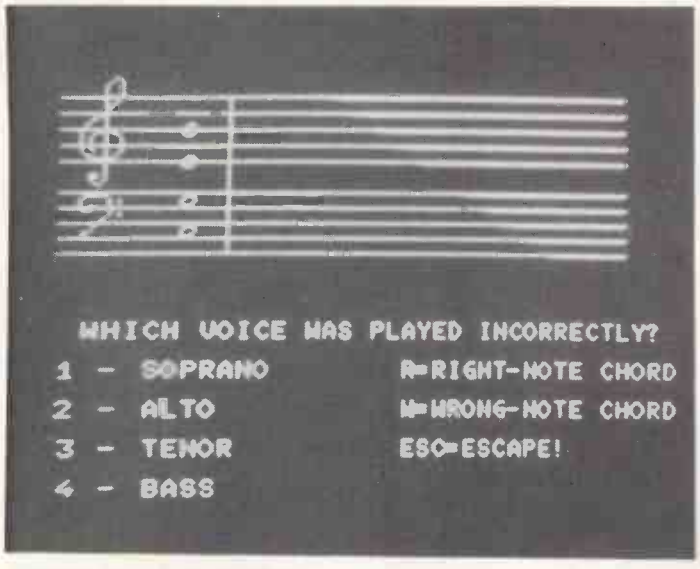
What Temporal Acuity Products need to do is halve their prices, put related programs on a single disk, and remove the very effective copy protection. Otherwise, I don't see much chance of educational Apples in this country benefiting from Micro Music's expertise.

David Ellis **CM**

Availability: Music Tutor software and Soundchaser keyboard from Triangle Software Ltd., 38 Belleville Road, London SW11 6QT (Tel: 01-223 4192); Micro Music software and DAC board from Temporal Acuity Products, 1535 121st Avenue S.E., Bellevue, Washington, WA 98005, U.S.A. (Tel: 800-426-2673).







Temporal Acuity Products display.

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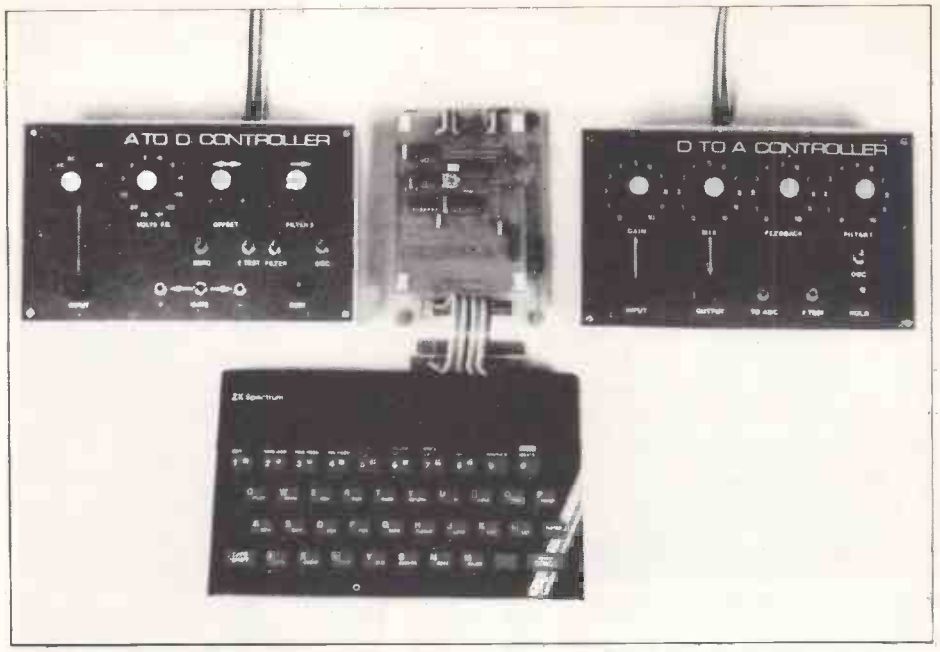

DIGITAL SIGNAL PROCESSING

by Charles Blakey, Steve Thornton and David Hall

Part 3. Extended Echo Delay and Fourier Synthesis using the Digital Conversion Hardware.

The previous article in August '83 E&MM concluded with setting up the analogue to digital and digital to analogue converters presented in this series, together with an introduction to the echo program contained in the DIGISOUNDER 3 software.

For the delay routine we set aside a fixed block of 30K of memory within a 48K SPECTRUM and so to change the maximum delay time we simply vary the rate of writing information into memory. In other words, the slower the rate of entering data into memory the greater the maximum echo time. On using 'e' to enter the real time echo program, the sampling rate is set to 14.8 kHz, which happens to be the same rate as the digital storage oscilloscope routine (not 12 kHz as initially estimated). This rate combined with 30K of memory gives a maximum delay of just over two seconds and you have the option of entering any delay time between one millisecond and the maximum value shown on the TV display. As stated in earlier parts, the sampling rate determines the bandwidth of the input signal, which must be less than half the sampling rate if one is to avoid excessive noise and distortion. Thus with the default value of 14.8 kHz the input signal should not contain components having a frequency above about 7 kHz. The filters on the converters may be adjusted to meet any bandwidth requirements.

In some instances one may be willing to reduce the maximum echo time in order to obtain a greater bandwidth. There are also other situations, such as vocals, where the bandwidth may be reduced so as to obtain a longer echo. The program therefore contains an *expansion* facility which is accessed by entering 'x'. One then has the opportunity to enter any bandwidth within the range of 5.6 kHz to 22.4 kHz which corresponds to maximum echo times from greater than five seconds to about 1.3 seconds. When you return to the echo program with an 'e' the new sampling rate is displayed, together with the values of minimum and maximum delay times that may be entered. For example, if a sample rate of 10 kHz was entered in the expansion routine, then the display will show that any delay time between 1 and 2999 milliseconds may be obtained.

Fourier Synthesis on the Spectrum

Any waveforms which are periodic in nature, such as musical signals, can be expressed as a series of harmonically related sine and cosine waves. This is termed a *Fourier series* in honour of the French mathematician who discovered this technique of describing and analysing waveforms.

The Fourier series is the foundation of electronic music and in fact the early works of the German school made extensive use of banks of sinewave generators. Nowadays we can re-create the effect of this type of hardware by using a microprocessor to combine any number of sinewaves together in the desired proportions and then listening to the resultant sound by converting the digital data into analogue form. To demonstrate this, start by running the following program on the SPECTRUM:

```
10 FOR n=0 TO 255
20 PLOT n, 88+80*SIN(n/128*PI)+26.77*
   SIN(n/42.66*PI)+16.06*SIN(n/25.6*PI)
30 NEXT n
```

The plot is shown in Figure A and line 20 is simply the sum of three sinewaves representing the first three odd harmonics which make up a square wave. Even with just three harmonics the square wave is quite distinct. One can also plot the three individual sinewaves, but remember to add the 88 each time so as to centre the plot on the screen.

Next substitute line 20 by the following which represents the first five harmonics of a sawtooth waveform, as shown in Figure B.

```
20 PLOT n. 88+50.9*SIN (n/128*PI)+25.4*
SIN(n/64*PI)+17*SIN(n/42.66*PI)+12.7*
SIN(n/32*PI)+10.2*SIN(n/25.6*PI)
```

For a triangle wave, illustrated in Figure C, line 20 should be as follows, which again is the first three odd harmonics:

```
20 PLOT n, 88+72.9*SIN(n/128*PI)-8.1*
SIN(n/42.66*PI)+2.9*SIN(n/25.6*PI)
```

Note the minus sign for the third harmonic and if a sinewave of the same proportion was added, instead of being subtracted, at this point we would obtain the waveform shown in Figure D.

DIGISOUNDER 3 contains a program for producing waveforms using Fourier synthesis. Enter 's' for synthesise and you will be prompted for the amplitude of the first harmonic (fundamental). Any number between 0 and 380 may be used in response to any of the amplitude prompts. After entering the first number a prompt appears for the second, and so on up to and including the fifth. After five the prompt is then for the phase angle to be used and there is a choice of 0 or 180 degrees. A zero will produce an addition of the harmonic whereas 180 will result in a subtraction, as in the case of the triangle waveform of Figure C.

Try out the program by entering the numbers 318,159,106,79.5 and 63.5 for the amplitudes and then 0,0,0,0 and 0 for the phase. When the last phase has been entered the information supplied will be displayed in the form of a frequency spectrum and a table of phase angles. A copy of the screen display is shown in Figure E. The micro will then calculate the 256 terms of a wavetable at a rate of about two a second and so you can sit back for a couple of minutes. After this it goes into an automatic scaling routine, which takes about fifteen seconds, and finally loads the waveform into the 30K of reserved storage memory.

Apart from the memory loading routine, the remainder of the program is in Basic to make it easier for the user to modify. For example, if one wishes to study this aspect of synthesis in greater detail then the number of harmonics and the choice of phase may be extended although five is adequate for most demonstration purposes. When memory loading is complete, a pair of inverted commas will appear as a prompt for the next command. Entering 'w' at this time will plot the waveform that has been computed and the result for the above set of data is shown in Figure F. This is the same sawtooth as Figure B but the display looks a bit more ragged due to compression which is necessary in order to generate a satisfactory frequency on conversion.

The 'w' command may in fact be used with all programs to display the contents of the first 127 bytes of storage memory. Likewise, entering 't' will recall the spectrum display of the current synthesised waveform. The command 'p' for print can also be used to print out the TV screen display at any time the inverted comma prompt is showing.

The synthesise routine is principally educational and offers an excellent opportunity to demonstrate the sounds produced by different waveforms, many of which may not be readily available using analogue equipment. Try the following:

a. harmonic amplitudes of 203.0.68.0.41 and phases of 0.0.0.0.0: Figure G
b. harmonic amplitudes of 203.0.68.0.41 and phases of 0.0.180.0.0: Figure H
c. harmonic amplitudes of 324.0.36.0.12.8 and phases of 0.0.180.0.0: Figure 1

Note that the frequency spectrum of the

waveform in Figure G is exactly the same as that in Figure H. Does the latter sound more like a square wave or is it closer to the triangle waveform of Figure I?

The synthesise routine may also be extended to the most common technique of analogue synthesis, namely, generating a waveform of high harmonic content such as a sawtooth or pulse and then modifying the harmonics by filtering. The effect of a 24dB/octave low pass filter can be quickly examined after any synthesis by using the filter on the digital to analogue controller. The frequency measurement routine from DIGISCOPE 3 is also available with the current programs and this allows the cut-off frequency of the filter to be determined when required. The latter is done by connecting 'f TEST' on the D to A Controller to the '+ GATE' on the A to D Controller (make sure the gate select switch is on +), switching the filter into oscillation and entering 'f'. The frequency is displayed on the TV screen and continually updated so as to allow precise setting of filter frequency.

By using numbers, however, we are able to simulate any type of filter. We can even examine effects which are beyond the capabilities of most analogue synthesisers, for example, the effect of a super notch filter capable of completely removing a harmonic. This is easily achieved by entering zero for the amplitude of the harmonic to be removed and Figure J shows the sawtooth waveform of Figure F with the second harmonic removed, which makes it look more like a square wave. More conventional filters can also be simulated by reducing the amplitude by the cut-off rate. Thus a 12dB/octave filter will remove successive harmonics beyond the cut-off frequency by -12dB, -24dB, -36dB and so on.

To calculate what this means in decimals use the formula 1/antilog(dB/20) and so -12dB necessitates multiplying by 0.251; -24dB by 0.063; and -36dB by 0.016. Using our earlier example of a sawtooth with amplitudes of 318, 159, 106, 79.5 and 63.5 and a 12dB/octave low pass filter set above the second harmonic yields new amplitudes of 318, 159, 26.6, 5 and 1 and the resultant waveform is illustrated in Figure K. Substituting a 24dB/octave low pass filter yields amplitudes of 318, 159, 6.7, 0.3 and 0 and the waveform is shown in Figure L. Both waveforms still show a marked sawtooth shape and this is another example of sound being more relevant than shape since the two are audibly quite different — with the 24dB/octave filter the 4th harmonic is some 60dB down on the fundamental and the 5th harmonic is absent.

Playback methods

Hopefully the above examples illustrate the power and usefulness of Fourier synthesis. The main problem when using the technique for comparing the sound of different waveforms is that some minutes elapse between samples which makes such comparisons difficult. Although the waveforms may be recorded digitally using the 'save' program it will probably prove simpler to make conventional tape/cassette recordings of the sounds and to compare them later by sequential playback. First, however, we have to get the data converted into analogue form and three such playback methods are available. These are: 'i' which provides a single shot replay; 'h' which is called 'pitch shift' and is a continuous replay routine, and 'z' which is a sequencer program. In this article we will describe the 'h' (continuous replay).

After entering 'h' you will be successively prompted with three questions:
(a) transpose?, which is any whole number between 1 and 255 and this response deter-

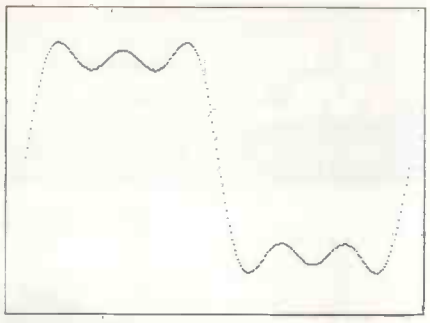

Figure A. Sum of first three harmonics making up a square wave.

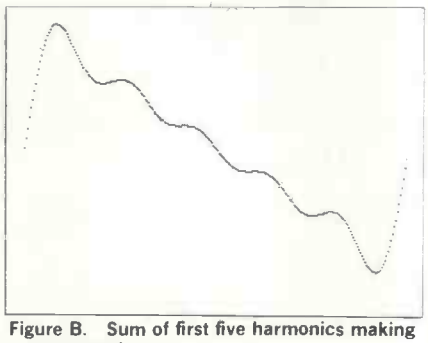

Figure B. Sum of first five harmonics making up a sawtooth wave.

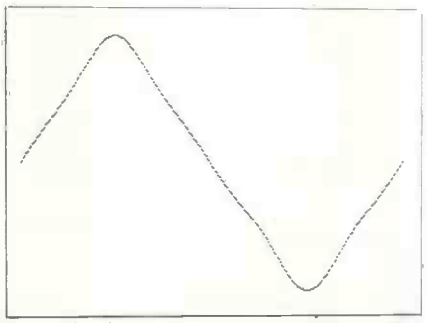

Figure C. Sum of first three harmonics making up a triangle wave.

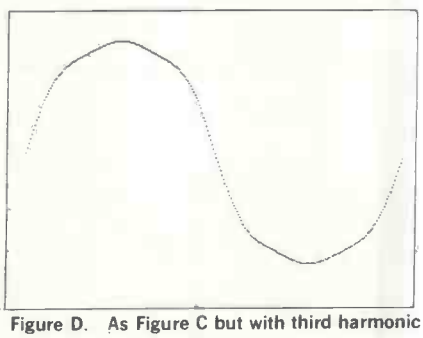

Figure D. As Figure C but with third harmonic added instead of subtracted.

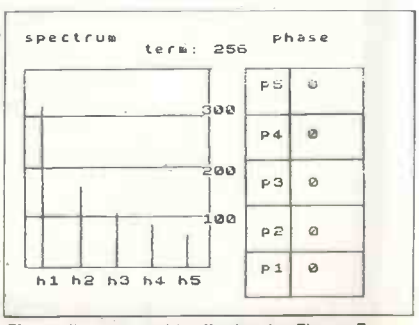

Figure E. Wavetable display for Figure F.

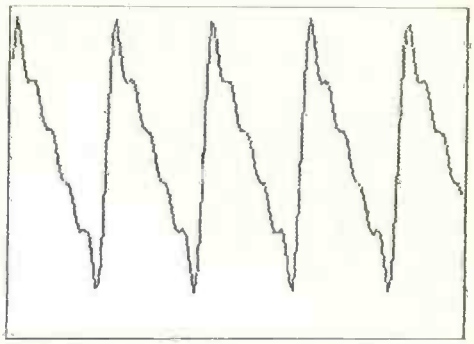

Figure F. Sawtooth waveform generated by Fourier Synthesis program.

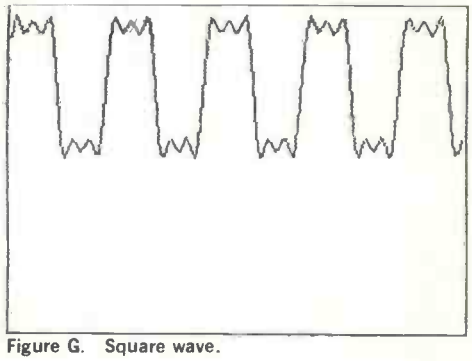

Figure G. Square wave.

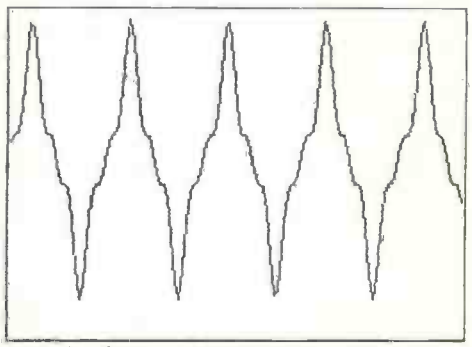

Figure H. Effect of changing phase angle of third harmonic of square wave.

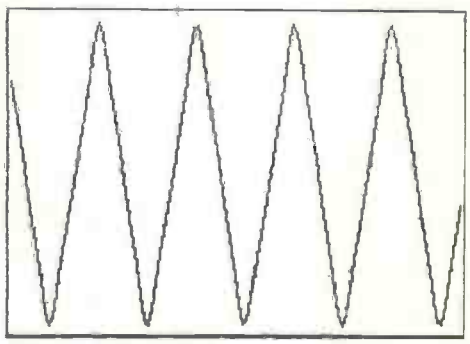

Figure I. Triangle wave.

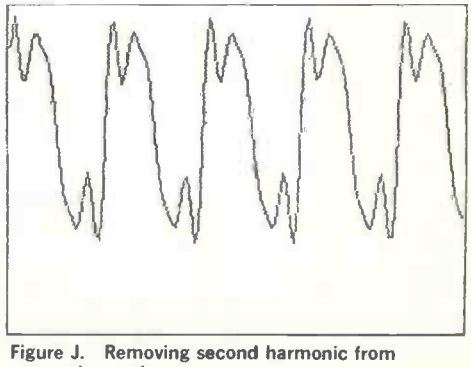

Figure J. Removing second harmonic from sawtooth waveform.

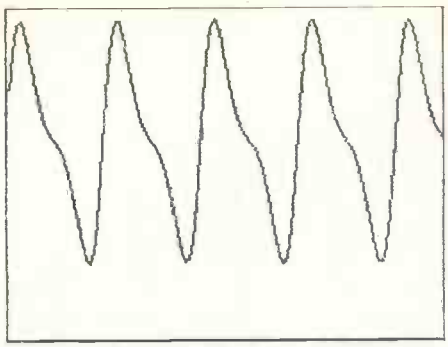

Figure K. Effect of 12dB/octave low pass filter on part of sawtooth waveform.

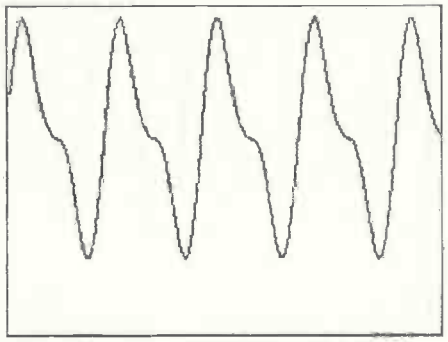

Figure L. Substituting 24dB/octave filter in Figure K.

mines the frequency of the waveform on playback. From 'synthesise' a value of 1 will give a frequency of 1264Hz, 10 gives 542Hz and 50 yields 153Hz. The higher the number the lower the frequency and so the longer it will take to play out a given length of memory;

(b) length?, which means the length of memory to be played back before returning to the beginning of the memory and starting again. The value can be any number up to 30,000 and generally the higher the value the better.

The reason for this is that the analogue voltage equivalent for the last byte in storage memory may not be the same as for the first byte in memory and so each time a new cycle commences an audible 'glitch' may occur and the time between glitches will be longer the higher the length entered. In fact this glitch may be eliminated by slightly altering the length of memory so that the start and end of the waveform will be the same. A length of 29,850 with a synthesised waveform will give a noticeable improvement and this could be improved with a little experimentation (patience!).

(c) forwards or backwards?, which is obviously the capability to play the contents of memory either forwards or backwards. This is useful with some other forms of signal processing but playing our sawtooth waveform backwards means that the voltage will ramp up instead of down.

After entering 'f' or 'b' for the last response, the contents of memory will be continuously played back through the digital to analogue converter and the output filter should be adjusted for the best signal to noise ratio. Pressing the 'HOLD' button on the D to A Controller will stop the playback and put up the inverted commas prompt.

In the next issue we will complete the description of the routines in DIGISOUNDER 3 as well as covering outstanding matters from earlier articles.

E&MM

For sales and technical information relating to hardware and software for this series please contact Digisound Limited, 14/16 Queen Street, Blackpool, Lancs. FY1 1PQ. Ready-built units are also available, as well as systems for other micros. Tel. (0253) 28900.

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NEWS & LETTERS

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Also contained within the ZX Interface 1 are an RS232 interface and local network, the complete unit attaching to the underside of the Spectrum and duplicating the latter's peripheral port.

The RS232 industry standard serial interface enables the Spectrum to drive full-size printers and to communicate with other computers having the same interface; it also permits transmission of data over telephone lines. The local area network, on the other hand, acts as a high speed communications link between up to 64 Spectrums (or should that be Spectra?) transmitting at 100 kilobaud.

More details on the ZX Interface 1 from Sinclair Research Ltd, 25 Willis Road, Cambridge CB1 2AQ.

System Control

Dear Mr. Ellis,

Being a musician and a computer buff I welcome the Computer Musician section of the E&MM with great enthusiasm. Having said that, I would like to make a few suggestions if I may. Firstly I would like to see less space taken up on in depth reviews of Zillion Dollar Systems that the average reader can't afford, or gain access to in any degree. I have found from my own personal experience, that articles on equipment that the average person can afford or construct, eg. OMDAC – has more relevance and gives more creative instinct to the reader of the article. So please keep the reviews and projects at an economical level, I'm sure more people would end up reading E&MM.

Also I agree that an Ideas Forum would be a good idea, especially on the programming side eg. Machine Code Subroutines to scan I/O ports more quickly than Basic, Software exchange through the printing of names of clever programmers, who would like to learn about actual musical skill etc.

Anyway let me tell you about the system I hope to complete before the end of the year.

When complete the set up will be:

A ZX Spectrum connected to an OMDAC unit. Which will in turn control two SH101s and an MC202, through the first three sample and holds and trigger outputs. The other five will be configured to trigger an analogue drum console I'm halfway through constructing, using E&MM Syntom, Synwave, Syntom 2, Synbal and Maplin Synchime PCBs. The MC202 will be used to write the individual lines for each piece, then passing the CV information into the OMDAC step by step. The information will then be added to the Trigger timings for the drum units to create a master programme.

I hope to store the information for each piece on a file system via a Microdrive connected to the Spectrum, then a new programme can be written to extract the relevant CV and Trigger information for an unlimited number of songs. This programme I hope to write in Machine Code for greater speed and accuracy when playing in a live situation, which is what the whole system is being set up for. This is where the Ideas Forum could help, I know a fair bit about basic – but nothing about Machine Code. To be quite honest I don't want to get bogged down by it, I'd rather pay a small sum for a bit of assembler programme, and implement it into my system. At present I have one of the SH101s and the MC202, I also have access to a Spectrum and I've sent off for the OMDAC PCB. So when all the hardware is complete I'll have to swot over a few months programming.

Keep up the good work, and I'll keep you up to date on how I'm using the System.

Steve Simpson
Stockton
Cleveland

EST. 1975

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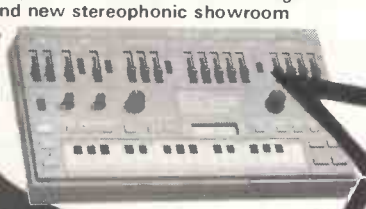

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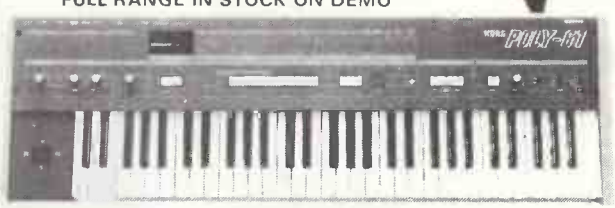

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MXR 185 Drum Computer

As the prices of digitally-sampled drum machines begin to plummet, they become an even more attractive proposition to the musician in the street. I would hazard a guess that the majority of previous such devices are currently occupying space in recording studios, video and film production suites, as well as the home studios of songwriters and famous musicians. These are generally the only people able to afford the asking price of a Linn or Movement. The appearance of the Drumulator has encouraged manufacturers to produce drum machines with a wider market appeal and a suitably lower selling price. It therefore comes as no surprise to find the MXR Drum Computer also being launched into this sector. At around £1500 it falls right in the centre of the price range of available sampled drum machines. Let's then look at what it offers.

Appearance

The unit is superbly presented in a greyish-brown coloured case with wooden end cheeks. Measuring 17½"(W) x 10½"(D) x 3¼"(H) and weighing in at around 12lbs, it is a sturdy, yet portable unit that would fit snuggly into a 19" rack with a couple of flanges attached to the end cheeks.

The machine is fully programmable and features 12 real drum sounds, digitally recorded and stored in memory (PROMs). The front panel is divided neatly into four sections. The top half contains fourteen sliders, eleven of which control the relative levels of their respective sounds in the overall stereo mix available at the main left and right output sockets on the rear panel. One slider governs the volume of the built-in click track which acts as a metronome aid when composing rhythms. The remaining two sliders are labelled Tempo and Pitch and tempo can be adjusted from 40 to 250 beats per minute which is quite a usable speed range. Pitch allows for a degree of drum tuning but unfortunately acts on the overall pitch of every single sound. Moving this control whilst a rhythm is running is similar in effect to the varispeed on a tape recorder. Pitch information is not stored in memory, however, which would have been a useful bonus.

The right hand panel contains the twelve, larger square-shaped buttons which are used to enter the drum voice beats – one button per voice. These are arranged in three rows of four buttons as follows: (top row) Tom 1, Tom 2, Crash, Claps; (middle row) Hi-hat open, Snare, Tom 3, Block; (bottom row) Hi-hat Closed, Kick (Bass drum), Rim Shot and Bell. The positioning of these buttons means that they can easily be played by hand, using each of your five fingers to hit a different drum.

The left hand panel has four fair-sized, seven segment LED displays that indicate the Step Number and Song/Pattern Number, as well as giving essential visual feedback on every record and playback mode of operation. Below these is a ten-digit keypad for entry of all number information.

Controls

The remaining fourteen pushbuttons deal with the selection of various control parameters, some of which serve dual functions. 'Tempo' gives a digital readout of the beats per minute set by the tempo slider control. 'Shift' is used to give a human feel to the rhythm by randomly retarding or advancing the drum beats. There are four levels of shift available (0, 1, 2, 3) which can be programmed according to your needs. Level 3 gives quite a margin of error introducing a fairly authentic jazz-type 'swing'.

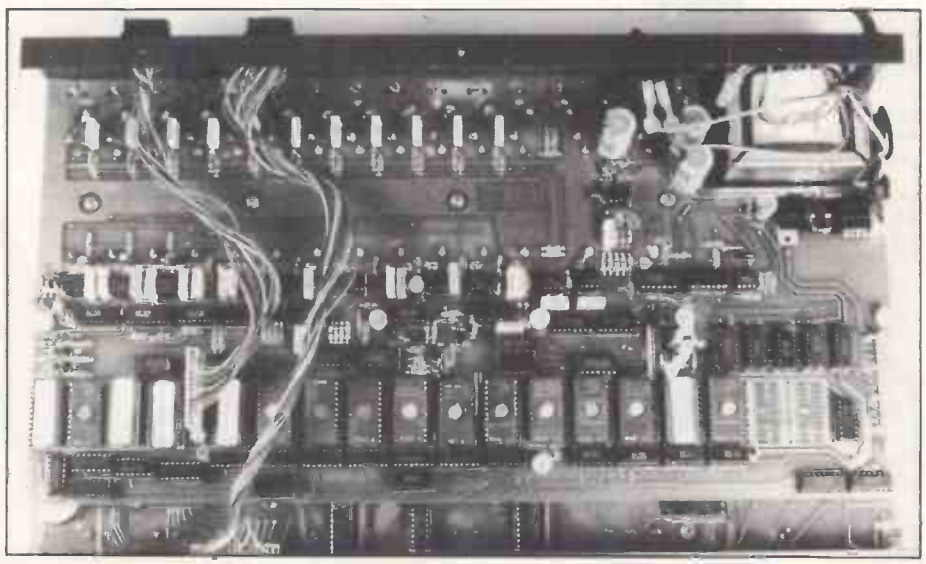
'Accuracy' can only be pressed when the machine is in its Pattern mode. If so, one of seven possible accuracy levels will be displayed in the LED display, ready to be modified by pressing specific buttons on the keypad. ¼ note triplets through to $\frac{1}{32}$ note triplets can all be recorded.

The 'Length' control determines the number of beats in each pattern. A maximum of 99 beats is possible for every single pattern. When in Song mode the Length button also indicates on the readout exactly how much unallocated memory space remains in which to write more patterns or songs. In this way, you can avoid erasing memory patterns when full capacity has been reached.

The next two buttons each have an associated status indicator and select either 'Pattern' or 'Song' modes. The memory space on the MXR 185 allows up to 100 patterns to be programmed and stored, then combined into 'songs', with the maximum capability of songs being 100. This is certainly adequate for a whole evening's worth of rhythm backings and should satisfy the needs of the most ardent jazz-rockers (for it is these people that often like to have their drummer playing completely different rhythms in every bar!).

The 'Insert' and 'Delete' buttons are used to edit patterns from songs when composing long chains of drum sequences, and it is here that 'Copy' helps, as this function allows the user to copy any pattern into another memory location at the push of a button, rather than having to re-programme a whole pattern unnecessarily. It is also used to double the length of an existing pattern thus providing a quick way of achieving an even number of pattern repeats. Also when composing sequences or songs, the 'Step Forward', 'Step Backward' buttons can be used to step through patterns quickly. 'Erase' and 'Record' buttons complete this group of controls. However, pressing 'Tape' converts the two 'Step' buttons and 'Erase' to their 'To Tape', 'From Tape' and 'Verify' functions, which enable the data in memory to be read out and dumped onto tape (allowing a library of rhythms to be created) or stored rhythms to be loaded into the machine and checked, before the memory contents are wiped.

An Accent button lets you emphasise individual beats and works separately on each voice. However, the accent level is not adjustable, being preset internally for each voice as with the MPC 1 drum computer.



Voice board.

Building Patterns

Recording a rhythm pattern on the MXR 185 is simplicity itself – the controls are quick to master and logically laid out. Basically, to create a pattern what you do is enter Pattern mode, select a pattern number from 00 to 99. Pressing down the Length button, you can enter the required number of beats for your bar, then selecting Record and Run together causes the click track metronome beat to sound (if the slider is up), at the tempo set by the slider.

As an aid to programming, the metronome click sounds louder on the first (down) beat of the pattern, and the LED display and Record indicator all blink. All you have to do then is press the necessary drum voice buttons whenever you want a drum to sound and they will be recorded. The pattern

cycles round continuously also, to help you get a feel for the rhythm.

If you make a mistake, by setting the pattern length to 00 the whole pattern is erased, but if you only wish to rectify a specific misoccurrence of a particular drum, you can do so by holding down Erase and pushing the relevant drum button in time with the mistake and it will be erased at the end of the pattern. Easy, simple and very quick to operate; a necessary requirement when 'time is money'.

Using different length patterns means you can obtain different time signatures in conjunction with the Accuracy control, and Tempo slider. Once several patterns have been created you can begin to construct whole songs by entering the Song mode, choosing a song number and selecting 'Record'. Simply key in the pattern numbers you require in the correct order, each time depressing the 'Insert' button. Editing your songs is similar in procedure, except that 'Delete' is used along with the 'Forward' and 'Backward' controls to step through the selected order of rhythm patterns sequentially.

Mixing

You can have great fun once a song/pattern is recorded by changing the levels on the drums. Cutting one drum out of the mix can drastically alter the whole feel of the rhythm, for example. It's a good machine to use if you prefer to leave your rhythm creations to chance, rather than sit down and draw out mathematical charts of exactly where each beat should occur for maximum effect.

The individual ¼" jack sockets on the rear panel give access to each voice but only at a preset volume level. Also, when in use, these sockets do not cut out the drum sound from the main mix (as with the TR808); this can only be achieved by turning off the slider level control. For recording or PA benefits, there is a main left and right output. This gives a pre-panned stereo image of all the drums when both sockets are in use, or a mono output mix when either is used alone, thus providing an ideal mix to feed direct onto your multitrack tape when making song demos.

The click-track is available at the To Tape socket in the form of trigger pulses (24 per crotchet), which can be recorded and used to synchronise several drum computers, or sequencers – a vital requirement for anybody considering its use in a jingle/film music context. The unit can also be driven externally using the From Tape socket on the rear panel.

The final rear panel features are the rather unusual 15 pin sockets. There are two of these, labelled 'External Voice' and 'Trigger Inputs', and the latter allows a computer with 5 volt TTL outputs to trigger the voices, whilst the first connector is designed for future expansion of the machine – most likely it'll link up to external drum pads for conventional 'playing' of the drum sounds.

Sounds

Talking about sounds, how good are those on this MXR unit? The answer is, 'very good'. All twelve voices have a particularly 'modern' feel to them. The three toms, for example, sound distinctly African, having a very fast decay and harsh attack. Very similar in fact to the Peter Gabriel-influenced drum sound that is currently 'in vogue'. The snare is my favourite, being sharp with a nice ring to it, whilst the clap is a distinct let down. With no built-in ambience it sounds extremely lacklustre on its own but blends well with the kick (bass) drum and hi-hats. Open and closed hi-hats actually have separate programming facilities but share a common output socket and slider, which is not a problem at all.

The block, cowbell and rim shot are equally as good, but the crash cymbal, albeit realistic (naturally), has a sudden cut-off as the sample length is marginally too short. This is only really heard when the crash is used at the end of a measure, say, and allowed to decay, but a dash of reverb helps smooth the sound over.

Internal Circuitry

Internal layout of the device is once again exemplary; neat wiring with perfectly soldered voice and processor control boards. The processor circuitry is based upon the ubiquitous Z80 chip, and 52K of memory space (in the form of programmable read-only memories; PROMs) contains the drum voice samples. Interestingly enough 24K of that is used to obtain the crash symbal sound alone! The signal-to-noise ratio of the unit is only about 48dB, being an 8-bit machine and the system voices are multiplexed through an average quality DAC (DAC0800), which generally accounts for the odd few sizzling and gurgling noises emanating from the computer when in Stop mode.

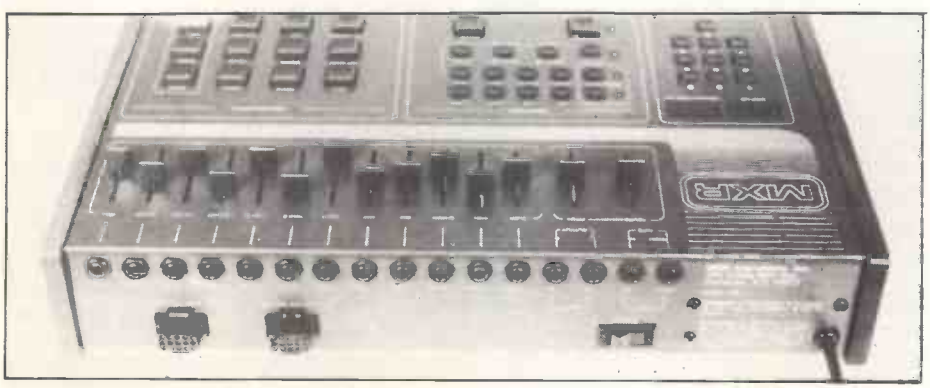
Conclusions

A good machine with a good range of sounds. The vast memory capability should please virtually everybody, and the ease of operation certainly will. The 'Pitch' control is the biggest criticism of the unit, if it were programmable it would be of use but the current design modifies the pitch range of every drum simultaneously, so it's only real use is in tuning your 'kit' to a specific musical range perhaps to suit a particular song key.

The MXR 185 Drum Computer is amongst the easiest of the digitally-sampled drum machines to programme and the use of separate PROMs does mean that voices can be modified and your own samples installed (theoretically), which puts it one above the Drumulator. The price is a little high I feel, but discounting should help bring down the price to a more realistic level, where it shall be able to compete with the cheaper digital units. All that can be said now is 'when are Roland going to bring out one of these?'

Ian Gilby **E&MM**

The recommended retail price (including VAT) of the MXR 185 is £1550.77. It is available through Atlantex Ltd, 1 Wallace Way, Hitchin, Herts SG4 0SE. Tel. (0462) 31511.



Rear view.

SIEL Opera 6

Touch-Sensitive Polyphonic Synthesiser

In our British Music Fair Report (E&MM September '83) we noted the fact that touch sensitivity was a major feature of new keyboards being introduced, and singled out the SIEL Opera 6 as being one of the products created to meet the demand from musicians for more keyboard control of their instrument. The first keyboards to feature this facility tended to be outside the average keyboard player's price range, but at about £1,300, the Opera 6 is one of the cheapest touch-sensitive keyboards on the market, helping make this added control available to many more players.

As its name implies, the SIEL is a six-voice poly (that is, each voice has separate oscillators, filter and envelope generator) with 100 memory locations for voice programs. The look of the instrument has changed greatly from previous SIEL products. The tough, all-metal case has a dark blue panel with individual sections of the programming divided into light blue boxes thus keeping the separate elements of the process distinct from each other. The keyboard spans five octaves (C-C) and has a nice, positive feel which is, of course, quite important on a dynamic keyboard.

Oscillators

Each voice on the Opera 6 has two oscillators which are of the analogue type. Both VCO A and VCO B have a choice of pulse or ramp wave and these can be mixed on either oscillator. They are selected by a unique single switch system which occurs repeatedly on the instrument. Starting from the off position, one push lights the LED above the switch (in this case indicating the ramp wave has been selected) a second push changes this to the lower LED (pulse wave), a third push lights both LEDs (signifying both functions are on) and a final push returns it to the off status.

There are three footages available on each oscillator — 16', 8' 4' (a convention which has been continued from the organ and refers to the length of organ pipe required to create a note at these pitches) and there is also a Pulse Width control on each, allowing the harmonic content of the pulse wave to be altered. The pulse width of both oscillators can also be modulated by LFO III as we shall see later.

A principle criticism of this section would be that little subtlety in the programming of respective volumes is possible. VCO A is either 'on' or 'off' (depending on whether a waveform has been selected or not) and VCO B is only slightly better with a half volume option. However, where the volume knob for VCO A might have been there is a fully variable volume control for Noise and this is infinitely preferable to those six-voice polyphonics in a similar price range which simply replace the second oscillator with noise. This configuration with an independent noise signal is much more flexible.

However, this criticism of lack of subtlety could not be applied to the Detune controls between the oscillators as there are two of them provided. Coarse detune allows intervals of up to a fifth to be set up quickly and easily whilst larger amounts can be programmed in conjunction with the footage switches. Fine detune, on the other hand, gives access to those rich ensemble sounds which can be created using a very small tuning difference between the oscillators. These two prime uses of two oscillator instruments are therefore well catered for on the SIEL and the problems of accuracy which can often result from use of a single knob are avoided.

Filter

The filter on each voice is of the 24dB/oct low pass variety (in other words it attenuates the higher harmonics of your sound first, acting last of all on the fundamental). This is the essential configuration necessary for most sounds and gives the machine the same quality and flexibility as other similarly priced six-voice polysynths, with the added bonus that the keyboard velocity can also be routed to control the filter cut-off frequency. This is manually controlled (ie. the initial level set) by the Cut-off knob but can also be automatically controlled by the LFO and the dynamic ADSR. There is a knob marked ADSR Amount which controls the subtlety of this latter effect.

There are two further controls in the filter section, Track and Resonance. Track allows the frequency of the filter cut-off to be adjusted by the note played on the keyboard, from 0 to 100%. On the latter setting each note played will have an identical timbre, whereas lesser amounts will cause higher notes to be less bright. The Resonance control amplifies the frequencies around the cut-off point and once past two-thirds of its travel, pushes the filter into sine wave oscillation. This is very useful for effects programs and in combination with Track allows you to tune and 'play' the filter without using the oscillators (particularly as the tracking on the Opera 6 is pretty accurate).

Dynamic ADSR

Now we come to the principle feature of this instrument. Besides the conventional Attack, Decay, Sustain and Release functions, the envelope of each voice is controllable from the way the keyboard is struck. The velocity at which each individual key is depressed can be used to control the overall ADSR level or to override the Attack time, or both (using the cyclic switch function we first saw on the oscillators). The ADSR can be routed to the VCA (determining the shape of the sound) or the VCF (controlling filter cut-off) or to both using the same switch function again. This gives you quite a few routing possibilities and it is here that the cyclic switches really come into their own, allowing you to quickly step through the different routings and compare the effects produced.

If the ADSR is routed solely to the filter (VCF) then the VCA (amplifier level) resorts to an organ envelope ie. full volume when a key is depressed and off as soon as the key is released. This is where the limitations of the single envelope per voice begin to show, but it must be said that in this respect, polyphonic synthesisers with two envelope generators per voice cost considerably more than the Opera 6 and it more than matches conventional machines in its price bracket with the single dynamic envelope.

Wheels

Above the left hand end of the keyboard are two wheel controllers. The first allows pitch bend of either VCO A or B, or both giving an interval of a fifth above or below. The second controls the introduction of low frequency modulation from the LFOs and again the actual routing is controlled by the cyclic switch function.

LFOs

According to the front panel there are no less than three of these, but this is somewhat misleading. Presumably LFO I is reckoned to be controlling pitch and LFO II the filter (or vice-versa) but as they share the same Depth and Speed controls they can hardly be seen as two independent LFOs, rather one with two possible routing destinations.

LFO III is another matter. With its own separate Depth and Speed controls it is genuinely independent and is used to control the pulse width modulation of either or both oscillators. This is vital as the most satisfying pulse width modulations tend to occur at slow rates whereas vibrato (pitch modulation) and other LFO effects need to be much faster. This means that on single LFO machines you can only have one or the other in any single program but combinations are possible on the SIEL Opera 6. Both LFOs (it is fair to say there are two) also have a separate LED which flashes to show the speed at which the LFO is set.

Programmer

This consists of a numeric keypad and two seven-segment LEDs which indicate the program number selected. An Enter button actually changes the program when you have put new numbers on the display and a Free button allows you to use the panel settings as they stand. The Write button enables newly created sounds to be stored in memory.

The two knobs in the right-hand section of the panel marked 'Masters' are the only two controls which are continuously live and not stored in the programs. These are overall Tune and Volume, both of which need to be adjusted to suit the other instruments with which you are playing. All other controls are always instantly available for editing sounds and edited programs can be stored in different memory locations.

Back Panel

Besides the standard jack output, there are several interesting features here. Firstly, there are two 5 pin DIN sockets which allow the pedal which SIEL supply to control either the VCA (volume) or the VCF (filter cut-off). I would have preferred to see just one socket and a switch on the front panel to enable the user to change pedal control during a performance and store this in programs, but it is still good that both can be controlled from a pedal.

Next to these we have the cassette interface sockets (mini jacks) which allow a library of sounds to be built up and reloaded at a moments notice. Last of all we have the most interesting interface — MIDI in and out connections. SIEL have certainly come up to date with a bang as it is still early days for this universal interface system, and this is one of the few machines from less well known companies to feature it.

Conclusions

Clearly SIEL's recent co-operation with Sequential Circuits has led them to be very forward-looking. The Opera 6 has several features which are as yet unavailable from some of the traditional 'big name' synthesiser manufacturers: velocity sensing, MIDI interface, independent LFOs etc. This clearly means that this keyboard is not about to become obsolete and makes it excellent value for money.

The clear panel layout and unique cyclic switch function makes programming quick and easy and the sound is clear, rich and flexible. Whilst the casing is a little high it does push the front panel forward to an easily visible angle and the LEDs enable you to keep a check on what is going on, even on a darkened stage.

This instrument would make an ideal first polyphonic especially for the piano player interested in 'going electronic' and fits well into a growing keyboard set up, thanks to the MIDI interface.

E&MM

SIEL are now distributing their own products in the UK so for further details contact SIEL (UK) Ltd., Suffolk House, Massetts Road, Horley, Surrey, RH6 7DT. Tel. (02934) 76153/4. The recommended retail price of the Opera 6 is £1,299 including VAT.

Calrec 600 Series Microphones

Here is a unique UK made set of three cardioid capacitor mics, specially produced with the enthusiast in mind but with a full professional pedigree. Nowadays, the 600 series use the same capsules as the other ranges of Calrec capacitor mics. These are the 1000, 2000 and 2100 series which are used by the BBC and other UK organisations for TV applications.

The 600 series is offered as a low cost way of getting 'proper' capacitor mics (i.e. non electret) into the hands of enthusiasts. How are the costs reduced? First the powering is simplified with 50V DC being required, and the mic receives this on one wire of its lead with the signal being fed down the other, unbalanced. Both use the screen as return or common. The other ranges have the usual phantom powering, with various voltages catered for.

This alone doesn't account for the cost differences, but actually there isn't really any other reason nowadays. Originally the 600 series was a way of using up capsule production that was just outside specification for the other ranges, but now there has been a significant improvement in performance, particularly in high frequency smoothness. Also, the consistency of manufacture has improved so much that there are now no capsules outside tolerances, so the 600 series get the regular capsule production.

Common Features

The three mics in the 600 series all have 3-pin locking DIN connectors, hence the 'D' suffix. These are perfectly reliable and as each mic in a collection has to have a lead it doesn't really matter if the 'standard' XLR cannot be used. The idea seems to be to reduce the chance of inadvertently connecting XLR-fitted mics to the unbalanced 50V feed that these Calrecs need. Normally, putting a moving coil mic on a phantom fed XLR lead would not matter as no current can flow through the coil. In theory, this could be a problem with the 600 series arrangement but as I have done it with an AKG D202 with no ill effects, perhaps there is no real fear.

Calrec have a mains power supply unit for the 600 series called the CP622A. An address is given at the end of this review for one of the 600 series suppliers who has a free DIY circuit and other hints to enable further cost saving in the acquisition of capacitor mics.

Calrec CM652D.

The mics in this range are very robust and have handling noises below average. 'P' blasting is worse than average but this is only to be expected from a mic designed to respond to the ultimate subtleties of sounds.

As mentioned earlier, the signal feed is unbalanced. Most enthusiasts probably have unbalanced inputs on their recorders so this eases the connection aspect. Although balanced feeds would normally be considered necessary for long leads, the 600 series, with its high electrical output (much higher than moving coils or electret capacitors) is certainly not prone to hum pickup when used with long leads. Apart from the high output, the mics' source impedance is low and this also assists. They are intended to be used with inputs suiting 200 ohms or higher impedance mics.

The Calrec CP622A power unit has level-controlling preset potentiometers to allow trimming of levels at the recorder/mixer end. The same idea can easily be incorporated in any DIY PSU, whether mains or battery. See postscript at the end of the review.

CM652D Cardioid

These are flat frequency response cardioid stick mics which offer very smooth high frequency portrayal and a 'natural' sound pickup. If you want a crossed stereo pair for high class choral, orchestral, brass band or similar recording then the CM652s meet this requirement. I have also used them regularly as overhead mics on drum kits, acoustic guitar pickups and for miking guitar amplifier cabinets. Seeing as the bass end of the mic is full and many rooms are boomy, the employment of some low frequency roll-off will be necessary to clean up the sound, leaving you with the superior transient attack of a capacitor mic.

This class of mic offers low colouration and consequently its results are best heard on better-class low colouration speaker systems. The cardioid pickup pattern is well maintained at high frequencies and this itself reduces colourations.

CM654D and CM656D Cardioids

These are both response-tailored vocal mics. The bass is inherently rolled off and there is a presence peak, and significantly this is higher up the range than is typical with moving coils. The low frequency roll off compensates for the proximity effect when the mic is used close up to the sound source, and the characteristic high frequency lift always strikes me as giving an immediate clarity without harshness, avoiding the muddiness which I feel characterises most moving coil vocal mics.

The CM654D can be used on acoustic guitar to good effect, particularly for sound projection as the high frequency boost brings out the plucked string sound.

The foam 'P' blast shield supplied is not totally effective if the mic is used with enthusiastic singers. I find that a subsidiary acoustically transparent screen a few centimetres in front of the Calrec's foam eliminates this nuisance: I use a couple of metal tea strainers with ladies' tights material between the meshes.

The CM656D is to all intents and purposes the same as the CM654D, with the addition of a strong wire mesh over the foam shield.

Calrec 600 Series prices excluding VAT.

CM652D	£66.00
CM654D	£70.00
CM656D	£84.00
CP622A	£48.00

Manufacturer:
Calrec Audio Ltd, Hangingroyd Lane, Hebden Bride, W. Yorks, HX7 7DD. Tel. (0422) 842159.
DIY PSU Details:
Whitetower Records, 2 Roche Gardens, Bletchley, Milton Keynes, MK3 6HR. Tel. (0908) 73969.
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Mike Skeet **E&MM**

Calrec CM654D.

Calrec CM656D.

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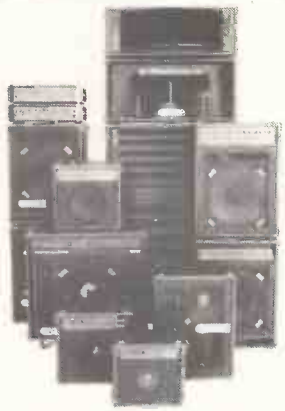

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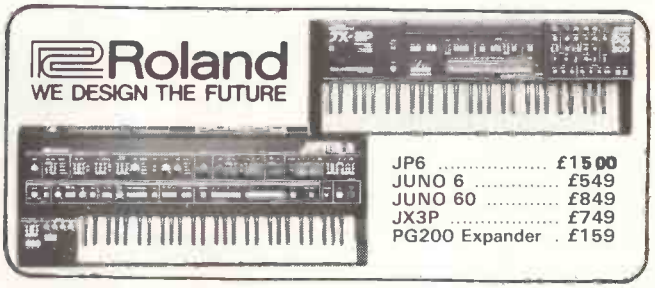

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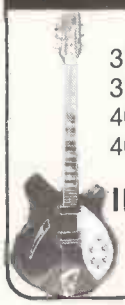

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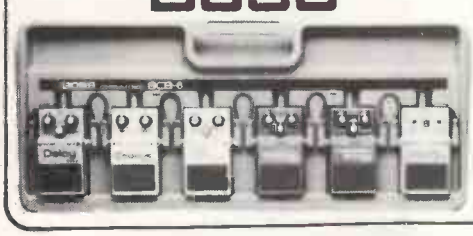

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Hohner Harmonica Pickup Systems

1480 — General Use Type
1481 — Blues Type

For too long, the humble harmonica has been something of a 'Cinderella' instrument, restricted largely to its own little musical ghetto of blues, folk, r 'n' b and country music.

It is a great shame because, as an instrument, it has a lot going for it. The sound is unique, always instantly recognisable and impossible to imitate. And it is a wonderfully expressive and satisfying instrument to play.

The keyboard-playing fraternity have only recently started to come to terms with the use of breath controllers to inject that extra something into their music. But to generations of harp players, it is pretty old hat. Different techniques using the tongue, lips, hands and vocal cords allow it to produce a staggering variety of sounds and to inject as much feeling into those sounds as can the human voice itself.

Another advantage is the sheer simplicity (and therefore relatively low cost) of harmonicas.

Someone learning to play, say, the guitar, usually has to make do with an instrument which is generally inferior to those used by professionals and more accomplished players. Even in these days of high quality low-cost Japanese guitars, it is hard to find an acceptable electric guitar for much under £150. A reasonable semi-pro's axe might cost upwards of £300 and a pro might spend double or treble that on his instrument.

If you fancy having a crack at playing harmonica, the chances are you will buy one of the Hohner range of diatonic harps (with only the natural notes of the scale). Such an item will set you back between £4 and £10, depending on which model you buy, but for that you are getting exactly the same instrument as is played by top players anywhere in the world.

It really is surprising that more people do not invest such a modest sum in an instrument which is easy to carry, requires no amplification for practising, and, as Hohner's own blurb says, "will be your friend for life!"

A lot has to do with fashion and the preconceptions of musicians about the roles of various instruments. I am, first and foremost, a blues/r'n'b player, but have used harp to good effect in a wide range of music, from jazz to reggae and pop.

Recently the harmonica has surfaced on a variety of hit singles, which might be an encouraging sign that the humble harp is, to borrow a political catch-phrase, "breaking the mould" at last. I certainly hope so.

But one major discouragement, I suspect, has always been the difficulty of amplifying harmonicas to cope with modern music. To do the job properly, the harp and a suitable mic are traditionally cupped in the hands — something which naturally tends to induce feedback at high volume levels.

So, enter, stage left, Hohner's new harp Pickup System, which aims to provide a better solution to the problem — and presumably make the firm's most famous products an even more saleable proposition.

Hohner have, in fact, launched two harmonica pickup systems, both based on the same transducer principle which has been successfully applied to acoustic guitars and other instruments for some time now. One is intended for general use — the 1480, and the other specifically for blues players — the 1481.

The bug in place on a diatonic harp. the Special 20.

Both come attractively boxed and comprise two main components — a pickup bug with lead and plug and a battery-powered pre-amp unit. Both also include a good quality ten-foot lead with moulded Switchcraft ¼-inch jacks to connect the pre-amp to an amp or mixer, plus a half-dozen sticky-backed tabs for attaching the bug to various harmonicas.

At the heart of both systems is a transducer pickup bug specially developed for Hohner by Barcus Berry. The bug is fixed to the comb of the harp of your choice by the sticky tabs, which are covered on the other side with a velcro-like finish. This engages a matching pad on the bug itself and allows a reasonably rapid changeover from one harp to another for key changes between songs, but not sufficiently quickly I would have thought, to allow easy changes *during* songs.

A six-foot length of extremely flimsy-looking cable leads from inside the bug to a plastic-barrelled mini-jack plug, of the kind of which I am always a bit suspicious. My experience has shown them not to stand up to life on the road very well in the past. Likewise, the attachment of the cable inside the bug looks on the weak side and the fact that the accompanying manual advises caution when removing the bug from the harp, re-inforced my concern about its durability on a crowded and darkened stage.

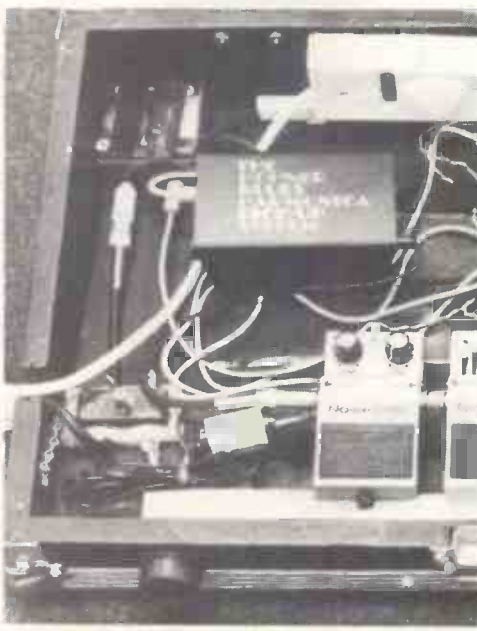
Fortunately, I did not manage to break one during the test period, but then I was being extra-careful as the gear was not mine. One sharp tug on the cable when it was accidentally trodden on or became snagged on something like a drum key would probably be sufficient to render the bug — and hence the whole system — inoperative. Replacement units are available, but Hohner couldn't tell me how readily so or at what cost.

It's therefore advisable that the working musician carries a spare bug to be sure he could continue playing.

Pre-amps

The 1480 system's pre-amp is housed in a sturdy little metal box, measuring 80 x 55 x 35 mm and has a mini-jack input socket on one end and a standard jack socket on the other end for output, along with a rotary volume control. On the back is a handy belt clip, which is removable via the velcro pad.

The blues pre-amp is in a considerably



The reviewer's effects set-up, with the 1481 pre-amp.

The two Hohner Systems. Left, the 1480 and right, the 1481.

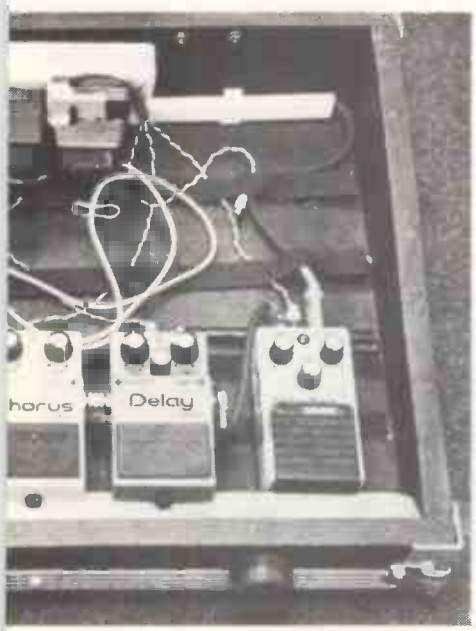
bulkier (134 x 60 x 84mm) and heavier version of the same box, with one end carrying the input socket and rotary volume control and the other the output and rotary tone control. Because it is bigger and obviously intended as a static unit, the 1480's belt clip is replaced with four rubber feet. In both cases, power from the standard 9 volt battery inside is turned on when the input jack is inserted, in common with the arrangement on most modern effects units.

Layout

My initial reaction to both units was that the control layouts were far from logical and therefore not designed to make use as easy as it could have been.

In the case of the 1480, one would assume it would be worn with the volume control upwards, giving the player instant access for a quick tweak, if needed. I feel it would have been more logical in this case to have had the input socket on the same surface, as opposed to the output. It is a small quibble, I know, but in a simple unit like this, one which could easily be put right.

My quibble with the 1481's control layout is far greater, and ought to be remedied on the next production run. It seems plain daft to me not to have both volume and tone controls on the same surface. The present arrangement means that wherever you put the box, one of the controls is out of sight. If you put it on top of your amp one knob is facing away from you. If it is at your feet on the floor, neither are visible, which could lead to difficulties under low lighting conditions.



Performance

At low to medium volumes, both systems sound good. Very good, in fact, with a clarity and tone which is difficult to obtain with a conventional mic, without picking up unwanted breath and handling noise.

The 1480 does its simple job well, sounding out loud and clear with both diatonic and chromatic harmonicas. The centrally-placed bug picks up the whole length of the instrument's reeds evenly and amplifies their sound faithfully.

It works particularly well run straight into a mixer and will doubtless find a use amongst players who like their sound clean and crystal clear.

For those amongst us who like a healthy helping of 'dirt' in their harp sound, the 1481 does a similarly good job, used with the right set-up. When I read the initial Hohner blurb, which mentioned the system's distortion capabilities, my initial reaction was one of trepidation, in case Hohner had plumped for some kind of 'fuzz-box' circuitry. But reading the instruction manual put me right on this as it advises the use of the system with a good old-fashioned valve amp. The pre-amp's distortion capability comes via the generous amount of gain which is available on the pre-amp output.

Run into my old faithful Fender Twin, the sound cooked up a treat, helped by a healthy application of distortion on the amp's master volume control. The tone control worked well and I was able to get the authentic, bassy 'Chicago' sound with no trouble at all.

The manual says the tone circuitry has a specially tailored frequency response to produce that kind of sound and in this department, at any rate, Hohner appear to have done their homework very well. The unit is also capable of a wide range of other sounds and will run clean, too.

But as soon as I started winding up the volume, the old feedback problem came howling back at me. Most of my playing is with my own band, Automatic Slim. While not the loudest of outfits neither are we the most subdued. We play very powerful no-nonsense r'n'b and as soon as I tried to lift the volume from test room levels up to my usual gig level, the unit started feeding back.

My usual set-up starts off with a Shure SM58 mic and runs to the amp via an Amdek distortion pedal (Used these days with all the controls turned down as an on/off switch for the system) and Boss delay, chorus, graphic and noise gate units. With the '58 – the best mic I have come across for resisting feedback — and judicious use of the noise gate, I find I can usually get the sound I want at the volume I want with little trouble.

But try as I might, I could not do so with the Hohner system. It didn't seem to like running through my effects either, particularly the chorus.

At lower volumes and without effects, it was fine, though, and I loved that gorgeous sound. The only problem was, it was not *my* sound.

In the studio, where effects can be added afterwards and volume is not important, it came into its own. In fact I ended up using the unit a couple of weeks ago when we went down to Spaceward to record our new single, Julie B. (plug, plug!) and I was well pleased.

Conclusions

The feedback problem and its lack of compatibility with my effects, which are primarily designed for other instruments, anyway, meant the system was a personal disappointment. But then it would have had to be really something to make me give up my old set-up anyway.

Personal reservations, apart, though, I reckon both systems have a fair bit to commend them to many players.

Both have their drawbacks. The slow changeover between harps, the odd control layouts on the pre-amps, and above all, the flimsiness of the most vulnerable parts of both systems must all be counted as such. But the system *will* pick up all the nuances and subleties produced by various hand techiques better than the traditional cupped mic at low levels. And both systems are useful tools which offer something different to players in a field where new items of specialist equipment are rare.

Pricewise, the 1481 Blues System costs £87.50 and the 1480 General Use System £69.95 and these prices compare favourably as an alternative to buying a reasonable mic. with the bonus of much improved performance for studio work and average level gigs.

Tim Aves **E&MM**

MUSIC MAKER EQUIPMENT SCENE

Three brand new guitars from Rickenbacker.

After a three-year absence from the UK market, **Rickenbacker** guitars are now here in some force under the aegis of their new importers, Golico Ltd, and three new models are to be announced shortly.

First up is the model 230, a budget-priced guitar aimed at making Rickenbackers accessible to all but the most impecunious musician. It features a contoured body, two pickups, high output circuitry and Schaller hardware.

Model 250 is the result of ten year's research and development, and features gold Schaller bridge and keys, bound body, active circuits and a special Gloss Black finish. Not surprisingly, this guitar will be substntially more costly than the 230.

Third in the line-up is model 350, a three pickup, semi-acoustic guitar featuring a full-scale neck. The double cutaway body gives full fret access and is styled on the famous 320 model which first brought the Rickenbacker marque to prominence during the sixties.

All three guitars should be available in Britain before the end of the year, and for further details you should contact Golico at Studio House, High Lane Village, Nr Stockport, SK6 8AA. Tel. 06632 3968.

Roland's SDE-2000 digital delay line has proved itself a popular unit in it's price bracket and the company have now announced (albeit a little belatedly) two further models, one more expensive than the existing unit, the other less so.

The cheaper machine carries the title SDE-1000 and features a delay time variable from 0 to 1125 milliseconds (the first 10 milliseconds are stepped in increments of 0.1 mS, enabling a wide range of flanging effects to be produced) and a 'Playmate' jack which enables the delay time to be set via a footswitch during live performances. Additional features are a four-channel programmable memory and 'mixed' and 'delay' output jacks providing stereo chorus effects. It's expected that the SDE-1000 will sell for around £400.

The more sophisticated SDE-3000, on the other hand, is due to sell for twice the price, but for this the purchaser can expect delay time variable from 0 to 4.5 seconds, and eight memories instead of four. Roland claim an effective dynamic range of over 100dB with only 0.03% total harmonic distortion and the LCD delay time display is said to be accurate to 0.04%. Should you have sufficient capital, two SDE-3000s can be linked together in stereo, via a Modulation CV Inv output jack.

Further information from Roland (UK), Great West Trading Estate, 983 Great West Road, Brentford, Middlesex, TW8 9DN.

Roland SDE-1000.

AKG Acoustics have introduced a new gooseneck cardiod microphone which, the company claim, offers high quality to all but the most impecunious musician. Titled the D541, the mic has a frequency response tailored for speech, making it suitable for most PA and intercom applications. The 'neck' extends to a usefully long 340mm, while cable entry to the single hole fixing can be accomplished above or below the mounting surface.

Omnidirectional, hypercardioid, and longer (up to 600mm) gooseneck models are currently at the development stage, and further information on these and the rest of the AKG range is available from AKG Acoustics Limited, 191 The Vale, London W3 7QS. Tel. 01-749 2042.

AKG D541.

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B.E.L. Marketing
29 Guildford Street, Luton, Beds.

bel

TECHNICAL DATA

GAIN —
variable from 1 to × 50.
INPUT —
100k.
MAX. INPUT —
1V at 300Hz.
BASS —
± 14dB at 50Hz.
TREBLE —
± 15dB at 5kHz.
DELAY —
variable 40mS-340ms.
DELAY FREQ.
RESPONSE —
40Hz-6kHz at max. delay.
SIGNAL/NOISE —
dynamic compander control.
REGEN —
zero repeats to full regeneration.

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Ross Effects Pedals

This month we're looking at four effects pedals under the brand name of Ross (a subsidiary of the International Music Corporation, Texas). The complete Ross range is comprised of nine models competively priced between £27 (for the Distortion) and £99 (for the Stereo Delay).

The models under review — Compressor, Distortion, Chorus and Direct Box/Noise Gate — all come in identically finished high impact, black die-cast cases. Input and output sockets are the standard ¼" jack variety and there is a 3.5mm socket, labelled PWR, for connecting a 9 volt DC power adaptor. Otherwise, all units run off a standard 9 volt battery located inside the case. Unlike many of today's effects pedals there is no special battery compartment which means that you have to undo four screws and remove the baseplate in order to change a battery — not an ideal situation but one you can live with.

Other features common to the four models are the latching on/off footswitch located on the surface of the sloping case, and the two recessed rotary controls which are virtually flush with the case but still accessible to the fingers. One benefit of this design is durability, as these knobs are unlikely to snap off if the pedal is dropped.

Now to the effects themselves.

Distortion

This has two controls labelled Distort and Level, and employs a dual op amp-based circuit to create signal clipping, producing a square wave output rich in harmonics from most input signals. Distort actually varies the degree of clipping, ranging from a smooth overdrive sound (counter clockwise) to a full rasping fuzz on full setting. The Level knob adjusts the effect output level and is used to match signal levels between each effect or between your amplifier for example.

A useful unit this, whose distortion remains full but clean enough to keep individual notes distinguishable. If Level is turned up and your amp input level kept low, then quite a long sustain can be obtained from the device. At £27, it is one of the better distortion units around for the price.

Compressor

This is an often misunderstood effect which can be a beneficial sound aid if used correctly. A compressor, if you didn't know, is effectively a levelling device which works by reducing or 'compressing' large signals and boosting low level signals, prolonging the length of a note, for example. This is why the circuit is widely used in sustain pedals.

However, in boosting low level signals there is, of course, the danger of also amplifying background noise, so you need to ensure that such things as guitar leads and amplifiers are well maintained and well screened.

The amount of compression is adjustable, using the Sustain control, from 15 to 40 dB. The more compression used, the longer the effective sustain. There will also be less level difference between the loud and quiet sounds. The overall output is determined once again by the Level control and needs adjusting once the compression ratio (Sustain) has been set. At about £32 this a good little device capable of producing a smooth compression effect with few side defects.

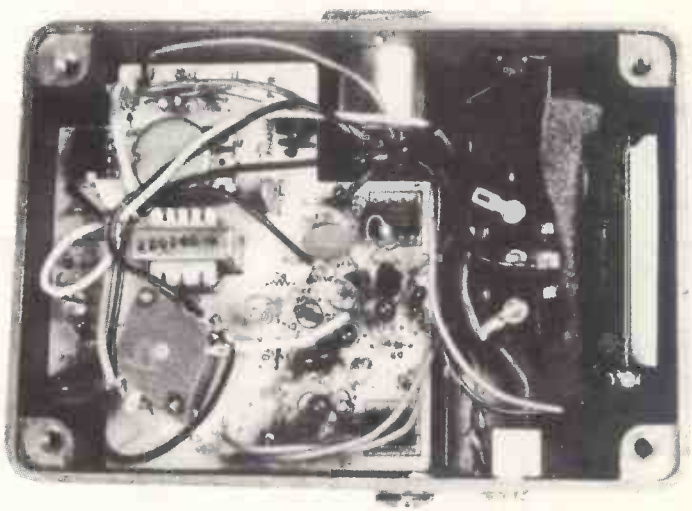
Chorus

Based upon two bucket brigade devices this unit produces a very deep, rich chorus effect that was superb on electric guitar and drum machine. Rate and Depth controls provide adjustment of the LFO speed and amount of effect, respectively. When Depth is completely off no appreciable effect can be heard regardless of the Rate setting. Using these two controls in combination, a range of processing effects can be achieved, from automatic double tracking (ADT), ensemble, Leslie speakers to a deep, bright chorus. The unit has a quoted 90 dB dynamic range, and in use no perceivable background noise was ever audible.

This is probably the best mono chorus pedal on the market in my opinion and at a cost of £49 represents very good value. Certainly one to make a beeline to your nearest dealer for.

Direct Box/Noise Gate

An unusual combination to find in pedal format this one. Like the previous devices there are two recessed rotary knobs. One is labelled 'Threshold' and this determines the volume a sound must be at before the gate 'opens' and that sound is heard. Any sound below the threshold (such as noise) will be too quiet to trigger the gate and so no output will be heard — a simple method of noise reduction.



Direct Box/Noise Gate interior.

Turning the Threshold control clockwise raises the threshold level with the result that any decaying signal is cut off abruptly. This technique is currently used to help obtain the ambient drum sound much beloved of Peter Gabriel, Bill Nelson and Phil Collins amongst others. The drums are placed in a 'live', reverberant room, miked up and the signal passed through noise gates. The threshold can then be set on the noise gate so that only a loud drum stroke will open the gate, allowing the drum mixed with the reverberant room sound (ambience) to be heard. Then as soon as the drum sound begins to decay it falls below the threshold level and is cut off suddenly. The end result is a tight drum sound that packs a lot of punch and sounds extremely live.

The second control on the DI Box/Noise Gate is a three position rotary switch which allows you to bypass the ground (earth) connection to your amplifier, mixer or both. This has obvious benefits in preventing the formation of earth loops between various equipment which generally manifests itself as an annoying 'hum' or 'buzz'.

The direct inject section of the pedal lets you plug your unbalanced instrument lead (jack) into the unit and interface it with balanced equipment such as a mixer. There's an unbalanced (jack) output or balanced, transformer isolated XLR output connection, ensuring correct impedance matching between instrument and amp, or instrument and mixing desk.

Internal construction of all four units is adequate. There really should be an isolated battery compartment though. One extra feature of the DI Box is the provision of a 'phantom powering' facility. Inside the case is a short jumper lead that can be hooked onto the relevant pin on the PCB to allow use of an external 15 to 48 volt supply, for increased screening protection.

Conclusions

The sound quality of these Ross pedals is high indeed, particularly that of the Chorus which impressed me a lot. Prices are very competitive and it's a refreshing change to see a Direct Box/Noise Gate at £39 amongst the model range. With so many effects pedals on the market it's good to come across a range that has that little something extra.

Ian Gilby **E&MM**

Other models in the series comprise: Phaser (£39), 10 Band Graphic Equaliser (£49), Phase/Distortion (£54), Flanger (£69) and Stereo Delay (£99). The Ross range is distributed in the UK by John Hornby Skewes, Salem House, Garforth, Leeds LS25 1PX. Tel. (0532) 865381.

AMERICA

Jerry De Muth

Speaker manufacturers, perhaps in response to the end of the home stereo system boom, are moving into professional sound. The 12-year-old MTX company, which had focused on home and automotive systems, introduced its Pro Line series — a set of six technically advanced drivers in 12 and 15 inch diameters — this past summer. They feature the company's exclusive process of voice coil winding which incorporates heavy gauge copper wire wound around a high-temp aluminium wire core to increase efficiency and power handling capacity. With mounting depths ranging from 4⅞ inches to 6¼ inches, MTX also supplies Thiele-Small parameters for installation in all six Pro Line drivers.

The 100 watt expanded range MTX PY-12 and PY-15 feature polypropylene cones for increased power handling, clean, detailed sound reproduction and have sensitivity ratings of 95.5 dB and 97 dB, respectively, at a 1 metre 1 watt input with an on-axis bandwidth of 25- 1400 Hz.

The 150 watt MTX PL-12 and PL-15 feature moulded black paper cones with plastiseal surrounds. Sensitivity for both is rated at 98 dB and on-axis bandwidth is 35-2700 Hz.

The 150-watt MTX PA-12 and PA-15 have seamed black paper drivers with treated paper surrounds. Sensitivity is rated at 99 dB and 99.5 dB respectively; on-axis bandwidth is 65-3000 Hz and 70-3100 Hz respectively.

Each MTX loudspeaker has a DC resistance of 6 ohms and a nominal impedance of 8 ohms. The suggested list prices for the six range from $69.50 to $79.50.

Modular Sound Systems, which introduced its Bag End loudspeakers in 1976, has introduced its new bi-amped AF-1 loudspeaker series which employs a three-way system with single proprietary 12 and 18 inch isolated drivers and a constant-directivity horn/tweeter. Passively crossed over at 3500 Hz and electronically crossed at a recommended 125 Hz, the AF-1s, said Modular's president, Jim Wischmeyer, were originally developed to complete a custom-ordered sound reinforcement package for the United States Air Force.

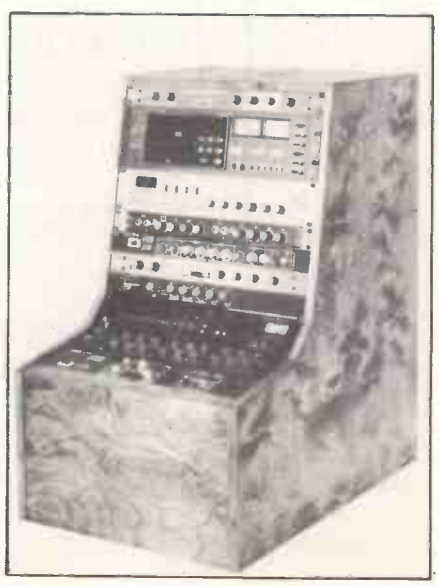
The AF1s are offered in a choice of vertical or horizontal cabinets with either a rugged textured-black paint or a rich dark brown walnut stain on a choice of imported birch or domestic plywood. The units measure 22¾" high x 37½" wide x 24" deep. Two road versions, which include castor covers, stand 32 inches high and are equipped with four handles on each side, one for carrying and the other set for stacking. Prices range from $980 to $1,360.

Bag End's TA-12 speakers with time offset correction.

Time offset correction is incorporated into Bag End's new TA-12 to ensure that sound from both drivers reaches the listener's ears at exactly the same time. The two-way system has capabilities of up to 300 watts continuous programme; sensitivity of 103 dB SPL, 1 watt, 1 metre; a nominal impedance of 8 ohms, and frequency responses of +/-3dB, 125 Hz to 17 kHz and +/-6dB, 70 Hz to 19 kHz.

The drivers are a proprietary Bag End 12 inch loudspeaker with a rear-vented 80 ounce magnet assembly and a constant directivity-type horn/tweeter that reproduces frequencies above 3.5 kHz and is protected by a specially designed passive limiter which prevents component failure by dissipating excess energy rather than by switching the unit off.

Offered in either floor monitor or rectangular configurations, the TA-12 cabinets are constructed of either domestic or birch plywood with interlocking joints and birch baffles for strength and durability.



Bag End's new Studio Rack Model A.

Modular Sound Systems has also expanded Bag End's product lines with the introduction of its Studio Rack Model A which contains 12 vertical rack spaces, two diagonally positioned spaces and four spaces in the lower body that allow equipment to point straight up at the user.

Measuring 38 inches tall by 20½ inches wide, the Studio Rack Model A is 29¼ inches at its deepest point. It comes with castors, a removable vented back for easy access to inner connections, an opening for wires to pass through and a storage area that accommodates extra jacks, cable and other necessary items. Construction is of either oiled birch veneer or a plastic laminated material. The Bag End Studio Rack can also be ordered in custom-made versions to fit virtually any application.

JBL's MI Series monitor and cabinet.

JBL has also expanded its speaker lines with six new models. The three new MI Series loudspeakers in 10 inch, 12 inch and 15 inch configurations, appropriately identified as MI10, MI12 and MI15, are designed for use with guitars, electric pianos, organs and synthesizers or with PA systems. They are designed to deliver a cooler, more even response in contrast with the hot sound of JBL's E Series musical instrument speakers. Priced from $87 to $99, they have a 150 watt power capacity, sensitivities of 98 dB SPL, 100 dB SPL and 102 dB SPL, with frequency ranges of 70-8000 Hz, 60-7000 Hz and 50-6000 Hz. All three models also feature die-cast frames, precision-wound flat ribbon voice coils and JBL's Symmetrical Field Geometry magnetic structures.

JBL has also introduced two PA systems utilising components from its new MI Series — the MI 631 Stage Monitor and the MI 632 Compact Sound Reinforcement System. The MI 631 incorporates an MI Series 12 inch loudspeaker and a flat-front, bi-radial horn and provides a frequency response of 50 Hz to 15 kHz and high directivity.

The MI 632, which was engineered for optimum playback in small to moderate-sized rooms, has an MI Series 15 inch extended range driver and a flat-front, bi-radial horn, providing uniform on/off axis frequency response in the horizontal plane from 630 Hz to 16 kHz. A directional baffle increases directivity for greater midrange punch, while low frequency venting extends bass response and lowers distortion. Suggested list prices are $399 for the MI 631 and $498 for the MI 632.

JBL's new Cabaret Series model 4628, a self-contained three-way cone-midrange system, was designed for a variety of sound reinforcement and keyboard instrument applications, such as organs, pianos and synthesizers. According to JBL, the 4628 is an ideal portable system for touring musicians and also excellent for fixed installations in lounges and restaurants. It incorporates an improved E145 15 inch long throw, low distortion woofer, a 2118H eight-inch midrange driver and a 2404H bi-radial constant coverage tweeter. Response is a flat

3 kHz to 21.5 kHz and the dispersion pattern is a tight 100 degrees by 100 degrees. Suggested list price is $750 and a flush-fitting cover and polycarbonate cover guards are available at $48 for added protection.

A relatively new company, Rane Corporation, that now has some seven audio products in its catalogue, will begin international distribution in early 1984, according to Larry Winter, vice president of marketing.

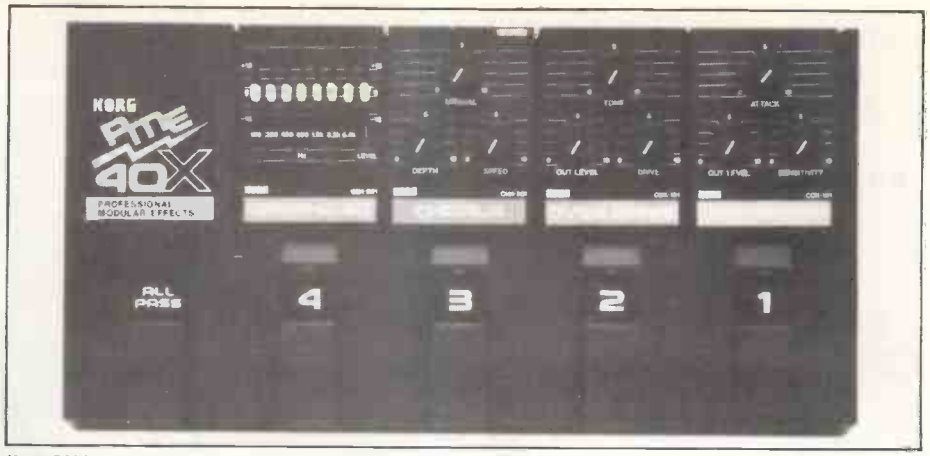
Rane MM12 monitor mixer.

At this year's National Association of Music Merchants show, Rane introduced three new products — the MM 12 monitor mixer, the MA 6 six-channel amplifier and the GE 27 state variable third octave graphic equaliser.

The MM 12 monitor mixer, which measures only 21 inches high, 19 inches wide and 2½ inches deep, has 12 inputs with built-in microphone splitter, three-way input EQ, access loops and input sub-mixing. Each of six different outputs has two-stage parametric EQ, cue, expand inputs and auto unbalanced/floating transformerless RTS outputs. Suggested list price is $1,299.

The MA 6 six-channel amplifier can be used as a monitor mix amplifier, stereo biamplifier or triamplifier, zone amplifier or for other applications. Each channel delivers 100 watts RMS into 8 ohms, 150 watts RMS into 4 ohms, all channels driven. Built-in automatic bridging yields 300 watts RMS into 8 ohms from each pair of channels, while built-in limiters provide an additional 15 dB headroom before clipping for driver protection and a 4 dB increase in continous SPL. The MA 6 also features a cooling fan, auto balanced/unbalanced inputs, out-relays, electronic V-I protection and a 3.3 kilowatt power supply. The suggested list price is $1,199.

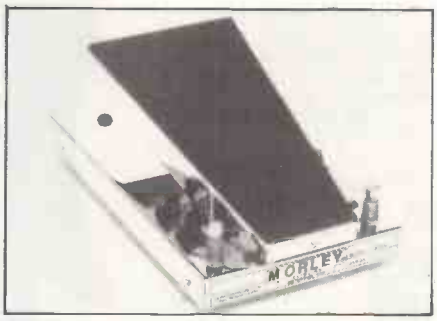
Rane's GE 27 graphic equaliser employs special state variable filters to maintain a constant, well-defined third octave bandwidth at all slider positions to cut filter overlap, adjacent band interaction and overall loss of resolution. The GE 27's state variable filters provide 12 dB of boost and 15 dB cut on 27 ISO frequencies which, says Winter, allow more effective feedback control with minimal effect on sound quality, reduced interaction between adjacent bands and substantially increased overall precision and resolution. The GE 27 has a suggested list price of $449. Rane's previous products include the HC 6 Headphone Console and the RE 27 Realtime Equaliser.



Korg PME 40X pedalboard.

Effects

New effects devices have been introduced here by Morley, EXR and Unicord.



Morley Slimline Distortion Wah.

Morley's new Slimline Distortion Wah Pedal offers distortion, wah, volume and wah-distortion combined. Two LEDs indicate which effects are in use. Distortion ranges from a very subtle effect with the heel down to full distortion with the toe down. Additionally, a separate treble and bass distortion boost provides an extra punch for shattering hard rock sustain or an easy, mellow overdrive. Separate wah and distortion output level controls permit signal balancing.

The new EXR Projector Model SPIII, which is being billed as "the world's first psychoacoustic footpedal," provides three functions. First, with the psychoacoustic processor, the instrument will be projected into the foreground without cranking up the volume or equalisation. Second, the volume pedal has a fully adjustable EXR Process Pre-Set. Third, a built-in full-frequency direct box has a continuously variable input/output of up to 40 dB gain and XLR connector output. All three functions can be visually monitored at a glance by means of a 12 segment, three colour bar graph and four function LEDs. Suggested retail price for the SPIII is $299.

Unicord has introduced the Korg Professional Modular Effects 40X, a pedalboard that incorporates four effects processors of the user's choice. Modules available include Stereo Chorus, Stereo Flanger, Compressor, Graphic Equaliser, Overdrive and External Selector. An on/off switching system completely bypasses any effect or bypasses the entire system to prevent loading, improve frequency response and provide an overall punchier sound when the effects are in the 'on' or 'off' positions. The dynamic range, frequency response and low distortion of the PME 40X, according to Unicord, make it highly suitable for use with keyboards and guitars in both live performance and recording applications.

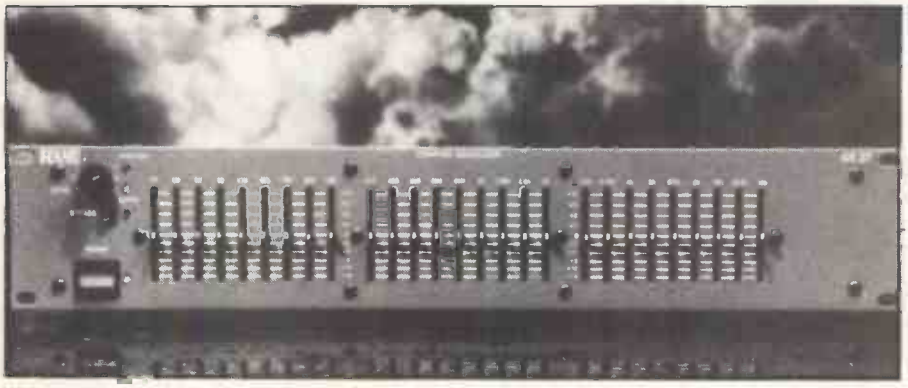
Oberheim has followed on the heels of E-mu, introducing the DMX programmable digital drum machine, a microcomputer system programmed with digital studio recordings of drums and cymbals, including rolls, flams, odd time signatures, uneven phrases, changing tempos and off the beat.

As many as 100 sequences of any length or time signature can be recorded in real time or one note at a time, played and modified quickly. Individual drums or individual notes can be recorded, erased and then re-recorded until the drum beat is exactly right. Quantize modes will correct your rhythm to any beat between 1/4 notes and 1/48 notes and a Swing mode will give rhythms the uneven feel that is often used in jazz.

The DMX also features a built-in nine input stereo mixer and eight modular voices, each with its own output, control voltage input and external triggers so that the DMX can be controlled by sequencers, synthesizers or even a drum kit. A cassette interface enables quick changes of all of the sequences and permanent data storage and a rechargeable battery maintains power to the memory when the DMX is turned off.

E&MM

Manufacturers and companies mentioned:
EXR Corporation, 3373 Oak Knoll Drive, Brighton, MI 48116.
JBL Incorporated, 8500 Balboa Boulevard, P.O. Box 2200, Northridge, CA 91329.
Harman (UK) Ltd., Mill Street, Slough, Berks. Tel. (0753) 76911.
Modular Sound Systems Inc., P.O. Box 488, Barrington, IL 60010.
Morley, 6855 Vineland Avenue, North Hollywood, CA 91605.
MTX, One Mitek Plaza, Winslow, IL 61089.
Oberheim Electronics Inc., 2250 South Barrington Avenue, Los Angeles, CA 90064.
Chase Musicians, 22 Chalton Street, London NW1. Tel. 01-387 7626.
Rane Corporation, 6510 216th S.W., Mountlake Terrace, WA 98043.
Unicord, 89 Frost Street, Westbury, NY 11590.
Korg, Rose-Morris, 32 Gordon House Road, London NW5.



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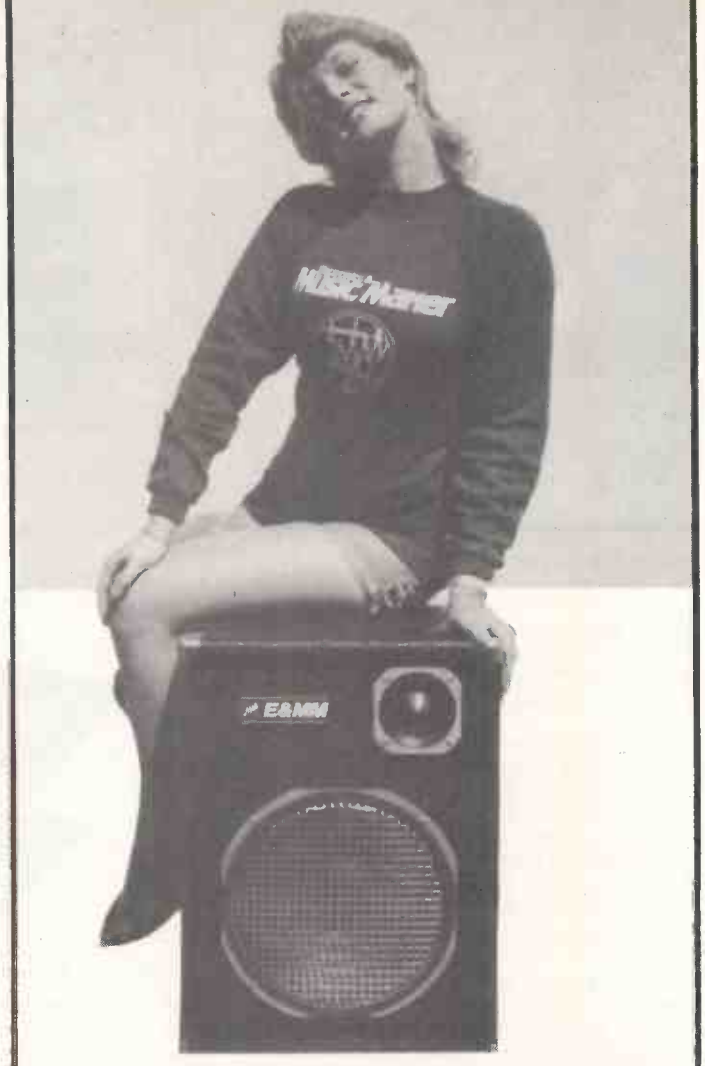

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- ★ Ready-built PCB assembly with detailed instructions

Many of our readers will already appreciate the great value of an equalisation device either in the home recording studio, on stage or even on the hi-fi. An equaliser allows the frequency response of a system to be modified so that an uneven or unnatural response can be 'ironed out', or indeed exaggerated for special effects. A graphic equaliser utilises several discrete frequency bands whose effect on the signal can be independently controlled by a 'graphic' array of slider controls. Ths graphic equaliser is also especially useful for eliminating any unevenness in room acoustics which can cause frequency response anomalies and, on stage, premature feedback.

The Amdek GEK-100 Graphic Equaliser Kit provides ten frequency bands spaced at one octave intervals to cover the range 31Hz to 16kHz. Each band is controlled by a slider pot such that the gain of each band can be set from −12 to +12dB. A bypass switch has been thoughtfully provided to allow A/B signal comparison, and to allow the response to be instantly 'normalised'. Another nice touch is the use of centre detent sliders, enabling the zero position to be quickly and accurately found. Being mains powered eliminates the worry and inconvenience of dud batteries.

The Kit

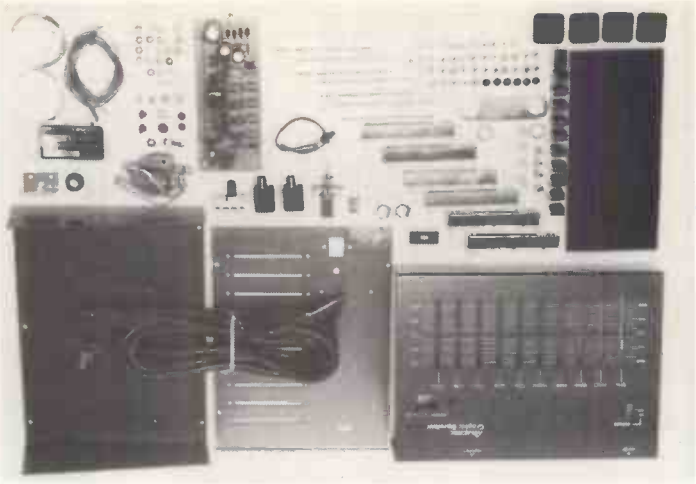
The only tools required in addition to the hexagonal wrench supplied with the kit are: a fine tipped 15-30W soldering iron, side cutters, wire strippers, pliers, screwdrivers, and a crimping tool for the mains terminations.

Firstly, lay out all the parts so that they can be identified and checked off easily. The step by step construction commences with preparing and soldering lengths of insulated wire to the ready-built PCB assembly as described in steps 1-4. After mounting the PCB assembly and the slider controls on the sub-chassis (steps 5-7), the LED is fitted, and all parts are wired up as shown in steps 8-10. The slider by-pass switch, mains switch and mains transformer are now fixed to the sub-chassis and wired in accordance with steps 11-16.

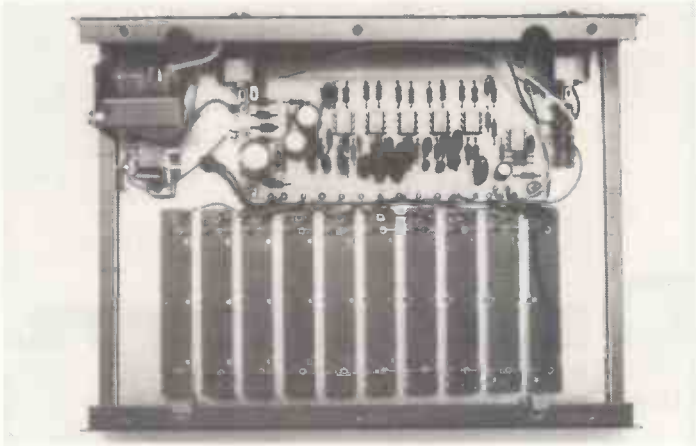
The rubber slider pot mask and the slider switch mask are now fitted, and the sub-chassis mounted in the upper part of the case as in steps 17-19. Steps 20 and 21 describe fitting and wiring the jack sockets. After preparing and clamping the mains lead in position, it is terminated firstly to the two transformer primary leads, the joints of which are protected by crimped caps; and secondly to the sub-chassis earth by means of a solder lug, as shown in steps 23 and 24. Steps 25 and 26 see the completion of the project by fitting the case bottom, the rubber feet and the control knobs. The 2-pin plug moulded onto the mains lead could be changed for a 3-pin type if required.

Circuit

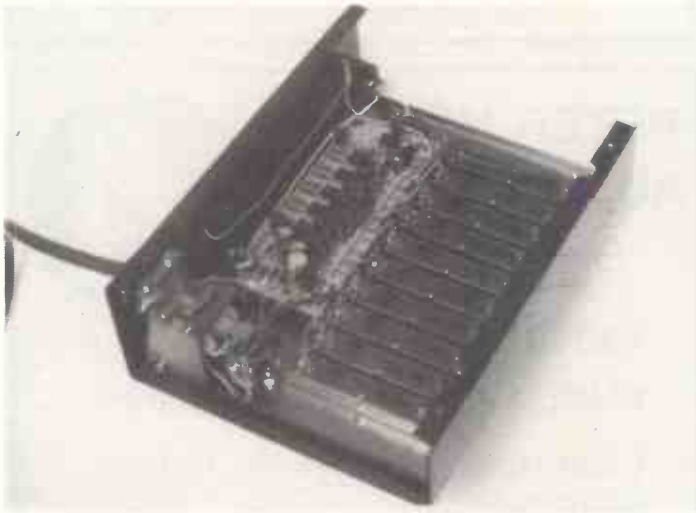
The circuit is an inductorless design, using op-amps IC1-IC5 as gyrators to give the equivalent of series LCR band—reject circuits, one for each frequency



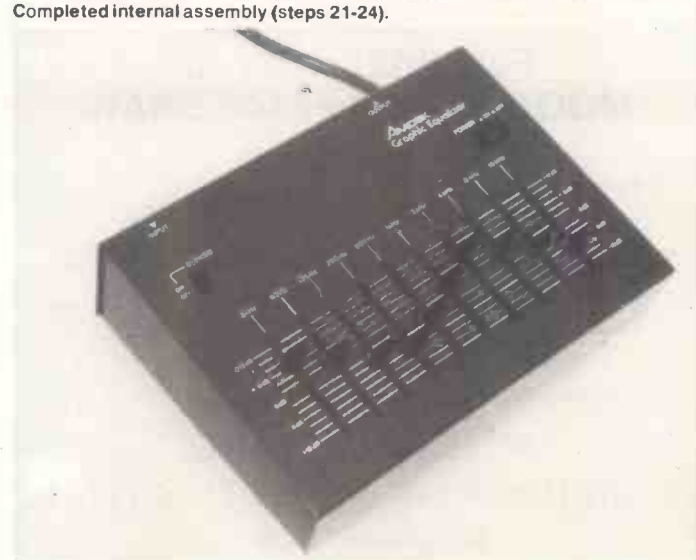
Complete set of parts ready to be checked off.



Wired sub-chassis installed into case (steps 10-20).



Completed internal assembly (steps 21-24).



Completed unit.

band. These can be either in the inverting input circuit of IC6 for boosting, or in the non-inverting input circuit for attenuating, according to the setting of the sliders. The values of the capacitors determine the centre frequencies of each band. The 16kHz band uses a CR series circuit, which gives boost or cut to all frequencies above 16kHz. The inputs and outputs are buffered by IC5 and IC6 for high input and low output impedances respectively. The power supply is quite conventional, using resistors to split a single rail unregulated rectified voltage.

Operation

Since a fully tested PCB assembly is supplied, there is no reason why the unit should not work first time. If you have any problems, ring the 'Amdek Hot Line' on 01-847 1671. The best way to get to know the graphic equaliser is by experimentation, using the by-pass switch to compare the equalised signal with the original. Unless you have access to a spectrum analyser, room acoustics equalisation will be largely by trial and error. The unit will accept signals directly from instruments such as guitars, which will benefit greatly from the wide range of tonal variation available.

Modifications

Amdek suggest a couple of possible modifications, both of which involve changing components on the PCB assembly. The centre frequencies of the bands can be altered by using the equations given in the instruction booklet. The range of the controls can also be lowered to +/– 6dB for finer control by changing R29 and R30 from 2k7 to 680 ohms. It should be possible to increase the range of the controls slightly by increasing the values of R29 and R30, although stability problems may be encountered if you make them too high.

Since the on-off switch is on the secondary side of the transformer, it is advisable to unplug the mains when the unit is not in use.

E&MM

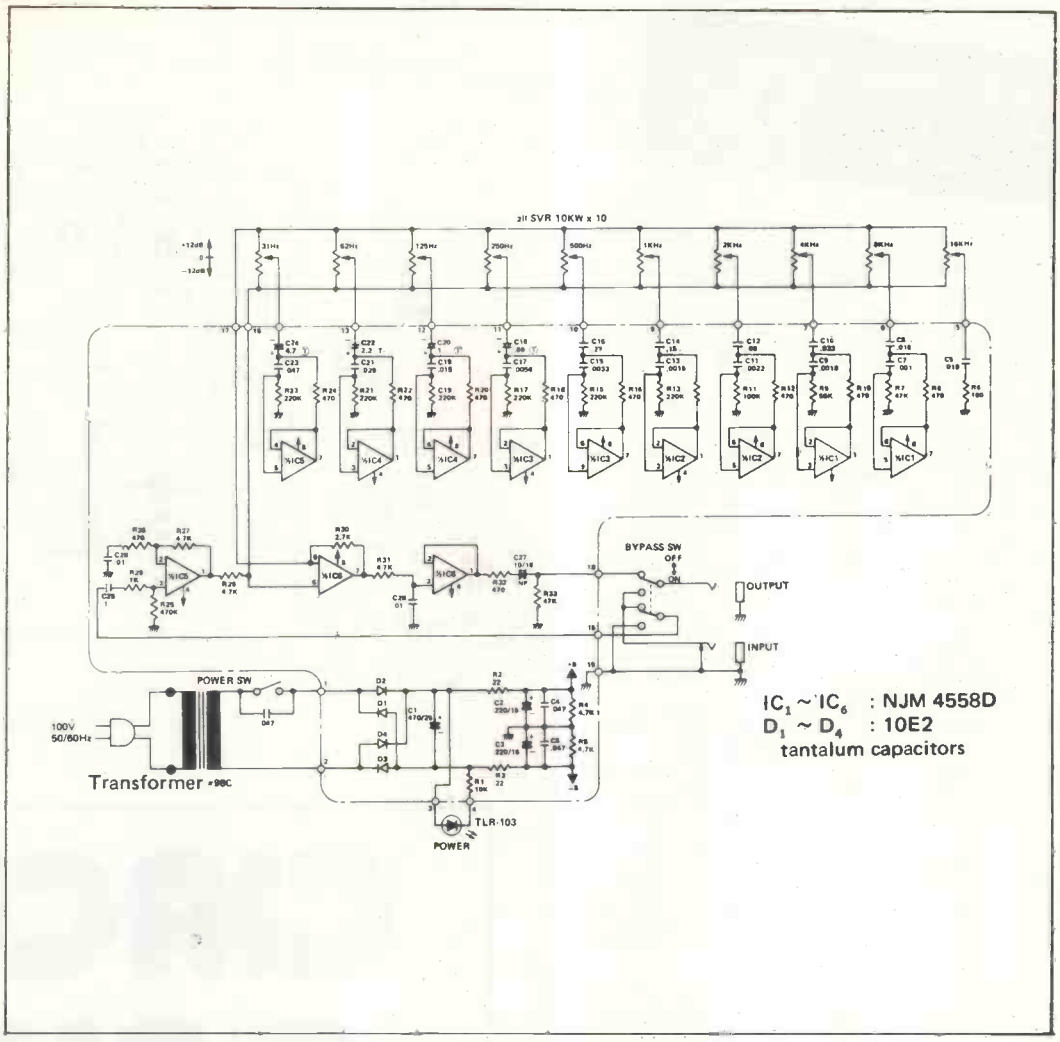


Figure 1. Circuit diagram of graphic equaliser.

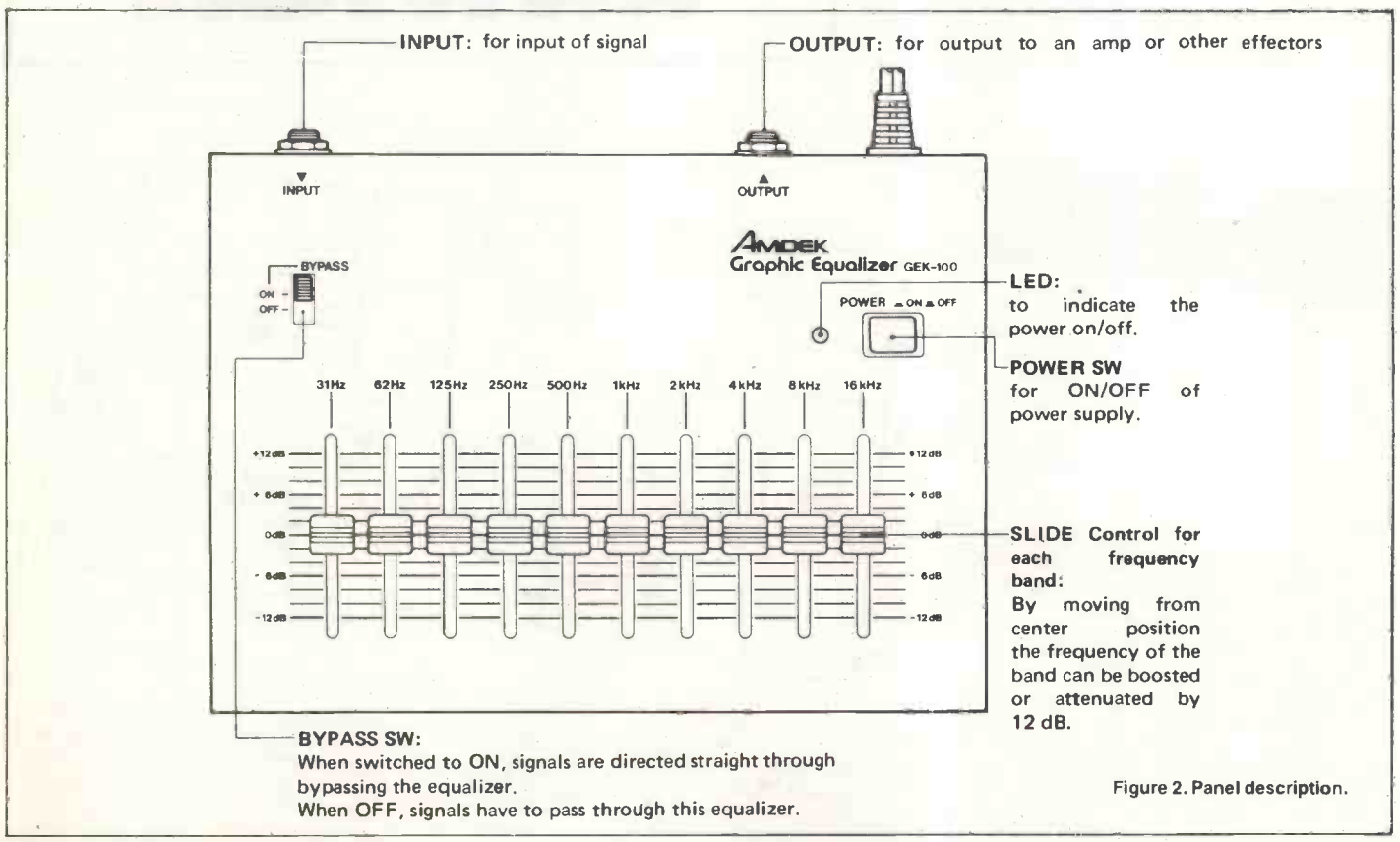


Figure 2. Panel description.

E&MM's special offer price for the Amdek Graphic Equaliser Kit is £67.50 including VAT and P&P. Please order as GEK-100 and send to : E&MM, Mail Order Department, 1 Milton Road, Cambridge CB4 1UY.

Guitar Headphone Amplifier

Robert Penfold

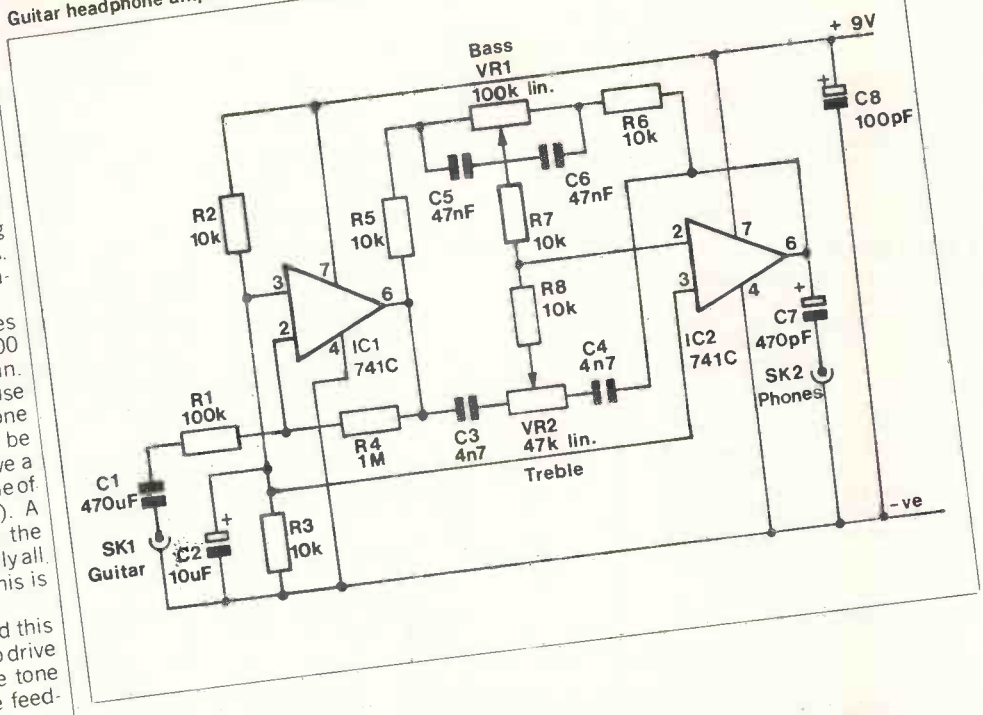
For guitar practice a small self-contained amplifier plus a pair of headphones is often more convenient than a high power combo. This simple headphone amplifier design will operate well with most high, low and medium impedance headphones giving good volume and low noise/distortion levels. It also includes Bass and Treble tone controls.

IC1 is a preamplifier stage which gives the circuit an input impedance of 100 kilohms and provides 20dB of voltage gain. This gives the circuit adequate gain for use with most guitar pickup and headphone combinations, but if necessary R4 can be raised in value somewhat in order to give a higher level of gain (increases in the value of R4 give a proportional boost in gain). A volume control could be included at the input of the unit if desired, but as virtually all guitars incorporate a volume control this is not essential.

IC2 is used as the output stage, and this provides an adequate output current to drive any normal type of headphones. The tone control networks are included in the feedback circuit of IC2, and this stage has a nominal voltage gain of unity. However, the tone control networks can be adjusted to boost or cut the gain over their respective operating frequency ranges, and about 12dB of boost and cut is available at 100Hz and 10kHz. VR1 is the Bass control and VR2 is the Treble control.

The circuit has a quiescent current consumption of about 2 milliamps, and this only rises to around 5 milliamps at high volume levels. A small (PP3 size) 9 volt battery will therefore give many hours of operation. When using the unit with high and medium impedance headhones results are likely to be best with the phones wired in series, but for high impedance types results will probably be best using parallel connection.

Guitar headphone amplifier circuit.



CIRCUIT MAKER

Auto Switchover

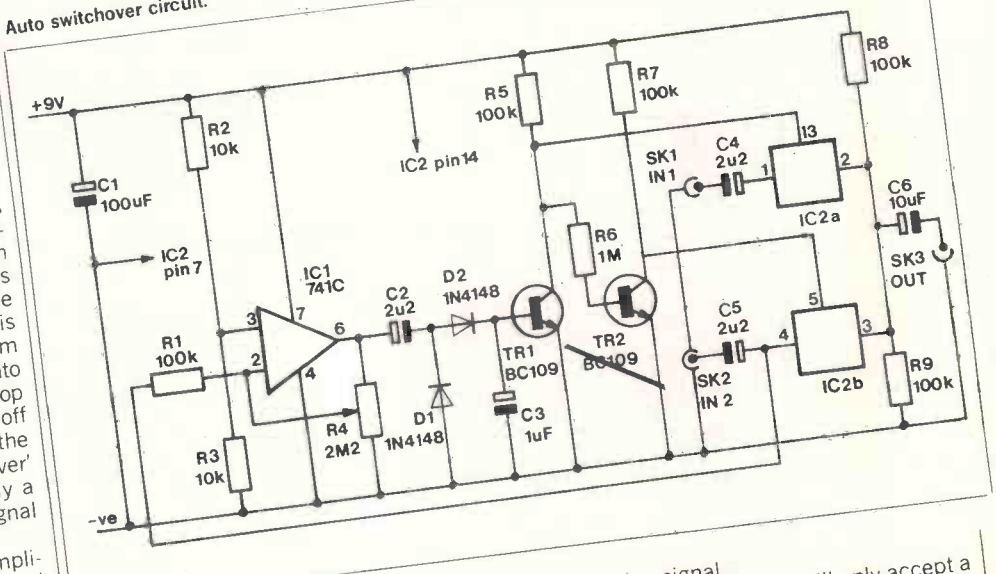
Robert Penfold

This circuit is a form of auto 'ducking' or 'voice-over' unit, and it is based on a CMOS 4016BE quad analogue switch. The music signal is fed to Input 1 and the voice signal is applied to Input 2. Under quiescent conditions the control input of IC2a is taken high so that this switch is turned on and couples the music signal at input 1 through to the output. Tr2 acts as an inverter so that IC2b is turned off and the voice signal is cut off from the output. However, if Tr1 is biased into conduction the two control voltages swop states so that the music signal is switched off and the voice signal passes through to the output. In order to produce the 'voice-over' effect it is merely necessary to supply a suitable bias to Tr1 whenever a voice signal is present at Input 2.

This bias is supplied by IC1, which amplifies the voice signal, and the amplified signal is then rectified and smoothed by D1, D2 and C3. R4 enables the voltage gain of IC1 to be varied from zero up to a maximum of 22 times, and this is set for the lowest gain that gives reliable operation of the unit. With a higher level of gain the unit will work, but there is a danger of background sounds producing spurious operations. The circuit has a fast attack time so that the voice signal is switched through to the output almost instantly as it commences. The circuit also has a fairly rapid decay time so that the music signal is switched through to the output again soon after the voice signal ceases, but the decay time is sufficiently long to avoid switching during brief pauses in the voice signal.

As the circuit stands it will only accept a mono music signal, but by duplicating the switching circuit using the remaining two sections of IC2 it would be possible to control a stereo music signal and mix the voice signal into both channels. The current consumption of the circuit is only about 2 milliamps and a supply voltage of around 9 to 18 volts is suitable.

Auto switchover circuit.



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1981

MARCH Matinée Organ ★ Spectrum Synthesiser ★ Hi-Fi Sub-Bass Woofer ★ Balanced line system ★ Yamaha SK20 review ★ BBC Radiophonic Workshop

APRIL Syntom Drum Synthesiser ★ Workshop Power Supply ★ Direct Inject Box ★ Ultravox ★ Paia 8700 review ★ Matinée ★ Spectrum

MAY Noise Reduction Unit ★ Lowrey MX-1 review ★ Apple Music System ★ Matinée ★ Spectrum

JUNE Wordmaker ★ Guitar Tuner ★ Hi-Fi/Group Mosfet amp ★ Fairlight CMI review ★ David Vorhaus ★ Matinée

JULY Alphadac 16 Synthesiser Keyboard Controller ★ Synwave effects unit ★ Matinée ★ Atari Music ★ Duncan Mackay ★ PPG Wave 2/Wersi Pianostar reviews

AUGUST PA Signal Processor ★ Powercomp ★ Hexadrum ★ Matinée ★ Resynator/Casio VL-Tone reviews ★ Irmin Schmidt

SEPTEMBER Partylite ★ Tape-Slide Synchroniser ★ Synpac 9V effects supply ★ Noise Gate ★ PA Signal Processor ★ Digital Keyboard ★ One-handed Guitar ★ Chromascope & Linn Drum reviews ★ Kraftwerk revealed

OCTOBER Harmony Generator ★ Securigard burglar alarm ★ Effects Link FX-1 ★ Music at City University ★ dbx noise reduction & Blacet Syn-Bow reviews ★ Micro interfacing ★ Disco equalisation

NOVEMBER Landscape explored ★ Casio MT-30, Roland GR-300 Guitar Synthesiser, Roland CPE-800 Compu-Editor reviews ★ Melody Making on the Apple ★ Phasing ★ Auto Swell - Electric Drummer - Soundbooster - Toneboost projects

DECEMBER Rick Wakeman in 1984 ★ Orchestral Manoeuvres in the Dark ★ Bio Music ★ Yamaha CS70M, Vox Custom Bass & Custom 25, Roland CR5000 & CR8000, Alpha Syntauri, Fostex 250 ★ Synclock project ★ ZX81 music

1982

JANUARY The New Tangerine Dream ★ Japan Music Fair ★ Fact File ★ Guitar Workshop ★ Reviews: Casiotone 701, Teisco SX-400, Aria TS-400, M.C.S. Percussion Computer, Soundchaser, Beyer Mics, TC Effects Boxes, Tempo Check ★ Projects: Spectrum Synthesiser, Electric Drummer, Volume Pedal

FEBRUARY Ike Isaacs ★ Digital Audio Discs ★ Yamaha GS1 & 2 ★ Reviews: Korg Trident, AKG D330BT & D202 Mics, Menta Micro, Roland TR606 Drumatix, JHS C50PM & C20B amps, Fostex A-8 8-track Recorder, Tokai ST50 & PB80 Guitars ★ Vocal PA ★ ZX81 Music ★ Projects: Digital Delay Effects Unit, Spectrum Synth, Percussion Sound Generator ★ Resonant Filters

MARCH Klaus Schulze ★ Robert Schröder ★ Kraftwerk Music to play ★ Killing CB Interference ★ Reviews: Firstman SQ-01, SC1 Pro-One, JHS Pro Rhythm Mini Synth, Tascam 124AV, Wersi Comet, Hamer Prototype, Shure 517SA & B ★ Synth Buyers Guide ★ Projects: Power 200 Speakers, 1.6 sec Digital Delay Effects Unit

APRIL Martin Rushent, Human League in the Studio ★ Cardiff University Electronic Music Studio ★ Reverberation explained ★ Reviews: Korg Mono/Poly Synthesiser, Fostex 350 Mixer, Roland TB-303 Bass Line Sequencer ★ Projects: MF1 Sync Unit, Multireverb ★ Electro-Music Crossword.

MAY Holger Czukay ★ Depeche Mode ★ Keyboard Buyers Guide ★ The Peak Programme Meter ★ Reviews: Moog Source and Rogue Synthesisers, Suzuki Omnichord, Acorn Atom Synthesiser, Calrec Soundfield Microphone ★ Projects: Soft Distortion Pedal, Quadramix.

JUNE Jean-Michel Jarre ★ Classix Nouveaux ★ Studio Sound Techniques ★ Making Music with the Microtan 65 ★ Reviews: Carlsbro Minifex and E-mu Systems Emulator ★ Projects: Panolo and Multisplit.

JULY Ronny with Warren Cann and Hans Zimmer ★ Drum Machines Buyers Guide ★ Jean-Michel Jarre Music Supplement ★ Reviews: Roland Juno 6 Synthesiser, Peavey Heritage Amplifier, Steinberger Bass Guitar, TI-99/4 Music Maker Software ★ Projects: Universal Trigger Interface, Electric Drummer

AUGUST Kitaro ★ Spectro Sound Studio ★ Jon Lord Interview & 'Before I Forget' music to play ★ Reviews: The Synergy, Korg Polysix, Tascam M244 Portastudio, Shergold Modulator 12-String Guitar, Yamaha Professional System Effectors ★ Warren Cann's Electro-Drum Column ★ Projects: 8201 Line Mixer, Guitar Buddy practice amplifier.

SEPTEMBER Richard Pinhas ★ Non-Concordant Tone Generation ★ Yamaha CS-01 Breath Controller ★ Reviews: Jen SX1000, Casio 1000P Synthesisers, Fender Squier Guitar, Carlsbro Stingray Electro-Acoustic Amplifier, Pearl Effectors, Delta Lab DL-5 Harmonicomputer ★ Projects: Comp-Lim, Twinpak ±15V PSU.

OCTOBER Kate Bush interview and 'The Dreaming' music to play ★ Digital Recording, A New Landmark ★ Ken Freeman ★ Spectrum Micromusic ★ Reviews: Rhodes Chroma, Fender Squier guitars, Kay drum machine, Carlsbro Power Amp ★ Projects: ElectroMix 842 Mixer, Amdek Distortion Kit.

NOVEMBER Patrick Moraz interview and 'Adagio For A Hostage' music to play ★ Robert Moog ★ Bill Nelson ★ K. Schulze and K. Crimson in Concert ★ Reviews: Yamaha PC-100, Technics SX-K200, Casio MT-70, Hohner P100 and JVC KB-500 MiniSynth Supplement, Gibson Firebird 2 Guitar, Alligator AT150 Amplifier, Allen & Heath 1221 Mixer, Eko Ritmo 20 ★ Projects: ElectroMix 842 Mixer, Amdek Chorus.

DECEMBER Cliff Richard interview and Little Town music ★ Patrick Moraz ★ ARS Electronica ★ Digital Recording Pt II ★ Reviews: Elka Synthex, Crumar Stratus Synths, Tokai Basses, Shure PE Series Microphone, The Kit Percussion Unit ★ Projects: The Transpozer, Amdek Percussion Synth, Canjak.

1983

JANUARY Richard Barbieri of Japan ★ Ultravox Music ★ Patrick Moraz ★ Ars Electronics ★ Reviews: Westone Bass Guitar, BGW 750C Amp, Korg EPS-1 Keyboard, Clef Band Box, Zildjian Cymbals ★ Projects: Synblo, The Transpozer, Amdek Compressor.

FEBRUARY Isao Tomita ★ The Human League ★ The Novatron Revisited ★ E&MM Index 1981/82 ★ Reviews: Linn Drum; Godwin Drummaker 32P; Wersimatic CX-1; Mattel Synsonics; Simmons SDS Drum Sequencer; Klone Kit; Movement Drum Computer 2; Korg KPR-77 Programmable; Memory-moog; Synclavier II; Powertran Polysynth; Vigier Guitars, Tokai TA35 Amp; Pearl Mics ★ Projects; Synbal; Caltune; Amdek 6-2 Mixer.

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MAY Keith Emerson ★ Guitar Buyers Guide ★ Roland MC-202 ★ Introducing the MIDI ★ Reviews: Fostex X15 Multitracker, Echo Unit Supplement; 13 echo reviews, M&A K-1/B, Yamaha Portasound MP1, Carlsbro Cobra 90 Amplifier, Technical Projects DI Boxes, Boss TU-12 Tuner ★ Projects: MicroMIDI, Home Active Speaker, Amdek Flanger Kit.

JUNE Steve Hillage ★ Arthur Brown ★ Larry Fast ★ History of Guitar Synthesisers ★ Casio Modifications ★ Reviews: Synton Syrinx, Synclavier II, Clarion 4 track, Cutec MR402, Ovation Balladeer Guitar, Drumulator, Vesta Fire Flanger/Chorus, Aria AD-05 Delay, Suzuki, Mic ★ Projects: OMDAC, Amdek Power Distributor, Active Bass Guitar.

JULY Marillion ★ Hans Zimmer ★ Programming Yamaha's DX Keyboards ★ Reviews: Kawai SX-210 Synthesiser, Aria U60 Deluxe Guitar, Trident VFM Mixer, MXR Omni Effects, Milab Mics ★ Projects: Digital Signal Processing For Sinclair Spectrum, Tap Tempo, Amdek Delay Kit.

AUGUST Bill Nelson plus 'Chimera' music to play ★ Hubert Bognermayr ★ MIDI Dump ★ Barclay James Harvest ★ Reviews: Roland JX-3P/PG200, OSCar Synthesiser, 360 Systems Digital Keyboard, Music Percussion Computer, Fender Stage Lead Amplifier, Yamaha SG200 Guitar, Tubby Drum System, Frontline Effects ★ Projects: Digital Signal Processing (Part 2) — Echo programs for your Sinclair Spectrum, Amdek Phaser Kit.

SEPTEMBER Peter Vetesse ● Which Synth? Comprehensive Guide ● Prophet T8 in focus ● Goldsmith's College Studio ● Reviews: Oberheim DX Drum Machine, SCI Pro-FX 500. Rickenbacker 360/12 String Guitar, Rickenbacker TR75GT Amplifier ● Projects: Synclap, Amdek Tuning Amp Kit.

Advanced Music Synthesis

Envelope Generators

Part 2

by Steve Howell

This month, the topic of the workshop is envelope generators, also known by various manufacturers as contour generators (Moog) and envelope shapers or trapezoid generators (EMS). The title 'envelope generators' is the name given to these devices by most manufacturers as they are usually used to generate a voltage which, if applied to the control input of a voltage controlled amplifier (VCA) or voltage controlled filter (VCF), shapes the envelope of any given sound. But before we look at envelope generators let's first see what an envelope is.

The envelope is a major constituent of sound. Every acoustic instrument has its own unique envelope which, even on what might appear to be a simple sound, can be very complex indeed if analysed. On most synthesisers we have the ability to define the attack, initial decay, sustain level and final decay (or release) elements of a sound in the form of an ADSR envelope generator. These devices allow us to get a fairly close approximation of the envelopes found on acoustic sounds, however, they do fall short of the inherent complexities and irregularities of naturally occurring sounds and instruments. There are ways around these shortcomings which I will show later, but first let's have a look at the envelope generator's function and how it works.

Basically, the envelope generator is a device that puts out a varying voltage every time it receives an incoming trigger or gate pulse. This pulse is usually derived from the keyboard so that every time a key is depressed, as well as sending a control voltage to the voltage controlled oscillators (VCOs), the keyboard also sends a pulse to the envelope generator(s) so that the note can be shaped (or some other task can be performed). The basic patch for a simple envelope shaping system is shown in Figure 1a. The four controls associated with the envelope generator can now be used to define the shape of the note or sound. These controls are:

Attack — This control allows us to vary the time it takes for the note to reach full volume.

Decay — This control determines the length of time it takes for the note to die away to the sustain level.

Sustain — This control sets the volume or level at which the decay is interrupted while a note is held.

Release — This control determines the time it takes for the sound to finally die away after the key is released.

Whenever a pulse is received from the keyboard (or wherever) the voltage output of the envelope generator rises and falls in accordance with the settings of these four controls as in Figure 2a. If one considers that a VCA will not allow any sound to pass through it until the voltage applied to its control input increases, you should be able to see how it is possible to shape the amplitude envelopes of your sound. Figure 2b gives examples of possible envelope shapes and, as I'm sure you can see, there are many permutations.

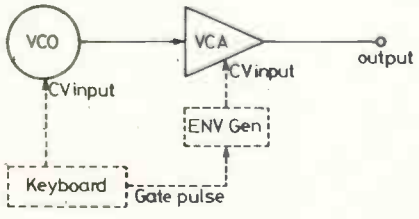
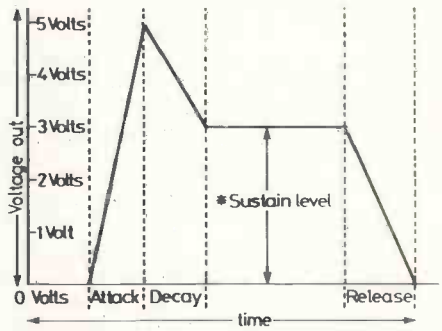


Figure 1a. Basic envelope shaping patch.



*Note sustains as long as key is held down

Figure 2a. Typical envelope.

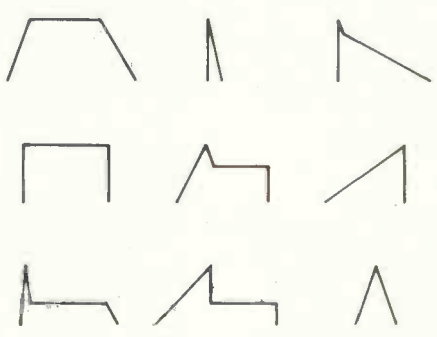


Figure 2b. Example envelope shapes.

Apart from simply increasing and decreasing in volume, a sound will also vary its harmonic content throughout its duration. This is where the VCF comes in. By applying the output of the envelope generator to the control input of the VCF, as in Figure 1b, it is possible to create many interesting and dynamic sounds which have a continuous change in tone and volume throughout the course of the note. Many synthesisers have two envelope generators one assigned to the VCF and the other to the VCA (as in Figure 1c) which allows a greater range of sound variation than on synths having only one envelope generator. I'm sure most of you are familiar with the various effects that are possible by applying the envelope generator to control the VCF as this was discussed in the previous article on filters.

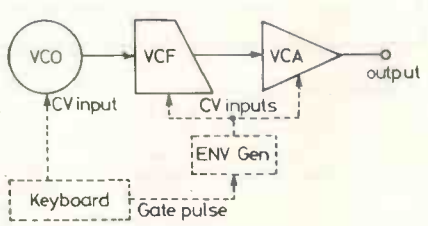


Figure 1b. Applying envelope shaper to VCF and VCA.

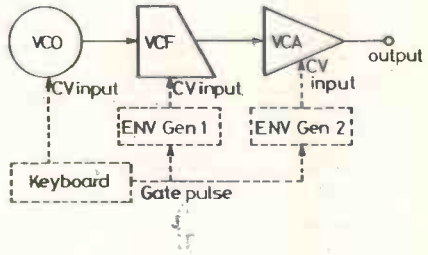


Figure 1c. Applying separate envelope generators to VCF and VCA.

If you have a modular synthesiser such as the ARP 2600, Roland System 100M or 700 then it is possible to route the outputs of two envelope generators to the control inputs of the VCF as shown in Figure 3a. With careful setting of the respective controls many varied and interesting sounds can be produced which resemble more closely the complex envelopes of acoustic instruments. One such envelope is given as an example in Figure 3b. If applied to the control input of the VCF which is being fed with a sawtooth wave, it could be used to successfully imitate a French Horn, where the initial attack/decay cycle is followed by an increase

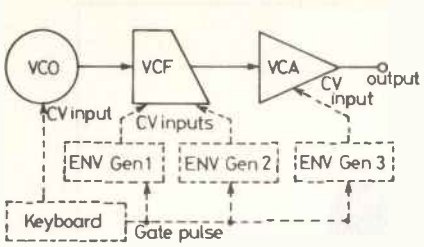


Figure 3a. Applying two envelope generators to VCF control voltage input.

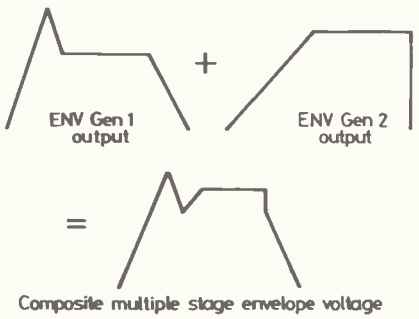


Figure 3b. Creating a composite multiple envelope.

in tone. By experimenting with the various envelope generator controls many more 'animated' sounds can be produced than if you had used only one envelope generator.

Another option available to those of you with modular systems is to route the various VCOs through independently shaped VCF/VCA combinations as in Figure 4a. This patch can be used to create a variety of sounds. For example, tune VCO1 an octave and a

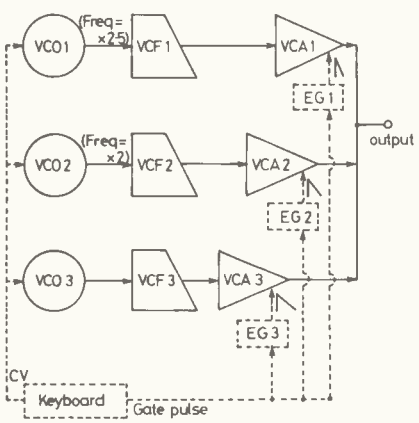


Figure 4a. Assigning VCOs and VCFs to separate amplitude shapers.

fifth above VCO3 and give it a very short, 'plucky' envelope. Now tune VCO2 an octave above VCO1 and give it a slightly longer envelope than on VCO1. Finally, VCO3 should have a longer envelope than VCO2. By using sine or triangle waves or by using filtered square waves you will be able to produce some very realistic marimba, xylophone and celeste sounds amongst others. What is actually taking place here is that VCO1 and VCO2 (the high frequency content of the sound) die away leaving only VCO3 to sustain a little. The end result being more natural-sounding.

However, if you don't have a modular synthesiser but have access to a few monophonic synths with control voltage and gate/trigger inputs and outputs, you could try experimenting with this technique by hooking them up as in Figure 4b. Those of you with a polysynth capable of layering two sounds together might also like to try this. If you want to hear good examples of how multiple envelope generators can be used to create a more 'animated' sound then I recommend you take a listen to

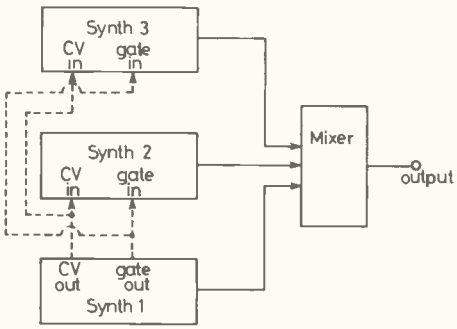


Figure 4b. Composite envelope patch using separate synthesisers.

Wendy Carlos' version of the Brandenberg Concerti. Carlos said, in a lecture in America some time ago, that she finds multiple envelope shaping far more musically creative than the usual approach, which is to use multiple oscillators through a single envelope generator. She can use up to eight envelope generators on one sound alone which probably accounts for the fact that the music she creates is much more 'alive' and dynamic than a lot of other synthesised music.

Envelope generators need not only be used for tonal or level shaping, however. They can be used for a variety of other control purposes such as pitch bend if routed to the VCO(s). The output of an envelope generator can also be applied to the CV input of a low frequency oscillator (LFO) to enable vibrato or other modulation effects to be produced that speed up or slow down as the note either sustains or dies away. Many interesting synth sounds and realistic string sounds can be created using this technique. An extension of this is to route the output of the LFO through a VCA which is being controlled by an envelope generator (as in Figure 5) so that every time a note is played, the modulation effect fades in (or out if the inverter is omitted) thereby

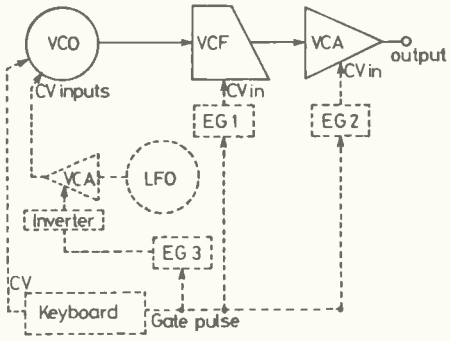


Figure 5. Delayed modulation using envelope generators.

creating delayed vibrato and modulation effects that are dependent on the settings of the ADSR controls.

So far, we've only looked at fairly standard ADSR types of envelope generators but some manufacturers provide envelope generators which are more flexible. RSF, a French firm, for instance, provide the facility to voltage control the attack, decay and release times. Many things are possible with this feature by routing the keyboard voltage to control the envelope so that the various times of these parameters can vary across the range of the keyboard in much the same way as on an acoustic instrument. Many of the latest polysynths have this feature 'onboard' in the form of a Key-follow switch associated with the envelope generators; so those of you with a Jupiter 8, Memory-Moog, Jupiter 6 or DX7 may like to experiment with this.

By using a velocity sensitive keyboard and assigning the velocity voltage output to the control voltage input of, say, the attack time, one could vary the attack of the sound simply by hitting the key a bit harder or softer. This is a very expressive technique that until recently has only been available on the large modular systems but now the Rhodes Chroma, Prophet T8 and RSF Polykobol have this feature.

Other envelope generators worth looking at are made by an American firm, Serge. They make a device known as the 'dual universal slope generator'. As well as functioning as an envelope generator the device can be patched up to act as a VCLFO, a portamento device that can be voltage controlled, a VC trigger delay, an oscillator, a sub-harmonic series generator and a fairly primitive lowpass filter. As if this weren't enough, there's a separate trigger output that fires when the unit has reached the end of it's cycle (when being used as an envelope generator). This can be used to trigger another slope generator. In this way, it is possible to produce multiple stage envelopes that allow far more sound variations than with the ordinary four stage ADSR type unit.

That just about concludes this workshop, although we will be looking at envelope shaping using other modules in future articles. Next time, as a logical follow on to this month's article, we will be looking at trigger and gate pulses and their application.

E&MM

MUSIC WORKSHOP

Clean up your mains with E&MM's

Super Screened Mains Distribution Board

This feature deals with the cautionary subject of AC mains. Under no circumstances should you attempt to work on circuits to which live mains is attached. Readers are not so plentiful that we can afford to terminate them in such a perfunctory manner!

Distributing the mains may seem like a relatively tedious and uninspiring business when compared to the unashamed esoteric nature of the modern electro-musician's battery of high technology – yet it's still one of the most potentially embarrassing and hazardous areas for any musical enterprise. No mains distribution system has been designed to cope with the requirements of the numbers of mains operated pieces of equipment in the average living room – let alone the considerations of a performer: mixers, amplifiers, keyboards, computers, effects boxes, lighting – the list Is not difficult to extend. Thus we all need some means of turning one 13 amp mains lead into many.

Then there are the apocryphal tales of musicians who subscribe to the school of electrical engineers that rely on poking the wires into the mains sockets using matchsticks. A practice which gives a whole new dimension to the expression 'electric guitar'.

Performers frequently get hot, sweaty and rather enthusiastic. Tugging at cables, draping invitingly conductive flesh within millimetres of the National Grid. Such events may contribute to the performance in ways hitherto unplanned and unimagined by audience and artist alike.

Many of the 13 amp distribution units available are less than adequate after the sort of pounding received at the hands of the brutal musician, since all 13 amp mains plugs are not alike, and the variety of dimensional tolerances can lead to slackness that does wonders to equipment through the induced arcing and intermittency that most readers will have chanced across 'in their time'.

We're not finished with this cautionary tale just yet, since it is as well to remember that the flashing of the obligatory light show, the switching of the triacs and the delicacy of the 64K dynamic random access memory in the latest computerised equipment are about as compatible as Frank Zappa and Dame Myra Hess. (Who's he?). In brief, a good tweak of the mains supply will readily reset a computer and reduce a carefully preprogrammed synthesised musical extravaganza into something that would shame a novice stylophone operator.

What you need is an E&MM mains transient protection distribution unit. Or the EMMMTPDU, for short.

You and the EMMTPDU

The circuit of the Mains Distribution Board is displayed in Figure 1.

Following through from the mains input end of the circuit, you will note that there's a fuse. It's a great deal easier to change this type of fuse than to fiddle about unscrewing the plug, so make certain this fuse is rated below the main 13A plug fuse. You should not attempt to distribute the mains if your 'Christmas' tree is likely to be taking in excess of 10A anyway. The ratings of the switch are the prime consideration, but so are the ratings of the individual outlets. No single outlet should exceed

6 amps.

"But why?" you ask. After all, a piece of 6A fuse wire is only a fraction of the size of the pins on the 6A plus/socket.

A practical demonstration is to unplug a 2.5-3kW heater from a 13A socket and just check how warm the pins on the plug have become. be careful, since many of the less stoutly constructed arrangements will actually be far too hot to touch, even at 'only' 10A. The answer is simply to be found by reference to Ohm's law, one derivative of which is:

W = I.I.R (W = power in watts, I = current in amps, R = resistance In ohms)

In other words, if you introduce even a small resistance in the path of a large current, it generates much heat. Ultimately in mains applications, that heat will cause the cable or connector to get so hot it deforms, and may then arc, causing carbonisation and a situation which is virtually irrecoverable. If you have a 13A mains outlet that is blackened around the Live pin, then the chances are that you will have to replace it entirely if you want to use it to full capacity again. Never unplug high capacity equipment without first using the outlet switch to disconnect the circuit without a flash and a bang.

Back to the rating of the distribution block: even the relatively small resistance offered by the contacts in the outlet sockets means that you must not exceed the ratings to ensure reliability and longevity. If you dismantle most of the moulded 13A distribution strips, you may well be amazed/unnerved at the relatively insubstantial nature of the conductor and contact surfaces. Most such blocks are not really recommended for more than 3A per outlet.

All that, and we're only as far as the fuse! On past the switch to the mains 'on' neon indicator. The second neon (Ne2) is placed between the neutral and earth, and if this should light, then you should not connect anything but attempt to trace the reason why there is a significant voltage present on a line where there should be none. 13A mains wiring is a vexed enough subject not to be covered here: buy the Readers Digest DIY book or whatever . . .

The coils (L1-L5) are wound on dust iron toroids. Similar to ferrite toroids, but better suited in most cases to the function of interference suppression whilst under the influence of current. The manufacturer produces a range of technical support literature for those interested, otherwise take it as read that the details given here are a suitable general purpose compromise for an application such as this. Purists with computer programs may want to match source and load impedance, current ratings etc., but that's beyond our scope here, although we shall concede that such efforts may be rewarded – marginally.

Thus each outlet has a degree of isolation from the next. The circuit is shown wired in series, and it's arguable that it may be better to run them in parallel from the main feed points (A and B) after the prime input filter formed by L1, C1 and C2. But now we move into the most vexed question of all (as far as the electric musician is concerned): "When is an earth not an earth?"

Briefly, certainly not necessarily when it's connected to the earth point of the mains. The impedance of the earth Is a vitally important consideration in all AC engineering, and the earth connection should always be the heaviest gauge possible in order to keep its resistance to the barest possible minimum. Note that the earth is drawn as a bus bar function, not a direct series line.

When connecting equipment arrays you are likely to find that it's important to isolate certain items from their own

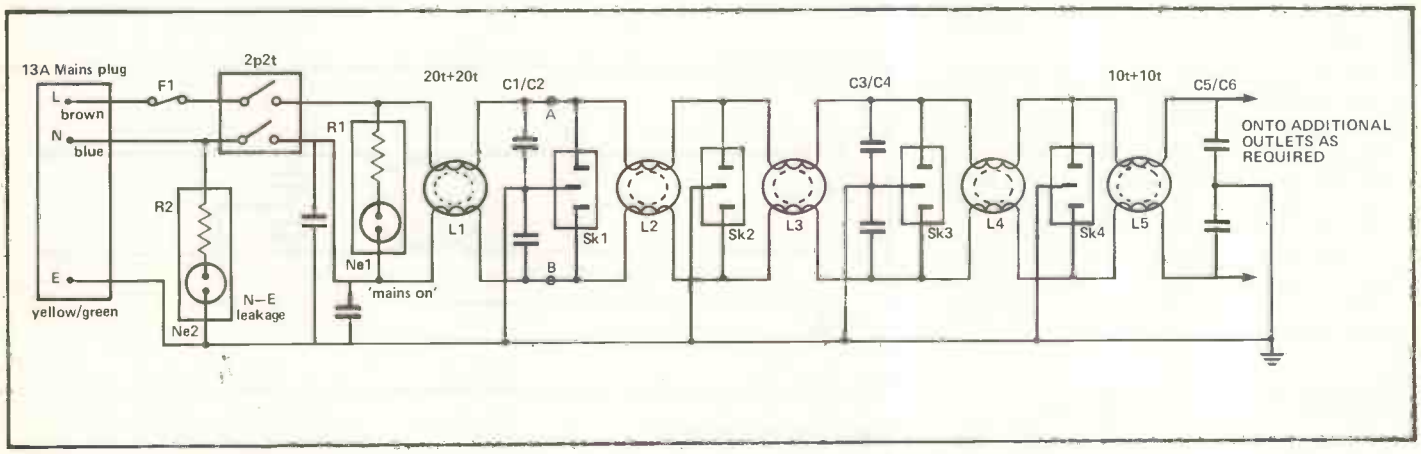


Figure 1. Mains Distribution Board circuit diagram.

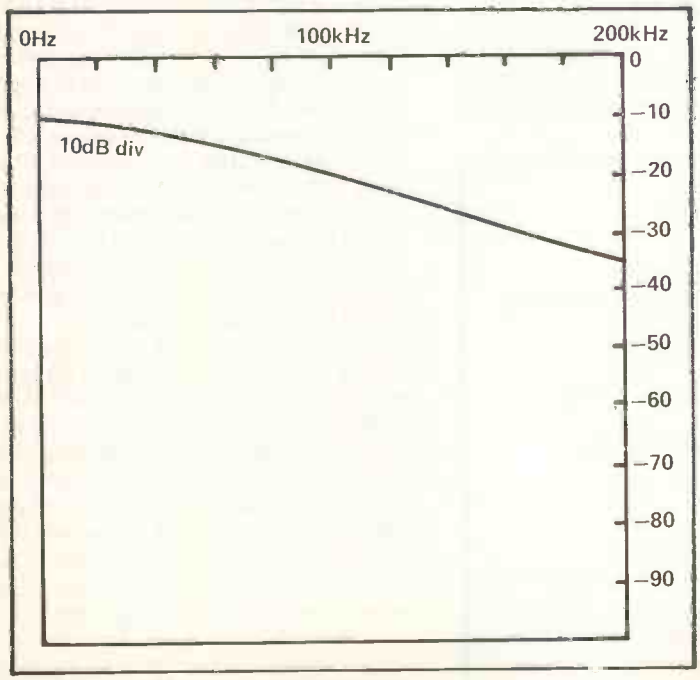
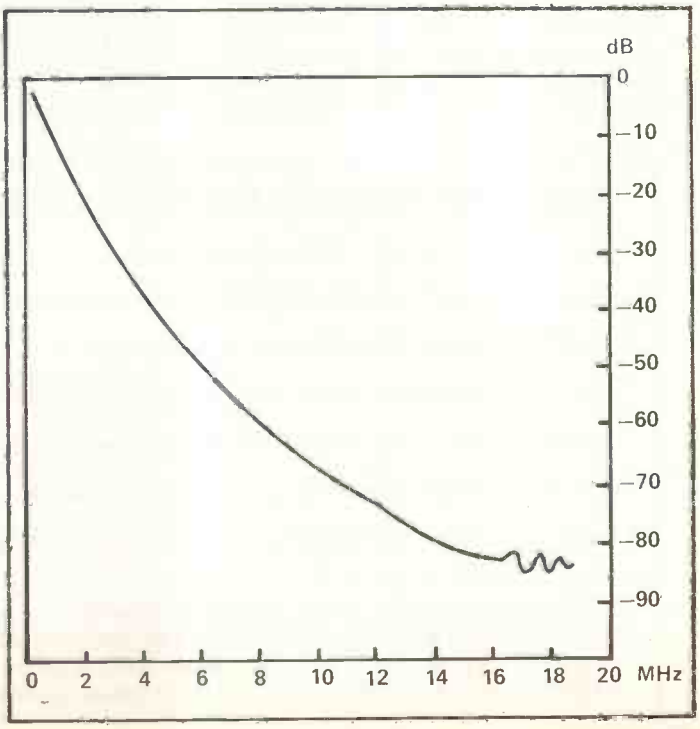


Figure 2. DC – 200kHz attenuation of a typical mains filter network.

Figure 3. DC – 20MHz attenuation.



An alternative water resistant/'yank' resistant mains connector range – Bulgin's 'Buccaneer' range.

mains earth. if the connection is made via another piece of gear. The sport of tracing the 'hum loop' is one which few of you will not have participated in. ALWAYS mark sockets and plugs with an earth pin present, but without the mains earth connected accordingly. It will save you trouble, time and possibly your neck should you subsequently change the equipment array and lose the earth.

Building and testing

Assembling and testing the distribution block may not seem like the most complicated construction project you've ever undertaken, but don't allow a blase approach to cause you to forget the basics. Check the continuities with a reliable ohmmeter before plugging in.

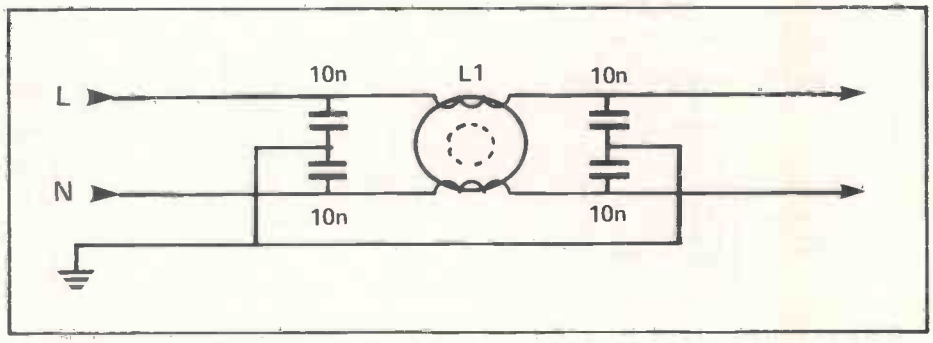


Figure 4. Mains filter network.

Enhancements and add-ons

There is an excellent chance that you will be operating your distribution system on the very distant end of a 13A circuit. So distant that the cable resistances will become significant under load. Fitting a 240V AC meter on the box (possibly the variety with the scale expansion to read 210-250v only) will give you a good idea if the strange hum apparent on the equipment arises simply from the fact that the rectified voltage in the equipment PSU has fallen below the threshold required for operation of the voltage regulation circuitry. It happens frequently, and you might like to watch for it.

The box described here uses the Ambit 10-02024 and 10-02035 plug and socket system, which are part of the internationally approved IEC system. If you want to provide a degree of security that the cables cannot be pulled out under mild strain, then the Bulgin "Bucanneer" range of water resistant screw-down mains connectors will provide both security against accidental disconnection and (provided the rest of your construction does as well . . .) a good degree of environmental isolation if you ever need to operate 'al fresco'.

E&MM

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Sk1-4	Ambit 10-02024 IEC outlet (use plug 10-02033)
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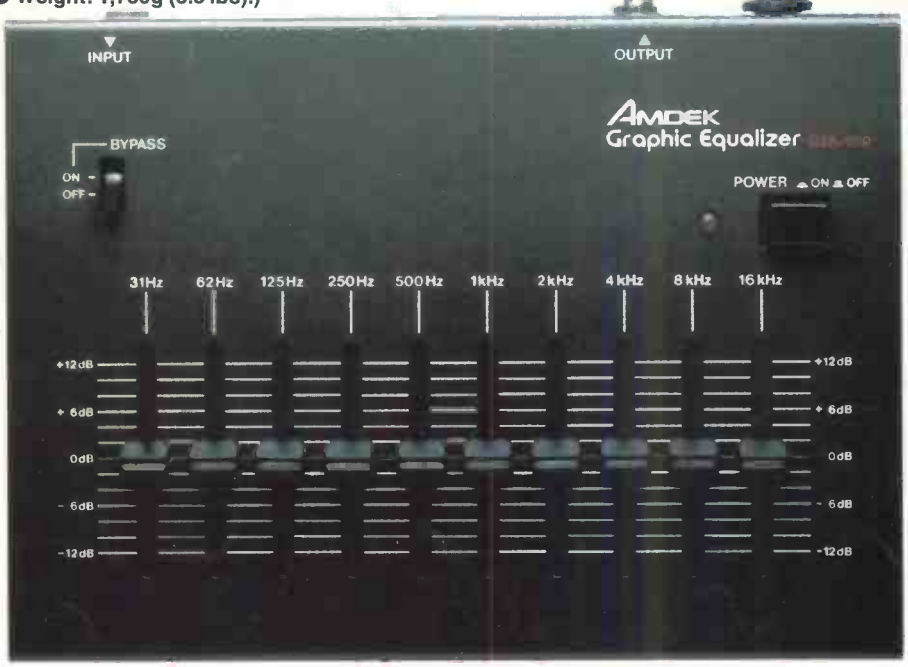

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