Electronics & Music Maker
INCORPORATING COMPUTER MUSICIAN
NOVEMBER 1984 95p

CABARET VOLTAIRE

PETER HAMMILL
AXXESS
UK ELECTRONICA

REVIEWS:
EMULATOR II
YAMAHA D1500
AMSTRAD COMPUTER
CHROMA POLARIS
CASIO CT6000

BIT ONE

JUNO-106

PROGRAMMABLE POLYPHONIC SYNTHESIZER

MIDI

The JUNO-106 is a completely new polyphonic synthesizer that accepts all MIDI information. The Juno-106 features three MIDI jacks on the rear panel — In, Out, and Through — as well as a Function switch used to select the send and receive mode for I KYBD, II KYBD + BENDER + PGM CHANGE, or III ALL. The settings of all front panel controls (LFO, DCO, HPF, VCF, VCA, ENV, and Chorus) can be sent and received using the Exclusive Message in the ALL mode. There are sixteen MIDI channel select buttons on the front panel, enabling you to interface with other MIDI products. Several MIDI devices can then be simultaneously controlled using the MIDI Through jack. All instrumental parts of a composition can also be performed using the data stored in a computer.

ELEMENTAL PARTS

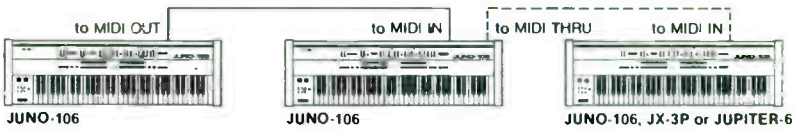
The JUNO-106, 61-key, 6-voice polyphonic synthesizer is easy to operate and packed with exciting functions. The JUNO-106 features a highly stable DCO, the same kind as used in Roland's famous JX-3P and JUNO-60. There are 2 groups (A and B) with 8 banks stored in each group. Each bank stores 8 patches for a total of 128 patch memories. All the LFO, DCO, HPF, VCF, VCA, ENV, and Chorus settings can be memorized. A cassette interface is provided to allow all program data to be stored on a cassette tape.
Since the program data of groups A and B are saved and loaded independently, it can be combined or rearranged as you like.
A memory protect switch is provided to prevent the program data from being accidentally erased.

PROGRAM MEMORY

The DCO's waveforms and ranges are selected by touch pads and the PWM, Sub-Oscillator, Noise and LFO controls are adjusted by sliding controls. The tone color is tailored at will by both VCF and HPF. The VCA has a level slider and ENV/Gate select switch. A Chorus effect is provided to reproduce realistic string or organ sounds. And for the first time in this price class, the JUNO-106 features a portamento function that is effective for both live performances and multitrack recording.

Typical set-ups using MIDI

A. JUNO-106 + other MIDI Keyboards

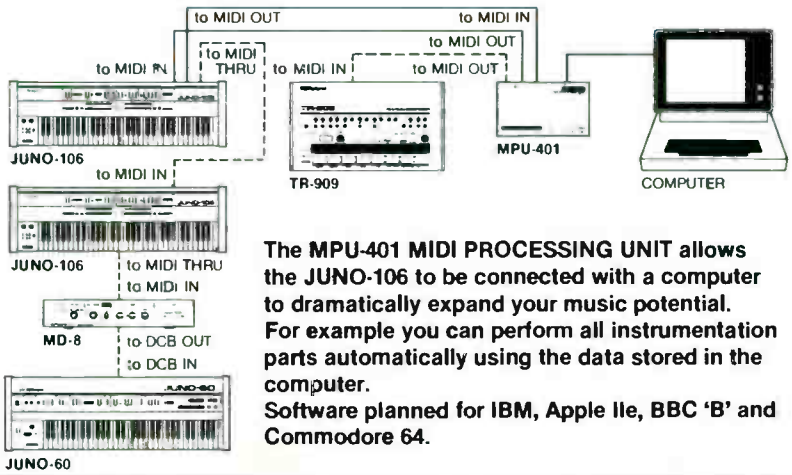


The JUNO-106 can control another MIDI keyboard. By connecting with its MIDI THRU jacks, the JUNO-106 can also control more than one MIDI keyboard simultaneously.

B. JUNO-106 + MSQ-700

When the JUNO-106 is connected with the MSQ-700 MIDI/DCB MULTI-TRACK DIGITAL KEYBOARD RECORDER, the MSQ-700 can memorize the JUNO-106's performance data.
If two JUNO-106 units are assigned different MIDI channels when writing performance data into the MSQ-700, the two JUNO-106 units can simultaneously perform two different instrumental parts.

C. JUNO-106 + MPU-401 + Computer



The MPU-401 MIDI PROCESSING UNIT allows the JUNO-106 to be connected with a computer to dramatically expand your music potential.
For example you can perform all instrumentation parts automatically using the data stored in the computer.
Software planned for IBM, Apple IIe, BBC 'B' and Commodore 64.

Roland

Roland (UK) Ltd Great West Trading Estate, 983 Great West Road
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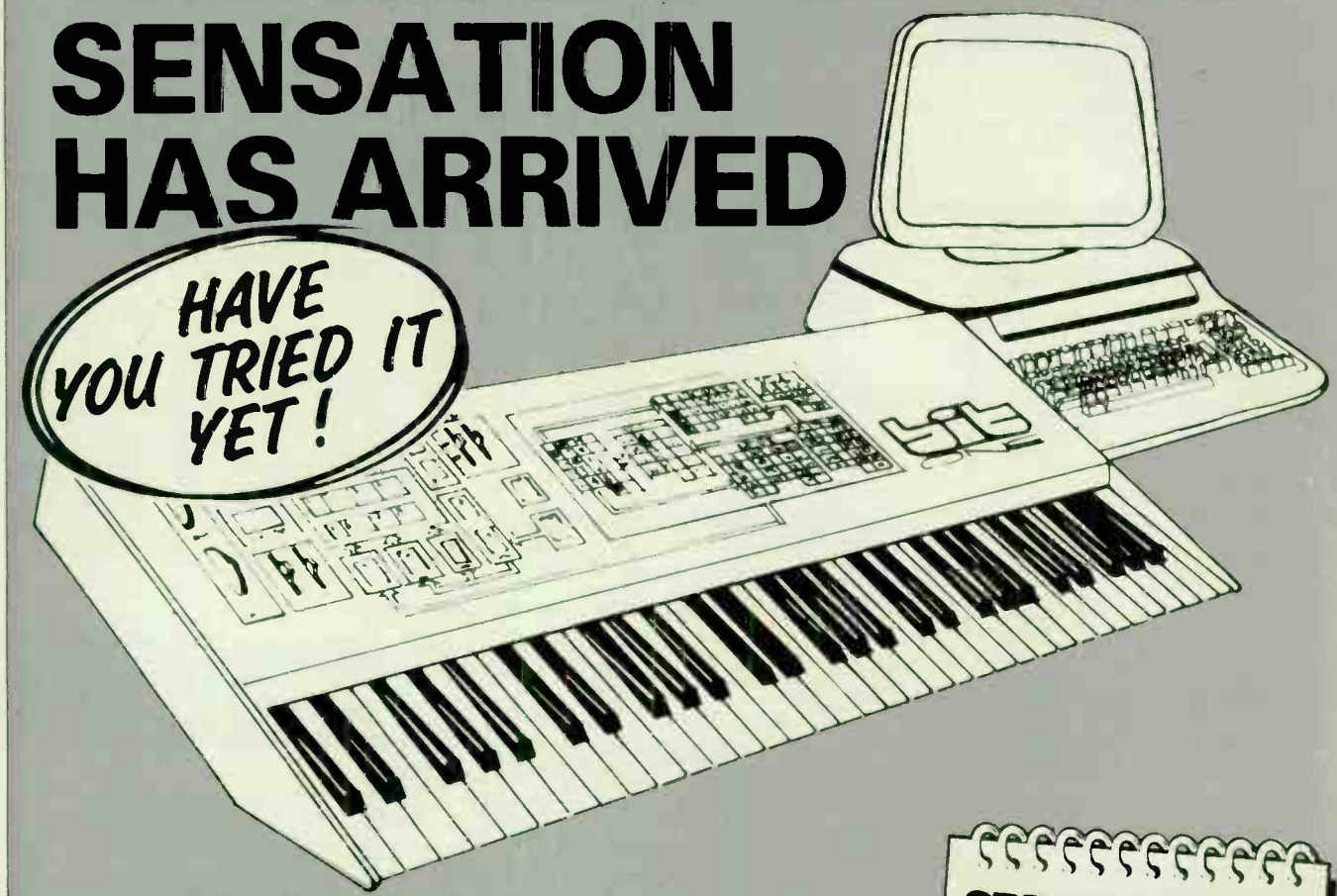
THE CHASE "BIT ONE" SENSATION HAS ARRIVED



The new "BIT ONE" heralds the dawn for a new age in synthesizers. It is what every true musician has been waiting for – the ability to control musical expressivity from the keyboard alone.

Sounds Great

The keyboard is completely touch sensitive giving you total control through the velocity of the keys over the attack and envelope of the VCF's, the attack and amount of the VCA's, the pulse width modulation of the DCO's and the modulation rate of the LFO's – all by the way you touch the keys – note by note ..but you'll really have to hear it to appreciate the difference this makes.

Great Sounds

In addition this six voice dual oscillator synthesizer combines the perfect blend of Digital access controls linked to Analogue filters to give a unique blend of the benefits of each technology combined with assignable splitable keyboard, doubling mode, unison feature, stereo output and cassette and midi interfaces.

The Complete System

Designed for simplicity of operation the "BIT ONE" is the first of a new series of modular electronics.

Also coming soon,
the "BIT ONE Expander Unit",
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the "BIT ONE Rhythm Unit"

And The Price

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E&MM November 1984 Volume 4 Number 9

NEWS

HARDWARE

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COMMENT

The Best of British

Patriotism is not something we at E&MM feel particularly strongly about, regarding it more as a necessary evil than something around which whole lives should be based, but recent events in this fair isle of ours have given some cause for a bit of national trumpet-blowing.

Despite (because of?) the efforts of the present Government, Britain's industry is still not essentially competitive when compared to those of several of its European neighbours, let alone America and Japan. Yet in the field of music technology, the country seems to be getting its act well and truly together.

Admittedly, the synthesiser world has seen Britain play a comparatively small part in the development story. Most of the pioneering work was done by the Americans, who then left it to the Japanese to bring the requisite technology down to a price most musicians could afford, while the UK added its twopenny-worth (some would say rather more) in the shape of the EMS synthesisers, the EDP Wasp, and its immediate successor, the OSCar monosynth.

We've also managed – in the shape of Dave Simmons' electronic drums – to come up with an entirely new concept in music hardware that's revolutionised the way rock percussion is performed and recorded, while Bill Aitken and his Synth-Axe team seem to be on the verge of a major British breakthrough. In general, however, Britain has lacked (and continues to lack) the research and production know-how – not to mention the finances – necessary to become a world force in the manufacture of electronic musical instruments.

But if that is the case, what we do seem to be particularly good at is taking hardware from outside sources and developing it further to enhance its capabilities. Sycologic's MX1 extension board for the Yamaha DX7 is a fine example, as are the rapidly-growing numbers of add-on systems for home computers, becoming more ingenious by the day.

Take Greengate's DS3 sampling system reviewed last month. For only £200, it transforms the expensive and frankly ageing Apple IIe home micro into a powerful sampling machine of surprising quality. Truth be told, I was none too impressed by a couple of initial demonstrations of the system, but now Mainframe – the band behind the DS3's development – have released an excellent 12-inch EP that was recorded with the sampler as the only sound source (see *On Record*, elsewhere in this issue). It's a mighty impressive piece of work.

This issue sees a review of another sampling add-on – this time for Sinclair Spectrum – whose current and future software plans look as though they could almost turn it into the (very) poor man's Fairlight. Like the Greengate, Ricol Electronics' Action Replay is cheap, easy-to-use, and quite significantly, as yet unmatched by any other product from Japan, America, or indeed anywhere else in the world.

Talk of home computers leads us inevitably onto the subject of MIDI, to the numerous British software companies that are springing up as if from nowhere, and to Powertran's extraordinary MIDI Controlled Sampler, whose circuits are published in full in this month's E&MM. The non-technically-minded amongst you will probably flinch at the thought of so many editorial pages being devoted to

circuit diagrams, but we feel the MCS1 to be of sufficient technological significance to justify the space. And next month, the machine's innermost workings will be revealed . . .

On reflection, it's perhaps not surprising that Britain as a nation is playing such an important rôle in the development of music technology. On the one hand, our pop music charts were the first to embrace synthesiser music in any quantity, while more recently, our consumer population has taken to the home computer like no other public in the world. And if that sort of enthusiasm for things hi-tech can be maintained, it won't be long before we *are* challenging the likes of Japan, Italy and the US for supremacy in the music hardware stakes.

So to all those budding researchers, designers and software writers out there, keep it up! ■

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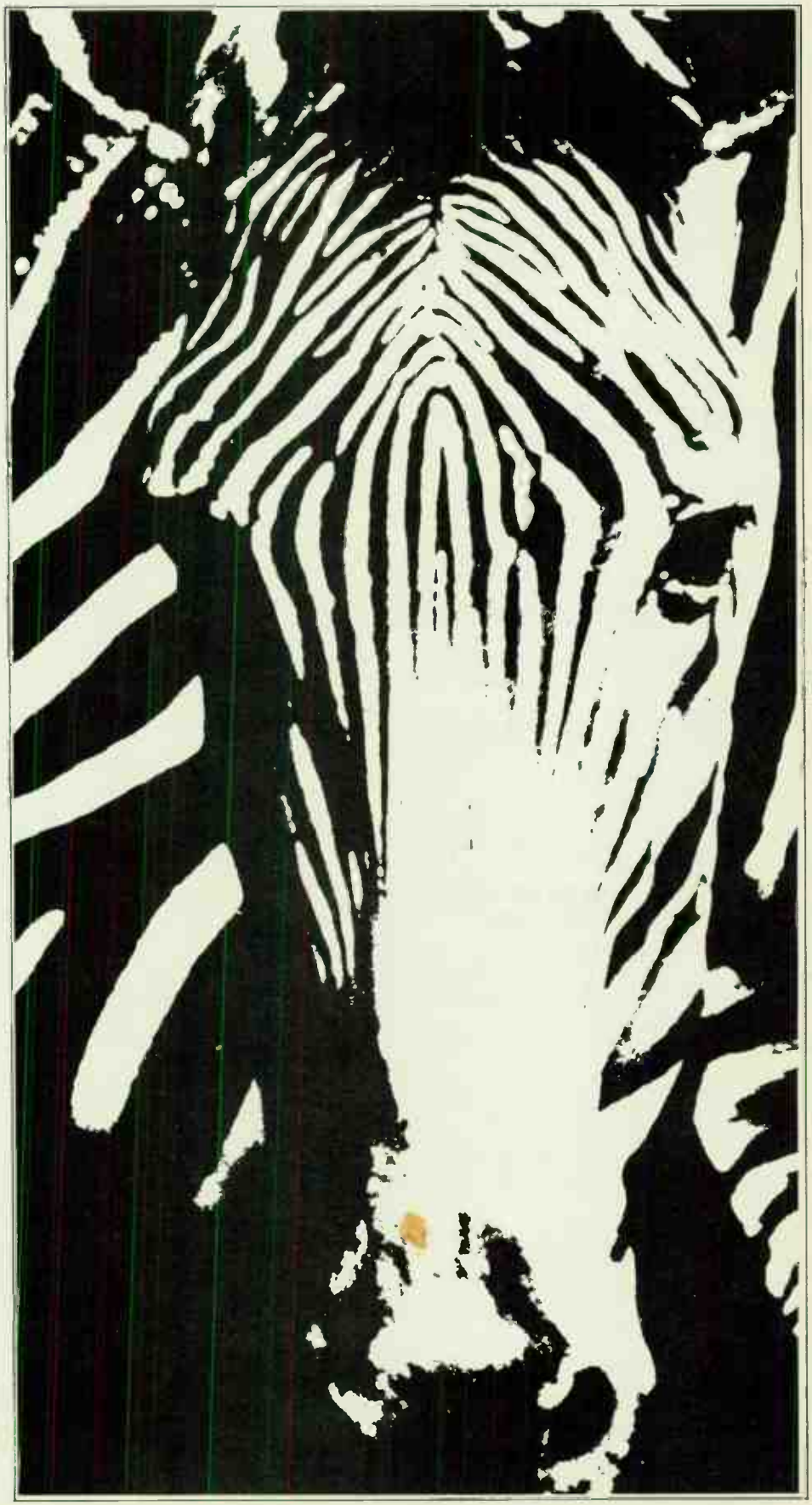
EII, successor to the popular Emulator, brings the power of high quality sampling within the reach of most professional musicians. Featuring a five octave dynamic keyboard with a variety of possible keyboard modes, the inclusion of filters, VCAs, envelope generators and independant LFOs allows you to extensively modify any sampled sound. An eight track sequencer with MIDI and SMPTE interfaces enables complex compositions to be recorded. These features, together with a dramatically increased sampling memory make the EII a powerful creative tool.

Kurzweil 250 features an 88 note piano-type keyboard. Utilising technology from the fields of artificial intelligence and pattern recognition it achieves extraordinary realism of sound with unprecedented expressive capabilities. It's supplied with thirty preset sounds, (expandable to 60), can accommodate up to 40 keyboards set-ups, and features a twelve track sequencer. Ideally suited to live performance and studio work, the Kurzweil 250 is the only viable alternative to an acoustic grand piano.

All of these instruments are available for you to see and hear at our demonstration suite in W2. So next time you're looking for something very special, try the best sampling keyboards.

The Black and White Collection.



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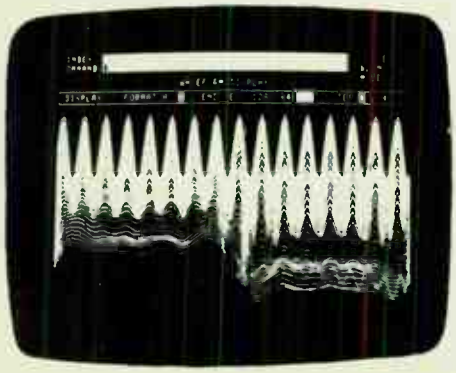

Syco. We are

INTERFACE

Write to: Interface, E&MM, Alexander House, 1 Milton Road, Cambridge, CB4 1UY

If you've a view, query or problem, then write to E&MM at the above address. We will endeavour to answer each query regardless of whether there is sufficient space for its inclusion in the magazine, so please include your full address and phone number.

MIDI Off

Dear E&MM,

I use a Yamaha DX7 and Roland Juno 106 playing live, and though I can get some good sounds when the two synths are linked by MIDI, there are some moments when I need to cancel the function (when I want to play a solo with the DX and sustained chords on the 106, for example). Is there an easier way of de-activating the MIDI connection than pulling one of the DIN plugs out of its socket?

Kevin Thomson
London

At present, neither the Juno nor DX7 incorporate a simple 'MIDI Off' control that enables you to switch the interface out of action at the touch of a button. In fact, the only synths in that price range that do include such a facility are the Siel DK600 and Expander. However, you could try altering the MIDI Channel number assigned to the 106 whenever you want the two synths to be playable separately. That way, the Juno should ignore any data the DX7 (whose MIDI Channel is sadly not assignable) may be trying to send it along the MIDI bus.

Syndrom Samples

Dear E&MM,

Are there any plans to bring out new sounds for the Syndrom, as I would like to get hold of some Simmons drum sounds? Also, is it possible for me to burn the EPROMs with sampled sounds myself, as I have a 48K ZX Spectrum and was wondering if it could be used with an add-on EPROM programmer to program them.

I hope that one of the above suggestions is possible, as I have built a Simmons look alike drum kit, and the Syndroms would make an ideal addition to it.

D Boulden
Kent

This is possible in theory, but you'd need an eight-bit analogue-to-digital converter (ADC) on the input to process the sound prior to recording. You'll then need to write a program, almost certainly in machine code, that would on receipt of a trigger pulse or keystroke load the input code into a large block of memory in real time. If you are capable of doing this, then you should have little trouble in dumping the sound onto EPROM via an EPROM programmer.

We have no circuits or software of this kind as such, but if other readers out there have developed a similar system to run on a popular home computer, why not write it up as a project for the rest of our readers and get paid into the bargain?

First Step

Dear E&MM,

I own a DX7, JX3P with PG200 programmer, and a Roland SH2. Is there any software on the market that can drive my two MIDI synths along with the SH2, and which computer does it work with? Although Spectrums and Commodores are easy to come by here, anything else is very expensive. I'm looking for both step- and real-time sequencing with some editing facilities.

Pete Healey
South Africa

In a nutshell, the SH2 can be incorporated partly into your MIDI system – but it's an expensive proposition. A couple of analogue-to-MIDI converters are available (see E&MM August '84 for reviews of the Digi-Atom 4800 and the Sycologic AMI) but conversion is strictly one-way and there is no provision for playing analogue machines from MIDI devices.

If you plan to concentrate on either the Spectrum or Commodore 64, then you could check out the facilities available from Sequential Circuits' Model 64 Sequencer (reviewed June '84), EMR's MIDItrack package for the Spectrum (due shortly), and Jellinghaus Music Systems' MIDI packages, which are available for both computers mentioned.

Soft Apple

Dear E&MM,

A simple question. I want to know if there is a MIDI interface available for an Apple IIe computer, and if so, whether there is software available on disk.

A van Rooyen
Johannesburg
South Africa

*The Roland MPU401 MIDI Processing Unit should fit your requirements admirably, and was reviewed in E&MM September. As reported in 'MIDI and the Micro' (E&MM June), US company Passport Designs also offer a MIDI interface, MIDI/4 software (also reviewed E&MM September), and Polywriter transcription software (see 'The Gentle Art of Transcription', E&MM June). (Well, that should keep the back issues department busy – **Ed.**)*

New Look 1

Dear E&MM,

OK, so the magazine's editorial content is invaluable, but why the sudden desire to look hi-tech as well as reading that way? I don't know about the rest of your readership, but to me E&MM is still primarily a music magazine – now it looks more like a computer book! By all means strive to improve the appearance of the magazine – the last thing I want is something that looks like the Bible – but all this hi-tech graphic design is getting in the way.

Sam Pembury
Hunslett

New Look 2

Dear E&MM,

Well, what can I say? Your magazine was already the only electronic music publication worth considering seriously, and now it's been given an aesthetic spring-clean to bring it right up to date.

The adverts still leave something to be desired though: some of them have such tiny text that I need a magnifying glass to read them!

Dave Maguire
Sawbridgeworth

Who's Boss?

Dear E&MM,

I have a synchronising problem with a Boss DR110 drum machine and Roland TB303 Bass Line. I've succeeded in triggering the Bass Line from the DR110, but the Bass Line runs too slowly.

The DR110 triggers on every accent, with a maximum of one trigger pulse per 16th of a bar (depending on where the accent is programmed) but the Bass Line requires 24 pulses-per-quarter note.

Could you possibly design a circuit to synchronise the DR110 with the Bass Line?

W Smith
Peterborough

Unfortunately, there is no simple solution for 'multiplying up' in this way (it's generally much easier to 'divide down'). We can only recommend that you try a Garfield Electronics Mini Doc, but since these are by no means cheap, it would probably be more sensible to opt for a different drum machine such as the TR606, which would be less of a problem in this respect.

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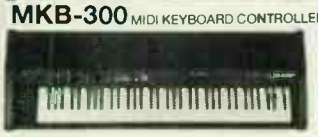

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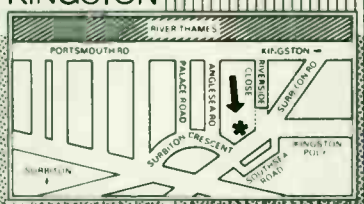

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NEWSDESK

Akai AX80 polysynth.

HARDWARE

Akai are soon to launch their long–awaited music products, the **MG1212** multitracker and **AX80** polysynth.

The MG1212 is a combined 12-track ½" tape recorder with built-in 12-channel mixer, using Akai's 'Lambda' tape loading system and featuring functions such as computerised channel/track routing and memory, and program auto search. In addition to the 12 audio tracks, the MG1212 has two tracks for control and sync.


Akai MG1212 Micro Studio.

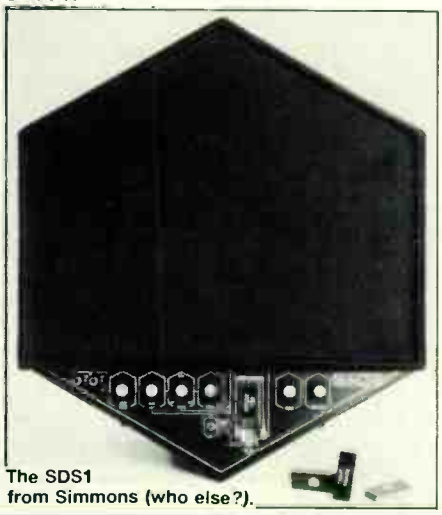
Their 8-voice polyphonic synthesiser, the AX80, incorporates two oscillators and one sub-oscillator per voice, two banks of 32 programmable memories, 32 preset voices (giving a total of 96 sounds), a touch-sensitive keyboard and, of course, MIDI.

For further information, contact *Akai (UK) Ltd, Hazelmere, Heathrow Estate, Silver Jubilee Way, Parkway, Hounslow, Middx.*

Carlsbro's new 150 watt, 5-channel keyboard amplifier, the **Keyboard 150**, is available as either a head or combo (1 × 15" plus two bullet speakers). Channel 5 is a Tape/Aux input designed for backing tapes, and each channel comprises Gain, Bass, and Treble, while Reverb and FX send and return sockets feature on Channels 1–4.

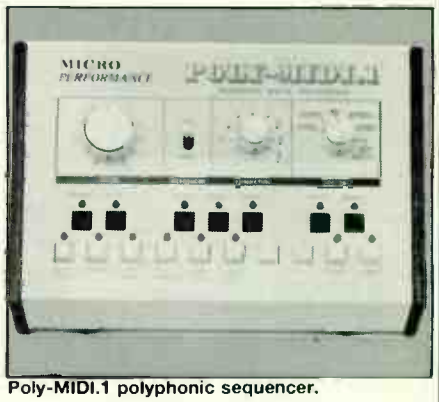
Further information may be obtained from *Carlsbro Sound Equipment Ltd, Cross Drive, Kirkby-in-Ashfield, Notts, NG17 7LD. ☎ (0623) 753902.*

From **Simmons** comes the **SDS1**, a battery-powered digital drum with a library of sounds available in EPROM. The unit itself has pitch, pitch-bend, sensitivity and volume controls as well as a Trigger In facility. Further details from *Simmons Electronics Ltd, Alban Park, Hatfield Road, St Albans, Herts, AL4 0JH. ☎ (0727) 54601.*


The SDS1 from Simmons (who else?).

The **Poly-MIDI.1** is a new MIDI-compatible polyphonic sequencer which should retail at under £500 when it comes to the UK towards the end of the year. Its capabilities include 6500 notes of real-time or step-time sequencing (assignable in a maximum of five sequences, with two chains also possible) and being used as a cassette interface for saving sound libraries from synthesisers without this facility (eg. Yamaha DX7, SCI SixTrak).

Further information from the UK distributor, *Oxford Synthesiser Company, 5 Gladstone Court, Gladstone Road, Headington, Oxford. ☎ (0865) 67065.*



Poly-MIDI.1 polyphonic sequencer.

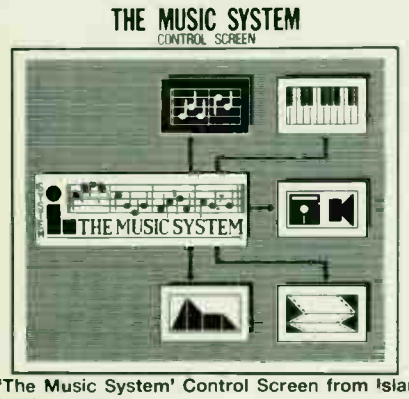
TECHNOLOGY

Cass London are offering several five-day courses in Elementary Recording (£250), Synthesisers – Theory & Practice (£250) and Fairlight CMI (£500) during November, December and January. Further details from *Cass London, Studio 2A, Metropolitan Wharf, Wapping Wall, Wapping, London E1. ☎ 01-480 5149.*

COMPUTER MUSICIAN

'MSX – An Introduction' is the title of a new book published this month by Century Communications. Covering the essentials of computer programming in MSX-BASIC, the book should prove of value to anyone contemplating buying a Yamaha CX5, or indeed any other MSX micro, and is available from leading retail chains priced at £7.95, or £12.95 for the book and software cassette.

Island Logic – a new software company to be launched during October as a division of the hugely successful Island Records label – have announced a complete music package for the BBC B, with further software developments promised.



'The Music System' Control Screen from Island Logic.

'The Music System' – as the package is called – comes in both disk and cassette formats. The disk version comprises five different elements: the Editor, the Keyboard, the Linker, the Printer and the Synthesiser, and retails at £24.95, while two software cassettes (retailing at £12.95 each) are necessary to store the same information, Cassette 1 comprising the Editor and the Printer, and Cassette 2 the Synthesiser and the Keyboard.

For further details contact *Island Logic Ltd, 22 St Peter's Square, London, W6 9NW. ☎ 01-741 1511.*

Towards the end of September, London's **Gateway Studios** were broken into and a number of items stolen, namely a Roland Vocoder Plus VP330 (serial number 951405) with flightcase; a Shure SM10 Headset Microphone; a Roland Juno 106 (SN 437622) with Kohler Carrier; and a Roland SH101 monosynth (grey) with modulation grip. Anyone coming into contact with any of the above equipment should contact Lavender Hill Police Station or *Gateway Studios, 1A Salcott Road, London, SW11 6DQ ☎ 01-350 0340.*

Electronic Music TV Special, South Bank Show, LWT – Sunday, November 4.

London MicroMarket, Wembley Conference Centre, London – November 10/11.

Leisuretronics (reported last month) is now cancelled.

Musicom '84, Hilton International Hotel, Rotterdam, Holland – November 9/10/11/12.

Provisional dates for the **Roland Road Show** to be held throughout November and consisting of two live performances (usually at 3pm and 8pm) are as follows:

Dates	City	Venue
2–3	London	Westminster Theatre
4	Bournemouth	The Pier Theatre
6	Bristol	Bristol Central Hall
7	Birmingham	Digbeth City Hall
8	Liverpool	Neptune Theatre
9	Newcastle	New Tyne Theatre
11	Edinburgh	Royal Lyceum
12	Glasgow	Moir Hall
13	Manchester	Opera Theatre at Royal Northern College of Music
16	Nottingham	East Midlands Conference Centre
17	Norwich	Kenny Theatre
18	Chelmsford	Exhibition at Basildon Towngate Theatre

Final details from Roland, ☎ 01-568 4578.

This year's **Hands On Show** will be held on Saturday November 10 and Sunday 11 from 10am to 6pm at the Clive Hotel, Primrose Hill Road, London (nearest tube Chalk Farm). It'll include seminars on the use of the latest processors, specialist microphone techniques, solving home recording problems and wiring for maximum flexibility, and amongst the speakers due to appear are Dave Ward of Gateway Studios, Bob Wilson of Atlantex and Andy Munro of Turnkey Two.

Exhibitors will include Accessit, Fostex, MXR, Otari, Rebis, Sennheiser, Soundcraft, Tascam, Tannoy and Yamaha, all sporting, no doubt, the latest in budget home recording equipment.

E&MM and sister magazine *Home Studio Recording* will also be there in force to answer queries, sell back issues and T-shirts, consume alcohol . . .

Admission to the exhibits is free, but seminar pre-registration costs £2. For full programme details including an advance registration form, contact *Turnkey, Brent View Road, London NW9 7EL. ☎ 01-202 4366.*

HARDWARE

Chroma Polaris

Programmable Polysynth with Sequencer

Over a year after its announcement, the poor man's Chroma is now in full production. But is the autumn of 1984 the right climate for an '83 design?

Mick Jones

Valerie Lerigo-Jones

According to a certain authoritative encyclopaedia, Polaris is situated an estimated 1086 light years away from Earth. And judging by the time it's taken for CBS-Fender's latest synth project to get off the ground, you can almost believe it.

The review sample – the only one in the country, no less – arrived without the preset sounds, sequences and instruction manual with which all production models will be supplied. If and when the time comes at which you feel like parting with the requisite £1700, your Polaris should come with 132 preset voices and 12 factory sequences courtesy of Chroma endorsee Herbie Hancock. The machine will then require only a mains lead and a pair of headphones in order to provide a complete self-demonstration.

The locations for all those voices are stored in an area called 'Bank Select/ Program Select', located to the extreme right of the Polaris' front panel. There are blue-shaded alphanumeric touch-pads with associated red LEDs (A–J & 1–12) which I found a bit awkward mechanically. However, voice selection needs only a letter and a number while sequences are labelled with a number only, which is some consolation. This zone also doubles as a master control section for a variety of other functions from save and load for cassette (both voice programs and sequences can be saved either singly or together) to organisation of sync and metronome or MIDI channels, plus memory check, diagnostics, location swapping and many more. Next-door, a cluster of 14 touch-pads (and LEDs) nestle around a single slider in an area called 'Assignable Control'. There are various performance parameters which can be called up one at a time and set by the slider before moving on to the next until performance controls are set to your satisfaction for each individual voice. If I reel off all 14 functions here, this article will rapidly degenerate into a shopping list, but suffice to say that it includes pedal controls and volume (input stage, I assume) on the left-hand side, and LFO mod, pitch-bend and vibrato to the right.

> 'There is no after-touch facility such as that provided on the DX7, but with velocity sensing as good as this, I really don't think you'd miss it.'

Specification

The layout of sound-generating controls on this six-voice, two VCOs per voice poly is fairly conventional, but examination of the two oscillators provides at least one interesting feature. At first glance, the option of a triangle wave

appears to have been left out, but in fact the Polaris allows the effect of modulating between rising and falling ramps ('Saws' on the panel) in the same way many synth players are used to adjusting pulse waves. At the mid-point of travel on the pulse-width slider it is usual to find a square wave, and in the same way, you'll find your triangle wave in the middle of travel when the slider is controlling 'saws'. Pulse width modulation can be switched between sweep (LFO) or envelope, and each oscillator can be transposed up or down by any interval over the whole keyboard.

VCO1 has a facility for ring modulation, while VCO2 differs in sporting a 'sync' option which locks the pitch of the two oscillators in unison. The LFO (Sweep) can be sine or square wave, while the low-pass filter has a touch-pad for switching in noise or, alternatively, can itself be set into oscillation, as it can on most of today's synth designs. It's worth mentioning that the envelope for the filter is in five stages, as 'sustain decay' has been added immediately before release, while sustain itself has been omitted from the volume envelope to leave the user with a three-stage ADR section. The ability to switch velocity sensing into either envelope (or both) is very useful indeed. In fact this and the ring mod, which added an exciting edge to some otherwise fairly ordinary sounds, have to rate as my two favourite features on the synth. My *least* favourite feature has to be the complexity involved with actually switching an oscillator off: first you need to select pulse-wave, then set width to maximum or minimum, set PWM at centre, and *then*, well if you've no vibrato in that voice you'll be OK, but if you have, you may need to go to the 'assignable control' section and cancel that as well. The operation is as painful as the description.

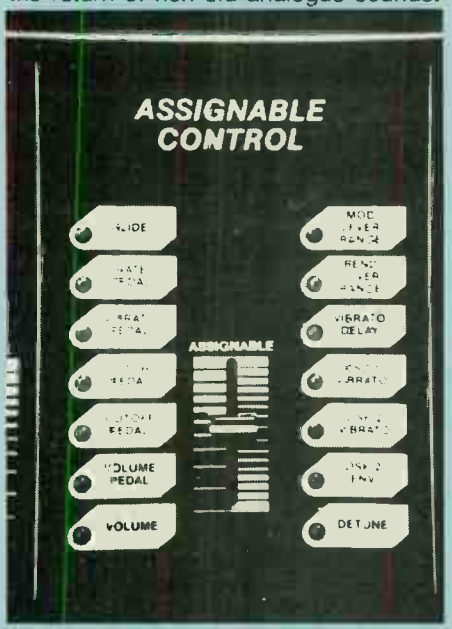
Anyway, to the left of the master volume (and tune) slider is a section marked KYBD, which allows you to split the keyboard at whichever note suits your purpose best or to link two voices together in 'unison'. At this point your six-note polyphony is reduced to three, but the good news is that key assignment is so versatile and effective that the public at large will probably never know: I can't see this being used as an advertising gimmick on a machine in this projected price range, but check it out for yourself – some of the possible 'linked' voices are truly excellent.

The remaining panel feature is the sequencer, which is a simple real-time unit with Stop, Record and Play touch-pads together with an option to move forward or back one beat at a time, though there are no editing facilities in the sense of provision for correcting playing mistakes.

If any of you can remember far enough back to conjure up an image of the Chroma Polaris as it was being advertised a year or more ago, you might not find exactly what you expect when production samples finally appear in the shops. The cheerful ARP orange of the prototype has been replaced by subdued shades of blue, but then again, beauty is only a coat of paint or two deep: in the eye of this beholder, the long spell under wraps seems to have chrysalised – rather than crystalised – Polaris' cosmetic appearance.

Sounds

There *are* some rather good points about the new Polaris, however, the first and most important of which has to be the return of rich old analogue sounds.



You should find it fairly straightforward to compile strings, brass, and the usual harpsichord and clav variations, and the ultimate sonic range is broad, encompassing hard drum sounds, and 'woody' marimbas, not to mention extensive possibilities in the silly noise department. The voices stored in memory when I switched the test sample on were a somewhat motley selection, doubtless the result of twiddling by un-deserving reviewers (like myself), though at least one previous experimenter really knew what he was doing: even on first brief scrutiny, there was more than enough available to whet the appetite for the factory presets, when they eventually appear.

> 'The cheerful ARP orange of the prototype has been replaced by subdued shades of blue, but then again, beauty is only a coat of paint or two deep.'

Polaris employs a somewhat curious system of sharing memory between voices and sequences. Thus, with all preset locations occupied you have 700 notes to spread over your 12 sequences, but with all presets erased to the default setting, you get a total of 1500 notes, almost enough to make the unit worth consideration as a master sequencer, in the studio at least, if not on stage. As mentioned earlier, there are no editing functions for correcting mistakes, but at least you're able to chain and loop. Don't forget that if your sequence is the type that uses only two or three notes at a time, then the notes remaining will be at your disposal to play along with 'live' on the keyboard with the voice of your own choosing, though there are no facilities for overdubbing.

There is no after-touch facility such as that provided on the DX7, but with velocity sensing as good as this, I really don't think you'd miss it. Being able to route the sensing *via* filter envelope, volume envelope or indeed both gives a degree of control which made me rather reluctant to switch the machine off at all.

The Transpose feature is also all it could be, since you can move both oscillators over the whole keyboard independently of each other. This provides more octaves in total range than I could comfortably compute, as well as any key-change or interval spacing your heart may desire. A further point worth mentioning is the 'assignable control' section, as changes in performance parameters affect all voices. It's only rarely that two different voices require identical depth and speed of vibrato, and these elements may well require constant attention and updating during live performance. The Polaris allows you to program depth and level for a wide range of pedals such as glide and sustain, as well as the usual pitch-bend, LFO modulation, and vibrato. One parameter in this section that takes us off at a slight tangent is the 'detune' facility, which replaces the more commonly-fitted onboard chorus. It's the old horses for courses syndrome really, I suppose, but I don't see this as a drastic omission since most players with £1700 to spend will already have decided on (and acquired) a favourite chorus device. On the other hand, the lack of a stereo output was a little bit disappointing.

Interfacing

As far as I know, no other analogue polysynth comes equipped with quite such a wide range of interface facilities. There's CBS' own Chroma and MIDI In, Out and Thru as well as Sync In and Out sockets for use with a drum machine or tape, and finally a five-pin DIN to make life easy saving to and loading from cassette. For once, a keyboard interface section that makes a serious attempt to be friendly with the rest of the world. CBS are not the most enthusiastic advocates of the MIDI concept, so all credit to them for at least conceding the point. The sync facility is alleged to be adjustable for a wide range of clock rates to allow compatibility with just about anything on the market, and although I couldn't persuade my Drumatix to tap along, I don't think you'll have too many problems once you have the benefit of a user manual. The ▷

machine that arrived on my doorstep had no mains lead, never mind a manual!

The debit side of this (p)review has to be handled with kid gloves, as the pre-production model I was lucky enough to get my hands on did have one or two little idiosyncracies that I'm *sure* won't appear on the production models when they hit the shops. I can't imagine that the follow-up to the Chroma could be released on the market receiving MIDI an octave higher than normal, and with an abrupt cutoff on release of any length, instead of the usual natural fade. The problem facing the unfortunate (p)reviewer is to decide, or guess, which shortcomings will have been eliminated for distribution and which are straightforward weaknesses in the system itself.

One small niggle from my own point of view was that with such excellent scope for interfacing already present on the Polaris, the job has been left unfinished with the omission of old-fashioned CV and Gate connectors. A certain well-known Chroma demonstrator made the valid point that a line has to be drawn somewhere, and that with so many digital-to-analogue converters available, the problem could be easily overcome. It must also be pointed out that CBS are far from being alone in conveniently forgetting this humble device, but I still wonder whether Polaris' designers have missed an opportunity to tie up digital and analogue equipment for the extra cost to purchasers of only a few leads, thus further endearing the unit to keyboardists who possess much-loved but now almost unusable monosynths brooding in the bottom drawer, awaiting just such a new lease of life.

I detected a little unevenness on the slider for the 'Assignable' section, particularly when setting pitch-bend depths: another case for quality control that I would hope to see cured in time. Something that caused me greater concern was a similar but more tangible problem with the performance levers. The usual pitch-bend and LFO modulation are provided on sprung levers that return snappily to centre when you let go, the depth and/or speed of effect being programmed from the 'Assign' section. So far so good, but I was disappointed to discover that only a very small percentage of travel was actually effective on either function so that, in a sense, the controls' action has more in common with that of a switch than a lever. Then there's the problem of distinct interval changes occurring whenever you attempt to move over an interval much wider than a tone: I found it impossible to get a slow, smooth manual glide. It's true that, like touch-sensitivity, performance wheels, joysticks and the like can never be all things to all players but my personal assessment is that from a player's point of view, these are by far the weakest link in the Polaris chain.

Functions

The synth comes equipped with an enormous range of dual function buttons offering all sorts of routing possibilities, but in amongst all this ergonomic cleverness, I can't help thinking the designers have fallen into their own trap. The vast array of available options is undoubtedly useful to have, but the layout of upper and lower functions on the 'Bank Program select' offers no help to the uninitiated whatsoever (though voices and sequences are simplicity itself to locate and store). I fear that a good deal more flipping through the user manual than most of us are used to may be necessary before all the functions become anything approaching second nature to use. I pined for an LCD *à la* Yamaha DX7, or even a diagram like the one on the JX3P, just for a hint or two. I can tell you that 'Memory Store' converts the 'Assignable' section into a crude bar graph that gives a rough idea of how much memory has been used to date, but I *can't* detail how to go about setting Sync In and Out to a specific rate or condition, or indeed 101 other things.

The Polaris behaved beautifully as obedient MIDI slave, but nothing software buff Jethro Hill or I could do would induce it to take on the rôle of master. Hill loaded a program into a Commodore 64 that detects any hint of output from the relevant MIDI socket (as well as muttering something malevolent about oscilloscopes that I couldn't quite make out), but drew a complete blank. He gave me a quick and convincing demonstration of the bug-free condition of his program, and after much discussion we came to the firm and unavoidable conclusion that a manual would have helped . . .

Conclusions

Trying to assess a programmable polysynth without any of its factory presets – especially when there are going to be 132 of them – is a bit like trying to road test a Ferrari Daytona without road wheels. You can map out a few personal comments on aesthetics or available facilities, look at the finish of the paintwork, and maybe even rev the engine up a bit, but at best, a fair proportion of your judgement is likely to be speculative.

What can't be disputed is that at its current asking price, the Polaris is facing some pretty stiff competition from a number of rival keyboards that cost an important bit less. And as it stands at the time of writing, it's riddled with unfortunate details – like unfriendly levers and push-buttons and a grossly over-complicated control section – that undermine what is a potentially excellent concept. Mind you, the 16-bit Intel microprocessor that lurks beneath Polaris' neat exterior is something of an intellectual giant, so if some user-friendly software for popular (in Britain!) home computers were to become available, all my reservations about the control panel's awkwardness would be firmly brushed to one side.

Personally, I really enjoyed having a Polaris in the house for a few days, despite the numerous operational headaches it caused me. Its basic sound is good enough for it to succeed as a performance instrument, and I only hope its manufacturers don't sacrifice quality control in a misguided endeavour to push it into dealers' showrooms as soon as possible. The Polaris is probably the make-or-break instrument for CBS' keyboard division, so they've got to get it absolutely right. Because £1700 is a lot of money to pay for a polysynth that isn't. ■

Further information from: CBS-Fender, Fender House, Jeffreys Road, Enfield, Middx, EN3 7HE. ☎ 01-805 8555.

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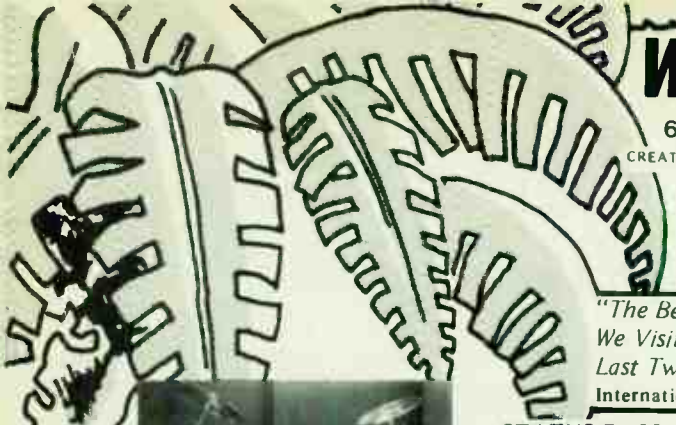

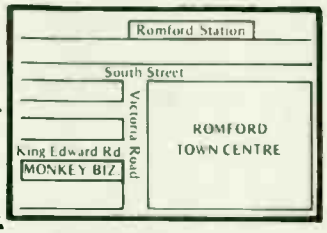

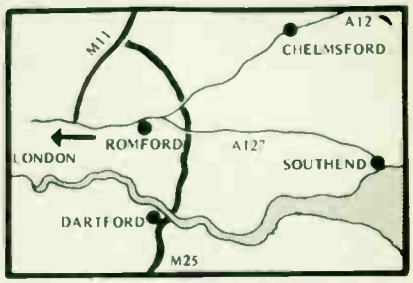

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Emulator II

Eight-voice Polyphonic Sampling Keyboard

Much improved in fidelity and facilities, the first of the new Emulators has now arrived in the UK. With 17 seconds of sample storage and enormous treatment and assignment flexibility, it gives the keyboard player almost complete control over samples. *Paul Wiffen*

Right from the word go, this is obviously a product from the E-mu Systems stable. It sports the now familiar blue colour scheme and the simple, understated lines that have typified the company's previous instruments, but at the same time, technological advances have meant goodbye to the sparsely-arranged and crudely-constructed controls of the original Emulator. EII has a five-octave keyboard instead of a four-octave one, and programming is now achieved by use of a slider parameter control and a numeric keypad complete with back-lit LCD to keep the user informed of operation status.

On powering up, the EII's operating software is loaded from disk, as there is no battery-backed memory for either system control or sound programs. In fact, the instrument uses two different types of disk – Library disks, which contain some basic samples as well as the operating software, and Performance disks, which group modified samples together with their keyboard and wheel assignments. As their name suggests, the Performance disks ready the instrument for playing in exactly the same way as presets and memories do in a normal programmable synthesiser.

Other musicians might not agree, but it's my view that the provision of this facility on the EII is as great an advance for the performance of sample-based music as the introduction of programmable voice memories was for the analogue synth. However, it's precisely this comparison between sampling systems and conventional sound synthesis that shows up the weaknesses in the former, particularly when it comes to live performance. In addition to the precariousness of disk-based operating software (as opposed to that held onboard in ROM), the most obvious disadvantage of disk storage is load time. It takes around 25 seconds for a Performance or Library disk to load, and that's going to be more than a little inconvenient for the average keyboard player on the road, having to persuade the singer to tell jokes between songs or suffer the torture of half-a-minute's worth of improvised drum solo, just to get a new instrument set-up for each new song. . .

Mind you, it's not without reason that EII – and instruments like it – make use of disk storage. To begin with, samples are an extremely memory-intensive way of generating sound, and since solid state RAM is not exactly cheap, employing magnetic disks on which the user can build up a library of sounds and assignments is much more cost-effective than putting all the requisite memory onboard. As it happens, the EII *does* contain rather a lot in the way of RAM in its own right, but this is fully occupied with the task of storing samples for readiness during performance. When you consider that these samples can be of up to 17 seconds in length, you begin to realise just how much of a necessity those disk systems really are.

> 'Looping – always a headache on the original Emulator – can now be achieved quickly and easily, and with not a trace of glitching or unevenness.'

Sample Theory

For those unfamiliar with the principles of sound sampling, here's a brief resumé.

Essentially, the quality of a sample depends on three factors – sample rate, (how often the original sound is analysed by the sampler), sample resolution (how precisely the sound is analysed) and the way in which the sampling data is stored and retrieved. Sampling rates are measured in kHz, and the audio bandwidth (ie. the range of frequencies that can be reproduced faithfully) is directly related to this measurement. A sample rate of 10kHz would probably result in a 3–4kHz of sound spectrum (nothing special), whilst a rate of 60kHz gives an audio bandwidth of 20kHz, or about as much as the human ear can cope with.

Moving on to resolution, the EII – like most other sampling systems currently available – relies on an eight-bit system. This compares with the Synclavier (16-bit, but at present only monophonic) and the Fairlight and PPG (eight-bit, but with 12- and 16-bit systems under development). But if its paper sampling spec is nothing out of the ordinary, where EII really scores is in the way the sampled data is treated within the machine. Whilst the sampling rate is only 30kHz (giving a bandwidth of about 12kHz) and its resolution still only eight-bit, some rather clever companding means that the EII can use software techniques to compress the stored information for retention in memory and then expands it again just before it is converted back into sound.

Listening to the EII for the first time, you'd be hard pushed to guess that the machine had such run-of-the-mill sampling specs: the sound is that good. Quite simply, EII is audibly superior to any other eight-bit sampling system this reviewer has heard. And if all this can be achieved using the current system, why bother going up to 12- or 16-bit?

Sample Manipulation

As already mentioned, the EII has enough working RAM to hold over 17 seconds' worth of sample(s) at any one time. But that's only the start of what the second-generation Emulator has to offer.

Think back, if you will, to the original model, which even in its top-of-the-line eight-voice polyphonic form – only provided the user with the bare minimum in the way of sound manipulation options once a sound had been sampled. That operational rigidity has now given way to an altogether more elaborate – and more useful – system of sound control. those 17 seconds, for example, can be allocated to as many different samples as you wish, so you could have twenty 0.85-second samples, ten 1.7-second ones, or just one 17-second monster, stored onboard in the new Emulator's RAM. And whereas the original instrument only provided for some very basic sample truncation, EII lets you pick elements of a sample out for later use, discarding the rest in the interests of saving memory space, *and* you can do this at what amounts to a byte-by-byte level. Meanwhile, looping – always a headache on the original Emulator – can now be achieved quickly and easily, and with not a trace of glitching or unevenness.

We still haven't finished: once your sound has been sampled, trimmed, and looped to your satisfaction, the real fun can begin. In a fascinating blend of old and new technologies, E-mu Systems have given their new baby a complete analogue sound shaping section (yes, that's right, filters, LFOs, envelope controllers) which opens up entirely new programming avenues. And this increase in control has been extended to the performance section by the implementation of dynamic keyboard control, itself fully user-adjustable.

Now, these glorious new functions are accessed on two levels. First, you select the general section in which you wish to work (eg. Filter, Real Time Control, Preset Definition, Disk Functions, and so on) by calling it up from disk. One disk must be kept in the machine at all times during this procedure, since the information contained therein is essential for changes in parameter section to be carried out. There's a delay of a second or two before each section is loaded, but this is never sufficiently long to constitute an irritation.

The second stage of programming takes place once the section due for attention has been called up. Each section contains a list of adjustable parameters, and dialling up a number on the EII's keypad (unlike so many other parameter-select instruments, EII lists all the relevant numbers on the front panel) puts up to four different parameters under the control of four sliders, A, B, C and D, whose function and current value are indicated on the built-in LCD. This is a useful variation (*similar to that provided by the Oberheim Xpander – Ed*) on the digital parameter selection theme, since it allows closely-related parameters to be quickly modified in conjunction with each other, as opposed to one at a time.

Sample Practice

Let's begin our whistle-stop tour of EII's range of parameters with the sampling section itself.

I should say from the outset that the Emulator in its latest incarnation takes the hard work out of sampling like no other device I know of. The machine's LCD can function as an accurate peak programme meter which holds the most recent level peak, and this is invaluable in obtaining a sample that suffers neither from distortion caused by too high a signal level or from a poor signal-to-noise ratio due to undersampling. During the review period, several samples that the machine pronounced unsatisfactory (*via* a number of LCD messages) sounded perfectly respectable to me, which says something either for the state of my hearing (*Too many Asia records – Ed*) or for the standards E-mu Systems expect EII users to apply to their sampling.

Selecting '2' on the keypad takes you into a function known as Define Voice, which readies the keyboard to accept information relating to which note will play the pitch of the original sample and the upper and lower limits of the range over which the sample is to be operated. This means that several registers of the same instrument can be sampled and spread up the keyboard accordingly, thereby alleviating the all-too-obvious sonic problems suffered by lesser systems when a sample is played more than an octave or more away from its original pitch.

Further functions within the sampling section allow the user to centre the variable input gain around 0, 20, or 40dB, set the threshold at which the sample is triggered (again, using the LCD in its PPM mode), and to select the length of sample to be stored in 0.2-second intervals.

Once the basic sample has been made, the EII's Voice Definition section is brought into play, and this allows the user to tailor the sampled sound and decide how it should be controlled dynamically. Dialling up '11' on the keypad sets up all four sliders for the purpose of sample truncation: Sliders A and B act as coarse and fine controls respectively, and with the LCD showing the current byte number, enable the truncation's start-point to be selected. Sliders C and D (again, coarse and fine) perform the same function for the truncation's finish point. Pressing 'Enter' then stores the sample in its new, truncated form, the rest being erased automatically.

> 'Voices can be assigned to separate, overlapping, or identical keyboard ranges, giving a split/ layer capability unequalled by any other electronic keyboard currently available.'

Both display and sliders take on similar roles in the looping process ('12' on the keypad), but to assist in what by anybody's standards is a fairly tricky operation, E-mu have included an AutoLoop function which fine-tunes the user's idea of the best loop point. And don't worry – the function is easily overriden if you decide you don't like what the machine wants to do to your sample.

In addition to 'AutoLoop', there's also 'AutoSplice' which, as its name suggests, assists in effecting smooth fading out of one sample and the fading in of another. In other words, something similar to what can be achieved with reels of tape and a razor blade, only rather more flexible and a good deal easier to use. Mind you, it can be a bit disconcerting, hearing a sampled string ensemble being gradually transmogrified into a herd of angry wildebeest. . . .

Codes '21' to '25' on the keypad activate a variety of functions connected with keyboard performance, such as how levels and filters react to harder and softer keystrokes, the attenuation and tuning of each voice, and the implementation of single triggering, a useful feature for the keen keyboard soloist and a further indication that EII is intended to be a performance instrument as well as a sound sampler.

Codes '27' and '28', on the other hand, make rather more dramatic sonic alterations. The former is used to play a sample backwards – loops and all – while the latter enables a voice to be combined digitally with another. This results in some totally unpredictable – but nonetheless quite fascinating – effects, simply by adding two sounds together byte-by-byte. And remember, the resultant sample can be processed just like any other sample on the EII.

Lastly in this section. real-time controls such as wheels, pedals and so on are enabled using code '29', while dialling up '30' on the keypad stores your freshly-modified sample to disk for permanent storage.

Sample Filtering

EII's filter is given a separate programming section of its own, and one of the first things that strikes you on approaching this area of the instrument's performance is just how wonderful it is to be able to apply something as instantaneous and as effective as a low-pass filter to a digital sound. Oh for a similar facility on the DX7!

Specific numeric codes are used to call up such parameters as filter frequency, LFO amount, keyboard tracking (especially noteworthy since it can be adjusted so that the sound gets brighter as you play up the keyboard), and ADSR: again, all these parameters are controlled by means of the four sliders A to D.

The VCA is also dedicated a section of its own, with ADSR variable in the same way as the filter envelope and an exceptionally versatile LFO, for which Slider A controls rate, B the delay before the effect is introduced (useful for delayed vibrato effects, for instance), and Slider C introduces an innovation I'd very much like to see more of on analogue synths, namely the facility to vary LFO rates for each key played.

Sample Definition

In most respects, E-mu Systems have avoided introducing unnecessary new jargon in order to make their product look more innovative than it really is. Thus, a Filter Envelope is called just that, not a Harmonic Content Envelope (thank you, NED). However, EII does have one term – 'Preset' – which is used in a way most keyboard players and programmers will be unaccustomed to, since in this case it refers to a total keyboard set-up as stored on a Performance disk. with modified samples being assigned to different parts of the keyboard.

Along with various Get, Copy, Erase and Catalogue commands that assist in the compiling of a full Preset, the Preset itself can actually be defined. Dialling up '21' on the keypad enables you to give your Preset a suitable name, and once you've done that, '22' puts the machine in Assignment mode. Any voice – complete with attendant modifications – can now be allocated to any part of the keyboard over two octaves, while voices can also be assigned to separate, overlapping or identical keyboard ranges, giving a split/ layer capability unequalled by any other electronic keyboard currently available. You probably don't need me to tell you that the performance possibilities opened up by all this are simply staggering.

Two velocity control options are provided by codes '25' and '26', and these are referred to as Velocity Switch and Velocity Crossfade respectively. The former enables a hard keystroke to trigger an entirely different sound to a soft one, while the latter relates the speed of the keystroke to the balance between two sounds. A further feature – known as Posi-

tional Crossfade – uses the position of the key played within a definable keyboard range to balance the two voices. This is in many respects similar to the Keyboard Level Scaling feature on the DX7, since it allows one sound only to be heard at the bottom of the keyboard, two sounds in varying level proportions in the middle and finally only the second sound at the upper end. This is ideal for authentic transfer between samples of different original pitches as well as for creating more off-the-wall effects. It's also possible, incidentally, to disable keyboard pitch information for a particular sample so that pitch is constant throughout the keyboard's length: especially appropriate for rapid triggering of percussive samples, for instance.

Neither of the EII's pair of performance wheels – one is centre-sprung, the other free to suit all applications – is permanently assigned to any one function, but these are routed separately for each patch, as are the machine's pedal and footswitch sockets. Routings are programmed by entering two numbers on the keypad, the first representing the source, the second the destination of the modulation.

Lastly, a 'Special' section is provided to perform tasks generated in additional software, to be included as and when it becomes available. So far these include Channel Disable, Filter Trim, disk copying and service routines, with more in the E-mu Systems pipeline.

In fact, a major section of the EII – namely the machine's built-in sequencer – wasn't present on the review model, since the software to operate it is not yet available. Similarly, although the necessary connections for MIDI and SMPTE compatibility are already fitted, their operation is software-based and is still to be completed, though I'm reliably informed that the first batch of EIIs to be sold in this country will feature full MIDI compatibility. What's more, all additional disks will be supplied to existing EII owners free of charge, which is good to know.

In addition to the MIDI and SMPTE connections mentioned above, EII contains eight separate channel outputs, a mix output, and the sample input (whatever you do, don't forget to use a decent mic when you're sampling, otherwise no amount of modification will get you the results you're after).

> 'Quite simply, EII is audibly superior to any other eight-bit sampling system this reviewer has heard.'

Sample Keyboard

After the glowing terms in which I've described the new Emulator's sound quality, programmability, and flexibility, you might be forgiven for thinking that the instrument approaches perfection itself. However, in addition to the long loading times mentioned at the start, there is a major grouse – the quality of EII's keyboard. Now, although I wasn't expecting a T8 or MKB1000 keyboard (both of which, incidentally, you should be able to play the EII from, assigning pressure parameters to one of the MIDI controls), I think E-mu could have come up with something a bit better given the £7500 asking price. Clearly, the company have put a lot more emphasis (and therefore more money) on developing the new instrument's software flexibility rather than making its keyboard more playable, as it's actually only a slight improvement over that on the original Emulator: nasty, over-sprung and incapable of adding anything to your playing technique.

Conclusions

There can be no doubt that the EII represents an enormous breakthrough in putting the full creative potential of sound sampling techniques at the fingers of the performing musician. Despite the long load times and the disappointing keyboard, its unimpeachable sound quality, sample manipulation options, dynamic keyboard and assignable performance controls point to a rosy future spent not only in the dark depths of the country's most prestigious recording studios but also in the heady glare of stage lights.

The disks supplied with the review sample (no pun intended) sounded superb, and only a few hours' fiddling with EII's extensive control facilities has convinced me that the possibilities are not only endless but also eminently accessible and usable. Here – at last – is a software-derived instrument designed just as much for the performer and experimenter as for the recording engineer and computer buff. I want one. ■

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HARDWARE

Chase Bit One

Programmable Polysynth

The Bit One might come from an unexpected manufacturing stable, but its specification and competitive price make it difficult to ignore.

Paul White

Although the Bit One is a new name in polysynths, it's been created by a European design team with many years of experience in the field of electronic musical instruments.

Although a budget-priced machine, the Bit One is a fully-equipped six-voice (two DCOs per voice) polysynth with a velocity-sensing keyboard, programmable keyboard split 63 patch memories, and, of course, MIDI.

In common with many contemporary programmable synths, editing of sounds is accomplished not *via* a sea of knobs and switches but rather by entering numeric characters from a keypad corresponding to the value of the parameter being edited.

Construction

Measuring 34½" × 16" × 3¼", the Bit One enjoys the protection of a steel and aluminium case – always more reassuring than the Fablon-covered chipboard favoured by some other manufacturers I could mention. Internal construction is also to a high standard, everything being well secured and easily accessible. As the photograph shows (always assuming Stu's remembered to take the lens cap off), the circuit layout is very orderly and separate functions are located on their own PCBs, which should make for easy servicing. The main microprocessor resides on the right-hand side under the lid and the sound generation board can be seen in the base of the unit behind the keyboard. In fact, the manufacturers claim that this design incorporates two microcomputers so that the voice memories, keyboard scanning and DCO control can run efficiently.

In terms of control panel layout, the Bit One is both smartly arranged and ergonomically sound, which is a good thing, and no fewer than eight seven-segment LED displays show the patches in use and the parameter address and value when the machine is in edit mode.

> 'The Bit One proved capable of competing with the fullest-sounding Stateside synths as well as the brighter, cleaner, Japanese models.'

To the left of the front panel are the bend and modulation wheels, the former being sprung, but these are located one above the other at the end of the panel and above the keyboard, which could make them tricky to use.

Patches can be designated to operate on the upper or lower keyboard sections, and two sliders are incorporated so that these levels may be adjusted independently. Two further sliders are provided for fine tuning/detuning and noise, but all other communications are instigated by means of soft-touch pushbuttons, there being eight of these in total, all with built-in status LEDs.

The majority of the front panel is taken up by parameter tables for the oscillators, filters and envelope generators, so it's probably about time we turned our attention to the Bit One's back panel.

As previously intimated, the upper and lower keyboard voicings have separate outputs, these being on quarter-inch jacks at a maximum output level of OdBm (0.775V rms): connecting only one of these results in a mono output, as opposed to the normal – and occasionally disconcerting – stereo.

Next comes the inscrutible MIDI section on five-pin DIN connectors, which is only as it should be, and it's good to see a MIDI Thru connector as well as the usual In and Out. As it stands at present, the Bit One's version of MIDI only operates on Channel 1 and can only receive – not transmit – pitch and patch information, but a software update (available towards the end of the year) will expand this feature considerably, as the instrument will then be able to handle MIDI velocity and bend information as well as being assignable to any one of 16 MIDI channels. And the even better news is that this update will be made available at no extra cost to purchasers of early versions of the Bit One.

Next comes a socket marked Trigger Out, but curiously the Bit One's promotional literature says nothing about this. A couple of minutes' experimenting with a voltmeter revealed that this output sits at around five volts and drops to ground for a few tens of milliseconds whenever a key is depressed, so I'm sure someone somewhere will find a use for it.

Tape In and Out connections (for patch storage) are again on quarter-inch jacks, and a Memory Protect switch is also fitted which reduces the possibility of accidental patch erasure and/or modification.

Facilities

On switching on, the Bit One enters what is known as Play mode, and this configures the synth as a conventional six-voice poly playing whichever patch is indicated by the 'lower' display: this defaults to Patch 1 at switch-on.

In this mode, the keyboard is velocity-sensitive and the current patch may be changed simply by punching in two new numbers from the keypad. As only one sound can be played at any one time in this mode, the makers have given it the rather quaint name 'monotimbic'. Perhaps it means something more in Italian.

Double mode allows the user to select any two of the 63 patches which then sound simultaneously when a key is pressed, though unsurprisingly this limits the polyphonic capability to three notes, as the six voices are being split into two groups of three and then layered.

Split mode operation (*can't help thinking this is getting a bit predictable – **Ed***) allows the user to select his or her own breakpoint anywhere on the keyboard, and this is accomplished by pressing the key immediately to the right of the desired split point. This keystroke produces no sound, but any further playing will cause the 'lower' patch to be controlled by the keyboard below the split and the 'upper' patch by the keys above it. Again, only three notes may be played simultaneously at either side of the split point.

In both Double and Split modes, the stereo outputs carry one voice each so that different signal processing may be applied to each output, and this is particularly useful for the production of string sounds, as the Bit One has no built-in chorus unit and an external one must be patched in.

Unison mode, as you might expect, causes all the oscillators to play the same note and the slight natural detuning between notes results in a satisfyingly rich, fat sound. The Split and Double keys are dual-function switches that control the tape Save and Load operations in conjunction with the Tape button. This is a simple (and these days quite familiar) process that allows the user to compile a library of useful patches on tape which may be later read back into the machine for use as they are or for further editing.

One novel feature is the Park function which allows you to tuck away a copy of the patch you're working on so that further editing does not destroy the original. This not only means you don't have to put the sound into the patch bank until you are satisfied with it, it also enables you to compare the newly-edited sound with the original to see if you really *have* improved it. Definitely a bright idea.

> 'It has no built-in chorus, no arpeggiator, and no sequencer, and looks therefore to have been designed for keyboardists who can really play.'

Each of the 12 DCOs has its own 24 dB-per-octave low-pass filter and the two LFOs can produce three different waveforms to modulate either the filters or the DCOs.

Sounds

Initial listening tests were carried out *via* a pair of pretty decent stereo headphones connected to the appropriate socket on the Bit One's rear panel. Over that medium, the machine's factory presets sounded strong, clean and bright, but perhaps a little lacking in warmth and low-end 'oomph', for want of a better word. However, connecting the instrument up to a fully-fledged speaker system proved a revelation, as the Bit One proved capable of competing with the fullest-sounding Stateside synths as well as the brighter, cleaner Japanese models. The brass and grand piano voices are particularly impressive, and only the previously-mentioned absence of some form of on-board chorus unit prevents the Chase from generating first-class string ensemble sounds.

Each of the Bit One's DCOs is switchable to one of four octaves, with a choice of triangle, sawtooth, and pulse waveforms, and it's also possible to detune one oscillator apart from another in semitone steps over an octave.

If your playing technique is up to it, the touch-sensitive keyboard – while not being an especially striking example of its type – adds real spice and variation to your performance: not surprising when you consider that key velocity can be made to modify the timbre of a sound as well as its amplitude.

The Bit One's split/layer capability is also a real boon – something that's hard to live without once you've had the use of it for any length of time – and the option of a Unison mode is also a welcome feature. It makes lead-line work a lot more convincing.

Conclusions

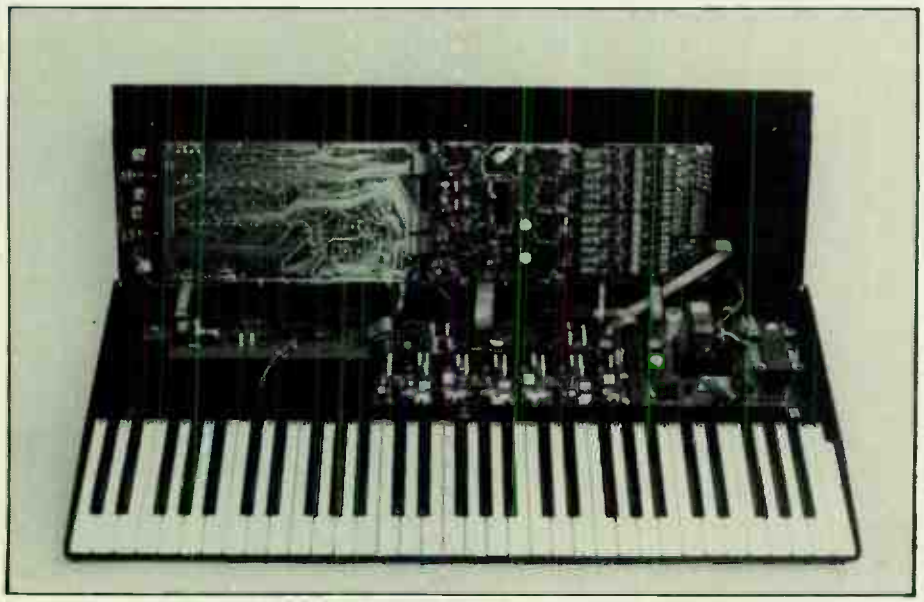
The Bit One has no built-in chorus, no arpeggiator, and no sequencer, and looks therefore to have been designed for keyboardists who can really play. As if to underline this trend, most of the synth's 'extra' facilities are intended to aid live performance, which certainly makes a change in this age of computer-activated automation.

Mind you, further developments in the Bit One series should see a rack-mounting MIDI expander module that effectively duplicates the facilities offered by the stand-alone synth, a sound-sampling drum machine (also rack-mounted), a sequencer to run the whole system and a full-length wooden keyboard to control it in real-time. In other words, a complete MIDI-based performance system from one manufacturer.

My own personal preference would be some form of parameter control other than the digital system employed here (though the Bit One is by no means alone in using it: it's one of the reasons why so many people find the DX7 such a difficult beast to tame), since there really is no substitute for being able to hear how various synth parameters interact, but if the digital selection has been a major factor in keeping the instrument's price down – and I suspect that it has – then there can be no complaints.

So, judging the Bit One on what it is rather than what it will be or what we might like it to be, I can say that, despite a couple of odd ergonomic decisions, it's easy to use, it sounds excellent, it's extremely versatile and above all, its price is low enough to give rival manufacturers a real headache. ■

RRP of the Chase Bit One is £699 including VAT, and further information is obtainable from Chase Musicians, 58 Oldham Street, Manchester, M4 1LE. ☎. 061-236 6794/5.



Hot Licks

Instruction Tapes for Piano and Synthesiser

If classical piano tuition does nothing for you and you're too ashamed of your technique to ask anyone else, instruction tapes may be the answer.

Jay Chapman

The tapes under review here come in two sets: the first is 'Rock Piano' as taught by American pianist John Jarvis, while the second is 'Synthesizer Workshop', accompanied by the voice of synth player T Lavitz. Both courses are part of a whole collection of musical instrument instruction tapes produced by the Hot Licks company in New York and distributed in the UK by Labtek International.

I should point out that playing keyboard instruments is one of my main interests; so I've considered the usefulness of both courses in much the same context as you would. When I got hold of them for review it was in the hope that they would improve both the technical aspects of my playing and its musical content.

Reviews of this type nearly always suffer from the fact that the items under review are only available to the reviewer for a very short time, and in the case of instructional material such as the Hot Licks tapes – which should normally be used over a period of months – a short test period could only result in a shallow appraisal lacking in any real conviction. However, I'm pleased to be able to say that I have been using these two sets of tapes for my own personal tuition over the past few months, so whatever else they might be, my findings are not jeopardised by lack of reviewing time.

Both sets consist of six tapes and cost £49.95 per set, but luckily, you don't have to buy a complete set in one go, as each one-hour tape is available individually at £7.95. This represents conspicuously good value since a piano teacher could easily set you back that amount in exchange for just one hour of tutoring, and believe me, there's more material on each tape than anyone could comfortably cope with in anything less than a day or two.

Each tape comes with a single sheet of paper, the content of which relates to the aural lesson contained on the cassette. The lessons themselves are intended to obviate the need for written support material, but given the nature of the subject matter involved, I feel Hot Licks would do well to improve the documentation of future releases.

One great advantage of these tapes is that the teachers are well respected and currently active musicians. And since they are active in the same (or at least similar) areas of music to you and I, it's probably fair to say that what they have to teach us – and the style with which they do it – is likely to be of more immediate interest than the lecturing of the local piano teacher.

As a bonus (!), each tape has a sprinkling of anecdotes interspersed with the serious business of tuition, and as well as providing some form of light relief between periods of study, these also serve to give a limited insight into the world of the professional session musician.

Rock Piano

One of the real problems facing producers of aural instruction material is finding a tutor who not only knows his stuff but can put it across in a clear and easy-to-understand manner, *and* doesn't get dull during six hours of listening.

In John Jarvis, I think Hot Licks have found a real gem. He starts off a little nervously – primarily, I suspect, through unfamiliarity with the medium – but soon gets into his stride and from there on in never really looks back. His personal style of teaching is pleasant and he really *does* have some useful ideas and techniques to pass on.

It's my view that the absolute beginner should at least do some basic work (learning note names and their position on the keyboard, getting to grips with what constitutes a major scale, going through major, minor and seventh chords) before starting into a course of tapes such as these. Thus, Jarvis kicks things off at too low a level for my liking, instructing pupils in major scales – work that would be much better dealt with *via* a beginner's book and an hour or two spent with a keyboard-playing friend.

This introductory section over, however, Jarvis sets off on a well-structured tour of what you need to know to progress further. Subjects dealt with include rhythm, bass, chords and melody (all on the first tape!) and the approach employed is so simple and methodical that your playing really should improve every day – provided you practice what he preaches, of course.

Highlights for me during the six hours included the use of 'blue notes', technical exercises for soloing, ear training, a complete examination of chords and their use, and the way Jarvis breaks down some superb riffs and solos to give a complete guide as to how they're achieved.

As testament to his keyboard-playing prowess, John Jarvis mentions at one point that Art Garfunkel would only decide the key of 'Bridge Over Troubled Water' just before he sang it at a concert, depending on how his voice was standing up to the strain.

Could you play the intro to 'Bridge Over Troubled Water' in C# at a moment's notice? Jarvis can.

Synth Workshop

T Lavitz' tapes are also full of useful stuff, though perhaps listening to the Jarvis set first wasn't such a good idea: they set a standard that was hard to follow.

You'll probably need more in the way of perseverance to get through the synthesiser collection, partly due to Lavitz' unfortunate sense of humour and partly due to the fact that he has a tendency to digress at length during his, er, lengthy digressions. But, if you can cut through the verbiage and – by comparison with the rock piano tapes – a certain lack of structure, you'll find the effort worthwhile.

The sections on improvisation and the use of scales and modes are particularly useful, and the tape on pitch-bending (though half a tape would probably have covered it just as well) is also worth ploughing through.

In conclusion, I feel confident in recommending both the 'Rock Piano' and 'Synthesizer Workshop' courses. If you're prepared to listen carefully to what's coming out of the tape machine and – above all –to practice the skills that are being passed on, your playing technique will almost certainly reap some sort of benefit. As I said before, the fact that playing is covered from a rock musician's angle means that the techniques used relate directly to what so many people want to learn. And somehow, practising isn't nearly so stuffy and confined when you're being taught by someone whose musical interests aren't a million miles away from your own.

By the way, further Hot Licks tapes are currently being planned, including one that'll go by the name of 'Chops Builder' – take ten points off your street (*Avenue? – **Ed***) credibility if you don't comprehend the significance of that. If it matches the quality of the tapes reviewed here, it should be well worth tracking down. ■

RRPs are given in the text. Further information on the range of Hot Licks instruction tapes can be had from Labtek International, Middlewich Road, Northwich, Cheshire, CW9 7DX. ☎ (0606) 48684.

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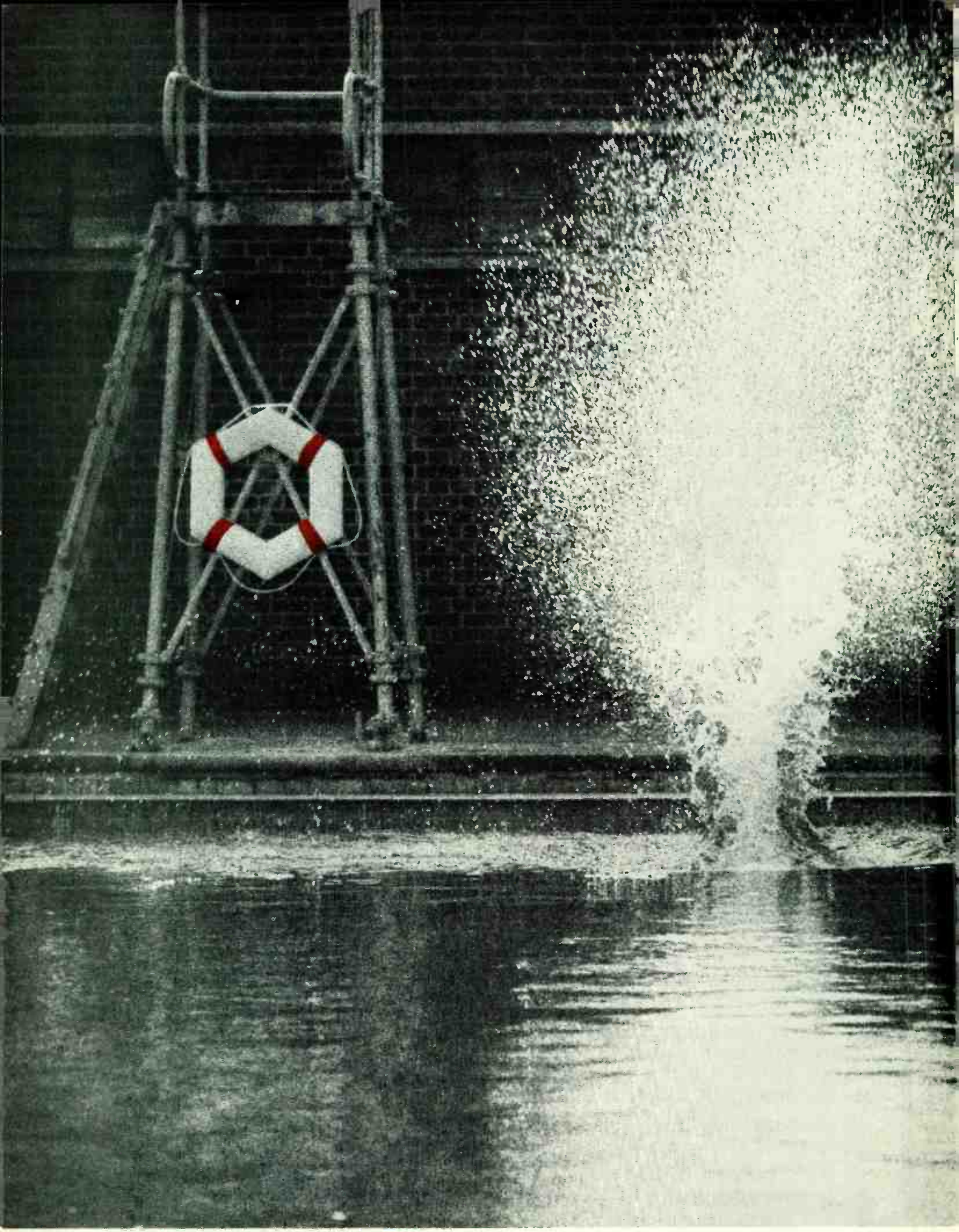

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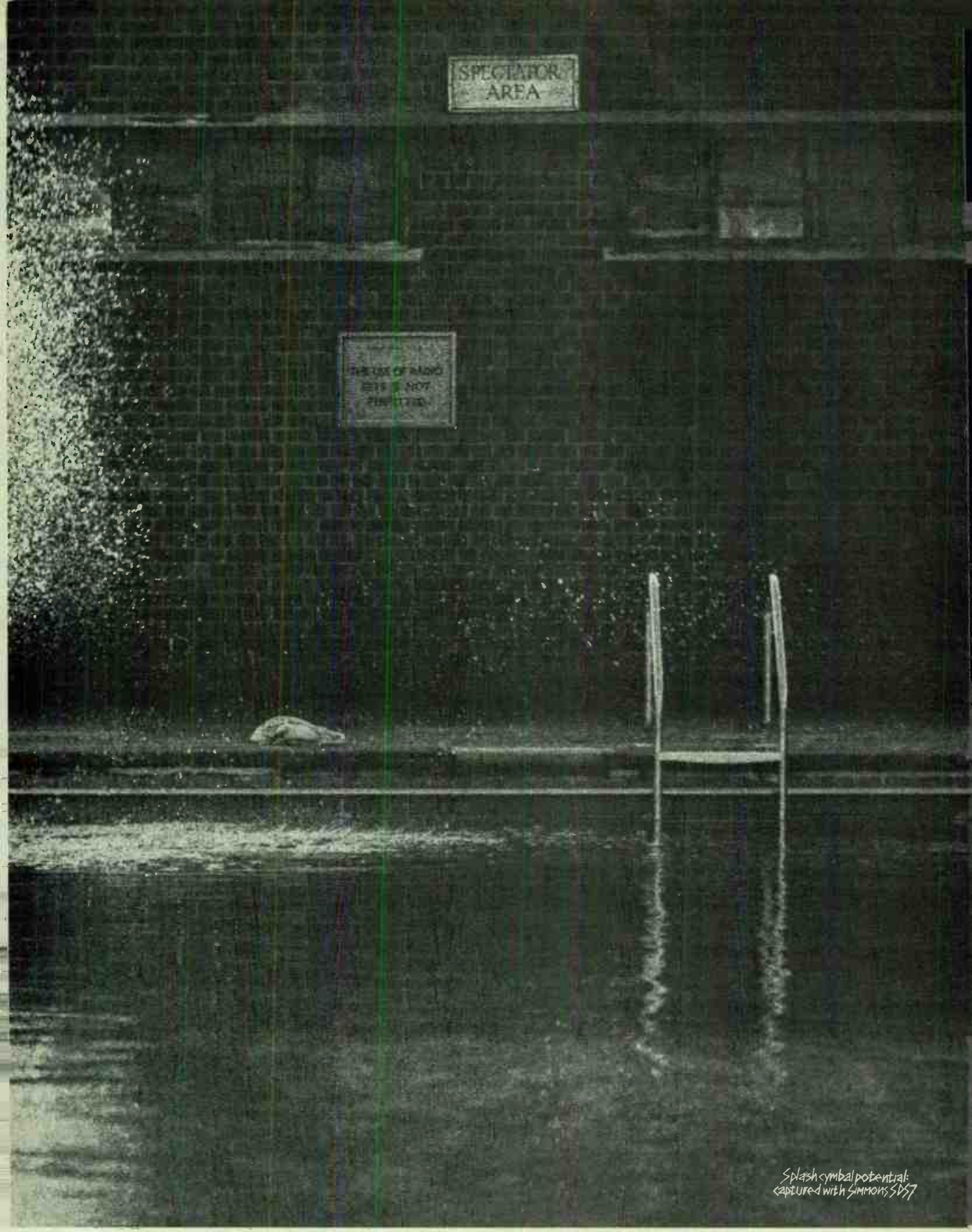

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Casio CT6000

Electronic Keyboard

They've had the technology to do it for some time, but the 6000 is the first concrete indication that Casio are willing to make concessions to the semi-pro musician. *Paul White*

Casio have a firm foothold in the consumer electronic marketplace: their calculators, watches and musical instruments have brought modern-day technology to the masses in attractive and cost-effective packages that are both easily affordable and easy to use. Until recently, Casio had concentrated their musical resources on budget keyboards intended primarily for domestic use, complete with automatic rhythm and accompaniment facilities that enable absolute beginners to create some form of music with the bare minimum of practice.

With the possible exception of the CT202, no Casio products have really made the grade for live performance or serious recording work, but the CT6000 may be an indication that Casio are about to span the gulf which presently separates the home user from the professional and semi-pro.

Casio's first MIDI-compatible keyboard, the CT6000 is a polyphonic instrument with 20 preset voices, a keyboard spanning five octaves and the familiar Casio autochord and rhythm sections, which are present in a more sophisticated form than previously. The system permits up to eight notes to be played simultaneously, and this number is not reduced when the auto-accompaniment section is in use. No manual was supplied with the review model, and it's a testament to the 6000's logical control layout that no real problem was experienced in operating the beast.

Construction

Measuring only 38″ × 13½″ × 5″, the CT6000 incorporates two loudspeakers and built-in power amplifiers which provide ample volume for practice or home use, though as is customary, stereo line output jacks are fitted for recording and live work.

The bottom 18 notes on the keyboard may be linked to the Casio's autochord section, and directly to the left of these is the pitch-bend wheel, which is centre-sprung.

> 'The string ensemble – so often a weak point on previous Casios – is simply astonishing, especially when played with sensitive application of the after-touch facility.'

Touch controls (or 'membrane switches', as Casio call them) are located behind a thin plastic facia for voice, accompaniment and rhythm selection, and the individual sections are colour-coded in decidedly Yamaha tones – an indication that Casio *want* pro musicians to take this instrument seriously. However, unlike Yamaha's touch-switches, the buttons on the 6000 have no positive 'click' in their action, which makes them a mite tricky to use: a clear case of technological considerations overriding human ones.

Anyway, above these selectors is a row of slider controls for level, rhythm tempo, and keyboard transpose adjustments, while an orange bar conveniently located above the bottom octave of the keyboard allows the instantaneous selection of intros or fill-ins.

The entire case is tastefully fabricated from sheet steel and finished in two-tone metallic grey, and although it's quite heavy for its size, it's nonetheless quite easily portable.

The keyboard itself has an unremarkable action, but what is remarkable is the inclusion – on an instrument in this price and market category – of touch-sensitivity and after-touch sensing. It should be pointed out that this feature isn't quite as complete as it sounds, since while softer-than-average keystrokes produce a correspondingly quieter output, harder than average playing only results in the same level output as that obtained from normal playing. Still, you can't have your cake . . .

Functions

Before we look at the auto-accompani-

ment section in detail, it's worth devoting a bit of space to analysing how the preset voices perform. Of the 20 present on the CT6000, some are good, some are bad, and some are indifferent, which, as many of you will probably recall, was pretty much the situation on the CT202. However, the good sounds are really rather special: Funky Clav is an excellent rock harpsichord sound, enhanced even further by the addition of the 'Unison 2' treatment (see later), vibraphone has a gorgeous percussive attack and retains its full tone throughout the keyboard's length, chimes are similarly impressive, and the string ensemble – so often a weak point on previous Casios – is simply astonishing, especially when played with sensitive application of the after-touch facility. It's not all roses, though. The koto is nowhere near as good as the voice of the same name provided on the 202, while some of the other ensemble presets could do with a bit of cleaning up, but the most significant fault is that, due to the digital nature of the 6000's voice-generating system, chords played in the upper registers can exhibit unpleasant dissonant overtones that might be safely concealed in a live performance but could pose problems during a serious recording session. This hiccup has been present on just about every Casio keyboard I've ever encountered, but you'd have thought that for £700, they could have attended to it . . .

Those points aside, the 6000 is a definite sonic advance for its manufacturers. It's no DX7, but some of the presets come pretty close.

A variety of sound effects can be applied to any of the voices (some of them are applied automatically when the voice is activated, so it's up to you to get rid of them if you don't want them getting in the way), and these include two separate chorus effects (going by the curious titles of 'ensemble' and 'celeste'), sustain, vibrato, delayed vibrato, and three unison modes, the last of which adds a fifth to whatever note(s) you're playing.

Moving to the 6000's rhythm section, the basic drum machine sounds are a definite improvement over Casio's previous efforts, and most of the problems that do arise are more a result of inappropriate (and sadly not user-adjustable) level settings than inadequacies in the voices themselves. The hi-hat, for instance, is outrageously high in the mix, overshadowing some of the better voices such as bass drum and toms.

Once you've selected your desired pattern (there are 20 to choose from) and activated it, a green LED flashes in time with the rhythm, and this turns to red on the first beat of each bar – a thoughtful touch.

Casio Chord

This is where performance skill sinks into the background and the CT6000's auto-accompaniment section takes over. Essentially, the section has four modes of operation. The first is 'Off', which lets you use the whole of the keyboard's five octaves as a normal, non-mechanised pitch controller. Next comes a button labelled 'On' (*makes a change – **Ed***) which causes the bottom 18 notes to control the auto-accompaniment. This enjoys a selection of ten preset voices, many of which (the harp and human chorus, for example) are unique to this section.

> 'For domestic players considering entering the world of computer music *via* MIDI and a suitable home micro, the CT6000 is an extremely attractive package.'

When a key is pressed, a major chord corresponding to that key is produced automatically, but if a higher key (still within the bottom 18) is depressed simultaneously, a minor chord is produced instead. Add a further higher note and the chord becomes a seventh, and if you can manage four fingers at once, you get a minor seventh for your trouble. In this mode, the automatically-generated chord continues to sound indefinitely until a new key is depressed and, if the rhythm section is also engaged at this point, the notes within the chord arpeggiate in an extremely agreeable fashion dependent on the rhythm and accompaniment voicing selected.

This mode really is simplicity itself to operate, but just in case you still can't handle everything, a chord memory section lets you record your sequence so that when you go into Play mode, the chords play along in time with your chosen rhythm, leaving you to concentrate all your attention on the right-hand melody.

A further mode (somewhat distastefully titled 'fingered') frees the user from forced adherence to the CT6000's chordal patterns but, since this also entails playing chords manually, it might be considered dangerously close to musicianship for some people's liking.

'Free bass chord' had me fooled at first, but actually it's rather useful since it allows you to play bass notes in real-time without interference from the automatic arpeggiator.

Connections

In addition to the usual mains input and stereo line outputs, the Casio allows you to connect sustain and volume pedals and a pair of stereo headphones for private musical self-abuse. Overall tuning – distinct from the instrument's automatic transpose function mentioned earlier – can be adjusted *via* a preset on the rear panel, but most significantly of all, MIDI In and Out sockets are also present, enabling the 6000 to control (or be controlled by) any other MIDI-compatible device such as a synth, drum machine, or computer-based sequencer. Sadly, though, no MIDI Thru socket is provided.

Conclusions

There can be no doubt that the CT6000 packs in an awful lot in the way of facilities for its asking price, and that those facilities can be more or less equally divided between domestic and pro options.

The quality of some of its preset voices, the extra possibilities afforded by the touch-sensitivity and after-touch, and the inclusion of performance controls and MIDI all point to an increased commitment to serious musicians on Casio's part. It remains to be seen whether sufficient numbers of said players will be willing to pay this much for an instrument that has such an extensive (read 'costly') auto-accompaniment section, but what is beyond question is that for the more discerning domestic players – particularly those considering entering the world of computer music *via* MIDI and a suitable home micro – the CT6000 is an extremely attractive package.

Personally, I'm still waiting for the time when Casio come up with the fully professional instrument line-up they've been promising for some while – and which we all *know* they're capable of producing. But the CT6000 is an important step in that direction. ■

RRP of the CT6000 is £695 including VAT, and further information can be had from Casio at Unit 6, 1000 North Circular Road, London NW2 7JD. ☎ 01-450 9131.

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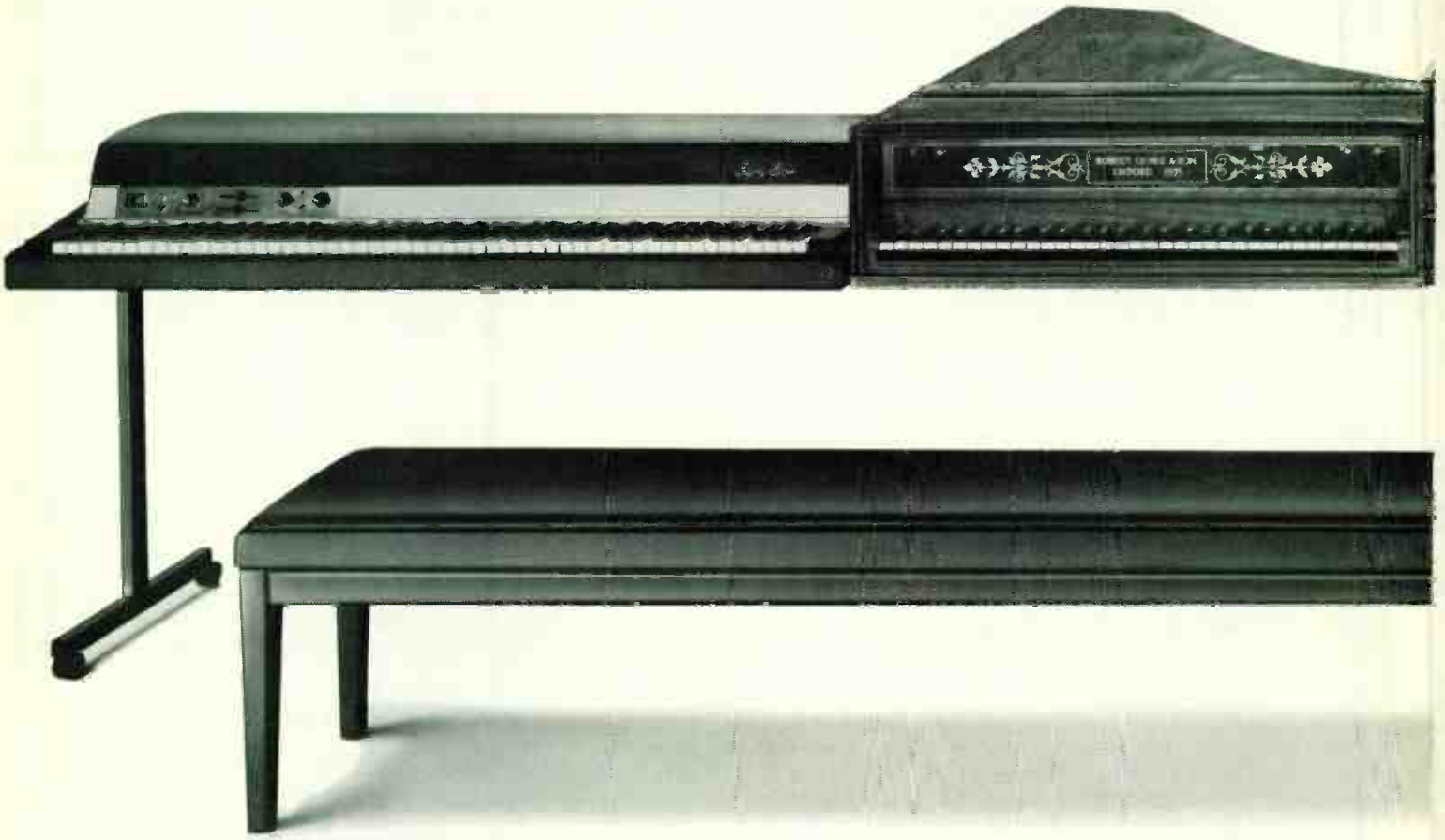

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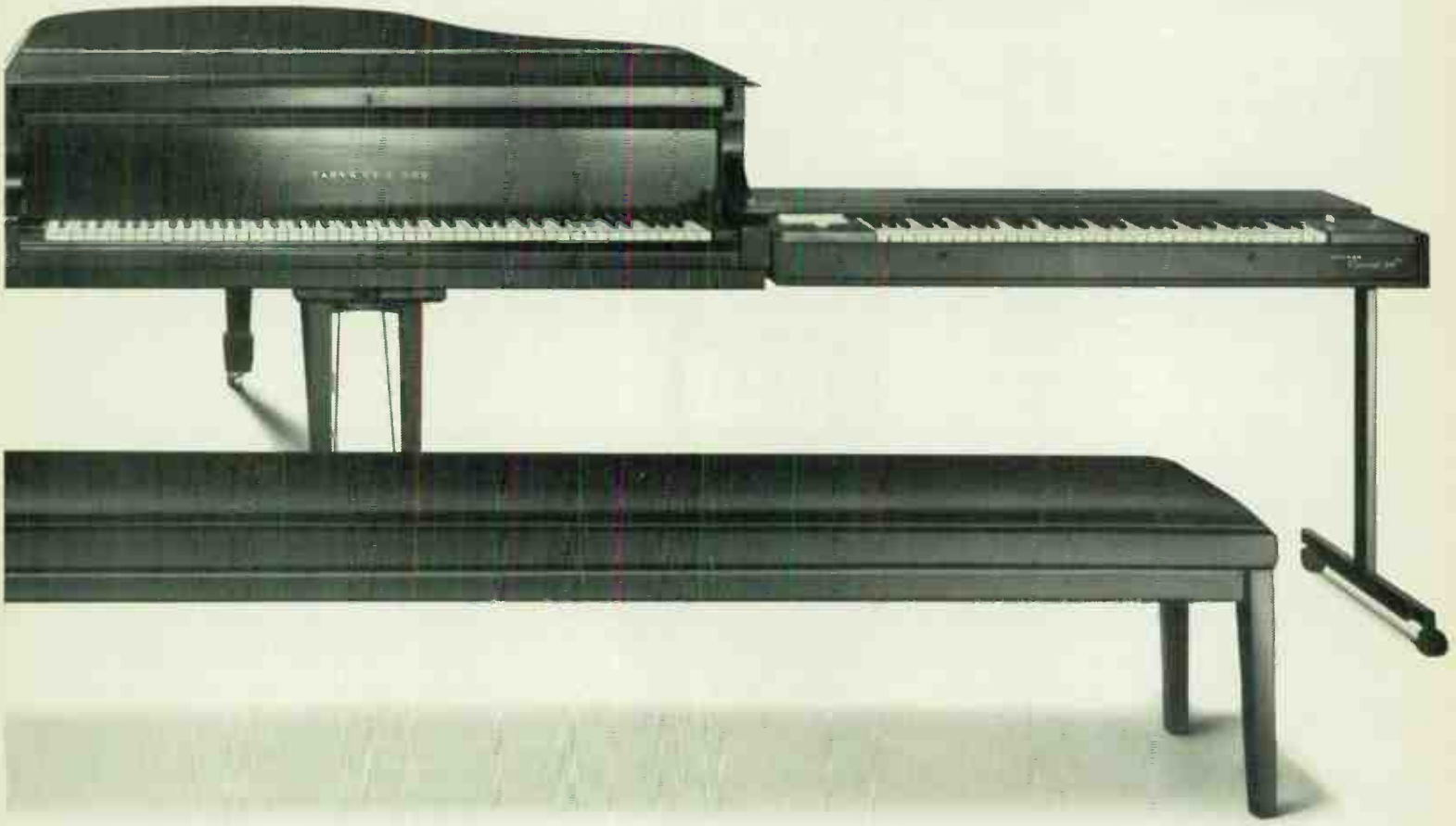

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Digital 10.

Action Replay

Sound Sampler for Sinclair Spectrum

It's not an Emulator for £200, but if you've already got a Spectrum, Ricol Electronics' new hardware and software should get you something close.

Mike Drane

As an add-on for the 48K Sinclair Spectrum, the Action Replay consists of the hardware necessary to digitise an input waveform, perform some digital signal processing under the control of the associated software, and finally convert the digital signal back into analogue so that you and I can hear the result.

Any such device must consist of an input filter to prevent aliasing, an analogue-to-digital converter (ADC), some memory store (the size of which determines the amount of sound you can store for a given bandwidth), and a digital-to-analogue converter (DAC) with a low-pass filter to smooth the quantisation of the input signal. The Action Replay uses 32K of Spectrum memory for storage, and a maximum sampling rate of 32kHz gives a maximum storage time (or delay time) of one second.

The amount of noise present in a digital system depends on the number of bits being used to quantise the signal, and given that the Spectrum is essentially an eight-bit system, the dynamic range *ought* to be something in the region of 48dB. However, Ricol Electronics data sheet quotes 72dB, so all is not what it seems to be: clearly, some form of companding must be going on in order to achieve that extra 24dB of (rather useful) dynamic range.

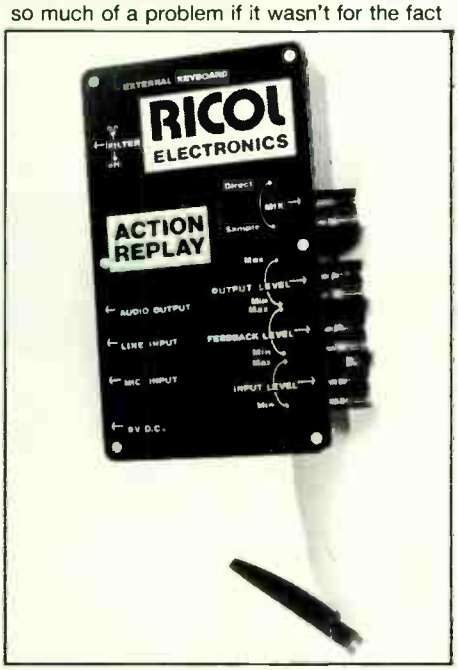
Meanwhile, input and output filters are both 36dB/Octave, while the cutoff frequency is under software control to match whatever sampling rate is selected. There's also a provision for turning off the input filter, which I suppose might come in handy if you're interested in hearing what aliasing sounds like . . .

The Action Replay comes in a smartly unobtrusive ABS plastic box (190 × 110 × 60mm) with all control designations neatly printed on the lid. The connecting cable supplied is only 8cm long, which does limit the user's positioning options somewhat, but on the credit side, the edge connector itself is of high quality and fits snugly onto the Spectrum, so it's unlikely to work its way loose. Internal construction is compact and professional, all components being mounted on two large PCBs, but input and output connections are 3.5mm mini-jacks, so you'll need some converters if you're only equipped with more common phonos or quarter-inch jacks.

In Use

On loading up the software supplied, the user is presented with a menu of options and a graphic representation of a music keyboard which relates notes to keys on the Spectrum's QWERTY keyboard. You start off in Mode 7, which just samples the input waveform and outputs it again without processing to enable you to set the correct levels. In practice – and especially if you've never done any sampling before – this process is initially a bit hit-and-miss, though you'll get there in the end, and when you do, the results are well worthwhile.

The software's available options are Record, Play, Reverse, Echo, Harmonisation and Set-Up. The last-mentioned mode allows you to select the sample rate and the amount of memory to be used, this being selected in pages from 1 to 121. Taking Echo first, sound quality was surprisingly high (though whatever you do, don't expect it to match that of studio quality machines) on both synthetic and vocal signals, and using maximum bandwidth (ie. fastest sampling time) and varying the number of pages of memory being used makes a whole range of related effects possible, from a decent ADT to vast, cavernous echo. One minus point is that the unit's Feedback control is far too sensitive, which wouldn't in itself be so much of a problem if it wasn't for the fact



that if you go just a little bit too far, you end up with an unpleasant attack of gross digital howling.

Of the remaining options, Play and Reverse are probably the most useful. Again, you're required to specify sample rate and number of memory pages, but this time, the sample is stored in memory permanently until you ask for another one. The sound in memory can be replayed *via* the Spectrum's QWERTY keyboard over a four-octave range, though only 17 semitones (C-to-E) are available at any one time. The Play option outputs the signal right way round, while Reverse (surprise, surprise) replays it backwards.

The Harmonisation feature is less usable in practice, since it suffers from excess noise and sounds a shade flat – to these ears, at least. The supplied instructions suggest winding up the Feedback control at this point, but although this undoubtedly increases the harmonic content of the output waveform, the signal rapidly breaks up into 'Cosmic Space Battle' noises: not really musically viable outside a Tomita concert.

Fourier Analysis

The only other software module available at present is a waveform plot and Fourier analysis package, and this program operates in two parts. The first section behaves very much in the manner of a digital storage oscilloscope, and requires you to specify sample rate (variable from 100Hz to 70kHz), display resolution and trigger level. The user manual suggests that the sample rate be 20 times the input frequency, but I found 40 times gave a rather better display. Once you've produced a good clean display of your waveform, you can then proceed to the second section of the program, which computes and displays the waveform's Fourier transform. For those not in the know, a Fourier transform is a means of converting a periodic time-domain signal into its frequency spectrum. This is of tremendous use to engineers and musicians alike, and I was fascinated to see a time waveform being broken down into its harmonics. Using nothing in the way of special hardware (actually, the VCO output from a Korg MS10 monosynth, with no filtering whatsoever) and taking a bit of care over ensuring reasonable sample quality, it proved astonishingly simple to produce spectra almost identical to classic text-book examples of triangle sawtooth, and square waves.

Conclusions

You'll doubtless have gathered by now that the Action Replay system as it stands at the moment is far from being fully comprehensive, but several future additions are at an advanced stage of development. These include a keyboard interface that plugs into the back of the unit and enables samples to be played from a conventional one-volt-per-octave keyboard instead of the Spectrum's typewriter one, and at least two further software packages. These are a Fourier synthesiser (basically, the same as the Fourier analysis routine except that it works the other way round, ie. it enables you to create a waveform by selecting the amplitudes of up to 16 harmonics), and a further waveshaper that'll allow waveforms to be drawn on-screen using a light-pen: provision will be made for two user-specified waveforms to be programmed to fade into one another at a predetermined rate, thereby providing a form of dynamic timbral control.

When you add the Action Replay's RRP to that of a Spectrum, the total cost is similar to that of budget dedicated digital delay lines, and if that was the only function the unit could perform, its value for money would be questionable. However, the additional software already available and the potential open-endedness of the design put the system in an entirely different league from dedicated units. And if, as I do, you believe in the Spectrum as a micro of the future as well as the present, the possibilities of connecting the Action Replay to other systems based on the same computer (eg. E&MM's own OMDAC and MIDI interface boards) are clearly immense. ■

The Action Replay hardware unit and sound storage and replay software retail at £178 all in, inclusive of VAT and p&p. Further software modules cost £10.95 each. Further information – and an audio demonstration tape – from the manufacturers, Ricol Electronics, 48 Southport Road, Ormskirk, Lancs L39 1QR. ☎ (0695) 79101.

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Yamaha D1500

MIDI Digital Delay

MIDI keyboards and drum machines have already become commonplace, but now Yamaha have taken uniformity a step further by introducing the first DDL equipped with the new interface. *Paul White*

I suppose the obvious question must be: why put MIDI on a digital delay? Unlike synthesisers, rhythm machines, personal keyboards and music computers, the average DDL doesn't have a great deal to say to the outside world *via* MIDI or indeed any other kind of interface. Yet by equipping the D1500 with MIDI In and Thru sockets, Yamaha have given keyboard players the facility to control the unit's programmable memories from a MIDI synth. Hence, if you assign both synthesiser voice and DDL patch the same memory number, you get a tone colour accompanied by a delay effect tailor-made for it, all at the touch of a button.

In addition to providing all the standard delay effects up to a maximum delay time of 1023mS, the Yamaha boasts a professional specification and is capable of storing up to 16 programs, all selectable remotely *via* MIDI. In the normal run of things, I suspect that most users will use the patch change buttons on a keyboard to select these programs, but it's not inconceivable that a MIDI-compatible computer or drum machine could be used to perform the same task.

Construction

Housed in the now almost-obligatory, 1U-high 19" rack mounting case, the D1500 is smartly finished in black satin enamel with gold legending. Another compulsory fitting on Oriental DDLs these days is a block diagram printed on the unit's top cover, so the Yamaha has to have one of those, too.

The front panel sports only two rotary controls (for input and output level), all other parameters being accessed by means of small soft-touch pushbuttons. A seven-segment illuminated display is mounted to the left of the input level control to assist the user in optimising said level, while a five-digit alphanumeric LED display shows delay time and program number simultaneously.

When the D1500 is in Edit mode, this latter display indicates parameter values which can then be incremented or decremented by means of the appropriate pushbuttons: there are 14 of these, located to the right of the display window.

The Yamaha's rear panel is uncommonly busy, there being no fewer than 11 connectors in permanent residence. Both input and output connectors are on balanced XLRs as well as jacks, while MIDI In and Thru are implemented *via* standard five-pin DIN sockets. To ensure successful matching with a wide range of audio equipment, both input and output levels are switchable between −20dB and +4dB levels, while the unit can be set to operate from either 110V or 240V. Three jack sockets are provided for further footswitches (one can be connected to a similar socket on the front panel for remote stepping through of bank numbers), and these can be used to disable modulation, activate the Hold function, and cancel the effect altogether.

Should the sine and square wave modulation options not be sufficient for your purposes, you can insert the waveform of your choice into the D1500's CV In socket, which requires a voltage of between 0 and 10V to operate correctly. It transpires that the Yamaha's front panel controls do not function when the machine is in Hold mode, so the only way of varying the pitch of the stored sound if Hold has been selected is to apply some sort of waveform to the CV In: our own Multi-waveform LFO project (published in E&MM June) should fit the bill nicely.

Operation

On powering up, the D1500's output is muted for three seconds to shield sensitive

ears from the potential aural armageddon of the sound of several kilobytes of random rubbish being flushed out of the unit's memory. The unit is then ready for use, and initially the display shows program number and delay time, the default condition being program bank A.

In order to get a single-digit display to handle 16 programmable memories, Yamaha have numbered the banks in hexadecimal. For those of you who hide under tables at the first mention of computer jargon, don't panic: all it means is that you count from 0 to 9 in the normal way and then from A to F, F being 15.

Creating a program is really pretty straightforward.

The required parameter is selected using one of the D1500's function buttons and its value subsequently raised or lowered using the data entry controls. Once all the parameter values are to your liking, the modified patch may be written over the original simply by pressing the Store and Bank selectors. And just in case you don't want to lose your original program, Yamaha have thoughtfully provided a Copy key that enables your precious patch to be transferred to a spare memory bank before receiving surgery. Needless to say, full battery back-up is provided so that patches and their memory locations are stored even when the D1500 is powered down.

Unlike the majority of its competitors, the 1500 incorporates a variable low pass filter. This resides in the feedback loop and enables repeats to become progressively less harsh as they're recirculated, giving an impression of distance. The filter's cutoff frequency can be stored as a parameter value, and the discrete frequencies available are 2.5, 4, 6, 8, 10, and 20kHz at a slope of 6dB per octave. Feedback may be set between values of 0 and 99, the latter being the most feedback that can be applied without the sound actually increasing in level: at this setting, the repeats take over 30 seconds to die away.

In order for the D1500 to communicate amicably with its controlling MIDI instrument, both devices must be set to the same MIDI Channel number, and on the delay, this is selected by – wait for it – the MIDI Channel key. Once you've selected your channel, however, it's still necessary to instruct the Yamaha how you want it to interpret incoming MIDI data, and this is where the Yamaha Program Change key comes into play. When this is pressed, the current program bank number and MIDI program number are displayed, and by using the data increment/decrement keys, matching specific memory banks to MIDI program numbers is a simple (if somewhat laborious) task. Pressing the MIDI Program key again stores this data and disengages the MIDI Program Change function.

Effects

Manufacturer's spec for the delayed signal passing through the D1500 includes a frequency response of 20Hz–18kHz and a THD figure of 0.08%, but curiously no indication of noise performance is given. This would seem to indicate that Yamaha are a little ashamed of the D1500's performance in this area, but judging by my experience with the unit, they've no reason to be. The delay sounds are clean, bright and free from any undue quantisation noise, though there is a slight discernible difference between the direct and delayed signal.

Many DDLs fall down in the area of flanging, but not so the D1500: properly set up, its flanging is as deep and exciting as the best of them. Meanwhile, the unit's Feedback Invert mode invokes a subtle but useful change in colour at short delay times, while shimmering chorus effects are easy to produce using lower levels of feedback.

Conclusions

This is a highly desirable piece of equipment for both the studio user and the gigging musician, though it's the latter that'll probably benefit most from the Yamaha's MIDI control options. My only reservation concerning the 1500's programmability is the fact that you actually *need* some sort of MIDI controller to select programs without incrementing or decrementing them one by one. It could be more than a mite awkward, mixing a multitrack recording with a DX7 on your lap just so that you can access the D1500's programs instantly . . .

The only other thing the 1500 lacks is some sort of triggerable sampling system. This facility costs very little provided that it's included at the design stage, and if Boss can include it in their budget DE200, why can't Yamaha do the same for the D1500?

In all other respects, though, Yamaha's MIDI delay is a finely designed and engineered piece of hardware that even the wealthiest electronic musician would be proud to include amongst a rack of signal processing gear.

Still, all good things must come to an end and, sadly, it's now time to give it back. ■

RRP of the D1500 is £693 including VAT, and further information can be had from Yamaha Kemble, Mount Avenue, Bletchley, Milton Keynes, Bucks MK1 1JE. ☎ (0908) 71771.

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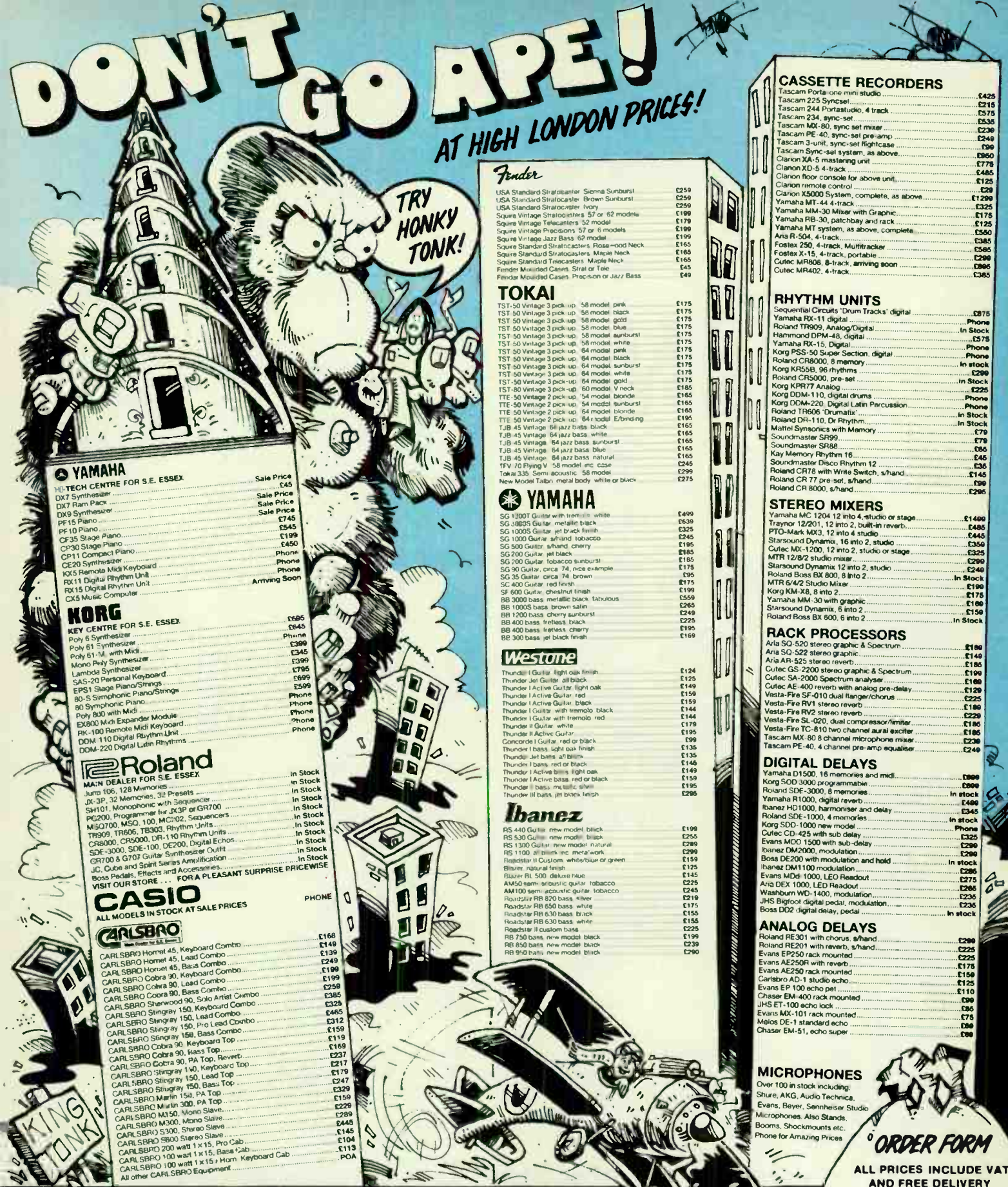

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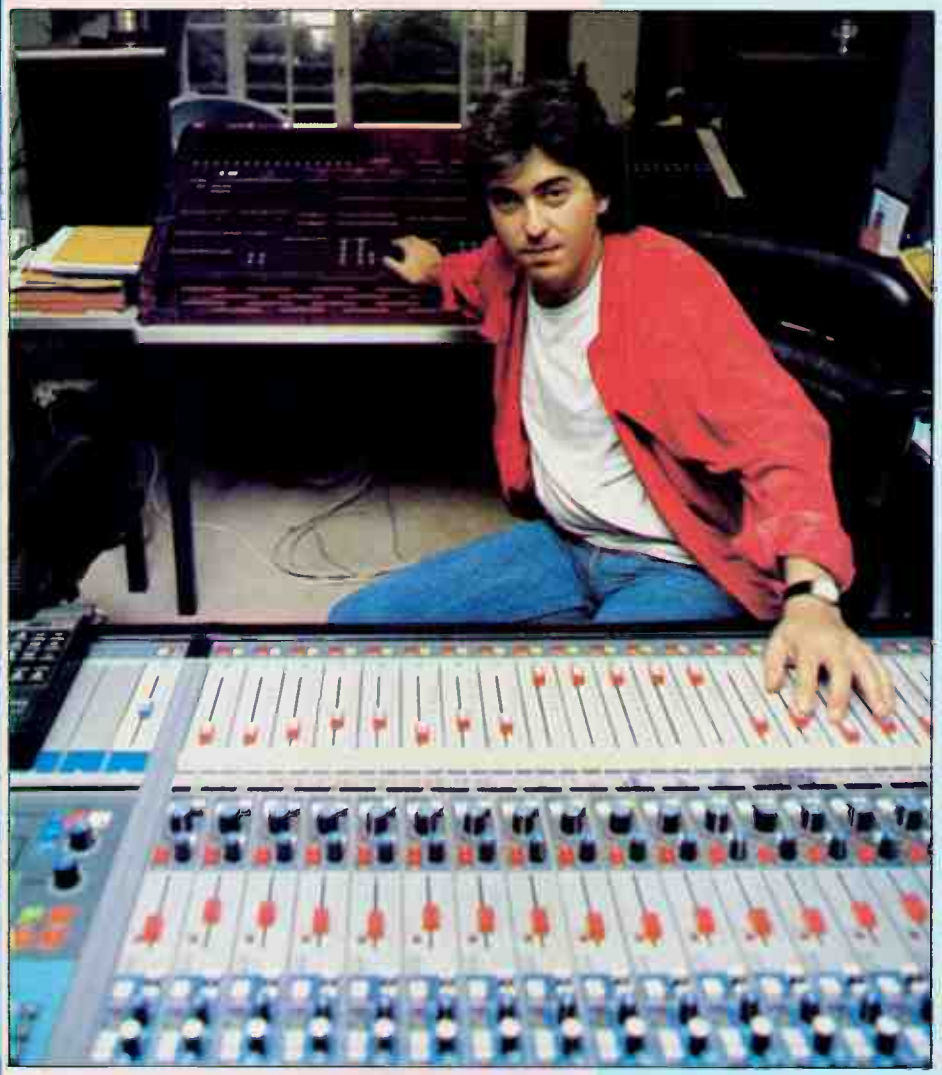
MAN & MACHINE

Behind the Axxess album featured in E&MM May lies a man committed to the beauty of electronic music and one of the most remarkable custom-designed synthesisers ever built. *Dan Goldstein*



Regular readers will no doubt recall that a few months back (May, to be precise), E&MM carried a free flexi-disc featuring excerpts from an album of electronic music entitled *Novels for the Moons*. The album's creator, Patrick Mimram, is boss not only of Lamborghini Records (on which label the album appeared) but also of the world-renowned Italian motor-car concern of the same name, hence his enviable position as catalyst of probably the most ambitious – certainly the most technologically demanding – custom synthesiser designing and building operations in the world.

However, Mimram the musician is an entirely different man from Mimram the financier. He is refreshingly modest about his own musical achievements, and his dedication to the cause of electronic music is almost unnerving in its completeness.

The Musician

'I first became interested in synthesisers when I saw Tangerine Dream and their modular Moog system about 10 years ago – maybe more. I then trained in the technology of music for four years, and that gave me a grounding in basic synthesiser design.'

Mimram's desire to take part in a synth-building exercise of his own was fuelled by a meeting a couple of years back with a Berlin-based electronics engineer, Andreas Bahrdt. Bahrdt had been working in New York with former Tangerine Dreamer Peter Baumann, and the fruits of their co-operation took the form of a custom-built 16-voice programmable polysynth incorporating computer-controlled sequencing, among other things. Understandably impressed by that instrument, Mimram asked Bahrdt to design something similar for him, though by the time that machine was completed – about a year later – technology had advanced sufficiently for Bahrdt to incorporate further musical and ergonomic improvements. The engineer gives a brief rundown of his system's bewildering specification.

'Well, like Peter Baumann's machine, Patrick's is based around a Hewlett Packard 16-bit microprocessor. The operating system is 16-channel – that is, 16 channels each with four analogue VCOs. There are also noise sources and FM voices similar to those on the Synclavier, as well as extensive filtering and modulation sections, and the parameters for each channel are controlled by a microcomputer. Also, the system has

provision for 16 channels of real-time recording.'

That sequencing capability - pattern and program data is stored on 20MByte Winchester disks – obviates the need for multitrack recording tape, *Novels for the Moons* being recorded direct from synthesiser to two-track master. Yet in spite of that, the album sounds surprisingly colourful and dynamic. Did Mimram use much in the way of outboard effects to help create that sonic variation?

'No, not really. The synthesiser has so many modulation possibilities, most of the effects can be generated onboard. The only external effects I used were reverb units and some occasional phasing provided by digital delays.'

The album was recorded at Mimram's home in Geneva with the help of a Neve 24-channel mixing console. It took nearly a year to complete (the elaborate accompanying video – produced in conjunction with director Kif Macmillan – was similarly time-consuming), but although it's an undeniably impressive and elegantly-constructed work, it's by no means the limit of Mimram's creative output.

'I'm working on a new Axxess album at the moment, which will be quite different to the first one, I think. My problem is that I'm too impatient. I'm always working too fast and I really have to slow myself down before the music I make becomes interesting.

'I'm also working with a German painter and singer, Ernst Fuchs. He's already recorded one album – *Aphrica* – with Klaus Schulze, but that was all in German: this time his dialogue will be in English so that more people can understand it.'

Mimram also plans to take his music out of the recording studio and into the concert hall, but at present the complexity of his planned stage show – not to mention the pressures inherent in his business life – have meant that plan has had to be put to one side for a while, at least.

The Designer

Mimram's determination to improve his compositional skill is matched by a similar desire to extend the frontiers of current music synthesis technology. Since the completion of the *Novels* modular synth, he's continued working side-by-side with Andreas Bahrdt, and the two of them are at this very moment drawing up plans for an altogether more awesome and grandiose machine.

Bahrdt takes up the story.

'Our ambition is to build a modular synthesiser that is entirely digital, the only analogue part being the output amplifier. We'll be using additive synthesis techniques applied to sinewaves, and when the machine is finished it will be the only one of its kind in the world.'

It's a big 'when', though. It seems the only other development along these lines was undertaken by a team of engineers at IRCAM in Paris: things were going pretty much according to plan until a cost accountant in the French Government took a look at a set of yearly figures and called a halt. Perhaps sensibly, Mimram and Bahrdt have set themselves a realistic date of 'sometime during 1986' for the new system's completion.

All the same, Mimram is convinced the wait will be a worthwhile one.

'The new synthesiser will have a far greater sequencing capability. It will allow recording in both step-time and real-time, with extensive editing facilities and provision for looping.'

The amount of memory space necessary for successful application of additive synthesis technology will, of course, require a more advanced magnetic storage system, and to this end, Dr Bahrdt – himself a graduate of information technology and computer science – has been investigating the possibilities afforded by 300MByte Control Data hard disks. They're not cheap, but they'll do the job. What's more, loading data to and retrieving information from them takes a maximum of five seconds, which should be fast enough to satiate Mimram's innate impatience.

So which is more important to Mr Lamborghini – musical creativity or the advancement of technology?

'The music is the most important thing – definitely,' he stresses. 'My music is the reason for having all this machinery – not the other way around, and the reason I want to have the latest technology is that, not being a trained musician in that sense, I need easy access to as many different types of sound as possible. You see, I'm interested in a lot of different forms of music and a lot of different sorts of instruments. Having machines like the synthesiser I have now and the one that's being developed enable me to play all those different sounds myself . . .' ■

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ON CASSETTE

A round-up of the latest readers' demo tapes to find their way into the E&MM offices. *Chris Heath*

Travel Agents *London*

I wish we got more demos like this: just three songs and all of them worth hearing.

The first two feature Mark O'Brien on everything bar keyboards (provided by Gail Lanbourne), the third an added guitarist and drummer. O'Brien has a strong pop voice – at its best slightly akin to ex-Squeeze vocalist Chris Difford – and this is heard to best effect on 'Hole in the Head', a track that's all the more impressive for its inventively arranged and well-performed backing vocals.

On the evidence of this, a lot of other bands could take a leaf or two out of Travel Agents' book and use multitrack capability not for endless instrumental overdubs but for *making* an instrument out of the human voice itself.

Central Processing Unit *Wiltshire*

I detect a fairly serious degree of insanity at work here.

CPU – a synth duo specialising in instrumentals – start their tape with a bizarre medley comprising 'Fame', 'I Lost My Heart to a Starship Trooper', and 'Rasputin' and never really recover.

Wandering through this live recording (why didn't the audience lynch them?) I also discovered the corpses of the Kinks' 'Lazing on a Sunny Afternoon', Jean Michel Jarre's 'Oxygene', Bach's 'Musette in D' and 'Take Five'.

This is junk of the first order. Go and see them before they are locked away.

Daz Odeum *Berkshire*

Ten(!) promising tracks from 17-year-old schoolboy Alan Gubby, recorded on two Hitachi cassette decks and utilising instruments borrowed from schoolfriends and relatives. In addition to the usual essential recording accessories such as pots and pans, Alan advises us that somewhere in there is the sound of a ZX Spectrum printer . . .

Musical direction is modern: the list of influences includes Cabaret Voltaire, Paul Haig, DAF, Kraftwerk and Fad Gadget, and in fact, the vocal style is somewhat reminiscent of the last of these – Gubby has almost perfected Frank Tovey's sarcastic snarl.

He also achieves some extraordinary instrumental sounds (among them an excellent, driving synth bass) for such limited equipment, and the only embarrassment is the lyrics, which are almost unfailingly terrible. I suspect time will cure that.

Johnny Pop *Sussex*

According to the artist, this offering comprises 'three electro bubblegum digital space-pop creations and one plain old synthesised gothic thing'. And very good they are, too.

Titles like 'Bop-A-Nova', 'See You Later Modulator', and 'Gotta Lotta Moonbeams' suggest a somewhat frivolous imagination, but Mr Pop can certainly write a good tune or two, and receives excellent vocal backing from one Cinderelly into the bargain.

The first three (most recent, and best) pieces were recorded using two Portastudios, and a four-bounced-down-onto-two recording method has provided six tracks of unimpeachable sound quality.

Johnny Pop's accompanying letter cites his influences as 'J S Bach, various modern jazz guys, the Marx Brothers . . . and myself'. Nuff said.

An Impact *No address supplied*

A good, full-sounding offering from Kevin MacFarlane (bass, vocals and keyboards) and Patrick Berry (guitars, keyboards and backing vocals) recorded on a Fostex X15.

The guitar playing is especially effective, relying as it does on the simple, shifting structures of the Joy Division/New Order school, and this contrasts with the slightly ponderous but nonetheless memorable melodies and a Soundmaster SR88 drum machine that's been inventively programmed to imitate live new wave drum patterns.

Strangely, An Impact choose to close their tape with a version of Gerry and the Pacemakers' 'Ferry Cross the Mersey', which would be all very well if it didn't invite inevitable comparisons with the Frankie/Trevor Horn cover of the same song on the reverse of 'Relax'.

Best of the Rest

If you could draw a square with OMD, Ultravox, Howard Jones and Genesis *circa* 'Abacab' at each corner, you'd be able to enclose within it about half the demos we receive each month. **Some Other Year** (from Essex) are in the Genesis corner, but suffer from a lack of both good melody and a spark of originality, as do **Touch and Go** (Middlesex), though they do possess a degree of melodic inventiveness that's allowed to surface now and again. Similar, but treading more modern ground, are the delightfully-named **Loopy with Love**, principally one Welshman – Gorwel Owen. Best track is the not quite so catchily-titled 'Galwad Y Dwyrain', which features some effective distant backing vocals from one Fiona Stangetharm. OMD are proving as popular as ever as a rôle model: this month's best imitation comes from Yorkshire two-piece **Changeant Vogue** who sent us an overdose of doleful synth pop recorded on a bedroom four-track. They do have a redeeming feature, though – singer Tony's mildly wonderful Sylvian-esque crooning. Meanwhile, Spikiest Hair of the Month award must go to Northampton-based **Clawdia** who profess in their letter of introduction to a distaste for 'clones'. This comment takes on a certain irony after listening to their reasonable – but utterly conventional – brand of synth pop. E&MM's demo department is also well stocked with instrumental demos, showcasing one of three things – sub-Eno ambience, the vocabulary of sounds one synth can make (amazing, isn't it?), or worst of all, the 'I've just discovered the arpeggiator' syndrome. Thankfully, **Richard Chandon** from Cheshire sidesteps all of these pitfalls using nothing more mind-boggling than a Roland Juno 6 and a Korg MS20. He scores plenty of points in my book for realising what so many others seem to forget – that instrumentals are allowed to have tunes too. Surrey's **Nigel Hills** also offers a taste of mainly instrumental music, though he reveals that most of the tracks contained within his demo are songs that have had the vocal line replaced by a synth as a result of their creator's 'appalling' vocal technique. I think he should put the singing back on: the best track here is 'See it for Yourself', the only one to feature Hills' voice which, incidentally, is a good deal better than most this reviewer has to endure. Finally, and as an antidote to all this polite pop, come Hertfordshire's **Maelstrom** who, you may not be surprised to learn, play heavy metal. Like an awful lot of eighties HM, Maelstrom's music does little but cultivate and regurgitate the genre's softer clichés, but in this case, it's all done with a considerable instrumental prowess. The songs are good and the overall effect is a little akin to mid-period Deep Purple, though doubtless Maelstrom will be a little embarrassed to learn that their 'China Run' bears an almost identical chord sequence to the Motors' wimpish pop classic, 'Airport'. ■

Changeant Vogue.

Nigel Hills.

If you've made a demo tape you'd like reviewed in E&MM, send it well-protected (accidents do happen) to On Cassette at the editorial address. Please confine your submission to a maximum length of three songs or ten minutes, and don't forget to include plenty of equipment/recording details as well as a recent photograph if possible.

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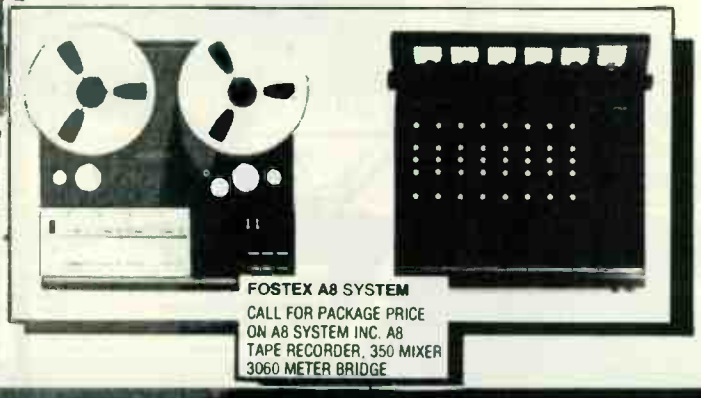

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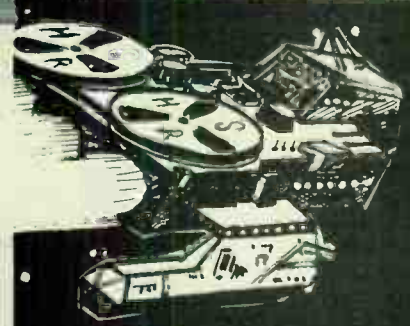

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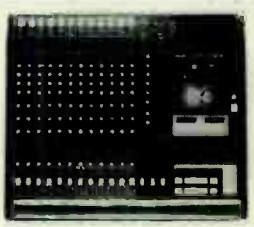

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ON RECORD

The pre-Christmas season is under way, and with it comes a new spate of electronic music albums and singles. *Dan Goldstein*

Depeche Mode
Some Great Reward
Mute STUMM 19

With Europe's singles charts eagerly awaiting each new pop creation and half the female teenage population of Britain at their mercy, Depeche Mode turned the world on its head with their last long-player, the marvellous *Construction Time Again*.

As a follow-up to that record, *Some Great Reward* doesn't have the same musical immediacy – the range covered by its instrumental colours isn't so wide and its arrangements are less varied – but in career terms it's an even more uncompromising statement.

The singles – 'People are People' and 'Master and Servant', the latter still sounding a bit too much like The Cure's 'Let's Go To Bed' for comfort – are both here, accompanied by seven other original compositions, highlights among which are the lovely, lilting 'Lie To Me' and the unfaltering closing opus, 'Blasphemous Rumours', as complete a synthetic arrangement as you're likely to hear in 1984.

Any problems? Why yes.

Martin Gore's lyrics – while undoubtedly brave in their condemnation of matrimonial tradition and its associated flaws – are a little on the twee side for my liking, while there comes a time in every synth record's life when sampled industrial percussion sounds get a little wearing, but in general there can be no denying that Basildon's finest have succeeded in producing yet *another* great wadge of music that's as fresh, as striking, and as confident as their first ever release.

Heaven 17
How Men Are
Virgin V2326

The third long-player from Messrs Gregory, Ware and Marsh since the last two split from the Human League sees Heaven 17 develop the sugary, orchestral sound that was *The Luxury Gap*'s downfall or saving grace, depending on your viewpoint. Lyrically, it's a major tirade against nuclear arms (song titles like 'Flamedown' and 'Five Minutes to Midnight' give the game away, though in general the attack is quite subtle) while instrumentally, the threesome are assisted not only by the abovementioned orchestra but also by Afrodiziak (a trio of female backing singers) and The Phoenix Horns Esquire (whose musical rôle should be obvious).

These various musical ingredients (mixed in with the band's own Fairlight and original Roland System 100) are blended together in an extremely satisfying manner, and the recording quality of *How Men Are* is beyond reproach. However, the album falls down in an area that was once the band's forté, namely that of melody. The first single – 'Sunset Now' – is little more than a 'Let Me Go' re-hash, 'Shame is on the Rocks' is more of the same, while both 'The Fuse' and 'Flamedown' are three minutes each of disorganised chaos with an embarrassing lack of structure.

Still, *How Men Are* as a record is saved by the magnificence of two songs. 'The Skin I'm In' – side two's opener – is a lush, downbeat ballad with a superb 'simulated guitar' (actually, it's that System 100) solo from no less a player than Nick Plytas, while the album's closing epic, 'And That's No Lie' shows off Heaven 17's arranging skill at its best. A haunting Fairlight-vocal intro gives way to the main body of the track (it lasts a shade over two minutes) complete with sparkling orchestral touches, which in turn takes second place to

some magnificent vocal gymnastics from Afrodiziak, thrown into isolation at the record's end.

Normally, you'd be hard-pushed to find an album that had two tracks that were worth spending £5.99 on, but in the case of *How Men Are*, that expenditure would be money well spent.

M+M
Mystery Walk
RCA PL70246

If the name M+M is a mystery to you, perhaps I should explain that they consist of Martha Johnson and Mark Gane, formerly one half of Canadian pop purveyors Martha and the Muffins. *Mystery Walk* is therefore their fifth album release, and it's a record of surprising power and originality.

Johnson is the main songwriter, while the two of them share vocal responsibilities, though in reality neither of them is particularly proficient at executing them. M+M's strength lies in their composition and arrangement, as exemplified by the dreamy ambience of 'Garden in the Sky' and the modern commercialism of 'Come Out and Dance'.

Mystery Walk was recorded by Eno collaborator Daniel Lanois in Toronto, which partly explains the efficient – but nonetheless original – manner in which the album is produced. What it doesn't explain is the lyrical genius within some of M+M's material (try 'Nation of Followers' as a prime example of how to write a brief but poignant bit of social commentary), and the sheer instrumental confidence exuded not only by Gane and Johnson (they both play keyboards, incidentally) but also by the numerous guest players that appear on the album to beef up the sound.

This is a record that improves with every listen, the aforementioned 'Garden in the Sky' eventually emerging as the finest work, with Lanois' brilliant pedal steel guitar solo – highly influenced by one Holger Czukay, I suspect – setting the whole thing off beautifully.

Whichever way you look at it, *Mystery Walk* is a very welcome surprise package.

Best of the Rest

If you read last month's E&MM you'll no doubt be aware of the Greengate DS3, a sound-sampling add-on for the Apple IIe home computer that's been developed by electronic duo **Mainframe**. Now said duo have made a twelve-inch single – 'Into Trouble with the Noise of Art' – recorded at home on a four-track machine with the DS3 as the only sound source. If I tell you that 'Into Trouble . . .' is out on the Ying Yang Yumm label (matrix number YYY001), and that track titles on the EP include 'War', 'Sex' and 'Religion', you should have no doubts as to which well-known artist/producer/former rock journalist combination Mainframe are taking the mickey out of. What you won't know – without actually hearing the thing – is that 'Into Trouble . . .' serves not only as an effective demo record and as a clever and topical take-off but also as an intelligently-crafted work in its own right – far, far more forward-looking than the band's previous vinyl effort, *Tenants of the Lattice Work*. Like I say, there's really no substitute for spending some listening time with the EP yourself, so if you're having trouble securing a copy, try contacting Mainframe themselves at: *24 Missden Crive, Hemel Hempstead, Herts, HP3 8QR*.

Another band who make nonsense of the 'it's no good unless it was recorded at a £150-per-hour studio' school of thought are **Attrition**, whose first album, *The Attrition of Reason*, has just appeared on Third Mind Records (TMLP 06). The band's music – though almost entirely synth-based – has a decidedly baroque feel, quite unlike anything this reviewer has heard in some while. Attrition's lyrical and melodic style is decidedly dark, doomy and mystical, but the most noteworthy thing about this album is that it was recorded on a Tascam 234 Syncaset: the quality is absolutely astonishing. This young three-piece are clearly full of good musical ideas (the fact that they also used an E&MM Spectrum synthesiser in the making of *The Attrition of Reason* is entirely irrelevant, of course), but again, availability may be a problem, so try getting in touch with Third Mind at *20 Spire Avenue, Tankerton, Whitstable, Kent* if all else fails.

Finally, electronic beatsters **Portion Control** have come up with a striking debut LP for Illuminated Records (yes, that lot again) entitled *Step Forward* (JAMS 44). Unfaltering in its rhythmic dedication, it's nonetheless a surprisingly varied album, with softer, more melodic tracks such as 'Mutie' showing the band's compositional versatility. Incidentally, *Simulate Sensual*, a compilation of Portion Control's earlier musical wanderings, has also been released by the band's previous label, In Phaze (PHA 5). For those unfamiliar with the band's work, it certainly helps put PC's present output into a better historical perspective, so get hold of a copy from In Phaze at *Top Floor, 737 Eastern Avenue, Ilford, Essex*. If you're quick, you might just catch the threesome on national tour with Depeche Mode. Which, if my memory serves me correctly, is exactly where we came in. ■

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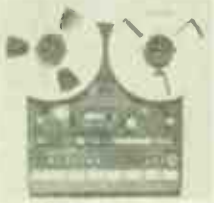

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'BEEN ALONE SO LONG'

Peter Hammill, one of Britain's most consistently innovative songwriters and performers, explains the reasoning behind a recently-released compilation of love songs re-mixed using contemporary instrument technology. *Chris Heath*

Peter Hammill's adventurous musical career began over a decade and a half ago when he formed the first incarnation of Van Der Graaf Generator in 1967 while at Manchester University. The following year he went solo, but so many of the other musicians returned to the fold to appear on the album he subsequently recorded, *Aerosol Grey Machine*, that it was released as Van Der Graaf's debut. Yet after three more albums by what Hammill calls 'the real Van Der Graaf', things slipped apart again.

'I never made a move to go solo: Van Der Graaf stopped. Post *Pawn Hearts* Van Der Graaf didn't exist in our minds, and we were faced with the possibility of making a Van Der Graaf record that wouldn't be us. The concept Van Der Graaf no longer existed.

'Van Der Graaf was a tightrope between experiment, noise, melody, success . . . whatever it was that we called *it*. But the chemistry dissolved; it was becoming just like any other job. I think in any case that groups are for a certain age range – the group has to be the most important thing in your life'.

Nevertheless, he did give Van Der Graaf Generator a further chance towards the end of the seventies, though by that time Hammill was regularly releasing the unorthodox solo tapestries that have sustained his reputation since.

Today

His latest album, *The Love Songs*, is neither a completely new work nor a retrospective compilation in the strict sense of the term, as he explains.

'I began by simply redoing 'Just Good Friends' (off 1983's *Patience*) because I wanted to do a wide-screen version with lots and lots of stuff, rather than just the band. Eighteen months or so before there had been talk of doing a compilation, but generally I don't like compilations as there's usually too much judder, both as regards one's capacities as a songwriter and musician, and also as regards the technology involved. I preferred the idea of a thematic album: in addition to *The Love Songs* I had some other ideas – redoing the 'rock' area, or maybe the 'epic' area – but I'm not sure if I'll follow them up now, because this was very demanding; almost more so than doing a completely new work.

'Just Good Friends' was completely re-recorded last December, but rather than remaking all the other tracks I used the original masters, taking some things out and putting others in. Doing them all as complete remakes would have made it *too* homogeneous – and I like the idea of using the studio as a time machine.

'The only track I didn't put a new vocal on was 'Been Alone So Long'. I tried one but it was too knowing, too aware of the original vocal. So I simply remixed and slightly re-edited it as I discovered an extra bit at the end that hadn't been on the original version.

'I suppose you could say that the album is an attempt to sell me as a singer/songwriter balladeer, but it's not just that. I think that anyone who listened to *The Love Songs* expecting something like a Barry Manilow record might discover unexpected elements of subversion in it. And in any case, MOR is an area to which attention *should* be paid by artists: it reaches an immense amount of people who at the moment are effectively having cotton wool stuffed in their ears. I hope my songs have a bit more genuine heart, of course.'

Yesterday

Peter Hammill's first real contact with music came at the age of eight when he sung in the choir at Beaumont College, Old Windsor, though it was later on, while singing the Hallelujah Chorus, that he claims to have first experienced 'that chill down the spine that music can bring'.

Age 14 and he took up guitar, at first imitating the urban blues style of the likes of Sonny Boy Williamson: he took up the piano much later when he discovered its use as a composing tool in Van Der Graaf Generator.

Now he reckons he can play 'anything with a fretboard and anything with a keyboard' to a greater or lesser extent, and on *The Love Songs* he can be heard playing along with the gradually improving instrumentalist incarnations of old.

'I like the juxtaposition of the different times and capacities – it's like a band splayed out across the years. In fact, I'm now more used to these versions than the originals, though when I listen back I do still expect them to be followed by whatever the next track is on the original album.

'The main instrument I added was the DX7, which I think will be a major instrument for me when I get round to exploring it. Its humanity, especially when you treat it, is a great attraction. I put it through an Ursa Major for echo tracking, and also through cheap Boss flangers and stuff, because I like messing things up! I still really like tape manipulation too, which seems to have gone out the window a bit with the advent of sampling. I do the usual crude things – chopping, reversing, looping, changing tape speed. I actually did a whole cassette, available only by mail order, called *Loops and Reels*, which consisted of dance music using those techniques.'

Personally, I can't help thinking that *The Love Songs* is a poor reflection of the scope of Hammill's work, denying as it does the original context of relatively accessible tracks placed side-by-side amongst more awkwardly ambitious *avant garde* pieces. It was that juxtaposition, after all, that gave Hammill's work so much of its charm. On the other hand, the album is a convincing demonstration of PH's abundant skill as a songwriter.

'It's quite easy to write totally structured songs and it's also quite easy to write totally unstructured ones – the area that interests me is somewhere in the middle. I don't like the classic pop song formula of verse-chorus-verse-chorus-middle bit-chorus. I like a bit of change between each verse, and I suppose I now have my own classic song structure, something like verse-chorus-verse-extra middle bit-chorus-chorus-second middle bit-two bits of the first middle bit slightly warped around. . . . That makes it sound very analytical, I know, but at the moment of writing I don't think of the audience or the structure or anything. When I'm writing I write for myself, and for something to be true for anyone else it has to be true for me first.'

Fifteen years on, Peter Hammill is still making a comfortable living from his music, selling to a 'regrettably diminishing number of people', and living and working at home in the country.

'I still enjoy it. I work nearly all the time on music. . . . I do a bit of gardening. I shut myself in the studio at home, and that's where I really like to be most of all – shut away in the time machine.

'I'm just a workaholic, basically!' ■

BACK ISSUES

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This back issues page supercedes all previous listings, and the contents of each issue are presented in summarised form. See E&MM Feb 83 and Feb 84 for full Indices of 1981/82 and 1983 issues respectively.

1981

MARCH (SOLD OUT) ***Music*** BBC Radiophonic Workshop ***Hardware*** Yamaha SK20 ***Computer Musician (CM)*** Using Microprocessors ***Technology*** Advanced Music Synthesis (VCOs, FM), Spectrum Synth, Hi-Fi Sub-Bass Woofer

APRIL ***Music*** Warren Cann (Ultravox) ***CM*** Using Micros Pt2, Programming Micros ***Technology*** Advanced Music Synthesis (PWM), Spectrum Synth Pt2, Syntom I

MAY ***Music*** Tim Souster ***CM*** Apple Music System, Using Micros Pt3 ***Technology*** Spectrum Synth Pt3, Noise Reduction Unit

JUNE ***Music*** David Vorhaus ***Hardware*** Fairlight CMI, Yamaha PS20 ***CM*** Using Micros Pt4 ***Technology*** Mosfet Amp

JULY (SOLD OUT) ***Music*** Duncan Mackay ***Hardware*** PPG Wave 2 ***CM*** Using Micros Pt5

AUGUST ***Music*** Irmin Schmidt ***Hardware*** Resynator Synth, Casio VL1 ***Technology*** Harmonics, PA Signal Processor Pt1

SEPTEMBER (SOLD OUT) ***Music*** Kraftwerk ***Hardware*** Linn LM1 ***CM*** Using Micros Pt6 ***Technology*** Noise Gate, PA Signal Processor Pt2

OCTOBER ***CM*** Using Micros Pt7 ***Technology*** Harmony Generator, Effects Link FX1, dbx Explained

NOVEMBER ***Music*** Landscape ***Hardware*** Casio MT30, Roland GR300 and CPE800 ***CM*** Using Micros Pt8 ***Technology*** Speech Synthesis, EMT (Phasing), Auto Swell Pedal

DECEMBER (SOLD OUT) ***Music*** Rick Wakeman, OMD ***Hardware*** Yamaha CS70M, Vox Custom Bass & Custom 25, Roland CR5000 & CR8000, Elka-Orla X50, Vox AC30, aphaSyntauri, Fostex 250, ElectroVoice Mics ***Technology*** Synclock

1982

JANUARY ***Music*** Tangerine Dream ***Hardware*** Casio 701, Teisco SX400, Aria TS400, MCS Percussion Computer, Soundchaser, Beyer Mics ***Technology*** EMT (Flanging), Spectrum Synth Update Pt1, Volume Pedal

FEBRUARY ***Music*** Ike Isaacs ***Hardware*** Korg Trident, AKG Mics, Roland TR606, Fostex A8, Tokai ST50 and PB80 ***CM*** PolySequencing on ZX81 ***Technology*** Yamaha GS1&2 (FM) Explained, Digital Delay Line Pt1, Spectrum Synth Update Pt2

MARCH (SOLD OUT) ***Music*** Klaus Schulze, Robert Schröder, Kraftwerk 'Computer World' Music ***Hardware*** Firstman SQ01, SCI Pro One, Tascam 124AV, Shure Mics, Hamer Prototype ***Technology*** Power 200 Speakers, Digital Delay Line Pt2

APRIL ***Music*** Martin Rushent (Human League) ***Hardware*** Korg MonoPoly, Fostex 350, Roland TB303 ***Technology*** MF1 Sync Unit, MultiReverb

MAY ***Music*** Holger Czukay, Depeche Mode ***Hardware*** Moog Source & Rogue, Calrec Soundfield Mic ***Technology*** Soft Distortion, Quadramix

JUNE ***Music*** Jean-Michel Jarre, Classix Nouveaux ***Hardware*** Emulator, Carlsbro Minifex ***Technology*** Panolo, Multisplit

JULY ***Music*** Ronny with Warren Cann & Hans Zimmer, J-M Jarre 'Magnetic Fields' Music ***Hardware*** Roland Juno 6, Peavey Heritage, Steinberger Bass ***Technology*** Universal Trigger Interface

AUGUST ***Music*** Kitaro, Jon Lord ***Hardware*** Synergy, Korg Polysix, Tascam M244 Portastudio, Shergold Modulator 12-string, Yamaha Pro-FX ***Technology*** 8201 Line Mixer, Guitar Buddy practice amp

SEPTEMBER (SOLD OUT) ***Music*** Richard Pinhas ***Hardware*** Yamaha CS01, Jen SX1000, Casio 1000P, Fender Squier, Carlsbro Stingray, Pearl Effectors ***Technology*** Comp-Lim, Twinpak

OCTOBER (SOLD OUT) ***Music*** Kate Bush, Ken Freeman ***Hardware*** Fender Vintage Series, Rhodes Chroma, Kay Memory Rhythm ***Technology*** EMT (Performance Controls), ElectroMix 842 Pt1

NOVEMBER ***Music*** Patrick Moraz, Robert Moog, Bill Nelson ***Hardware*** Yamaha PC100, Technics SXK200, Casio MT70, Hohner P100, JVC KB500, Gibson Firebird 2, Alligator AT150, AHB 1221 Mixer ***Technology*** ElectroMix 842 Pt2, Sweep Equaliser

DECEMBER ***Music*** Cliff Richard ***Hardware*** Elka Synthex, Crumar Stratus, Tokai Basses, Shure PE Mics, The Kit ***Technology*** Transpozer Pt1, Canjak

1983

JANUARY ***Music*** Richard Barbieri (Japan) ***Hardware*** Westone Bass, BGW 750C Amp, Korg EPS1, Clef BandBox, Zildjian Cymbals ***Technology*** Synblo, Transpozer Pt2

FEBRUARY ***Music*** Isao Tomita, Human League ***Hardware*** Novatron, LinnDrum, Simmons SDS6, Klone Kit, Movement Drum Computer 2, Korg KPR77, MemoryMoog, Synclavier II, Powertran Polysynth, Vigier Guitars, Pearl Mics ***Technology*** Synbal, Caltune

MARCH ***Music*** Klaus Schulze, Michael Karoli, Francis Monkman, Bernard Xolotl, Chris Franke ***Hardware*** RSF Kobol Expander, Korg Poly 61, Aria Mics, BGW 7000 Amp, Ibanez Pedals, Tokai Flying V ***Technology*** Shaper, 842 Mixer Meter Bridge

APRIL ***Music*** Naked Eyes, Gabor Presser ***Hardware*** Casio 7000, SCI Prophet 600, Chroma/Apple Interface, Eko Bass pedals, Vox Guitars ***Technology*** Syntom II

MAY ***Music*** Keith Emerson ***Hardware*** Roland MC202, Fostex X15, Carlsbro Cobra 90 Kbd Combo, M&A K1/B Kit, Echo Unit Supplement (13 reviews, inc. Roland SDE2000, Fostex 3050, Korg SDD3000) ***Technology*** Introducing the MIDI, MicroMIDI, Active Speaker

JUNE ***Music*** Steve Hillage, Arthur Brown ***Hardware*** Synclavier II, Synton Syrinx, Emu Drumulator, Vestafire Dual Flanger, Aria AD05 Delay, Suzuki Mics, Clarion and Cutec four-tracks ***Technology*** OMDAC

JULY ***Music*** Marillion, Hans Zimmer ***Hardware*** Trident VFM Mixer, Kawai SX210, Aria U60 Deluxe BBS, Deanvard VA30K Amp, MXR Omni FX, Milab Mics ***Technology*** Yamaha DX synthesisers, Ditigal Signal Processing Pt1, Tap Tempo

AUGUST ***Music*** Bill Nelson, Hubert Bognermayr, Barclay James Harvest ***Hardware*** Roland JX3P/PG200, OSCar, 360 Systems Digital Kbd, MPC Music Percussion Computer, Yamaha SG200, Fender 100W Stage Lead, Frontline FX ***Technology*** Digital Signal Processing Pt2

SEPTEMBER (SOLD OUT) ***Music*** Peter Vettese ***Hardware*** Prophet T8, Oberheim DX, SCI Pro-FX 500, Rickenbacker 360 12-string & TR75 GT Combo ***Computer Musician (CM)*** Music Composition Languages Pt1, Sounding Out the Micro Pt1 ***Technology*** Which Synth Guide, Synclap

OCTOBER (SOLD OUT) ***Music*** John Miles, Andrew Powell ***Hardware*** Yamaha DX1, OctavePlateau Voyetra 8, Siel Opera 6, MXR 185 Drum Computer, Ross Pedals, Fender Elite Precision Bass 1, Steinberger six-string ***CM*** Sounding Out the Micro Pt2, Speech Synthesis, ***Technology*** Digital Signal Processing Pt3, Mains Distribution Board

NOVEMBER ***Music*** Tony Banks, John Foxx ***Hardware*** Seiko Digital Keyboards, Eko EM10, UC1 Sequencer for SCI Pro One, Doctor Click, Klone Kit 2, Ibanez HD1000, Korg KMX8 Mixer, Ibanez RS315SC Guitar ***CM*** Music Composition Languages Pt2, Software Envelope Generator (ZX Spectrum), MUZIX 81 (ZX81) ***Technology*** Digital Signal Processing Pt4

DECEMBER (SOLD OUT) ***Music*** Gary Numan, Psychic TV, Philip Glass ***Hardware*** Prophet T8, Yamaha PC1000, Carlsbro AD1 Echo, Personal Keyboard Guide ***CM*** Decillionix (sound sampling for Apple) ***Technology*** Valve Driver

1984

JANUARY ***Music*** Simple Minds, Saga, Hawkwind, Dave Hewson ***Hardware*** Oberheim OB8, Vigier Bass, Siel Cruise, Ibanez DM2000, The Kit + Accessories ***Technology*** Using Sequencers, Electronic Metronome

FEBRUARY ***Music*** Daniel Miller, China Crisis, Don Airey ***Hardware*** Korg Poly 800, Siel PX, Yamaha PS55, Eko EM12, Boss DE200, Roland Chorus Cube 60, Washburn Bantam Bass, Carlsbro Marlin, Dr Böhm Digital Drums ***CM*** Mainframe ***Technology*** Drumatix Mods, Voltage-Controlled Clock

MARCH ***Music*** Vince Clarke & Eric Radcliffe, Blancmange ***Hardware*** SCI SixTrak, Roland SDE3000, Roland System 100M, Electronic Percussion Guide (nine reviews inc. SCI Drumtraks, Boss DR110, AHB Inpulse One, Hammond DPM48) ***CM*** Music Composition Languages Pt3 ***Technology*** S-trigger Converter, Lead Tester

APRIL (SOLD OUT) ***Music*** Fad Gadget, Vic Emerson (Sad Café) ***Hardware*** Simmons SDS7 & SDS8, Jupiter 6, Roland TR909 & MSQ700, Yamaha PS Kbds, Crumar Composer, Ibanez UE400 & UE405, Klone Dual Percussion Synth, Vox White Shadow Bass ***CM*** Gentle Art of Transcription Pt1, Ins & Outs of Digital Design ***Technology*** Understanding the DX7 Pt1, Syndrom Pt1, Bass Pedal Synth

MAY ***Music*** Wang Chung ***Hardware*** PPG Wave 2.3 & Waveterm, Roland Juno 106, Roland JSQ60, Casio 310, M&A Electronic Drums, Dynacord PDD14 ***CM*** PDSG Pt1, ***Technology*** Understanding the DX7 Pt2, String Damper ***MIDI Supplement Pt1*** Specification, Theory & Practice, Product Guide, MIDI By Numbers (Steve Levine)

JUNE ***Music*** OMD ***Hardware*** Roland GR700/G707, SynthAxe, Siel Expander, SCI Model 64 Sequencer, MFB512 Digital Drum m/c, Jen Musipack 1.0, Boss DD2 Delay Pedal ***CM*** Gentle Art of Transcription Pt2, PDSG Pt2 ***Technology*** Understanding the DX7 Pt3, Syndrom Pt2, Multiwave LFO ***MIDI Supplement Pt2*** Inside MIDI, MIDI & The Micro, BeeBMIDI Interface Pt1

JULY ***Music*** Human League, Steve Jolliffe, Jade Warrior ***Hardware*** Yamaha DX9, Korg Super Section, Yamaha MK100, Microsound 64 Kbd, TED Digisound, Ibanez DM1100 DDL ***CM*** JMS MIDI Software, PDSG Pt3 ***Technology*** Spectrum MIDI (SCI SixTrak and DX7 Patch Dump), Understanding the DX7 Pt4, RackPack, BeeBMIDI Pt2

AUGUST ***Music*** Rusty Egan (Visage), Cocteau Twins, Hans-Jaochim Roedelius ***Hardware*** Synclavier Update, Technics SXK250, Yamaha PF10 & PF15, Siel Piano Quattro & PX jr, Roland HP300, HP400, PB300 & PR800, Garfield Electronics MiniDoc, Electro Harmonix Instant Replay & Super Replay ***CM*** EMR BBC B MIDI Software Fairlight Explained Pt1, ***Technology*** Understanding the DX7 Pt5, BeeBMIDI Pt3, Syndrom Pt3, Miniblo, SynthMix Pt1

SEPTEMBER ***Music*** Thomas Leer, Chris & Cosey ***Hardware*** Oberheim Xpander, Korg EX800 & RK100, Digi-Atom 4800, Cutec MX1210, Microlink ML10 System, Roland MPU401, Sycologic AMI & MX1 ***CM*** OMDAC Update, Passport MIDI/4 Software, Fairlight Explained Pt2, Steptime Composition on the SCI Model 64 ***Technology*** SynthMix Pt2, Dual VCLFO, Understanding the DX7 Pt6

OCTOBER ***Music*** Ultravox ***Hardware*** Roland Mother Keyboard System, 360 Systems Update, Yamaha PS6100, DDrums, Yamaha RX Series, Korg DM220, Tama Techstar Electronic Kit, Frazer Wyatt Speakers ***CM*** Yamaha CX5M & Software, Greengate DS3 Sampler, PDSG Pt4, Fairlight Explained Pt3, OMDAC Update 2 ***Technology*** Powertran MCS1 Pt1, Understanding the DX7 Pt7.

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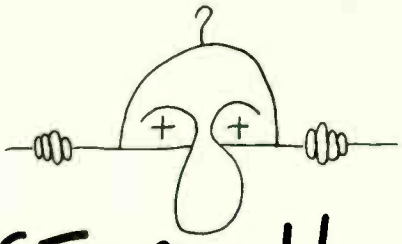

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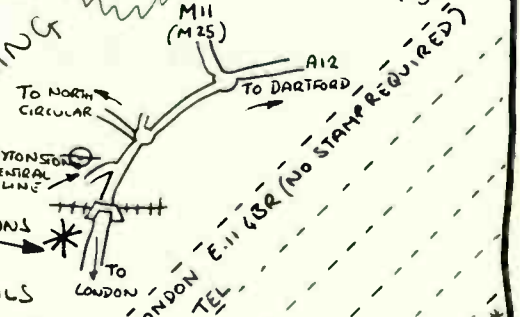

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Life is a Cabaret

A major force in Britain's underground electronic music scene for the best part of ten years, Cabaret Voltaire's music is now more forward-looking, more refreshing, and more accessible than it has ever been. Here the Sheffield duo explain how it's done. *Dan Goldstein*

Back in the early seventies, when 'progressive' rock had largely stopped progressing and Britain's pop charts had fallen victim to the likes of Gary Glitter and the Bay City Rollers, a few groups of enlightened individuals began experimenting with sound synthesis and how it could be applied to music that was essentially improvised in nature. Most of these – bands such as Can, Neu, Faust and Kraftwerk – were based in Germany, but their influence was felt by a few artists working in the UK, and three of them, Richard Kirk, Stephen Mallinder and Chris Watson, formed Cabaret Voltaire in Sheffield 'sometime around 1972 to 73.'

Watson left the band some time ago to pursue a career in television (though he maintains an interest in music-making through his participation in The Hafler Trio, a group of uncompromising experimenters currently engaged in challenging widely-accepted theories of sound), but Kirk (the technician) and Mallinder (the vocalist) have continued their activities as a duo, pursuing a wide variety of musical avenues and releasing a bewildering array of records on labels big and small.

'It all began in Chris' loft with the three of us and an assortment of tape recorders', Kirk recalls. 'Gradually we went from cutting up bits of tape to buying our own instruments such as cheap electric guitars and wind instruments. Then Chris sent away for a Dewtron synthesiser kit and built it up himself, and we used that mainly as a processing device because it had no keyboard of its own. If we had anything, we'd put it through the synth.

'It was really just a series of coincidences that made us do what we did in the early days. I suppose our use of tapes came from being interested in people like Eno. He was the first person to incorporate the use of tape into a conventional band line-up, and we were very much influenced by his idea that anyone could make music, regardless of whether or not they were a trained musician. Using tapes was an easy and inexpensive way of getting into electronic music. Often we'd go out into the street and record sounds, because once you've got a sound on tape, you can do all sorts of things with it – cut it up, play it backwards, anything.'

The advent of the Dewtron caused the Cabs to move away from the tape recorder as a prime sound source, but tape techniques have continued to play a major rôle in their musical development. Even now, with digital sound sampling more commonplace than ever, Kirk still sees a place for the art of tape manipulation.

'Yes. Even in 1984, I think two tape recorders are worth more than a Fairlight in terms of their creative potential: you only have to look at what people like Holger Czukay are doing to show you that. In some ways, even with all this new technology, it's the old ideas that are the best. You can look at the Fairlight and see that it's an easy way of doing what you can do with tape technology, and in many ways I see myself now as being a scholar of tape techniques. The potential of the tape machine is really only limited by your own imagination.'

Still, you can't go on making music with an Akai 4000DS forever, and by the time punk had begun to make its mark and the Cabs had made the move from loft studio to concert hall, they'd built up an awesome variety of musical hardware, most of it fairly rudimentary and very little of what could be described as 'professional' standard. Richard Kirk again.

'I've got a whole history of *dreadful* drum machines that we've been through over the years – a Farfisa, a Selmer, some sort of combo that's got a drum machine built into the top, an Electro-Harmonix that's only got a separate output for the bass drum, all sorts of rubbish.

'When we started off as a band, we definitely had a fascination for cheap equipment like beaten-up old organs and drum machines. I think it was probably a result of our interest in sixties psychedelic music and bands like the Velvet Underground, who used really cheap and nasty guitars and tacky drum machines. Also, when you look back on it, there actually wasn't much in the way of good equipment *available* at that time – or at least, not that we could afford.'

Studio

Expense, it seems, was the major hurdle facing Cabaret Voltaire when the band's fascination for electronic instruments began to take on unmanageable proportions. Things started looking up, however, as the Cabs' live appearances resulted in the building of a small but dedicated cult following, which by 1978 was sufficient to encourage Rough Trade (themselves one of the many recipients of CV demo tapes) that it was worth dedicating the band's individual brand of improvisational music to vinyl. And in the wake of that first

release and several subsequent ones [on both RT and fellow-independents Factory), the band moved musical operations to their present location – Western Works, a large Victorian building not a stone's throw from Sheffield University that looks as though it might once have been a factory, a mill, a warehouse and prison all at the same time. Now it's a modestly-equipped but curiously comfortable 16-track recording studio, complete with a 'live' performance area containing just about every piece of musical gear the band have accumulated during their long career. They don't throw much away.

The control room features a multitrack machine and mixing console courtesy of Soundcraft, the ubiquitous Revox for mastering, and a selection of rack-mounting shapers and effects. It hasn't always been like this, however, as Richard Kirk explains.

'When we first moved in here – which was just about when the first record was coming out – we had a Revox, a six-channel Sony mixer, a couple of (very) cheap guitars, plus our second synth – an EMS Synthi Hi-Fli. All right, it *does* look a bit like a toilet seat, but it really is an amazing instrument: there are some effects you can get by putting other instruments through it that are just impossible with today's synths. Right from the start, we made a conscious decision that our music would never become entirely electronic, which is probably one reason why in the early days, we used a synth not as the basis of a sound but as a treatment for other instruments. It used to annoy us that people always referred to us as a synthesiser band. To begin with, I'd say we were actually anti-keyboards; we were much more concerned with using a synth to process things.

'To be honest, I don't think our music will ever be totally electronic: there'll always be guitars and wind instruments and percussion. I've just bought an old AKS synth in a suitcase, which I like because it hasn't got any presets and I can muck about with it for days and *still* not exhaust all its possibilities. It's strange to think that EMS stuff was once considered the bee's knees in synthesisers; they've been superceded by so many other things.

'In some ways it's good to get back to some of yesterday's synths – they make you use your imagination a lot more. And in the early days I suppose that's all we had – not much equipment but a lot of imagination.'

That imagination manifested itself in a series of fresh, invigorating record releases that merged drum machine patterns, improvised guitar and synth parts, taped sounds and vocals treated 'to sound like they were being spoken by a Dalek.'

Unlike many electronic acts, the Cabs always considered playing live to be an important part of their work, and their live performances were more rewarding still: a collage of slides and/or videos would more often than not be used to accompany music that was even more improvised than its recorded equivalent. Kirk agrees that the band's live work was more uncompromising.

'We never pandered to an audience in the sense of giving them what they knew or what they were expecting to hear. Our live music has always been a lot looser in its structure, and we played some concerts that were made up of an entirely new set of songs or of completely improvised music, and people have still enjoyed it.'

Evolution

Recently, however, Cabaret Voltaire's output has become more accessible, both live and on record. Random synth noises have given way to interweaving sequencer parts and polysynth melodies, the drum machine patterns have become clearer and better defined, and now, just to make a change, the eccentric treatments have been removed from Mallinder's vocals. At last, CV fans can hear what 'Mal' is talking about, and he's glad of the fact.

'Some time ago we realised the danger of becoming too esoteric. We put a lot of effort into our work but it was all a bit wasteful because we were still only reaching a very limited audience: things were getting too self-indulgent.

'As a reaction to that, I suppose we've more or less slipped into giving our music more structure, and it's paid off – there are more people listening to our stuff than ever. It means that we've given, say, our use of tapes more power by putting it into a more accessible structure.'

But if you think the band's most recent output – their first album for Virgin, *Crackdown*, and a new one yet to be titled – has been consciously crafted to comply with a more commercial formula, you'd be wrong. True, it does sound as if Kirk and Mallinder are writing verses and choruses, but any songs of this structure that *are* recorded occur entirely by accident, it seems. Mal illuminates.

'We have given our music more of a conventional structure, but when I listen to a record I can never tell when a chorus is going to come in or what's going to come next. When we're writing something, we just add lines and different bits of melody where *we* think they ought to go, without paying attention to whether or not that's where musical convention says they should be. That's why I don't think either of us see ourselves as musicians, because we haven't really got any idea what musical conventions are.'

Like his colleague, Richard Kirk sees the band's change in musical style as a perfectly natural – though nonetheless quite dramatic – process.

'Put it like this, our music's got tunes in it now, and it never used to have in the past! That's a bit of a sweeping statement, but it is more or less the case. I think it's come about partly because we want more people to hear what we're doing, and partly because the instruments we've got now have enabled us to write and play things easier – a programmable drum machine is a good example of that.'

So changes in technology have been just as important as changes in attitude?

"Yes. For instance, we've always been fascinated by repetition and rhythm in music. It's always been a factor underlying what we do, and as we've got hold of better equipment, we've been able to write our own drum patterns and bring them higher up in the mix. Our main drum machine now is the MXR Drum Computer, which I personally prefer to the Linn because the sounds are a lot sharper and clearer, and as a result of getting that, the rhythmic side has been brought to the fore as the available technology has progressed.'

Kirk also makes use of a Roland TR808 rhythm composer and a TB303 Bass Line from the same company, though curiously, the two machines don't work as well together as they should. . .

'They just won't interface properly. The way you're supposed to work it is to build up a pattern on the Bass Line first and then construct a rhythm around that, which I don't particularly like because I prefer to work the other way. If we decide we're going to do a rhythm-based song, we always start with the drum pattern first, layering the other instrumental parts on top of that on the multitrack machine.'

Recording

The studio, it appears, is the other technological influence governing CV's writing process. Stephen Mallinder says they couldn't live without it.

'We use the studio as a writing tool, and we've developed a sort of layering process using it. In the early days we might have used a simple tape loop to give a track a nucleus or structure, and now that same rôle is performed by the drum machines. We tend to work from rhythm patterns as the backbone of the piece. ▷

Even if we've got a melodic idea in our heads before we start, we'll still begin with an acoustic drummer or a drum machine. Once that's done, we'll layer the other parts on top, leaving a lot of it to chance elements because we still rely to a large extent on improvisation when we're recording. Once that process is complete, we introduce some sort of structure by dropping parts in and cutting them out again at the mix-down stage.'

Does having more tracks to work with result in a better finished product?

'Well, the music is certainly more accessible and better arranged than it used to be. In some ways, having 16 tracks makes things a lot easier because it eliminates most of the bouncing-down, but on the other hand, the more tracks you have, the more options you have, so it can make the recording process longer as well.'

Although Western Works remains the nerve centre of the Cabs' writing activities, when it comes to making an album, the duo invariably move operations to a professional 24-track facility when the time has come for final overdubs and mixing-down. Kirk explains the rationale behind this somewhat eccentric procedure.

'For me it's very important to have access to good equipment. Unless you're playing rock 'n' roll or some form of music that doesn't involve much in the way of technology, you've got to have good gear to make the best of your ideas. That's really why we like to do the last stage of recording and mixing at state-of-the-art studios, because they give us access to a wider range of rack equipment as well as providing more tracks to play around with, of course.

'For the latest album we did the basic tracks in Sheffield and a lot of the overdubbing at Sarm in London, which proved ridiculously expensive. The only reason we went there was that it was the only studio that offered a Solid State Logic desk at short notice: afterwards we did the last bit of mixing at the Townhouse, and in general I think I preferred the atmosphere and the people there.

'We hired a few instruments during the recording, such as a DX7 and a Fairlight. When we hired the DX7 out, I took the manual home for a few days and understood about half of it, which was enough to get me editing the factory sounds. I'm sure I didn't know why I was doing what I was doing, but I got some good sounds out of it just the same. I'd really like to have a DX7 in the studio all the time, because the principles behind it are so different from those behind any other synth.

'With the Fairlight we didn't even bother trying to work our way round it: we just hired a programmer when we hired the machine. Basically, I knew what I wanted from it and it saved a lot of time, having someone who could get what I asked him for almost instantly. I had a lot of sounds recorded on quarter-inch tape that I wanted to play from a keyboard, so the operator just sampled them all: we sampled Mal's voice and I played that from the keyboard too, which was interesting.'

In the interests of extending the range of their musical activities, Cabaret Voltaire have worked on and off with a number of other musicians, and for the latest album and its mildly wonderful 45rpm excerpt, 'Sensoria', they enlisted the help of percussionist Mark Tattersall, Tabla player Eric Random and drummer Roger Quail. Mal gives the reasons for their inclusion.

'It comes back to our desire not to make things totally electronic. The most interesting music is always a hybrid of different influences and backgrounds, and I think the blend of acoustic and electronic percussion is a lot more intriguing than the use of something totally electronic: we use percussion players to inject an acoustic feel into the electronic pulse. We feel that they're more likely to be sympathetic to what we're doing than session musicians. If we want something new melodically – a particular sound colour that appeals to us – then we'll get that sound from something like a Fairlight or a DX7 and play it ourselves. That way we can have the range of sounds available to a session player but still play them in our own style.'

Influences

The addition of both more advanced musical machinery and extra percussionists has given much of the Cabs' output a distinctly dance-orientated flavour: a far cry from the unwieldy improvisation of yesteryear. An obvious question came to mind. Was the progression an entirely internal one, or were Kirk and Mallinder influenced by musical trends outside their Sheffield base?

'It's a strange state of affairs', Kirk reflects. 'If you look at the electro stuff coming out of New York at the moment, it's obviously been influenced by the likes of Kraftwerk *via* the English underground – the likes of us. Black music has always been very forward-looking: it's always embraced new technology as it's become available, and now that music has come back and influenced us in turn – it's like a sort of cross-fertilisation of ideas.

'Some of the things we've heard that have come out of America – like Praxis and Malcolm X – are some of the most powerful pieces of rhythmic music there's ever been. What's interesting is that it's getting more and more minimal: we've got to the stage now where they've pared it down to just rhythm box and vocals, with maybe a synth line with a delay on it here and there and a bit of Emulator or tapes. On the one hand it's great that music can be so minimal and yet so powerful, but on the other hand, I don't think our music will ever be as stripped down as that.'

The New York scene hasn't passed Stephen Mallinder by, either.

'It's been a big influence on me. I like the rhythmic structures they're using – they're quite similar to what we do – and the notion of combining completely alien source material with a well-established dance structure. It's not the only rhythmic thing, though. African and aboriginal rhythms have also been a strong influence on me, though I'm equally interested in some of the atmospheres and sound colours they use: in general I find I'm more susceptible to the sounds of instruments rather than any musical structure.'

The Future

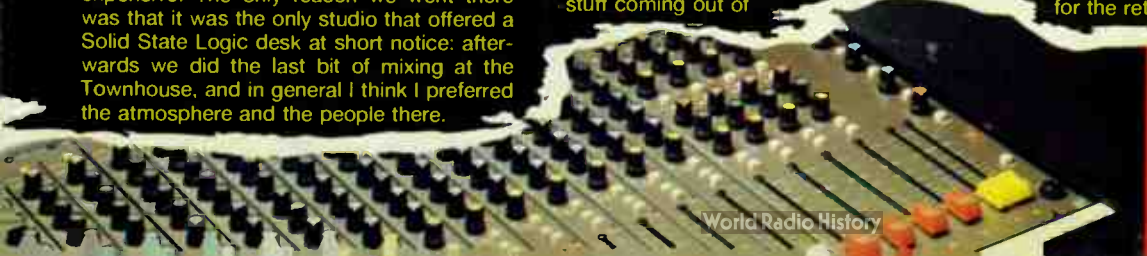
The move to a major record label has increased Cabaret Voltaire's UK audience by at least 100%, as well as taking their music to territories the world over. Record company advances have also proved useful in allowing the duo to invest in some more up-to-date hardware (such as the MXR drum machine and recording gear already mentioned, plus a Roland Juno 60 that now acts as the band's main keyboard instrument), but as is so often the case, the current equipment situation isn't as good as it might be.

Richard Kirk has set his heart on an Emulator II ('now all I need is someone to give me the money for one') while both Cabs are anxious to upgrade their recording set-up to 24-track, thereby sidestepping the need to visit other recording studios and enhancing the facilities at the band's continuous disposal.

On an artistic level, the duo are hoping to extend their promotional video work to the making of a full-length feature film, though again, finances are the major stumbling block.

It's nice of you to come up here', Kirk comments as we leave the studio in readiness for the return trip to London. 'Until we get all the gear we want, we need all the coverage we can get.'

At least he's honest about it. ■



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ON STAGE

This year's UK Electronica festival was even more rewarding than the 1983 event – for exhibitors, musicians and public alike. *Tony Mills*

Dr Phil

The move from Milton Keynes to Sheffield did this year's UK Electronica Festival of synthesiser music no harm at all. The fans were still there, the musicians enjoyed themselves, and the atmosphere – if a little lacking in last year's breathless excitement – was as friendly and positive as ever.

The reasons for the move to South Yorkshire included use of the wonderful Octagon Centre in which the evening concerts, featuring Spanish synthesists Neuronium supported by Mark Shreeve, were held. Daytime acts had the use of a smaller hall with few facilities for visuals or lighting effects, and the fact that every act found its enthusiastic fans says much for the variety and quality of the music played.

Doors opened at 11am with an immediate flood of punters to the Lotus Records stand, which was packed as ever with albums, tapes and rare items such as the limited edition UK Electronica 1984 T-shirt. Other stands included Pulse (with albums by Jade Warrior, Richard Pinhas and White Noise), Haze (the Sheffield rock band who filled in at short notice for Jade Warrior, who unfortunately couldn't appear), Integrated Circuit Records and Tapes, Mirage (tapes from Fortuna, Carl Matthews, and many others), Chris and Cosey's CTI, Hawkfan, and of course organisers INKEY$ with the Klaus Schulze/IC fan club. E&MM were also out in force, selling back issues of the magazine and its sister publications (*Home Studio Recording* and *Guitarist*), thrusting T-shirts into the arms of unsuspecting passers-by, and relieving the Student Union bar of excess quantities of John Smith's Yorkshire Bitter. . .

Steve Jolliffe

The Day

Daytime concerts were opened by Frenchman Dr Phil, a Hawkwind follower who used synths, guitar, sequencers and drum machines to produce a selection of songs and tunes ranging from the cosmic Tim Blake style to a heavier rock feel – all completely unassisted by backing tapes. Next up were industrialists Konstruktivits, who layered tapes, a Casio, synths and distorted vocals to provide a sound collage admired by many for its power and dynamism.

During the short break the audience were able to wander around displays from Computer Music Studios (showing the Voyetra and alphaSyntauri systems and Mainframe's Apple-based DS3 polyphonic sampling system), Mensana with their Spectrum and BBC-based MIDI sequencer, and the local Carlsbro branch with a wide selection of synths, sequencers and drum machines.

The next concerts were by Carl Matthews, who made his first ever live appearance with a gentle set of floating synth/sequencer music which went down well after the heavier first part; by Haze, who played progressive rock from their Cellar Tapes and album *C'Est La Vie*; and by Tamarisk, another progressive group who merged synths, guitars and drums in a very satisfying package.

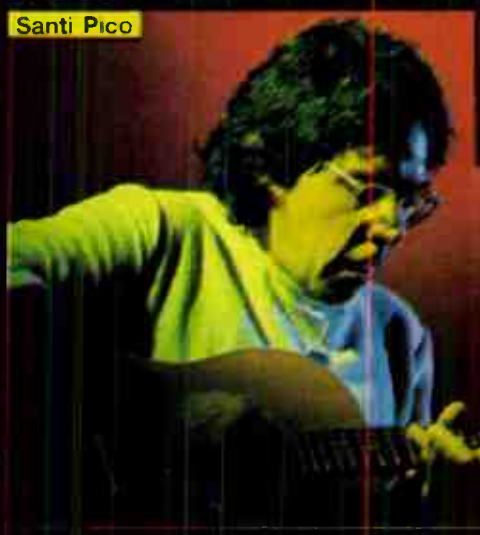
Paul Nagle then took the stage to a welcome whose warmth was probably boosted by his bad luck on the technical side at last year's event. This time there were no such accidents – a very accomplished set using his newly-acquired DX7 showed the possibilities of his gently rhythmic style to the full, with able accompaniment by keyboardist Michael and flautist Kathleen.

Acoustic instruments seemed to be making a big contribution this year, from flutes to doubleneck guitars to 'real' drum kits, so it came as no surprise when ex-Tangerine Dream stalwart Steve Jolliffe took to the stage with a Revox, DX7 MIDI'd to a JX3P *and* a stand full of saxes and flutes.

Jolliffe's set was undoubtedly one of the highlights of the day, and

Martz, Shreeve and Shreeve

received sufficient audience enthusiasm to force the man back for three encores. Those who missed his Journeys *Out Of The Body* album will last have heard SJ on the Dream's *Cyclone*, and in many ways his use of voice and wind instruments over churning sequences, huge string chords and Eastern backdrops harked back more to the *Cyclone* days than to Journeys. In fact, the Sheffield material will form part of his next album, *Death of a Japanese Butterfly*, which now has an expectant audience awaiting its release.



Santi Pico

Michel Huygen

The Evening

The end of the daytime acts led to a wait of about an hour before the evening concerts, mainly due to problems with Neuronium's light show and with the recording facilities in the Octagon. For the rest of the proceedings there was nothing but praise for the sound crews from the University's Ents committee who did stirling work all day: by the time Mark Shreeve took the stage they deserved the two hours' rest they were to snatch before cracking everything down again.

Mark was joined by Julian Shreeve, American madman Jasun Martz and the sepulchral figure of Sue Gresty, who got the proceedings off to a sinister start with a little recitation from Steven King's 'The Stand'. A massive thunderclap took us into 'Flagg', which went down well last year and which had been rearranged to make full use of Shreeve's DX7, Jupiter 6 and MSQ700 MIDI system. Then straight into a new piece which combined some breezy sequencer lines with Shreeve's typical *Sturm und Drang* approach, and then all hell was let loose in the form of Jasun Martz striding around the stage with a massively-fuzzed guitar and a fine disregard for the conventions of tuning. In fact, there was a fair bit of guitar work, and before the set was over Julian Shreeve's Juno 106 (loaned for the occasion by Roland UK) was battling against two of the things as Mark too struggled under a guitar strap and slid into a few well-timed breaks. As for the end, suffice it to say that the *Assassin* concept from Shreeve's Jive album of the same name had a little visual help, but you really had to be there. . . .

Neuronium's set was a little gentler at first, with slides casting images of both the macrocosmic and microcosmic over the heads of synth player Michel Huygen and guitarist Santi Pico, but after five minutes of slow chord work in a piece composed especially for the show, the sequencers started pulsing, a TR909 opened up its output channels and Pico was gyrating on his stool as if caught in an earth tremor. Huygen's performance on Jupiter 6, DX7 and Moog Prodigy became hysterical (in a very refined way – he doesn't move much on stage!) and heads started banging amongst sections of the audience across the hall.

After another slow piece, the duo launched into 'Torquemada' from their recent Jive album *Heritage*, and Pico switched to acoustic guitar to lay some Knopfleresque licks over Huygen's synths and sequencers.

In fact, most of the duo's set came from *Heritage*, and a cleverly-constructed programme built up tension and then defused it again in just the right proportions. Finally, the pitch-benders came out, Huygen began tearing his lead lines out over a six-octave bend range and Pico positively *attacked* his much-abused Les Paul and guitar synth. It's difficult to believe two men could make so much noise: not a backing tape in sight and an almost perfect blend between guitar and synthesisers.

A slow encore piece left the audience wanting yet more, which duly came in the form of a modified 'Torquemada', which I reckon deserves to be a single in its own right, quite apart from Huygen's solo 12", 'Capturing Holograms'. A better combination of support and lead acts would be hard to imagine – who could possibly do it next year?

On the subject of UK Electronica '85, organisers INKEY$ already have some idea of the programme and are attempting to find a London venue, costs permitting, for the sake of easier communication, transport and so on. In the meantime, those who missed this year's show will shortly be able to regale themselves with a cassette of highlights, a video, and a booklet (cufflinks, computer game, scarf . . . ?) courtesy of INKEY$ and Lotus. Oh and by the way, if anybody wants a T-shirt. . . . ■

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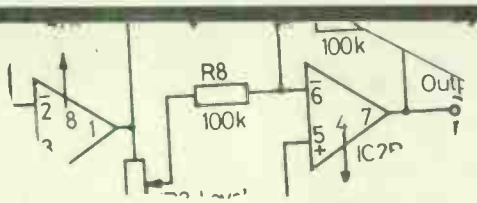


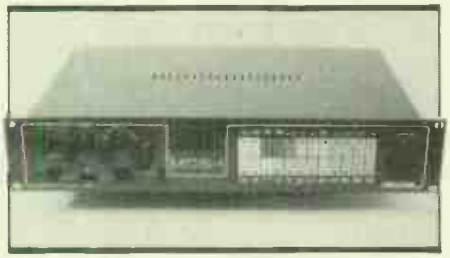
Powertran MCS1

Part 2: The Circuit

E&MM's most advanced project ever is a digital delay line and sound sampler in one unit. The second part of our constructional series includes the circuits behind the MCS1's operation.

As explained last month, the Powertran MCS1 is a digital sampling unit that can also function as a high-specification digital delay line. The pitch of the sound stored within the MCS1's memory can be controlled *via* either MIDI or one-volt-per-octave keyboards, and the kit itself, although complex, represents a significant cost saving over any other commercially-available ready-built product.

The following four pages contain the circuit diagrams that lie at the heart of the MCS1. The first of these incorporates the master clock generator from which the whole delay line is driven, the second includes the components used for memory



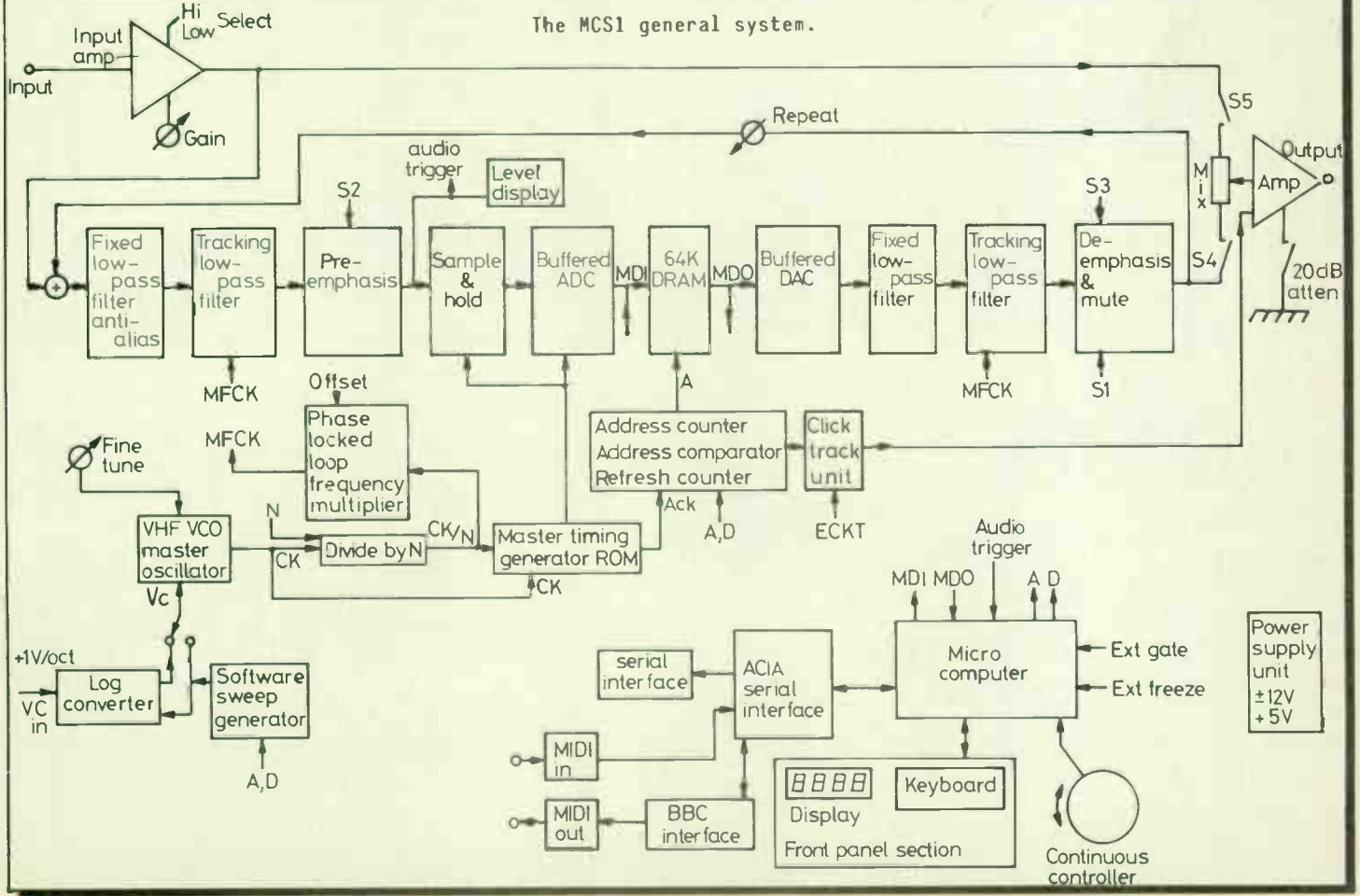
address functions, the third includes the microprocessor, MIDI and BBC B computer connections, while the fourth contains the filtering and companding stages.

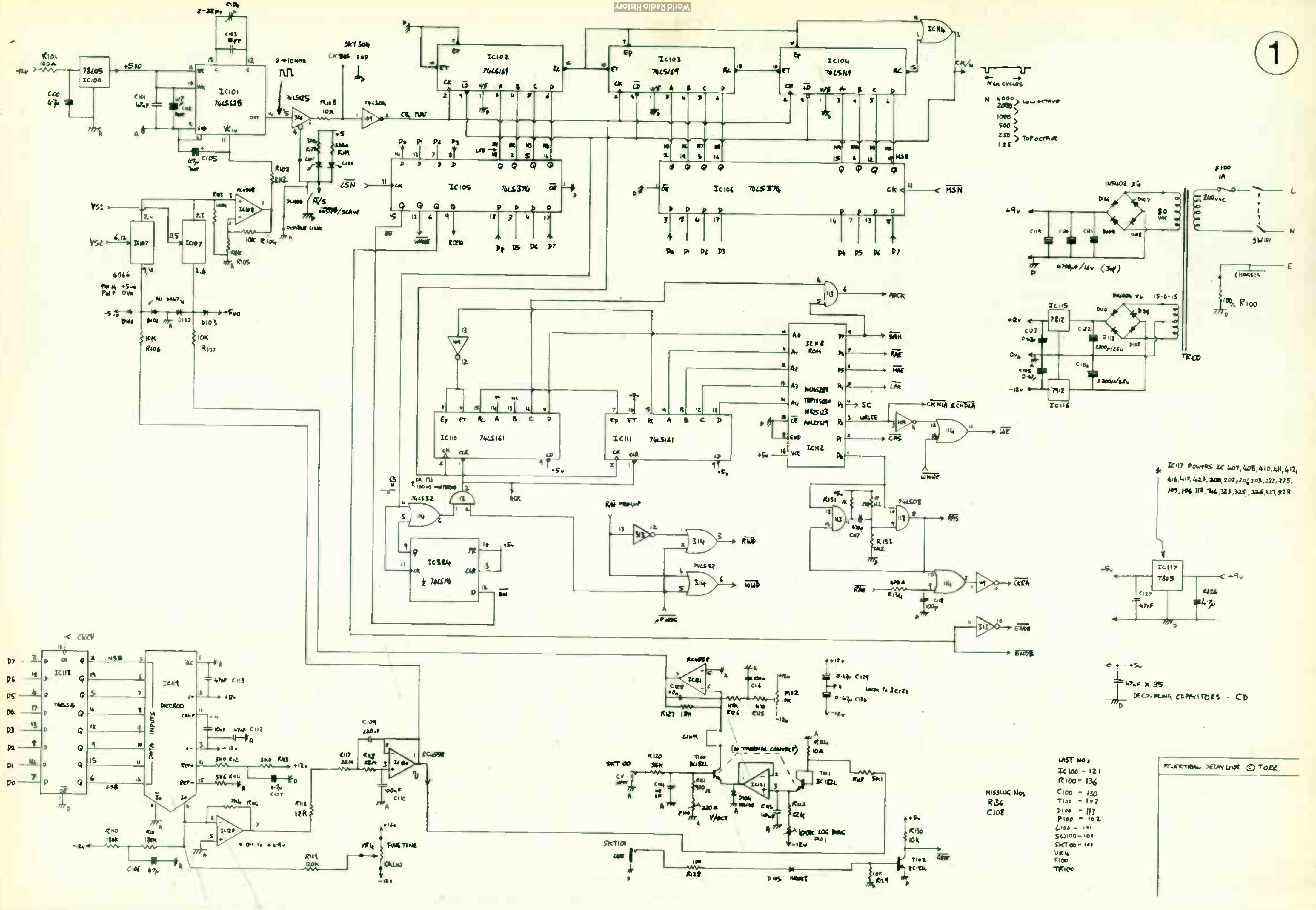
For the less technically-orientated, the table on this page is a block diagram that displays the MCS1's operating system in what are more or less layman's terms.

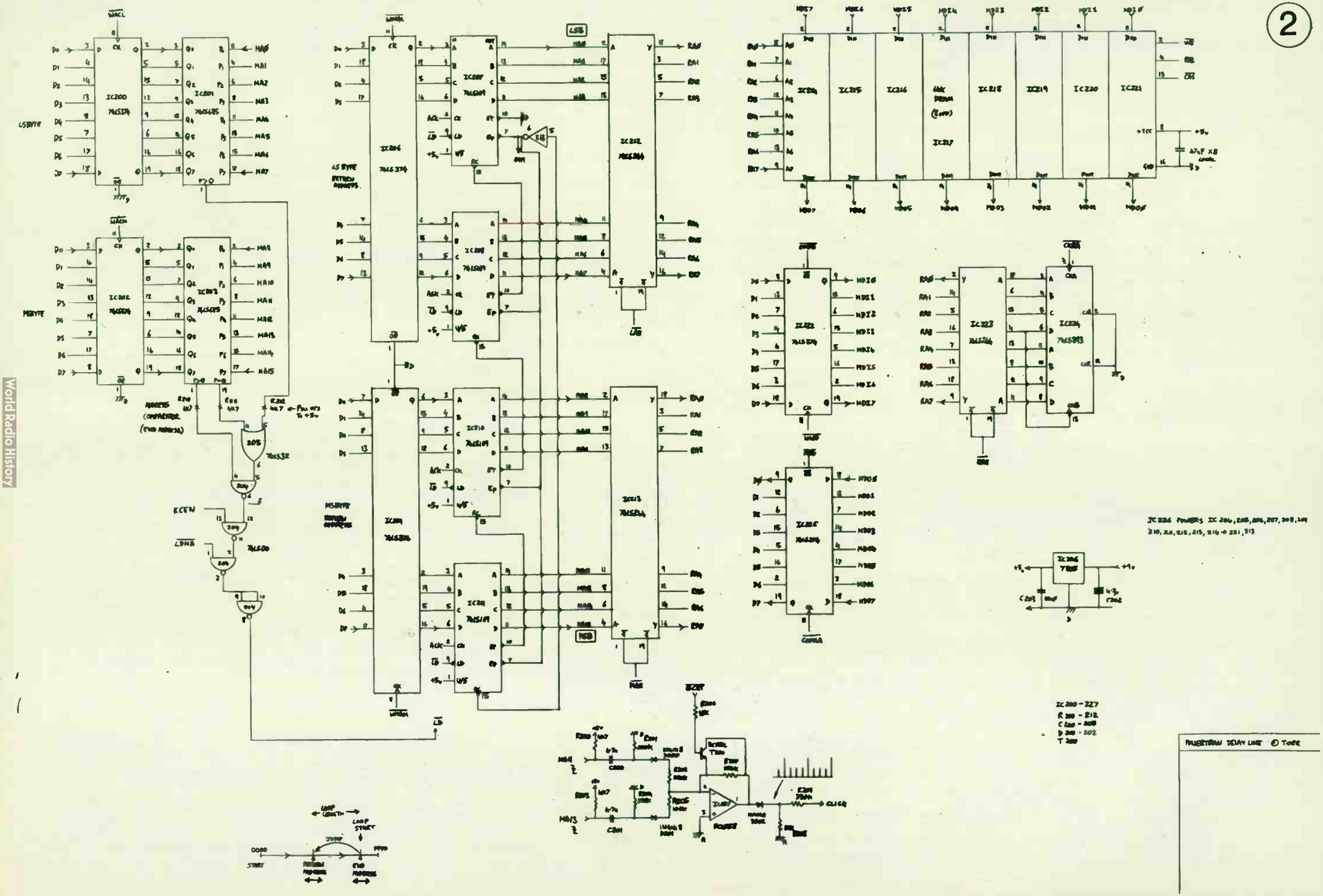
Next month will see a full circuit description related to the diagrams printed on the following pages, so whatever you do, don't lose this issue before the next E&MM appears on the bookstalls!

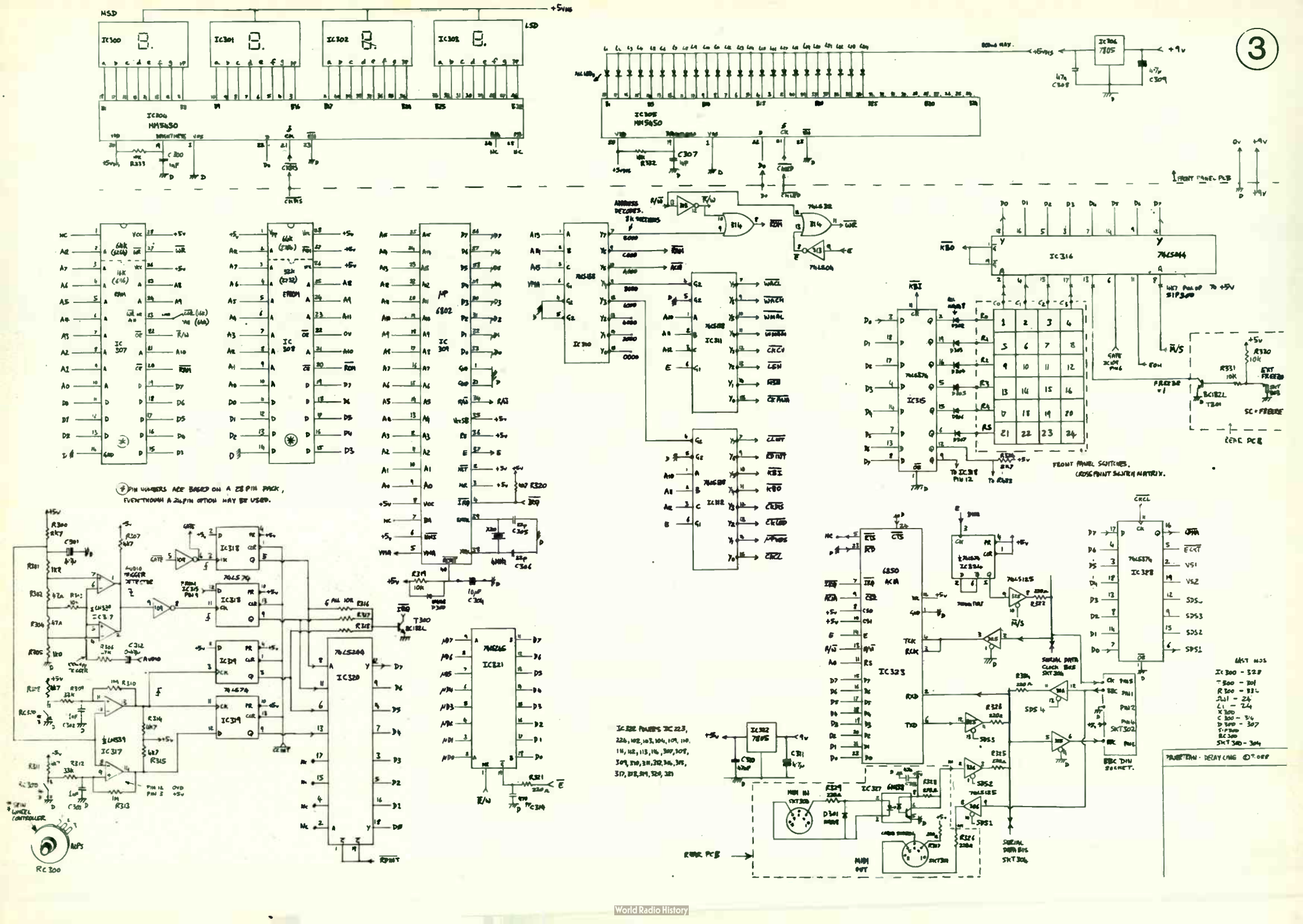
Meanwhile, selling prices for the MCS1 in both kit and ready-built form have now been fixed at £499 and £699 respectively, to which VAT must be added at the current rate. Orders are now being taken by the manufacturers, Powertran Cybernetics Ltd, Portway Industrial Estate, Andover, Hants, SP10 3EM. ☎ (0264) 64455. ■

The MCS1 general system.









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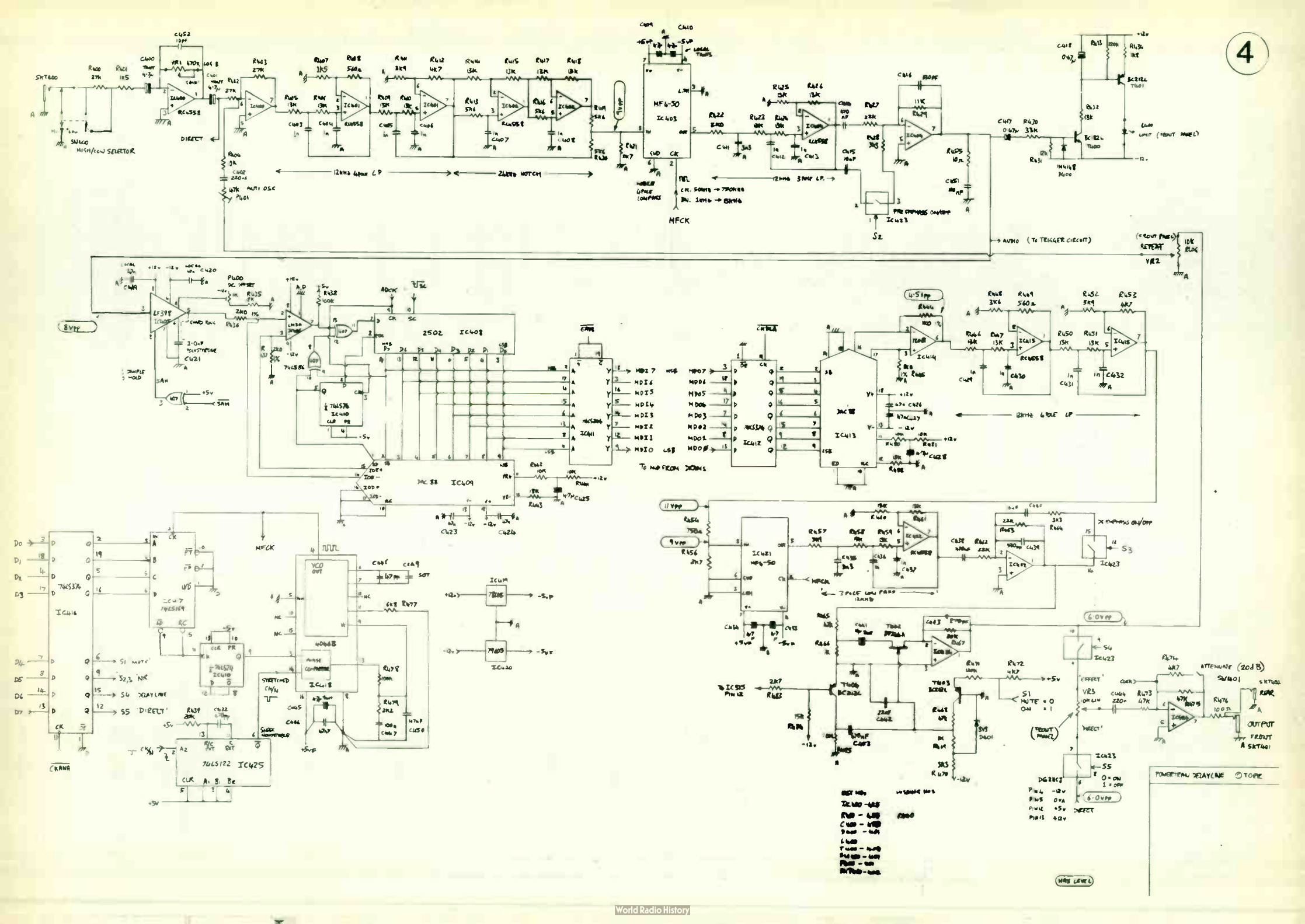

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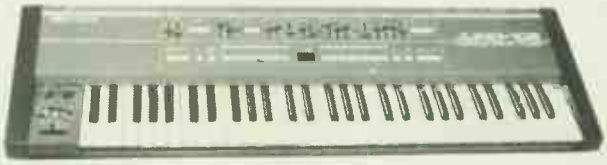

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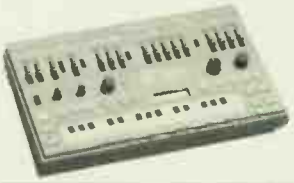

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MODULAR SYNTHESIS

Click-tracks Continued

Or how a synthesiser's modules can be driven from an audio signal off-tape. *Steve Howell*

Last month we saw how it is possible to override a sequencer's internal clock and drive it instead from a signal off-tape. This technique means that sequencers can be synchronised during a multitrack recording, for example, saving tracks and enabling complex rhythmic and melodic sequencer patterns to be created with relative ease.

The basic concept behind last month's technique was the conversion of a spikey audio signal off-tape into a voltage that could more easily be 'interpreted' by a synthesiser for triggering purposes. We've already seen that this technique can be used to step through a sequencer's events, but in fact there's no reason why the pulse can't be applied to any synth module that requires a trigger pulse in order to work. Such devices include envelope generators (EGs) and sample and hold units (S/H), both of which can of course be used to shape an incoming signal of some kind.

Triggering EGs

The first application that springs to mind is the use of a click-track to trigger a synth's EG. This would be shaping a VCF and VCA which, in turn, could be fed from a polyphonic source. The latter could be almost anything – from a string synth or organ to a guitar or the output of your record player, though the last-mentioned option isn't guaranteed to provide musically viable effects . . .

The patch for all this is shown in Figure 1, and the prime audible result of its application is quite fascinating: chordal rhythm patterns appear as the sound is 'chopped' by the automatically-triggered EGs.

One point to bear in mind here is that the envelope of the polyphonic sound should be kept very 'organish', that is, straight on and straight off with full sustain. The reason for this is that all your envelope shaping is now being derived from the modular synth's EGs and VCFs/VCAs.

There's no reason why you have to use a polyphonic sound source, however. Simply using an internal VCO (or more than one) and routing this into the VCF/VCA in the usual fashion should provide you with some quite sophisticated 'sequencer' effects, because although the synth patch itself is quite standard, the trigger is being derived from the click-track (Figure 2). It must be pointed out though that both the above-mentioned techniques require the player's note and chord changes to be timed with a fair degree of accuracy. The whole object of employing these patches is to obtain metronomic timing, but get it wrong and it'll simply turn out sounding like a mess. Still, practice makes perfect.

Noise Source

In addition to pitched sounds, it's also possible for a noise source to be used for percussive effects, and if you use the patch shown in Figure 3, you'll be able to key in noise effects intermittently. Again, a simple on/off envelope is all that's required of EG3/VCA2, as the actual shaping is accomplished by EGs 1 and 2.

Not enough EG/VCA/VCF options on your synth? Try laying down a whole track full of repeated noises triggered off ▷

Figure 1. Patch for processing a polyphonic sound triggered off-tape.

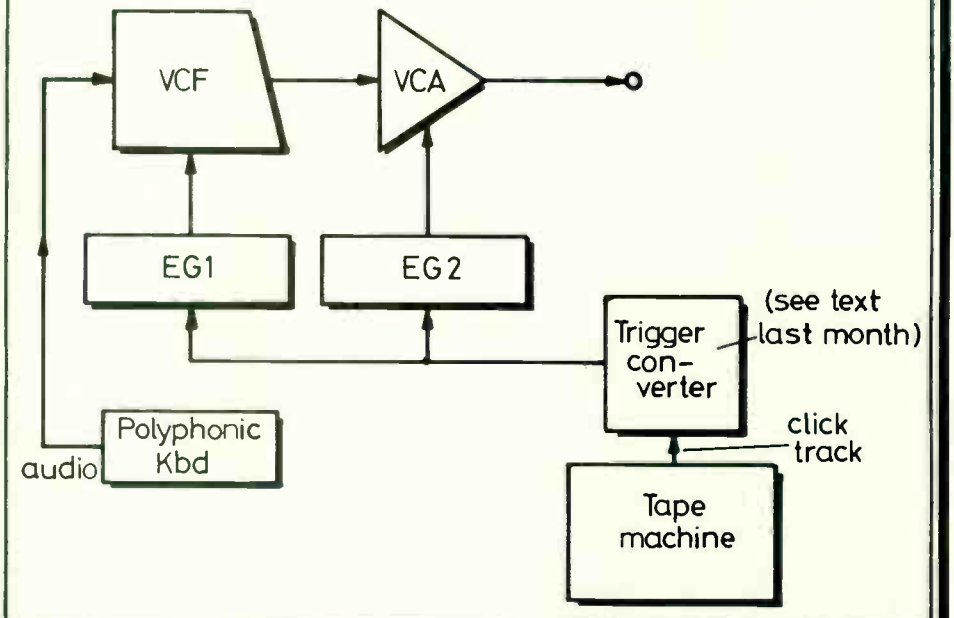
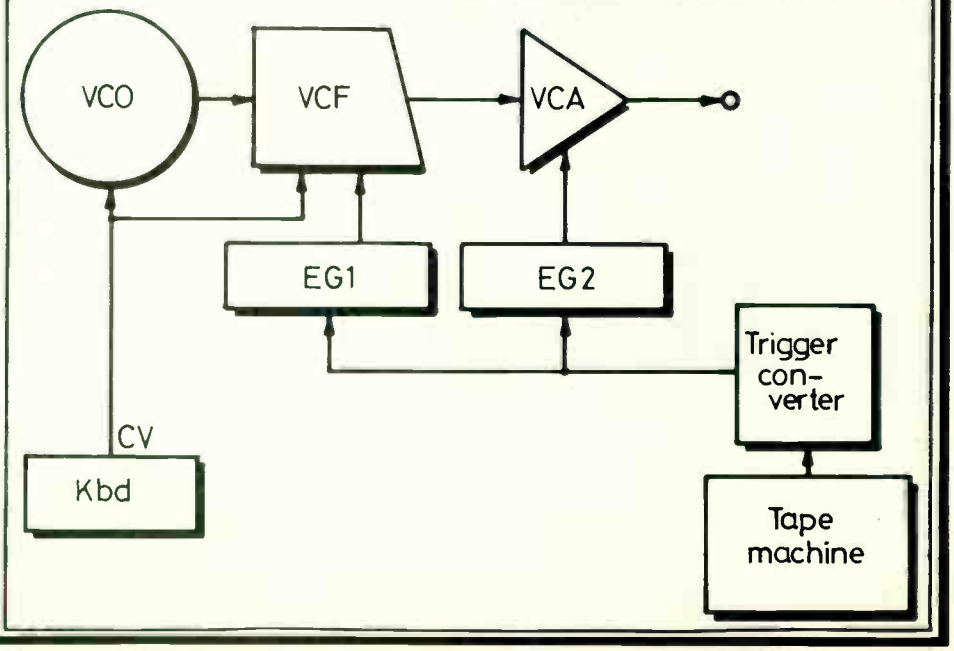


Figure 2. Patch for monophonic 'sequencer' effects.



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the click-track and then, during mixdown, 'dub' the effects in and out as required using the channel mute or routing switches on the mixer. This technique can also be useful if you're at all indecisive as to when and where your bursts of noise should be, as it enables such decisions to be left until the very end of the recording process, when all other tracks have been laid down.

Do ensure though that the switches on your mixer are clean and click-free if you want to avoid embarrassing crackles and pops appearing during the process and giving the whole game away.

If your mixer doesn't possess any in/out switches, try using the patch given in Figure 4(a), in which the track containing the continuously triggered noise (or any other sound, for that matter) is routed back into the synth during mixdown and the bursts introduced by initiating the EG/VCA *via* a remote push-to-make switch conveniently located next to the mixer.

A typical circuit for such a switch is shown in Figure 4(b), and this is suitable for all positive-going 'V' triggers. Korg users will have to reverse the polarity of the battery, while Moog owners are in the fortunate position of being able to do without the battery altogether, since simply closing the switch is enough to trigger the 'Contour Generators', as Moog call them.

Tonal Variation

Introducing tonal variation is no more difficult than sweeping the VCF with an LFO, but a more interesting – and more original – effect can be obtained by using a sample and hold (yes, it's the good ol' S/H again!) stepped through by the click-track for random tonal changes. The sound source can be anything and the technique employed any of those described above.

The voltage output of the S/H can be routed to some other CV input such as a voltage-controlled phaser or flanger, a DDL set up for similar effects or, for somewhat more unusual results, longer repeat echoes. As explained in last month's column, the CV output of the S/H can be used to trigger the EGs randomly, so that polyphonic sound is heard at completely unpredictable moments, ie. whenever the CV from one sample and hold rises above the EG's trigger threshold level.

Last month's modular chapter also revealed how it was possible to use the envelope follower to convert the audio signal into a voltage suitable for the EGs. A variation on this technique is to use the voltage output from the envelope follower to shape the incoming sound source (polyphonic or otherwise), and the patch for this is represented by Figure 5. You won't, of course, have such an extensive degree of control over envelope shape if you do things this way, but it is a quick and easy way of achieving metronomically-chopped chords. ■

Figure 3. How to achieve noise bursts for percussive sounds.

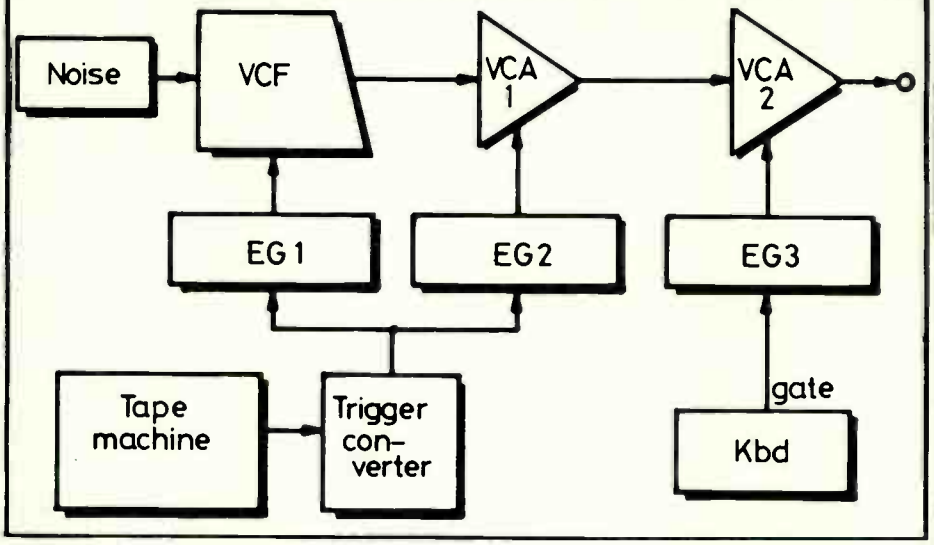


Figure 4(a). Keying in bursts of noise during multitrack mixdown.

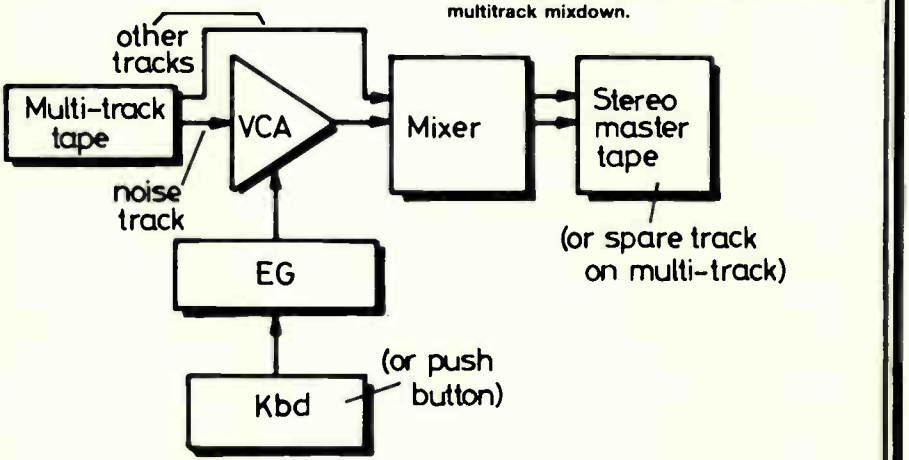


Figure 4(b). Circuit for remote switching of EGs.

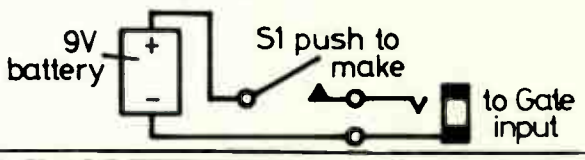
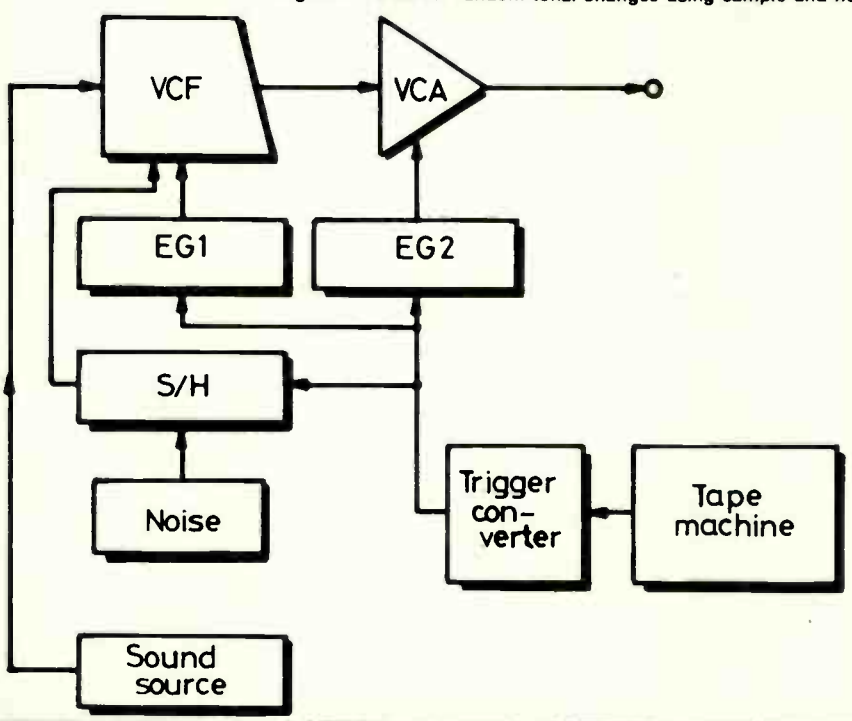


Figure 5. Patch for random tonal changes using sample and hold.



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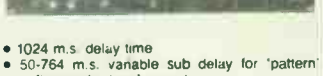

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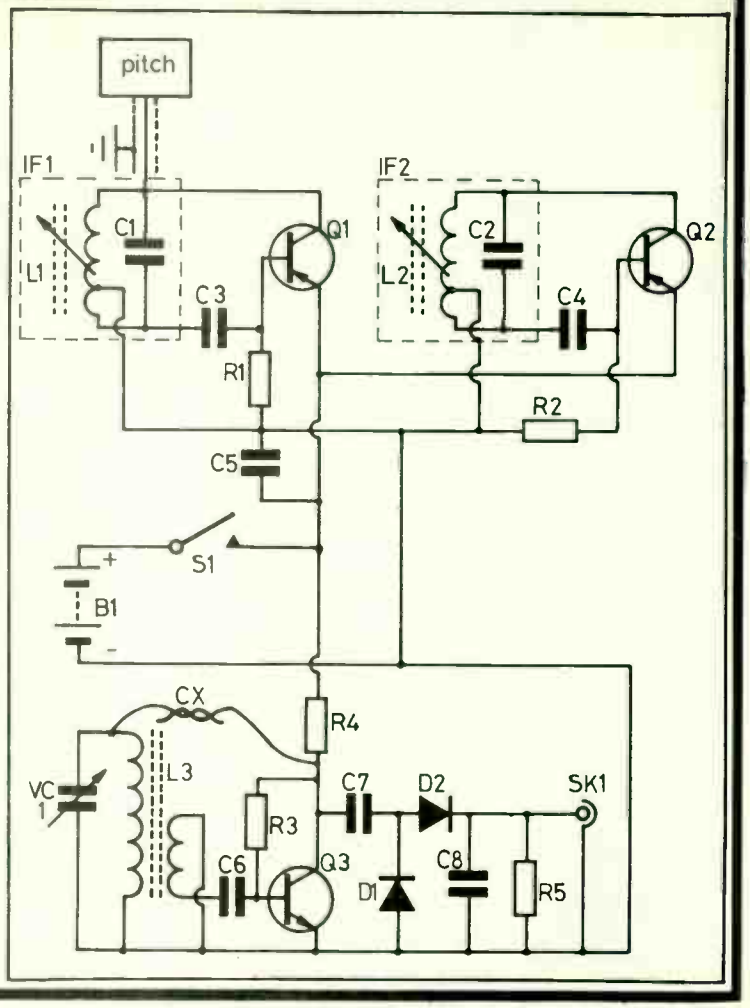
SHORT CIRCUIT

The start of an occasional series in which readers send in circuit details of their own music projects. This months sees a much-requested theramin circuit. *Paul Balfour*



The circuit outlined below provides an excellent theramin which is both inexpensive and easy to construct. Only the pitch is proximity controlled, but if volume is controlled using a pedal, the theramin can be used whilst playing keyboards.

The circuit consists of two Hartley oscillators. One of these is fixed, while the other varies in pitch with the proximity of the player's hand to the pitch plate. The oscillators are at around 470kHz and the beats are audible. The resulting signal is picked up by the second half of the circuit – a simple medium-wave receiver. You could omit this element and use an ordinary MW radio instead, but more often than not this results in a noticeable reduction in sound quality.

Oscillator coils L1/C1 and L2/C2 are Toko YMCS 17104 IF transformers, with their screening cans removed. The sound is very much dependent on adjusting the slugs to obtain the desired effect. ■

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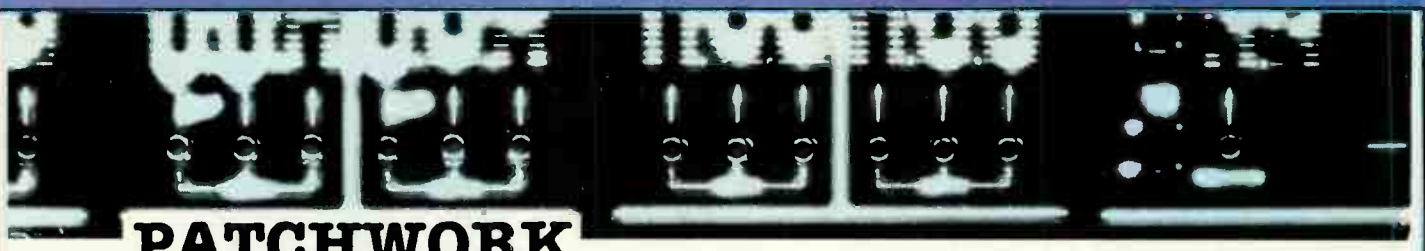


PATCHWORK

Readers send in details of their own synth patches and how to play them...

Patchwork provides *you* with a chance to show off your best synth sounds, so if you're of a sharing nature, send your offering on a copy of an owner's manual patch chart (including a blank one for artwork purposes) to: ***Patchwork,* E&MM, Alexander House, 1 Milton Road, Cambridge, CB4 1UY.**

KORG POLY 800 — 'Electric Harpsichord' — T Bonney, Australia

Meanwhile, Korg's most recent polysynth found its way down under and was immediately transmogrified into an electric harpsichord. Best results are obtained standing on your head. . . .

Seriously though, harpsichord sounds have recently found their way into the music of the eighties (listen to the Stranglers' 'Golden Brown' for instance) and can still be incorporated into even the most modern of compositions. Bonney suggests swapping waveforms in DCOs 1 and 2, increasing the Cutoff Frequency, and trying different Trigger settings (ie. multi or single) to provide personal variations.

E&MM Contributor Jay Chapman adds that this patch benefits from a staccato playing technique as this allows the synth (especially when being used to play chords) to cut through a band line-up. Also, he felt DCO Mode (18) set to 1 (instead of 2) gave a more authentic harpsichord, and if the VCF Cutoff (41) is reduced from 54 to 20, the top octaves provide the makings of some steel drums.

DCO 1							MODE	DCO 2								NOISE	VCF					CHORUS	DEG 1						DEG 2						DEG 3						MG				MIDI		
OCTAVE	WAVEFORM	16'	8'	4'	2'	LEVEL	DCO	OCTAVE	WAVEFORM	16'	8'	4'	2'	LEVEL	INTERVAL	DETUNE	LEVEL	CUTOFF	RESONANCE	KBD TRACK	POLARITY	EG INT	TRIGGER	ON/OFF	ATTACK	DECAY	BREAK P	SLOPE	SUSTAIN	RELEASE	ATTACK	DECAY	BREAK P	SLOPE	SUSTAIN	RELEASE	ATTACK	DECAY	BREAK P	SLOPE	SUSTAIN	RELEASE	FREQ	DELAY	DCO	VCF	RCV CH	PROG CHANGE	SEQ CLK
2	2	0	1	0	1	29	2	3	2	1	1	1	1	31	12	3	1	54	3	0	2	9	2	1	0	24	31	19	20	24	0	20	31	26	20	20	0	19	14	25	0	24	8	9	1	0	–	–	–

YAMAHA CS5 — 'eCStasy 5' — Steve Bell, Portsmouth

Ever since the Mellotron rendered the Choir of Worchester Cathedral practically redundant (!) synths have been constantly called upon to try to emulate the human voice. Steve's patch for the budget CS5, although intended to be a female voice singing, is perhaps more like the 'Ecstasy of Gold' (theme) from *The Good, the Bad and the Ugly* by Ennio Morricone.

LFO
Speed 5

VCO
Feet 8'
LFO Mod 2
Portamento 2
PWM 10

Mixer
Ext/Noise 0
Ramp 10
Square 0

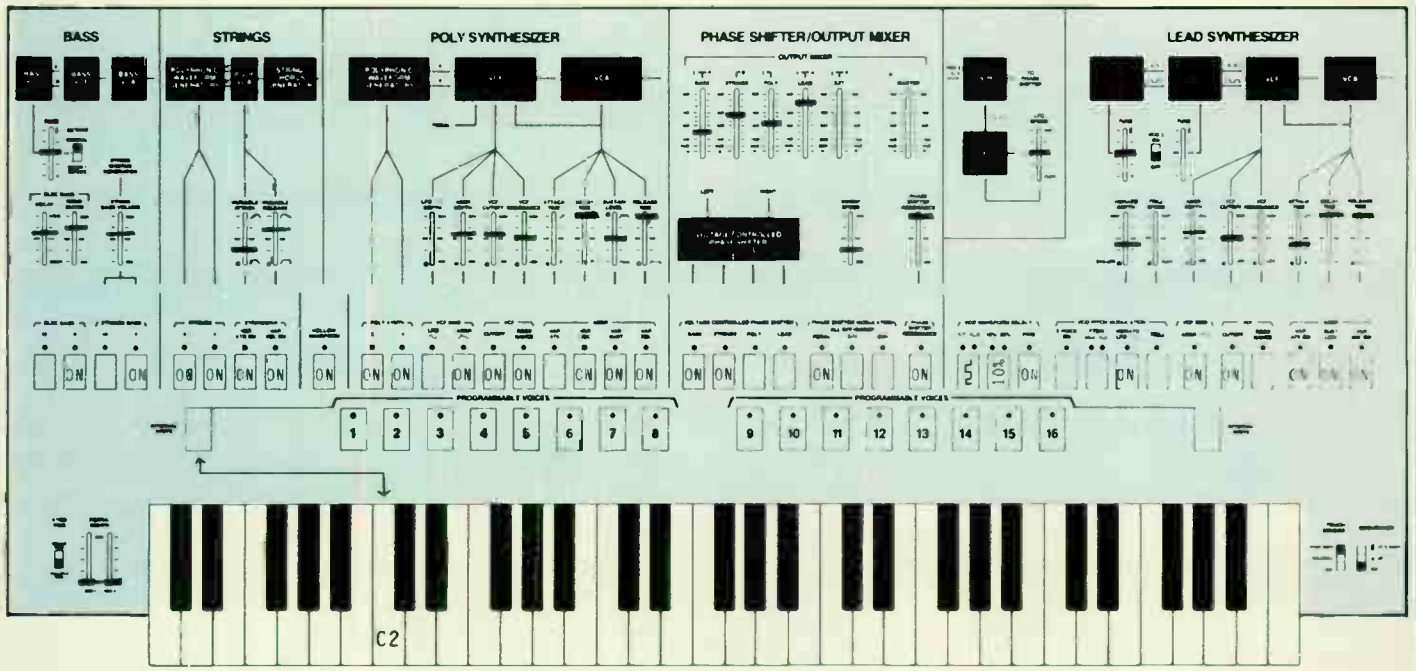
VCF
Cut Off Freq 0
Resonance 10
LFO Mod 0
EG Depth 3

VCA
LFO Mod 0
Initial Level 0
EG Depth 10

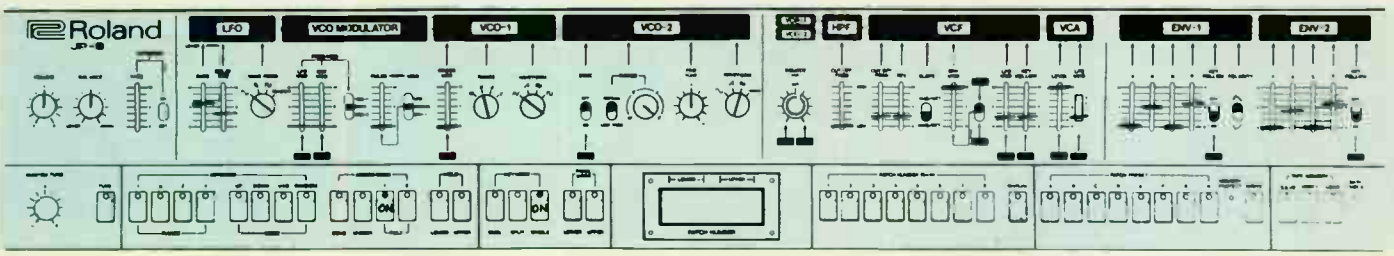
Envelope
Attack 1.5
Decay 10
Sustain 10
Release 5

ARP QUADRA — 'A Clear Lead' — Martin Straw, Southampton

Another newcomer to these pages, the Quadra was the last (and only programmable) synth produced by ARP before their amalgamation into CBS-Fender. Martin has supplied a lead sound that makes use of each of the Quadra's four sections, and adds that 'lead VCO 2 is off, while the programmable scale for VCO 1 is given by interval write and C2'.



ROLAND JUPITER 8 — 'Good Vibrations' — Paul McGeechan, Glasgow



The 'ole Guvnor' of the Roland range, the Jupiter 8 is capable of a multitude of analogue sounds that never seem to date. Paul's vibraphone patch 'uses VCO 1 set at 8' (triangle waveform) to give a low body to the sound, while VCO 2 (pulse waveform) gives a higher, more percussive edge to the sound.'

'Fine setting of the Cutoff Frequency and the Resonance controls is needed for a full-bodied result, usually just over the first marker. Note that there is also a slight difference in Envelope 1 and Envelope 2 decay settings, and that the LFO can be set to the desired frequency, simulating the part played by the motor on a vibraphone. The Delay applied to the LFO is designed to imitate the initial strike of the hammers, but need not be as high as illustrated.

'Note also that the LFO Modulation to the VCF can be removed and the Filter and Resonance values changed slightly to obtain a sound more akin to that of a glockenspiel'.

Featured in this issue

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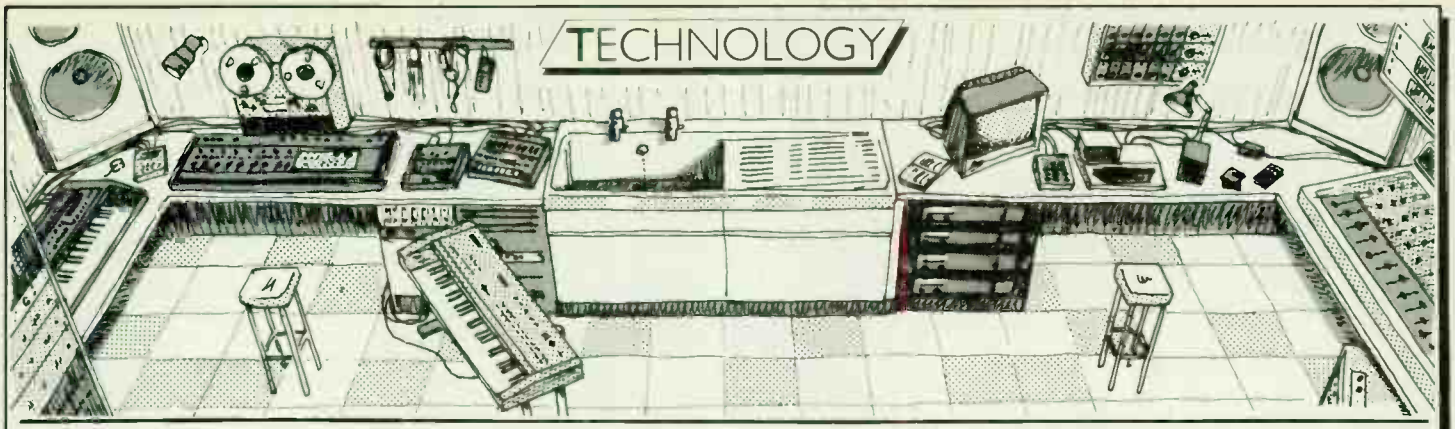

Everything but the Kitchen . . .

Or how to get the best from your electronic instruments by syncing them together. The first part looks at syncing hardware to tape. *John Harris*

Recording with modern electronic musical instruments like drum machines and sequencers is now commonplace, and whether you have four-track or 48-track recording facilities, you can't deny that more hit songs are written, demoed, recorded and performed with their help than ever before. The modern musician's language is full of an odd assortment of figures and letters – MSQ700, SBX80, KPR77 – which can be dropped casually into the conversation as a form of musicians' one-upmanship to embarrass pals who are not so well up on the latest trends but which sound like gibberish to the non-muso.

Now that we've got used to the terminology (interface, cassette dump, synchronisation – well explained in Ian Gilby's review of the Mini Doc in E&MM August '84 – MIDI and so on), the world is at our feet. Well, perhaps not quite. After all, it's what you do with the technology that counts. However, one thing that has proved to be of great benefit to the musician – whether he or she records on a home studio set-up or at one of the nation's top studios – is the sync-to-tape facility.

Sync and Tape Sync

Modern drum machines and sequencers have a built-in clock determining the speed at which the machine will run. This clock is in fact a series of regularly-spaced pulses, and the time base for each unit is defined by the number of pulses-per-beat (crotchet). Incidentally, it's worth mentioning here that the Americans have their own name for a crotchet – they call it a 'quarter-note' based on the fact that if you're playing in 4/4, a crotchet will be equal to one quarter of the bar (similarly, quavers become eighth-notes, semi-quavers become sixteenth-notes, and so on).

Now, if your drum machine or sequencer has a socket labelled Sync In and one labelled Sync Out, or alternatively one socket labelled Sync In/Out with a switch to select one or the other, you'll be able to drive external devices with your machine's clock. Alternatively, you can override your machine's internal clock with a signal from the clock of another machine. In order for this to work, though, both machines must have the same time base (ie. utilise the same number of pulses-per-beat),

otherwise they will not run in time with each other. For instance, if one machine's time base is 96 pulses-per-beat (eg. Oberheim) and the other's is 48 (eg. LinnDrum or Roland MC202), the latter will run at twice the speed. There are, however, units available which 'translate' from one timebase to another. Examples are the Doctor Click and Mini Doc devices, both of which, incidentally, will also read sync codes off-tape.

If your machine has a sync-to-tape facility it will have tape sync output and input sockets, and these supply and receive a processed version of the clock signal (sync code) with the result that your machine's code can be recorded onto tape and used later as the recorded code to run the machine.

There are a number of reasonably-priced products with this facility available. The Roland MC202 Microcomposer was the first budget machine with built-in tape sync and

this has been around for a couple of years, but other manufacturers have been rather slow on the uptake of the tape sync idea, regarding it as an option only to be made available on more expensive models. Machines that come into this category include the Roland TR909 and MSQ700, Sequential Circuits Drumtraks (which has a switchable sync out of 24, 48 & 96 pulses-per-beat), E-mu Systems Drumulator (five trigger conversion), the Oberheim DX and DMX, Korg KPR77 and Yamaha's new RX series drum machines.

A number of units which aid drum machine, sequencer and multitrack synchronisation are now available in addition to the Dr Click and Mini Doc already mentioned. The Korg KMS30 MIDI Synchroniser is another unit which aids sync-to-tape among its many other functions, while a very modestly-priced unit made by MPC called the Sync Track (see review, E&MM May) allows you to convert the sync output of any machine into a form whereby it can be recorded onto tape. It also reverses the process, ie. reads the code off-tape and translates it back into a clock pulse. This unit was designed primarily for use with Roland Products not provided with tape sync, but with the help of the instruction booklet supplied, you *can* use the Sync Track with any machine having sync or clock outputs. Incidentally, some retailers are offering this unit with the Hammond DPM48 drum machine as a package deal.

Recording the Code

The sync code has to be recorded on its own track, and most machines will give you a line level output which should be recorded onto tape at the level recommended by the manufacturer. As you'd expect, advice varies, and where the manual for a drum machine like the Linn (which generates its own code) recommends a level of −3dB, the designers of the Sync Track suggest you use a level between −3 and −7dB. By the way, the Linn manual also recommends you bypass any noise reduction system.

It's certainly worth experimenting with levels until you find out what suits your recording set-up best, but be prepared for a certain degree of crosstalk onto adjacent tracks caused by the nature of the sound of the code. Problems ▷

may arise when attempting to retrieve the code off-tape if you have dirty heads on the recorder, and well-used tape is prone to drop-outs which certainly won't aid recovery. In addition, if you're using a track on the edge of the tape, bad head alignment could cause difficulties. Finally, highly transient sounds, such as drums, recorded on adjacent tracks have also been known to interfere with the smooth operation of the code.

Using the Code

With your sync code successfully recorded onto tape, you can, on playback, run several machines at once off the one code. For example, if you put the code down from a Roland MC202, on playback you could use the 202 synced up to a TR808 drum machine (providing handclaps, say) and use 808's trigger outputs to drive the clock inputs on the arpeggiator of a polysynth. In the studio recently we used a TR606 Drumatix with a Sync Track into a BBC B computer *via* an Electromusic Research Miditrack Composer interface box, using the MIDI Out of this to run a Yamaha DX7. As we had plenty of tracks to play with, but only one DX7, we ran off the programmed sequence several times, using a different voice each time to obtain a layering of sounds, but you could get the same effect rather quicker if you linked several DX7s together!

Basically, there are two main advantages of using a sync-to-tape system. The first is that you are able to change or add to your sequence or drum pattern at any time during your recording without having to start from scratch, so that, for example, you can leave writing the drum part till the end if you wish. The other advantage is that if you have a problem with shortage of recording tracks, you can run all your drum machines, sequencers, handclappers *et al* perfectly in sync with the rest of the track through separate channels on a mixer off the one sync code

track, EQing and adding effects as you please, without having to *record* them at all. And as a bonus, this also means they're recorded first-generation onto the master tape when you mix.

One drawback to this method of tape syncing (it's known as the FSK system, incidentally) is that as a rule it doesn't allow you to drop-in a sequence (or whatever) during a piece. For the machine to run in time with the track, it's necessary to start from the beginning each time. The MPC Sync Track gets over this to some extent by providing a Run/Stop switch that enables you to start the machine manually at any time during the track, though this is a bit tricky to accomplish.

For the ultimate in tape syncing, look no further than the newly-announced Roland SBX80 Sync Box, which generates SMPTE (Society of Motion Pictures and Television Engineers), a code originally devised for use in the broadcasting and film industries for syncing soundtracks to film. This machine (amongst many other things) *will* allow you to drop-in in the middle of your track: you could also use it to sync a video to your demo!

Summing Up

With the price of hardware incorporating tape sync facilities dropping all the time, and the availability of helpful gadgets like the Mini Doc and Sync Box to sort out the major headaches of incompatibility between gear from different manufacturers, the future is looking rosy for modern musicians, be they pro, semi-pro or amateur. The system is of particular benefit to four- and eight-track studio owners who find themselves running short of tracks, as they're now able to designate one track to the code and run sequencers, drum machines and so on without the signal degradation that bouncing-down invariably causes.

Who knows? Maybe one day we'll all be doing our demos on two-track – one for the code and one for the vocals. ■

RRPs (inclusive of VAT) for products mentioned above are as follows:
***MPC Sync Track** – £39.95, contact MPC Electronics Ltd, The Gables, Station Road, Willingham, Cambs. CB4 5HG. ☎ (0954) 60264.*
***Roland MC202** – £235, **SBX80** – £900, **MSQ700** – £950, contact Roland UK Ltd, Great West Trading Estate, 983 Great West Road, Brentford, Middx. TW8 9DN. ☎ 01-568 4578.*
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COMPUTER MUSICIAN

One of the few advantages of the medical profession is that it makes you pretty resilient: in fact, it takes quite a lot to ruffle my feathers. Or at least, that's what I thought until picking up the September issue of *Your Computer* with its by-line of 'Music and Micros. Two Tribes in Harmony'. This refers to an interview with one Steve Lipson, a studio and computer engineer working at Sarm Studios on the Frankie Goes To Hollywood album under the omnipresent Trevor Horn. Now, there's nothing censorial about that – indeed, I admire the latter's skill as a producer – but what raises my gall is Mr Lipson's comments about home computer-based systems.

First, about Commodore 64s and Yamaha CX5s, he says: 'Nothing is going to happen with all that stuff. MIDI's useful but going to run out shortly.' Then, he adds some choice comments about eight-bit synthesis, the Fairlight, and the CX5 and Commodore 64 (again): 'eight-bit sounds are unusable – the Fairlight's different because it has got a graunch noise of its own. It just lowers the quality of what we're going to be hearing. Very few people have got all the gear and then everyone else with their CX5s and Commodore 64s will be struggling desperately hard with not really a hope in hell, apart from the odd genius.'

Mr Lipson, of course, uses the Sinclavier (the article's mistake, not ours, but didn't they always call Hollywood Sin City?), so perhaps he should know best. Actually, he's wrong on just about every count. MIDI *won't* run out shortly because people are working out ways of getting around its limitations (see this month's *Rumblings*, for instance). Its problem of speed is being met by a technique – 'concurrency', meaning activities that operate in parallel – that's set to be the word on the tip of many tongues in the computer music industry.

And eight-bit sounds? Well, they're as usable as any other – including the 16-bit sampling overkill of the Synclavier – but surely what counts is how they're used, whether that be in imaginative digital drum patterns, MCL sequencing, or whatever? Perhaps we should turn the table on Steve Lipson and ask him to defend the sledgehammer-cracking-a-walnut practice of using a £30 000 system to churn out slapped bass riffs at nineteen-to-the-dozen.

But what really gets my umbrage going is the suggestion that musicians using the Commodore 64 and Yamaha CX5 are wasting their time. Indeed, it worries me that people might have read the *Your Computer* article and gained the (misguided) impression that musical activities based around the home micro are futile. Aside from the fact that the Commodore 64 is being used for both studio and stage sequencing work, courtesy of MIDI, there's a host of software now available for making good (if not brilliant) music at home. And in the case of the CX5M, things are taken a few steps further. After all, this machine is, to all intents and purposes, multiple DX sound sources in a single unit – the poor man's TX816 if you like – and is quite capable of giving even the Synclavier a run for its money.

Which brings me to another point. Why does Mr Lipson assume that users of home computer-based music systems are out to compete in the rat-race of commercial rock? Surely the important point is that such systems give the average musician on the street the opportunity to create his or her own music rather than live perpetually off the waxings of this or that group immortalised in the over-produced and over-expensive vinyl of the media's latest darling? That, for me is what the micro musical revolution is all about.

And anyhow, the CX5's sounds are 12-bit. So who gives a monkey's what Frankie says?

David Ellis

Rumblings . . .

This month's round-up of all that's new in the world of computer music.

David Ellis

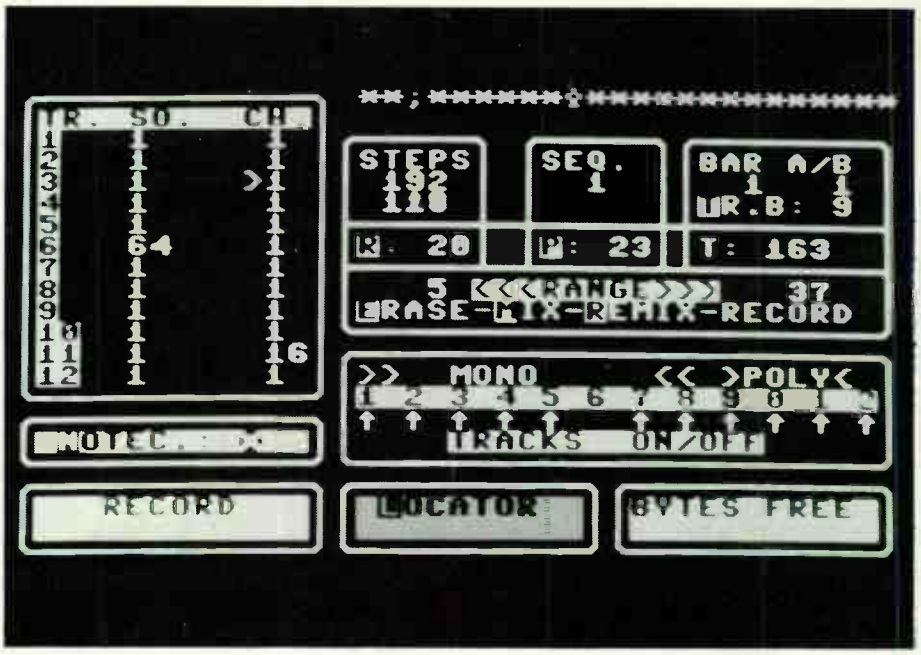
MIDIsoft

At long last, some feedback on the two-day MIDIsoft event held back in May in a San Francisco hotel under the banner of the **IMA (International MIDI Association)**. Given that this wasn't a free event ($35 for IMA members, $60 for non-members), the quoted attendance of 219 was pretty good. The major problem with this sort of umbrella event is that everything stands or falls on the support of the manufacturers, and unfortunately, Korg, Kurzweil, Oberheim, and E-mu were as far as the manufacturers' conclave went. And with the exception of Korg, all those names are of companies that have come late (Kurzweil and E-mu) or reluctantly (Oberheim) into the MIDI game.

Anyhow, what transpired from the various question-and-answer sessions over the two days was that (a) most of the attendees were there for serious software purposes, (b) much thought was being devoted to getting around the very obvious limitations of the MIDI standard (parallel ACIAs, use in conjunction with memory-mapped sound generators, and so on), and (c) many felt that they were being cold-shouldered by the manufacturers.

Curiously, most of the timetabled lectures were somewhat detached from the MIDI pure and simple. For instance, Dr Gareth Loy gave a talk on software (running on a sizeable minicomputer) that has been developed at the Computer Audio Research Laboratory at the University of California in San Diego; Robert Barkan of DocuPro suggested how to write decent manuals; Dr Charles Goldfarb spoke on musical databases; and Alan Marrs from Lucas Films discussed the subject of glyphs and icons in the context of constructing film soundtracks with the infamous Audio Signal Processor.

All in all, a lot was said, a good deal was discussed, and plenty of confusion reigned about where things are going to go next. Clearly, an unbiased arbiter of the MIDI standard is needed – and the IMA would seem to be in a good position to offer this role – but how do we go about convincing so many large and powerful manufacturers that we're not just a bunch of jokers out to extract freebies and the like from gullible publicity departments? Very difficult, I'd say. What's more, the situation is complicated by the fact that the big boys – Roland, Yamaha, Sequential Circuits – are planning their own meeting at the forthcoming NAMM convention, and of course, the IMA, haven't been invited along.



Still, you can't put a good man down, and the IMA are scheduling a further convention (MIDIsoft II, logically enough) to take place in Boston in October. Let's hope they get the support they deserve this time. Perhaps the time has come to organise something similar in the UK – even if only to discuss the predilection among British entrepreneurs to pre-announce their MIDI software and then develop it with the cash collected from average over-eager musos.

Yet More MIDI

Well, MIDI software continues to pour onto the marketplace. Pity the poor old consumer who's got to distinguish chalk from cheese. Still, the MIDI Composer that German firm **Micro Music** have just announced for that stalwart of the MIDI software industry, the Commodore 64, looks a lot more interesting than most. What's more, a good deal of care has been taken to make the display as useful as possible. The package provides both step- and real-time input with 'rapid, interactive note graphics', variable quantisation, freely definable 'n-plets', autolocation, a mix and remix facility (converting mono tracks to poly, and vice versa), two independent sequencers, editing facilities, a 4000-note capacity, and a good deal more besides.

On the hardware front, Micro Music have produced their own interface box (MIDI In, two MIDI Outs, plus the option of syncing) which seems almost too good to be true at a roughly estimated £20. As the software costs DM360 (around £80), this looks to be a very fair deal all in all. Micro Music are looking out for UK distribution, so if anyone's interested, try contacting Lars Hidde of *Micro Music* at *Fruchtallee 19, D-2000 Hamburg 20, West Germany. ☎ 040-439 2919.*

Mac Music

At long last, there's some music software for the **Apple Macintosh**: a program called (very grandly) 'Professional Composer' at a suitably professional price of – wait for it – £429 plus VAT. The claim is that this is the musical equivalent of a word processor, allowing the user to copy and move passages, transpose parts, add lyrics, create piano reductions, and print finished scores.

Sounds great. Or rather, it doesn't actually sound – this is what could be called a dumb composer. And if that price tag doesn't totally phase you out of orbit, details are available from *P & P Micro Distributors Ltd, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancs, BB4 5HU. ☎ (0706) 217744.*

Live Wire

As someone who was quite involved with the contemporary dance world for a time, but also suffered at the hands of

unsympathetic choreographers and the recalcitrance of the Musicians' Union on the subject of prerecorded tapes, I'm always on the look out for new ways of putting movement back into music, and vice versa.

One good place for investigating alternatives is the International Dance Course, held every year at the University of Surrey with the assistance of the Gulbenkian Foundation. August's course saw an intriguing merging of talents in the shape of musicians/programmers **Live Wire** (Nic Bourne and Alan Smith) and a Birmingham dance group known as Precision Dance. What Live Wire have done is to develop a set of movement sensors that interface with a BBC Micro to control drum sound modules, synths, and the like from the action of the dancers.

So for instance, they've got pressure pads for rhythm and preset chords, infrared beams for triggering musical events, ultrasound for getting sequences going, and a microwave (low power!) doppler module that allows the dancer to play notes from a sort of pitch ladder by moving underneath the beam.

Aside from dance, of course, what Live Wire are trying to do raises all sorts of intriguing possibilities for real-time interaction with MIDI-encoded scores on micros. Let's face it, the major deficiency of the sequencer – MIDI or otherwise – is the obligation it places on the musician to adopt a 'tape-recorder' mode of working, where once all the notes have been entered, the user's playback interaction is limited to playing another line on top or fiddling with output levels. What's needed are some real-time sensors that can be used to colour and shape the music – much like a conductor and his baton.

Imagine having a couple of Live Wire's Doppler pitch ladders interfacing *via* MIDI to a synth or two, with the sequencer's operation controlled by MIDI timing events from a tap-dance routine on pressure pads. Definitely food for thought. Clearly, this is an area that's ripe for experimentation, and I'd say Live Wire deserve all the encouragement they can get. They're keen to develop the consultancy side of their work, so make a note of their address: *Coombe Fishacre, Newton Abbot, Devon, TQ12 5UQ.*

Bassyn and Synbad

From the musical point of view, the **Research Machines** 380Z and 480Z micros are pretty much non-starters. More's the pity, since so many of them are in use in schools courtesy of the Government's micro-educational policy. Still, a computer science lecturer at the North London College by the name of Ian Ferguson has now come up with a cheap monophonic digital synthesiser add-on for these machines. His BASSYN software extends the RML BASIC Version 5.0L to add further instructions for sound synthesis *via* some extra hardware. This comprises a specially designed DAC and low-pass filter that's been put together by E&MM contributor, Jim Grant, of the London College of Furniture.

The software allows limited Fourier synthesis of waveforms for the first seven harmonics, ADSR envelope specifications, and the ability to play a specified sound with any pitch, volume, or duration. The only hassle with all this is that CALLing a particular sound instruction has the same effect on the Z80 processor as high-resolution graphics – namely that the processor becomes totally pre-occupied with that task and nothing else.

Still, this limitation is only really important if your intention is to use the BASSYN software in a games context, meaning that your eyeballs won't exactly be grabbed by the speed of action. For purely musical applications, its monophonic digital synthesis capability is certainly a step in the right direction, albeit a good few miles away from what's currently being developed around Apples, BBC Micros, *et al.*

A further avenue is explored in ILECC's accompanying SYNBAD software – that of monophonic sequencing using the touch-sensitive Concept keyboard, though as this is just a flat membrane with assignable key areas, it's hardly akin to the real thing. No firm pricing for the package has been decided as yet, but it's intended that the system will be available from the autumn to ILEA schools and colleges, and for wider distribution shortly thereafter. Other interested parties are invited to contact Ed Carter at ILECC, Bethwin Road, London SE5 0PQ.

Other plans afoot from the same source are for a very different beast altogether – a high-quality polyphonic digital synth that's designed for portability between different computers, BBC Micro included. Features on the cards include a wide range of synthesis techniques (additive, FM, and sampling) and step-time and real-time polyphonic sequencing. Worth watching out for, I'd say. ■

E&MM Digital Music

The Programmable Digital Sound Generator

Part 5: Sound Systems Revisited

Our coverage of Clef Products' music system for the BBC Micro comes to a conclusion. *Alan Boothman*

A BASIC program was written which gives level values rising in the manner of a natural progression as the key velocity increases. Sixteen points were chosen covering the 2mS–32mS depression period mentioned earlier, and the term 'natural progression' covers a combination of non-linearity, shape of slope, and lower and upper limits of level. Four curves are available for use, varying in extent between 1 and 4 and containing suitable level offsets. Thus, for the strings only curve 3 is used, so as to give a relatively gentle touch control to both the rise and fall of the sound. The electric piano specification shows a contrasting situation where oscillator 1 uses a very hard velocity curve and oscillator 3 adopts the same curve used in the strings. Since the curve in oscillator 1 is controlling a relatively bright waveform (17) a sharp increase in high harmonics will occur under heavy playing. In contrast the more mellow waveform (20) will be the dominant sound with light touch.

The variation in tone at this stage only covers the moment of attack and corresponds to dynamic tone and level by touch-sensitivity. Later parameters in the envelope specification will decide the moving tonal pattern throughout the period of the envelope, while a zero in the velocity curve position means that the oscillator concerned will be non-touch sensitive, controlled only by 'MAX LEV'.

Frequency Tables

The generation of the tables was covered earlier, and requires only a simple BASIC program. Sound System 1 adopts the convention that Tables 1, 2 and 3 are on pitch, sharp and flat, respectively. Thus, in the string specification, all three tables are used, one for each oscillator, to produce a chorus effect. In the case of the electric piano, the longer mellow portion of the sound is on pitch whilst the attacking brighter oscillator is deliberately sharp, thereby giving a dynamic pitch variation throughout the envelope plus a small pitch response to keyboard touch.

Frequency Table 4 has been reserved to give a non-harmonic relationship to the fundamental frequency, but by using the simple BASIC program suggested, it's possible to load alternative table groups containing the characteristics required by the user.

A separate BASIC program within Sound System 1 allows waveforms to be developed by additive synthesis of chosen harmonics of sine, square, triangle and sawtooth waveforms. In BBC Micro terms, this is a 'chained' activity which preserves the machine code operating routines and tables below PAGE in the computer, and replaces the master BASIC program (which controls the displays and operating routines) with the waveform generation program. Before using this facility, it's necessary to set up an instrument specification which gives roughly the required envelope-shaping. Where a waveform is not already available, Tables 1 to 4 should be inserted into the blank WF Number positions. Within the wave generation program, the waveforms can then be modified in positions 1–4 whilst the user checks the overall result by playing the keyboard or using a stored sequence. The use of high-resolution graphics (MODE 4) to display waveforms makes this program substitution necessary, but the speed of the BBC DFS is such that all this occurs very rapidly. Reverting back to the main system is equally rapid and the newly-developed waveforms move with you, allowing further tailoring of the other parameters. At any stage, individual waves can be saved or grouped into a 16-waveform set and used in conjunction with the other 16 permanently present in the PDSG.

Channel

The string specification makes maximum use of the channel facility in that the centre channel (3) contains in-pitch sound, which mixes with 0.5% sharp and 0.5% flat sounds in left and right channels respectively, whilst the larger 1% difference between Tables 2 and 3 gives a faster relative phase movement across the stereo image.

Programming to remain compatible with two envelope edge shapes can become surprisingly complicated, particularly when touch-sensitive levels are also involved. In the linear mode (2), Sound System 1 treats all rates (Attack, Decay, and so on) after suitable scaling as an increment of amplitude, and the program simply accumulates from zero to maximum level (or the level defined by touch), and then drops by subtraction through Decay, Sustain and Release. If any of the rates ▷

```
CURRENT INSTRUMENT                    P-TO CHANGE

(1)   OSCILLATORS USED 3    NO1    No2    NO3
(2)   VEL. CURVE   (1-4)     3      3      3
(3)   FREQ.TAB.    (1-4)     1      2      3
(4)   W.F.NO.     (1-32)     22     22     22
(5)   CHANNEL      (1-3)     3      1      2
(6)   LOG-LIN      (1-2)     2      2      2
(7)   MAX LEV.   (0-255)     255    255    255
(8)   ATT.RTE.   (0-100)     55     53     50
(9)   DEC.RTE.   (0-100)     23     18     18
(10)  DEC.LEV.   (0-255)     160    160    160
(11)  SUS.RTE.   (0-100)     0      0      0
(12)  REL.RTE.   (0-100)     40     40     40
(13)  FED.RTE.   (0-100)     10     10     10

MODE    O-ON     S-SEQ.     C-CONT.     R-REC

SPACE STOP : A-ALTER  L-LOAD  F-FILE  INSTR

  INSTRUMENT-STRNG4T      M-MENU      MODE-OFF
```

Figure 1. Instrument specification – 'STRING 4T'.

```
CURRENT INSTRUMENT                    P-TO CHANGE

(1)   OSCILLATORS USED 2    NO1    No2
(2)   VEL. CURVE   (1-4)     1      3
(3)   FREQ.TAB.    (1-4)     2      1
(4)   W.F.NO.     (1-32)     17     20
(5)   CHANNEL      (1-3)     2      1
(6)   LOG-LIN      (1-2)     1      1
(7)   MAX LEV.   (0-255)     255    150
(8)   ATT.RTE.   (0-100)     1      2
(9)   DEC.RTE.   (0-100)     30     18
(10)  DEC.LEV.   (0-255)     120    99
(11)  SUS.RTE.   (0-100)     50     50
(12)  REL.RTE.   (0-100)     23     10
(13)  FED.RTE.   (0-100)     10     10

MODE    O-ON     S-SEQ.     C-CONT.     R-REC

SPACE STOP : A-ALTER  L-LOAD  F-FILE  INSTR

  INSTRUMENT-PELEC1       M-MENU      MODE-OFF
```

Figure 2. Instrument specification – 'PELEC 1'.

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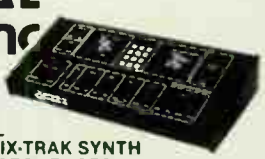

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involved are particularly fast, the increment is suitably scaled down and fed to the PDSG at a faster rate to give a smoother edge.

If a logarithmic or exponential edge shape is required, a table is used to define the falling activity but the rising edge is translated from the touch data to give a series of exponentially-reducing increments which are accumulated to form the edge.

Envelope Parameters

The remaining parameters come within the general area of ADSR with the ability to fix the maximum level for each oscillator and the level at which decay rate is replaced by sustain rate. The electric piano uses logarithmic edges, the attack rate of which is scaled progressively slower from 1 to 11, and the falling rates are scaled to be roughly equivalent to their counterparts in overall time, using numbers between 0 and 100 to indicate increasing speed. The amplitude increments mentioned in the previous section are actually two bytes long in order to give a wide range of time to the envelope edges. This gives a maximum limit of around 17 minutes spread over 65,000 numbers, so in order to use a sensible number of displayed increments (0–100), all ADSR rates have to be non-linearly scaled as part of the BASIC control program.

The electric piano uses oscillator 1 as the percussive component and oscillator 2 for the longer sustain portion. However, the overall sound is dynamic in tone by virtue of the relative numbers chosen for each parameter. The string specification uses linear edges throughout, but an interesting feature is the use of a decay rate which reduces the amplitude of sound before reaching the constant sustain section. This assists further in producing a clean sound when both chordal and melodic activities are occurring on the keyboard at the same time. The strings would normally be used in Pedal Mode 2, which means that the parameters on line 13 only come into force when all keys are released and the pedal is pressed. In contrast, the electric piano would use Pedal Mode 1, replacing the release rate with pedal rate under all conditions of pedal depression.

A summary of the sort of programming required to create a practical instrument along the lines of Sound System 1 is shown in Figure 3. This should give further food for thought on how the PDSG, with or without a keyboard, can be adopted to your own personal requirements. ■

PDSG pricing and availability details from: Clef Products, 44a Bramhall Lane South, Bramhall, Stockport, Cheshire SK7 1AH. ☎ 061-439 3297. See this month's Back Issues page for details of how to obtain previous instalments in the 'E&MM Digital Music' series.

BASIC Programming

1. Provide screen display of instrument index and enable selection of an alternative instrument from the computer keyboard.
2. Provide screen display of a single instrument specification and enable modification of any parameter from the computer keyboard.
3. Scale ADSR rate parameters to give suitable two-byte amplitude increments and a flagged indication of update frequency.
4. Control back-up storage for instrument specifications and sets, recorded sequences, waveforms and waveform sets.
5. Create multiple two-byte frequency increment tables to be loaded as required.
6. Create multiple non-linear velocity curves to be loaded as tables.
7. Create non-linear edge tables for envelope shaping.
8. Provide a means of creating waveforms of varied harmonic content with both screen display and audio feedback.

Assembly (MC) Programming

1. Scan keyboard, stacking important events for further processing.
2. Execute allocation and cancellation of logical oscillators.
3. Prime oscillators with required frequency, waveform and channel information.
4. Perform calculation and table manipulation to control oscillator level.
5. Write, read and interpret sequence information.
6. Provide fast routines for waveform and instrument specification transfer.

Figure 3. Sound System 1 – Software requirement summary.

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Amstrad CPC464 Home Computer

Music can't have been high on the list of design priorities for Amstrad's first entry into the home micro market, but could the 464's specification make it the budget MIDI computer of the future? *David Ellis*

If you've never come across the name 'Amstrad' before, then the odds are you've had your head in the sand the past few years. No disrespect intended, but Amstrad's low-cost, racked audio systems do have a certain notoriety for being almost as commonplace as flying ducks making their way up the flocked wallpaper behind the imitation Chippendale sideboard. 'NQOCD' ('Not Quite Our Class, Dearie'), as one of my NHS colleagues put it. Fortunately, the CPC464 is a good bit more tasteful than all that and marks the latest and calculated marketing ploy of Alan Sugar, Amstrad's whizz-kid chairman: namely, a cheap well-turned out micro that borrows the best ideas from all around the micro field and comes packaged as a ready-to-run system.

Two options are offered to the consumer. First, the basic £229 version, comprising the micro with built-in cassette drive and monochrome monitor; and second, the deluxe £339 version, comprising all the foregoing but with a medium resolution colour monitor in place of the black & white one. And yes, those quoted prices are correct. When you consider that a colour monitor of the quality in the Amstrad package is likely to set you back the best part of £200, and a cassette deck around £30, it's not beyond the bounds of mathematical genius to see you're getting the actual CPC464 micro for just £100, give or take the odd green one.

Design

There's no doubt that the CPC464 is a micro that's designed to serve rather than be serviced. The chip count inside really is remarkably low – especially when viewed alongside the 100 or so ICs in the BBC Micro – and that can only mean a decreased chance of Sod's Law coming into effect. And although the direct soldering of the chips is something of a two-edged sword (the CPC464 is bound to be more difficult to service if one of the blighters *does* fail), the Amstrad's immunity to pounding fists dislodging chips from cheap sockets should make this a micro that's as suitable for the playroom as it is for on-stage MIDI sequencing. Furthermore, the low chip count, judicious use of air vents and separate power supply can only mean that the 464 will also prove less prone to the over-heating problems that have always thwarted the attempts of owners of BBCs and Apples to get their charges performing properly on the stage of the Hammersmith Odeon and other emporia of audiovisual delights.

The Amstrad has a full QWERTY keyboard, a cluster of cursor keys, and a numeric keypad that doubles as a group of function keys. Alongside, there's the data recorder (with a mechanism borrowed from Amstrad's hi-fi ventures), but whilst it's obviously good

for the first-time user to have a built-in cassette machine, it's also true that the addition of this extends the length of the CPC464 to a somewhat unwieldy number of inches. I must admit that if I'd been designing this computer, I'd have considered some sort of modular construction (like that employed by some mixers, in fact) that allows either a data recorder or disk drive to be slotted on the end of the main unit. As it is, adding a disk drive to the system entails finding yet more space on an already crowded desk or table.

At the back of all this, there's a row of connectors for making the necessary micro moves to the outside world. The Amstrad's is a plentiful array, but one connection that is lacking is a duplicate of the cassette I/O, a fact that might seem a bit thick if you've already got a favourite cassette machine (unlikely, I admit) that you want to use with the CPC464 or if the built-in unit goes down on you.

Mind you, the Amstrad has almost everything else. First, there's the inevitable (on a machine that's destined for the games market, anyway) joystick port. Next, we find a Centronics-type printer connector: unfortunately, this is of the edge connector type rather than a decent D-type socket, which doesn't augur well for secure connections. After that, we come to the expansion socket – again, an edge connector – which is actually labelled 'floppy disk'. Now, assuming that most 464 purchasers will eventually realise the sense in going 'floppy', one wonders how Amstrad intend making provision for other peripherals to be added on once the disk drive is in place. I suppose it's the old stacked connector syndrome again, but to my mind, it seems short-sighted not having separate connectors on the back for the disk drive and general system expansion. Oh, well, I suppose I shouldn't grumble too much at this price, but it does strike me that some corners aren't worth cutting.

However, the disk drive that Amstrad intend supplying later on this year should actually give you much more than yer average floppy. Not only does the £199 price tag get you a 3" Hitachi-type drive (the sort that withstands idiotic advertising executives indulging their fantasies by driving over disks with 10-ton trucks) with interface, but also extra memory, the CP/M operating system, and Digital Research's LOGO to boot. A complete CP/M system for well under £500, in fact. Pretty impressive.

The remaining trio of back panel connectors concern sound, video, and power. Even though the CPC464's sound source is the bog standard General Instruments AY-3-8910, Amstrad's designers have made sensible use of the three separate channel outputs by providing stereo positioning of same. And although the basic machine has a really grotty speaker doing its best to distort like mad, one of these connectors allows the stereo sound to be piped off to your hi-fi, Amstrad or otherwise.

The CPC464 also breaks with tradition in the way it organises its power supply. In contrast to most machines that either put the power supply in an ugly, chunky box outside the micro or cram the necessaries under the keyboard, the 464 puts the power supply in the monitor, with an umbilical power cord supplying the main unit with the necessary juice. Finally, and next to this, there's the video output itself.

Performance

Seeing that one of the perpetual preoccupations of the human condition is to know who or what is bigger and better, computer magazines routinely use so-called 'benchmarks' – short programs which illustrate one or another aspects of a machine's performance – to judge a newcomer against the competition. Doing this with the CPC464 gives the following results against the BBC Micro, Apple II, and Spectrum for three benchmark tests:

	Test 1	*Test 2*	*Test 3*
BBC Micro	102 sec	3 sec	12 sec (Mode 7)
Amstrad CPC464	156 sec	3 sec	40 sec (Mode 1)
Apple II	257 sec	4 sec	18 sec
Spectrum 48K	540 sec	8 sec	55 sec

Test 1 is a string sort program that takes the numbers from 1 to 100 inclusive and sorts them so that they're in reverse order, Test 2 merely instructs the micros to add up the numbers between 1 and 1000 and then print the result, while Test 3 does the same except that each number has to be printed on the screen in turn, thereby giving some idea of how good the machines are at handling text display.

In fact, the display features of the CPC464 are really quite impressive – a maximum number of 16 colours (from 27) with a maximum resolution of 640×200. That compares with 8 of 8 at 640×256 on the BBC Micro. Three different graphics modes are available and, unlike the BBC, the more memory-greedy modes don't chew up the memory available to the user, meaning that 42K of the machine's 64K is always available for use. The one drawback to the generally very acceptable colour monitor supplied with the review system is that the mode supporting 80-column text (essential for serious word processing, I'd say) just wasn't clear enough for extended use. That means having to use the higher resolution monochrome monitor instead.

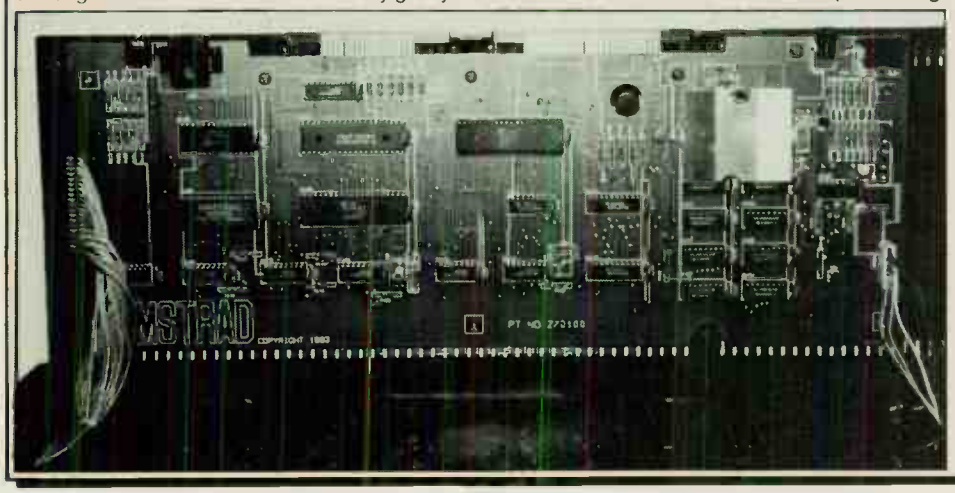
But hold on, what happens if you want to use the CPC464 for both word processing (where you want clarity) *and* games (where you want colour)? Well, therein lies the real dilemma posed by Amstrad's over-enthusiastic packaging. If you buy the version with colour monitor and then decided to add on a black and white one of non-Amstrad pedigree for the purposes of word processing, you'll find that the colour monitor still has to sit where it sat before for the simple reason that (a) the micro gets its power supply from the monitor, and (b) the power cable is too short to allow the monitor to be shifted to one side. And of course, exactly the same problem would apply if you'd bought the monochrome version first and subsequently wanted to use the CPC464 with a colour monitor. Amstrad's way around this problem is to sell a separate modulator/power supply for £30, but you still have to buy the monitor in the first place, which means that you're paying for two power supplies. Clearly, not a very satisfactory state of affairs.

Locomotion

For most users, the Amstrad's performance will be judged on what they can get out of the resident version of BASIC – the so-called 'Locomotive BASIC.' In fact, this is quite a nice BASIC, even if it does lack the multi-line procedures or functions with the facility to pass local variables that makes BBC BASIC such a strong contender in the structured programming stakes. Unlike BBC BASIC, there's no 'REPEAT . . . UNTIL' loop structure, but it does have 'WHILE . . . WEND' instead and, aside from the fact that I love the archaism of wending one's way in a program, the Locomotive way of doing it means that the test for executing the loop is performed at the start rather than the end of the process, which is intuitively neater and more efficient.

Also very neat is the feature of Locomotive BASIC that allows it to handle Z80 interrupts directly. Typically, this means you can have a number of programs running alongside each other with each grabbing the processor's attention from the other according to where they're at. Lots of musical applications in that. In addition, Locomotive BASIC also has a special ON SQ GOSUB command which checks whether there's space in a given channel's sound queue and interrupts to a sound subroutine automatically: very similar to the queuing side of sound on the BBC Micro, really.

Actually, there are quite strong similarities with the BBC Micro on a more basic side of the CPC464's musical capabilities. For instance, both have a multi-parameter statement called SOUND which orders all the necessary values together before they're sent off to the operating system's sound queues and the sound chip's registers. But one black mark Amstrad do get is for the way in which pitch values are programmed. The Beeb makes the sensible move of having a linear series of values going from 0 to 255, with 0 being the B an octave below middle C and 255 being God knows where very high up. So, wherever you are in the range, an increment of 48 changes the pitch by an octave, 20 by a fourth, and so on. All very sensible. Amstrad, on the other hand, have insisted on perpetuating the tiresome and entirely unmusical tradition of plugging in very large values that ▷



have no correlation with musical intervals. So, a 'period' of 3822 gives a bottom C, 1911 the C above that, and 956 the next C up. In other words, you're obliged to work out pitchings on an inverse logarithmic basis. Awkward in the extreme, if you ask me.

On the other hand, Locomotive BASIC does separate out the BBC's ENVELOPE statement into a more manageable format, with one statement governing the amplitude envelope and the other the tone envelope (sic), ie. 'ENV' and 'ENT'. So, if you want to use one without the other, life is marginally easier. For a taste of similarities and differences, Figures 1 and 2 give a couple of examples of sound programs on the BBC Micro and the CPC464. Program 1 is designed to maximise the gruesome side of micro music, by (mis)use of the RND function, simulated reverb (the two silent SOUND statements – lines 50 & 60 on the BBC, 60 & 70 on the Amstrad), and pitch offsets. Program 2, on the other hand, is designed to appeal to the more romantic side of the spirit and, unlike records, it won't get stuck at the wrong moment... (No prizes for guessing the source of the two bars of rhythm held in the DATA statements.)

Figure 1: Fangs for the memory/filename: CREEPY/Acornsoft (C) 1984

```
10 REM BBC Micro
20 del%=3
30 dur%=20
40 ENVELOPE 1,6, -1,1,-1,1,1,1,
   126,-1,0,-126,126,126
50 SOUND 2,0,0,del%
60 SOUND 3,0,0,del%*2
70 REPEAT
80 pitch%=RND(24)*4
90 SOUND 1,1,pitch%,dur%
100 SOUND 2,1,pitch%-1,dur%
110 SOUND 3,1,pitch%+1,dur%
120 UNTIL blood%=0
```

```
10 REM Amstrad CPC-464
20 del%=25
30 dur%=100
40 ENV 1,100,2,4
50 ENT 1,3,1,3,3,-1,3,3,1,3,
   3,-1,3,3,1,3
60 SOUND 2,0,del%,0,0,0,0
70 SOUND 4,0,del%*2,0,0,0,0
80 WHILE blood%>0
90 pitch%=INT(RND(1)*100)
100 SOUND 1,pitch%,dur%,15,1,1,0
110 SOUND 2,pitch%+20,dur%,15,1,1,0
120 SOUND 4,pitch%+10,dur%,15,1,1,0
130 WEND
```

Figure 2: Music for '10'/filename: DUD/Acornsoft (C) 1984

```
10 REM BBC Micro
20 ENVELOPE 1,1, 0,0,0,0,0,0,0,
   127,-6,0,-48,110,0
30 N%=23
40 DATA 9,3,3,3,9,3,3,3,9,9
50 DATA 9,3,3,3,9,3,3,3,3,3,
   3,3,3
60 REPEAT
70 RESTORE
80 FOR I%=0TON%
90 READ dur%
100 SOUND 0,1,4,dur%
110 NEXT
120 UNTIL sex%=10
```

```
10 REM Amstrad CPC-464
20 ENV 1,2,3,1,1,0,3,5,-3,2
30 N%=23
40 DATA 9,3,3,3,9,3,3,3,9,9
50 DATA 9,3,3,3,9,3,3,3,3,3,
   3,3,3
60 WHILE sex%<10
70 RESTORE 40
80 FOR I%=0TON%
90 READ dur%
100 SOUND 1,0,dur%*4,15,1,0,14
110 NEXT
120 WEND
```

Conclusions

Well, to be candid, I think this is a very nice micro. On the design side, there really are very few miscalculations, so it's a shame that the same isn't also true about certain aspects of interfacing, pitch values, and power supplies. But these are small points, and I'm sure the CPC464 will sell and sell.

From a musical viewpoint, there's no point in beating about the bush when it comes to the less than ingratiating capabilities of the Amstrad's AY-3-8910 sound chip. So, let's remind ourselves instead of the requirements for a micro to be used in MIDI applications – reasonably fast, plenty of memory, good graphics, a full-size keyboard, easy interfacing, decent storage capabilities, and a fair price. The CPC464 has them all. So come on, all you MIDI software companies, forget the Spectrum – this is the MIDI micro for 1985! ■

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BeeBMIDI 4

A look at how our MIDI interface for the BBC home micro receives MIDI data and the usefulness of interrupts. *Jay Chapman*

The simplest method of receiving MIDI data *via* MIDI In involves looking at the 'Receive Register Full' bit in the 6850 ACIA Status Register to see if a byte has arrived. This is both useful and very easy to understand (and has already been described several times in the pages of E&MM). Unfortunately, it is not consistently fast enough on the BBC Micro, for reasons which will be explained below.

To be more exact, the problem is not simply one of sheer speed but one of response. The BeeBMIDI interface and BBC Micro certainly have sufficient speed provided the micro responds fast enough when a byte arrives, but the crux of the problem is that the computer might not 'choose' to look to see if a byte is present for some time after the byte actually arrives. By the time the micro looks, and notices that a byte has arrived, the next byte might also have arrived, and one of the bytes, the second, will be lost (this is a simplification – for those interested, it is the arrival of the start bit of the third byte which causes the loss of the second).

Those of you who are using the DX7DUMP program published in E&MM August will already have had some experience of the problem described above: you may have noticed that it can take several attempts to receive voice data from the DX7. What happens is that sometimes the Beeb is not fast enough and one or more data bytes are lost. DX7DUMP uses the checksum calculation to make sure we know when the data has been received correctly so that we're not left with any bad data, and deals with the problem by simply retrying until a 'clean' copy of the data arrives. This is the method used by some more automatic communication systems where data is checked on arrival; if it is corrupted, the receiver asks for a retransmission. Since the Yamaha DX7 doesn't understand any such commands sent over MIDI, the DX7DUMP program has to use its human user as an intermediary: you keep pushing the voice selection keypad until the 'voice received OK' message appears.

Real Time Input

This is where the problem really rears its ugly head.

By real time input, I mean any input where a guaranteed response time is required to avoid corruption of the data being input. There are several situations in which we are interested in real time input when using a microcomputer with MIDI, and these include (a) receiving voice (or other parameter) data from a synth, (b) receiving rhythm track data from a drum machine, (c) receiving keyboard and controller data during a (real time) performance, and (d) receiving such data during step time input.

Points (a), (b) and (d) relate to the DX7DUMP problem discussed above, in the sense that if the data is not received correctly, and provided that you can *tell* that it wasn't, there is no real harm done apart from the inconvenience of organising a second attempt. The real subject matter of this article applies more importantly to point (c), because in this case you *can't* retry. If you lose some data then you've already blown it; you can't stop your performance (in front of all those thousands of fans, you know) saying 'whoops – hold on lads – lost a byte there – can we do that last bit again?'.

Before we spend time solving the problem, perhaps we should look at what pain it could cause us.

The extent of the pain depends on which byte you lose, the format of the data being received, and the reaction your particular synth has to the given situation. We need a little understanding of the MIDI protocol to see what is happening.

First off, have a look at the streams of bytes in Figure 1: note that '&' before a number indicates hexadecimal. Let's assume that Stream A is part of what we are supposed to receive from the synth *via* MIDI In. Having 'recorded' the data in the micro's memory, we can then 'replay' it by sending it back to the synth on MIDI Out. Those of you that are on form will realise that the timing associated with the data (ie. when the notes were actually played) also needs sorting out, but we'll ignore that for the sake of simplicity. For those not over-familiar with MIDI Protocol, Stream A tells the synth (or the micro) that: &90 – 'key on' information follows; &3C, &40 – the key middle C, whose number is &3C, should be struck with medium strength/velocity because the &40 is out of a possible &7F ie. use 64/127ths of full strength (&40 = 64 decimal, &7F = 127 decimal; &90 – 'key on' again; &3C, &00 – turn middle C off since a 'key on' velocity of zero actually means turn the key off! Note that Stream A does not use Running Status where only the first &90 would have been required.

Moving on to Stream B, we see that the first &3C byte has been lost during reception. So what will happen when the micro sends the altered sequence back to the synth? Simple. The synth will see the &90 and expect a pair of bytes (key number and velocity) to follow. The &40 will be taken as the (wrong) key number to play, but since a new status byte (the second &90) is seen instead of the expected velocity byte, the synth will probably just ignore the misformed 'note'. So nothing too terrible has happened: one note of our *magnum opus* has been lost, but we'll live.

In Stream C the &00 byte is lost, which will certainly create trouble on most synths since, assuming the misformed 'pair' is ignored as above, the middle C note is now never turned off at all. If you're using a sound that sustains while a key is held down, such as an electric organ, you'll have a drone note continuing for ever. If too many notes are left on in this way, my DX7 gets a form of the hiccups and I have to turn it off and back on again to restore it to sanity. If, on the other hand, you're using a sound that decays (a piano, say), then you won't *hear* the drone, but one set of sound generators is still tied up forever!

If you MIDI 'record' and 'playback' some notes played on a Roland JX3P and lose the &00 byte on the way, the drone would be cut off because the JX3P sends an 'All Notes Off' message after every batch of completed notes, which turns off any drones on 'playback'.

Unfortunately, the DX7 ignores such

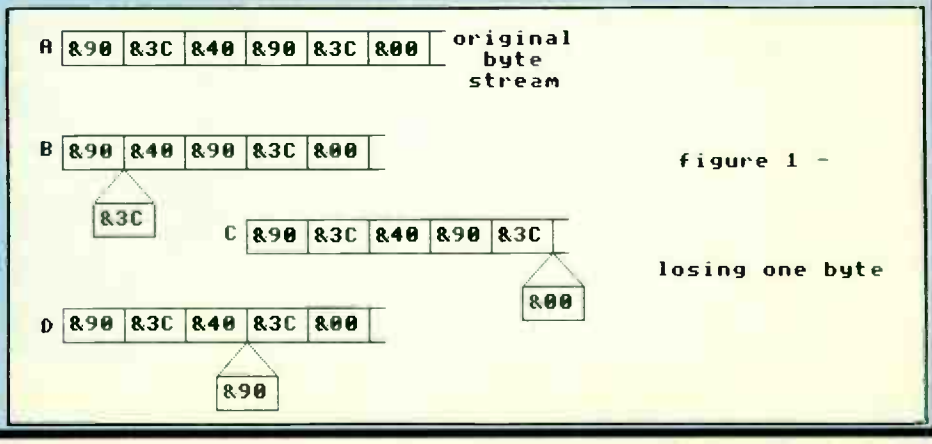


figure 1 -

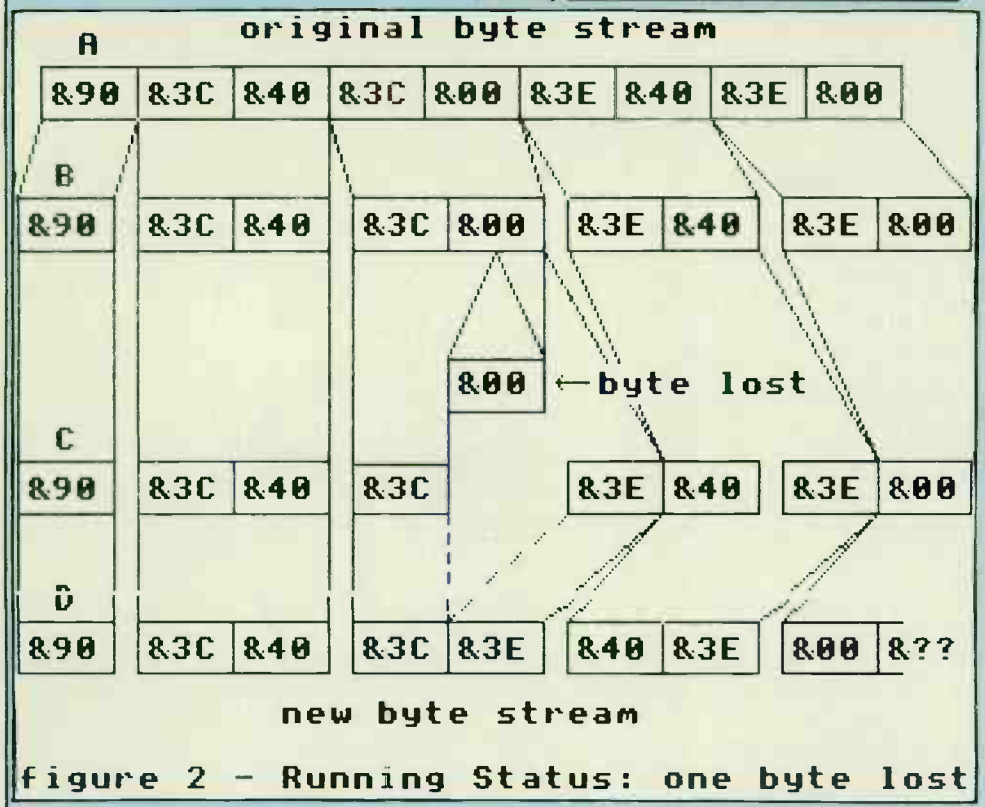


figure 2 - Running Status: one byte lost

messages.

Note that in Stream D, losing the second &90 byte does no harm, since MIDI Running Status allows the receiver to assume that the status continues to be that of the first &90. If the byte lost had been a new status we might have been in trouble. We might have ended up replaying pitch-bend information for a different channel as key on/key off information for the synth on MIDI Channel 1. I suppose it's one way to get into *avant garde* electronic music . . .

Finally, have a look at Figure 2, where Running Status is being used. Stream A might be several hundred bytes long, and after the first status byte, &90, consists of key number/ velocity pairs (shown in Stream B) which start off by 'playing' middle C (&3C, &40) and then turning it off (&3C, &00) followed by the D above middle C being on (&3E, &40) and then off (&3E, &00), and so on, *ad infinitum*. Stream C shows the new stream formed when the first &00 byte is lost, and Stream D shows the new key number/velocity pairing.

We now have middle C on (&3C, &40) but never off, followed by middle C on again with slightly less velocity (&3C, &3E), followed by the E above middle C on (&40, &3E) but never off, followed by . . . well, the whole of your brilliantly played keyboard extravaganza using randomly pitched drone notes.

These problems are caused not because the micro isn't fast enough but because it simply didn't choose to look to see if a byte had arrived. 'Why does the micro choose not to look?', I hear you ask. Well, there are two distinct reasons.

The simpler of the two to understand is down to the programmer trying to organise the real time input. Once a byte has arrived, there's still a lot of work to do. The current byte must be put away in the correct place in the sequence of bytes being stored, and data pointers and counters must be kept up to date. And what about the legality of the current byte? – is it a status byte? – do we have a change of running status? – has the clock which is timing the arrival of these bytes ticked? – must a timemark be stored? – has the user pressed the abort button? – . . . I could go on.

All of the above take time, naturally, and yet if this 'housekeeping' were not done, the MIDI In data bytes would be useless, so the programmer (and therefore the micro) 'chooses' not to be looking for a byte arriving all the time. Sometimes it just takes too much time, and when we check the 6850 ACIA we find we've had an Overrun error and have lost at least one byte.

The second reason will become apparent as we progress.

Interrupts

This article won't teach you everything you need to know about interrupts, but it should provide you with a commonsense understanding of what goes on. We will assume that the 6502 CPU in the BBC Micro is executing our real time input program, ie. doing the housekeeping already mentioned and expecting data bytes to arrive over MIDI In. How do we arrange for any bytes that arrive during the housekeeping to be kept safe until we can deal with them? Simple. We arrange for the housekeeping to be interrupted.

When a byte arrives in the 6850 ACIA from MIDI In, the 6850 NIRQ (Not Interrupt ReQuest) line is used to signal to the 6502, and to cut a long story short, the 6502 stops what it's doing – executing the housekeeping – and starts running another routine that we have previously set up. This routine grabs the byte from the ACIA, stores it safely; and then lets the 6502 continue with the housekeeping. In this way the byte is dealt with as soon as it arrives: the housekeeping routine can pick the byte up from storage some time later but the ACIA is already 'empty' and can safely accept the next byte.

So, interrupts allow us to do two things at the same time, since the housekeeping routine doesn't know that the interrupt has occurred or that the other routine has been executed. In fact, the BBC Micro makes extensive use of interrupts to perform a number of 'background' tasks keeping the clock pseudo-function TIME ticking along, for instance.

Interrupts Interrupted

We can now talk about the second reason why a program might not choose to look to see if a byte has arrived over MIDI In.

Imagine that an interrupt occurs just after some other interrupt took place. If the first interrupt's routine has not yet finished, the 6502 stops executing this routine and hands control over to the routine for the second interrupt. When the second routine finishes, control is handed back to the first routine when it will continue from where it was interrupted and – with luck – finish and hand control back to the original program. Unless another interrupt occurs first . . .

It can be extremely inconvenient, not to say disastrous, to let an interrupt routine be interrupted in this way. However, if it does happen, we can prevent an interrupt being noticed by 'masking' it out, and we'll examine this process in more detail next month. Now, if an interrupt occurs just before our MIDI In interrupt, and the first routine masks out interrupts and then takes so long before enabling interrupts once more that the next MIDI In byte is overwritten (by the one following it) then we're in trouble yet again.

Since the BBC Micro makes extensive use of interrupts, bytes do occasionally get lost if we use maskable ones. However, the 6502 has a second sort of interrupt called 'NMI' ('Non Maskable Interrupt'). If you use NMI, your interrupt will definitely be dealt with immediately, though because of the potential for disruption (ie. the chances of crashing your programs if the thing is used incorrectly) presented by NMI, it should be used carefully. In fact, very little is said about its use – even in the Advanced User Guide -- so read next month's article to find out what to do.

Interface Amendments

This non-maskable interrupt is accessible *via* the NNMI (or Not NMI) line on the BBC's 1MHz bus. In order that those souls brave enough can use NMI, our BeeBMIDI interface PCB has been amended to allow the use of a wire link ▷

figure 3 - ORIGINAL board

6850 NIRQ connects direct to 1MHz bus NIRQ as shown

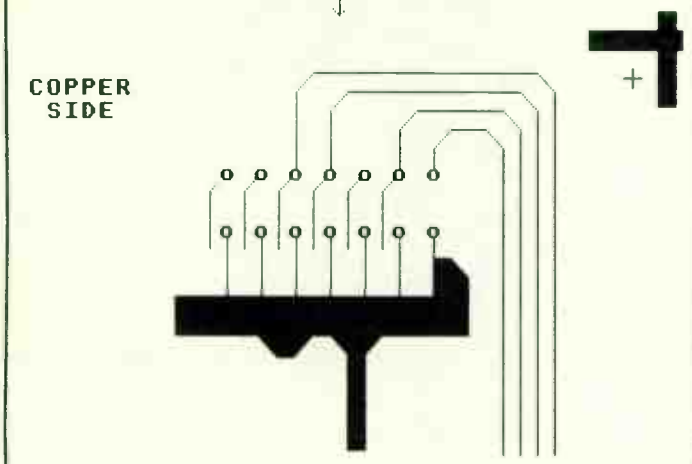
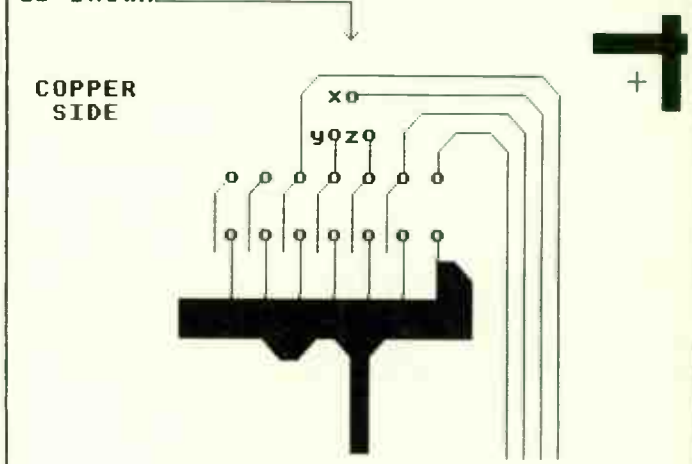


figure 4 - AMENDED board

6850 NIRQ can be connected to either 1MHZ NIRQ (link x-y) or NNMI (link x-z) as shown



to specify which 1MHz bus interrupt line (NIRQ or NNMI) is connected to the Interrupt Request pin of the 6850 ACIA. Figures 3 and 4 show the relevant part of the PCB's copper side before and after amendment.

If you already have an original board, you can cut the original PCB track to the NIRQ line and solder a short link on the track side of the board to the NNMI pin (instead of the NIRQ one) to give the same effect – and since I'm still using the *original* original BeeBMIDI interface, that's just what I have had to do!

If you don't want to use interrupts, don't worry about the amendment to the board: don't make either of the links and it won't affect you.

This month was the theory. Next month sees the actual code to handle both IRQ and NMI interrupts and the necessary buffers, pointers, counters and communication with the main program. Don't miss it. ■

BeebMIDI 1 (E&MM June '84) contained the technological and constructional details of this MIDI Interface for the BBC Model B micro, Part 2 (E&MM July '84) continued with a full parts list and some MIDI software routines, while BeebMIDI 3 (E&MM Aug '84) featured a Patch Dump for the Yamaha DX7.

The PCB is available from EmmSoft, E&MM, Alexander House, 1 Milton Road, Cambridge, CB4 1UY, at £4.95 (inclusive of VAT and postage and packing).

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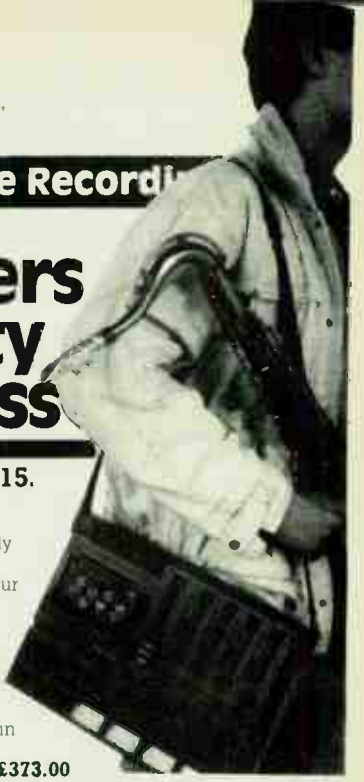

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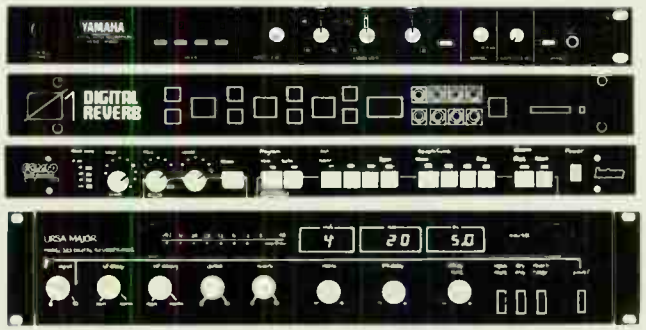

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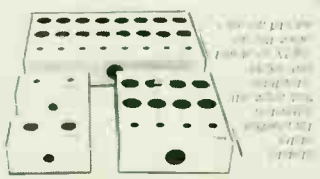

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THE FAIRLIGHT EXPLAINED

How the CMI provides for special effects and looping – in a language just about everyone can understand. *Jim Grant*

Last month we dealt with one of the Fairlight's main sound creation methods: sampling. The simple act of pointing a microphone at a sound source and typing 'S' on the alphanumeric keyboard transforms the Fairlight from an expensive computer into a powerful musical instrument. And the keyword here is 'musical'. The ability to create new and interesting sounds (or indeed sample them) is not in itself enough. What is required is *control* over that sound and, to coin a popular phrase, the control must be real-time. Musicians, of course, call this control 'expression', and it's a particularly difficult feature to build into a computer-based musical instrument.

Consider a typical case in which a Fairlight user might be playing the music keyboard while listening to a sequence pre-recorded on Page 9. Everything is running smoothly: the CMI is reading sequence information from the disk, sorting it out, and sending the data to the voice channels to be played. At the same time, the music keyboard is being scanned for pressed notes and more data sent to the channel cards: notes are stolen if necessary. Next the user may decide to swell a particular voice by moving the appropriate footpedal. Here the CMI is forced to deal with an asynchronous event in the normal proceedings, so the pedal value has to be updated constantly and the values obtained used to scale the amplitude of the voice throughout its duration. And if this were not enough, the Fairlight has 17 parameters capable of being controlled in real-time.

It's the unusual multi-processor architecture of the CMI that enables it to handle so many asynchronous tasks simultaneously, but let's move on to the presentation of the controls and their use.

Page 7

All the controls are handled by Page 7, and a typical display is shown in Figure 1. The page features all the usual controls associated with processing sound: each of the eight voices loaded can have its own unique control setting and can be saved to disk with a chosen filename and the suffix CO. When a voice is loaded into the CMI, it will pull in a specified control file if it was previously Linked to the voice, using the command LNK.

At the bottom of the display is a box which indicates currently-loaded voices. The control file may have a different name from its intended voice so the two are differentiated visually. The active control file is the name highlighted while the active voice is shown in the top right-hand corner. Other control files can be inspected by pointing the lightpen at the names in the display box or by typing 'V,n', where 'n' is the voice number.

There are six real-time faders and five switches patchable to most parameters. Three of the faders and two of the switches are on the left-hand side of the music keyboard, while the other faders (or footpedals) are accessible *via* Cannon-type connectors on the rear of the keyboard. In addition, the music keyboard

passes key velocity information to the CMI, and this can be patched to Level and Attack as KEYVEL.

Below the voice list in Figure 1 is a complete list of the controls and switches that are available. This is used in conjunction with the lightpen and provides a quick way of patching the controls to various parameters: the lightpen is pointed first at the parameter and then at the control list. A patch can also be established by tabbing a cursor around the display using the QWERTY keyboard and typing in the appropriate name or numeric value. Figure 2 shows one of the 'Help' sheets for Page 7 which provide a quick reference for the range and possible patches available.

Some of the control parameters are self-explanatory, such as 'Level', 'Vib Speed' and 'Vib Depth'. Again, we come across the enigmatic 'Mode' switch, which is best left until Pages 4 and 5 are discussed (*the suspense is killing me – **Ed***). 'EXP' is the other half of the companding process that was an option on Page 8 discussed last month. As you may remember, it's a hardware option and is very rarely fitted to the CMI due to the non-linear sampling data that results from its use. The Filter is a low-pass tracking filter resident on each Channel card, used to attenuate any unwanted high-frequency content present in the voice: the cutoff frequency is raised by simply increasing the value. It's all really a case of swings and roundabouts – a high filter setting gives a bright realistic sound but often with digital birdies warbling in the background, while low filter values suppress any funnies but reduce the sound to a dull noise.

When Portamento is on, each Channel allocated to the voice produces a continuous glide between each new pitch it is to play and the last pitch played, the rate of note glide being set by the Speed control. 'Glissando' differs from Portamento in that the glide is not continuous but chromatic, and all the notes on the keyboard between the start and end notes are played. If both Portamento and Glissando are selected, Portamento takes precedence. 'Constant Time' is a switch which selects between two types of glide: when it's turned on, the same time is taken to travel any musical interval and the rate of change alters according to that interval, hence the name 'Constant Time'. This results in polyphonic portamento or glissando, in which the notes arrive at their destinations at the same time producing a coherent chord. With the switch off, the rate of change remains fixed (determined by Speed) and the time taken to glide varies with the size of the interval.

Attack and Damping

The Attack parameter has a range of zero to 16,384 milliseconds, and may be patched to 'KEYVEL' for touch-sensitive control of the attack time. It's active only for Mode 4 sounds, and is extremely useful for imposing a degree of artificial enveloping upon sampled sounds. 'Damping' has a range of zero to 65,536 milliseconds, reduced to 16,384 milliseconds in Mode 4. The value determines the final decay time of the voice, ie. from key release to silence. If a loop is active and one or more segments are repeated continuously, the voice plays the loop until the damping time expires (when the key is released), otherwise the voice continues through the remaining segments. Should the end segment be reached before the damping time expires, the voice stops abruptly.

The 'Slur' switch is useful for glissando

and portamento effects, as it causes Channel cards allocated to a voice to sustain indefinitely in a loop that may be active until a new note is played. New notes are started at the beginning of the loop without playing any of the preceding segments. 'Sustain' determines the behaviour of the voice once the key is released. Normally, a voice fades out either playing its loop or until it hits the end of the segments, but when Sustain is on, Damping is ignored and the voice loops for the duration of key depression: upon key release, the voice continues to play its remaining segments with no decay of amplitude.

Looping

Choosing the correct looping point of a voice waveform can make or break a good sound on the Fairlight. Nasty glitches can occur if an inappropriate sample rate is chosen or if the section to be looped spans a natural change of amplitude.

Imagine trying to loop a percussive sound such as a drum. The three loop controls on Page 7 provide a quick way of finding the best loop, and a typical setting might be as shown in Figure 3. Here Control 1 is used to define start point of the loop while Control 2 sets the length. Switch 1 freezes the effect of Control 1 and Control 2 when off, preventing accidental movement of the looping points once these have been decided. A useful feature is that loop parameters are saved with the voice information as well as any Linked control file, so that the sound is playable even though no performance controls are required. The actual loop points are displayed graphically on Page 4, as shown in Figure 4, where the horizontal axis represents the segment number and therefore time. The loop is indicated by the row of highlighted boxes under the Harmonic Profiles graph, and since the voice shown was sampled, there are none of these present. This Page offers a convenient method of selecting looping points using the light-pen.

'Start Seg' is a powerful expression control. It allows the starting segment of the voice to be chosen according to a control value as a new key is played. To explain: suppose we had sampled the classic synthesiser filter sweep and playing the keyboard resulted in a 'fruity' decay. Using a control fader to set the start segment would then enable us to play the synth sound from different parts of the filter sweep. As the control was moved from segment 1 to 128, the sound would begin with plenty of filter sizzle at low control values but become shorter and more mellow as we started the sound further down the sweep (by increasing the Start Segment number). This technique can also be used to control the amount of 'breath' on sampled wind sounds or the amount of bowing on stringed instruments.

Next month, page 5 and some revelations concerning the mysterious 'Mode'. ■

Figure 1.

```
INDEX                  *** PAGE 7 READY ***                  VOICE: 1
COMMAND                                                      BDD2

                          CONTROL PARAMETERS

                      CONTROL FILE:   BDD2      C0

      MODE = 4            GLISSANDO = OFF       LOOP CNTRL = OFF
       EXP = OFF          PORTAMENTO = OFF      LOOP START = 1
     LEVEL = KEYVEL           SPEED = 0        LOOP LNGTH = 1
    FILTER = 12         CONST TIME = ON         START SEG = 89

   DAMPING = 200          VIB DEPTH = 0              SLUR = OFF
    ATTACK = 0            VIB SPEED = 0           SUSTAIN = OFF


   VOICES:    BDD2        STICK      BASSGT      STRMID1
              STRMID2     CBELL000   TANN        GANGSA

   CNTRL:  1  2  3  4  5  6          SWTCH:  1  2  3  4  5

   ON   OFF   ZERO                   KEYVEL
```

Figure 2.

```
PAGE 7          PAGE 7   HELP SHEET  6 of 15          FRE  TOP  FWD  BWD
QUICK REFERENCE CHART shows ranges and possible patches for
each control parameter

   Control Parameter   Range      Patch
        MODE           1,4
        EXP            ON,OFF      S          S  SWTCH1-5
        LEVEL          0-255       C K        C  CNTRL1-6
        FILTER         1-15                   K  KEYVEL
        DAMPING        0-65535     C
        ATTACK         0-16383     C K
        GLISSANDO      ON,OFF      S
        PORTAMENTO     ON,OFF      S
        SPEED          0-127       C
        CONSTANT TIME  ON,OFF      S
        VIBRATO DEPTH  0-127       C
        VIBRATO SPEED  0-127       C
        LOOP CONTROL   ON,OFF      S
        LOOP START     1-128       C
        LOOP LENGTH    0-128       C
        START SEGMENT  1-128       C
        SLUR           ON,OFF      S
        SUSTAIN        ON,OFF      S
```

Figure 3.

```
INDEX                  *** PAGE 7 READY ***                  VOICE: 4
COMMAND                                                      STRMID1

                          CONTROL PARAMETERS

                      CONTROL FILE:   LOOP      C0

      MODE = 4            GLISSANDO = SWTCH3    LOOP CNTRL = SWTCH1
       EXP = OFF          PORTAMENTO = OFF      LOOP START = CNTRL1
     LEVEL = KEYVEL           SPEED = 34       LOOP LNGTH = CNTRL2
    FILTER = 8          CONST TIME = ON         START SEG = 1

   DAMPING = 50           VIB DEPTH = CNTRL3         SLUR = SWTCH2
    ATTACK = 10           VIB SPEED = 0           SUSTAIN = OFF


   VOICES:    BDD2        STICK      BASSGT      STRMID1
              STRMID2     CBELL000   TANN        GANGSA

   CNTRL:  1  2  3  4  5  6          SWTCH:  1  2  3  4  5

   ON   OFF   ZERO                   KEYVEL
```

Figure 4.

```
INDEX                  *** PAGE 4 READY ***                  VOICE: 4
COMMAND                                                      STRMID1
                          HARMONIC PROFILES                  MODE: 4

                                                  LOOP   JOIN   PLOT

 1 2 3 4 5 6 7 8 | 9 10 11 12 13 14 15 16 | 17 18 19 20 21 22 23 24 | 25 26 27 28 29 30 31 32

 CLEAR  DELETE  RESET  ZERO  COMPUTE                  INTERP: ON OFF
```

Electronic Drum Sequencer

Software for BBC Micro

Some new software that allows E&MM's electronic percussion modules to be sequenced using either the OMDAC or the user port of the BBC B.

Dave Burden

Last month's issue gave details as to how our OMDAC music control peripheral – already compatible with Acorn Atom and Sinclair Spectrum home computers – can be modified for use with the BBC Micro. Elsewhere in the same issue, there was a description of how a complete electronic drum kit could be built using E&MM's analogue electronic percussion modules – the Syntom, Synbal, and Synclap. This drum sequencer software was written to control a custom electronic percussion unit built along similar lines (though without a set of kit pads), so it's not inconceivable that some readers could combine these two developments to provide a complete performance and sequencing system, all at a fraction of the cost of commercially-available units.

Alternatively, the sequencer can be used to control any other drum unit that will accept the OMDAC's +5V trigger (E&MM's digital Syndrom, for example), while 'OMDAC-less' readers can connect modules direct to the BBC's User Port.

System Outline

The software for the system is disk-based, and although the ideal state of affairs would be to employ two drives (one for the Systems disk, the other for the File disk), the system is almost as easily used with just the one, and frankly, that's all this designer's finances are ever likely to see. Cassette operation is sadly impractical, as extensive use of random access files and program overlays is made and using a cassette would be unbearably slow.

The software was written using BASIC II (gives (c) 1982 when you type "REPORT"), and makes use of several commands available only on this version, notably OPENIN and OSCLI.

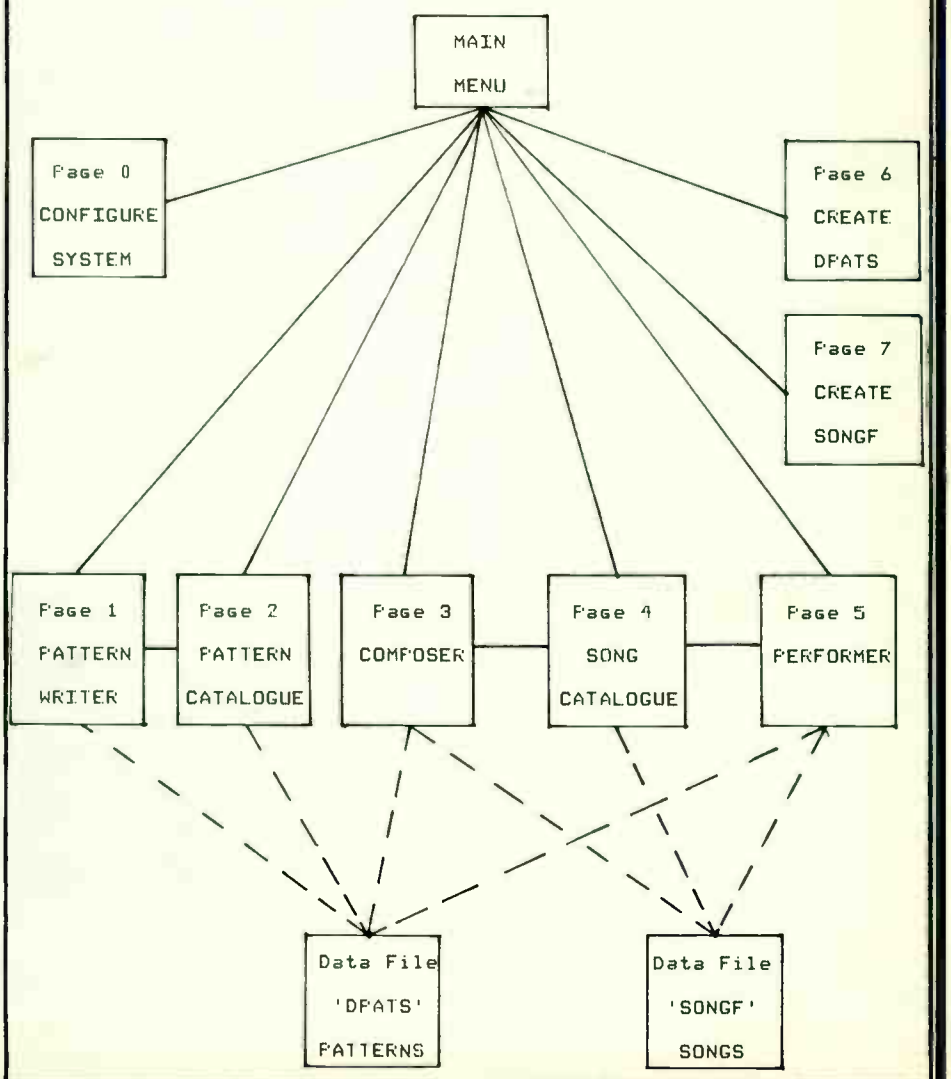
The sequencer provides for triggering of up to 12 percussion channels, though if you don't have that many modules at your disposal, some of these channels may be used instead to control accent or hi-hat open/close functions, for example.

The software is arranged as a succession of Pages which guide the user through the composition process. First, patterns are written using a cursor on a 32 × 12 grid, the pattern being played continuously with changes programmed taking immediate effect. Once you're happy with your pattern, it can be assigned a six-character name and stored in a Pattern File for later use.

The next Page enables percussion tracks to be composed using previously written patterns chained together in sequence. A simple composition language provides Repeat, Segment Loop, and Tempo Change commands: songs are limited to a maximum of 200 bars, using as many as 20 different patterns. However, the Performance Page enables up to 15 songs to be strung together automatically, providing about an hour's worth of programmed percussion, which should be enough for anybody. Since File disks can be created at will, there's no limit to the number of patterns that can be written and stored using the Composer and Performance Pages.

An outline of the system software is shown in Figure 1. Seven main pages are selected from the menu, and some of these consist of a couple of interlinked programs – usually a machine code loader and screen set-up, accompanied by the main number-cruncher. All these programs are supplied with the Systems disk and add up to about 40K of software in all.

Figure 1: OUTLINE OF SYSTEM SOFTWARE



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Software Description

PAGE 0: CONFIGURE SEQUENCER

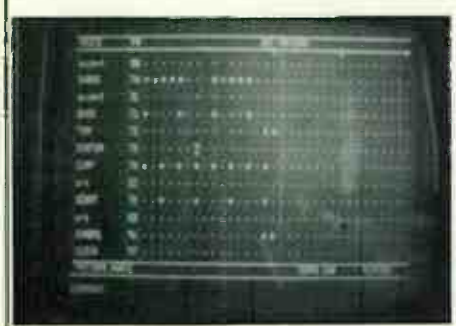
This page is provided so that sequencer displays and output format can be tailored to the user's particular needs. Names can be assigned to each channel (eg. Snare, HiHat, Accent) and are stored for later use by Page 2. The user can also specify which of the three possible output formats is to be used as the default format. The choices available are:

a) OMDAC using eight triggers and four switch outputs
b) OMDAC using only the eight trigger outputs
c) eight-bit output to BBC User Port

The default format can be over-ridden for a particular session if desired.

PAGE 1: PATTERN WRITER

The computer displays a 32 × 12 grid on which drum patterns can be written. Each row represents a channel, and the channel name and type (Trigger, Switch or User Port) are shown to the left of the display. The 32 columns represent the maximum of 32 beats possible in each pattern, and a default pattern



length of 16 beats is set up initially, a line indicating the pattern end. Near the bottom of the screen, status boxes show the pattern name (six characters), the stored tempo for that pattern and how many free patterns are left in the file.

A pattern is written by moving a cursor across the screeen (using the BBC cursor keys) and pressing <Copy> where a hit is required and <Delete> to erase a hit: tempo and pattern length can be changed by using the function keys, the tempo can be anything between 10 and 900 beats-per-minute. The function keys also control storage and naming of patterns, reloading of old patterns for editing, and resetting to blank grid. To assist in pattern writing, the pattern can be set to a looped play: a small cursor shows which beat is being played, and normal editing can continue throughout the process, thus enabling results of any changes to be heard immediately.

PAGE 2: PATTERN CATALOGUE

This produces a list (on screen or printout) of all the pattern titles stored in a file. Pattern length and stored tempo are also shown, in addition to the number of free patterns remaining, as shown in the photograph.

PAGE 3: SONG COMPOSER

For this Page, the screen is split into three vertical sections (see photo). The left-hand side contains a text window where commands are typed in and the composed song displayed. The centre consists of a status display showing song name and length, which mode the Page is in and, in Play mode, an indication of how far the song has progressed. The right-hand side shows a list of the patterns stored in memory ready for use in composing the song.

The Page works in four Modes: Command, Compose, Edit, and Play. Command mode allows songs to be loaded and stored, patterns loaded into memory and the other modes

entered. Compose mode enables songs to be written, and this is done by using a BASIC-like composition language. The patterns displayed are the 'palette' from which the composer works, each being identified by a number between 0 and 20. The commands available are as follows:

a) pn *Play pattern pn once*
b) pnRx *Pattern pn repeated x times*
c) L y *Begin a loop, repeating loop y times*
d) E *End loop*
e) T t *Set tempo tot (ignore stored tempos)*
f) T+/−i *Increase/Decrease tempo by i*
g) T 0 *Restore stored tempo*
h) Q *End song*

Loops can be nested up to three-deep. Song length is limited to a total of 200 bars, and a maximum of 50 commands and 21 different patterns. However, these limitations may be overcome by chaining songs together for actual performance to form one track consisting of several normal-length song parts. Once a song has been composed to the user's satisfaction it can be stored on disk, and the stored data file contains song particulars (name, tempo and so on), the names of the patterns used, the composition language command lines and the 'compiled' version of the song generated by the program.

Should you want to edit a pattern, then, logically enough, you go into Edit mode. This enables a command list to be edited using Insert, Delete and the composition language commands already mentioned. The new song can then be stored under a new name.

Final mode for Page 3 is Play. When a song is played, the status screen shows the details of the pattern being played and the next to be played, together with the number of bars performed and the number of bars remaining.

PAGE 4: SONG CATALOGUE

This page produces a list of all the songs stored in a file. The name, length in bars, length in command lines and number of patterns used are shown for each song. Again, listing may be to screen or printer, while an indication of bytes free is also given.

PAGE 5: PERFORMANCE

For performance, a total of 15 songs or song-parts may be loaded into memory, the titles being listed on-screen. Song-parts can then be designated by setting follow-on flags: if a follow-on flag is set for a song, then when the song has finished playing, the play routine will continue with the next song without pausing. When a song is playing, a 'beats left' count is given at the bottom of the screen, and the next song to be played can be altered at any time.

PAGE 6: CREATE PATTERN FILE
PAGE 7: CREATE SONG FILE

These two pages are provided to automate the creation and initialisation of blank disk files for use by the sequencer. All the user need do is insert a disk and enter the size of file required. ■

The sequencer software is now available from EmmSoft, E&MM's music software division, at a price of £8.95 for a 40- or 80-track Systems disk (please state requirement) inclusive of VAT. Orders should be sent to the Mail Order Department at the address at the front of the magazine, and cheques/POs made payable to Music Maker Publications. Please allow up to 28 days for delivery. Next month's E&MM will contain a further article that details how the sequencer software was written and some possible developments for the future.

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Step-time Sequencing

for Wasp Synthesiser and Commodore 64

In the wilds of darkest Worcestershire, research has revealed that EDP's Wasp monosynth can be interfaced with the Commodore 64 without any additional hardware. *Jethro Hill*

Some of you CBM 64 owners must have one lying around somewhere. Maybe that's it in the greenhouse, upside down with seedlings in its base troughs. It might look like a seed tray, but turn it over and the Wasp is a serviceable monosynth. So, wipe the dust off it, get rid of the spiders (pun intended) and try this little project.

I promise that there are no complicated electronics, none of those spidery (there I go again) 74 . . . chips nobody knows what to do with, no MIDI – nothing like that at all. All you need is a couple of connectors, some cable and a soldering iron. Ready? Right, this is what you do.

Construction

Obtain a standard seven-pin DIN plug, a 2x12 way 0.156" edge connector, some cable of suitable length and capable of carrying seven signals and an earth return (seven-core or more screened, eight or more ribbon, or eight separate wires: any will do!). Connect the DIN plug to the edge connector, with your cable in between as shown in the wiring diagram. There's not much room inside the DIN, so do it carefully as any short circuits will only lead to tears. Finished yet? Well, that's it!

If you hear a sound, everything is working as it should be. If you don't, check both wiring and typing, and have another go.

How it Works

What you have now is a uni-directional interface allowing control of the Wasp through the user port of the 64. This control is achieved by applying a 'number' in the form of a six-bit binary word and a trigger to the appropriate pins of the DIN socket on the Wasp. The number is capable of representing any decimal number between 0 and 63 but, in fact, the Wasp only uses the numbers 0 to 11, 16 to 27, and 32 to 43 to give the notes indicated in the note number table. The shrewd observer will note that this gives 33 notes as opposed to the Wasp's 25-note keyboard. In fact, we've extended, the range of the Wasp, not a particularly difficult task since the synth's 25-note capability is set by its keyboard design, not its internal circuitry. Further, it can be seen that the octaves are simply related by a difference of 16. The lowest note is C# (N=43) while the highest is C (N=0), corresponding to the top Wasp keyboard note.

Switch off your CBM 64 and insert the edge connector. Now check it and put it in the right way up. Failure to put this in correctly (most of the soldered connections should be towards the bottom), will put 9V AC into your Wasp and so back into the wrong parts of the 64. Tears again.

Check that the Wasp is set up to give a decent sound when you press its keys, and insert the DIN into either of the sockets on the right. A short attack time and long decay are ideal at this stage, since the link can give sharp clicks even if it is not working properly: the long decay time helps you to distinguish these. A long attack time will only wash out the note, preventing you from being able to tell whether or not it's working.

Now, the software. Type Table 1 into your 64.

Triggering the Wasp is achieved by a positive-going voltage pulse edge applied to the trigger pin of the control socket. Thus all we need is a control port capable of supplying the six-bit numbers and the trigger edge. The 64 is ideal for this purpose.

By using Pins C to J of the user port we connect to the six least significant bits of one of its 'complex interface adaptors'. POKEing the correct numbers to the relevant I/O memory locations then transmit the correct signals to the Wasp.

First, we must set the user port to be an output. This is controlled by the data direction register at memory location 56579. A zero here means input and a one implies output. Storing 255, all ones set, in this register will set all the port bits to outbit. Hence we use POKE 56579,255.

To apply the control bits to the Wasp, we simply supply the relevant number to the port itself: this is located at memory location 56577. Thus POKE 56577,N, where N is the note number from the note number table, will set that note. It is not necessary to know anything about the binary form of N since the user Port and the 64's system look after all that for us. The trigger is connected to the 'handshake' line of the user port and is automatically looked after. By simply POKEing to the user, the 64 also outputs a short pulse on this line to indicate that the data is ready. The Wasp then responds by reading the value of N from its control pins and playing the note.

Software

It can probably be seen that all that's needed now is a program that initially sets the user port to output, calculates a sequence of note numbers and the times at which they occur and POKEs them to the user port at the correct time. The form of this software is not fixed, and different people will do it in different ways depending on their needs, but a fairly versatile BASIC program is given here.

It does not allow retrospective editing but *does* permit relatively easy note entry from the QWERTY keyboard with pre-entry editing, post-entry appending, file storage to disk or cassette, and also uses a special music character to display the notes. In fact, very little of the software is actually to do with playing notes (lines 630-650); the bulk of the program being taken up by procedures to handle keyboard input and suitable displays on the screen.

Using the Program

Try typing the program into the 64: it shouldn't prove too long. When you're done, press RUN followed by the return key (R). I suggest you use RUN 80 while de-bugging, since this bypasses the time-consuming character set-up routine. The only thing you lose is the music character set (a machine language program would speed this up dramatically – but that's another story!). If all's well, the screen will clear and the prompt 'CASSETTE OR DISC (C OR D)?' should appear, to which you must reply accordingly, adding (R). The program then finishes its initialisation and responds with 'START ENTERING' and '<'.

Rests and time intervals:

Rests are obtained simply by pressing 'R'. The display will then register standard rest symbols, except 1/16th notes which, like their note symbol, have their fourth bar on the other side of the stick: such are the limitations of 8x8 Pixel characters. Time intervals are selected by using the keys '1234567' to give appropriate rest values. Again, these may be pre-entry edited until (R) is pressed.

Dotted notes and triplets are obtained by using '.' and 'T', while their effect can be cancelled by using '0'. Note that only one dot (or triplet) may be used at any time.

Repeated notes:

The last note entered is the starting base for the next note, so by pressing (R) n times, the last note may be repeated n times.

Playing:

Press 'P' and the program goes to the play mode without preventing more notes being added afterwards. It will first request the desired speed (CROTCHET BEATS PER MIN?) to which you must reply with a number and (R). The prompt 'HOW MANY TIMES?' then appears, to which you reply with the number of times you want the sequence repeated, plus (R). When the process has finished, 'FINISHED PLAYING' is displayed, and you are returned to note entry, where you may add more notes if you wish.

The '<' symbol will be with us from now on as a prompt to type; you simply press certain keys without using (R), which is only used for data entry.

Note insertion:

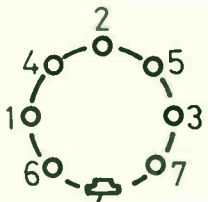
The keys 'ZXCVBNM' (the bottom row of the 64 keyboard), represent the notes DEFGABC respectively. Press one and the note will come up on the screen. This note is displayed only and will not be placed in the sequence until (R) is pressed. Pressing any other note key will change the note displayed. ▷

Table 1.

```
10 PRINT CHR$(142): POKE 56334,PEEK(56334)AND254: POKE 1,PEEK(1)AND251
20 FOR I=0 TO 2047: POKE I+49152,PEEK(53248+I): NEXT
40 POKE 1,PEEK(1)OR4:POKE 56334,PEEK(56334)OR1
50 POKE 56578,PEEK(56578)OR3
60 POKE 56576,(PEEK(56576)AND252)OR0
70 POKE 53272,32: POKE 648,200
80 I0=49152+64*8: I1=I0+20*8-1: FOR I=I0 TO I1: READ I2: POKE I,I2: NEXT
90 DIM N%(120),M%(1000),L%(1000),SC%(7),M(7)
100 PRINT "□CASSETTE OR DISC (C OR D)": INPUT DD$: REM SHFT CLR/HOME
110 POKE 56579,255
120 FOR I=1 TO 12: M%(I)=44-I: NEXT
130 FOR I=1 TO 7: READ SC%(I): M(I)=0: NEXT
140 B$="": N$="DEFGABC→↑←↓ CTRL 1 CTRL 2": REM CTRL WITH EACH OF KEYS @ABCDEFGHIJKLMN
150 D$="●_": N=1: L=5: Q=0: D=1: NN=0: LL=48: REM SHFT S,SHFT P
160 PRINT "□START ENTERING": PRINT"■": REM SHFT CLR/HOME.....CSR DOWN
170 GET H$
180 PRINT "□■■■": REM CSR UP,CSR LEFT,CSR DOWN
190 IF H$="■" THEN D=0: GOSUB 900: REM F1
200 IF H$="■" THEN D=1: GOSUB 900: REM F3
210 IF H$="■" THEN D=2: GOSUB 900: REM F5
220 IF H$="Z" THEN N=1: R=0: GOSUB 900
230 IF H$="X" THEN N=2: R=0: GOSUB 900
240 IF H$="C" THEN N=3: R=0: GOSUB 900
250 IF H$="V" THEN N=4: R=0: GOSUB 900
260 IF H$="B" THEN N=5: R=0: GOSUB 900
270 IF H$="N" THEN N=6: R=0: GOSUB 900
280 IF H$="M" THEN N=7: R=0: GOSUB 900
290 IF H$="S" THEN M(N)= 1: GOSUB 900
300 IF H$="F" THEN M(N)= -1: GOSUB 900
310 IF H$="=" THEN M(N)= 0: GOSUB 900
320 IF VAL(H$)>0 AND VAL(H$)<8 THEN L=VAL(H$): GOSUB 900
340 IF H$="." THEN D=1: GOSUB 900
350 IF H$="T" THEN D=2: GOSUB 900
360 IF H$="0" THEN D=0: GOSUB 900
370 IF H$="R" THEN R=1: GOSUB 950
380 IF H$="P" THEN GOSUB 600
390 IF H$="E" THEN GOSUB 800
400 IF H$="K" THEN GOSUB 1000
410 IF H$="L" THEN GOSUB 1100
420 IF H$=CHR$(13) THEN GOSUB 500
430 IF H$="Q" THEN GOSUB 1200
440 GOTO 170
500 X=SC%(N)+M(N): IF X>12 THEN D=D+1: X=1
510 NN=NN+1: N%(NN)=50: IF R=0 THEN N%(NN)=N%(X)-16*D
520 LL=2↑(L-1)*3: IF D=1 THEN LL=LL*1.5
530 IF D=2 THEN LL=LL*2/3
540 L%(NN)=LL: GOSUB 900
550 PRINT: RETURN
600 PRINT "CROTCHET BEATS PER MIN": INPUT JF: PRINT: DT=3600/(48*JF)
610 PRINT "HOW MANY TIMES": INPUT MJ: PRINT
620 FOR J=1 TO MJ: I=1
630 T=TI: POKE 56577,N%(I): T=T+L%(I)*DT: I=I+1
640 IF TI<T THEN 640
650 IF I>NN THEN 670
660 GOTO 630
670 NEXT
680 PRINT "FINISHED PLAYING": PRINT
690 RETURN
800 PRINT "YOU WILL ERASE THE COMPOSITION YOU HAVE AT PRESENT"
810 PRINT "DO YOU WANT THIS? H REPLY OTHER THAN 'YES' WILL CANCEL THIS MOVE"
820 INPUT H$: PRINT:IF H$<>"YES" THEN RETURN
830 NN=0: N=1: L=5: Q=0: D=1: LL=48: RETURN
900 R$="": IF D=1 THEN R$=" ": REM SHFT P
910 IF D=2 THEN R$="●": REM SHFT Q
920 IF M(N)=1 THEN R$="#"+R$
930 IF M(N)=-1 THEN R$="/"+R$
940 R$=MID$(N$,N,1)+R$+" "+MID$(N$,7+L,1)
950 IF R=1 THEN R$=" "+MID$(N$,14+L,1)
960 IF Q>0 THEN R$=R$+MID$(D$,Q,1)
970 PRINT "□                                    ": PRINT "■■■"+R$+"□": RETURN
975 REM CSR UP.....CSR UP,..CSR RIGHT,CTRL 2.../CBM 7
1000 PRINT "FILENAME": INPUT F$: PRINT F$: PRINT: F$=F$+",SEQ,W"
1010 IF DD$="C" THEN OPEN2,1,1,F$
1020 IF DD$="D" THEN OPEN2,8,2,"00:"+F$
1030 PRINT#2,NN
1040 FOR I=1 TO NN: PRINT#2,N%(I): PRINT#2,L%(I): NEXT: CLOSE2: RETURN
1100 PRINT "FILENAME": INPUT F$: PRINT F$: PRINT: F$=F$+",SEQ,R"
1110 IF DD$="C" THEN OPEN2,1,0,F$
1120 IF DD$="D" THEN OPEN2,8,2,F$
1130 INPUT#2,NN
1140 FOR I=1 TO NN: INPUT#2,N%(I): INPUT#2,L%(I): NEXT: CLOSE2: RETURN
1200 PRINT "ARE YOU SURE YOU WANT TO FINISH"
1210 PRINT "ONLY 'YES' WILL ALLOW YOU TO END" INPUT H$:IF H$<>"YES" THEN RETURN
1220 POKE 56578,PEEK(56578)OR3
1230 POKE 56576,(PEEK(56576)AND252)OR3
1240 POKE 648,4: POKE 53272,20: PRINT"□": END: SHFT CLR/HOME
2000 DATA 30,120,30,24,62,120,112,0,30,24,30,24,62,120,112,0
2010 DATA30,24,30,24,56,120,112,0,30,31,27,24,56,120,112,0
2020 DATA 1,1,1,1,1,1,1,0,6,6,6,6,30,50,102,60,0
2030 DATA 0,0,30,102,102,124,0,0,108,124,15,127,12,124,12,0
2040 DATA 102,126,6,126,6,126,6,0,102,126,6,102,126,6,6,0,102,126,54,6,6,6,0
2050 DATA 16,12,48,24,24,16,8,0,0,0,0,60,60,126,0,0,0,0,126,60,60,0,0,0
2060 DATA 96,96,110,114,102,108,112,0,28,12,236,12,30,0,0,0
2070 DATA 56,24,24,24,60,0,0,0,60,76,24,48,124,0,0,0,60,4,24,12,12,56,0,0
2080 DATA 0,0,0,48,48,0,0,0
2090 DATA 2,4,5,7,9,11,12

READY.
```

2×12 edge connector
(rear view)



7 pin DIN plug
(rear view)

Connections

DIN		2×12
6	to	8
1	to	C
4	to	D
2	to	E
5	to	F
3	to	H
7	to	J
Earth tag	to	A

so that each note may be inspected and edited before being entered using (R).

Typing in 'S' 'F' and '=' respectively sharpens, flattens or returns to natural the currently displayed scale note, meaning that the musical key can be pre-adjusted, though remember to reset accidentals if you use them.

The keys 'f1', 'f3' and 'f5' set the required octave and leave it until reset. 'f1' sets the lowest octave and 'f5' the highest, the indication on screen being no superscript for the lowest octave and superscripts 1 and 2 for the next and highest octaves. Note that keying 'S' on notes C to C# automatically changes the music up an octave.

Erasing and filing:

The 'E' key will erase the current sequence irrevocably after you've made sure that you really do want to do this and that you haven't just pressed 'E' by mistake.

Pressing 'K' or 'L' permits you to SAVE or LOAD from cassette or disk, sequences having names of your choice. Note that a file saved to disk with the same name as one already stored will unconditionally overwrite the latter.

Finishing:

Finally, 'Q' permits you to leave the program after a check, and the 64 is returned to its default character set and screen location.

Conclusion

Well, that's just about it. I hope you have as much fun with the program as I have. Interfacing really is as easy as I've explained, though I can't stress too strongly the importance of checking all your wiring, putting the edge connector in correctly – never insert it with the 64 switched on.

Finally, if you have neither the will or the time to type this program in, a cassette version – with preprogrammed examples – is available from Joreth Music, 25 Albert Park Road, Malvern, Worcestershire. Price is £2.50 including postage and packing. ■

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