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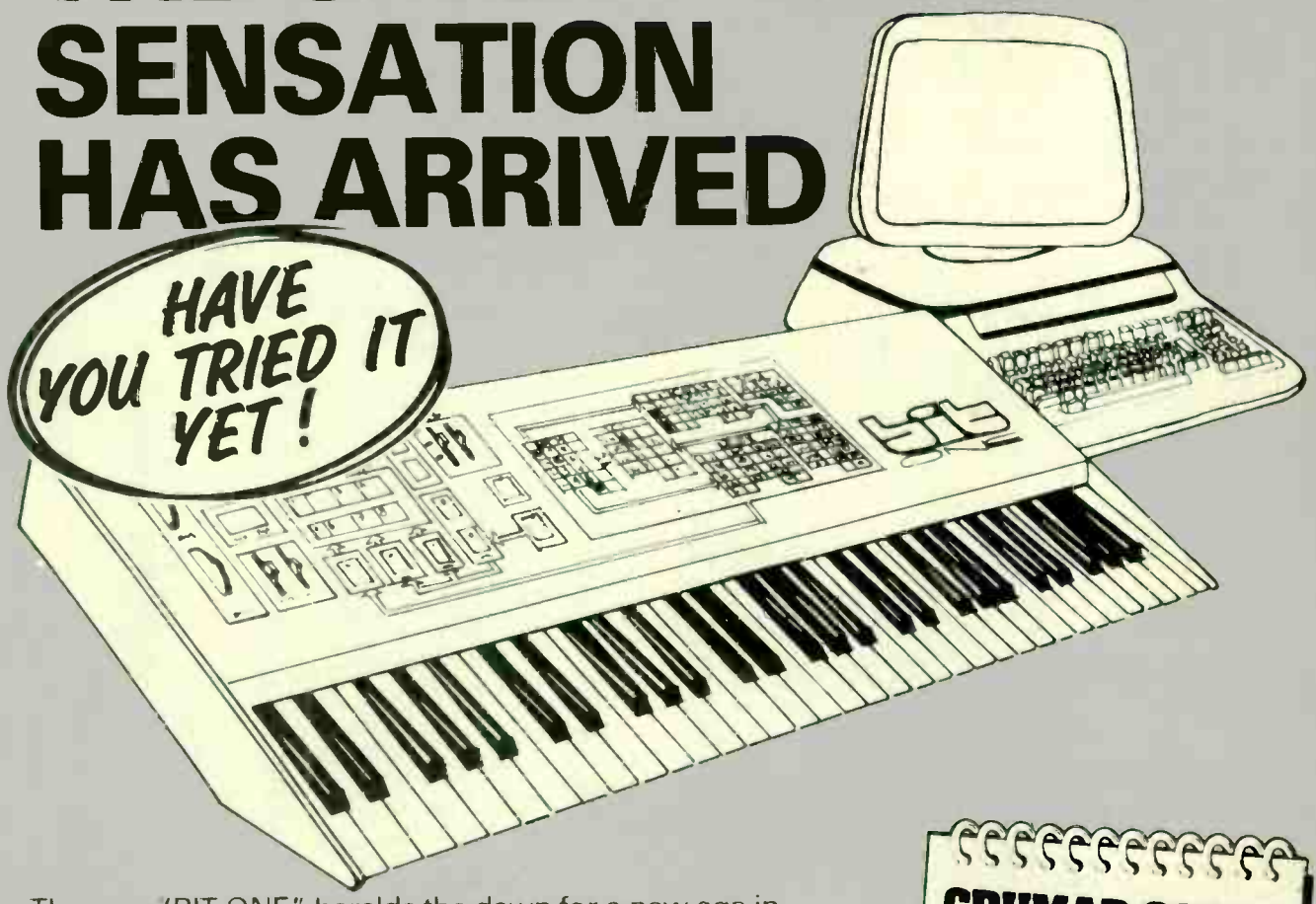

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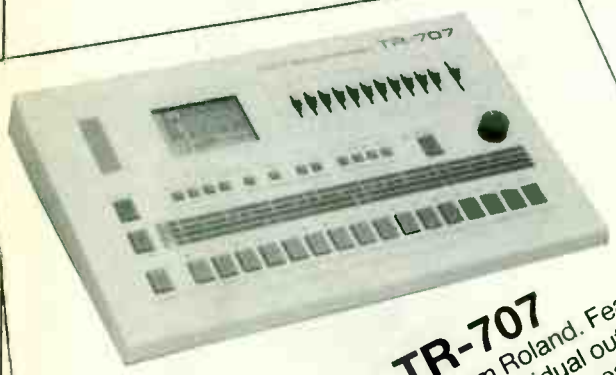

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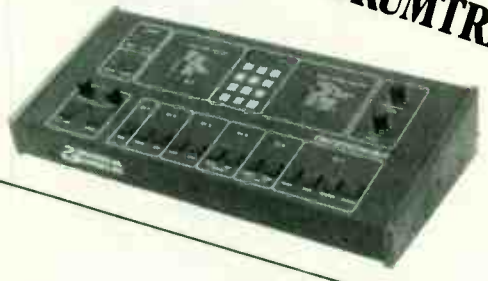

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E&MM December 1985 Volume 4 Number 11

NEWS

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COMMENT

Last month's news story on the Casio CZ101 polysynth was a bit of a tease, really. We already *knew* how stunning it could sound, how revolutionary its new synthesis principles were, and how earth-shatteringly low its price tag would go. So it's probably best if I leave the technical description and subjective adulation to Paul Wiffen, whose appraisal of the CZ starts on Page 10. We'd hoped, also, to bring you an exclusive review of Isao Tomita's performance on the 101's ancestor, the Cosmo system, at this year's Ars Electronica, but unforeseen production difficulties (no, *not* drinking all the Christmas booze a week early) have meant this'll have to await a future issue.

What shouldn't be left unsaid, however, is that the time it took Casio to come up with the 101 - and the rest of the pro gear that should make itself evident in the course of 1985 - can't all have been taken up by research and development. An innovation like Phase Distortion doesn't come about overnight, of course, but it's a fair bet that marketing indecision also played its part in delaying the synth's arrival. And that's made me wonder just how many other domestic keyboard manufacturers may have professional instruments ready and tested for full production, but awaiting the final go-ahead from the powers that be.

Take Elka as an example. Their X30 reviewed in this issue represents contemporary organ technology at its finest, but it remains packaged in such a way as to make that technology distinctly unappealing to most modern music performers. All that auto-accompaniment stuff really isn't on, but there's no denying that, if the Italian company were ever to produce a range of hi-tech, professional electronic instruments aimed at a somewhat younger audience, they'd be up there with the established names before you could say 'Project Series Contemporary Keyboard'. Because let's face it, inside that X30 is a mildly wonderful digital drum machine dying to get out: but will it ever get the chance? That's for the marketing men, not the technicians, to decide.

Technics have already shown the rest of the organ world what can be done if you take your voicing technology and put it into a more professionally-acceptable package: their Digital 10 (reviewed last month) is as good an electronic piano as you'll find under £1000, and if the company were to chance their corporate arm a little further by introducing some more products based on similar design objectives (and again, they can't deny they've got the know-how to make it happen), there's no reason why said products shouldn't be of comparable quality.

So if the design skill is already there, why are some companies so reluctant to enter the pro keyboard arena in a wholehearted fashion? It's a simple question but it lacks a similarly straightforward answer. However, I suspect that a major factor is simply that the marketing divisions of these major corporations (and some of them really are *major*) simply don't know how good a job their colleagues in R&D are doing.

The reason for that ignorance is probably not unconnected to domestic musical trends. The Japanese, for instance, are generally a lot keener on the go-anywhere, personal keyboard (as pioneered by Casio and now marketed by a host of imitators) than they are on fully-fledged, professional and semi-pro synthesisers. So are the Italians.

Which is why an industrial giant such as Yamaha can put some marvellously fresh and exciting digital drum sounds into a personal keyboard (the PS6100) but remain content at supplying their first-ever dedicated units (the RX series) with little more than sonic replicas of conventional drum kits. And why Elka - and an entire breed of organ manufacturers - won't enter the 'serious' end of the music market without making absolutely sure (as Hammond did with their DPM48 drum machine) that the product is right.

It's also why Casio had to go right to the top (the top, in this instance, being Isao Tomita) to find out whether or not their Cosmo computer system was really much cop, musically speaking. Still, at least they took the right decision in the end. We wish them well.

Strange as it may seem, almost all the current editorial staff at E&MM are ex-readers, rather than off-the-peg journalists who served their apprenticeship on the *Monmouthshire Regional Echo* or people who just happened to be walking by at the time.

Between us, we manage (don't ask me how) to form a productive and generally well-behaved work unit that enjoys putting together the country's leading electronic music magazine. However, it just so happens that there's a slot to fill within that unit, not because anybody's actually leaving, but simply because we've come to the firm conclusion we'd all be a lot happier if we didn't have to work the long hours that have recently become the norm. In other words, E&MM needs a Staff Writer. And fast.

So if you've got a basic grounding in music synthesis and its electronics and computer applications, a broad taste in music, an open, enquiring mind and the ability to string a few sentences together, write to Terry Day at the editorial address printed below.

You never know, you might be writing *Comment* for next month's E&MM. ■

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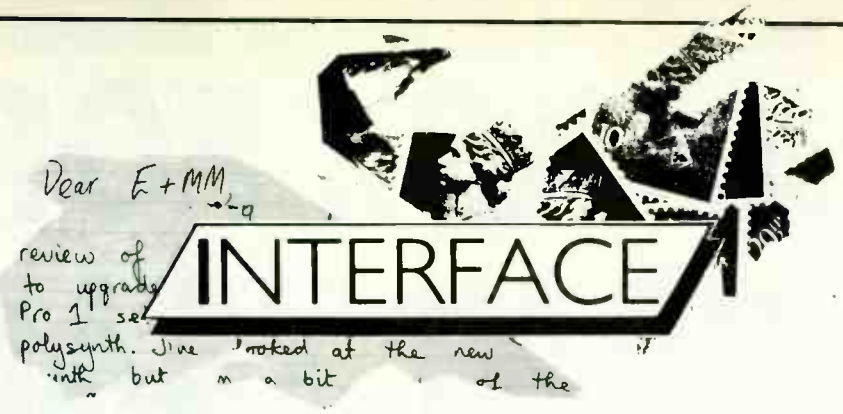


Sequencer Triggering

Dear E&MM,

I recently bought a Korg Poly 800 synth, but am unable to trigger the sequencer from a non-MIDI drum machine. Is it possible to buy (or build) a cheap interface to trigger the sequencer with a TR606 Drumatix? Can you advise me?

M A White
Oxford

Korg market an accessory to sync their new Super Drums and Super Percussion units to the Poly 800 (ie. a 24 pulses-per-quarter note to MIDI converter), and this should fulfil your requirements nicely. Contact your nearest Korg stockist for further information on the KMS30 MIDI Synchroniser (which retails at £155 inclusive of VAT), or contact Rose Morris, 32–34 Gordon House Road, Kentish Town, London NW5 1NE. ☎ 01-267 5151.

A Matter of Course

Dear E&MM,

In response to Max Howarth's letter in E&MM September concerning education on recording techniques, your readers may like to know that courses on Electronics in Music are currently being offered as part of the BA Music honours degree programme at Bath College of Higher Education.

The electronics elements enable students to become familiar with electronic instruments and the basics of sound recording, with the opportunity to use the fully-equipped eight-track studio located in the Faculty of Art and Music.

Michael Short
Principal Lecturer in Music
Bath College of Higher Education

Fiction or Fraction

Dear E&MM,

I am a professional, classically-trained flautist (and regular E&MM reader) as well as a composer with tastes ranging from Bach to Boulez and beyond. I have yet to actually buy either a synthesiser or a computer, simply because the ones I can afford are (for me) inadequate and the ones that are not are beyond my current financial grasp.

The reason I haven't entered the world of computer music concerns both manufacturers and reviewers, between whom there seems to be some unwritten conspiracy to ignore any musician whose needs extend beyond a four beats to a bar time signature. I want a sequencer that can (a) accept any time signature for any bar (not only 3/4 and 4/4 but also 5/8, 7/16, 13/16 or even 17/16) and (b) accept any fraction of that bar. We're all used to quarter notes and eighth notes, so why not fifths, sevenths and tenths as well? I expect it's easy enough for a computer – but the UMI 1B (to cite just one package I was able to try locally) won't even accept a 7/8 bar.

To be of any use to me, a review should either say if the sequencer or drum machine under test provides these highly desirable facilities, or suitably bemoan the fact that they do not. To do neither is to leave us in the lurch.

And just to show that all the above is not just a personal hang-up, I have enclosed photos of relatively simple pages from two masterpieces of boring old analogue music: Roberto Gerhard's 3rd Symphony *Collages* for orchestra and electronic tape (1961), and the final page of Boulez' *Le Marteau sans Maitre* (1954).

I'm not saying that this is what people should be writing, but even Vangelis might like to spread a C major scale of seven notes evenly across a 4/4 bar!

Richard Dobson
Bath

One of the many criticisms aimed at computer- or sequencer-controlled music is that everything seems to get written in 4/4 time, with a steady, (sometimes) monotonous pulsing rhythm (we've lost count of the number of patches sent to Patchwork *that are 'ideally suited to playing Ultravox, pulsing bass lines'). However, it is not the case that either the technology or the manufacturers using it follow musical styles to the extent that options such as playing fifths or changing time signatures are ignored or not pursued, though we accept your point that perhaps reviewers sometimes fail to highlight a facility which, while probably not of importance to some players, might be just what a classically-trained musician needs to allow his or her skill to shine through.*

Taking some of your comments in isolation, allocating a different time signature to every bar of a piece is not a problem. The Roland MSQ700, for instance, can be set to Free mode (ie. no time signature), in which case it's left to the composer to keep track of bar numbers and so on.

Programming different time signatures on a drum machine is a simple matter of allocating a different pattern (if need be) to each bar and stringing them along in Song mode to form the piece as it should be played. The Yamaha RX series (which sync via MIDI to the MSQ700, incidentally) can be programmed to accept anything from 01 to 99 beats to a measure, with the note length of each beat variable from a quarter note to a 32nd note, or even a 48th or 192nd note on the RX11. So a 17/16 disco rhythm is no problem for the RXs – though it might make a few TOTP dancers fall off their pedestals.

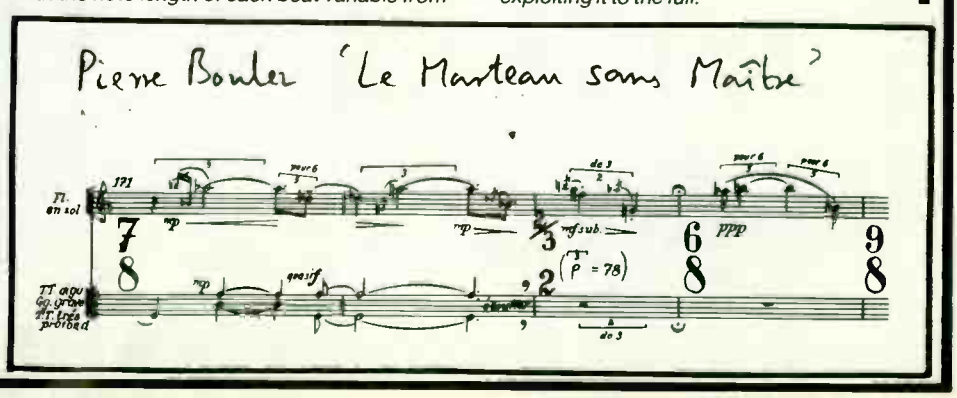
Incidentally, the London Rock Shop report that 7/8 is a possibility with their UMI 1B package – as are changes in time signatures.

However, perhaps the reason sequencer patterns are generally not overly complex has more to do with available memory space than anything else. Sequencers and drum machines (whether they be computer-based or stand-alone units, analogue or digital) can record only a limited number of events or steps, and quite a number of them are based entirely on a set number of 'pulses' per measure (this is often referred to as resolution). If only eight quavers are to be played in every bar, the resolution could be set to eight and a unit capable of recording 4096 notes could produce a sequence lasting up to 512 bars. However, since a pulse has to have the value of the shortest note, a resolution of 32 pulses per bar would be needed just to record the odd demisemi-quaver. And you don't have to be a mathematician to figure out that with the same memory capacity, only 128 bars could be recorded.

Considering recording perfect runs of five semi-quavers in the space of 4 and so on brings the fractions down to mind-boggling proportions (a resolution of something in the region of 1/80 might be needed). But the story isn't all gloom and doom. For instance, some software packages such as the JMS Recording Studio will record in real time at a resolution of 48 time events per crotchet – so if you can play runs of fifths and sevenths, the software will record it, albeit not strictly *to the exact fraction of the measure (but 'close enough for jazz . . .'). So the fact that quantisation can only be carried out to a 32nd of a measure is not to say that only demi-semi-quavers can be recorded.*

Finally, your letter only goes to prove that maybe there is a market out there for an enterprising software house to develop a package aimed specifically at the classical composer (perhaps with volume options ranging from pp to ff, instead of plus or minus 99!).

In the meantime, don't give up on technology simply because other musicians may not be exploiting it to the full. ■



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NEWSDESK

HARDWARE

Casio are set to launch the **CZ1000** hot on the heels of the CZ101 reviewed in this issue. Incorporating a similar specification to its smaller brother, the CZ1000 features a full-size four-octave keyboard, though it's still portable enough to be worn over the shoulder for the classic lead synth look . . . RRP should be around the £445 mark, availability sometime during March/April.

1985 will also see the launch of the **CZ5000** though Casio are playing a close hand when it comes to releasing advance information: any bets on a longer keyboard, more memories, and touch-sensitivity? One to look forward to.

Please note that the price quoted in last month's *Newsdesk* for the **Elka Synthex** from Oxford Synth Consultants should have read £1199 *excluding* VAT. Further information on ☎ *01-767 7052.*

Advanced Technology Products have announced details of their musical keyboard for the BBC Micro. Simply entitled 'Symphony', the full-size four-octave 49 note (C to C) keyboard comes complete with software enabling up to 100 different sound effects to be created and modified, and the complete set of sounds can be saved on disk or cassette. Each sound can be given a specific name which can be added to the Index, and facilities include octave shift, pitch-bend and an optional sustain foot switch. The package, priced at £125 (includes VAT and delivery), comprises the keyboard and connector cable to BBC micro user port, software (either disk or cassette) and a user guide. Further information from *Advanced Technology Products Limited, Station Road, Clowne, Chesterfield S43 4AB. ☎ (0246) 811585.*

COMPUTER MUSICIAN

Microsound have finally introduced their sound sampling add-on for the Commodore 64 (see review of the same company's digital music system in E&MM July 84). Software includes a variable sampling rate up to 32kHz, sounds being stored in 30K of RAM, waveform editing on screen *via* high-resolution graphics, envelope control of timbre and amplitude, and the facility to save samples to disk. The hardware incorporates an input amplifier suitable for mic or line signals, MIDI In/Out, programmable output attenuation and 24dB tracking low-pass filter.

The Digital Sampler and matching software retail at £299, while the four-octave controlling keyboard and software are £195, both prices inclusive of VAT. Further information from *Microsound, PO Box 14, Petersfield, Hants, GU32 1HS. ☎ (0730) 87403.*

STOP PRESS

ROSE MORRIS COMPETITION
August/September 1984

Entries flooded in from readers hoping to win both a Korg RK100 remote keyboard and EX800 expansion unit in this two-part competition. Congratulations and first prize go to Norman Fay, South Shields, Tyne & Wear, while the ten runners-up receive E&MM T-shirts – B A Andro, Italy; M Antal, Yugoslavia; R Callan, Penicuik, Scotland; J Eklund, Finland; R I Farquhar, Sunderland; D Fudge, Rosyth, Fife; S Klee, London NW1; S Mulholland, Sherwood, Notts; P Robinson, London SW7; and A Zipper, London N20.

OSCAR COMPETITION
October 84

Winner of the OSCar competition is Paul Young from Brighton, Sussex, seen here being presented with his new MIDI OSCar by Billy Currie of Ultravox. Copies of the band's *Lament* album have been despatched to the ten runners-up: C Berry, Birmingham; H Fern, Billingham; R S Green, Chesham, Bucks; S Lowther, Axford, Hampshire; I Popperwell, Stoke; W Punshon, Gateshead; A Sloan, France; M H Smith, Wiltshire; D W Storey, Merseyside; and J P West, Tonbridge, Kent.

TANGERINE DREAM COMPETITION
December 84

Twenty-five copies of the *Poland* album by Tangerine Dream are on the way to the following lucky winners of last month's competition: J Allen, Henfield, Sussex; I P Brockley, Stoke-on-Trent; D Brown, Hatfield, Herts; G Denison, Arnold, Nottingham; P Dome, North Anston, nr Sheffield; K Dulay, Leamington Spa, Warks; P C England, Salfords, Surrey; M Evison, Greenhill, Sheffield; R J Ford, Oxford; D Fox, Sligo, Eire; S Gaddis, East Kilbride, Scotland; C Hook, London SW18; K Hopwood, Gravesend, Kent; S P Kelly, Birmingham; C Krzywinski, Bristol; G McCracken, Dunbartonshire, Scotland; M Markwell, Horsham, West Sussex; S Moorcroft, Brinscall, Lancs; K Nolan, Dublin 16, Eire; D Orrell, Manchester; P Rogers, Westhoughton, Lancs; G Siegwart, London SW20; J Stevens, Bath; G Stewart, Glasgow; and S J Wallace, Brighton.

Computer Music Studios have moved lock, stock and barrel to *Berwick Farm, Berwick Road, Bynea, Dyfed, South Wales. ☎ (0554) 751169.*

NAMM Winter Market, Anaheim, USA – February 1 to 3.

Frankfurt Musik Messe, Frankfurt, West Germany – February 9 to 13.

For special package deals to Frankfurt, contact *New Apollo Travel ☎ 01-836 1406 or Press-Plan Travel Ltd ☎ (0727) 33291.*

Electronic Music TV Special, South Bank Show, LWT – Sunday, January 27 (*deferred from November 4*). An overview of the development of electronic music, featuring Tim Souster and Andy Mackay – not to be missed. ■

Out-of-Phase Distortion

Gary McLeod.

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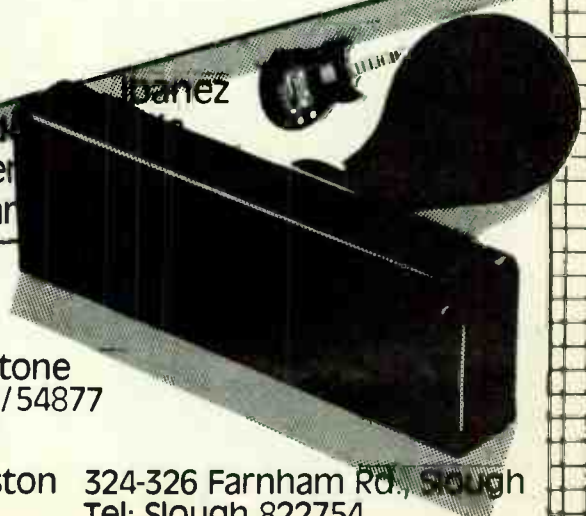

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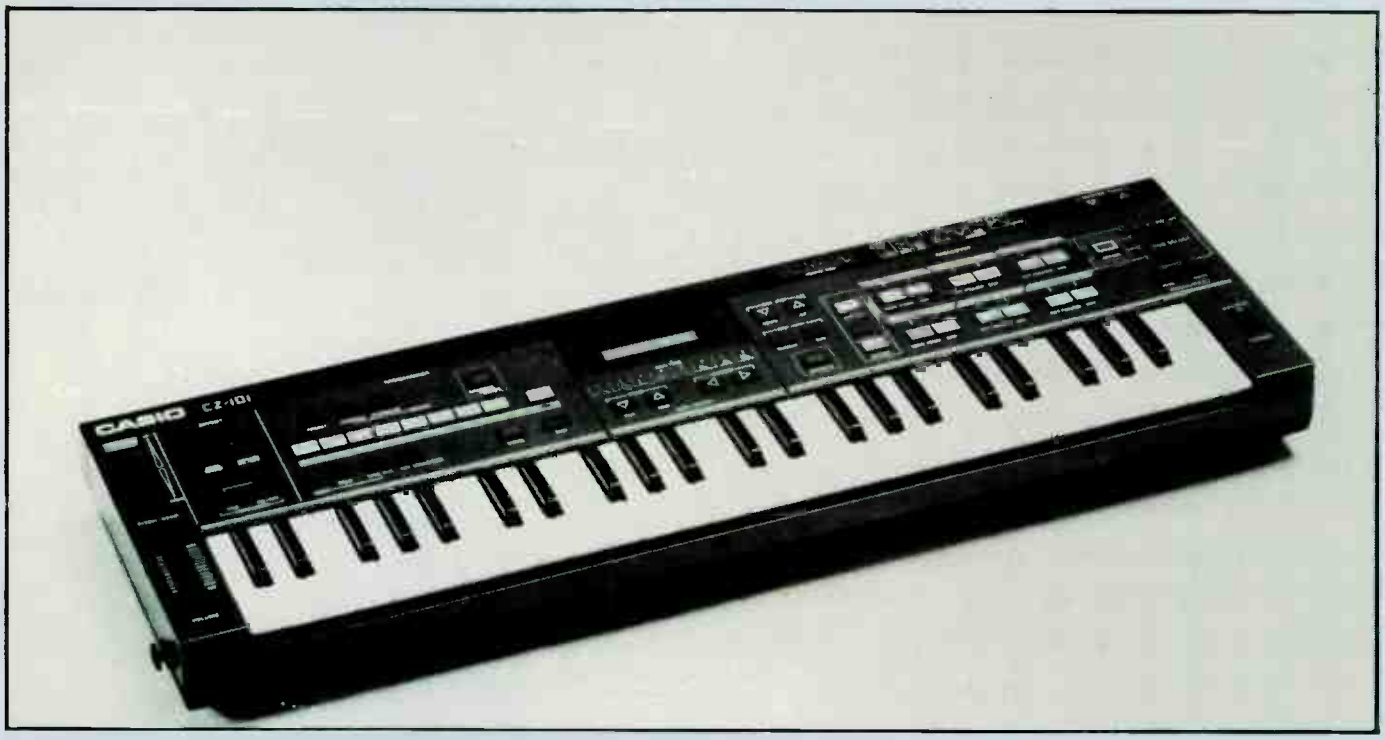
Casio CZ101

Programmable Phase Distortion Polysynth

Casio launch not only a new product aimed at a new market, but a new concept in sound synthesis – Phase Distortion. Can all this innovation really cost just £395? *Paul Wiffen*



Ever since the company's miniature VL-Tone took the electronic keyboard out of the specialist music shops and into the High Street chains of Dixons and Argos, the world and his wife have been waiting for Casio to produce a professional synth to turn that market on its head in a similar manner. Their first musical instruments – the CT201 and its successor, the 202 – were reasonable enough. For under £300, they gave the semi-pro keyboardist access to a variety of good-ish sounds, but both were short on – if not entirely lacking in – programmability. That was supposed to be rectified with the advent some little while later of the CT1000P, but for my money it retained too much of the 'preset' philosophy – certain waveforms only available at certain octaves, not much in the way of memory space, and so on.

After that disappointment, I was sceptical that the pocket calculator people would ever really cut it at the 'serious' end of the keyboard market, particularly after the domestic monstrosity that was last year's Symphonytron modular home organ. However, it would now seem that Casio have put these abberations firmly behind them: the CZ101 is the first of a

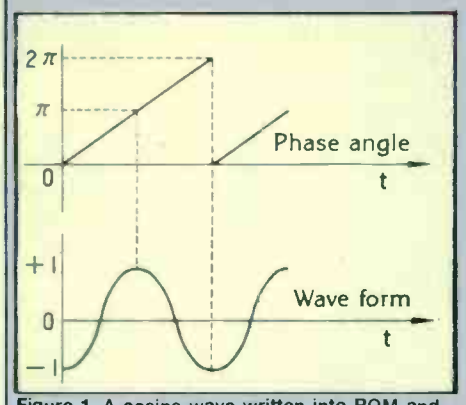


Figure 1. A cosine wave written into ROM and read out in linear form.

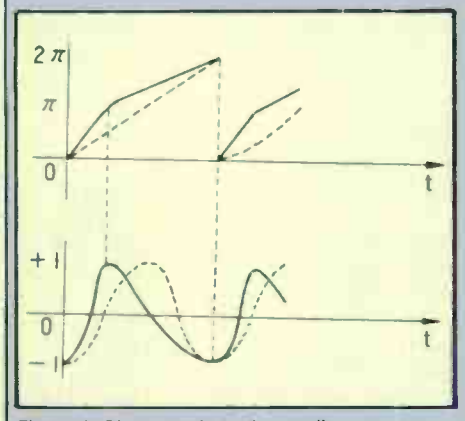


Figure 2. Phase angle no longer linear.

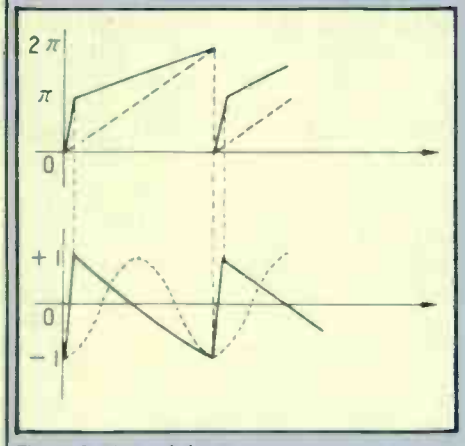


Figure 3. More of the same.

whole range of pro gear that'll emerge during the course of 1985, and brings with it a new synthesis technique by the name of Phase Distortion.

The 101 has only a four-octave mini-keyboard and a rather awkwardly-placed bend wheel, but the fact that it's MIDI-compatible over five octaves means this will be a limitation only to the first-time MIDI buyer. And yes, a standard-sized keyboard variant – the CZ1000 – will be available in the Spring for about £50 extra, though personally I'd rather put that money towards another MIDI instrument with a five-octave keyboard span, since it's the *sound* of the 101 that's the really worthwhile thing (as we'll see later). Depends on whether you intend adding to your collection of MIDI keyboards, I suppose.

PD in Theory

That highly desirable sound comes from a new and Casio-developed synthesis process called Phase Distortion. How does it work? Well, imagine a simple waveform – a sinewave, say. Store it in ROM, read it out, and as you do so, alter the phase angle during each cycle so that a distorted version of the original waveform is produced. Figure 1 shows a cosine wave (generated when the phase angle is read out at a constant speed) between the values of 0 and 2π. Change the speed so that reading out is faster between 0 and π than it is betweeen π and 2π (ie. faster in the first half-cycle than in the second), and distortion starts to become evident.

As you can see, the result of this distortion is to displace the position of the positive peak towards the front of the cycle, a process not entirely unlike changing the width of a pulse wave *(but not entirely like it, either – Ed)*. The logical conclusion of this process tends towards a sawtooth wave, as the difference in readout speed is increased (Figure 3).

As you probably already know, a perfect sinewave consists of its fundamental frequency and nothing else. More complex waveforms add various harmonics of the fundamental, and one of the most intricate of these that succeeds in going about its business without actually losing the level of the fundamental is the sawtooth, which contains all the harmonics in inverse proportion to their number.

Now, the beauty of the Casio system is that these changes in readout speed can be implemented *as you play the keyboard*. This is accomplished by an envelope known as the **DCW** (methinks it stands for Digitally Controlled Waveshape), which can be considered the PD equivalent of a filter envelope. It operates like this. When the envelope begins, the waveshape is a simple one – let's say the sinewave again. As the envelope opens, phase distortion is increased to a user-preset level, so that the waveform produces an increasing quantity of higher harmonics in much the same way as a low-pass filter.

PD in Practice

What this means in terms of sound is that, unlike the FM principle by which filter sweep effects can be rather tricky to ▷

create, a PD synth can actually make an approximation of analogue-type sounds. However, seeing as digitally-stored simple waveforms of high resolution are still the basic building blocks from which sounds are created, the 101's outstanding sonic characteristic is one of cleanness and purity – the output lacks analogue harmonic distortion.

Any comparisons with FM are probably misleading, but sound-wise the CZ101 excels in the same areas as Yamaha's DX polys – natural 'acoustic' textures, especially those with percussive envelopes.

Full marks to Casio, though, for the way in which they've made their technique accessible to the musician. The layout of the panel is logical and easy to get to know, while a liquid crystal display gives a readout of each parameter value, these being selected by switches entirely separate from those used to effect program changes. Hence getting the synth to respond to your patch editing wishes is a lot simpler than it is on those instruments (DX7, Poly 800, SixTrak) that force you to keep switching between program and edit modes.

What makes editing more straightforward still is that the results of parameter changes are a lot more *predictable* than they are on the DXs. Within half an hour of seeing the 101 for the first time, I was altering values with total confidence in what the procedure would achieve.

Two different modes allow the Casio's eight voice channels to be used for eight-note polyphony (one channel per voice) or four-note operation (two channels per voice). Each channel has entirely separate envelope and PD controls.

Eight independent waveforms are available in total (they're displayed diagrammatically on the front panel), and each **DCO** has two assigned to it, one to provide the sound source and the other to generate the Phase Distortion. Like all the other envelopes on the 101, the pitch envelope can have up to eight steps, each with its own variable rate and level (can't help thinking I've seen those phrases somewhere before). As I've already mentioned, the DCW controls the PD-induced harmonic content level, and is made up of two sections – a key follow to allow the effect to be varied up and down the keyboard, and a further eight-step envelope (illustrated in Figure 5) to control the amount of the effect. Use just four of the envelope steps and you can imitate a standard VCF ADSR, and Figure 4 shows how the effect of a filtered sawtooth can be induced. At the maximum point, the PD has turned the sinewave (ie. the fundamental) into a sawtooth, but as the filter closes again and the waveform turns back into a sine, the harmonics are reduced in number.

The **DCA** or amplifier section has the same key follow and envelope controls as the DCW, and these allow volume to be varied across the keyboard and complex envelope delay effects in addition to the standard ADSR variations. For instance, repeats can be triggered by reducing one of the eight levels to zero and opening the envelope again at a later stage.

If you're in four-voice mode, the two channels can be tuned apart in one of three amounts – fine, semitone, and octave. And, logically enough, each of the channels can be assigned not only different waveforms but also different DCW and DCA effects. This means that 'doubled' voices are easily created, and if you're really clever, you can manipulate the individual key follow parameters so that the 101's keyboard can be split with one voice at the bottom and another at the top, though be warned – the sounds will still merge in the middle.

> 'The voices were good enough to convince me there should be plenty of sonic mileage to be got out of Phase Distortion.'

Sounds

The CZ101 holds 16 Casio factory presets (these are not erasable) and enough space for you to store another 16 of your own. The factory voices I found in the review sample are not, apparently, those that'll appear on machines when the model is properly launched in the UK towards the end of January. And a couple of good flute and piano sounds apart, that's probably no bad thing. Still, amongst the user-programmed sounds (courtesy of Casio demonstrator Richard Young), was an excellent clav that made use of the 101's built-in digital ring modulator (if I had my way, this facility would be standard on *all* synths, no matter what their country of origin), and the remainder of the voices in this bank were good enough to convince me that there should be plenty of sonic mileage to be got out of Phase Distortion.

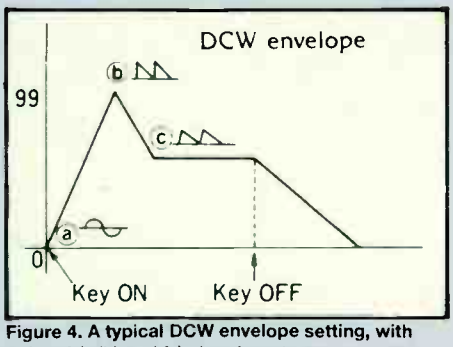


Figure 4. A typical DCW envelope setting, with points (a), (b) and (c) showing the wave output at that point of the envelope.

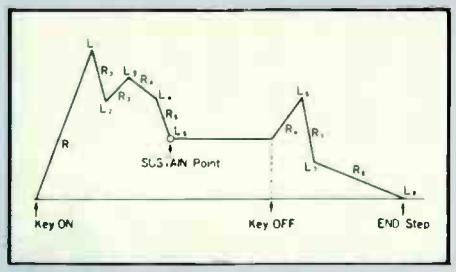


Figure 5. An envelope using all eight of the CZ101's programmable steps.

And once you've exhausted the 101's program memory space (no, it isn't enormous, but how many keyboard players actually *need* the 128 memories provided by other machines?), Casio will be happy to supply you with cartridges that hold a further 16 – they're due to be £29.95 each.

Casio have also blessed their baby with an excellent implementation of MIDI. As I've said, five octaves of pitch are recognised (if you're using a very long MIDI controlling keyboard, the Casio duplicates its top and bottom octaves to avoid any dead areas), as are pitch-bend and program-change enable and disable functions. You can switch remotely between Poly and Mono modes (the 101 can receive and transmit on any of 16 MIDI channels), and I only wish other Far Eastern manufacturers had entered the MIDI minefield with the same dedication as the CZ's designers – it would have made interfacing life a lot easier for all concerned.

Conclusions

If there's one fact that almost escapes unnoticed about this new Casio – such is the degree of competence and innovation within the machine – it's that it is remarkably good value for money at only £395. It's probably the least unexpected aspect of the machine's specification, given Casio's reputation for offering consumers a little bit more for their greenbacks.

So yes, I more or less expected that when Casio produced a professional polysynth, it would carry an RRP calculated (no pun intended) to make some of the competition look very silly. What I *wasn't* expecting was that the synth would employ a completely new method of sound synthesis, and that its designers would succeed in making that method so easy to apply from the word go.

As I see it, the only problem facing Casio (apart from the possibility of the UK division experiencing supply problems) is one of trying to convince pro players to accept an instrument from a company with a somewhat tarnished serious keyboard reputation. Isao Tomita, who played the CZ101's prototype ancestor at Ars Electronica earlier in the year (see report elsewhere this issue), has blessed the production model with the name Cosmo. From where I'm standing, that's something that ought to be changed as soon as possible if the marketing strategy isn't to deter potential purchasers before they even get the instrument out of its box.

You'd be right in thinking that Casio have produced some decidedly unprofessional products in the past, but wrong in deciding that the CZ101 is one of them. Because this is the keyboard that changes everything. ■

Further information from Casio Electronics, Unit 6, 1000 North Circular Road, London NW2 7JD. ☎ 01-450 9131.

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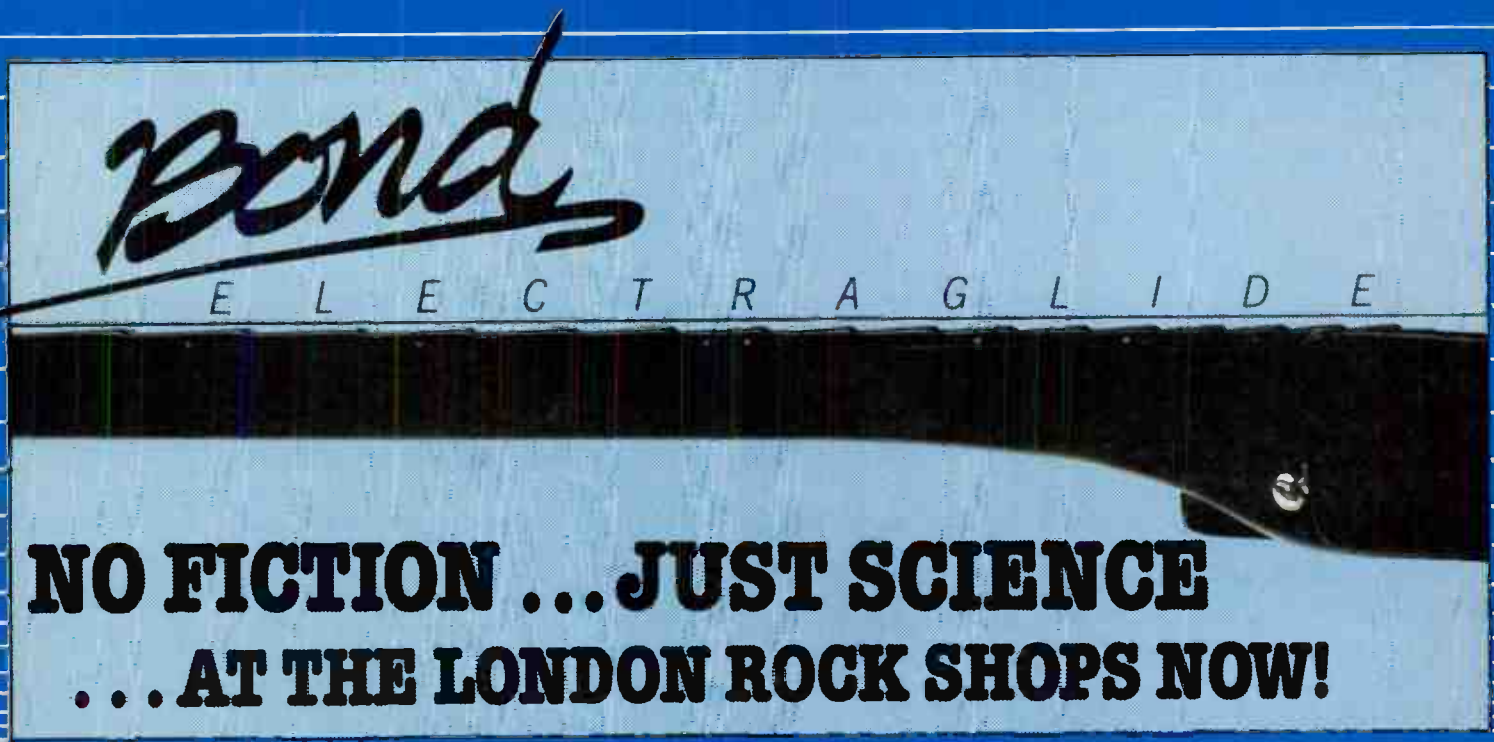

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FOSTEX

FOSTEX: B-16 NEW 16-track on ½" tape
FOSTEX: 8090 remote control for B-16
FOSTEX: A-8 8-track on ¼" tape recorder
FOSTEX: A-2 2-track reel-to-reel recorder
FOSTEX: 350 8 into 4 into 2 mixer for A-8
FOSTEX: 3060 6 way meter bridge for 350
FOSTEX: 250 4-track Multitracker w/Dolby C
FOSTEX: X-15 NEW baby 4-track cassette
FOSTEX: MN-15 4-1 mini mixer/compressor
FOSTEX: 8070 AC mains adapter for X-15
FOSTEX: 9060 "Orange" foot drop in/out
FOSTEX: 3180 Stereo spring reverb
FOSTEX: 3070 Stereo compressor/limiter
FOSTEX: 3050 Digital delay with modulation
FOSTEX: 3030 Dual 10-band graphic equaliser
FOSTEX: 3040 4 ch Dolby C noise reduction
FOSTEX: 2050 10 x 2 line mixer for mon mix
FOSTEX: 6301 Powered mini monitor
FOSTEX: SP-11 200w mini monitor 2 x 4"
FOSTEX: 3010 32 way all phono patch bay
FOSTEX: 8030 A-series remote control
FOSTEX: 8050 250/A-8 drop in switch

SPECIAL "GO FASTER" FOSTEX A-8 PACKAGE:

During December we are offering a ready-to-roll eight track system at a very special price including all the following items absolutely FREE:

8030 A-8 full remote control £46
8050 drop-in footswitch...£9
ACCESSIT compressor ... £51
ACCESSIT power supply for above.....£8
3 reels of AMPEX GM-1800 7" tape..... £24
plus all necessary cables. £27
Total FREE offer value £165

Offer extended to end of January 1985 SALE

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SPECIAL JANUARY SALE PRICES — CALL IN NOW!

TASCAM: 38 8 track on ½" recorder
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TASCAM: DX2D 2 channel dbx noise reduction
TASCAM: 244 Portastudio with dbx noise red.
TASCAM: Porta One mini portastudio —NEW!
TASCAM: 234 Syncassette rack-mounting unit
TASCAM: 133 3 channel A/V cassette
TASCAM: 122 Professional rack cassette
TASCAM: 225 Sound-on-sound syncassette —NEW!
TASCAM: Meter Bridge MB-20 for M-2A
TASCAM: Mixer M-2A 6 into 4 desk
TASCAM: Mixer M-30 8 into 4 Pro desk
TASCAM: Ge-20 dual 10-band graphic equaliser
TASCAM: M-1B 8/2 line mixer
TASCAM: MH40B 4 way headphone amplifier
TASCAM: MX-80 rack-mounting mic/line mixer
TASCAM: PE-40 4ch. 4-band parametric eq.
TASCAM: PB-32P 32 x jack patch bay
TASCAM: PB-32R 32 x phono patch bay
TASCAM: PB-32H jacks (front) phon (rear)
TASCAM: PB-32W mixed jacks & phonos
TASCAM: RC-30P punch-in switch
TASCAM: RC-71 remote control
TASCAM: Microphones and TEAC. accessories

*Special introductory prices on all TASCAM recording equipment during our December promotion: please call in person to our London or Bristol stores for full details of our extra special December deals (must end Dec. 31st) Instant Credit (Club 24) up to £1,000 on all TASCAM recording gear for credit card holders (subject to status). Please ring for further details

HOME RECORDING

REVERB UNITS:

LEXICON: PCM-60 NEW digital reverb
YAMAHA: R-1000 digital 4 delay settings
FOSTEX: 3180 stereo spring with pre-delay
VESTA-FIRE: RV-1 mono in stereo out spring
GREAT BRITISH SPRING: updated black tube model
CUTEC: AE-400 spring with analog pre-delay
ACCESSIT: mono in stereo out spring inc. psu
BOSS: RX-100 mono/stereo in/out spring

DIGITAL DELAYS:

YAMAHA: D-1500 MIDI 1023ms. 16 memories
DELTA LAB: Effectron 3 1024ms. 4 memories
ROLAND: SDE-3000 8 full memories digital readout
KORG: SDD-3000 8 memories with excellent mod.
ROLAND: SDE-1000 4 memories long delay
DELTA LAB: Effectron 2 1024ms 17khz
KORG: SDD-1000 NEW with ext. trigger
IBANEZ: DM-1100 long delay suitable for guitar
IBANEZ: DM-2000 digital read-out of echo time
BOSS: DE-200 with external trigger input
VESTA FIRE: Dig 410 excellent all-round DDL
DELTA LAB: Effectron 1 1056ms. 12khz
FOSTEX: 3050 Short delay ADT/chorus/flanger
Please call for further technical details

COMPRESSORS/LIMITERS etc.

DRAWMER: DS-201 Dual noise gates
DRAWMER: DL-221 Dual limiter/compressor
DRAWMER: DL-231 Limiter/compressor/expander
FOSTEX: 3070 Gated compressor/limiter
VESTA FIRE: SL-020 Dual compressor/limiter
IBANEZ: HD-1000 Pitch shifter + digital delay
ASHLEY: SC-33 Stereo noise gates
APHEX: Model "B" aural exciter
ROLAND: Dimensions "D" few only left
VESTA FIRE: TC-810 2 channel driving exciter
VESTA FIRE: SF-010 Dual flanger/chorus
IBANEZ: UE-400 Multi-effect pedal rack unit
ACCESSIT: Compressor
ACCESSIT: Parametric equaliser 2 way
ACCESSIT: Noise gate
ACCESSIT: 4-way power supply
ACCESSIT: Headphone splitter box
ACCESSIT: Stereo 15w power amp for above

JANUARY SALE NOW ON!

FOSTEX 250 MULTITRACKER

The quality cassette Multitracker that gives up to ten bounced tracks with the aid of Dolby C at 3¾ips tape speed. 1-4 inputs may be recorded at the *same* time with separate equalisation on to four different tracks. Ideal for the electro musician with sync-to-tape and triggering facilities. The professionals rate the Fostex 250 as "The best Multitracker" ... Call in for our "Better Price".

London Rock Shop 250 case .....£39.

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Tascam's new little baby is also a winner! Built-in dbx noise reduction, 4 independent channels with full eq. and VU monitoring. Battery or mains operation (AC adapter optional extra) running at normal cassette speed.

Somehow all four Multitracker/Portastudios are slightly different ... and the choice is yours!

Full descriptive brochures are available on all models – just send us 35p in stamps to cover postage and we'll send you details on all four models and a FREE copy of the Fostex Cookbook.

Extended credit available on all models subject to finance company approval. Instant credit for credit card holders through Club 24. Full details to personal callers at our London and Bristol stores.

FOSTEX X-15 MULTITRACKER

Real multitracking on a budget! For only £279 you get a 4 track cassette recorder running at normal cassette speed (1⅞ips) that can work off its own battery pack (supplied) or the optional mains unit. A pair of headphones and a microphone are all you need to get started and Dolby B works well for the seven track bounce!

MN-15 Fostex "Squash" 5 channel mixer and compressor: ideal for mixing down with live vocal overdub £40.95
9060 Fostex "Orange" punch in/out switch..... £7.95
8070 Fostex "Juice" AC mains power unit..... £28.95
9015 Fostex soft carrying cover for X-15..... £21.95
London Rock Shop hard case for X-15 ..... £29.95

TASCAM 244 PORTASTUDIO

Tascam's trusty successor to the 144 (the one that started it all) features dbx noise reduction and double normal cassette speed. With its versatile tone controls, stereo echo send facility and angled VU meters the Tascam 244 has a little extra to offer. The choice is yours!... ...Call in for a demo and our "Better Price"

INTEREST-FREE (0% APR) CREDIT ON SELECTED LINES (PLEASE CALL FOR FURTHER DETAILS)... PLUS MANY IN-STORE CLEARANCE ITEMS NOT LISTED HERE.

SYNTHESIZERS

ROLAND: MKB-1000 NEW 88 note Mother keyboard
ROLAND: MKB-300 NEW 76 note Mother keyboard
ROLAND: MKS-80 NEW Super Jupiter rack polysynth
ROLAND: MPG-80 Programmer module for MKS-80
ROLAND: MKS-30 NEW Planet "S" polysynth module
ROLAND: MKS-10 NEW Planet "P" piano module
ROLAND: AXIS 1 Remote MIDI keyboard controller
ROLAND: Jupiter 8A DCB/MIDI compatible polysynth
ROLAND: Juno 106 polysynth 120 memories
ROLAND: JX-3P programmable/preset/poly synth
ROLAND: PG-200 add-on programmer for JX-3P
ROLAND: MD-8 Midi-DCB interface unit (Juno 60)
ROLAND: MC-4B Microcomposer & OP-8 interface
ROLAND: OP-8M CV/Gate to MIDI for DCB
DIGI-ATOM: CV/Gate to MIDI Rack-mounting unit
ROLAND: MC-202 Microcomposer with sync-to-tape
ROLAND: SBX-80 Sync Box SMPTE to MIDI
ROLAND: MSQ-700 Multitrack MIDI sequencer
ROLAND: MSQ-100 Midi sequencer
ROLAND: JSQ-60 JP-8A & Juno 60 d.g. sequencer
ROLAND: SH-101 Monophonic synth with built-in 100 step sequencer and arpeggiator
ROLAND: MGS-1 hand grip and mod control for SH-101
KORG: Poly 800 Midi polyphonic synth w/sequencer
KORG: Poly 61M now with MIDI & 64 memories
KORG: EX-800 Expander polysynth (no keyboard)
OBERHEIM OB-8 Midi polyphonic synth
OBERHEIM XPANDER amazing analog/digital hybrid
OBERHEIM DSX multi voice polyphonic sequencer
UMI: Midi multi-track sequencer for BBC "B"
SEQUENTIAL CIRCUITS: Prophet 600 w/sequencer
SEQUENTIAL CIRCUITS: Prophet 5 no with MIDI
SEQUENTIAL CIRCUITS: Prophet T-8 Wooden keyboard
SEQUENTIAL CIRCUITS: Six Traks Midi polysynth
MOOG: Source new model with clock in, sync in
YAMAHA: DX-7 Midi 32 memories + RAM storage
YAMAHA: DX-9 Midi 20 memories FM sounds
YAMAHA: CX-5ME MSX computer with full-size keyboard
YAMAHA: CX-5ME MSX computer with mini keyboard
YAMAHA: CS-01 incredibly versatile mini synth
YAMAHA: Breath controller for CS-01 and DX-7
CASIO: CT-6000 New touch-sensitive keyboard

ELECTRIC PIANOS

***Prices listed are RRP only. Please call in person to either store for our competitive prices.**

YAMAHA: PF-15 FM 88-note weighted keys £1049
YAMAHA: PF-10 FM 76-note touch sensitive £849
YAMAHA: CP-7 5 octave stereo chorus £399
SIEL: Piano PX 10 voices ..... (Bristol only) £635
SIEL: Piano QUATTRO ..... (Bristol only) £985
SIEL: Piano PX JR ..... (Bristol only) £399
ROLAND: NEW HP-20 5 octave wood or silver £275
ROLAND: HP-400 & HP-300 Home pianos (Bristol)
ROLAND: HP-70, HP-60 & HP-30 Piano Plus (Bristol)
ROLAND: EP-11 Piano w/rhythms/auto acc (Bristol)

DRUM MACHINES

OBERHEIM: DMX extra memory & software updates
OBERHEIM: DMXe Main frame choose your own cards
OBERHEIM: Replacement cards for DMX from stock
OBERHEIM: DX now with sync-to-tape
SEQUENTIAL CIRCUITS Drum Traks tuneable
DRUMULATOR: New 64 song model crash or ride
ROLAND: MPC-8 MIDI Pad Controller NEW!
ROLAND: TR-909 digital/analog hybrid RAM pack
ROLAND: TR-707 NEW Digital drum unit
ROLAND: TR-606 "Drumatix"
YAMAHA: RX-11 digital 16 voice & RAM pack
YAMAHA: RX-15 digital 12 voice tape drum
KORG: DDM-110 Digital drum unit—NEW!
KORG: DDM-220 Digital percussion unit—NEW!
MPC: Sync Track sync-to-tape for TR-606/808
BOSS: DR-110 New Dr. Rhythm best value budget unit
YAMAHA: MR-10 presets with playing pads

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This incredible MSX compatible micro from Yamaha is simply staggering value for money!

YAMAHA: CX-5ME MXE Music Computer **£449**
YK-01: Mini keyboard **£85**
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YRM-101: FM Music Composer ROM: 8 part, 8 different FM voices for song composition **£36**
YRM-103: DX-7 voicing ROM: create and edit DX-7 voices via MIDI **£36**
YRM-104: Music Macro ROM: add sounds to your programmes via MSX Basic language **£36**
UDC-01: Data Cartridge **£65**
CA-01: Single cartridge adapter **£19**

... and don't forget that other MSX standard programmes will run on the CX-5ME.

CASIO KEYBOARDS

All models are available at our Bristol store but only selected models in London.	RRP:	OUR PRICE:
CASIO: CT-7000 digital multitracking	£525	£475
CASIO: CT-6000 NEW touch sensitive MIDI	£695	£645
CASIO: CT-810 Full size MT-800 stereo	£395	£345
CASIO: CT-610 5 octave stereo full size	£395	£345
CASIO: CT-410V full size MT-400V	£345	£295
CASIO: CT-310s portable but full size	£255	£199
CASIO: MT-800 stereo with ROM pack	£295	£249
CASIO: MT-400V stereo with ADSR filter	£255	£199
CASIO: MT-200 mini with computer interface	£155	£129
CASIO: MT-66 best value portable grey	£155	£129
CASIO: M-46 same as MT-45 but cheaper	£125	£99
CASIO: MT-35 small portable keyboard	£95	£79
CASIO: PT-80 ROM pack reader	£79	£69
CASIO: PT-20 mini, programmable	£59	£49
CASIO: PT-1 updated V-tone	£44.95	£39
CASIO: NEW CZ-101 MIDI polysynth- amazing value		£345

BOSS EFFECTS UNITS

Please note: Prices listed are RRP for your reference only. Please call in person to either store for our "Better Prices"!

ALL NOW AT GREATLY REDUCED JANUARY SALE PRICES!

BCB-6 Effects pedal carrying case £75
BF-2 Flanger pedal £105
CE-2 Original mono chorus pedal pale blue £59
CE-3 Stereo chorus pedal metallic blue £99
CS-2 Compressor/sustainer for guitars £82
DD-2 Digital delay pedal £195
DE-200 Rack-mounting digital delay w/trigger £350
DF-2 NEW Distortion and feedbacker pedal £75
DM-3 NEW Stereo analogue delay pedal £125
DR-100 Doctor Rhythm drum unit £150
DS-1 Distortion pedal fuzz box type £69
FV-100 Volume pedal with minimum volume £71
FV-200 Stereo volume and/or filter pedal £82
GE-7 7-band graphic equaliser with boost £99
GE-10 10-band graphic equaliser (mains) £135
HA-5 Play Bus "Rochman" type unit £125
HC-2 Hand clap unit with ext. trigger or pad £75
HM-2 Heavy metal overdrive pedal £60
NF-1 Noise gate pedal £57
OC-2 Octaver pedal with 1 & 2 octaves down £71
PC-2 Percussion synth/syndrum type w/ext. trigger £71
PD-1 Rocker distortion foot controllable £99
PW-1 Rocker wah-wah pedal variable depth £109
PV-1 Rocker active boost volume pedal + 20db £105
PH-1R Phaser pedal with added resonance £99
PH-2 NEW Super Phaser £105
RH-11M Stereo mini headphones & mic for HA-5 ..... £75
RH-10 Lightweight stereo headphones £27
RX-100 Mono or stereo add-on spring reverb £181
SD-1 Super overdrive pedal £69
TW-1 Touch Wah auto triggered wah-wah pedal £81
VB-2 Vibrato pedal excellent for bass harmonics £87
PSM-5 Power supply/effects for up to 8 pedals £82
PSA-220 Mains adapter for SH-101 synth £18
ACA-220 Individual pedal battery eliminator £18
MA-5 Mini 5 watt mains/practice combo 2 inputs £83
MA-15 Ace 15 watt keyboard/practice combo £143
MS-100 100 watt 2x4" mini mic stand monitor £109
MS-100A Microphone stand adapter for MS-100 ..... £27
J-44 Junction box phono-mini jack-jack £23
J-5 5-way interconnected jack socket splitter £24
KM-04 4 into 1 battery powered compact mixer £59
BX-400 4 into 1 mixer £109
BX-600 6 into 2 stereo mixer lightweight £165
BX-800 8 into 2 compact mixer £300
TU-12 Chromatic auto guitar/bass tuner C1-B5 ..... £57
TU-12H NEW extended range auto tuner C2-B6 ..... £60

Mail Order: just ring Bristol store with your credit card number and we will despatch within 24 hours (subject to stock availability). Personal cheques take some time to clear.

MIDI SOFTWARE

In our computer music showroom we have a good selection of MIDI software for a wide range of home computers. The BBC B, Commodore 64, Spectrum, Apple II/IIe and IBM PC are all covered but the quality of sequencing programmes varies greatly.
At the moment we have MIDI interfaces from JELLINGHAUS, SIEL, EMR, ROLAND DG, SEQUENTIAL CIRCUITS and UMI-1B but software is not interchangeable between the various interfaces, so beware! Prices start from £99.95 complete.
Rather than just produce a list of all software available we would rather talk to you about your own requirements—so why not give us a call? Try London on 01-267 7851, 5381, or 1771 and Bristol on 0272 276944.

AMPS, CABS & COMBOS

The London Rock Shop is the main London outlet for the superb TRACE ELLIOT bass equipment.

TRACE ELLIOT: GP-11 Rack-mounting bass preamp
TRACE ELLIOT: AH-150 150w bass head 7 band eq
TRACE ELLIOT: AH-250 250w bass head 11 band eq
TRACE ELLIOT: 4x10" and 1x15" cabs
TRACE ELLIOT: 4x10" 150w combos 7 or 11 band
TRACE ELLIOT: 1x15" 150w combos 7 or 11 band
ROLAND: Cube 60 Keyboard (silver) 2 inputs
ROLAND: Cube 40 Keyboard (silver)
ROLAND: Cube 60 Chorus (grey) stereo chorus
ROLAND: Cube 40 Chorus (grey) stereo chorus
ROLAND: Cube 60 footswitch overdrive (orange)
ROLAND: Cube 40 1x10" w/master volume (orange)
ROLAND: Cube 20 w/master vol and reverb
ROLAND: Cube 60 Bass portable small combo
ROLAND: Spirit 10 w/master volume budget amp
ROLAND: Jazz Chorus JC-50 1x12"
ROLAND: Jazz Chorus JC-120 2x12" "a classic"
CARLSBRO NEW Keyboard 150 combo 9 inputs
CARLSBORO Cobra 90 bass combo 1x15"
CARLSBORO Cobra 90 keyboard combo and head
CARLSBORO Hornet 45 keyboard combo 2 ch w/rev
CARLSBORO Hornet 45 bass combo 1x12"
SESSIONETTE Mk. 2 SG: 75 1x12" Mos/Fet
SESSIONETTE Mk. 2 SG: 75 2x10" Mos/Fet

GUITARS We now stock only a few, very tasty models. At the moment these range from the best value budget basses by WESTONE right up to STATUS, STEINBERGER and the ROLAND GR-700 guitar synth.

TO: THE LONDON ROCK SHOPS
Please send me more information on the following item(s)_____
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I enclose 34p in stamps to cover postage and catalogues.

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The London Rock Shops

HOME RECORDING ACCESSORIES

MICROPHONES

N.B. All prices listed are "LIST PRICE (R.R.P.)" Please call in person for our "Better Price"

FENDER: D1 Dynamic £74.86
FENDER: D2 Dynamic £123.84
FENDER: D3 Dynamic £127.80
FENDER: P1 Condenser £204.98
FENDER: P2 Condenser £91.81
FENDER: M1 Miniature condenser £164.41
All FENDER microphones carry a lifetime warranty
AKG: C-451 Condenser body excluding capsule £107.53
AKG: CK-1 Cardioid capsule for C-451 above £71.30
AKG: D-330BT Vocal microphone with roll-off £149.50
AKG: D-320EB Vocal microphone with roll-off £107.53
AKG: D-310 Vocal microphone £68.89
AKG: D-190E All purpose Portastudio mic £64.98
AKG: D-80 Best budget buy microphone £29.95
SHURE: SM-58LC Professional lo-z microphone £179.06
SHURE: SM-57LC All purpose pro stage mic £138.85
SHURE: SM-10A Headset mini microphone £145.64
SHURE: 518-SA Unisphere vocal mic £54.33
SHURE: 517-SA Unidyne general purpose £44.83
SHURE: PE Series colour catalogue available
SENNHEISER: MD-441 Dynamic hypercardioid £166.75
SENNHEISER: MD-421 Beautiful "black beauty" £120.63
SENNHEISER: K3-U Electret condenser module £51.90
SENNHEISER: ME-20 Omnidirectional capsule £33.46
SENNHEISER: ME-40 Unidirectional capsule £46.57
FOSTEX: M-505 Black or grey dynamic £49.95
Discounts on all microphones if purchased as part of a recording or P.A. package. N.B. prices quoted are "List Price (R.R.P.)"

MICROPHONE STANDS:

Budget lightweight boom £16.95
Professional boom stands from £24.95

MICROPHONE CABLES:

SHURE: SC-2 Jack-Cannon £8.95
RHINO: For American microphones
RHINO: For Japanese microphones
WHIRLWIND: MK-3 Jack to Cannon (F)
WHIRLWIND: MK-4 Cannon (F) to Cannon (M)

HEADPHONES:

BEYER: DT-100 Classic studio headphones
BEYER: DT-202 Increased bass response
SENNHEISER: HD-222 Enclosed model
SENNHEISER: HD-410 Slimline open back
ROLAND: RH-10 Lightweight model

TAPES:

AMPEX: Grand Master ¼" 7" for FOSTEX A-8
AMPEX: 456 ¼" 10½" spool for REVOX/TASCAM
AMPEX: 456 ½" for FOSTEX B-16, TASCAM 38
TDK & TEAC: "Reel" cassettes for Portastudios
TDK: Floppy disks for UMI-1B and MIDI data

ACCESSORIES:

Head cleaning fluid
THEATRE PROJECTS: D.I. boxes
Head demagnetizers
Ready-to-run cables and connectors

STANDS: Console stands for Mixing desks and complete FOSTEX A-8/B-16 package formats available.

MONITOR SPEAKERS:

ELECTRO-VOICE: Sentry 100A ..... pair £550.00
ELECTRO-VOICE: NEW Cristal monitors ..... pair £295.00
FOSTEX: NEW SM-6600 3-way 200w ..... pair £595.00
FOSTEX: 6301 powered mini monitors as used by the BBC and NBC news ..... each £80.44
JBL: 4401 broadcast monitors ..... pair £295.00
TANNOY: Stratfords ..... pair £265.00
BOSE: Studiocraft 300ST ..... pair £169.95
AURATONE: 5C reference mini monitors ..... pair £72.45
VISONIK: David 6000 ..... pair £115.00
AKG: LSM-50 Auratone size monitors ..... pair £59.95
YAMAHA: MS-10 powered mini monitors ..... pair £199.95

PATCH BAYS

ACCESSIT: Patch Bay jacks (F) phonos (Rear) £73.54
ACCESSIT: Patch Bay 16 way jacks (F & R) £73.54
ISOPATCH: CP-44J 22 way jacks (F & R) £86.25
ISOPATCH: CP-44P jacks (F) phonos (R) £86.25
ISOPATCH: CP-44T jacks (F) open (R) £86.25
SOTA: 32 way jackfield open (R) ..... POA
TASCAM: PB-32P 16 way jacks (F & R) £65.00
TASCAM: PB-32R 16 way phonos (F & R) £65.00
TASCAM: PB-32H 16 way jacks (F) phonos (R) £65.00
TASCAM: PB-32W 6 way all jacks (F & R) mixed with 10 way all phonos (F & R) £65.00
FOSTEX: 3010 16 way normalised all phonos £45.14

PATCH CABLES:

PHONOPRO: Pack of 2 x 4m phono to phono £5.75
PHONOPRO: Pack of 4 x 2m phono to phono £6.95
PHONOPRO: Pack of 8 x .5m phono to phono £8.65
ISOPATCH: Assorted pack of 4 x 175mm, 4 x 320mm & 2 550mm jack to jack cables £36.80
KORG: Pack of 7 x "long" jack-to jacks £20.52
KORG: Pack of 10 x "short" jack-to-jacks £20.52
ROLAND: T5 5m. MIDI-MIDI cable £9.00
ROLAND: T10 10m. MIDI-MIDI cable £14.00
ROLAND: Pack of 3 x 1m. mini to mini PCS-14A £7.00
ROLAND: Pack of 2 x brown/green jack cables £7.00
ROLAND: Pack of 2 x jack to mini jack £7.00
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Simmons SDS EPB

As the sound-sampling war hots up, Simmons strike another percussive blow for Britain. *Paul White*

After months of superhuman patience on behalf of E&MM staff, the long-awaited EPB finally arrived in the editorial office last week. Designed primarily to complement Simmons' SDS7 electronic drum kit, the EPB enables the musician to store natural sounds on EPROMs so that they may be used later as percussive elements within the SDS7. It's not inconceivable, however, that the EPB will find applications other than as an add-on to the SDS7, as stored sounds may be triggered from a sequencer, click-track, or indeed Simmons' own newly-developed SDS1 pad, making the EPB a useful device for studio applications.

Either the 2764 (8K) or 27128 (16K) type EPROMs may be used, giving maximum sample time of 0.8 seconds and 1.6 seconds respect-ively.

Whilst not being long enough to capture entire party political broadcasts (and let's face it, who'd want to capture them in the first place?), the EPB's capacity does allow it to accommodate a wide range of percussive sounds and, using the larger EPROM, ambient effects such as reverbed snare drum, for example.

The EPB has a single input channel which incorporates a peak LED for level matching purposes. Once it's been fed into the unit, the sound is digitised into eight bits and stored in an area of RAM (up to 16K), and it's at this point that whatever it is you've sampled may be replayed so that its relative worth may be evaluated before it is immortalised in EPROM form. Once the EPROM has been programmed, it may be played back *via* the EPB or used to replace one of the existing EPROMs in an SDS7, should you be lucky enough to possess one.

A computer interface is also provided, and this allows samples to be transferred between the EPB's memory and that of the computer, making the editing of sounds (or even the creation of new ones from scratch) quite feasible. The catch is that if you want to take advantage of this facility, you'll have to write your own software, but it shouldn't be long before some enterprising soul starts to market a suitable package.

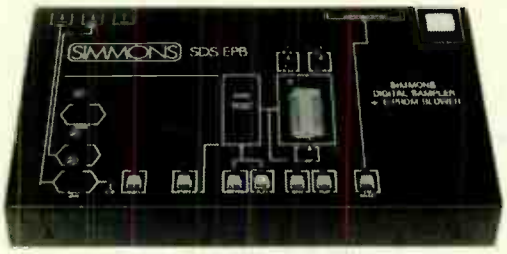
Construction

This is a functional bit of gear, and its 320 × 210 × 75mm steel case makes few concessions to fashion. All the switches and pots are mounted on the top surface, along with the zero-insertion-force EPROM socket, whose nomenclature is conveniently and charmingly shorted to 'zif'. The rear panel contains the computer interface connector, the input and output sockets, and the trigger input socket. No surprises there.

For the enlightenment of those readers who have never encountered a zif, it's simply an IC socket into which a chip may be plugged without whoever's doing the plugging having to use force. The clever part is that once the chip has been fitted, a lever clamps the IC's legs, thus holding it firm and ensuring good contact. This is obviously desirable in situations where an IC needs to be inserted and withdrawn on a frequent and regular basis, as otherwise the socket would wear out and half your EPROMs would be walking around with wooden (non-conductive) legs.

Mode D'emploi

Didn't know I could speak Serbo Croat, did you? The first item on the agenda is to decide whether you're going to record the sample live (using a microphone), or whether you're going to sample something you've already recorded on tape. You'll need to plug the EPB's output into a monitor system of some kind in order to check the sound quality of your handiwork, and the output monitors the signal *after* it has



been through the digitisation process, so you can check for side-effects that might be caused by the sampling rate you're using. Sadly, this facility is only audible during sampling.

Whatever you decide to record, it must first be stored in the RAM section of the EPB, and the Record RAM button is used to select this function. The input level should be adjusted so that the clip LED just glows if you want to obtain the optimum signal-to-noise ratio without distortion.

Depending on which EPROM size you intend to use, 8K or 16K should be selected, and recording may then be initiated by pressing the Start button.

In order to obtain the highest quality of recorded sound, the sample speed should be set as high as is possible without cutting off the end of the sample. If there's a hefty chunk of silence recorded after the sound has died away, you're sacrificing bandwidth and signal quality to no purpose. So stop it at once.

The beauty of being able to store the sound in RAM first is that all these finer points can be optimised *before* the end result is burned into the EPROM. Of course, trying to synthesise the exact beginning of a percussive sound to the pressing of the Start button can be a bit of a pain, to say the least, so Simmons have wisely built an auto-trigger facility into the EPB.

Pressing the Ready button puts the EPB into this automatic mode, and recording starts as soon as an input signal is present. A variable threshold helps to ensure reliable triggering and this is best set empirically.

Finally, the moment of truth. You plug an EPROM into the zif, pausing only to check that the Safe/Blow switch is in the former position. Pin 1 of the EPROM *must* be next to the lever, ie. the indent at the end of the EPROM should point towards the rear of the case. Moving the lever down locks the EPROM into place, and the Safe/Blow switch can then be moved into the Blow position.

At this point, you simply press Save followed by Start and wait for the Start LED to go out (between 40 and 80 seconds). When this event has come to pass, the Select switch can be thrown back to Safe and your handiwork checked by pressing Play PROM followed by Start.

A Loop facility is also incorporated, and this causes the stored sound to cycle indefinitely (at a rate set by the Sample Speed control), enabling you to set up repeated signals and thereby create that mystical entity we call A Rhythm.

If you find that you loathe your latest sample with an intensity normally reserved for tax inspectors, your EPROMs can be erased and reused by subjecting them to half-an-hour of electronic brainwashing in an ultra-violet eraser supplied as an optional extra. To give you some idea of what this implies, half-an-hour in one of these things is equivalent to a week or so in the Sahara, only without the sand.

Sound Quality

This really depends on the sample speed set during Record mode, though for every sample I made while the EPB was in my possession, a certain amount of quantisation noise was always evident. This is generally unobtrusive in the context of percussive sounds, but where it *does* become a problem is when the sampled sound is so short that you end up storing a little of the following silence or ambience. In this case, the noise really shows up directly after the beat, and I can't help but wonder if Simmons would have been better off opting for a shorter sample time with better quality. Even sampling at the fastest possible rate, a snare drum beat wastes a fair amount of memory, and all this does is generate unwanted noise.

At the maximum sample time, it's only possible to get something like a 4kHz bandwidth, so bright sounds such as snare drums or cymbals suffer rather badly if things are stretched too far – but a one second sample using the 16K setting is both bright and long enough to capture any ambience that may exist, whether acoustically or artificially.

Used in conjuction with the SDS7, even the EPB's low-bandwidth samples are useful, as analogue stick-click or pitch-bend can be added to liven things up. However, it's worth noting that the SDS7 cymbal sound takes up two 16K EPROMs, and I can't think of any simple way of replacing that.

Conclusions

The EPB may be considered as being something of a luxury, particularly if your musical endeavours are being sponsored by no greater a benefactor than the Department of Stealth and Total Obscurity, but SDS7 owners and recording engineers may well feel that the added flexibility justifies the unit's high initial cost.

It does mean that recording studios and musicians alike can build up a library of sounds for future use though the cost of EPROMs shouldn't be ignored: a 16K (27128) job will cost around £12 or more.

I have some reservations about the quantisation noise, but the EPB does its job in an efficient and user-friendly manner, and if you do use it in conjunction with the SDS7's analogue processors, the noise side-effect should all but disappear. ■

The EPB retails at £392.04 including VAT. Further information from Simmons Electronics, Alban Park, Hatfield Road, St Albans, Herts. ☎ (0727) 36191.

POWERFUL COMBINATIONS

Manufacturers are finally waking up to the fact that keyboard amplification requires something better than a hyped-up guitar amplifier. We look at five of the latest high-power keyboard designs. *Paul White*

Ohm KA140C Keyboard Combo

This is a solidly built but still easily portable keyboard combo capable of delivering up to 140 watts. An eight-ohm, 15" cone driver and high-frequency tweeter are built into the cabinet, but as the solid state amplifier delivers its full power output into a four-ohm load, you'll need to add an extension speaker cabinet if you want to realise its maximum potential.

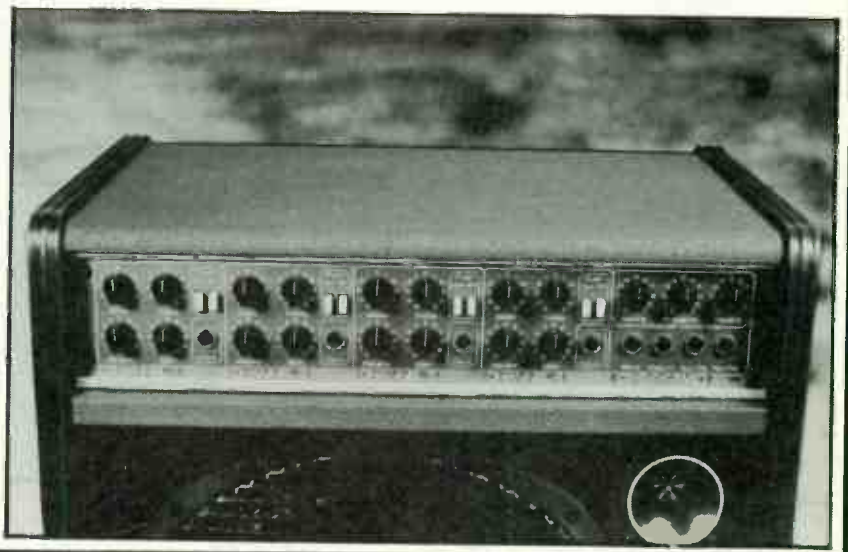
The ported enclosure is tastefully finished in deeply textured matt vinyl, and measures a compact 645×535×380mm, the corners being protected by tough plastic extrusions.

A multikeyboard set-up demands completely independent input channels, and the Ohm satisfies this requirement by providing four such channels, each with its own Reverb Depth control as well as the mandatory Volume, Treble and Bass adjusters. Additional pushbuttons are fitted for Effects Send and Auxiliary (or DI) output, and the Master section includes a Master Volume control, Pressure and Reverb controls, plus the effects loop sockets, auxiliary output and reverb footswitch socket. Rear panel facilities include the extension speaker sockets, the slave output and the IEC mains sockets.

At £365, the Ohm KA140C offers both power and flexibility in a compact, economical package and should fill the requirements of a good many keyboard players. The use of high quality loudspeakers ensures undistorted sound up to very high levels, and this combo is also suitable for drum machines and electronic drum kits.

Subjectively, the Ohm has a clean sound with more than adequate tonal range, and the reverb works well without introducing any noticeable background noise.

The words 'value for money' usually imply compromise, but Ohm have cut few if any corners in producing this high quality, cost-effective package.



Marshall KC60

Although undeniably better known for their rock guitar amplification, Marshall aren't hiding from the fact that the electric keyboard, and the synthesiser in particular, is enjoying tremendous popularity at the moment, and consequently generating a sizeable market for specialist amplification.

The KC60 is distinctively styled in the tradition of its guitar ancestors but in reality it's designed specifically for keyboard use and is not simply a revamped guitar combo.

Measuring about two feet square by 12" deep, the KC60 is built around the ported loudspeaker system and incorporates a heavy-duty 15" speaker and a horn tweeter.

The cabinet construction follows the simple but solid design traditions laid down by its manufacturer, and all the hardware is typically Marshall, from the bar handles to the gold front panel with its metal-capped knobs. Solid state circuitry is used throughout, as the famous Marshall valve sound has little or no relevance to the world of the keyboard player.

Both input channels have their own Volume, Bass and Treble controls, and these share a common Master Volume and Master Reverb section. An inspection of the back panel reveals a reverb footswitch socket, an effects loop, and line and headphone outputs, but there is no extension speaker facility presumably because the built-in speakers are capable of handling the full output power of the amplifier.

Because of its relatively large cabinet size

and powerful speaker, this combo delivers a fat punchy sound which, because of the built-in tweeter, still has a bright edge to it.

In terms of range, the tone controls are remarkably effective (if a little noisy when used to excess), and are certainly more than adequate for most normal keyboard applications. The reverb is also very effective, and if you use it properly, generally flattering.

The KC60 is a powerful combo offering a useful range of tones that should be able to hold its own against a drum kit in an ongoing artiste/audience exchange-of-vibes situation. Conversely, it looks meaty enough to handle synthesised drums and, as there are no specific combos built for that purpose that we know of, it's definitely worth a try.

Carlsbro Keyboard 150

This impressive-looking offering from Carlsbro can deliver 150 watts into four ohms, though as is normal, the power delivered to its internal eight-ohm speaker system will inevitably be somewhat short of this.

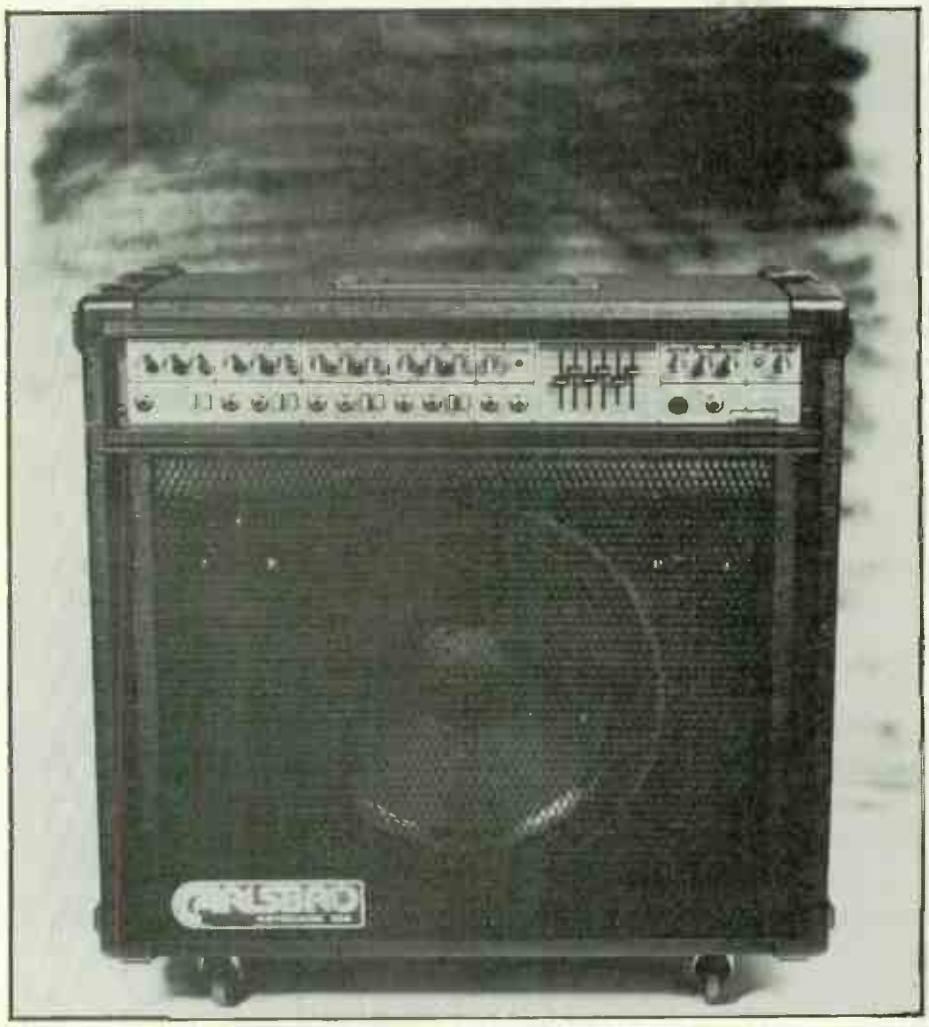
Four instrument channels are provided, but there is also a tape input channel which offers a choice of jack or five-pin DIN inputs (but don't plug your MIDI cables in here, folks!). Although each channel has its own Bass and Treble controls, a six-band graphic equaliser is included to add further treatment to the mixed sound: this would prove to be a big advantage in awkward acoustic environments. Each channel has buttons to select reverb or external effects, and the rear panel provides effects loop, line out, headphone and extension speaker sockets.

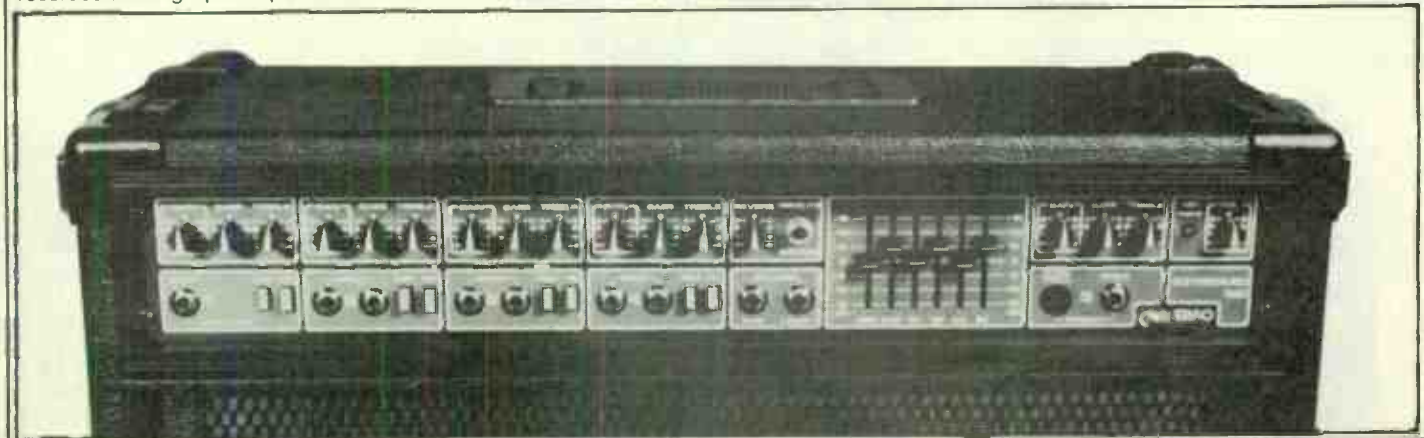
The whole combo looks very tasteful, measuring a little over two feet square, and the cabinet is a ported design housing a 15" speaker (*not another one – Ed*) and two HF tweeters. All the fittings are distinctively Carlsbro in appearance, but I would prefer to see a tough steel speaker grille in place of the chorus girls' tights normally fitted.

Seeing as the 150 is rather a heavy beast, side handles and castors are fitted as standard, the rear ones having toe-operated brakes which should preclude the eventuality of the combo running away on an uneven stage, for example.

The combo coped happily with a variety of DX7-generated sounds as well as electronic percussion voices and the tonal range provided by the combined efforts of conventional and graphic EQ sections was well in excess of what would normally be required. By incorporating a Tape In channel, Carlsbro have extended the usefulness of the amp to embrace those performers who rely on pre-recorded backing tapes as part of their act, but I think a separate Reverb Depth control for each channel would have been a sensible addition.

In most respects then, this is a fine and versatile combo with a good reverb, and should find a fair degree of popularity with both keyboard players and electronic percussionists seeking clean, loud amplification.





Roland Keyboard Cube 60

This highly portable but nonetheless punchy-sounding keyboard combo from the Land of the Rising Yen is easily recognised by its silver vinyl. In fact, the amp's appearance strengthens my conviction that Roland's design team are becoming increasingly influenced by *Doctor Who*. For whereas the G707 guitar synth controller resembled a Dalek's handbag, this combo could easily be mistaken for a Cyberman's lunchbox.

The cabinet is of the fully-enclosed type, which affords a welcome degree of protection to the rear of the loudspeaker, though this does have a cut-out for cable stowage which also acts as a rear vent. Weighing in at a little over 36lbs, the Cube 60 incorporates a 12" loudspeaker and a small horn tweeter, enabling it to handle most of the frequencies generated by modern synthesisers. And it measures a mere 370×465×300mm, making it one of the most compact combos in its power range.

This is a two-input amplifier, each input having its own Volume control and a Reverb on/off switch, but both inputs are routed *via* a common three-band EQ section: The reverb control is also a joint affair. Turning now to the rear panel, we find a pair of phonos (which provide a split mono output suitable for feeding to a tape recorder), and also a pair of effects loop sockets, plus, of course, the almost obligatory extension speaker outlet. All the controls, switches and sockets are deeply recessed to minimise the risk of accidental damage, but again, I would have preferred to see a tougher grille material than that fitted to the review sample. It really isn't good enough.

The Cube's output remains clean up to moderately high sound levels and possesses a warm, convincing reverb sound, but I could have done with a little more range in the EQ department, particularly for the Treble control. By using only one set of EQ controls, Roland will undoubtedly have managed to reduce their production costs, but the compromise may be a bit uncomfortable if you're unlucky enough to have a couple of keyboards that are ill-matched tonally.

If it were not for its fairly hefty price tag, the Cube 60 could be forgiven its compromises: after all, it's portable, compact, and does what it sets out to do very well. The fact remains, however, that for around the same price, you can buy a British product offering twice the power output and four times the facilities. It's not often that Roland lose out in the value stakes, but the Cube 60, I'm afraid, happens to be one of those rare exceptions.

HH K80 Combo

It must be a difficult choice for a manufacturer to decide how many channels to build into a keyboard amplifier, and of all the companies whose models we've checked out in this round-up, HH are the only people to have decided on three.

This 80-watt combo uses a 15" speaker and a horn to provide a full range of sound, but the facilities provided on the amplifier are surprisingly comprehensive. Each channel has its own Bass, Treble and Volume controls as well as a Reverb on/off switch, which in itself is not earth shattering news, but there's more to come! All the Treble controls incorporate a pull-for-bright facility (great news if you're having to deal with a muddy old electric piano) and each channel has its own private effects loop. And yes, there's even more. The main effects send/return socket is located on the K80's deeply recessed rear panel, and this is connected *via* the auxiliary controls and switches on each of the three channels, so that effects may be used creatively and in combination.

As the reverb can only be either on or off for each channel, a Master Reverb control is located adjacent to the Master Volume knob, beneath which resides the obligatory illuminated HH emblem.

For private practice, a headphone socket has been thoughtfully provided, and an extension speaker may be connected providing that the minimum load impedence of no less than four ohms is observed. Lastly, a line output for DI or slave connection is also fitted, making this combo most suitable for live situations where a sound reinforcement system is used.

Like the Marshall reviewed earlier in this section, the HH's Tone controls are very effective but noticeably noisy if you start adding a lot of treble. The pull-for-bright facility should be a real boon for Fender Rhodes owners, and the flexibility offered by the effects patching system is hard to beat. And as with most HH products, the K80's reverb is good, too.

Being a few inches narrower than the Marshall combo, the HH is fairly easily carried by means of its strap handle, and its smart appearance is typical of other HH products.

Apart from the noise generated at high settings of the EQ and Level controls, the sound quality is really very good – certainly well up to semi-pro standards. As with most combos incorporating good 15" speakers, the HH should be a good bet for use with drum machines or electronic drums as well as synths, pianos and organs.

I know it's a bit predictable, but this is another good British buy. ■

Prices and Addresses

Ohm KA14OC (£365) – *Ohm Industries, Wellington Close, Parkgate, Knutsford, Cheshire WA16 8XL. ☎ (0565) 54641.*

Marshall KC60 (£305) – *Jim Marshall Products, First Avenue, Denbigh Road, Bletchley, Milton Keynes MK1 1JE. ☎ (0908) 75411.*

Carlsbro Keyboard 150 (£385) – *Carlsbro Sales, Lowmoor Road Industrial Estate, Kirkby-in-Ashfield, Notts NG17 7LD. ☎ (0623) 753902.*

Roland Cube 60K (£299) – *Roland UK, Great West Trading Estate, 983 Great West Road, Brentford, Middx TW8 9DN. ☎ 01–568 4578.*

HH K60 (£249) – *HH Electronic, Viking Way, Bar Hill, Cambridge CB3 8EL. ☎ (0954) 81140.*

Elka Project Series X30

Not a square inch of wood veneer in sight, yet all this high technology represents the organ of the eighties. *Gerry Queen*

Elka have a long-standing reputation for producing electronic organs, but it's all too easy to forget that the recent advances in synthesiser technology have their parallel in modern organ design. The X30 is designed to fulfil the requirements of the mobile professional musician and is equipped with a digital rhythm section of outstanding quality and MIDI, but it's somewhat incongruous that it also incorporates the type of auto accom-paniment that usually forms the crutch of the musically inept. It's unlikely this facility will endear the X30 to pro musicians seeking an alternative to the MIDI synth/ drum machine/sequencer system: traditional organ players probably won't mind so much. As it happens, the section even extends to the provision of a sample tune, fully orchestrated and locked within the sequencer memory which, though of little practical use to the prospective X30 owner, will undoubtedly be a boon to those organ salesmen who are less than skilled in the art of musicianship.

Specification

The X30 is a two-manual portable organ with a 13-note bass pedalboard, both keyboards having 49 notes and extending from C to C. Seven flute drawbars are coupled to the upper manual (they include percussion at 4′ and 2′), and the addition of a chorus device makes the generation of convincing string sounds a straightforward matter. As well as flutes and strings, both the upper and lower manuals have preset (polyphonic) and solo (mono) options, there being some 18 preset sounds assignable to the upper and lower manuals.

The lower manual also boasts impressive strings and vocal chorus sections (the chorus sounds as if it's been taken straight off John Foxx's 'Pater Noster'), and sustain and slow attack envelope options are available on both manuals. It's also possible to split the lower manual in order to allow manual bass playing. The instrument features mono and stereo outputs, and the latter give full rein to the electronic rotary speaker simulator, which has wind-up and wind-down times preset to simulate a mechanical Leslie-type speaker.

Rhythms

The X30's 16-pattern rhythm unit offers four variations on each factory-programmed pattern, as well as intros and fill-ins. However, it's possible to program your own from the lower keyboard, and all the voicings are digitally generated, presumably from real samples. In terms of sound quality, these drum sounds are as good as anything available in the 'serious' music marketplace, and I only hope that Elka see the potential of their samples and offer the device as a stand-alone programmable drum machine in the not-too-distant future.

Once you decide on your favourite registrations, 14 of them may be stored for instant recall, which requires only the touch of a button.

Complete accompaniments comprising your own rhythms, chords and bass lines may also be stored in either the real-time rhythm programmer or the step-time chord programmer. Another useful aid to rapid registration changes is the Orchestrator, which allows you to pre-program flutes, strings and solo voices.

MIDI

No tribute to modern musical technology would be complete without MIDI, and the X30 may be configured to operate on as many as four MIDI channels – one for the upper manual, two for the split lower manual and a fourth for the bass pedals. In this way, any of the instrument's existing sounds may be reinforced by connecting another MIDI keyboard or expander as a slave to one or more sections of the X30. However, the X30 has only one MIDI Out (as well as MIDI In and Thru) sockets so the use of something like a Roland MM4 MIDI Thru Box might be necessary if the slave keyboards don't possess MIDI Thru sockets. Conversely, the X30 may be played remotely by between one and four external remote MIDI keyboards, though this particular scenario seems less likely.

MIDI mode is entered and disengaged by simultaneously pressing four specified rhythm keys, and the tempo display then indicates the MIDI channel number.

Sounds

Drum voices apart, nothing particularly exciting here. Most of the sounds are the staple diet of the traditional organist, but they're generally well implemented, and there are some additions that stand out as being exceptional, such as the pan flute and the strings/choir already mentioned.

Conclusions

Although the word organ is not directly mentioned in Elka's publicity, the X30 is most definitely an organ and a rather impressive one at that. Its styling is both modern and functional and, with the lid fitted, the whole outfit is quite portable, though it's no featherweight.

Despite the 'even the family pet can play it' auto-accompaniment section, this really is as professional an instrument as its price tag might indicate, but its appeal will almost certainly be to traditional organ players rather than to pop musicians. The latter will gain satisfaction only from the X30's drum machine and MIDI capability, since in purely sonic terms the instrument is outclassed by most modern (and considerably less costly) polysynths. It's a shame that Elka have assigned so much of the X30's cost to developing the automatic performance features rather than improving the quality of its preset voices, but it's clear that the company are instrumental in keeping the traditional organ on the map, even if they seem somewhat loath to call it by its name.

If you require proof that, despite the odd common feature or two, the organ and synthesiser worlds are still poles apart, then look no further than the X30. ■

RRP of the X30 is £3000 including VAT. Further information from Elka-Orla (UK) Ltd, 3-5 Fourth Avenue, Bluebridge Industrial Estate, Halstead, Essex CO9 2SY. ☎ (0787) 475325.

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Sequential MAX

Preset Polysynth

The MAX is Sequential Circuits' idea of what a MIDI expander should be, but unusually, this one can operate as a preset polysynth in its own right. *Dan Goldstein*

So, you've got yourself a MIDI polysynth, you've written a couple of potential Top Ten hits on it, and now you want to extend its sonic power as easily and as cost-effectively as possible. What you need is a MIDI expander module such as those marketed by Korg, Siel, Roland, and now, with the advent of the MAX, Sequential Circuits.

But hang on a minute. This expander is different. It has its own keyboard so you can use it without any other MIDI instrument, and its factory voices are preset - you can't do any programming of your own. Actually, things aren't quite that simple in reality, but there's no doubt that, concept-wise, the MAX is something of a novelty.

Presentation

For once, a product that doesn't give the game away about its origins before you've even so much as switched it on. With its silver-and-black metal finish, understated black sides and mysterious 'MIDI Voice Expander/Computer Peri-

pheral' front panel legend, the MAX looks nothing like any SCI instrument there's ever been. Obviously, the company are keen to eradicate the traditional, wood-endowed appearance that characterised their produce for so long.

And in fact, the only concrete clue to the MAX's ancestry lies in the layout of its patch selection and multitrack sequencer switches, which bear more than a passing resemblance to those of the SCI SixTrak, a fully programmable model that first hit the UK about a year ago.

As on the SixTrak, MAX's switches don't inspire confidence (their feel is rubbery and their action imprecise), but they do at least incorporate status-indicating LEDs, and their positioning is logical enough to be remembered by the average user within a very short period after coming across the synth for the first time. And one happy result of the MAX being essentially a preset instrument is that the SixTrak's distinctly dodgy value incrementor is thankfully absent from these proceedings.

As if in acknowledgement of the fact that a lot of potential MAX synth buyers will be relatively unfamiliar with the workings of a MIDI polysynth (must be all those other magazines), Sequential have printed what almost amounts to a user guide on the front panel. Not only are all the voice groupings listed along with their respective names, but a full rundown of the numbers needed to access various aspects of the synth's MIDI operation is also given at the extreme right of the panel. So no more searching around for the manual when you want to refresh your memory about how to change MIDI modes, for instance.

Fifteen-love to Sequential on the user information front, then.

Specification

The MAX owes the majority of its internal design to the SixTrak, which isn't, all things considered, all that surprising. What that means in practice is that it's a six-voice polyphonic synthesiser with one VCO-per-voice and a four-pole filter for each of those voices. It also shares the SixTrak's multi-timbrality - that is, each of its six voices can be assigned to individual functions decided by the user, though in the case of the MAX's preset sounds, that decision is taken for you by the SCI programmers. In fact, the MAX's multi-timbrality extends only to the built-in multitrack sequencer and MIDI channel assignment - more on both of these subjects later.

The MAX features the same keyboard as the SixTrak, too, which is something of a disappointment in view of the fact that it's both spongy in its action and ungenerous in its length (four octaves C-to-C). And whereas the costlier poly possessed two (albeit ill-placed) control wheels for pitch and modulation, the MAX has none at all. Presumably, part of the reason for this is that the MAX also lacks the SixTrak's Stack mode (sorry about the involuntary tongue-twister), whereby all six voices (with different sounds, if you so wish) can be assigned to the same note and the keyboard played monophonically for soloing purposes. I don't know about you, but I regard these omissions as more than a mite unfortunate, as they diminish the instrument's versatility by no small degree: if all you want from the MAX is to be able to play it in real time as a conventional polysynth, then fine - but you won't be able to do realistic Keith Emerson solos on this one, that's for sure.

> 'You won't find FM clarity here, but the MAX makes a pretty good stab at the sort of percussive sounds digital synths seem to be so good at reproducing.'

Sounds

All these control omissions pale into insignificance when you remember the greatest limitation of all - the fact that MAX's voices are not user-programmable. Well, that's not quite the whole truth, because if you possess a Commodore 64 home micro and a disk drive, Sequential's

920 software will let you edit MAX's sounds *via* the Commodore's QWERTY keys and some nifty parameter screen displays. In fact, if you're reasonably conversant with the synth's internal workings and MIDI protocol, you can edit sounds *without* the help of the software - all you need is for the Commodore to be linked to the MAX *via* MIDI, since it's over the communications bus we all know and love that the parameter data is transmitted and received. The MAX's MIDI manual is about three times the size of the normal operation one, and for good reason: it tells you exactly how the synth's patch information is digitally coded.

Alternatively, if you already own a SixTrak, you can edit MAX sounds remotely from its controls, again over MIDI.

Like the SixTrak, the MAX has 80 factory presets in all, but those who fear these are the same as the voices fitted to the programmable model when it first came out needn't worry: the MAX's programs are entirely new, and so pleased are Sequential with their programmers' endeavours, they've fitted the most recent generation of SixTraks with the same set of voices.

Even if it wasn't readily apparent at the time, it's now pretty clear that the range of preset sounds fitted to the SixTrak when it first appeared did scant justice to the capabilities of the synth's internal voicing and filtering circuitry.

The MAX voices will put an end to all that. Logically grouped in tens depending on which sonic family they happen to belong to (and with a set of consecutive voice numbers to match), the sounds are generally full, pleasing and effective. Only rarely are more than a couple of tones within one family strongly reminiscent of each other, and although you won't find FM clarity here, the MAX makes a pretty good stab at the sort of percussive sounds digital synths seem to be so good at reproducing.

As it happens, those percussion voices are more useful than they might at first appear. Using the MAX's bass and snare drum sounds and something appropriate from the pitched bass range, you can coax the six-channel sequencer into behaving pretty much like a programmable rhythm section - and still have three of MAX's timbres to experiment with on the keyboard. Note entry into the sequencer is still only in real time, of course, so you've got to have a reasonable sense of rhythm, but seeing as the MAX is intended to appeal primarily to first-time polysynth buyers, it makes sense to offer

those buyers a rhythm programming facility they can use without having to gain access to dedicated percussion and sequencing devices.

One problem surrounding the sequencer is that, unlike the one in the SixTrak, it doesn't incorporate any battery-backed RAM to hold your sequences in memory when the synth has been powered down for the night. Instead, Sequential have seen fit to store two demo pieces in a non-erasable ROM, which means they're in there forever, regardless of whether or not they're to your musical taste. They may help shift synthesisers from dealers' shelves, but their inclusion won't please musicians of a reasonably creative bent who would rather have seen MAX's chip money spent in a less narrow-minded fashion.

Interconnections

The back panel of a synth is rarely the scene of much surprise or technological debate these days, but in the case of the MAX, there's a lot that catches the attention, for both good and bad reasons.

First, the power. In what I can only term a bizarre move, SCI have blessed their new baby with a power requirement of 8V AC, which isn't exactly the most common operating voltage in the universe. Of course, if you buy a MAX in the UK you get a suitable 220V-to-8V transformer so that you can plug the machine in and play it as soon as you get it home, but what happens if it subsequently breaks down or goes astray? I hope Sequential are going to keep a good supply (pun intended) of spares.

You want some better news? Well, how about the fact that the main/headphone output is stereo and that two additional outputs (marked A and B - both phonos) enable you to connect MAX to, say, a domestic hi-fi system without so much as an interconnection hiccup?

The rest of the back panel news is concerned more with what *isn't* there than with what is. It seems SCI haven't paid much attention to the critics who pointed out the SixTrak's dearth of decent interfacing facilities, because what the earlier synth lacked, MAX lacks too. That means no separate outputs for each of the synth's six voices (it would have been a real boon for recording fans), no tape connectors for storing voices and sequences on cassette, no MIDI Thru socket (from the people who invented the system in the first place), and no sync socket other than that inherent within the MIDI connectors: the only drum machines that will sync to the MAX are those that recognise (and are friendly towards) the MIDI clock.

> 'Unlike the sequencer in the SixTrak, this one doesn't incorporate any battery-powered RAM to hold your sequences when the synth is powered down for the night.'

Conclusions

You'll probably have noticed that throughout this review, I've placed almost as much importance on what Sequential's designers *haven't* seen fit to endow the MAX with as what they have. In reality, if you take the trouble to listen carefully to its full range of preset sounds and compare its implementation of MIDI with that of similar designs, you can't help but admire the way the MAX's design people have gone about doing their job.

What makes things a little more difficult is MAX's recommended retail price - an unexpectedly high £725. I say 'unexpectedly' simply because that does seem like an awful lot of money to pay for a preset synthesiser these days: there are a great many programmables around for a good bit less.

Personally, I can't help thinking Sequential would have been better off omitting the MAX's keyboard (thereby cutting component and production costs) and fitting the patch change software onboard, in much the same way as the manufacturers mentioned at the start have gone about their MIDI expander business.

The MAX's synergistic relationship with the SixTrak is not in itself surprising, but what isn't immediately obvious is just how far that relationship goes: many of MAX's sounds are designed to be doubled up by the corresponding preset on the SixTrak, while the prospect of 12-channel, multi-timbral synchronised sequencing (SixTrak as master, MAX as slave) in this price range is mouth-watering. So why didn't SCI pitch the MAX more towards existing SixTrak (and other MIDI polysynth) owners instead of going for the synth newcomer who just wants a library of sounds and a multitrack sequencer to play them on?

Time and the sales figures may prove me wrong, but I don't feel the above category of musicians is a particularly large one - at least, not any more. ■

Further information: Sequential (Europe), PO Box 16, 3640 AA Mijdrecht, The Netherlands.

TED Digisound Revisited

Dynamics and some new voices have been added to this Dutch-built range of sampled-sound percussion machines. How do they rate now?

Paul White

When I first looked at these units back in July 84, I felt they offered a fair degree of flexibility and sound quality for an admittedly modest asking price. Now they've been given some new features and have also undergone a change in UK distribution, which might help spread the Digisound word to a wider range of musicians.

Each TED module has a small, square, solidly-built metal case of unexceptional charm, but lurking within is a digitally-recorded drum sound whose triggering can be invoked in one of two ways: by sending a suitable trigger pulse to the unit or by pressing the Play button on the machine's upper surface.

So far, then, we have something that's not all that dissimilar from E&MM's own Syndrom project, the difference being that you don't have to do any of the construction yourself. Mind you, the Digisound costs a fair bit more than the aforementioned kit, so you'd expect to find everything nicely put together when you get a TED module out of its box.

There is no built-in power supply. Instead, an external unit capable of driving several Digisound modules can be connected up, thereby avoiding unnecessary component duplication. DIN cables are used to link things up power-wise, but all inputs and outputs are on standard jack sockets. There are three rotary controls on the upper surface that govern pitch, trigger sensitivity and output level, and these are all pretty self-explanatory, really.

So What's New?

As it turns out, TEDs are still flat, square and black, but now they have dynamics as well. Pressing the Dynamic Control button ensures that the module in question will respond to the amplitude of the incoming external trigger signal. This adds a useful degree of user programmable expression to the machine's output, and as a visual guide to just how high that incoming amplitude is, TED have fitted an LED to the Dynamic Control switch that glows with varying brightness in accordance with the dynamics.

It's worth noting, incidentally, that the Digisound's Manual Play button is inoperative when the dynamics are in use. This is no great loss, as hitting said button with varying degrees of brute force could result in its untimely demise at the hands of the ham-fisted – E&MM's Ad Department, for example.

TED do in fact produce contact mics that enable modules to be triggered simply by playing the ironing board or the

cat (these are just examples, you understand), but for the purposes of this review, I connected a few modules to an Ultimate Percussion electronic drum kit to see how they would respond. One of the modules so connected was a dual-voice model with both snare and bass drum sounds burned into its EPROM, though sounding both together proved impossible. The other voices under scrutiny were ride and crash cymbals, and in the event, all four sounds were excellent, the only slight disappointment being that

> 'TED now have a library of available sounds that includes such weird and wonderful voices as timbales, cowbells and gongs, in addition to a full range of conventional kit sounds.'

the crash sample was a little on the short side.

To be quite honest, I'm not entirely convinced of the virtues of sampled cymbal sounds. The reason? Well, every time a cymbal is struck, it produces a slightly different sound depending on where the stick hits it, how hard it is hit, and whether or not it was already vibrating before it was hit. It's these often subtle effects that give our ears clues to a sound's authenticity – and seeing as a digital sample can't possibly incorporate all of them, we soon know that what we're listening to isn't the real McCoy.

Obviously this goes for all cymbal samples, not just the TED ones, but it's a point well worth bearing in mind, nonetheless.

Conclusions

If you already have an electronic drum kit of some description, TED's Digisound modules are now an excellent source of effective alternative drum sounds. The fact that you only have to buy individual sounds as and when you need them is still a very real advantage, and as if in anticipation of the growing trend towards percussion exotica in modern music, TED now have a library of available sounds that includes such weird and wonderful voices as timbales, cowbells and gongs, in addition to a full range of conventional kit sounds and the odd Simmons drum sample.

If you're not a drummer but someone who nonetheless likes to have a hand in putting together percussion tracks, you can use a couple of Digisound modules to give your drum machine a sonic facelift – albeit without the luxury and versatility of dynamics – by connecting them to some appropriate trigger outputs. So if the bass drum on your analogue rhythm programmer sounds like a suitcase being slapped with a piece of partially thawed fish, a Digisound module could be the answer.

Mind you, I'm not altogether sure about the combined bass and snare module: surely, if you want to use both sounds, you're going to want them triggered on the same beat at some stage during their working life?

Finally, if you take the opportunity to purchase a few of the reasonably priced contact mics, you could even construct your own digital electronic drum kit in true *Blue Peter* fashion, using kitchen utensils and sundry other household items.

Just a thought. ■

Single-sound Digisound modules carry an RRP of £115, while dual-sound variants come in at £149, both prices including VAT. Further information from TED's UK distributors, Capelle Music Industries, 333a London Road, Hadleigh, Essex. ☎ (0702) 559383.

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Siel MK900

Personal Keyboard

Of all the domestic keyboards whose MIDI facilities allow them to be linked to other instruments and home computers, Siel's 900 is one of the cheapest. *Trish McGrath*

Following their success in the pro keyboard arena, Siel have turned their attention back to developing a competitive range of home keyboards, and examples of the first, the MK900, are at present filtering into Britain. As well as their range of organs and pro keyboards, Siel also market a MIDI computer interface and a wide range of accompanying software, so it came as no surprise to find that MIDI sockets are there in all their glory on the MK: there's no doubt this interface capability will be a bonus to home computer owners, many of whom, I suspect, will by now have explored their micro's internal sound chip to the full.

Housed in a robust, dark grey plastic case, the MK900 is decorated in Siel's traditional blue and white livery, while the selection buttons are moulded from a peculiar textured plastic, though the horror of these is quickly forgotten once the instrument is in use, because against all expectations, they actually work rather well. Dimensional statistics are 36" × 13" × 4", with a weight of over 15lbs. It's still highly portable, however.

Built-in stereo speakers provide a surprising 6.5W each (enough to drown out the mother-in-law at family get-togethers), and function-wise, the instrument is divided into five main sections, *viz* Sequencer, Rhythms, Accompaniment, Presets and Special Functions.

Presets

The MK900 can produce a different sound at each side of a split point, and this can be programmed to divide the keyboard into 16+45 keys, 24+37 keys, or 32+29 keys. Alternatively, with Program Split switched out, two preset sounds can be layered over the full keyboard range or, for the single-minded, just the one sound can be employed.

And so to the collection of ten preset sounds. Siel have opted for the usual space- and cost-saving policy of providing five pushbuttons with a Select pad to choose between the top and bottom rows. **Jazz Organ** is bright and cheerful from the mid to top octaves but strangely unmusical in the bass end, while **Pipe Organ** manages to retain its timbre nicely over the full range. **Piano** is perhaps the wisest choice for accompaniment chords and, although it's a bit growly and fuzzy in the lowest octave, it's a reasonable approximation of an acoustic piano. **Harpsichord** tries hard but doesn't really come close to capturing the delicacy of a whole keyboard's worth of Tudor mechanics, while **Strings**, though nothing special, are nonetheless usable and much improved by the application of some Stereo Chorus (see later). **Accordion** has an identity crisis or, at least, none of the characteristic sound imparted by the movement of bellows: a slower attack wouldn't go amiss, either. One of my favourites is **Trombone** – above its traditional acoustic range it offers an uncomplicated synth brass sound, while **Clarinet** produces a pretty reasonable hollow wind sound within the frequency range of the original instrument. Most home keyboards boast fairly realistic **Vibes**, but the Siel's version comes closer to a hollow Fender Rhodes impersonation than anything else, and perhaps the less said about **Synth** the better: if you're familiar with good synth sounds, this is not one of them.

Rhythms

Again, a Select button toggles between two ranges of five switches, and the patterns available are Waltz, Swing, 8 Beats, Country, Bossa, Samba, Rock, Disco, Ballad, and Slow Rock. An individual level control is provided for the section and the adjacent Tempo slider controls the speed not only of the rhythms but also of the Accompaniment section. The usual Start, Stop and Synchro Start facilities are available, as well as an Intro/Break that can be applied at will to any rhythm.

The Manual Drums feature lets you play your own drum pattern from the keyboard: the top five notes of the keyboard are adapted to work as Bass Drum, Snare, Cymbal, Tom and Cancel buttons. The drum voices are placed logically within the stereo image, and the Sequencer action allows any one of your patterns to be stored as a 'Custom Rhythm' for retrieval at any time. In addition, Manual Drums can be introduced to add variation to a preset pattern – though it's all too easy to overlook the fact that you've switched the facility in and finish your blinding solo in a cacophony of electronic percussion.

Accompaniment

When the 900's keyboard is in split mode, the Accompaniment section allows

the addition of auto-bass, arpeggio, and easy-finger chords. (For the uneducated, this is what makes the Siel a domestic instrument as opposed to a pro one.)

Chords may be executed in either one of three modes. **One-Finger-Chords** enables major chords to sound merely by the user pressing the tonic note, minor chords by pressing the tonic and a higher note, and a seventh by keying the tonic and two higher notes. (Higher in this instance means notes above the tonic but still left of the split point.) To be honest, this system provides a simpler way of obtaining chords than the usual method of tonic for major, tonic and semitone below for minor, as accuracy is not crucial and chords are more easily identified if the tonic remains the lowest note played.

Help is not a screen display telling you what to do if the answer isn't in E&MM, but it does enable you to play the most common chords using, again, the tonic and a specific interval. And just in case you want to play chords in the traditional manner, there's a **Free** button that allows you to do just that.

Memory freezes the chord selected while **Rhythmic** modulates the notes to the left of the split point in time to the rhythm pattern in play. Automatic **Bass** can be added at this point, and all that's needed once you've organised all this is the melody line. Unless, of course, you want to add an automatic arpeggio of the chord composed . . . The Bass drone can also be introduced left of the split point (with 'Rhythmic' off), in which case it applies itself to the lowest note played.

Finally, **Left to Mono** introduces the preset sound selected to the left of the split point to a monophonic melody line (or at least the top note keyed in the right-hand section) and this goes no small way towards beefing up the sound.

Other Special Functions include a **Counter Melody** of one or three voices (it takes its information from the chord selected left of the split point – use with care); **Sustain** which alters the release time to a non-variable length and reduces a run of notes to something of an aural blur; **Detune**, which generates a slight detune between left-and right-hand voices so as to create a worthwhile ensemble effect; and **Stereo Chorus**, which is really quite wonderful and forms a welcome enhancement for most of the preset sounds. Finally, **Transpose** allows the keyboard's tuning to be transposed *(well, what did you expect – **Ed**)* by up to 12 semitones.

One criticism I'd make of the whole accompaniment section relates to the volume of the accompanying chords. Although individual level sliders are provided for the Rhythm Section, Bass, Arpeggio and, of course, the keyboard as a whole, it's left to the Balance slider to regulate the relative volumes of the left-hand and right-hand portions of the keyboard (ie. between the chords and the melody). Sadly, on the review model the volume of the Left voices didn't vary at all, even when the slider was placed fully to the right, though everything went fine the other way around. What this means is that to mix the chords satisfactorily, the Rhythm and Bass sliders need maximum volume – which tends to drown out the melody . . . Shame.

Sequencer

No home keyboard would be complete these days without some way of memorising an accompaniment or arrangement, and Siel have provided a Sequencer section to do just that. The sequencer can record in any one of three modes: **Chords** (it can memorise up to 50 of them, though one proviso is that they must be recorded in One Finger Chord mode, so only major, minor and seventh chords can be considered)), **Solo** (up to 280 notes of melody or bass line), and **Custom Rhythm** (which can store your own rhythm pattern and loop it continuously).

Selecting a preset rhythm with a similar time signature (effectively a choice of either 2/4, 3/4, 4/4 or 12/8) sets that of the metronome, and pressing Start sets both the metronome and the recording in motion. The drum pattern can be built up in stages or in one take, and pressing Start (which doubles as Stop, incidentally), commits the pattern to memory as Custom Rhythm for recall at any time. Recording can be stopped by the Intro/Break button (instead of Start/Stop) in which case the sequence will loop indefinitely.

Connections

Apart from the aforementioned MIDI In and Out (there's no Thru), the usual array of sockets are provided on the rear panel – stereo phones, stereo phono outputs, volume pedal, 12V DC and the Power on/off switch.

With Program Split off, the MK900 receives and transmits on MIDI Channel 0 (Channel 1 if the manufacturer counts in the more usual 1–16 manner – why can't everybody agree on this?), and the resident DX7 chatted away nicely to it. With the Siel split into two sections, notes played to the left of the split point communicate on Channel 0, while those to the right send and receive on Channel 1 (in reality, Channel 2). These Channel numbers are unfortunately not variable, but chords composed with the aid of the One-Finger-Chord or Help options, as well as Counter Melodies, can be transmitted *via* MIDI to the slave keyboard.

Conclusions

To be honest, I think Siel are playing a bit safe with the MK900. Its features aren't particularly inspiring, while the quality of the preset sounds and percussion voices is no more than average. I find it hard to believe that all the possible advancements in personal keyboard design have been explored – so why haven't Siel explored a couple, as opposed to accepting the common denominator imposed by the other major manufacturers? The inclusion of MIDI is highly laudable, but I doubt if the MK900 will be used as either a master (it's not touch-sensitive and its MIDI channel assignment is not user-variable), or as a slave keyboard or expander unit (simply because the preset sounds don't make the grade).

I'd *like* to say that the MK900 is a truly great machine, as well as not mention the Demo Song of 'When the Saints Go Marching In' – but I can't. Gain solace, nonetheless, in the fact that this is Siel's first attempt at a home MIDI keyboard, and as such is not a complete disaster. The company have at least earned themselves another stab at what should prove a highly profitable market. ■

RRP of the MK900 is £449 including VAT. Further information from Siel UK, Ahed Depot, Reigate Road, Hookwood, Horley, Surrey RH6 0AY. ☎ (02934) 76153.

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OP/12/84

1984 Retrospect

As the year of Orwell's nightmare comes to a close, we look back at the products and events that made headlines during music technology's most hectic twelve months ever.

Yamaha's CX5M. More software to come.

Nineteen Eighty-Four was supposed to be the year of Newspeak and Big Brother, part of a time when the march towards making the human race a more cohesive whole had almost completely eradicated the human being as an individual. Instead, it turned out to be the year when the world's electronic musical instrument manufacturers finally made strides towards standardising certain aspects of their designs, so that an instrument from one part of the world could be used successfully with another from somewhere thousands of miles away.

So in a sense, the hi-tech music scene became a more cohesive whole itself, a process that was accelerated by a growing rift between the hi-tech field and the rest of the musical instrument fraternity. Manufacturers, distributors and retailers alike began to realise that electronic and computer-based instruments required a degree of specialisation that would inevitably divorce them from the traditional 'group gear' arena. E&MM helped this transformation come about by launching a sister magazine, *Guitarist*, so that guitar players could read a magazine whose editorial was written entirely for them, not for drummers, keyboard players, singers and computer buffs as well.

Thomas Dolby. Making computers make sense.

Frankfurt Fiesta

Things started quietly, of course, as musical instrument years always do. The annual pre-Frankfurt lull (during which manufacturers hedge their bets about new products, pending Europe's premier trade fair at the beginning of February) proved more devastating in its bleakness than for some while, but it was for good reason. When Frankfurt eventually came, it was the scene of more hi-tech music debuts than any previous exhibition. Journalists and public were agog with the glut of new design talent on display, and inevitably, some of the smaller exhibits didn't get anything like the coverage they deserved.

Yamaha were clever. They'd already stood the synthesiser world on its head the previous summer when the DX series FM polysynths were foisted upon an unsuspecting music-playing public, and in January 84 they flew a select party of pressmen to their Euro HQ in Hamburg, where the true extent of the company's technological leap forward was revealed.

There was a rack containing the guts of eight DX7s known as the T8PR (this has now become the TX816, and still hasn't reached full production), a MIDI keyboard recorder called QX1, Yamaha's first dedicated drum machines (the RX digitals) and most surprising of all, a music computer by the name of CX5, a machine identical to the new generation of MSX home micros but with a DX9 FM sound chip stuck inside.

With a line-up as impressive as that, ▷

Yamaha were still the centre of attraction at Frankfurt even though they had unveiled all their goodies in advance.

None of the remaining Japanese giants could hope to match Yamaha's endeavours, let alone exceed them. They were far from silent, however. Roland made great play of their GR700 MIDI guitar synth (it looked like bridging the gap between synths and guitars for the first time), while Korg managed to fill an enormous stand full of Poly 800s – the synth had been released a month beforehand.

What was more than a little aggravating – though not in the least surprising – was the length of time it took so many of the new products to reach full production once the show was over. Crumar's Bit One has only just come onto the UK market under the auspices of Chase Musicians, but there was a prototype ready and working (and getting a lot of attention) at Frankfurt, where it was accompanied by a whole host of other slow-to-arrive goodies.

These included Akai's Micro Studio System, Roland's mother MIDI keyboards and their associated voice modules (high price, low spec), the Oberheim Xpander (high price, high spec), a polysynth from organ people Solton called the Project 100 (it still hasn't been seen on these shores, though you can buy it in Europe), Dynacord's complete electronic percussion system, and AHB's bold move into the same market – the Inpulse One.

Simmons, the people who started making electronic drums in the first place, had two new kits in the shape of the SDS7 and SDS8, for rich and poor drummers respectively. Meanwhile, ddrums' novel percussion modules were much in evidence on the E-mu Systems stand, and E-mu themselves were showing the prototype Emulator II, another instrument that took its time getting into series production (though when it did, it was certainly worth the wait). PPG were also showing an update to their computer instrument range in the shape of the Wave 2.3 synth, and further modifications to the Waveterm, Processor Keyboard, and Expansion Voice Unit have since made the company's system rather an attractive proposition. Things weren't going quite so well for Kurzweil and McLeyvier. The former wasn't at Frankfurt at all (though the machine did materialise six months later) pending some more development work, while the latter hasn't been seen since. Shame.

Finally, Sequential Circuits, who at one time produced both the most popular polyphonic (Prophet 5) and monophonic (Pro One) synthesisers, unveiled their Traks Music System. This centred around a MIDI polysynth by the name of SixTrak, which was capable of transmitting each of its six voices along a different MIDI channel and could therefore confidently claim to be the world's cheapest multitimbral synth, and the Drumtraks, a programmable digital rhythm machine complete with its own MIDI sockets and tunable drum samples: the tuning could be stored in memory, too, so the machine was a pretty hot property when it came to Britain in March.

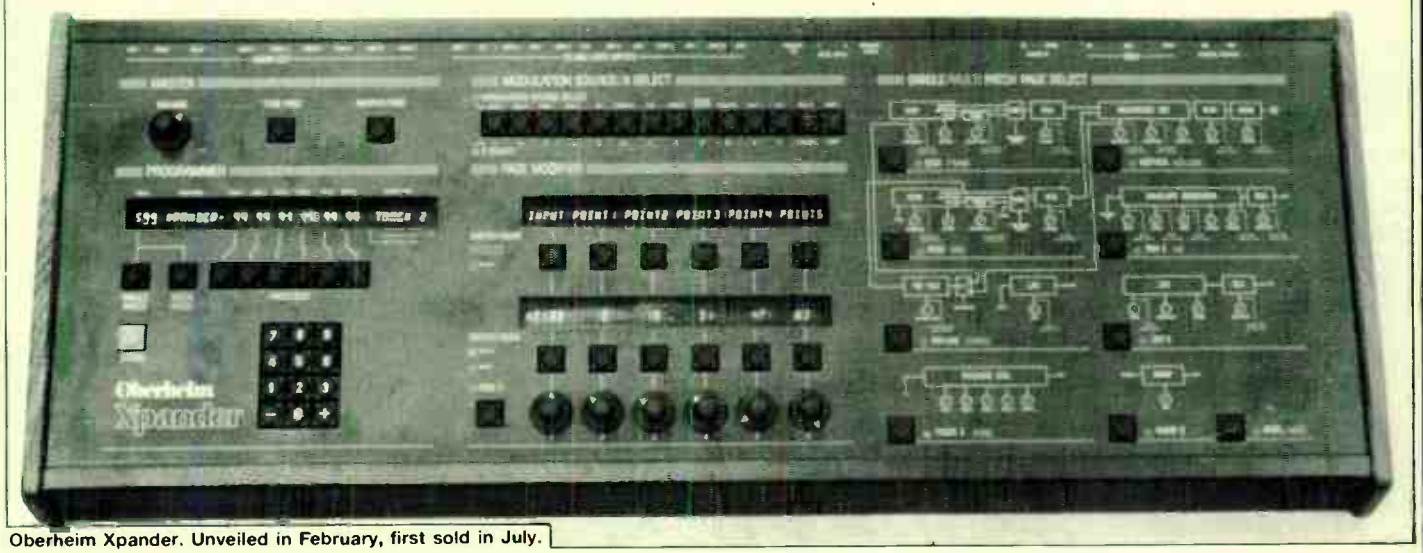
Vinyl Virtues

As it happens, the month of March was notable more for the quality of its electronic music records than the musical hardware that arrived.

Thomas Dolby showed that dabbling for a year or two with Fairlights and Emulators could result in music that was accessible as well as innovative, though some critics alleged that his album, *The Flat Earth*, wasn't as interesting musically as its predecessor, *The Golden Age of Wireless*. That didn't prevent Dolby scoring notable hits both with the LP and its first 45rpm excerpt – 'Hyperactive!' – and his live performances later in the year were some of the most exciting displays of techno-fun we've ever seen.

Another hi-tech luminary, New York's Laurie Anderson, released her second album the same month. Like its predecessor *Big Science* (from which the unexpected hit 'O Superman' was taken), *Mister Heartbreak* represented only a small, musical part of a much larger work of performance art. While Dolby's major instrument was the Fairlight, Ms Anderson focused her attention on the Synclavier, producing some fascinating sampled and synthesised sound colours and weaving them into a convincing overall musical picture. Bill Laswell, Phoebe Snow and Peter Gabriel were among the many collaborators who helped in the album's

Guitar synths agogo. SynthAxe and Roland GR700 system



Oberheim Xpander. Unveiled in February, first sold in July.

creation, Gabriel co-writing and co-producing the record's most stunning track, 'Excellent Birds'.

The world of commercial pop had witnessed the arrival of solo synth player and singer Howard Jones some six months before, and his first album, *Human's Lib*, fulfilled the promises made by his earlier singles. Cleverly and inventively produced by Rupert Hine, Jones' album had more than a fair share of good pop songs on which Hine's electronic arrangements could be based.

Two other electronic acts – The Assembly and Blancmange – were on the cover of E&MM March, and although the fruits of Vince Clarke's and Eric Radcliffe's Fairlight-based project have yet to see the light of day, Messrs Arthur and Luscombe succeeded in creating a wonderful collection of electropop miscellany in the form of *Mange Tout*, released in June. The album was thoughtfully arranged and competently produced, but what continued to set the duo apart was their unfailing sense of humour. More than any other electronics-based act, Blancmange sounded as if they were *enjoying* making music in 1984.

MIDI Madness

In May and June, E&MM put the emphasis firmly on MIDI, the digital interface standard that had by this time (*everything* at Frankfurt had it) been accepted by the entire electronic musical instrument industry. The system got off to a shaky start: most of the synths that came equipped with the interface shortly after its introduction in May 83 (SCI Prophet 600, Roland JX3P, Yamaha DX7) had incomplete or inconsistent software, and things weren't stabilised until the implementation of the MIDI 1.0 Specification the following March.

The first part of our two-month supplement listed that spec in full, as well as mapping out a few of the *known* incompatibilities between different generations of MIDI gear, and chatting to Culture Club producer Steve Levine on the implications the new standard could have in the world of professional recording.

Part Two looked at the technical aspects of the system, and CM editor David Ellis went through the various hardware and software packages that were available to link MIDI instruments to popular home computers, though the list has probably doubled since then. In the event, the second supplement was to some extent overshadowed by the arrival (well, sort of) not only of Roland's MIDI guitar synth but also of the SynthAxe, a British-built design with a more forward-looking approach to pitch and string control that had already received praise (and financial backing) from Fairlight in Australia. The SynthAxe was certainly a striking piece of machinery (it made use of Habitat cybernetic *haute couture* as opposed to Roland's Dalek hand-luggage chic), but in June was set to cost roughly six times as much as its Japanese counterpart: and that was without any voice-generating hardware.

Software Surplus

August's British Music Fair (with any luck, the last such event to be open only to trade visitors and spread across seven London hotels) saw if anything a shift in emphasis away from hardware and towards computer software. Aside from the odd exciting device such as Korg's ▷

Emulator II. Born to bring samples under musicians' control.

neat little digital drum machines, Tama's first excursion into the world of electronic drums, and sundry other items that had already been seen elsewhere, the main attractions were software packages from the likes of Siel, Jellinghaus, EMR and LEMI.

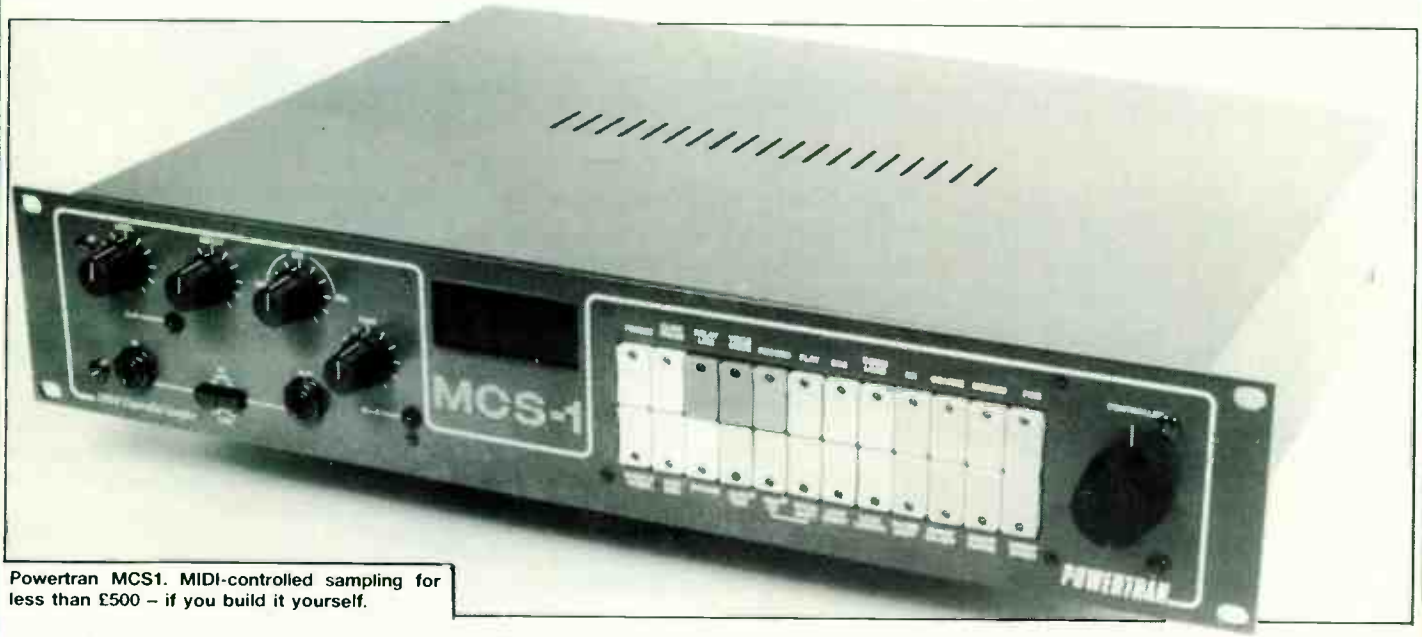
Two things were obvious from the many synth-plus-micro-plus-monitor demonstrations: that MIDI seemed to be the logical choice for anyone wishing to make the link between a micro's computing power and a keyboard's musical capabilities, and that of all the home micros currently on sale in the UK, four in particular (Spectrum, Commodore 64, BBC B and Apple) had been singled out as those most worthy – for whatever reason – of the software writers' attentions.

The only other notable trend evident at the BMF was the fitting of MIDI – and other 'professional' features – to keyboards that were primarily domestic in their intended markets. Hence the arrival of instruments such as the Casio CT6000, Yamaha's PS6100 and the Siel MK900 reviewed elsewhere this issue. The idea, of course, was that domestic players blessed with some sort of home micro could get into the world of computer music in as painless a way as possible.

International Inspiration

As summer turned into autumn, the city of Sheffield was threatened by an onslaught of hardcore electronic music fans seeking enlightenment at the 1984 version of UK Electronica, the country's foremost synth music festival. Actually, the 'UK' bit of the title was even less appropriate than it was last year: performers – as well as punters – came from as far afield as France, Spain and the USA. Former Tangerine Dreamer Steve Jolliffe (who'd appeared on E&MM's cover back in July) gave perhaps the most stirring performance of the all-day extravaganza, and event organisers INKEY$ should be able to look forward to an even more successful Electronica in 1985.

One of the year's better-conceived albums also made its appearance around this time. David Sylvian's *Brilliant Trees*, seven songs of great beauty and colour but misleading simplicity from the former Japan frontman, didn't exactly set the national charts alight, but the critics – E&MM included – recognised the deftness of its construction and the significance of its musical achievement. Sylvian drew on a wide variety of sources for inspiration, in terms of both cultural influence and musical collaboration: of the various composers and musicians that made an appearance on *Brilliant Trees*, most were already noted for the catholicity of their recorded output.



Powertran MCS1. MIDI-controlled sampling for less than £500 – if you build it yourself.

British Brains

Nineteen Eighty-Four drew to a close with the arrival of several new musical products that served to highlight this country's growing stature in the field of sound-generating technology. E&MM had already devoted five articles to Clef Products' Programmable Digital Sound Generator add-on for the BBC Micro, and in December we reviewed a similar system, Acorn's Music 500 synthesiser. The 500's unique music production language – AMPLE – looked like it could be a major step forward in improving the ease with which musicians could communicate their wishes to micros: let's hope other designers take the hint.

Powertran's MCS1 MIDI Controlled Sampler could also justifiably claim to be something of a revolutionary device. It offered all the standard DDL effects as well as allowing the user to store any sound and control its pitch from a MIDI keyboard, and we make no apologies for devoting so much editorial space to the machine's design and construction during 1984's closing months.

Another sampling system, Mainframe's Greengate DS3, proved what could be done for a relatively modest financial outlay (£200 if you've already got a suitable keyboard and the requisite Apple IIe micro), though the review we gave it in E&MM October was to some extent overshadowed by a similar appraisal of something Oriental – the Yamaha CX5M computer already mentioned. Still. Mainframe themselves succeeded in making a marvellous (both sonically and creatively) 12" EP, *Into Trouble with the Noise of Art*, that made much merriment at the expense of 1984's most successful computer musicians, Trevor Horn and his ever-innovative ZTT engineers.

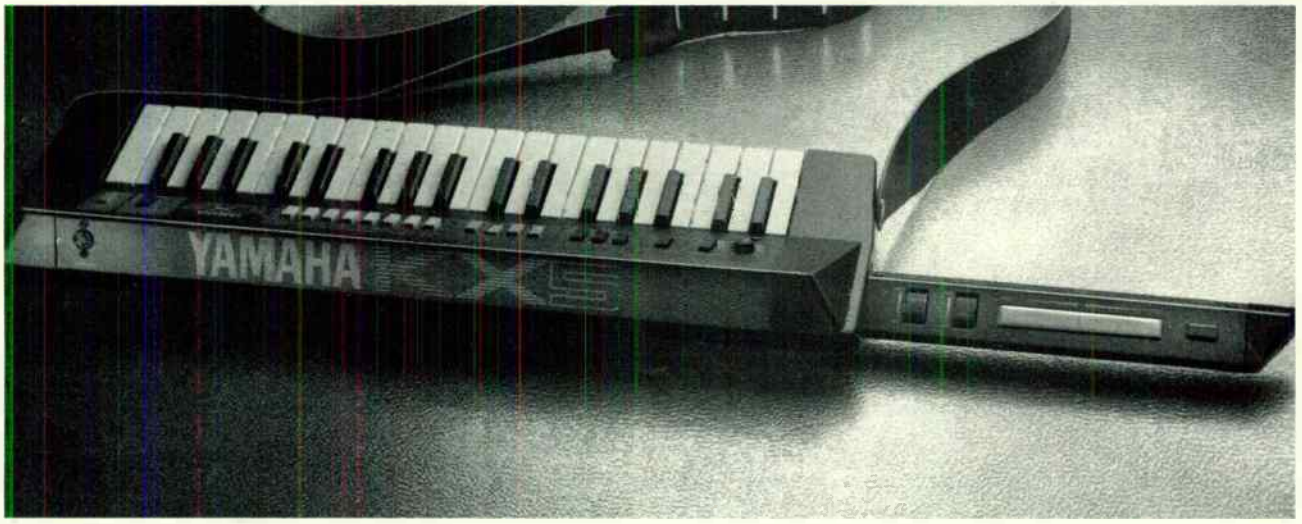
Future Fantasies

So much, then, for Orwell's nightmare. What will 1985 have in store? Well, it seems likely that this year's Frankfurt show might not be quite the technological feast it was in '84, but expect big things, nonetheless from the Japanese giants, several of whom – Akai, Technics, and in a sense, Casio – are new to the pro music arena, and therefore keen to make their intentions clear.

MIDI isn't going to get any faster or more versatile, but since it's unlikely to be replaced by anything substantially better within the next 12 months, the programmers are going to have to work hard to develop software that really gets the best out of the system as it stands now. And at the time of writing, it seems they're ready to do just that.

Music technology's other current pet subject, sound-sampling, has already received a shot in the arm courtesy of the DS3, MCS1 and Emulator II, but there's every indication that 1985 could see the technique's financial accessibility increase even more dramatically. No prizes for guessing it's the Japanese who are poised to take the sampling bull by the horns and make it something everyone can afford to do in the comfort of their own living room.

As for music, that's rather less easy to predict, but judging from what we heard emanating from their studio in Bath at the tail-end of 1984, the new Tears For Fears album should be one to watch. ■



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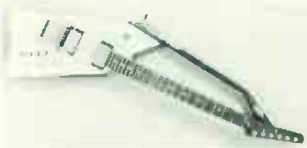

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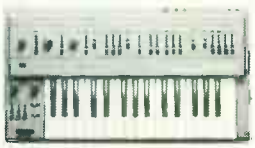

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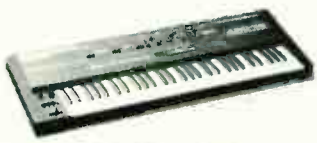

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The CX5M also has a Yamaha 8-data FM voice generator built-in — the same type of voice generator that has put our DX series Digital Programmable Algorithm Synthesizers at the forefront of the digital keyboard field. That means it is capable of producing rich, realistic sounds that are almost indistinguishable from acoustic instruments. In fact, 46 fine voices are provided pre-programmed. But you can also program your own to create virtually any voice you like. And you can save your original voices on a standard cassette tape.

A wide range of applications programs, interface units and accessories expand the music making potential enormously. **Supplemental Music Software YRM101 FM Music Composer:**

The musician program cartridge is a blast for all composers and arrangers. It is simply the most sophisticated, versatile, easy-to-use music composition and arrangement package in its class. You get an on-screen music staff onto which you 'write' notes by inputting them either from the computer keyboard or directly from the music keyboard. The ability to input notes from a piano-type keyboard is a real bonus for musicians. Up to eight parts can be entered, and each part can be assigned a different 'instrument'. You can use the superb pre-programmed FM voices in the CX5M, or voices you have programmed yourself. You also have full control over tone separation, key signature, tempo, dynamics and phrasing. What's more, any parameter can be changed at any time during the piece. Of course, your compositions can be saved on a standard cassette recorder and recalled whenever needed.

Furthermore, compositions written on the FM Music Composer can be edited in sequence MIDI synthesizers, drum machines, etc via the CX5M's MIDI interface. The possibilities of this software package are virtually endless.

YRM102 FM Voicing Program

This program gives you precise control over the CX5M digital FM voice generator to edit and alter the pre-programmed voices or create totally new voices of your own. The FM voice generator employs 4 operators, each with a sophisticated envelope generator, and a choice of 8 algorithms (different configurations of operators with different modulator-to-carrier relationships). The YRM102 FM Voice Program lets you precisely set all parameters relating to the operators and algorithms, as well as settings like amplitude and pitch modulation, LFO waveform, keyboard scaling, transpose etc. With a little practice you should be easily able to program just about any voice you can imagine. Save your original voices on any standard cassette recorder, and build up an original voice library. Voices you create can be used in arrangements created with the FM Music Composer program.

YRM103 DX7 Voicing Program

DX7 owner's, here is the key to easy DX7 voice programming. This program 6-layers all DX7 voice parameters right on the video monitor, and lets you program from the CX5M computer keyboard. The data is transferred to the DX7 via the built-in MIDI interface. Voice parameters are displayed in easy-to-understand graph form. For example, when programming envelope generator parameters you can actually see what the programmed envelope curve looks like, rather than having to think entirely in terms of numbers. The DX7 voicing program makes programming the DX7 so easy, that even if you're not a programmer, the CX5M's other capabilities are worth having one just to program your DX.

YRM104 Music Macro

The Music Macro is for people who want to incorporate top-quality musical voices into their BASIC computer programs. The Music Macro adds a special set of commands to the CX5M MSX BASIC language permitting control of the digital FM voice generator from written BASIC programs. This makes it possible to program games or audio-visual type programs incorporating music or sound effects using FM voices for real quality and impact.

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System includes CX5 MSX computer, YK01 Mini keyboard, YRM12 FM voicing software and FM cartridge hardware!

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A BUNCH OF FIVES

E&MM's main contributors list 1984's most noteworthy happenings in groups of five for convenient, easy reference. If you don't find them bigoted, opinionated, and grossly unfair, you're obviously not easily shocked . .

ONE

Ace Reviewer Paul 'give it to me and I'll slag it' White lists his favourite new products in chronic and logical order.

1: The SynthAxe

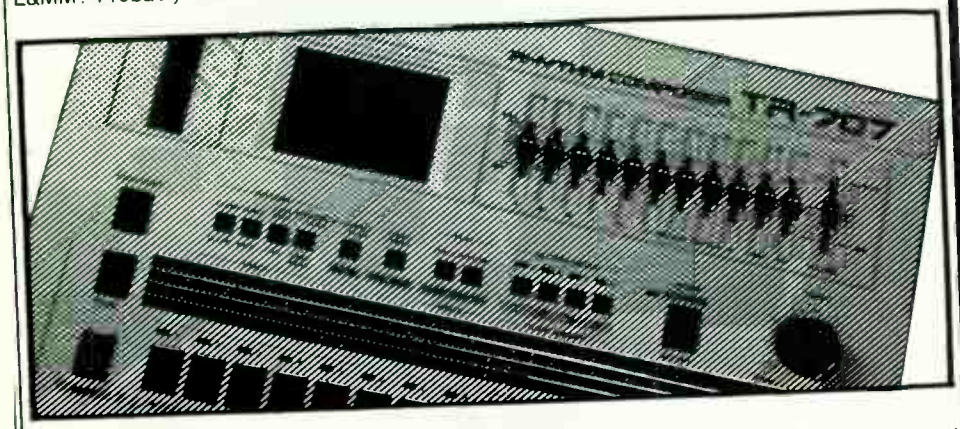
Unveiled to the vultures of the music press in May, this instrument obviously deserves more credit than anything else, as do its designers, who strove so hard and desperately to create an incredibly flexible and versatile instrument that could still be played and understood by the average *Guitarist* reader.

Reference has already been made to the instrument's unusual appearance in our *Retro* feature but what isn't so immediately apparent is that the SynthAxe actually contains more computing power than the entire Russian space programme (1958 to date). It does come a bit on the pricey side, but if you're in the market for a Fairlight, the SynthAxe is the ideal fretted complement and should comfortably be afforded out of the change.

2: Powertran MCS1

Tim Orr's outrageously cheap and powerful MCS1 brings high-quality digital sampling within reach of the serious semi-pro musician, and the pitch of the machine's output can be controlled *via* either MIDI or CV keyboards, so almost anyone can use it.

Not only does the MCS offer such sophistications as sample loop editing, pitch-bend and vibrato facilities, it also doubles as a conventional digital delay line during its time off. Involved as I was in the recording of Powertran's demo tape, I was surprised at just how many domestic utensils could be pressed into musical service using nothing more than the MCS1, a decent microphone and a deranged imagination. Even a humble milk bottle can be coaxed into producing a flute sound so convincing it would have James Galway crying into his Guinness. But does James Galway read E&MM? Probably not.



3: Roland TR707

After a veritable age of Great Expectations, Roland have finally come up with the Dickens of a good digital drum machine. Gone are the tinny electronic samples of the 707's predecessors, to be replaced by high-quality digital samples and the excellent LCD grid system first shown on the Boss Dr Rhythm Graphic: it makes pattern writing and editing simpler than ever.

At about £500, the 707 really *has* brought first-rate drum sounds within the reach of mere mortals, though some of us are so mere that we'll still have to do a bit of saving up.

4: The Syndrom

Despite Dr Ellis' demo cassette (bits of which sound uncannily like a deranged bat flying through the workings of an air conditioning system), E&MM's Syndrom is capable of producing sampled drum sounds of the highest calibre for, well, peanuts really.

Connect a couple of modules to the trigger outputs of an existing drum machine and you can replace, say, the bass and snare with sounds equal in quality to those of the Linn (where *did* you get those samples?), thus saving your trusty Drumatix or whatever from a fate worse than obsolescence.

5: Ultimate Percussion UP5

Hats off to the small Essex firm who unveiled this preset electronic drum kit at the British Music Fair in August. Combining superbly made and attractive pads with compact electronics, the UP5 can produce eight different drum sounds at the touch of a button or two, yet costs surprisingly little.

Actually, the kit's real advantage is that all those horrendous sounds we all *know* drummers are capable of programming using a conventional electronic set-up are placed safely out of their grasp. Just think of the torment we've all been spared.

TWO

Computer Musician Editor David Ellis looks at five products of a more computerised (well, sort of) nature.

1: Kurzweil 250

A keyboard of magnificent dimensions, performance, and price. A mite pretentious, perhaps, but it does point to a new direction for manufacturers to take their sampling *wunderkind*. If the 250 had lived up to all the advance publicity, it would have been incredible. As it is, a less than healthy percentage of the ROM-based sounds are fairly dreadful, which brings the 250 down to the level of being only excellent. The big question that remains is whether adding on an Apple Macintosh and the sampling hardware will succeed in turning it into the ultimate computer music system. For the answer to that, watch these pages in 1985...

2: Acorn Music 500

A quality digital synthesiser for the BBC Micro that has crept onto the scene without the benefit of Cambridge moles giving away advance details months before the event. With an MCL-type language called AMPLE, the Music 500 looks set to offer balm to the digits of BBC Micro owners who aren't so conspicuously gifted with keyboard skills. For those with a vested interest in digital flights of fantasy, the Music 500 may appear a bit too much like going back to school, but before you jump to any hasty conclusions, hang around for the music keyboard that'll be appearing next year.

3: Yamaha CX5M

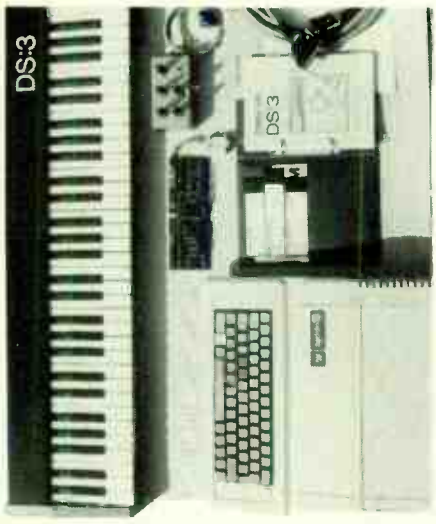
A boringly standard and over-priced MSX micro blessed with Yamaha's gift at turning ivory tower research into commercial reality – namely the remarkable FM/MIDI module that slots into the base of the CX5M. If Yamaha were to licence the FM chip ensconced in this unit to other manufacturers, they'd make an awful lot of people as happy as a sandworm (that's for *Dune* fans...). But they won't, so we'll have to make the best of the curate's egg that the CX5M is: great synthesis hardware, unimaginative and limited (32K) micro hardware, and a right hodge-podge of software. Mind you, the FM Music Composer Package still gets my vote as one of the more musical pieces of software to have emerged in 1984.

4: Korg DDM220

At long last a really cheap digital drum machine that grabs the ear with splendidly *unorthodox* sounds. And whilst following the latin gravy-train to Hollywood isn't exactly my cup of tea, there's no doubt that the DDM220 is great for blowing your horn at Trevor.

5: Greengate DS3

Yet another member of the sampling fraternity, but this time based around that stalwart of the home computer brigade, the Apple II. And even though Greengate Productions have a certain reputation for being difficult characters to get on with if you ring them up and complain about the difficulties you're having with the Hampton Court-like maze of instructions in the dire sequencing software or the highly idiosyncratic manual, it sounds good, it's cheap, and it steals some of the thunder away from the (now) over-priced Fairlight.



and the five that never quite made it:

1: Jen Music System

About which the least said the better.

2: Upstream MIDI system

Which only goes to prove that being a member of Mensa doesn't automatically mean business acumen or the ability to turn advertising copy into physical reality.

3: Buchla 400

So much was promised, but nothing actually materialised. However, the latest news is that Kimball Organs have teamed up with Don Buchla in a joint effort to get the 400 on the streets.

4: Yamaha QX1 & TX816

Wonderful on paper and high in price, but when are they actually going to appear? Talk about inscrutable marketing strategies...

5: Sharp CX3

The digital tape recorder that squashes 16 tracks on ⅛" cassette tape, remember? Another non-arriver, but watch out for remarkable developments along these lines next year.

THREE

A personal Christmas message from a debt-ridden Trish McGrath.

Dear Sanity Clause,

It's been a long time since I wrote to you last, but you can rest assured I've tried (very hard) to be on my best behaviour since then (December 1967). I'm dropping you a line to let you know details of the five presents I would most like to find in my stocking on Christmas morning, as I know you must be finding it difficult to keep track of all the advances in musical technology during 1984 (you may be reading the wrong magazines – have you renewed your subscription to E&MM?).

So, in order of preference, I would like a **Kurzweil 250 Digital Keyboard** – love at first sight, I'm afraid. Listening to the Kurzweil's representation of a concert grand with eyes shut, you might expect the instrument to resemble the bridge of the Starship Enterprise – but don't worry, Rudolph should be able to pull it along nicely (if not, ring Securicor). Still, maybe you'd better skip the chimney lark...

If my first choice is unavailable or temporarily out-of-stock, I wouldn't say no to a **Roland MSQ700 Digital Keyboard Recorder** (it would also save me having to knit a bigger stocking). With an MSQ, I could record in either step- or real-time using up to eight tracks and

6500 events, and it would quite happily control my MIDI- or DCB-compatible keyboards. However, it does look a bit like a clock radio, so you *will* be careful when you're browsing through the Argos catalogue, won't you?

Of course, with all this high-tech gear this might be a good time to replace my domestic percussion (pots, pans, jars – you know the sort) with a MIDI drum machine. I'm not fussy, so long as it's either a **Yamaha RX11** or the new **Roland TR707**. Both machines deliver high-quality digital drum sounds, offer versatile programming options, and will sync easily to the MSQ700 (hint, hint).

If all else fails, I guess I could settle for the budget-priced but nonetheless excellent **Korg DDM220** Percussion unit. Mind you, I suppose the congos, agogos and cabasa may seem out of place in cold, wet Cambridge this winter, so if you could chuck in a plane ticket to Hawaii as well, I'd very much appreciate it.

See you on Christmas Eve. I'll be waiting with some whiskey, Christmas pudding – and open arms...

Love, Trish

FOUR

E&MM contributor Paul Wiffen is now a reformed character after giving up selling synthesisers and becoming a freelance programmer. Here's his Top Five.

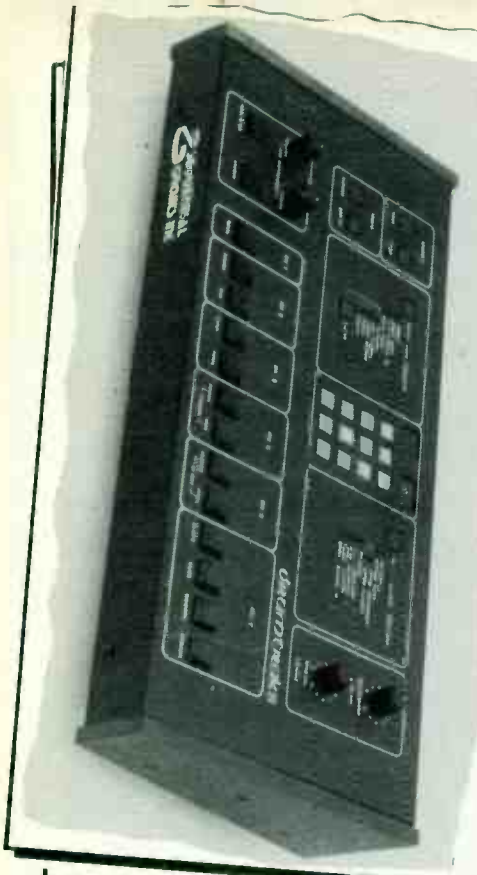
1: Emulator II

First past the post with usable sampling facilities for synthesiser programmers and keyboard players. Sensible length samples (unlike the CMI), polyphonic (unlike the Synclavier) and totally user-programmable (unlike the Kurzweil) for less than any of them. Cross-fades, sample mixing and splicing and analogue filtering are wonderful features. Only complaints are the nasty keyboard (which can be got around via the EII's excellent MIDI Implementation) the fact that you can't put more than two samples on any one key or move samples up or down by more than an octave. Definitely Product of the Year.

2: SCI Drumtraks

Twelve months after its release, the Drumtraks is still the only *drum machine for those (like*

▷



▷ *myself) whose music relies on Phil Collins tom-tom rolls round the whole kit for which 16 different levels of tuning are required. Programmed from the excellent (if over-priced) Prophet T8 keyboard via MIDI, Drumtraks velocity-sensitivity gives stunning control over dynamics. The original Bass Drum sound was a bit naff, but the replacement sample Rod Argents kindly supplied me with makes the SCI the best of a good crop in this, the year of the digital drum machine.*

3: Oberheim Xpander

In a year when so many manufacturers (Korg, Roland, Siel, PPG, Yamaha) simply chopped the keyboard off their best selling synth and called it a MIDI expander/guitar synthesiser, for me the only one that showed any real imagination was the Xpander. Not cheap, but then this is neither mutton dressed as lamb nor a jump on the MIDI bandwagon. Containing six voice channels which are probably the most complex yet available polyphonically, the Oberheim combines multi-timbrality (this year's most notable piece of Californian jargonese) with truly professional sound quality.

4: The Bit One

Despite a truly terrible name, this proved to be the only budget synth that could really deliver sound-wise. But then neither name nor sound quality were a surprise to me when I discovered the Bit One to have been designed by Mario Maggi (he of Elka Synthex fame). To provide touch-sensitivity at this price (£699) is a real achievement, and the future for the Bit One will be bright indeed if all the planned MIDI expansions come to fruition.

5: LEMI MIDI Software

One of the most disappointing aspects of MIDI has been the way in which the best software has been written for unreliable budget computers like the Commodore 64 and Spectrum, whilst more reliable models like the BBC have suffered a lack of user-friendly and versatile packages, the UMI system excepted. However, the Apple II has fared rather better thanks to the LEMI Future Shock MIDI Interface and software (reviewed in this issue). An excellent real-time multitrack sequencer, aids to DX7, Prophet 5 and Prophet 600 programming and sound libraries, plus a brilliant and unique idea, a MIDI digital delay which uses another (or indeed the same) keyboard to play the repeat signal.

FIVE

And finally, Dan Goldstein takes the easy way out, supplying a chart for people who are too lazy to make music of their own and prefer listening to other people's instead.

1: Brilliant Trees (David Sylvian)

The number Seven is a common enough concept. you know, seven virtues, seven vices, seven wonders of the world, Seven Brides for Seven Brothers, but the seven songs on *Brilliant Trees* are decidedly uncommon and much the better for it.

From the organised chaos of the opening 'Pulling Punches' to the emotional high-point of the album's title-track, Sylvian's voice casts a powerful, sensitive shadow over an instrumental backing that's as competent and as varied as its participants (Sakamoto, Hassell, Czukay, Barbieri).

When the album came out it was striking enough to be the best record of the summer, but I predicted then that 1984 would not see a better LP, and *Brilliont Trees* has worn far better than even a confirmation of that statement would suggest. Every time you play it, more intricate details of construction, arrangement and production come bubbling to the surface. Touching, progressive, intelligent, graceful. *Brilliant Trees* is all these and more.

2: The Flat Earth (Thomas Dolby)

In which the mad professor of *The Golden Age of Wireless* mellowed into an intelligent songwriter and producer with a *penchant* for corrupting traditional instrumental arrangements by dubbing Fairlight samples over the top of them.

Critics said *The Flat Earth* was too commercial but they were missing the point. In 1984 Dolby *proved* computers could make a positive contribution to the way music was played yet still not be too conspicuous by their presence. True, the man's output could be a bit more on the consistent side, but if he comes up with records (not to mention videos, tours, books and the like) of this quality at the climax to each work period, who can complain?

3: The Pearl (Harold Budd & Brian Eno)

So close (in both concept and execution) to the duo's 1982 album *The Plateaux of Mirror* that it might have been recorded at the same time, this was nonetheless the year's finest example of modern-day 'ambient' music. Budd's simple, repetitive piano melodies are strikingly but sympathetically contrasted by Eno's synthscapes, and while a few of the album's pieces are decidedly throwaway, others ('Against the Sky', 'Foreshadowed') have real beauty and passion.

Far too many dismiss this sort of thing as mere aural wallpaper, when in reality a lot more goes into its creation than is immediately apparent; if you really *listen*, you'll find more within *The Pearl* than a hundred albums of far more complex instrumentation. Even the cover is nice.

4: It'll End in Tears (This Mortal Coil)

If there was a record that logic *insisted* shouldn't have been an aesthetic success, but became one nevertheless, this was it. The line-up is a peculiar *pot pourri* of 4AD employees under the guiding hand of the label's mentor, Ivo Watts-Russell. The music varies enormously in both style and dynamics, but the arrangements are consistently inspiring, DX7s being juxtaposed at will with such unlikely bedfellows as a gizmo and a yang t'chin.

Two female singers, Cocteau Twins' Liz Fraser and Dead Can Dance's Lisa Gerrard, steal the show with vocal performances whose dexterity outshines even that of the album's instrumentalists, and while a couple of the tracks on *It'll End in Tears* don't achieve anything more than giving you a pain in the head, that fact only serves to make the remainder more gracefully tranquil.

5: Journeys out of the Body (Steve Jolliffe)

Formerly an innocent accessory to the improvisational antics of Edgar Froese and Klaus Schulze in the infant Tangerine Dream, Jolliffe returned to vinyl with a vengeance in '84 with a musical reflection of some extraordinary bodily happenings he experienced while staying in Somerset some time before.

Using only the bare basics of musical technology (grand piano, SCI Pro One), he succeeded in creating an album of great depth and effervescence, though seeing as he's now equipped himself with rather more in the way of studio hardware, Jolliffe's next musical endeavour – due for release early in 1985 – is likely to be a work of a very different kind.

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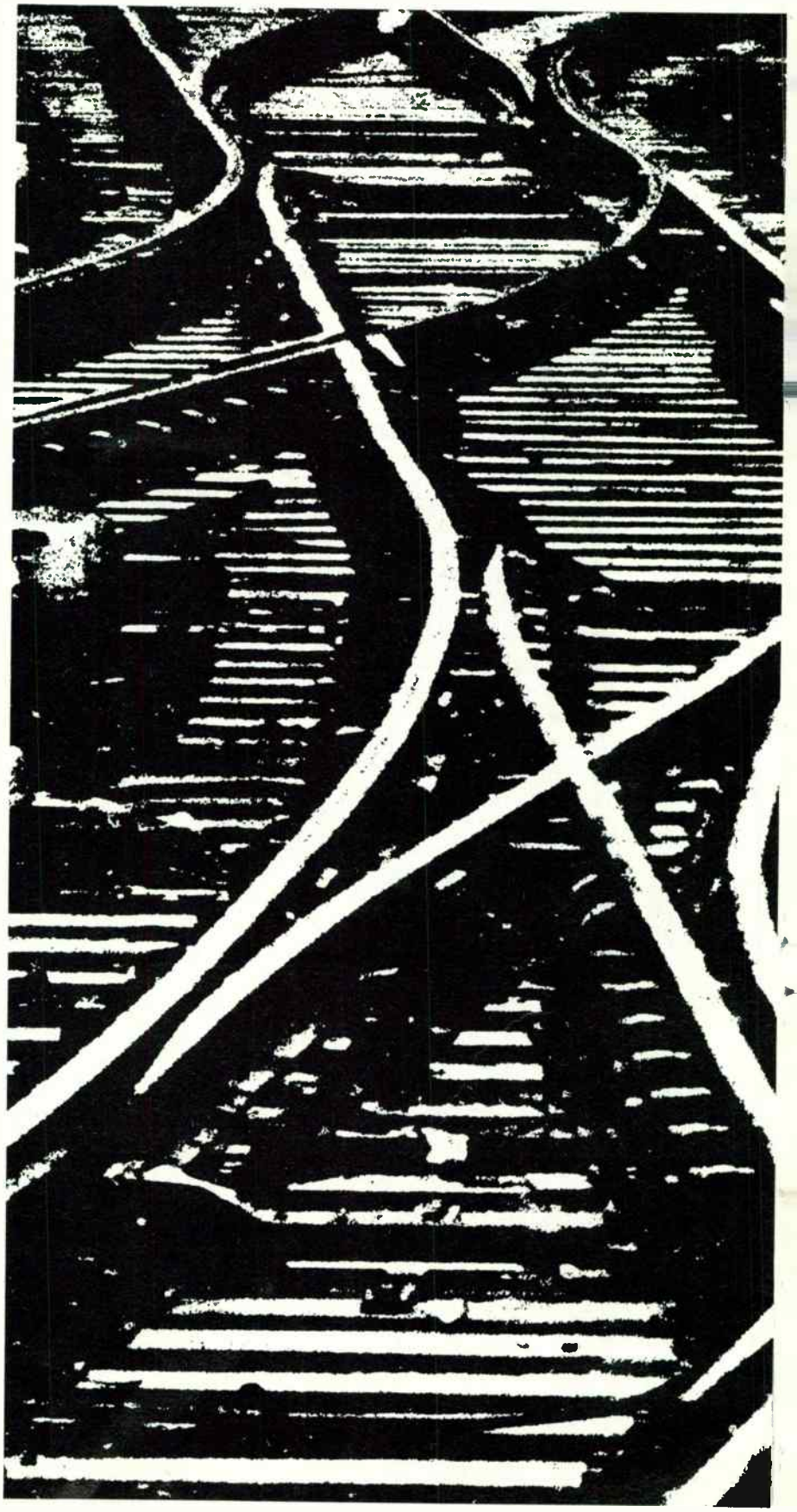

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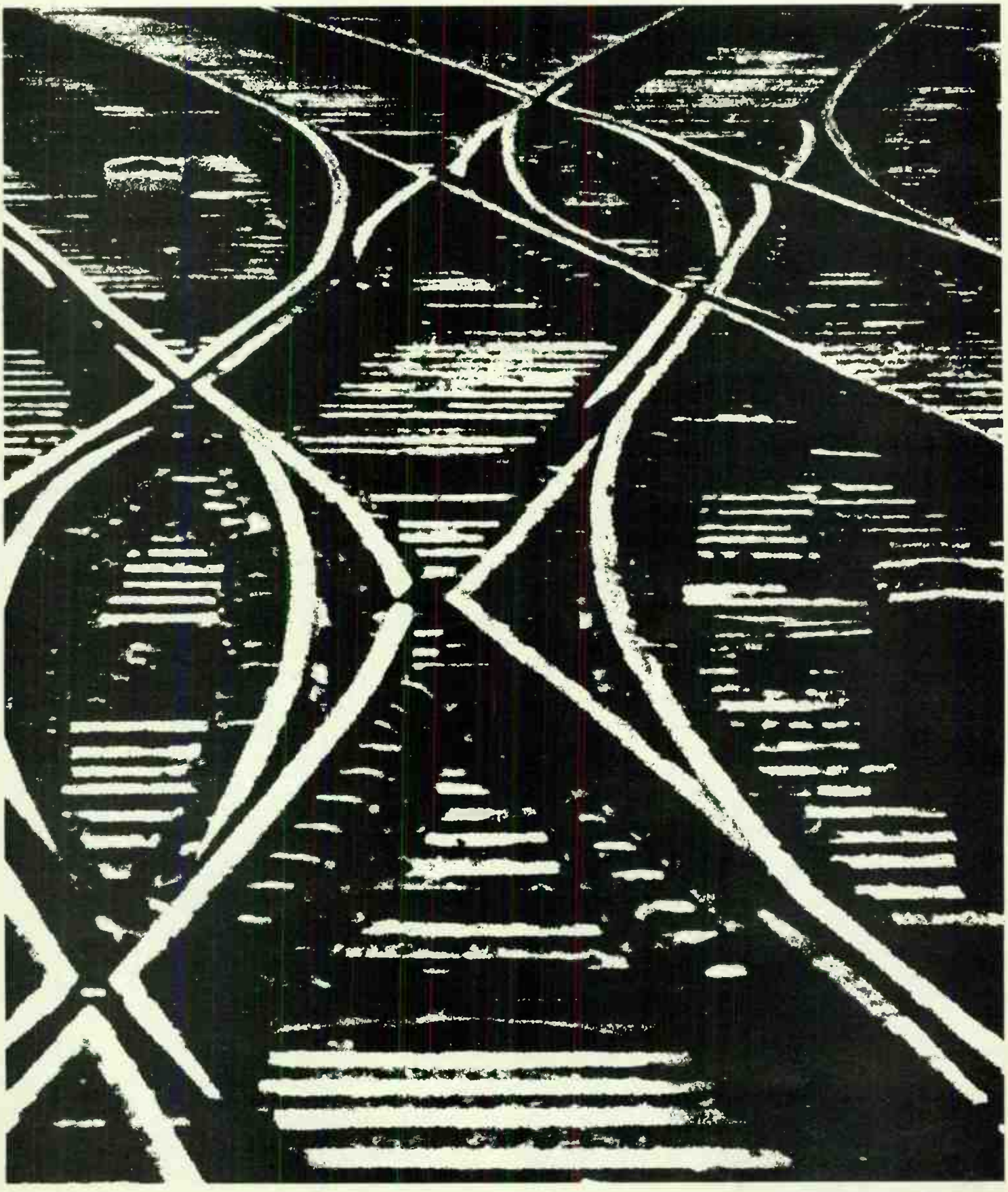

Syco. We are

ON CASSETTE

After a month's absence, our readers' demo tape column returns with a vengeance. *Chris Heath*

Merkworks *Australia*

Six technically excellent tracks from computer programmer Paul Murphy. This isn't 'new wave' (which is what his letter suggests) but a skilful juxtaposition of a much wider and more traditional range of musical styles. The odd track – like the epic 'Schizophrenic Dream' – is a mite too ambitious and falls flat on its face as a result, but the others are quite worthwhile, albeit in unexpected ways. 'Ultrahawk' succeeds not so much 'in the Zappa tradition of sending up life, the universe and everything else in it' but because it's an effective funk-soul drama in the Was (Not Was) vogue. 'Jazz Never Dies' intrigues as a bizarre 'Jazz Rock on 45', while 'Another Prick in the Door' is an (almost) amusing Pink Floyd parody that reshapes itself as a condemnation of door-to-door salesmen and religious freaks. Almost as strange as . . .

Red Ash & The Lebanese *Poole*

This month's ludicrous minimalists. Boasting possibly the worst mix ever to come out of an eight-track studio, 'She's So Sweet' places an Ian Dury soundalike vocal against an indistinct backing and then disturbs the scene with the odd outrageously high-level synth and female singer interlude. And that's the most sensible song. 'Lying' is the Flying Lizards Play Boogie (as bad as it sounds), while 'Respect' is the Otis Redding classic mauled into misshape by a vocal style that *would* sound like Lou Reed if it wasn't totally devoid of soul. The other side of the tape contains an absurd sound collage – backwards guitars and drums overlaid with telephones, clocks, bells, and chimes filched from some of the BBC's indispensable sound effects records. I could say that I liked this tape, but it would only encourage them.

Seven Dials *London*

Seven Dials successfully ape New Order's better rhythmic moments with their opening 'Captivation', before drifting off into mid-period Human League (after they'd learned how to use sequencers but before they knew how to spell 'jacuzzi') territory. The band make use of two Roland SH101s, a Prophet 5 and an SCI Polysequencer, and show considerable potential – all they need is a few more ideas of their own.

Roger *Torquay*

Music that employs the same unexpected melody lines and shifting vocal fragments as Dick Witts' Passage – though not quite as well. Roger's tape is titled 'How to Mend Pots' and purports to be concerned with 'the music business – its politics and selling ethics'. Lyrically, it's refreshingly bold and committed:

Erik Svahn.

Iconoclast.

far too many of the hopefuls that send tapes to *On Cassette* seem to treat lyrics as something incidental to be thrown on top when everything else is finished. My main reservation about this music is that it has the same kind of awkwardness that made bands like The Passage and (early on) Scritti Politti difficult to stomach and therefore rarely heard.

The Zane Grey Incident *Cardiff*

Four excerpts from TZGI's *Music for Operatives* (terrible title) tape show, from a band with a surfeit of strong melodies and a healthy imagination. They handle the combination of sung and spoken vocals particularly well: the opening 'Travel, Climate, Industry' is like a synth-based Gang of Four, if you can imagine what that might sound like. And although only that song was 'professionally' recorded (at Clydach Vale 16-track), the remaining three home recordings are equally well produced.

Best of the Rest

An avalanche of tapes from Sweden this month. Far away the best of them is a novel offering from one **Erik Svahn**. His looped speech fragments are laid over synth pieces that are less rhythmic than Cabaret Voltaire's but fuller than Eno's – quite special. Thankfully, Svahn's vocal snippets are in English, but the same can't be said for the work of **Peter Westerlund**, which I found somewhat difficult to appreciate. Songs such as 'Sanningen' ('The Truth') are a bit stodgy and overlayered (bounced sound-on-sound with an Akai 4000D; Polysix, Drumatix, Bassline and SH101 much in evidence), but I do like 'Meninglos Alle' ('Meaningless Alley'), with its repeating bass part and frantic alto sax interlude (almost too close to Soft Cell's 'Frustration' for comfort). **Topolini** offer more unintelligible Swedish, and although they boast a number of impressive DX7 brass programs within their sonic armoury, their songs plod mechanically. From further overseas (Australia, to be exact) come **Press**, playing jerky; primitive music. The band's main asset is that they don't really sound like anyone else, though the same can't be said for **Turquoise Days**, whose undeniably copious talents are wasted on almost exact replicas of OMD and Ultravox songs *circa* 1979. Mind you, **Iconoclast** aren't even successful plagiarists. They entertain claims to being Nottingham's answer to Joy Division, but end up sounding rather dreary, pompous and old-fashioned. 'The Way of All Flesh' is the title of a **Tissues for Men** effort that gets a little bit closer – it's one of four tracks recorded on the ever-popular Portastudio and performed on nothing grander than an SH101 and a Drumatix. Of the remaining diversity, the storytale soul of 'Paula and Iain' is the most striking: but it's an excellent song struggling under the woes of an amateurish execution. Instrumental magic this month from Cirencester's **Jim Griffiths**, who seems to take heed of the old adage that instrumentals need more, not less, in the way of melody than vocal songs. His quartet of offerings were recorded in a disused coal bunker lined with polystyrene, but are evocative and atmospheric in spite of their primitiveness. Will he achieve his ambition to be asked to write the music for the next *Mad Max* film? That is not a question I can answer, alas. Also instrumental are Worcester's **Arbitrary Names**, who do a smart line in layering but let their music appear suffocated by excess technology. **Alan Kyle** has similar problems, but can at least claim some technical credit for successfully sampling the word 'no' (itself a sample to begin with) from OMD's 'Tesla Girls' using a Boss DE200 digital delay, and using it on one of his tracks. On a completely different tack, **Camera Shy** (Cambridge) offer 'three commercial dance songs': as luck would have it, Graham Buxton's voice is unusually strong and human and the songs, which prowl confidently amidst Hall & Oates territory, are nicely augmented by a neat production and arrangement job. Finally, **The Kundalini** present your correspondent with three appallingly-recorded tracks and an incongruously pretentious letter. I do wish people would realise that you can only get away with such ZTT-isms if they're backed up by music of equal guile and intelligence. ■

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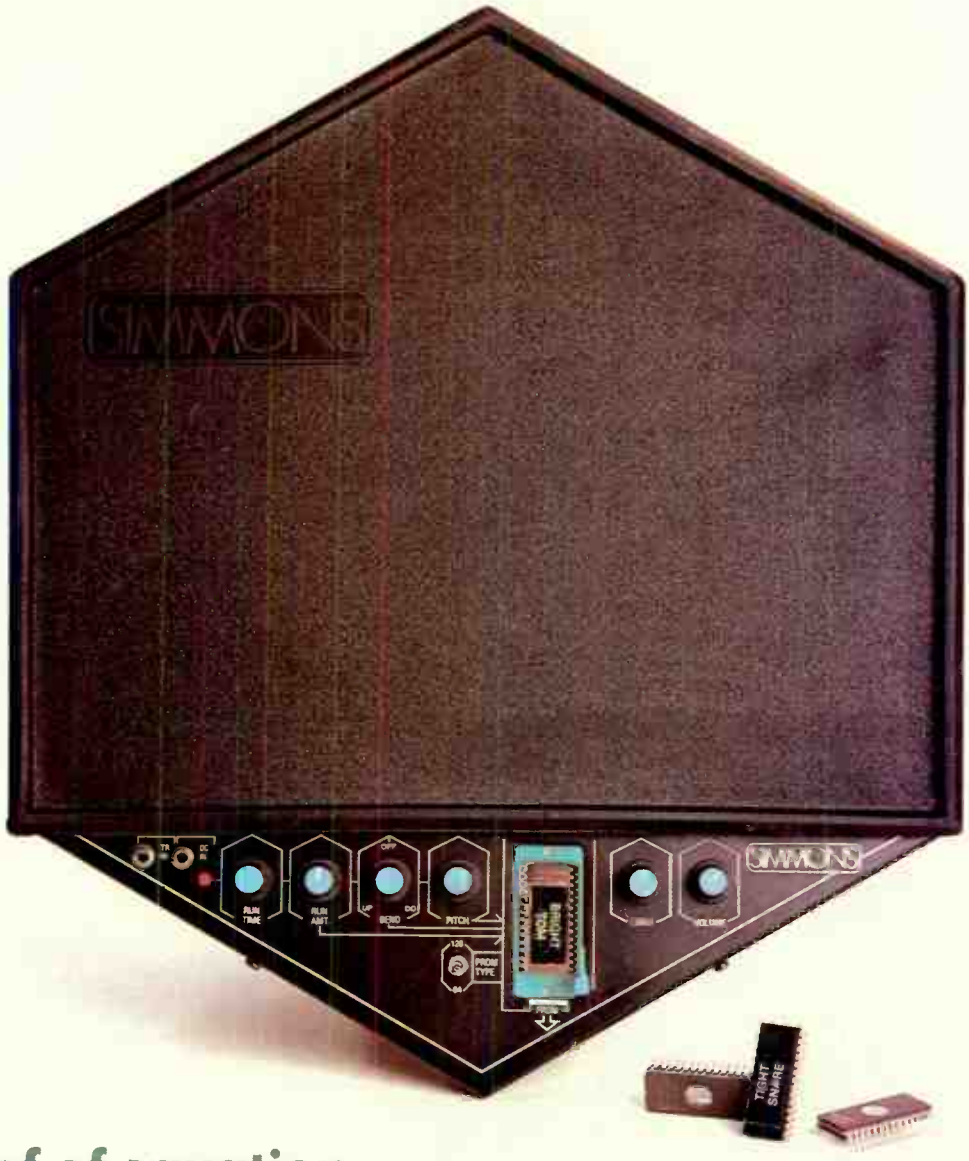

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TEARS FOR SOUVENIRS

CRYING AND SHOUTING WITH BATH'S FINEST

It's been a while coming, but Tears for Fears' second album – due for release early in '85 – should be well worth waiting for. How do the 'Mad World' duo go about writing and recording? *Dan Goldstein*

From the word go, Tears for Fears were more a duo that happened to use synthesisers than a synth duo in the accepted sense. They served their musical apprenticeship in several bands based around their native Bath, among them Neon (the other half of which is now Naked Eyes) and Graduate, a five-piece mod revival combo.

For some while after Curt Smith and Roland Orzabal came to the conclusion they'd be better off working as a two-piece and formed TFF, their instruments were no more than bass and guitar respectively.

They started writing the odd song or two in Roland's bedroom, but seeing as both young men were victims of the social disease of unemployment, neither could afford the luxury of a tape recorder. Any musical ideas they might have had brewing stayed firmly in their heads.

Things began to take off when a friend by the name of Ian Stanley asked Smith and Orzabal to record a couple of tracks at an eight-track studio he happened to have built into one room of his house, overlooking the ancient West Country city. And as it happens, the band have spent the last few months in that same house, recording their second album at the studio (it's now a 24-track) and playing host to the odd music journalist that might happen to drop by.

The Beginning

'This is where it all started', Roland reflects,

casting a familiar eye around the large sitting room at the top of Stanley's house, while simultaneously attempting to replace a string on his treasured Fender Strat. 'Ian's actually quite a character. He just approached us in a Bath disco one evening and asked us if we'd like to do some recording, and obviously that was a fantastic break for us because we'd never done anything like that before.'

Both musicians are still in their early twenties, but their music is a good deal more mature than their tender years would suggest. Roland is the more talkative of the two, but he's also nervy and a little uncertain: when Curt Smith does speak, it's with greater confidence and assurance.

'Before we came here, the limit of our experience was playing guitars in Roland's living room', he confirms. 'We didn't have the money to record.'

One of the band's demos got picked up by Phonogram subsidiary Mercury, and before Smith and Orzabal knew where they were, the company had released a couple of singles, 'Suffer the Children' and 'Pale Shelter', both classic examples of electronic pop livened further by the addition of guitar chords. It was David Lord – well-known for his production work with Bath's other famous musical export, Peter Gabriel – who had introduced the duo to synthesisers a little while earlier. From then on there was no turning back.

'David had a Synclavier and a Prophet when we did 'Suffer the Children'' remembers Curt. 'Up until that time our knowledge of electronic keyboards stretched only to a string machine and an electric piano.

'We used a Jupiter 4 when we were doing the demos with Ian. We got involved with them simply because they were exciting. Suddenly, something new and potentially limitless had arrived: with a synthesiser and an eight-track, you can learn to lay down one instrument at a time and produce God knows how many different sounds. Before we'd just been used to taking one line each.

'Synths didn't present a problem in the early days because there was just the JP4 and that was all we had. Even when we went on to do the first album, we used only two synths – a Prophet 5 and a Jupiter 8.'

The Hurting

That album was *The Hurting*, TFF's first long-player for Mercury. Produced by Chris Hughes, it was a varied and competent album full of neat musical structures, well-considered lyrics and tasteful arrangements. There was an undeniable and inevitable discrepancy between the band's commercial tracks and their more involved compositions (a discrepancy that still exists today) but strangely, it was one of the latter – 'Mad World' – that brought Tears for Fears their first chart success. Did its achievements come as a surprise?

Roland: 'Yes. we were very surprised about 'Mad World' because it's nowhere near as commercial as the previous singles. All I can say is that there must have been something basic and simple about it that people liked – it's a lot darker than 'Pale Shelter'.

'The thing is, once you've had a Top Five hit, once you've got your foot in the door, then more hits should follow, provided that your songs are good enough. So we haven't been surprised by anything since 'Mad World', though I must admit we fully expected that to reach about Number 50.'

Although *The Hurting* is technologically a very straightforward album, it's clear that Smith, Orzabal and Hughes spent a long while getting each layer of each piece absolutely right. And while that attitude undoubtedly worked while the hardware at the band's disposal was still quite limited, by the time they'd invested in the likes of Emulators, PPGs and DX7s, the technology was beginning to get the better of the music.

The Crying

Writing, arranging, and recording all became more of a chore than they should have been, and the duo's output became rather less prolific: just two singles, 'The Way You Are' and 'Mothers' Talk', in a little over a year. Roland takes up the story.

'We became interested in new equipment as soon as it came out. When we did *The Hurting* we felt that the JP8 and the Prophet lacked hardness, and that's exactly the sort of thing a digital instrument like the PPG Wave can give you. So the next things we bought were an Emulator and a Wave. Even though they're digital, they seem to have a much earthier sound than analogue instruments. Obviously on the Emulator you can make a sound dirty just by putting it in there: it'll take on a whole new character because it isn't really all that accurate.

'All instruments can create problems, and what we found was that having too many synthesisers was making us jack of all trades and master of none, like the trumpeter who can play a bit of trombone or saxophone.'

'When you're looking for a new sound', Curt continues, 'it's all too easy to walk around the studio going from JP8 to DX7 to Emulator to Prophet and so forth, without actually sitting down and thinking of exactly the sound you're looking for, and which keyboard you're most likely to find it on.'

Roland again: 'It's fair to say that after *The Hurting* we didn't really know which way to go. We were very much concerned with layering and synthesisers – there were no guitars on anything we did at all. We did spend an awful long time sampling sounds and so on, and we learned – slowly – that a lot of it really is a waste of time. The amount of work you put into making things sound absolutely right doesn't really come across to anyone not familiar with what it all involves. Unless they've got a high quality hi-fi system, they're not going to appreciate any of it.'

So the band sold their PPG and their Emulator, and between themselves and producer Hughes made the collective decision to make recording a more immediate process. But that wasn't the end of the duo's worries. Actually *writing* commercial songs (or 'money tracks', as they call them) has been a problem for Curt and Roland since 'Mad World' hit the charts . . .

'The songs from *The Hurting* that we started working from were the less commercial tracks like 'Memories Fade' and 'Start of the Breakdown' – they're certainly more relevant to what we're doing now.' (Roland). 'We've reached the same conclusion as Chris at about the same time: we wanted to do something a bit more direct, something that relied more on impression than perfection. We wanted to lose all the preciousness of *The Hurting*, but the problem with 'money tracks' is that you've *got* to spend a lot of time over them. They've got to come across on the radio and compete with other people like Nik Kershaw and Frankie Goes To Hollywood, so you've got to be a perfectionist when it comes to writing and recording.

'At first we thought 'Mothers' Talk' was going to be a hangover from 'The Way You Are', which was all layers of synthesisers. It was all very nice to listen to but it didn't really translate, so we ripped the song apart and lost all that preciousness.

'That really is a very old song – the first time we did it was on tour last year, when it was all synths. Actually, live it sounded as though it was mainly guitars, but the guy who mixes our live sound always whacks the bass and guitars up anyway, so you can't really judge. 'Mothers' Talk' was one song that was written a while ago but just took a long time to record, but generally it's the writing that takes the most time. What we've found is that if you take a song that's not finished into the studio, it ends up being a complete waste of time. So we either complete a song before we go in, or write everything in the studio.'

So what's the Roland Orzabal Method of Songwriting?

'At the moment I've been putting a lot of ideas together with just a Prophet 5 and a LinnDrum. We're not happy with acoustic guitar nowadays. When you take a synthesiser home, there are two areas that you can experiment with – the musical side and the actual sounds themselves. You get a chance to really get to *know* a synthesiser. because as we've found, when you're surrounded by four or five in a studio, you tend to move from one to another just playing the preset sounds. When you're confronted with just the one, it becomes a lot easier to get to know.'

Do certain sounds affect the way things are written?

'Very much so. That's the strange thing about synthesis. Because there are so many different sounds available on a synthesiser, you tend to think each one is devalued by the sheer scope of the instrument – but take the song we're working on at the moment. We only decided to do it because Ian was just playing the melody with a specific sound: before he found that sound, the song sounded a bit old hat. Then we went on to record it, changed the sound again, got stuck, went back to the original one, and realised it was that particular sound that was really the essence of the track – or rather, it was the *combination* of the song and the sound.'

The Shouting

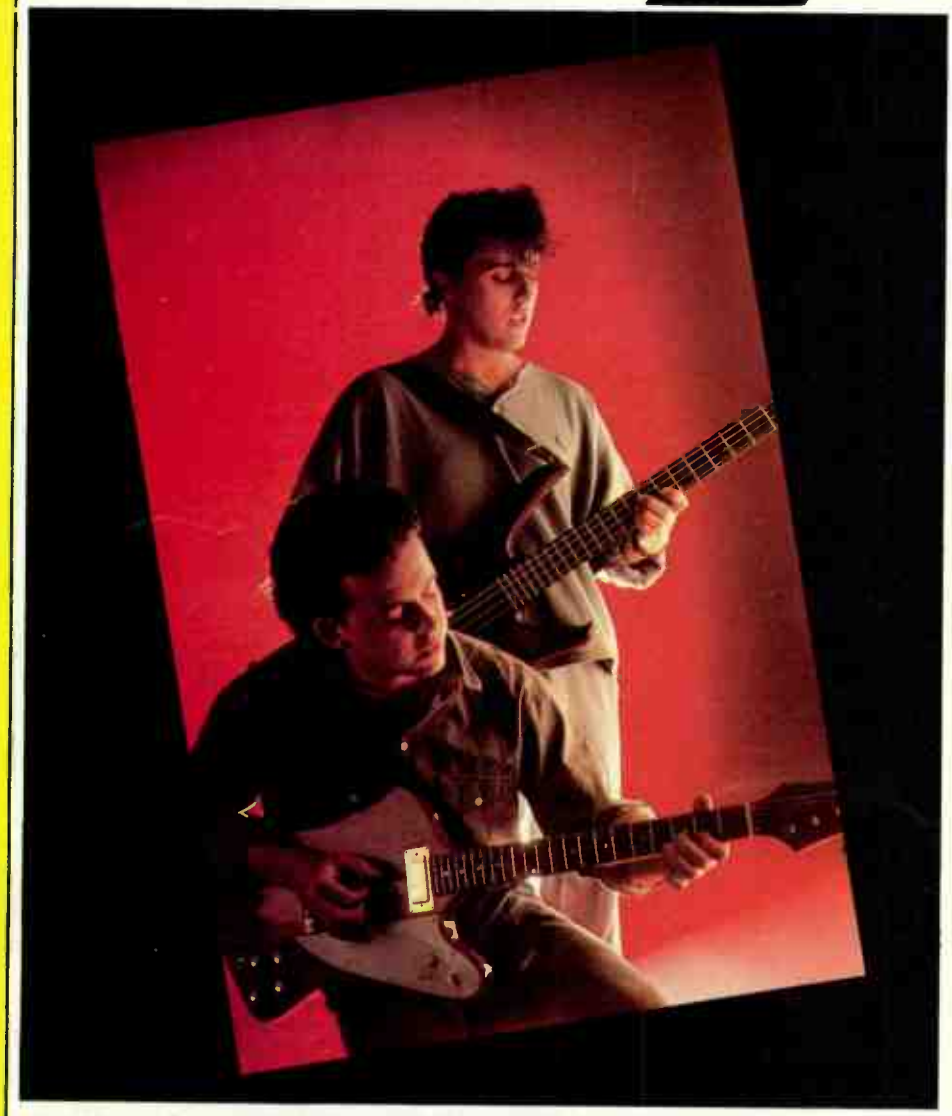
TFF's latest single – 'Shout' – continues where 'Mothers' Talk' left off. Strident and dramatic, it buries the ghost of earlier, wimpish Tears for Fears once and for all. Was the transition from the pleasant, melodic synth music of yesteryear to the aural apocalypse of '85 an easy one?

Curt: 'I still think *The Hurting* is a good first album. What probably changed our music more than anything else was playing live, because when we recorded that album we'd never really played at all. Obviously, the more you play, the better you play, and there's actually some very good playing on this new album. That's really what *The Hurting* lacked: all the parts were well worked out and layered, but it was all a bit sterile. And that's the last thing you could call this album – it's got a lot more feeling and roughness, a lot more honesty. Not that *The Hurting* wasn't honest, because that's what we were about at that time.'

Roland agrees with these sentiments precisely.

'Our music is definitely more mature now. We used to be known simply for things like 'Mad World', and people thought we were that kind of group, that we couldn't do anything else. It was only on stage that there was scope for doing other things. and it was always an eye-opener for people to come and see us live.

'We've suffered from the fact that we've only ever been put across in one specific way. That was our own choice, admittedly, but what we've tried to do with this album is open people's eyes in the same way we've done



when we play live – I think we've achieved that.'

It transpires that 'Shout' and 'Mothers' Talk' have taken the same time to record between them as the rest of the new TFF album put together. It's clear that the duo are proud of their achievement (just two weeks' recording remained at the time of our interview), and a number of factors have determined the way in which they've gone about their work.

One of the most important has been yet another improvement in the quality of the band's available technology. Chris Hughes' Fairlight has been pressed into service at every available opportunity, the band have replaced their PPG with a Prophet T8 and a Yamaha DX7, and the last two are run from the Rock Shop's UMI MIDI software and an E&MM BeeBMIDI interface box.

'We've had the UMI system since it came out', affirms Roland, 'though that isn't very long ago. It's incredibly useful and not that hard to use. In fact, we've used it quite a lot on the album, with the DX7, the T8 and a MIDI PPG Wave we borrow from a friend of ours.

'But it's not all hi-tech stuff. There's a lot more guitar playing on this album – in fact there's even a most amazing guitar solo on a track called 'Broken', played by a guy called Neil Taylor. He's played with us live, and he's actually a *brilliant* guitarist. He can do a lot of things on guitar that I'll never be able to do, and he's fantastic to work with.

'We're getting very interested in using other people to work for us. There are two saxophonists on this album – Mel Collins, who's very professional and will do anything you want him to, and a local guy called William Gregory, who's an unbelievable soloist.'

Do those players write their own parts?

'It varies. Mel's parts were all written out on manuscript. You *could* do that for William, but it's better to let him get on with it. The same goes for the drummers. There are actually three drummers on the album – Chris, our live drummer Manny Elias, and Jerry Marotta. They all have their own individual styles and are interesting in their own way. A lot of the drum writing was done by Manny, but we used it in different ways by sampling bits here and there. There's a lot of counterpoint on the album between the different ways that various musicians play things.'

If post-preciousness technology and the addition of some more musicians have helped make the new TFF album (untitled as yet, incidentally) as good as the band claim it is, then the same could probably be said of the duo's new-found technical competence and expertise, things they possessed in rather smaller quantities at the time of *The Hurting*. Not for the first time, Roland considers it's time to illuminate.

'The more you work in a studio, the more you learn, and the more equipment you have, the easier it is to learn. Even just the guitar side has improved a great deal since *The Hurting*. I can set up a good guitar sound in about five minutes now, and it'll be a lot better than anything I used on *The Hurting*. It took me a whole day trying to get a good guitar sound for the title-track, and in the end I scrapped it anyway!

'Part of that was down to the equipment I was using – just a Telecaster and a dreadful Yamaha amp, always close-miked in a very dry room – but things are a lot better these days. I've got a Roland JC120 combo and a Gibson Firebird, plus my favourite guitar of all which is just called The Strat – it's got more bottom end than an ordinary Strat and a cleaner sound, too.'

Curt continues: 'As a band we've become a lot more professional since the first album, and we now know our own equipment much better. On this album we've spent so much time getting to know synthesisers, our old instruments – guitar and bass – have been neglected, but I think we're probably better at playing everything nowadays.'

So you believe that technical competence is the key to good music?

'Very much so. You can't beat a good player. You should be able to go into a studio and get a good sound if you're using your own equipment. You shouldn't have to rely on an engineer to do it all for you.

'We're all capable of working the tape recorders and the rest of the recording equipment by ourselves, and that's how it should be. If you *know* that your sound is going to come together in five minutes, then all you need to worry about is the playing.'

The Gigging

It should be quite a spectacle, watching and hearing Tears For Fears (suitably extended to a seven-piece) playing songs from their new album live. A UK tour is planned for early Spring, with probable support band The Blue Nile, a Glaswegian trio for whom Smith and Orzabal have much admiration.

'The first album is superb', Roland enthuses. 'Neither of us actually listen much to other people's music, because if you work with music all day long, the last thing you want to do is go home in the evening and listen to some more. But The Blue Nile are special. They remind me a bit of us when we first started – they ignore convention totally. I go through crushes on certain albums – like *Peter Gabriel 3* and *Tin Drum* – and at the moment I'm going through a crush on theirs. Their music relies a lot on emotion, as opposed to something like *Tin Drum* which is actually very intellectual in the way it's put together.'

You still believe in the power of emotion, then?

'We've always had a lot of belief in it, though in the early days we explored those aspects most when we played live. Now I'm more interested in the power that music has to move you bodily. I don't just mean disco dancing, but material that is really strident.'

And there won't be any problems, translating the music that's been recorded for the new album into something that'll work in a concert format?

Curt: 'There shouldn't be, because we played most of it live before we recorded it. Even if there are differences, I think we'll just adapt things and improve them. We used to go out with a Revox tape machine just so that we could reproduce studio sounds live, but now I think playing live has to be treated differently from recording.'

'We'd also like to be in the position where we can ad lib and do things slightly differently as we go along', Roland continues. 'Next time we play live we should have a Linn 9000, which not only plays drum rhythms but records sequences as well – that should make things a lot easier.'

In addition to the Linn, TFF should also have an Emulator II (the waiting list is already a long one) to ease the playing of sampled sounds in concert. However, in an attempt to keep the band's keyboards down to a minimum, Curt Smith is convinced they're going to have to get rid of some more. Anybody wanna buy a Prophet 5? ■

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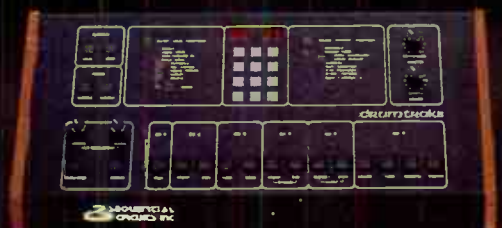

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Hybrid Data

Neuronium are a Belgian-born synth player, a Spanish guitarist and a psychedelic artist. Could 1985 be the year of the hybrid? *Tony Mills*

It's been a long hard road for Michel Huygen and the other members of Spain's best-known synthesiser band, Neuronium, but the general feeling now is that they've made it at last. With a powerful international record company behind them, it may be time for the band to break into the same world class as Jean-Michel Jarre, Tangerine Dream and Vangelis.

Which is ironic, because in the eight years the band have been playing they've become strongly connected with Vangelis, Klaus Schulze and many of the other major figures in the synthesiser music world. Neuronium's leading light, Belgian-born Michel Huygen, is firm friends with Vangelis, even persuading him to host and take part in a Neuronium jam session on Spanish television. Other collaborators have included Manuel Gottsching, Lutz Ulbrich and Ashra's Harald Grosskopf, who turned in a devastating performance with the band on Spanish TV show 'Music Express' a while back.

In the Beginning

Neuronium got started in 1976, and a year later recorded *Quasar 2C 361*. About to be re-released, it's an epic composition that makes use of string synthesisers, audio generators, acoustic and electric guitars, synths and keyboards. In some ways, the instrumentation seems primitive for its time – Tangerine Dream were touring America with Oberheim polyphonics and a massive laser show that year – but things in Spain were (still are) rather difficult. A luxury tax on electronic instruments which makes them at least 50% more expensive than they are in the UK.

However, the album was well received and the band (largely comprising the duo of Huygen and Carlos Guirao, with contributions from various vocalists and guitarists) were able to invest in new equipment and performed some spectacular concerts. In 1978 they recorded *Vuelo Quimico* ('Chemical Way') which featured Nico on vocals, and played to an audience of 11,000 in the Athletic Bilbao football stadium. After that came *Digital Dream*, which remains one of their best albums, the epic 'Flying Over Kai Tak' standing out as a landmark in the history of floating synth music.

The record that followed – *The Visitor* – seems to split synth music fans down the middle: you either love it or hate it. I think it's their best album so far, but in many ways it's not typical of the band. The title track is a song with lyrics inspired by Dylan Thomas' short story of the same name (for a Belgian living in Spain Huygen is a good bit more culturally

literate than the average Briton) delivered in heavily Spanish-accented English. This has put many people off, but it's possible to listen to the words as instrumental sounds rather than as lyrics – a view that's strengthened by the massively gothic 'Strange Affair', capable of producing nightmares even *without* its vocoded lyrics being entirely comprehensible.

Side Two of *The Visitor* strongly features guitarist Santi Pico, whose style is often reminiscent of Mike Oldfield's. 'I've heard Oldfield, of course', he commented at last September's UK Electronica show at Sheffield, 'but my real loves are the great jazz guitarists like Larry Carlton and Django Reinhardt'.

In fact, Pico's a devastatingly versatile player, gaining awards as Spain's best guitarist (not bad in the country that gave the world guitars as we know them today) and switching with ease from heavy rock to flamenco and on to pop. By this time, Carlos Guirao had left Neuronium to pursue a career in commercial synth music (actually, he left and rejoined

several times, as if in imitation of the T. Dream/ Peter Baumann split), and logically enough, Santi Pico had taken his place as the other permanent member of Neuronium.

Paintings

There's a third Neuronium member whose contribution is non-musical but nonetheless important. He's Tomás Gilsanz, a painter specialising in 'visions of the macrocosmic, microcosmic and ectoplasmic'. His psychedelic paintings adorn most Neuronium album sleeves and are projected onto a backdrop during concerts, giving the band a distinctive look as well as a distinctive sound.

Gilsanz' paintings are featured on *Chromium Echoes* and *Invisible Views*, as well as the latest Neuronium long-player, *Heritage*. It's their first album with Jive Electro, a relationship which came about largely as a result of a recommendation from Lotus Records' Andy Garibaldi. It was released along with Mark Shreeve's *Assassin* and Tangerine Dream's *Poland*, but apparently the big advertising push is due to come early in 1985, along with the second batch of Electro releases.

That's no reason why *Heritage* should be neglected, however. Huygen feels it's something a little unusual for the band: 'On *The Visitor* and *Digital Dream* we sometimes felt we *had* to fill up all 24 tracks on the tape machine', he commented during a recent visit to London. 'On *Heritage*, and particularly on the long track 'Secret Audience', there was no such compulsion. I wanted to create something sparser and gentler, so sometimes there are only three or four instruments playing.'

A sparser feel doesn't detract from the richness of Neuronium's sound. The band's current instrumentation is fairly up to date, though it falls short of the digital giants such as Fairlights and Synclaviers. At UK Electronica Huygen used a Roland MSQ700 sequencer, TR909 drum machine, Jupiter 6 and JX3P polysynths, Yamaha DX7 and a Moog Prodigy for lead lines, using those powerful 'sync bend' sounds the Prodigy does so well. In addition, his eight-track demo studio has a Prophet 5 (now virtually dropped in favour of the Jupiter's cleaner sounds), a Korg Poly 800 with EX800 Expander, various Casios and an SCI Drumtraks digital drum machine. At home he keeps another Poly 800, and purchased a Fostex X15 multitracker on his UK visit, to capture 'some of those midnight inspirations we all have occasionally'.

Pico's guitar set-up embraces a Roland GR500 guitar synth, a Gibson SG, a Yamaha SG, an Ovation acoustic and a Fender Strat. He also uses more effects boxes than Paul White could review in a week, and has recently got hold of a Roland 700 programmable guitar synth, which should prove highly effective in his practised hands.

> 'I don't use MIDI doubling much in the studio: I prefer to record each instrument individually to give everything a human feel.'

At the Sheffield show, his guitars alternated with Huygen's synthesisers to great effect, making the audience wonder (particularly on up-tempo numbers such as 'Torquemada') how just two men could make so much noise.

Best Yet to Come

Simultaneously with *Heritage*, Jive Electro released a Michael Huygen solo mini-LP by the name of *Capturing Holograms*. It's certainly off the beaten track for Neuronium, featuring as it does vocals, pop rhythms and shorter compositions in an attempt to break into a more commercial electronic field. Does this signal the end of Neuronium? 'Not at all. I just had to show that I could play other kinds of music apart from the 'cosmic', or as we call it, the 'psychotronic' style. In fact, pieces such as 'Torquemada' are quite commercial as well, and I'm hoping that we can remix that track and put it out as a single on Jive Electro.

'But the next album, which is called *Hybrid Data*, is going to be something very special. It uses a combination of analogue and digital techniques – which is why it's called *Hybrid* – but it also uses many musical styles, and will change from one to another during the course of each side.

'There's going to be a long track dealing with the downfall of the Inca civilisation and its cities, and there's a possibility I might use a well-known Spanish actress to add vocals to that part. We'll record the album on 24-track as usual, because we always use the same studio. I know the studio and the engineers, and they know the 'Neuronium sound'. That means that if I ask for a reverb effect they know *exactly* the kind of reverb I want, and chances are they'll already have it prepared.

'In the future I'd like to consider using a 16-track tape machine in my own studio to record the albums. The introduction of MIDI has made it possible to record many more tracks simultaneously and so save tape tracks, but at the moment I don't use MIDI doubling very much in the studio: I still prefer to record each instrument individually to give everything a human feel.

'Last month I used the new Akai MG1212 recording system for two weeks. It's a wonderful machine, with very high sound quality, and it lets you record 12 tracks onto a special tape and to drop in and out automatically, or play through a certain section as many times as you want until you've got the take right. At first I was dubious about the quality, but I certainly think you could master from it. Unfortunately, it's even more expensive in Spain than the £6000 it costs in the UK.'

By the time February gives way to March, Neuronium should have released their second album for Jive and be getting a little more exposure than they did for *Heritage*. That'll be no bad thing, since deserving though this kind of music may be, it has to be pushed hard if it's to gain wider acceptance. And of all the many musics that will no doubt be vying for audiences' attentions during 1985, there will be few more deserving than this talented duo's 'psychotronic music'. ■

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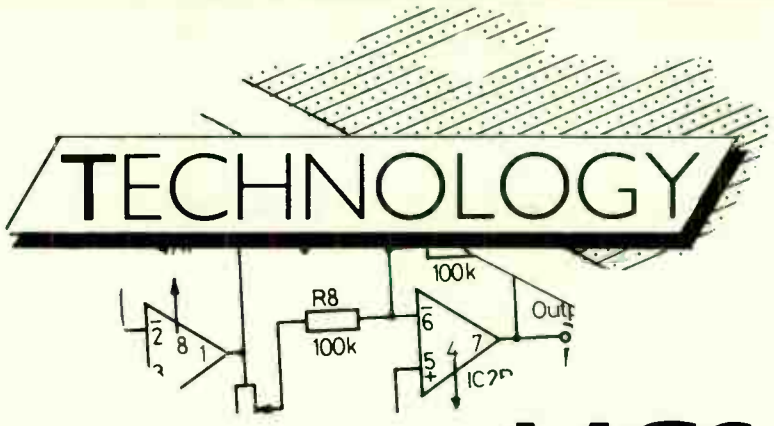


Powertran MCS1

Part 4: Testing, Testing

If you're buying an MCS in kit form, you'll need to know how to test it to make sure your unit's working as it should do once it's built. Here's how to do just that. *Tim Orr*

Now that the previous articles in this series have convinced you that the MCS1 is perhaps the greatest technological advance in musical history and you've built one from a kit, the last thing you want is for the unit to work incorrectly or, Heaven forbid, not at all.

But first things first. Make sure you inspect all the PCBs thoroughly, checking that all the components are in their correct places, that all joints are properly soldered, and that there are no open or short circuits caused by solder splashes, for example. The experienced constructors amongst you will probably undertake all these tasks as a matter of course anyway, but it's worth remembering that these all-too-common faults are easier to spot at the inspection stage prior to final assembly.

Whatever you do, don't fit the ICs yet. Make the wire connections between the PCBs and clean the solder connections: the MCS1 is best tested outside its box, as shown in Figure 1.

Powering Up

With no socketed ICs fitted, power up the unit. Be on your guard for smoke, small fires and minor explosions. Yes, I know it sounds alarmist, but the chances of a power supply smoothing capacitor that's been fitted back to front blowing up in front of you are unsettlingly high.

Using a digital voltmeter or a scope, test the power supply rails for their correct operating values, which are as follows. Unregulated inputs for the IC115 and 116 are +21V and −21V respectively, while that for IC117, 226 and 322 is +8.7V. Ripple (on load) for unregulated rails should be 300mVpp for IC115 & 116 and 700mVpp for IC117, 226 and 322. Current consumption on load should be 150mA for 12V rails and 1.8A for the 5V one, while other voltage regulators worth checking out are IC100, 306, 419 and 420.

In their present condition, the voltage regulators shouldn't even be warm: shorts across the rails don't usually destroy these regulators, as they incorporate their own thermal shutdown mechanism.

Next, turn the power off, fit all the op-amps and retest the ±12V rails, having already turned the power back on, of course. Turn it off again, and insert the logic chips in lots of ten at a time. Retest the 5V rails and continue this procedure until all the ICs have been inserted.

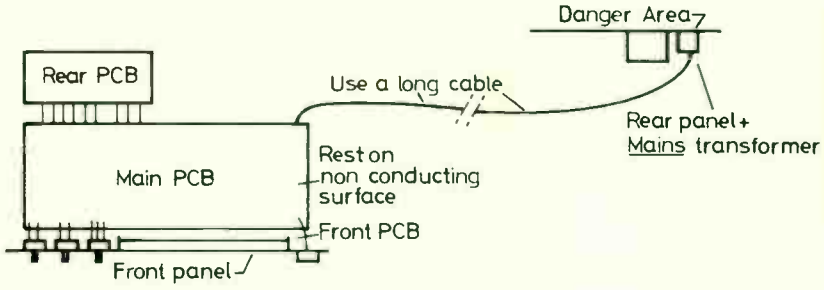
Your MCS1 is now fully powered and should operate without generating too much in the way of heat. The voltage regulators (with heatsinks), the microprocessor and the PSU power diodes may well be warm or even hot, but most of the remaining components should be only slightly warm. Retest the power supply rails: this is *vital* for the simple reason that the MCS1's electronics will not operate unless the power supply rails are as they should be.

The machine should now be capable of a safe power-up, and if everything else is OK, your MCS1 will operate first time. One encouraging sign of intelligent life is the processor going through a start-up sequence, during which it flashes all the display LEDs on the MCS1's front panel. If by some unlucky chance this doesn't happen on power-up, you've hit trouble, and a further visual inspection is called for. Typical faults are inter-track short circuits, ICs not being where they should be or fitted backwards, IC pins being folded over underneath the chip instead of going into the IC sockets, non-soldered pins, broken tracks, all the LEDs being inserted backwards or the displays being installed upside down. And if you think some of these eventualities are unlikely – not to say mildly amusing – don't laugh until you're *sure* you haven't made any of them yourself: it's very easy to do.

Now, even if your unit seems to come to life straight away on first power-up, it's still advisable to test everything. Thoroughly.

Using a DVM or a scope, test for correct power on all the ICs: refer to the power pin chart shown.

Figure 1. MCS1 Test layout.



Microprocessor System

Ideally, it's this section that should be tested first. If you're working with an oscilloscope, things won't be quite as easy as you'd probably like, but there are a few simple tests you can employ to locate faults, most of which involve connecting the scope to an IC pin or two and having a look-see at the results.

Have a look initially at pins 38 and 39 on IC309, the crystal oscillator. Figure 2 illustrates its correct operation, while Figure 3 does the same for the E signal on pin 37.

The data and address buses should all be busy for normal operation. Note that the data bus is buffered by IC321. Both the reset signal and the IRQ should be high. One thing that mustn't escape your attention is to look out for illegal logic levels on the data and address buses. Levels of between 1V and 1.5V are generally a sign that something is amiss – a bus clash caused by a short between two logic signals, for instance.

Next, check out the CE signal on the EPROM (IC308, pin 20). This should be relatively active, indicating that the software is running. ICs 310 to 312 generate a range of address codes, many of which are continually active, so if a particular machine function doesn't operate, it may well be the result of a decoder fault.

Now we come to the MIDI keyboard side of things. If nothing happens when you play a note on the keyboard, it could be because the ▷

Power pin chart.

	0v	+5v	+12v	−12v
6N138	5	8	–	–
MM5450	1	20	–	–
4066B	7	14	–	–
4046B	8	16	–	–
LF398	–	–	1	4
LM311	–	–	8	4
TL081CP	–	–	7	4
RC4558	–	–	8	4
MF4-50	4(−5V)	7	–	–
LM339	12	3	–	–
DAC0800	–	–	13	3
ROM (IC112)	8	16	–	–
HM4864* (DRAM)	16	8	–	–
HM6116**	14	26,28	–	–
2764	14	1,26, 27,28	–	–
6802	1, 21	8	–	–
6850	1	12	–	–
2502	8	16	–	–
DAC88	–	–	18	13
DG211	5	12	13	4
74LS00	7	14	–	–
74LS04	7	14	–	–
74LS08	7	14	–	–
74LS32	7	14	–	–
74LS74	7	14	–	–
74LS86	7	14	–	–
74LS122	7	14	–	–
74LS125	7	14	–	–
74LS138	8	16	–	–
74LS161	8	16	–	–
74LS169	8	16	–	–
74LS244	10	20	–	–
74LS245	10	20	–	–
74LS374	10	20	–	–
74LS393	7	14	–	–
74LS625	1,9	10,16	–	–
74LS685	10	20	–	–

*Note: reverse of normal convention.
**Based on 28-pin layout.

keyboard itself is not being scanned. Have a look at IC315: the Q output pins generate active low row scans. Take a look also at the KBI signal, which clocks the latch. One device certainly worthy of your attention in this department is IC316, the tristate buffer. Check its A inputs first of all, then look at pin 2 and check that switches 1, 5, 9, 13, 17 and 21 all pull this point low when pressed (low is only 0.8V in this case). Don't forget to test the other three column pins, too, and look for the KBO signal.

IC324 is used to divide the 1MHz clock signal by two, and pin 5 should be a 500kHz square wave – look for this signal at IC325, pin 8. Note that the M/S signal must be low for normal operation.

Finally, test the MIDI opto-isolator by injecting either a MIDI or a TTL signal into SKT300. This signal should be repeated at IC327, pin 6, and just in case you're stuck for a source of the latter kind, Figure 4 shows a simple circuit for a DIY TTL drive simulator.

Onward ever onward, in this case to the MCS1's spin-wheel controller. Have a look at IC317, pins 13 and 14: the two outputs should be 90° out of phase with each other when the controller is spun. Now spin the wheel in the other direction and check the phase reversal.

Figure 2.

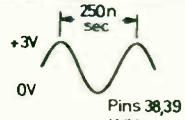


Figure 3.

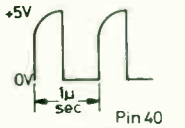


Figure 4. DIY TTL drive simulator.

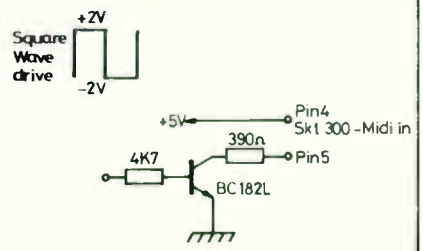


Figure 5.

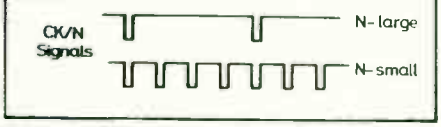


Figure 6.

Figure 7.

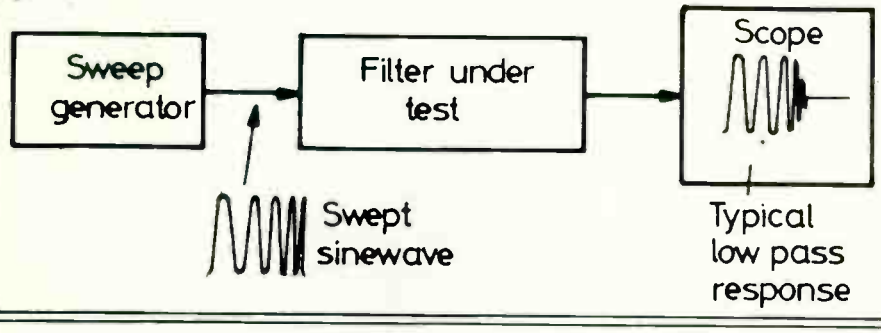


Figure 8(a).

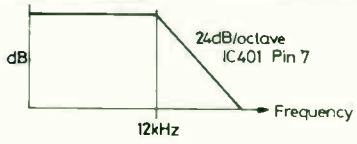
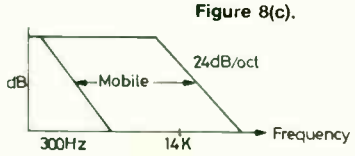


Figure 8(b).

Figure 8(c).



Moving to the audio trigger, you should inject a high-level signal into the audio input and take a look at IC317, pins 1 and 2: you should see a TTL signal of the same frequency as the audio one. Check to see that ICs 318 and 319 are cleared regularly by the CLINT signal.

Lastly in this section, we come to the LED display. Each time a controller function is altered, the display should be updated: check that the CKDIS signal is active at IC304, pin 21.

Panel Controls

Just because a component is in full view of everybody and not tucked away inside the MCS1's box, doesn't mean to say it shouldn't be checked for correct operation. This is really quite a straightforward procedure, and I'll run through each control in turn.

To kick things off, press the Delay Line and Voice Mode switches: the LEDs should follow the switch selections. In Delay Line mode, the Freeze and Click Track should both have an independent toggle action. Select Sample Speed – the display can now be varied *via* the controller. Now select RAM Size and try out the Coarse, Medium and Fine sensitivities; the Bypass has a toggle action.

Press Record in Voice Mode. The LED will flash until the system receives an audio trigger, and it will then remain on until the MCS1's maximum recording time has been exhausted. Once this has happened, the Play LED should illuminate if Play is pressed or if an external gate signal occurs. Once again, the Gate Trig and MIDI CV switches both have independent toggle actions – make sure yours have.

The Pitch Shift is a controller function, and since only one controller function can be selected at a time, the currently selected function takes over from that previously in operation. Loop Start and Loop Length are two further examples of controller functions.

It probably won't have escaped your attention that the MCS1's alphanumeric display is four digits long, while some parameters (such as memory address) are actually five digits in length. In these instances, the display simply loses the last digit, so that a memory address of 65535 (the maximum, incidentally) is represented on the front panel as simply 6553.

Moving back to the controller functions, Filter Shift, Sweep Range and Sweep Speed are all examples of these, with display ranges of 0–12, 0–100, and 1–100 respectively. Finally, both the Sweep On/Off and NR (noise reduction) switches are intended to have toggle actions.

Back to the Hardware . . .

. . . and the master clock generator (IC101), to be precise. Adjust C104 for an oscillation frequency of 2–5MHz, and have a look at pin 14 (C104 will be aligned later), making certain that the M/S signal is low. The next step is to follow the CK signal through to IC109, pin 2, and then on to the same pin of ICs 102, 103 and 104: this is the CK/N generator circuit. If you select Sample Speed mode, you'll be able to vary the value of N *via* the spin-wheel controller. Have a look at the CK/N signal (IC104, pin 9) and vary the value of N: Figure 5 shows what effect this variation should have. It's worth noting that this circuit should work fine at frequencies of up to 13MHz, but that above this speed, delays in the counters will cause the divide-by-N circuit to crash . . . Fortunately, normal MCS1 operation avoids going this high.

Let's turn our attention to the timing generator circuit, ICs 110–112. Sync from A4 (IC112, pin 14), and check that all the timing signals are as shown in the timing diagram reproduced

in E&MM December 83. Note that if N is large, all 32 portions of ROM are used as a result of extra refresh periods. As N is reduced, the extended refresh is curtailed.

Now for the software sweep. Set the Sweep Range and Sweep Speed to 100 and activate the Sweep On/Off function. Take a look at IC120, pin 7, and you should see a crunchy sinewave, but a filtered sinewave should be produced at pin 1 (Figure 6 illustrates the difference between these two). Try various Range and Speed settings. CKCV clocks the latch that stores the sinewave data that feeds the DAC (*very poetic – **Ed***).

The log converter circuit (IC121, T100, and T101) converts the input from a one-volt-per-octave keyboard into a log control voltage capable of controlling the master clock generator's frequency (see later for alignment notes on this). DC test points are at pins 1 and 3 of IC121, and should both be −0.6V.

To test the memory address counter (ICs 207, 208, 210 and 211) select the highest sampling speed and the largest RAM size possible. Once you've gone into Delay Line mode, the CK/N signal should be the same as the ACK signal, and the counters will all count up. Look at MA0 throught to MA15, a 16-stage binary counter.

The end and return address circuits are best tested by recording a sound in Voice mode. You may decide to record something along the lines of the classic phrase 'One, Two, Testing' – then again, you may not. Once you've recorded your speech, set the Loop Length to 0 and the Loop Start to 6553. Press Play and your words will be replayed as if by magic (or something).

Try taking the Loop Start value from 6553 down to 0 – less of the speech will be heard each time Play is activated. Now increase the Loop Length with Loop Start set at 6553 – a loop of increasing length should be audible. Lastly, try the effect of implementing Fine, Medium and Coarse sensitivities.

The 16-bit words generated by the two looping functions are held in latches. The Loop Start (end address) is held in IC200 and 202, which form one 16-bit input for the address comparator, IC201/3. Varying the Loop Start point obviously varies the data held in these latches. The Loop Length function is a computed return address, so that the end address minus the Loop Length equals the return address: this is held in IC206, 209. When the end address is reached, the counters are loaded with the return address. Varying the Loop Length alters the data held at the Q outputs of IC206, 209.

Buffers IC212 and 213 multiplex the memory address into DRAMs. Check the control signals LAE and MAE: again, refer to the timing diagram. IC224 is the refresh counter, so check CKRA and RAE against the timing diagram, too.

ICs 214 to 221 are the DRAM memory. To test this, go into Delay Line mode and inject an audio signal: look for multiplexed memory addresses on A0–A7 on the DRAMs. The data inputs (DIN) are driven directly from the ADC – check to see that they are all busy.

The data outputs are usually tristate, but are occasionally active. Check the RAS, CAS and WE signals against the timing diagram. Pressing Freeze at this point should result in the WE signal going high, preventing any further writes into the memory from taking place. The external Freeze at the rear of the MCS1 should have a similar effect.

Our last port of call for this section is the unit's built-in Click Track. To test the operation of this, set RAM Size to maximum and select Click Track. The click signal itself is generated at pin 1 of IC227: switch the Click Track off and T100 should sort out the signal.

Audio Section

If you have access to a sinewave sweep generator, the MCS1's active filter responses can be analysed very quickly, as Figure 7 shows.

The first thing to do is to inject an input signal into the MCS1. Test sensitivity selector SW400 by looking at pins 1 and 7 of IC400 – the signal should be unfiltered. However, as we saw in E&MM December, the MCS1 incorporates several filter stages, and some of these are illustrated in Figure 8. Pin 7 of IC401 is a 12kHz four-pole lowpass response (a), pin 8 of IC403 is a 12kHz elliptic response with a notch at 24kHz (b), while IC403 is the mobile filter as a whole (c). If the phase-locked loop is working, a filtered output should be visible at pin 5. Look at pin 2 to see the MFCK signal – this is a square wave with a frequency range of 15kHz to 700kHz, and the break frequency in Figure 8(c) is MFCK divided by 50. Varying the Filter Shift should move the break frequency of the mobile filter over a ±1 octave range. Maximum signal output level is 8Vpp. IC404, pin 1 is another 12kHz lowpass response, incidentally.

Set the Filter Shift to 12 and select the high sampling rate: the MCS1's audio bandwidth is now at its maximum. Take at look at IC404, pin 7, the noise reduction (pre-emphasis) circuit. With NR on, the circuit adds a treble lift to the signal. Beware of clipping when testing this circuit, and use a 3Vpp signal.

To test the MCS1's sample & hold device (IC405), inject a 1kHz sinewave, vary the Sample Rate control, then take a look at pin 5. Figure 9 gives some idea of the sort of waveshapes you can expect to see.

The next checkpoint is IC408, where pins 9 and 10 generate two signals (ADCK and SC) that must be checked against the timing diagram.

The ADC performs eight tests, going from the MSB to the LSB, and these data bits can be seen stabilising as the analogue-to-digital conversion proceeds, if you know where to look. I'll give you a clue – it's IC409, pins 2 to 9.

Moving logically from the ADC to the DAC, the latter can be tested by following this procedure. Select Delay Line mode, set RAM Size to 0, Freeze and Sweep off, and select the highest sampling speed. Use a 1kHz sinewave input. This signal should be converted by the ADC into binary code, which is stored in memory and subsequently converted back into an analogue signal by the DAC, ICs 412 to 414. Have a look at pin 6 of IC414, then at pin 7 of IC415 – Figure 10 shows two typical outputs. In fact, the DAC's output is further filtered by the mobile filter IC421 and fixed lowpass filter IC422 (pin 7) in turn.

Now have a look at IC422, pin 1. This is the de-emphasis circuit, and as already implied, can be used to make a sound appear bright simply by recording it with noise reduction switched in and playing it back with NR switched out, so that you're recording with a treble lift and playing back with a flat response.

Turning now to the Mute circuit, this is made up of IC424, T402 and 403. Select Voice mode, record a tone and then Play it. When the Play switch is released, the output signal is attenuated by about 90dB and is effectively off (Figure 11).

Our last place of interest on this whistle-stop audio section tour takes us back to the MCS1's front panel. Go into Delay Line mode, set the Pan control to centre and input a microphone signal: the MCS1's output will be a direct signal with echo. Press the Bypass switch, and the echo should disappear, leaving just the direct signal.

To check that the Click Track is working as it should be, select maximum memory size and activate the click signal. Assuming the metronome is now audible, you're free to lower the memory size, at which point a corresponding shortfall in the Click Track sequence's audibility will take place.

The phase locked loop is made up of ICs 410, 416, 417 and 418. If you select Filter Shift and vary it from 0 to 12, this will alter the division number loaded into IC417 by IC416. Sync from the CK/N input, pin 14 of IC418: pin 3 should be a square wave at the same frequency, while pin 4 will be a square wave with a frequency of CK/N × the PLL division ratio. To check this out, look at pin 4 and alter the Filter shift value.

The PLL is designed to limit at about 700kHz, whereupon it is no longer in lock.

Alignment Procedure

Anti-oscillation (P401)

Select Delay Line mode. Use a short memory length and turn the Repeat control up to maximum. Adjust P401 so that echoes are not *quite* self-sustaining. Experiment with other Filter Shift values, different Sample Speeds and with NR on and off. Readjust P401 so that it's as stable as possible with all configurations.

PLL SOT Capacitor (C449)

As already mentioned, the maximum frequency of the PLL is typically 700kHz. Set the Filter Shift to 12 and the Sample Speed to maximum. If the MFCK frequency exceeds 1MHz, add extra capacitor C449 (22pF) to reduce said frequency. However, this is not considered a very likely eventuality . . .

Sample & Hold DC Offset (P400)

The sample & hold device (IC405) has a DC offset that varies with the sample frequency. If recording with a frequency sweep is undertaken, this effect can move the quiescent DC offset past quantisation levels, and this process often generates small puffs of noise as it happens.

The solution? Select Delay Line mode with no audio input, no NR, and a short delay time. Look at IC414 pin 6 and listen to the delayed audio output. Vary P400, and you'll notice that as you do so, the sample & hold DC offset moves and the above-mentioned aural effects make themselves apparent. Adjust P400 for the most quiet position, which should be equidistant between two quantisation levels. Turn on the Sweep and select a 1Hz full-range sinewave. If this causes some further noise generation, readjust P400 accordingly.

Log Converter (P100, 101, 102 & C104)

This circuit has already been discussed and enables an analogue synthesiser to control the pitch of the MCS1's sound output. The normal control range is two octaves, but the MCS1 can add a further five octaves of pitch transposition *via* its CK/N divider circuit. Unfortunately, the log converter is not the easiest device in the world to set up, but the best method is described below and outlined in Figure 12.

First off, select CV Mode: this allows external voltage control of the master clock generator, IC101. Turn off the Sweep.

Our first job is to determine the voltage/transfer frequency function of the VCO (IC101). Figure 13 shows a typical graph for this function, but obviously the exact plot will vary from unit to unit, which is why your MCS1 came with a blank graph pad (don't tell me you used it as a bin-liner by mistake . . .). In order to plot your own function, adopt the following procedure. Measure the control voltage at IC108, pin 1, against the output frequency at pin 14 of IC101. Adjust P101 and P102 so that the external CV can move the voltage at IC108 fully over the 0V to +5V range. Set this voltage

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Figure 9.

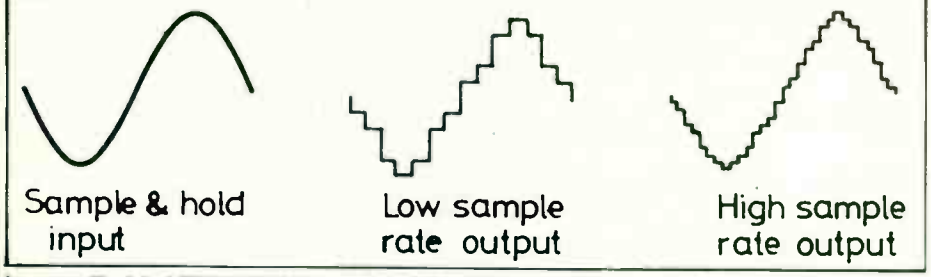


Figure 10.

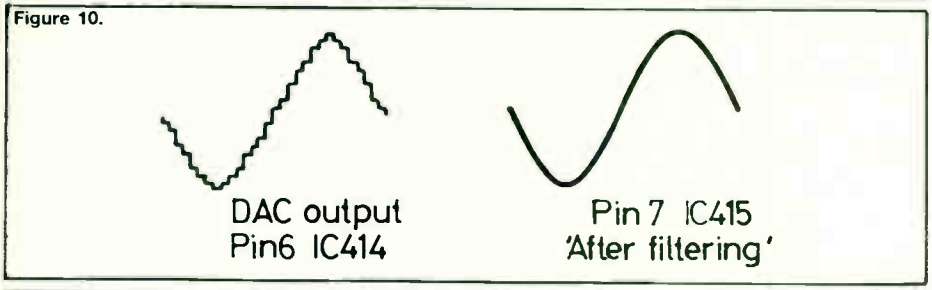


Figure 11.

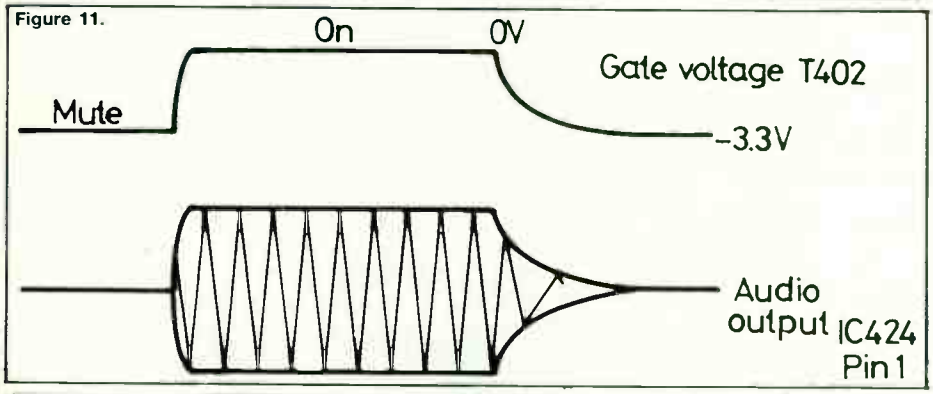


Figure 12. Typical log converter test set-up.

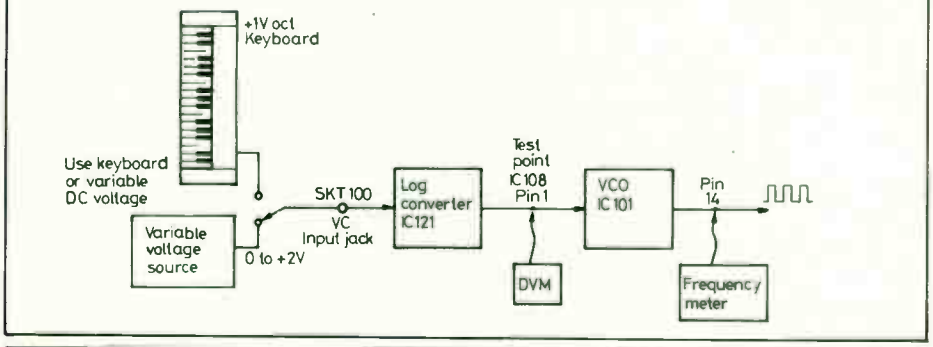
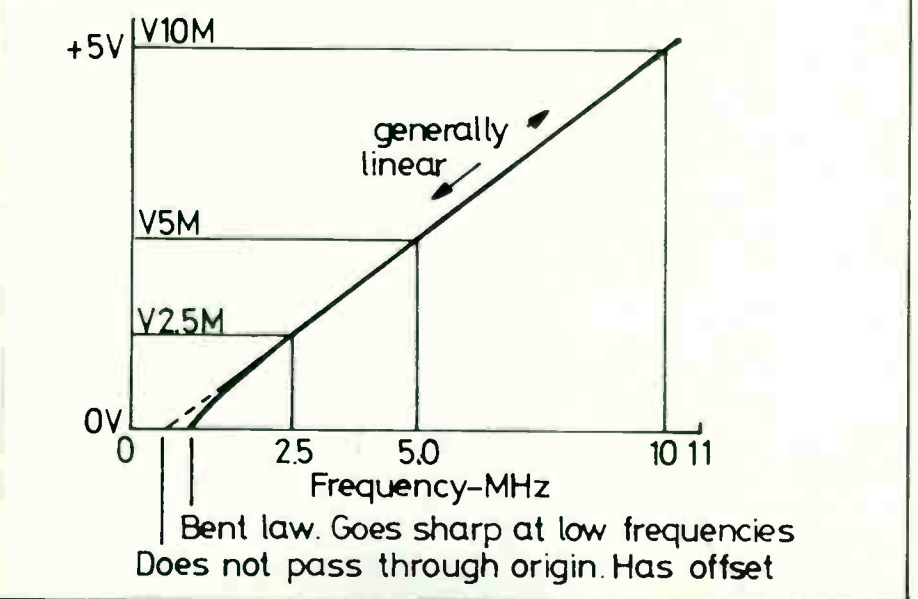


Figure 13. IC101 voltage/frequency transfer function.



▷ up to be +5V, and adjust C104 for an output at 11MHz. Now plot the transfer function on the graph pad, using 0.5V steps going from 0V to +5V.

Measure the voltages needed to generate frequencies of 10MHz, 5MHz and 2.5MHz (otherwise known as V10M, V5M, and V2.5M respectively). This is the two-octave range over which the MCS1 will operate in CV mode.

P100 is the volts/octave preset that adjusts the tuning of the keyboard voltage span. Log transistor T100 *must* generate a current that doubles for every volt increase in the input control voltage.

The next step is to cut the link between T100 and IC121 and insert a current meter to bridge the gap. Set the meter to a 0–2000μA range. For an input of 0V, set P101 to give an approximate current reading of 75μA and P100 to a central position. Make a note of the measured currents for input voltages of 0V, +1V, +2V (those CVs will generate the required two-octave swing). In order for everything to work properly, the current levels must form a ratio of 1:2:4, or in other words, a musical log law of an octave increase per volt. If the ratio is less than two per volt, rotate P100 clockwise; if it's more, rotate it anti-clockwise. Continue to adjust P100 in this way until the ratio is exactly 2.00: typical final currents should be in the order of 75, 150, and 300μA. Once these levels have been attained, it makes sense to increase the chances of P100 remaining in its proper position by daubing it with something indelible and instantly recognisable – a blob of Tipp-Ex fluid should do the trick. Once that's done, you can remove the current meter and solder the link back into position.

However, that's not the end of the procedure, because the log bias preset, P101, must also be aligned for this aspect of the MCS1's performance to be properly exploited. Using Figure 13 in conjunction with your own function plot, subtract V2.5M from V10M to give you the voltage needed for a two-octave shift (we'll give it the theoretical value of V2oct). Once this has been calculated, apply two external voltages, one of 0V and one of +2V. Adjust P101 so that the *voltage change* at pin 1 of IC108 is equal to V2oct for the input two-volt change. Clockwise rotation of P101 increases the size of the voltage change, anti-clockwise rotation decreases it. Beware of the fact that P102 may also have to be adjusted during this process so as to maintain the DC position on the graph.

Once you've calibrated P101, set the external control voltage to 0V and adjust the linear offset correction (*via* P101) to give a measured voltage at IC108's pin 1 of V2.5M. If you now apply an external CV of +2V, this voltage measurement should change to V10M.

If, by some miracle, this is precisely what happens, then both P101 and P102 are aligned, and the Tipp-Ex must be brought into action again. The log converter is now working and full aligned.

Just to make sure the theory works out in practice, try sampling a pitched sound (in Voice mode) and replaying it *via* a one-volt-per-octave keyboard in CV mode. Don't forget to make the Gate connections between synth and MCS1: the latter's gate-on is +2V or more, while gate-off is 0V or negative (the Play LED illuminates when the former condition is prevalent).

The recorded sound can now be played and pitched over a two-octave range, and pitch transposed over a five-octave range *via* the Pitch Shift function. However, as I mentioned in December, the tuning in this mode is not entirely perfect, due mainly to the bent VCO transfer function. If you have the option of using the now almost ubiquitous MIDI as a control source, then do so – the results are undoubtedly superior. ■

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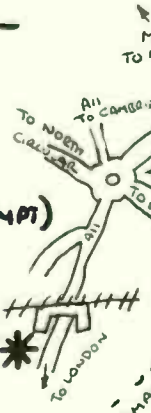

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SHORT CIRCUIT

A simple and inexpensive footpedal controller for the Roland SH101.

Steve Howell

This modification was originally designed for a pupil of mine who has a slight disability in that he doesn't have the full use of his right hand: he couldn't use the pitch-bender on the left-hand side of the SH101's keyboard effectively as most of his playing is done with his left hand. We toyed with the idea of modifying the optional 'poser's' grip controller and attaching it to the right of the synthesiser, but that proved to be fruitless, so instead we came up with the idea of a footpedal controller.

The design is simple. A nine-volt battery is routed *via* a potentiometer, the 'swing' being controlled by a variable footpedal normally used for wah-wah purposes. As the footpedal is moved, so varying degrees of DC voltage are applied to the VCO or VCF *via* the two pitch-bend sliders located above the bender lever. The footpedal plugs into the 3.5mm mini-jack socket that normally inputs the grip control, and the result is either pitch-bend (up *or* down with this design) or filter sweep the amount of which is regulated by the two sliders.

Construction is also simple. A Colour-sound Swell pedal was used for the prototype and rewired to accommodate the circuit in Figure 1. The value of the potentiometer is not critical, but a linear type must be used to ensure a really smooth sweep. Pressing the pedal down gives an upward pitch bend, but the circuit can be modified to produce down-ward sweeps. The jack socket is wired to turn the battery off when the lead is unplugged and not in use.

A second modification you might con-sider is to use a footswitch to introduce the LFO sinewave modulation normally obtained by pushing the bender forward. Any simple push-to-make footswitch will suffice (these are obtainable from many electronic stores) and the 2.5mm mini-jack socket is used to plug it into the SH101. Alternatively, you could use another rocker-type footpedal to fade the vibrato effect in, and the circuit for this is given in Figure 2.

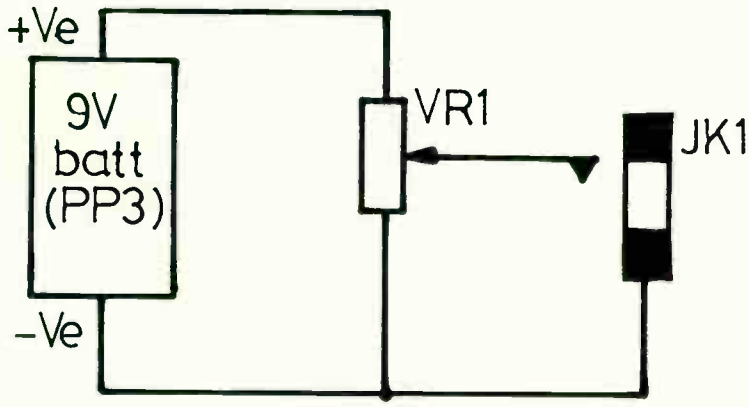

Figure 1. Circuit for pitch-bend.

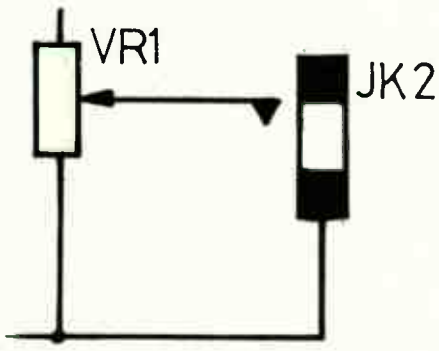

Figure 2. Circuit for introducing vibrato gradually.

It must be pointed out that when these two pedals are connected, you still have use of the bender lever and vibrato facility, so there's no reason why they shouldn't become a permanent part of the SH101. The extra flexibility they offer effectively gives you another hand to play either the controls or another keyboard. Together, the two pedals shouldn't cost more than £20, so it's actually cheaper than Roland's own grip controller and, to my mind, well worth the investment. The pedals could also be used with other synthesisers for similar purposes, as most synths have the facility to control the filter cutoff frequency with an external controller, but pitch-bending may require some modification to the synthesiser itself as not all synths have this facility.

Because of the simplicity of the circuit, it should be quite easy to come up with variations on the theme to provide other facilities (such as pitch-bend up *and* down), so don't be afraid to experiment. ■

If you've got a design of your own that you feel would be suitable for this column, send it to ***Short Circuit, E&MM, Alexander House, 1 Milton Road, Cambridge, CB4 1UY.***

Theremin Continued

Short Circuit didn't exactly get off to the most auspicious of starts in E&MM November, when our theremin circuit was published minus a parts list. Those responsible have been given free membership to the British Sub-Aqua Canoe Club, while the values are shown below for all you budding, er, thereminists . . .

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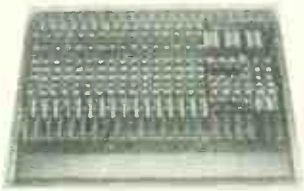

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BACK TO BASICS

Or everything you always wanted to know about synthesisers but were afraid to ask. If you're new to the world of electronic music, this new series is for you. *Steve Howell*

So there you are, listening to the radio, watching *Top of the Pops* (more fool you!), and all the while being exposed to a mysterious musical instrument that seems to be the key to fame, fortune, nubile women, large amounts of smoking substances of dubious legality, and the opportunity to do no more real work for the rest of your life. Further enquiries yield the following information: the instrument in question is the synthesiser.

The Roland SH101 – one of the most popular beginner's synths ever produced.

Once you've learned how to pronounce it, you make haste to your local music store, cash in hand (the bank manager is friendly), and on entering are confronted with a bewildering array of hi-tech machinery that seems about as easy to get to know as a Yugoslav railway timetable. Worse, the equipment possesses a unique terminology so complex that it could easily pass for an ancient ritualistic version of Serbo Croat.

Undeterred by all this, you hand over your money and walk out, the proud owner of one of these said instruments. You take it home, remove the machine's attendant polystyrene packaging (good for lining cat litters, this), and discover to your horror that even connecting the synth to the mains poses problems.

In search of help, you make a quick sortie on the local newsagent, whereupon you discover a smart, colourful and neatly-packaged periodical by the name of *Guitarist*. There are no synthesisers in it, so you put it back, picking up in its place the January issue of *Electronics & Music Maker* which, to your complete and un-precedented astonishment, contains the first in a series on how to get your synthesiser working. In the beginning, from the ground up, and for the complete novice.

The Theory

It's pretty obvious that if you want to get the most out of any musical instrument, you need to know as much about it as possible. This is especially true of synthesisers, as not only do you have to get your musical ideas into shape (can't help much with them, I'm afraid), you also need to be at least reasonably familiar with your model's technical operation.

Don't panic. This isn't nearly as difficult as it might appear at first, and will not require a degree in quantum astrophysics: the rules, such as they are, are actually quite straightforward.

Now for the boring bit.

Contrary to semi-popular belief, synthesisers have been with us for rather a long time – it could even be argued that they date back to the simple keyboard instruments of the Middle Ages – experimentation with electronic sound beginning at the turn of the century with such instruments as the Telharmonium and the Ondes Martenot. These were impressive machines that incorporated valves the size of large lightbulbs and allowed some quite intriguing creative projects to be realised, but further progress was lamentably slow: even in the fifties, composers such as Varèse and Stockhausen were messing about (academics call it 'experimenting') with sound generators and tone controls of an extremely basic nature.

It wasn't until the mid-sixties that a gentleman by the name of Robert Moog (pronounced as in Vogue, by the way) produced the first instrument we'd recognise today as a synthesiser. He succeeded in assembling a complete synthesiser system comprising the basic building blocks of sound, and these could be linked together (the process is often referred to as 'patching') in an almost infinite variety of permutations.

The major difference between Moog's

The Prophet 5 – analogue synthesis applied to a polyphonic instrument. Programmable memories made it an overnight success.

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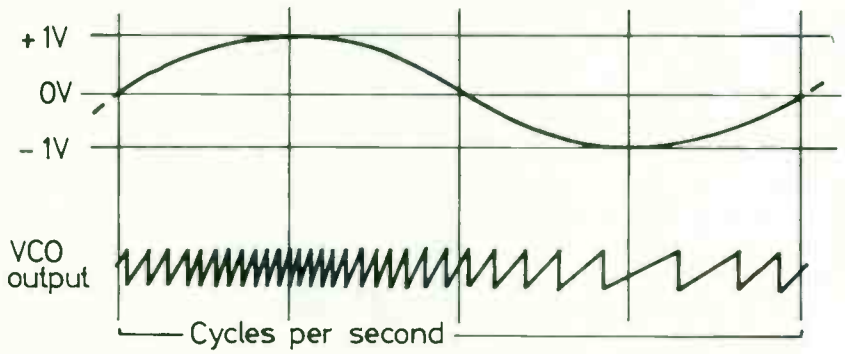

Figure 1. The effect of applying a slowly rising and falling voltage to the input of a VCO.

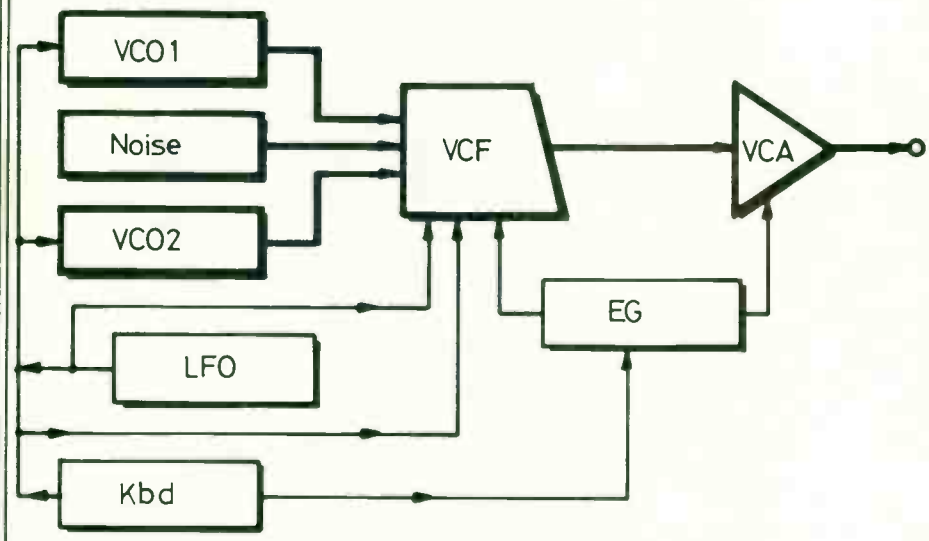

Figure 2. Typical analogue synthesiser layout.

work and those of competing designers was his rationalisation of the way in which these synth modules could be connected and manipulated. His theories were based around a system known as 'voltage control', and this principle has, as it turns out, formed the basis of almost all analogue synthesisers ever since.

The principle is based on the theory that applying a voltage to any voltage-controlled unit will have some sort of effect on that unit. In other words, if you apply a rising and falling voltage to the voltage control input of an oscillator, the pitch of that oscillator will rise and fall accordingly (and for those for whom even a thousand words cannot convey an image accurately, this action is shown in Figure 1).

Figure 2, meanwhile, shows the basic layout of a typical synthesiser in the form of a block diagram. Boxes with a heavy outline show the path of the audio signal, while those with a lighter border indicate purely controlling modules. Turning our attention first of all to the audio signal, it's useful to remember that any sound is made up of three different components – pitch, tone and amplitude. An analogue synth allows you control of these parameters through its VCO, VCF and VCA sections, and the signal passes through these oscillators, filters and amplifiers in turn.

Voltage-controlled devices may have various controllers routed to them and in amongst these you should find a low frequency oscillator (LFO), an envelope generator or two, and of course the keyboard itself. Controllers generate voltages which are then applied to voltage-controlled modules, and, logically enough, the more VC modules that can be affected by each controller, the greater the sonic possibilities your synth will be capable of producing.

The Practice

If you've just bought your first synth, chances are it'll be of the analogue, monophonic variety – examples of this are the Roland SH series, Korg's MS10 and 20, and all the monosynths from the Yamaha and Moog stables, among others. All these instruments make use of the analogue synthesis principle I've just been discussing, as do a surprisingly large number of today's polyphonic synthesisers.

The major difference between mono and polysynths (as most of you are probably already aware) is that whereas the former only allow you to play one note at a time on the keyboard, polyphonic instruments allow you to play four or more. Obviously, in order to facilitate this, a polysynth has to have at least as many oscillators as it provides voices: some provide two oscillators for each voice in the interests of fattening the instrument's sonic output.

As it happens, analogue polysynths (even those that use digitally controlled sound generators and modifiers) don't differ all that greatly in method of operation from their monophonic counterparts: examples of such instruments are the Korg Polysix, Roland Jupiter series, and SCI's highly-successful Prophet models.

It's not beyond the realms of possibility that your first synth has rather more in the way of facilities than the 'typical' instrument shown in Figure 2. The standard VCA and VCF sound modifiers are often supplemented by onboard signal processors such as chorus, phase shifting and flanging units, while almost all synths have some form of pitch-bender to augment the pitch control already provided by the keyboard.

But whatever your newly-acquired synth has come equipped with, none of it is so mind-bogglingly complicated to prevent you from getting the most out of it. Or at least, it shouldn't be if you carry on reading *Back to Basics* . . . ■

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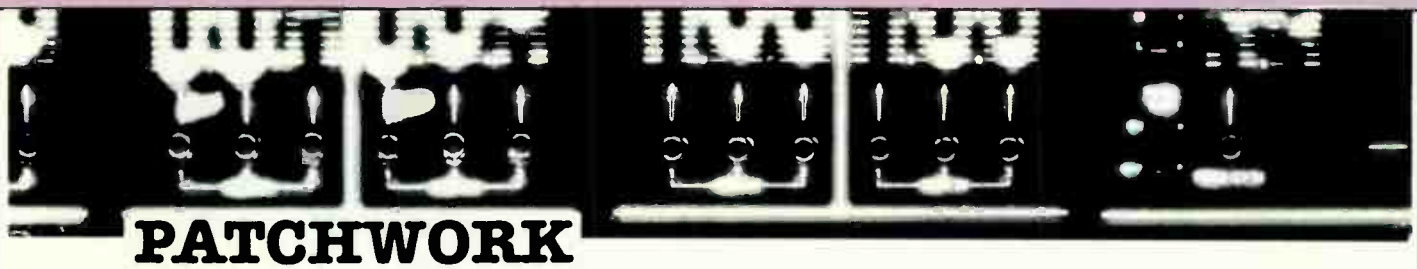


PATCHWORK

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.**

OSCar — 'Frankie Gets an OSCar' — Phil Mason, Cornwall

This sound makes good use of the OSCar's ability to combine an analogue-type waveform (Pulse Width Modulation on OSC1) with a digital one (preset waveform –7 on OSC2, selected by holding down the OSC2 waveform button and playing key –7, the F below middle C) with both sent through a dual resonant peak filter. Note that the bottom octave should be selected and that Filter Drive (programmed by holding down Store and turning the volume control to full) should be on maximum to provide harmonic distortion.

The actual keyboard pitch should ideally be bottom E, and the Repeat 1 and 2 setting of the Triggering Switch (together with the shown Tempo position) gives the rough speed of 'Relax'. If you turn the triggering switch to SG (single), any bass-line programmed into the sequencer can imitate bass guitar hammer-ons using the 'legato' facility: just play any 'hammered-on' notes that take your fancy in a legato phrase, and any 'plucked' notes staccato.

Adjusting the Frequency, Separation and Q controls varies the amplitude of the sound's 'synthetic' component, while adding noise will mix in an electronic snare.

KORG MONO/POLY — 'No Strings Attached' — Steve Clark, London

Korg's Mono/Poly is a welcome newcomer to *Patchwork*. Featuring four VCOs and an unusual (in both its concept and its sonic results) Effects section, the Mono/Poly can operate in either mono (unison) or four-voice poly mode, as its name implies.

Steve suggests using a chorus unit to enrich his Strings patch, whereupon the sound *should* closely resemble a CRB Diamond 709 string machine (remember them?) on full throttle.

VCO

	Waveform	Range	Level
VCO1		8	10
VCO2		8	10
VCO3		8	10
VCO4	PWM	8	10
PWM Intensity		7	
PWM Source		MG2	
PW Setting		–	

VCF

Cutoff	4¾
Resonance	1
EG Intensity	+3
Keyboard Track	10

VCF EG

Attack	0
Decay	6
Sustain	10
Release	1

Performance Controls

Bend Intensity	0
Mod Intensity	1
Switching	Pitch
MG1 (MG2) Frequency	2¾ (1)
MG1 Waveform	

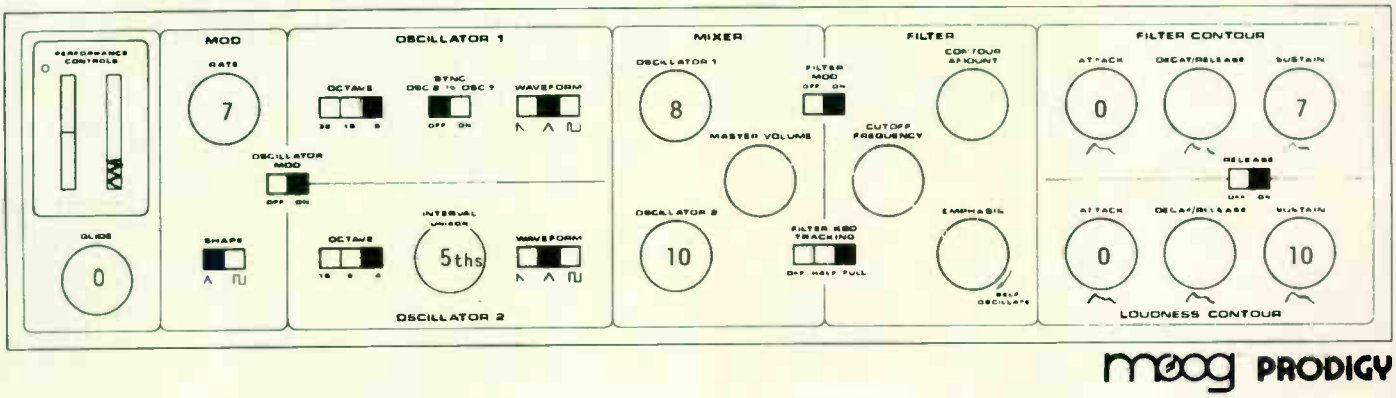
Effects

X-Mod	0
Frequency Mod	0
Switches	VCF/Sync/Single
Key Assign	Unison
(or Share with Effects off)	
Portamento	1
Detune	0
Transpose	Normal
Noise	0

MOOG PRODIGY — 'Hams Solo' — Ian Popperwell, Coventry

No, not a *Star Wars* sound effect. Ian has submitted a solo Hammond patch for the Prodigy which uses both oscillators set to triangle waveshapes, VCO2 being set an octave and a fifth above VCO1. The filter is set to remove the higher harmonics generated, the envelope has a sharp attack (for the well-known 'keyclick' sound), and the release time is designed to emulate a Hammond's distinctive envelope characteristics.

A fast staccato playing technique at the upper end of the keyboard adds to the patch's realism, while a touch of vibrato might not go amiss, either.



YAMAHA DX7 — 'Synth Full' — Martin Russ, Ipswich

Synth Full is a muted voice at low key velocities, but a strident, penetrating brass sound at higher ones. A sweep of high harmonics gives the same sort of aural effect as a filter decay, and a metallic edge toughens up the attack portion of the envelope.

The patch makes use of Algorithm 9: Operators 1 and 2 are set to give a variation on the classic FM sawtooth by having the modulator (OP2) frequency at just over half the carrier (OP1) frequency. This gives a bright sound with plenty of bunched harmonics. Operators 3, 4, 5 and 6 lack the sharp attack of 1 and 2, but supply instead the touch-sensitivity and overall tone. Operators 2 and 6 are deliberately mis-tuned to 1.01 – changing this to 1.00 reduces the beating in the upper octaves but also flattens the effect of the brassy-sounding filter decay.

Some players might feel the patch has too much release as it stands, but this can be reduced *via* EG rates 3 and 4 on OPs 1 and 3. The LFO speed is set to fill out the sound when the DX is used with an echo unit, while the LFO rate can be speeded up for vibrato effects. Finally, the touch-sensitivity helps create a highly expressive voice without users having to resort to a volume pedal.

YAMAHA DX7 VOICE DATA LIST

	ALGO-RITHM	FEED BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLI-TUDE	OP
	9	6	∿	34	33	0	0	OFF	1	0	6
										0	5
										0	4
										0	3
										0	2
										0	1
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

	POLY/MONO	PITCH BEND RANGE	PITCH BEND STEP	PORTAMENTO MODE	PORTAMENTO GLISSANDO	PORTAMENTO TIME

OP		OSCILLATOR MODE/SYNC	OSCILLATOR FREQ. COARSE	OSCILLATOR FREQ. FINE	OSCILLATOR DETUNE	EG RATE 1	EG RATE 2	EG RATE 3	EG RATE 4	EG LEVEL 1	EG LEVEL 2	EG LEVEL 3	EG LEVEL 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING CURVE L	KEYBOARD LEVEL SCALING CURVE R	KEYBOARD LEVEL SCALING DEPTH L	KEYBOARD LEVEL SCALING DEPTH R	KEYBOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1	PITCH EG RATE 2	PITCH EG RATE 3	PITCH EG RATE 4	PITCH EG LEVEL 1	PITCH EG LEVEL 2	PITCH EG LEVEL 3	PITCH EG LEVEL 4	KEY TRANSPOSE	VOICE NAME
6	R	ON	1	01	-7	66	27	10	8	99	90	82	0	B3	-LIN	-LIN	0	0	5	97	5									
5	R		2	00	0	30	25	14	5	99	90	88	0	A-1	-LIN	-LIN	0	0	6	86	4									
4	R		3	00	0	46	30	17	7	70	87	83	60	B3	-LIN	-LIN	0	0	4	94	4									
3	R		2	00	0	57	34	34	32	99	97	96	0	A-1	-LIN	-LIN	0	0	4	99	3									
2	R		1	01	0	78	25	9	12	99	90	87	0	B3	-LIN	-LIN	0	0	4	93	3									
1	R		2	00	0	57	22	32	32	99	97	94	0	A-1	-LIN	-LIN	0	0	4	99	3	94	67	95	60	50	50	50	50	C2	
			OSCILLATOR			EG								KEYBOARD LEVEL SCALING						OPERATOR		PITCH EG									

	MODULATION WHEEL RANGE	MODULATION WHEEL PITCH	MODULATION WHEEL AMPLI-TUDE	MODULATION WHEEL EG BIAS	FOOT CONTROL RANGE	FOOT CONTROL PITCH	FOOT CONTROL AMPLI-TUDE	FOOT CONTROL EG BIAS	BREATH CONTROL RANGE	BREATH CONTROL PITCH	BREATH CONTROL AMPLI-TUDE	BREATH CONTROL EG BIAS	AFTER TOUCH RANGE	AFTER TOUCH PITCH	AFTER TOUCH AMPLI-TUDE	AFTER TOUCH EG BIAS
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

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HELP US TO HELP YOU

THE E&MM READERSHIP SURVEY 1985

This is where E&MM's staff writers and contributors let go of the reins and give you, the long-suffering reader, a chance to have your say in the direction the magazine is taking. Fill in the questions below, send the completed form to us (a photocopy will do), and your comments will be taken into account as E&MM leaps into its fifth year.

If you're happy with the way things are, this is your opportunity to pat us all on the editorial back. If you aren't, now's the ideal time to air your grievances. And as an additional incentive, we're offering a year's subscription to E&MM to the first ten reply forms pulled out of the hat. Thanks in advance for your help.

PART ONE: YOUR EQUIPMENT

Below is a list of modern musical instruments. Please indicate which of these you play, stating the make and model on the line underneath each category.

Computer musical instrument ☐1

Digital polyphonic synthesiser ☐2

Analogue polyphonic synthesiser (MIDI) ☐3

Analogue polyphonic synthesiser (non-MIDI) ☐4

Monophonic synthesiser ☐5

Digital drum machine (MIDI) ☐6

Digital drum machine (non-MIDI) ☐7

Analogue drum machine ☐8

Digital sequencer (MIDI) ☐9

Digital sequencer (non-MIDI) ☐10

Analogue sequencer ☐11

Organ ☐12

Portable keyboard ☐13

Electric piano ☐14

Acoustic piano ☐15

Electronic drums ☐16

Acoustic drums ☐17

Electric guitar ☐18

Acoustic guitar ☐19

Bass guitar ☐20

Now a further list, this time for auxillary equipment. Follow the same procedure of ticking appropriate boxes and listing make and model on the lines provided.

Analogue delay line ☐21

Digital delay line ☐22

Reverb unit ☐23

Graphic or parametric EQ ☐24

Stand-alone effects pedals ☐25

Combo amp ☐26

PA rig ☐27

Microphones ☐28

PART TWO: YOUR MUSIC

Are you in a band? ☐29

Or do you play your music solo? ☐30

Do you play original compositions? ☐31

Or simply arrangements of existing material? ☐32

Do you gig on at least a fairly regular basis? ☐33

Do you record material in a studio? ☐34

If you do, is it at home? ☐35

Or at a commercially-run studio? ☐36

Would you class yourself as professional? ☐37

Semi-professional? ☐38

Or amateur? ☐39

If you could place your music in one or more of the categories listed below, which would it be?

Instrumental electronic music ☐40

Electro-pop ☐41

Electro-funk ☐42

Avant garde ☐43

Jazz/jazz rock ☐44

Progressive rock ☐45

Ethnic ☐46

New wave ☐47

Conventional pop ☐48

Classical ☐49

Euro rock ☐50

PART THREE: YOUR INTERESTS

Do you have an interest in electronics? ☐51
If you do, do you build your own electronic music devices? ☐52
Are any of these your own designs? ☐53
Do you buy kits or PCBs from E&MM? ☐54
Do you buy kits, PCBs or components from other sources in order to build E&MM projects? ☐55

Do you have an interest in computing? ☐56
If you do, do you have a home computer of your own? ☐57
(if yes, please specify make and model)

.....

Is your computer actively engaged in making music? ☐58
Is this music dependent entirely on the computer's internal sound chip? ☐59
Or does it involve external synthesis hardware? ☐60
Have you used any music software? ☐61
Have you written any music software of your own? ☐62

Does your daytime occupation involve music? ☐63
Or electronics? ☐64
Or computers? ☐65
Do you have any formal qualifications in music theory? ☐66
In music composition? ☐67
In music performance? ☐68
In electronic design? ☐69
Or in computing? ☐70

PART FOUR: YOUR VIEWS

In your answers to the questions below, tick the first box if you'd like to see more of the feature under discussion, the second if you think the present level of coverage is about right, and the third if you'd like to see less of it.

First, your views on E&MM's subdivisions.

	More coverage	Same coverage	Less coverage
News	☐71	☐72	☐73
Hardware	☐74	☐75	☐76
Music	☐77	☐78	☐79
Technology	☐80	☐81	☐82
Computer Musician	☐83	☐84	☐85

And now, your feelings on specific features.

	More coverage	Same coverage	Less coverage
Newsdesk	☐86	☐87	☐88
Interface	☐89	☐90	☐91
Synthesiser reviews	☐92	☐93	☐94
Portable keyboard reviews	☐95	☐96	☐97
Electronic percussion review	☐98	☐99	☐100
Effects reviews	☐101	☐102	☐103
Amplification reviews	☐104	☐105	☐106
Sequencer reviews	☐107	☐108	☐109
Accessory reviews	☐110	☐111	☐112
Artist interviews	☐113	☐114	☐115
On Record	☐116	☐117	☐118
On Cassette	☐119	☐120	☐121
On Stage	☐122	☐123	☐124
Build it! projects	☐125	☐126	☐127
Instructional articles	☐128	☐129	☐130
Computer hardware reviews	☐131	☐132	☐133
Computer software reviews	☐134	☐135	☐136
Computer music features	☐137	☐138	☐139

Do you look at all the advertisements within E&MM's pages? ☐140
Or just some of them? ☐141
Or none at all? ☐142

Which of the following publications do you also read regularly?

Melody Maker ☐143
Sounds ☐144
New Musical Express ☐145
International Musician ☐146
One Two Testing ☐147
Music UK ☐148
Electronic Soundmaker ☐149
Studio Sound ☐150
Sound Engineer ☐151
Home Studio Recording ☐152
Keyboard ☐153
What Keyboard? ☐154
Guitarist ☐155
Guitar Player ☐156

Do you also read any organ magazines? ☐157
Electronics monthlies? ☐158
Or computer magazines? ☐159
Do you buy E&MM every month? ☐160
More than six times a year? ☐161
Less than six times a year? ☐162
Do you obtain E&MM on subscription? ☐163
From a newsagent? ☐164
By borrowing it from a friend or library? ☐165
If you buy your copy, how many other people read it?
None ☐166
1–5 ☐167
More than 5 ☐168
What happens to your E&MM? Do you
keep it? ☐169
Pass it on? ☐170
Or throw it away? ☐171

PART FIVE: YOUR STATUS

Your sex:
Male ☐172
Female ☐173
Your age:
Under 18 ☐174
18–21 ☐175
22–25 ☐176
26–30 ☐177
31–35 ☐178
36–40 ☐179
Over 40 ☐180
Your occupation:
Professional musician ☐181
Studio engineer ☐182
Computer operator ☐183
Electronics engineer ☐184
Teacher ☐185
Civil servant ☐186
Manual labourer ☐187
Self-employed ☐188
Student ☐189
Other (please specify)

.....

Your annual income:
Less than £5000 ☐190
£5000–£8000 ☐191
£8000–£10,000 ☐192
£10,000–£20,000 ☐193
The average amount you spend on equipment to make music in a year:
Under £500 ☐194
£500–£750 ☐195
£750–£1000 ☐196
£1000–£2000 ☐197
£2000–£5000 ☐198
£5000–£10,000 ☐199
Over £10,000 ☐200

Please feel free to ignore this section and fill it in only if you wish your questionnaire to be included in the draw for ten free subscriptions to Electronics & Music Maker. All information given will be treated in the strictest confidence – and thank you once again for your co-operation.

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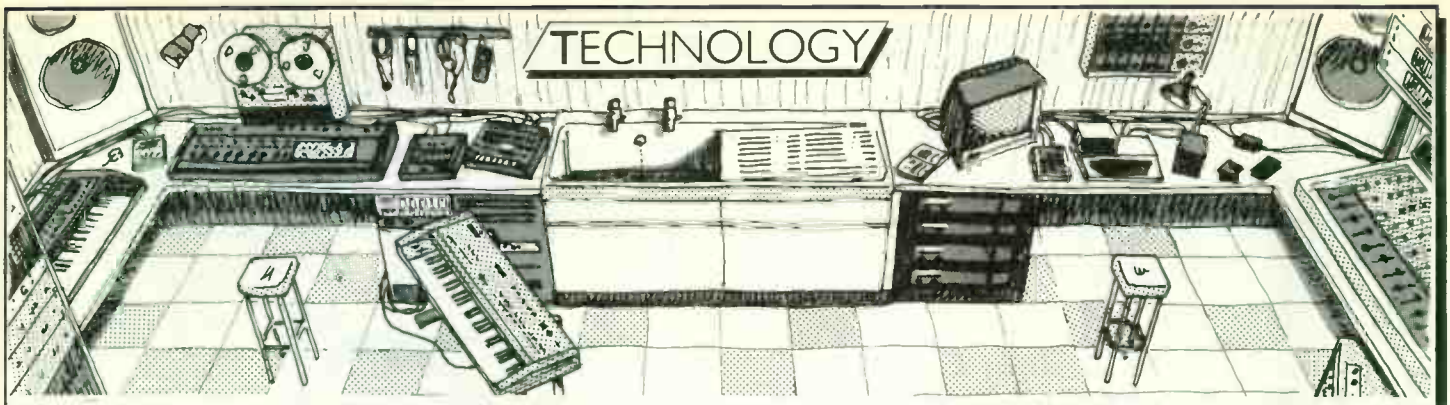

Everything but the Kitchen..

Or how to get the best from your electronic instruments by syncing them together. Part three looks at drum machines and sequencers. *Steve Howell*

Even if your synthesiser set-up is astonishingly basic, you must at some time or other have contemplated adding a sequencer. And what a good idea it is. Suzanne Cianni, American synthesist extraordinaire, feels the sequencer to be as important a piece of electronic music hardware as the filter or the voltage-controlled oscillator: I tend to agree with her. They are not, as many would have you believe, something to make up for deficiencies in playing technique. Instead they allow control over a synthesiser that would otherwise be impossible.

The sequencer's metronomic precision has a 'feel' all its own and whilst some may argue that this is cold and clinical, it remains a fact that some of the most technically-proficient synth and keyboard players employ sequencers and microcomposers in their music. And sequencers also allow someone who would otherwise be unable to realise his or her musical ideas to do so quite impressively, though having said that, owning a sequencer won't make your music a whole lot better overnight – if it's dull and boring it will remain dull and boring, sequencer or no sequencer. So, with reservations, sequencers are wonderful. The only real problems are the age-old ones of interfacing and synchronisation. Those of you who read last month's enthralling instalment will no doubt recall that while many synths operate under a standard control voltage law of one volt per octave, gate and trigger inputs and outputs don't always match up so readily.

Now, synths that feature one method of triggering cannot normally be used with sequencers employing a different method without a suitable interface, circuits for which were published last month. The other way round this problem is to use only compatible equipment, but this isn't always feasible, as you may wish to use the facilities provided by a sequencer not entirely compatible with your synth. Construction of these interfaces should present

TRIGGER OUTPUTS	TRIGGER INPUTS										
	ROLAND	ARP	MOOG	OBERHEIM	YAMAHA	LINN	EMU	HAMMOND	SCI	BOSS	KORG
ROLAND	S,M,C,PT	C,PT	C,PT(I)	X	M,S	PT	S	S	M,PT,C	PT,C	S,PT,C(I)
ARP	PT,C	PT,C	PT,C(I)	X	X	PT	X	X	PT,C	PT,C	PT,C(I)
MOOG	PT,C(I)	PT,C(I)	PT,C	X	X	PT(I)	X	X	PT,C(I)	PT,C(I)	PT,C(I)
OBERHEIM	X	PT	PT(I)	S,PT	S	X	X	X	PT,S	PT	PT(I)
YAMAHA	S,M	X	X	X	S,M	X	X	X	S	M	X
LINN	PT	PT	PT(I)	X	S	S	X	X	PT,S	PT	PT(I)
EMU	S,PT	PT	PI(I)	X	S	X	S	S	PT,S	PT	PT(I),S
HAMMOND	S	X	X	X	S	X	S	S	S	X	S
SCI	S,M	X	X	X	S,M	X	S	S	S,M	X	S
BOSS	PT,C	PT,C	PT,C(I)	X	X	X	X	X	PT,C	PT,C	PT,C(I)
KORG	S,PT,C(I)	PT,C(I)	PT,C(I)	X	S	X	S	S	S,PT,C(I)	PT,C(I)	PT,C,S

few if any difficulties and only costs a few quid, so the problem is not as serious as it seems.

Drum Machine

Having successfully connected sequencer to synthesiser, you now have the problem of interfacing sequencer to drum machine. Again, this procedure can be fraught with problems in the wake of manufacturers fitting their own interfacing systems.

Figures 1 and 2 show the internal layout of a typical sequencer and a typical drum machine respectively. They operate in a similar way in that the memory sections or both of them are stepped through by a clock of some form. It therefore follows that if you replace the clock in the sequencer, with the clock from the drum machine, you can control both units simultaneously and in perfect synchronisation. Well, that's the theory anyway!

If the drum machine's output isn't the same as the sequencer's, things may go drastically wrong. Let me explain . . .

In the good old days, when Cardiff City were in the First Division and things were a lot simpler than they are now, sequencers needed only one pulse to step through one note. And to oblige, drum machines used to output one pulse for each beat. Then one day Roland, in their infinite wisdom, decided that in order to improve the resolution of real-time sequencer programming they would use a system of 24 pulses for every note, and to this end devised their now famous five-pin DIN Sync socket. The pins carried the 24 pulses-per-beat clock output *and* a special start/stop pulse, effectively prohibiting any marriage between Sync-equipped hardware and earlier machines. Of course, it was a jolly good wheeze on Roland's part because people were more or less forced to buy their sequencers and microcomposers. In an attempt to follow suit, many drum machine manufacturers started incorporating this system into their products but, astonishing though it may seem, they couldn't even get that right and so we now have drum machines that output a variety of different clock time-bases:

24 pulses-per-beat – Roland, Hammond, Korg, E-mu Systems
48 pulses-per-beat – Linn
96 pulses-per-beat – Oberheim
Variable – Yamaha, Sequential Circuits

What this means in practice is that if you try to connect a Roland MC202 to a Linn it will run at twice its speed, while an Oberheim run off a Linn will run at half its speed. You follow?

To overcome this, you could try programming your sequencer at half or twice the normal speed (depending on the situation you find yourself in), though on purely musical grounds this isn't an altogether satisfactory solution.

An alternative is to invest in one of the several sync converters currently available (previous instalments in this series have already been through these, so I won't bore you by listing them all again), but seeing as some of these cost about the same as a decent programmable drum machine anyway, you've got to be pretty serious about your syncing before you invest in one.

Still, the advent of MIDI is a concrete indication that manufacturers are now willing to co-operate to some degree on this matter: in the meantime, things will just have to remain a little bit complicated. In an attempt to ease this complication, I've drawn up a table that sets out the sort of link-ups that *can* be achieved (albeit with a fair bit of customisation in many cases) and a list of 'commandments' which, if strictly adhered to, should make drum machine and sequencer syncing a lot less painful. ■

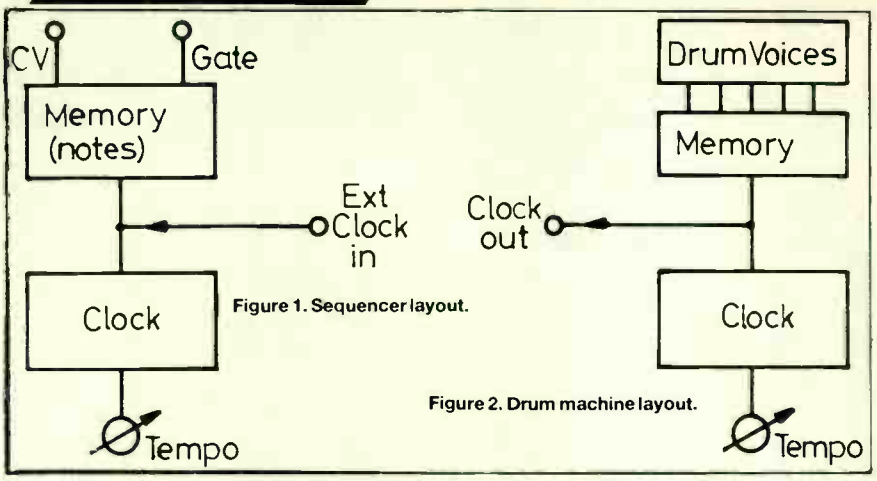

Figure 1. Sequencer layout.

Figure 2. Drum machine layout.

THE SIX SYNCING COMMANDMENTS

1 Thou shalt not try to connect equipment of opposing trigger type without the assistance of a suitable interface.
2 The DIN socket that is part of the Roland sync standard is not the same as that which represents the MIDI standard, nor can the two be considered compatible in any way, unless thou hast a Korg KMS30.
3 Thou shalt not use one pulse-per-beat hardware in conjunction with a device employing a multiple-beat system, unless the latter has an alternative trigger output.
4 The arpeggiators and auto-accompaniment sections fitted to domestic keyboards are not directly syncable to professional hardware, at least not without specialist – and very clever – customisation work.
5 The MPC Sync Track, though it be a wonderful device in many ways, cannot make machines of different trigger and clock systems instantly compatible.
6 Thou shalt not interface thy nine-foot Steinway concert grand with a Hammond B3 using MIDI, though who knoweth what the future may hold?

P · R · O · G · R · A · M S · D · S · 7

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COMPUTER MUSICIAN

There's a major row brewing on the music publishing scene at present, and it's all a result of the problems posed by trying to pigeon-hole new technology. Let's take an example: a new band called 'Deep Perforators' has penned a successful ditty ('Venus Returns') that's been immortalised in vinyl by a record company called Deep Records Ltd and turned into sheet music by a publishing company called Deep Music Ltd. Every time a copy of the 'Venus Returns' single is bought, a slice of the action goes in the direction of the group, another slice in the direction of Deep Records Ltd, a further slice to Deep Music Ltd, and a standard 10% to the Mechanical Copyright Protection Society, or MCPS for short. The MCPS looks after the interests of the composer, musician, or record company when the sound on a record is recorded onto a particular sort of medium – vinyl, tape, CD, film, video or whatever. But note the tag 'sound'.

Every time 'Venus Returns' is played over the air (assuming that enough freebies have been pushed in the direction of Radio 1 DJs *and* it's got past the BBC's obscenity squad), the Performing Rights Society (PRS for short) collects royalties which are distributed between the composer (in this instance the group, the creation of 'Venus Returns' being a democratic process), the publishing company (Deep Music Ltd), the arranger (the Trevor Horn lookalike), and the PRS itself ("for administration costs"). Fair enough.

But let's suppose you don't want to listen to 'Venus Returns' on the radio, or even purchase the single. Let's say, being of a more creative bent, you want to play the music from the sheet music score. So you go along to the aforementioned shop, part with a bob or three, and walk back to your home studio. As you start to think of ways and means of playing the music, bear in mind where that money will be going after subtraction of profit margins and the like – namely 50/50 between the group and Deep Music Ltd. Note that neither the MCPS nor the PRS are involved in this transaction.

After much deliberation, you decide that the best way to do the piece justice is to enter the printed notes into a computer so that it'll play *via* some MIDI keyboards and a drum machine. Let's say you're so pleased with the outcome that you decide to add your arrangement of 'Venus Returns' to a collection of MIDI-fied pop songs that you're marketing on floppy disk. At this stage, you start to think about copyright. Well, you're the arranger of this version of 'Venus Returns', so you write to Deep Music and tell them about what you've done. They're quite happy about this, and you agree on directing a percentage of the sale of the floppy disk in their direction. Next, you write to the PRS to notify them you've made an arrangement of 'Venus Returns' for performance *via* MIDI, and as the arranger, you know you'll receive a third of any royalties that might come in. Now all you have to do is sit back and wait for the PRS cheques.

And that's where it all ends. Or does it? Well, this is where we introduce the thorn in the flesh – the MCPS. They'd argue that the encoded MIDI score on the floppy disk comes under their jurisdiction. They'd maintain that it's a 'transcription' of the copyright work, and that this sort of storage of copyright music (meaning 'sound' in their eyes/ears) by a machine is a mechanical copy. But as anyone with an ounce of sense can see, it plainly isn't – that's why the distinction between 'sound' and 'score' is so important.

The reason all this has come to a head just now is not entirely unconnected with Hybrid Technology and their new Music 500 system. Not surprisingly, HT wanted to put together a number of AMPLE-encoded pieces for their demonstration (software!) cassette. They thought it'd be a good idea to check with the MCPS that it was OK with them for arrangements of various pieces to be included. After many months of deliberation, the MCPS informed Hybrid that they couldn't use arrangements of pieces by Paul Simon, Kraftwerk, or Ultravox, and that they'd have to pay a mechanical royalty on two other pieces ('Popcorn' and Satie's 'Gymnopédie'). On top of that, they put their collective feet well and truly down on the idea of the listing of AMPLE-encoded score being printed in any form.

Well, we all know that this is absurd. After all, an AMPLE-encoded piece, like any MCL- or MIDI-encoded piece, is merely an alternative format of the score, and has nothing directly to do with the sound itself. So by all conventional logic, this should be *outside* the territory of the MCPS.

Which begs the question as to why the MCPS are insisting that they have mechanical rights on something that's purely and simply a variant of music publishing. More to the point, who's going to be able to *convince* the MCPS now that they think they've got Hybrid Technology where they want them?

What's curious is that floppy disk music publishing had been going on for several years prior to Hybrid coming on the scene. Syntauri Corporation in the States have been gaily giving away disks with their arrangements of Henry Mancini *et al* for their alphaSyntauri system, Yamaha have their bar code versions of Christmas Carols and sundry pops, and Passport Designs and Rittor Music have released MIDI disks of music by artists as diverse as The Beatles and Richard Clayderman.

All of which makes me think that what appears to be a publishing loop-hole in the UK is something that's already been plugged elsewhere. But then again, maybe music publishers haven't woken up to the new technology, and maybe that explains why they're not doing anything to stop the MCPS from milking their just rewards.

No doubt we'll be hearing more about this in the New Year . . .

David Ellis

Rumblings . . .

Synergy Plus is the name given to the reincarnation of the **Synergy** just announced by Digital Keyboards Inc. Although it maintains its predecessor's *penchant* for pretending to be a high-tech grand piano (I'm not a lover of glossy black exteriors!), the insides of the new machine have had a thorough working over, with the addition of the General Development System voicing and cartridge generation software. What all this means is that the Synergy owner is now able to program his or her own voices (by virtue of GDS-like displays of waveforms, envelopes *et al*), extend the on-board sequencer's capabilities, and add the inevitable MIDI link.

Synergy II+ and Kaypro computer.

To perform these musical miracles, an external micro has been tagged on, and Digital Keyboards' suggested computer is the Kaypro II. Their choice seems curious – the Kaypro II isn't the micro that'd spring to my mind – but they do say that other CPM 2.2, Z80-based computers can also be used. The other good news is that existing Synergy owners (but do Synergy owners exist? – that's the question) can upgrade to the Synergy Plus.

And the price? Well, $7,500 is what's being quoted for the Synergy Plus with the Kaypro II computer. Sounds like good value – especially considering the $30,000 price tag of the GDS. For more information, contact *Tim Piggott* at *Digital Keyboards Inc, 105 Fifth Avenue, Garden City Park, New York, NY 11040, USA.*

Grand Canonical Ensemble

This somewhat bizarre name is attached to a new digital synthesiser that the equally curiously-named **Altered Media Project** have just released in the States (where else?). The GCE is said to be a 'high-speed, high-fidelity digital sound synthesiser capable of real-time operation with 16-bit stereo quadraphonic outputs'.

At the heart of the system, there's a 16-bit computer designed for real-time additive and FM synthesis. 128 instructions are provided in the operating system for defining the 'oscillators', including control of the waveshape, frequency, amplitude, and frequency or amplitude modulation. Other options include facilities for VOSIM synthesis and filtering, and the processing of external sounds. The maximum number of 128 oscillators is achieved with an individual sample rate of 32kHz (giving a bandwidth of something less than 16kHz). However, by reducing the number of oscillators to 80, the sampling rate can be made to exceed 50kHz, with a corresponding increase in sound quality.

The individual parts of the GCE include the synthesiser boards (a massive 13.5" × 17" each), a 16-bit processor, memory, a high-speed DAC, a high-speed DMA link for communicating with the user's controlling computer, and all *via* a 16-bit S100 bus. In fact, there's room on the bus to accommodate a further seven GCE synthesisers, and there's a special 24-bit bus for communication of digital sound between any devices plugged onto the bus. Not surprisingly, this isn't the sort of system you tag onto any old eight-bit micro that's lying around in the attic: the GCE needs something along the lines of a Unix 68000 system with a lot of disk space. Lucky you if you've got a sugar parent who'll drop one of those in your Christmas stocking . . .

But it does look as if the GCE's been designed with a rather keener eye on the old wallet than Lucasfilms' $750,000 Audio Signal Processor. Although no price has been confirmed, Altered Media say that the GCE is 'in the price range of current commercial digital synthesisers, but has the power and flexibility of the large research systems'.

The mind boggles at the thought of what Trevor Horn would get up to if he got hold of one of these – sampling the Portsmouth Sinfonia playing Beethoven's Ninth to sound like the Berlin Phil playing Beethoven's Ninth, perhaps? Still, if your name isn't Trevor Horn or Paul Morley and you're interested in knowing more about the GCE, you're invited to contact *Altered Media Project Inc* at *1811 Ward Street, Berkeley, CA 94703, USA. ☎ 415-658-9562.*

Machinations

The battle between Syntauri and Passport for the musical Apple user has by now reached legend proportions. Not that they ever actually gouged each other's eyes out, but you get the impression it's a good thing that Los Altos (home of Syntauri) and Half Moon Bay (Passport's base) aren't within spitting distance of each other.

Syntauri recently released their **Musicland** software – a suite of four 'musical games' aimed at the kids amongst us – designed by Martin Lamb at the University of Toronto and developed as part of the so-called Structured Sound Synthesis Project. Currently, the package includes Sound Factory (designing a sound through harmonic addition and envelope drawing), Timbre Painting (painting with tone colours), Music Doodles (drawing song shapes with an 'electronic crayon'), and Music Blocks (connecting together blocks of melodies). This seems eminently imaginative, and reasonably priced at £150, but it's a shame that Syntauri are still using the Mountain Computer synthesiser hardware, which is now looking rather expensive and distinctly lacklustre.

Still, if you're out to extract as much as possible from this five-year-old hardware, an item of software called **Metawave**, written by Paul Lehrman in the States, could prove useful. This takes as its starting point the Decillionix DX1 card, which is used to sample a sound into memory. The program then allows the user to play around with the sample, truncating it, filtering it, or whatever, and then saving it onto disk for use by Syntauri's other software. And all for $89.95. For more information on this, or other things Syntauri-ish, contact *Computer Music Studios* at *Berwick Farm, Berwick Road, Bynea, Dyfed, South Wales. ☎ (0554) 751169.*

This would be all very fine and dandy if it wasn't for the fact that Syntauri have been rather slow to jump onto the MIDI bandwagon – more than a year behind Passport, in fact – which has created certain problems as regards street credibility: the 'no MIDI, no way' syndrome. And the result of this is that Syntauri is no longer, though the company's products will continue to be marketed under the name **Metamatics** and the guiding hand of original Syntauri software designer, Charlie Kellner.

All of which leaves Passport Designs in a rather comfortable position. They've been quick to see the wider potential of the MIDI, and aside from the fact that Yamaha and Korg are using their Apple MIDI card, Passport have also signed a co-licensing deal with various music publishers (Hal Leonard in the States and Rittor Music in Japan) for the marketing of what they term 'computer sheet music'. A canny move, this – as will be obvious from this month's Editorial. ■

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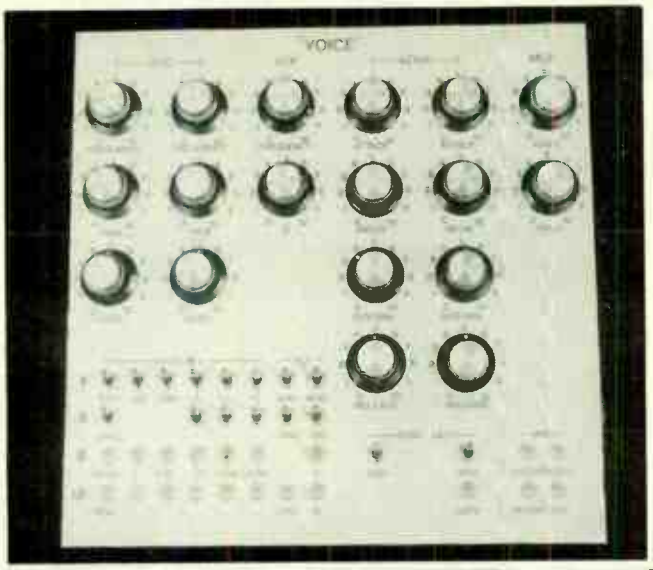

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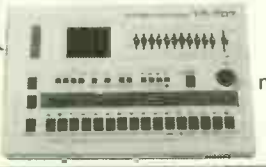

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LEMI Future Shock and AMP 83

MIDI Hardware and Software for Apple II Micro

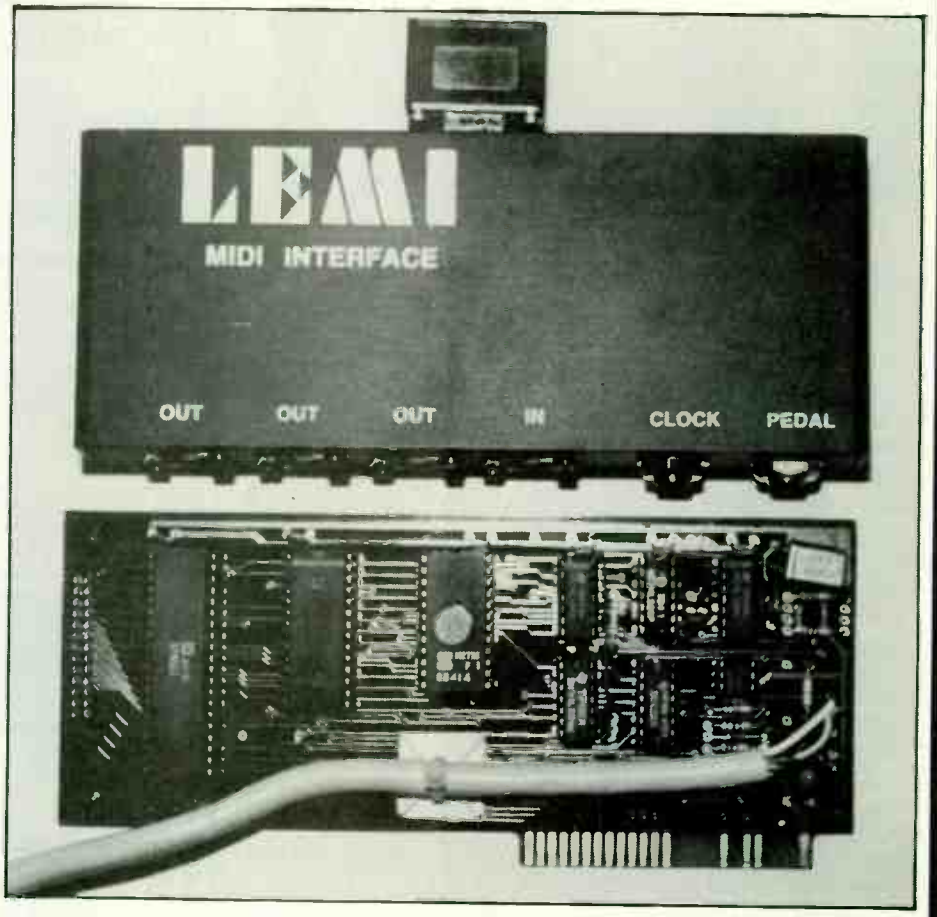
After months of Commodore, Spectrum and BBC MIDI domination, the Apple bites back with some new Italian hardware and software. *David Ellis*

For some reason or other, the Apple II has emerged as one of the least popular contenders in the MIDI applications stakes. As last month's *Software Surplus* demonstrated, everyone's rushing around the Commodore 64 and Spectrum like bees round a honey pot, but for all the look that the Apple gets in the picture, you might be led to believe that it has as much going for it in the direction of advancing science as a ton of Golden Delicious descending on Isaac Newton's head.

In fact, the Apple makes a pretty good starting point for any MIDI system, purely and simply because it doesn't suffer from some of the failings inherent in much of the opposition. For instance, any disk-based software running on the Commodore 64 is beset with a gremlin-infiltrated disk drive and DOS that'd give even Stephen Spielberg nightmares about what Snow White and her dwarves get up to in the forest – and no jokes about poisoned apples, either. Returning to the (in)sanity of the Spectrum point of view, there's the dubious pleasure of its rubbery keyboard, dodgy edge connector, and erratic cassette interface. So, in contrast, the venerable Apple looks like a breath of fresh air, with a decent DOS that can be souped-up with some of the fast DOS options on the market, a thoroughly workable keyboard, and of course, those expansion connectors on the motherboard that lend the Apple to MIDIfication with the minimum of hassle.

The only thorn in the flesh is the cost of the thing, but there is some sign (at long last) that Apple may be bringing down the cost of the IIe to a more equitable level. And if not, there are always the lookalikes and secondhand Apple IIs (down to the cost of a BBC Micro these days) to consider.

Until recently, the only Apple MIDI card that's been available is that from Passport Designs in the States, along with their MIDI/4 4-track sequencing software (reviewed in E&MM September 84). The card alone carries the fairly hefty price tag of $195 (translating into a UK price of just over the £200 mark), which is pushing it a bit for something that's really just a handful of chips on a smallish PCB with a trio of dangling DIN sockets. Especially when you consider that what's on it is little more than the sort of RS232 circuitry that's being pumped out with gay abandon by umpteen clone manufacturers in Taiwan for less than £30 a go. And any hopes that Yamaha would produce their own Apple MIDI card seem to have been dissipated by the news that their software (when/if it comes out) will use the Passport card. So all in all, the Apple owner seems to be getting a bit of a raw deal.



Which is where the Italian firm of LEMI step into the picture with their package of MIDI software and hardware. The card in question comprises the usual assortment of ACIA, opto-isolator and parallel port, but curiously, it also incorporates a 2716 ROM, which seems to have something to do with the 'AMP 83' software that's also available for running with the hardware. What makes the LEMI card potentially more hard-wearing and professional than the Passport version is the fact that all the MIDI DIN sockets (3 Out and 1 In), together with the external clock and footswitch jacks are mounted in a separate chunky aluminium box that connects *via* a multicore cable to the MIDI card in the Apple. I heartily approve of this, but there's no doubt that it also adds to the cost of the hardware – a still reasonable £120 (in Italy, anyway).

The Core of the Matter

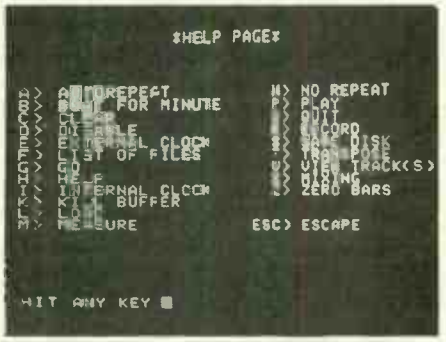
. . . is the software, which in the case of LEMI's home-grown program goes by the bizarre title of 'Future Shock'. This costs £60, comes on a single copyable disk, and provides the capabilities of an eight-track, real time, overdubbable sequencer. There's also a manual, which is currently undergoing a painful transmogrification from the original Italian into the Queen's English. As LEMI point out, sequencers need to be easy to understand, and that's also true of the manuals that come with them. In fact, the Future Shock software meets this requirement admirably by using single-key instructions

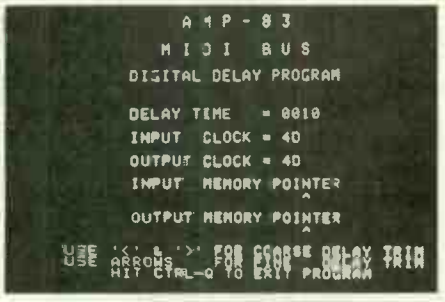
arranged in alphabetical order. So for instance, the command 'A' switches on auto-repeat, 'B' sets beats per minute, 'C' clears a track of notes,and so on to 'Z', which zeroes bars down to zilch. And to make all this plain even to Adam, there's also a Help page (accessed with the command 'H', not surprisingly) which lists all these commands just in case you've forgotten any of them.

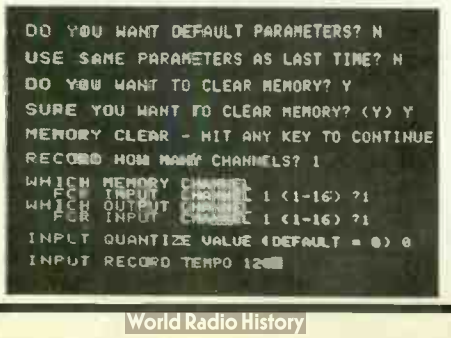
There's actually only one other display page involved in the software (meaning that yours truly doesn't have to take any more of his customary appalling screen-shots . .), and it's here that you do battle with the MIDI bytes. The first thing to note is that the serried ranks of MIDI events are shown as horizontal bars across the screen: A long bar means lots of notes (relatively speaking) on that track, and no bar means no notes at all. Down in the bottom right-hand corner, there's a counter which shows how many pages of memory you've used up: With all the tracks empty, it shows '92', which translates into something like 23K-worth of RAM. When a particular track is recorded onto (by pressing 'R' for record, '1' to '8' for the track number, 'G' to go, and the space bar to put everything in motion), whatever's left of those 92 pages will be 'dynamically allocated' (trendy term for 'every man for himself . . .') to that track. So, doing that on all eight tracks means you end up with a maximum of around 5800 MIDI events or 2900 notes (a figure that plummets downwards if modulation wheels and the like are engaged) spread around the Apple's memory.

Now, it strikes me that 2900 notes in 23K isn't inordinately generous by the standards set by other MIDI software packages. Passport's MIDI/4 software manages to find space for 4000 notes, for instance, and Siel's Live Sequencer (admittedly on the Commodore 64) quotes space for 9000 events. It'd be nice to see LEMI using data compression techniques to remove redundant bytes of MIDI data, or adding something along the lines of the compaction facility that's provided in the UMI BBC Micro MIDI package. Another obvious addition would be to provide the user with the option of using a RAM card for more event storage. As it happens a £40 16K RAM card (which the majority of Apple owners will probably have already) would open up space for another 2500 events, and I'm reliably informed that the next version of the software (out in January) will include this facility.

The recording side of any MIDI software is a pretty mechanical operation – either the MIDI bytes get recorded or they don't, and if it's the latter, you soon know about it. Luckily this side of Future Shock's operation seemed faultless, in that what you get is precisely what you put in (as far as I could judge, anyway). The only problem is that using a Yamaha DX7 as the source of MIDI events demonstrated in no uncertain way how using after-touch chews up those 92 pages of memory. Actually my own feeling is that the recording of MIDI frills like release







velocity and after-touch should be options that are selectable on recording, or alternatively, you should be able to edit them out at the production stage (with something like the UMI compaction facility) if that's what you want. Again, this is something that's already occurred to LEMI, and a later version of Future Shock will have an 'O' (for options) command that allow the user to decide whether or not he or she wants after-touch and mod wheel data to be entered into the Apple's frames of reference.

In fact, 'options' could be said to be the cornerstone of the LEMI software. For instance, a quantisation option (accessed with the 'Q' command) allows each track to be quantised independently at a particular level on playback. This is a much more musical way of going about things than the Sequential Circuits 64 Sequencer, which obliges you to set the quantisation level on *record* and live with the results. Furthermore, the 64 Sequencer only quantises forwards to the nearest note, whereas the LEMI software will quantise both back and forth depending on which is nearest.

Next, there's the 'D' (for disable) option which selectively cuts out tracks on playback – ideal if you're using sync-to-tape from a connected drum machine to record each of the eight tracks onto a multitrack machine. Also on the menu is an auto-repeat facility which operates on each track independently. Thus, if you record a couple of bars on Track 1, you can auto-repeat them to form a riff basis for further tracks, with each of the subsequent tracks having their own assignable loopings dependent on how many bars are recorded onto them. LEMI are also contemplating adding a means of specifying over how many bars these individual loopings are to take place on each track, which should make this part of the software an even more flexible friend.

Also equally independent is the 'T' (for transpose) command, which allows each track to be transposed separately in semitone steps up to an octave above or below the original. In contrast, the equivalent function on the Passport MIDI/4 software requires all the tracks to be transposed at the same time. Another area where the LEMI package has a point of comparison with Passport's software is in the area of mixing tracks together. The beauty of the LEMI implementation is that when tracks are mixed together, they retain their MIDI channels. This facility also serves in a different direction – that of providing what LEMI call 'an intelligent punch-in/punch-out facility. To start this editing process, the 'Z' (for zero) option is engaged to erase a certain number of bars on a particular track. Once that's done, another track is engaged with the same MIDI channel selected, the new notes put down in the gap left by the zeroing, and the two tracks then mixed together to recreate a new, (probably) faultless original. Now that's what I call intelligent. In contrast, the Passport 'punch-in' facility obliges you to re-record the entire track right from the point ▷

where you punched-in: in other words there's no punch-out whatsoever.

Other Future Shock options include seven different time signature modes, a bar counter at the bottom of the screen, a click-track box at the top left flashing and clicking away (with an over-sized flash and a louder click for the down-beat), plus all manner of disk operations that allow you to save or load tracks individually or *en masse*.

Pips and Pulp

In addition to Future Shock, LEMI also market a software package called 'AMP 83', originating from the States and written by one O Z Hall. The approach this takes to MIDI sequencing is markedly different to that of Future Shock, Indeed, whereas the latter makes a virtue out of simplicity, AMP 83 positively revels in multiple menus and covoluted commands – not that the results aren't impressive, I hasten to add. The point is that this is one suite of programs where a manual is a necessity (no Help pages this time round . . .), so it was rather unfortunate that LEMI's sole UK market at present – Computer Music Studios – saw fit to nab the AMP 83 manual and not return it in time for the Editor's deadline.

Briefly, though, the AMP 83 software comprises both a step- and real-time sequencer, and a collection of – well, let's say more experimental – programs. The capacity for the sequencer is claimed to be 4000 notes, and these can be divided up over 16 soft tracks. As with Future Shock, quantisation options are provided, as are transpositions, editing *et al*. The editing facilities look promising (though the resultant display is of the column and row variety I'm afraid) but more than that I can't say, as I got hopelessly lost without the manual.

Of the other programs provided on the disk (but all accessed *via* a main menu), those of current interest are the ones that do unusual things with MIDI data – the 'Keyboard Echo', 'Random Notes', and 'Keyboard Tracking' programs. Keyboard Echo cunningly simulates a DDL with no regeneration, and the delay time can be varied between a matter of milliseconds and up to a minute or so – great for doing Robert Fripp impersonations. This seems an imaginative way of using MIDI, but unfortunately the effect only works in isolation, not within tracks of the AMP 83 program.

This singularity of purpose is also true of the other two programs. As far as Random Notes is concerned, though, that's no love lost – a monophonic random note generator is really pretty mindless, whether it's *via* MIDI or any other route – but the Keyboard Tracking is a good idea, as it allows (among other things) keyboard filter tracking and tracking program changes if you've got access to System Exclusive codes, and is certainly worth inclusion in the context of a sequencer program.

Conclusions

Taken as it stands, the Future Shock software is a pretty good real-time MIDI sequencer. With the additions that are in the offing, it should easily stand comparison with the best around at present – the JMS 12-track Recording Studio and the rather pricey UMI software, for instance. The Apple MIDI card also seems a good buy, but it remains to be seen what the Italian price will translate into in the UK. The AMP 83 software (also £60) is something of a hodge-podge of programs that seems designed more for the average Apple hacker than the committed MIDI musician, but bear in mind that that comment is made in the absence of any instructional assistance.

Still, the success of LEMI's products depends ultimately on how widely they're distributed, and like other companies outside conventional technological trading routes, the Italian firm are finding it tough going. In fact, LEMI would be pleased to hear from any potential distributors in the UK, Europe, America or anywhere else on the surface of the globe. The man to contact is Felice Manzo at 37 Corso Matteoti, 10121 Torino, Italy (☎ 011-541654). ■

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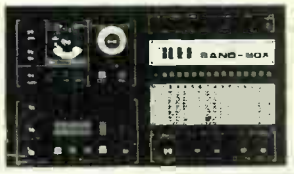

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This back issues page supercedes all previous listings, and the contents of each issue are presented in summarised form. See E&MM Feb 83 and Feb 84 for full Indices of 1981/82 and 1983 issues respectively.

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, Digital 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-Joachim 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 DDM220, 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.

NOVEMBER ***Music*** Cabaret Voltaire, Peter Hammill, Axxess ***Hardware*** Chroma Polaris, Emulator II, Chase Bit One, Casio CT6000, Yamaha D1500 Delay, Ricol Action Replay ***CM*** Amstrad CPC464, BeeBMIDI 4, Fairlight Explained Pt4, PDSG Pt5, Drum Sequencer (BBC B), Wasp/CBM64 Sequencer ***Technology*** Powertran MSC1 Pt2, Everything But The Kitchen (syncing to tape)

DECEMBER ***Music*** Vangelis, Tangerine Dream ***Hardware*** Kurzweil 250, Akai AX80, Siel DK600, Technics Digital 10, Roland TR707, Korg DDM110, MPC DSM8, Ultimate Percussion UP5 ***CM*** Acorn Music 500, BeeBMIDI 5, Fairlight Explained Pt5, Software reviews: Music Maker (CBM64), Siel Expander Editor (Spectrum), Island Logic Music System (BBC B), UMI 1B (BBC B), Siel Composer/Arranger (CBM64), JMS 12-Track Recording Studio (CBM 64) ***Technology*** Powertran MCS1 Pt3, Everything But The Kitchen . . . (interfacing analogue synths), Syndrom Pt4

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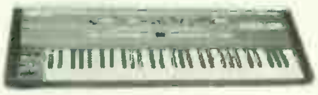

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BeeBMIDI 6

A program that allows you to dump Juno 106 voices onto disk or tape. And it can be adapted for other micros and MIDI synths. *Jay Chapman*

This article is NOT just for Juno 106 and BBC Micro owners. With a bit of luck the rest of you have now been dragged back from turning the page. Admittedly, if you don't have a BBC Micro you'll have to do a fair amount of work 'translating' this program for your micro, but the algorithms used should still be of interest. And if you have a MIDI synth other than the Roland Juno 106, the extra work is not so daunting: I'll mention the sort of changes you'll have to make as I go along. However, you *will* need to have a reasonable understanding of the MIDI protocol and its 'System Exclusive' details for your synth: if in doubt have a look at the user manual or, failing that, back issues of E&MM.

On the other hand, if your synth won't transmit voice data *via* MIDI System Exclusive messages, then both this article and the program are not going to be of any practical use to you – sorry! Of course, you might be saving up for a better synth . . . Anyway, even if you do possess such an instrument, you *may* have to set some control to allow it to send the necessary messages. On the Juno 106, the required procedure is setting the MIDI Function Selector Switch on the back panel to III. Best to do this straight away, as if it's forgotten, the entire program will be about as useful as a fork for drinking soup.

What Does it Do?

The program listed on the following pages allows you to capture, name and save several hundred voice patches from the Juno 106 and, of course, send them back to the synth and write them into its memory. You can save and load the complete library to and from your current filestore, it's possible to display the names of all the voices in the library (in case you forget what you called some stored marvel), and you can search for a particular name to confirm that it exists in the currently-loaded library. If you need to tidy the library up, you can delete voices, too.

My own system, which has PAGE set at &1B00, can store about 250 sets of voice data. If you have PAGE set lower, you'll be able to increase the size of the arrays holding the data to store at least 300 sets (disk users with PAGE=&1900) and in some cases even more (tape and other users with PAGE=&E00). Try running the program with different values for 'max_number_of_voices' set in line 2490. The procedure 'PROCclear_arrays' (line 3750) fills the arrays to their maximum size so that you run out of room immediately (if you're going to do at all) rather than have the program crash after saving a whole album's worth of voices. It might be sensible to save the growing library after every two or three additions anyway – no point in tempting fate.

How Does it Work?

'PROCinitialise' (line 2440) is called at the start of the program to set up various global values and 'DIMension' does the same for the data arrays. Notice that one of the values, 'voice_data_size', needs altering if you have a synth other than the Juno 106: it represents the number of data bytes that must be transmitted within the MIDI System Exclusive message that conveys voice data. There are other bytes to be transmitted, starting with the System Exclusive byte (&F0) and the Roland Identification byte (&41), and ending with the End of Exclusive byte (&F7). Obviously some of these also need altering in addition to the data bytes. A quick look at the assembly code routine 'TXvoice' will show all the bytes for the Juno 106.

In other words, this is where you'll need some precise knowledge of the *exact* MIDI protocol for your synth . . .

Lines 2570 to 2630 relate to the use of E&MM's BeeBMIDI board, which has already been covered several times in this series of articles. Line 2660 marks the buffer (which the transfers are effected from/to) as empty by setting an illegal value (ie. one that cannot occur if real data were in the buffer) into the first byte of the buffer so that we can tell it's empty when necessary.

Lines 2680 to 3340 assemble the routines which can't be in BASIC (either as a result of speed considerations or because, in the case of enabling and disabling interrupts, there is simply no other way of doing things) into the 'user defined character definitions' page at &C00, which is not in use. The interrupt enable and disable were discussed in last month's BeeBMIDI article. (You *did* get E&MM last month, didn't you?)

After initialisation, the program loops around lines 1070 to 1290 until exited, displaying the menu, taking the user's selection and calling these procedures selected. Before describing these procedures it's worth looking at the data structures the program uses.

Data Structures

The names given to stored voices are kept, in alphabetical order, in the array 'name$()'. Whenever a new name is inserted into the array, all the names above that new name are moved up one position to create a gap at the correct point in the array. Thus, the array remains in alphabetical order.

This is not a terribly efficient way of inserting items, though it *is* simple. It does take some time when the array is nearly full, since on average about 150 names need moving – even this amount of work should hardly be noticeable, however.

So that we don't have to move the voice data about as well – which would slow the process down to an unreasonable degree – a second array, 'index%()', holds a pointer to the start of the data for each 'name$'. Look at 'PROCinsert-voice' (line 3490). If some of this sounds a bit heavy you'll just have to brush up on your programming, I'm afraid!

The reason for keeping the names in alphabetical order is so that we can look for a name in a more or less straightforward and logical manner. Rather than searching through the list linearly (ie. is the first name the one we want, is the second, is the third . . .?), which would be very slow and in the worst case (nearly full table and a search for a name that isn't there anyway) would end up with our doing several hundred comparisons just to find out that it wasn't worth bothering in the first place, we use the 'binary chop' algorithm encoded in 'FNfind_voice' (line 3380). Actually, this is the same algorithm we use when we search for a name in a telephone directory. What we do is compare the name in the middle of the list with the one we are searching for, and if they match up, we've finished. If they don't match, we decide whether the name we want is before or after (alphabetically) the name we just compared and look in the appropriate half of the list. We then apply the procedure to the new, shorter list. So, on each comparison that fails we are left with half of what we started with to search: if we had 256 names to search, in the *worst* case we would only have to make nine comparisons instead of 256. You compare successively one name in (approximately) 256, 128, 64, 32, 16, 8, 4, 2 and finally 1.

Another benefit of storing the names in alphabetical order is that 'PROCdisplay' (line 1320) becomes a relatively trivial

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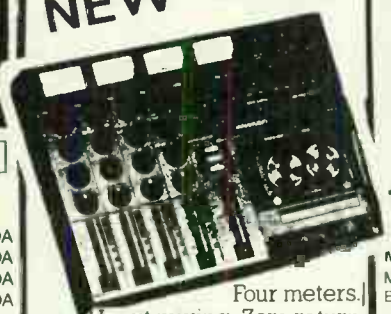

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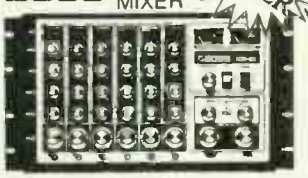

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exercise, as does 'PROCsearch' (line 1420) which uses the binary chop search routine 'FNfind_voice' to do its dirty work.

Receive and Transmit

'PROCreceive' (line 1520) calls the machine code routine 'RXvoice' to get the voice data into the byte array 'buffer', and then calls 'PROCinsert_voice' (line 3490) which puts the user-given name and the voice data into the 'name$()', 'index%()' and voice data structures. Note that 'RXvoice' checks to see that the MIDI protocol is being followed correctly.

The reason you have to indicate that you're about to press the last of the selection keypads (lines 1580 to 1600) is that the Juno 106 sends voice data on *each* Group, Bank and Patch Number keypress. If you were on B24 (Group B, Bank 2, Patch Number 4) and wanted to store A15, you'd send A24, A14 and finally A15, as you pressed the Group A, then the '1' and then the '5' keypads respectively. So, hit the space bar just before you press the '5' keypad on the Juno.

'PROCtransmit' (line 1760) gets the voice data that the user specifies into 'buffer' so that 'TXvoice' can transmit it. You should see the 'voice parameters altered' full-stops in the Roland's LED display come on when the transmission is complete. If you want to save the voice, simply follow the instructions in the Juno manual.

Conclusion

The rest of the program ('PROCs delete', 'load' and 'save') is fairly straightforward, but it's worth pointing out that when you save the library, a back-up copy is maintained. This assumes that you are using a disk-based filestore: cassette users will want to make changes around lines 2250 to 2410.

Don't be afraid to experiment with the program code: the procedures have all been kept quite independent so that you can put them into your own programs. Some of you might want to have several different libraries at your disposal, in which case you'll need to add some code to ask for the library name and create a suitable filename out of the answer in 'PROCload' and 'PROCsave'. ■

If you can't face typing the program in, then EmmSoft will be delighted to supply you with a cassette at the suitably modest price of £3.95 including VAT. Incidentally, Jay Chapman's earlier voice dump program for the Yamaha DX7 is now also available at £3.95 – a price reduction of £4.00. If you're interested in either of these, send your order with payment in sterling cheque, postal order or bankers' draft payable to Music Maker Publications, to EmmSoft, E&MM, Alexander House, 1 Milton Road, Cambridge CB4 1UY. Please allow 28 days for delivery.

```
1000 REM ================================================================
1010 REM ===         JUNO-106 VOICE DATA LIBRARY PROGRAM              ===
1020 REM ===                                                          ===
1030 REM ===              (C) 1984 J D G CHAPMAN                      ===
1040 REM ================================================================
1050 MODE 7
1060 PROCinitialise
1070 REPEAT
1080   CLS
1090   PRINT ''CHR$141" JUNO-106 VOICE DATA LIBRARY"
1100   PRINT  CHR$141" JUNO-106 VOICE DATA LIBRARY"
1110   PRINT ''"1. DISPLAY Voice Names."
1120   PRINT '"2. SEARCH the Library for a Voice."
1130   PRINT '"3. RECEIVE Voice Data from JUNO-106."
1140   PRINT '"4. TRANSMIT Voice Data to JUNO-106."
1150   PRINT '"5. DELETE Voice Data from Library."
1160   PRINT '"6. LOAD Library from Filestore."
1170   PRINT '"7. SAVE Library to Filestore."
1180   PRINT '"8. EXIT."
1190   PRINT '''"   Selection ( 1 to 7 ) ";
1200   REPEAT INPUT selection%:UNTIL selection% >= 1 AND selection% <= 8
1210   IF selection% = 1 THEN PROCdisplay
1220   IF selection% = 2 THEN PROCsearch
1230   IF selection% = 3 THEN PROCreceive
1240   IF selection% = 4 THEN PROCtransmit
1250   IF selection% = 5 THEN PROCdelete
1260   IF selection% = 6 THEN PROCload
1270   IF selection% = 7 THEN PROCsave
1280   IF selection% <> 8 THEN PROCcontinue
1290   UNTIL selection% = 8
1300 CLS:END
1310
1320 DEF PROCdisplay
1330 LOCAL pointer%
1340 CLS:IF number_of_voices = 0 THEN PRINT '''''TAB(11)"Library EMPTY"'':ENDPROC
1350 FOR pointer%=1 TO number_of_voices
1360   IF ( pointer% - 1 ) MOD 2 = 0 THEN PRINT '
1370   IF pointer% <> 1 AND ( pointer% - 1 ) MOD 20 = 0 THEN PROCcontinue:CLS:PRIN
T '
1380   PRINT ""name$( pointer% )" ";
1390   NEXT pointer%
1400 ENDPROC
1410
1420 DEF PROCsearch
1430 LOCAL voice$
1440 CLS:PRINT TAB(10,5)"Voice to SEARCH for"
1450 PRINT TAB(10,7)"(upto 16 characters) :"
1460 PRINT TAB(11,9)"
1470 INPUT TAB(12,9)voice$:voice$=LEFT$( voice$+"                ", 16
1480 IF FNfind_voice( voice$ ) THEN PRINT TAB(1,15)"Voice ""voice$"" IS in Library
":ENDPROC
1490 PRINT TAB(1,15)"Voice ""voice$"" NOT in Library"
1500 ENDPROC
1510
1520 DEF PROCreceive
1530 LOCAL voice$, pointer%
1540 CLS:PRINT TAB(1,5)"Select the voice to be RECEIVED by the"
1550 PRINT TAB(1,6)"computer FROM the JUNO-106 by selecting"
1560 PRINT TAB(1,7)"the Group, Bank and Patch Number ON"
1570 PRINT TAB(1,8)"Manual on the JUNO-106's control panel."
1580 PRINT TAB(1,11)"Press the SPACE bar just before"
1590 PRINT TAB(1,12)"pressing the LAST selection keypad."
1600 dummy$=INKEY$(25000)
1610 CALL RXvoice
1620 PRINT '''TAB(10)"Voice RECEIVED"
1630 PROCcontinue
1640 REPEAT
1650   CLS:PRINT TAB(1,5)"What is the name for this voice data
1660   PRINT TAB(8,7)"(upto 16 characters) :"
1670   PRINT TAB(11,9)"
1680   INPUT TAB(12,9)voice$:voice$=LEFT$( voice$+"                ", 16 )
1690   pointer% = FNfind_voice( voice$ )
1700   IF pointer% <> 0 THEN PRINT '''"VOICE ""voice$"" EXISTS ""CHOSE A DIFFERENT
NAME"'':PROCcontinue
1710   UNTIL pointer% = 0
1720 PROCinsert_voice( voice$ )
1730 PRINT ''TAB(4)"Voice ""voice$"" STORED"
1740 ENDPROC
1750
1760 DEF PROCtransmit
1770 LOCAL voice$, pointer%, data_pointer%
1780 CLS:PRINT TAB(10,5)"Voice to TRANSMIT"
1790 PRINT TAB(10,7)"(upto 16 characters) :"
1800 PRINT TAB(11,9)"
1810 INPUT TAB(12,9)voice$:voice$=LEFT$( voice$+"                ", 16 )
1820 pointer% = FNfind_voice( voice$ )
1830 IF pointer% = 0 THEN PRINT '''"VOICE ""voice$"" NOT IN LIBRARY"':ENDPROC
1840 FOR data_pointer% = 0 TO 17:buffer?data_pointer% = voice_data?( index%( point
er% ) + voice_data_size * data_pointer% ):NEXT data_pointer%
1850 CALL TXvoice
1860 PRINT ''TAB(11)"Voice TRANSMITTED"''
1870 ENDPROC
1880
1890 DEF PROCdelete
1900 LOCAL voice$, pointer%
1910 CLS:PRINT TAB(13,5)"Voice to DELETE"
1920 PRINT TAB(10,7)"(upto 16 characters) :"
1930 PRINT TAB(11,9)"
1940 INPUT TAB(12,9)voice$:voice$=LEFT$( voice$+"                ", 16 )
1950 pointer% = FNfind_voice( voice$ )
1960 IF pointer% = 0 THEN PRINT TAB(1,15)"Voice ""voice$"" NOT in Library":ENDPROC
1970 voice_data?( index%( pointer% ) + voice_data_size ) = &FF:REM mark as empty
1980 IF pointer% <> number_of_voices THEN FOR pointer% = pointer% + 1 TO number_of
_voices:name$( pointer% - 1 ) = name$( pointer% ):index%( pointer% - 1 ) = index%(
pointer% ):NEXT pointer%
1990 number_of_voices = number_of_voices - 1
2000 PRINT '''TAB(10)"Voice DELETED"'
2010 ENDPROC
2020
2030 DEF PROCload
2040 LOCAL file%, pointer%
2050 CLS:PRINT TAB(4,5)"LOADING Voice Data from Filestore"
2060 PRINT TAB(12,8)"Please WAIT ..."''
2070 PROCclear_arrays
2080 file% = OPENIN( "LIB106" )
2090 INPUT#file%, number_of_voices
2100 PRINT '''"Number of voices in Library is ";number_of_voices''
```

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```
2110 FOR pointer% = 1 TO number_of_voices
2120   INPUT#file%, name$( pointer% )
2125 index%( pointer% ) = pointer%
2130   FOR data_pointer% = 0 TO 17:voice_data?( pointer% * voice_data_size + data_
pointer% )=BGET#file%:NEXT data_pointer%
2140   PRINT ". ";
2150   NEXT pointer%
2160 PRINT ''TAB(10)"Library LOADED"'
2170 CLOSE#file%
2180 ENDPROC
2190
2200 DEF PROCsave
2210 LOCAL file%, pointer%, data_pointer%
2220 CLS:PRINT TAB(4,5)"SAVING Voice Data to Filestore"
2230 IF number_of_voices = 0 THEN PRINT TAB(5,12)"Library EMPTY - NOT saved":ENDPROC
2240 PRINT TAB(12,8)"Please WAIT ..."'
2250 file% = OPENOUT("NLIB106")
2260 PRINT#file%, number_of_voices
2270 FOR pointer% = 1 TO number_of_voices
2280   PRINT#file%, name$( pointer% )
2290   FOR data_pointer% = 0 TO 17:BPUT#file%, voice_data?( index%( pointer% ) * v
oice_data_size + data_pointer% ):NEXT data_pointer%
2300   PRINT ". ";
2310   NEXT pointer%
2320 PRINT ''TAB(12)"Library SAVED"'
2330 CLOSE#file%
2340 file% = OPENIN( "BLIB106" ):IF file% > 0 THEN CLOSE#file% ELSE GOTO 2370
2350 *ACCESS BLIB106
2360 *DELETE BLIB106
2370 file% = OPENIN( "LIB106" ):IF file% > 0 THEN CLOSE#file% ELSE GOTO 2400
2380 *ACCESS LIB106
2390 *RENAME LIB106 BLIB106
2400 *RENAME NLIB106 LIB106
2410 *ACCESS *LIB106 L
2420 ENDPROC
2430
2440 DEF PROCinitialise
2450
2460 LOCAL pass%, pointer%
2470
2480 voice_data_size     = 18
2490 max_number_of_voices = 250
2500 number_of_voices     = 0
2510 last_data_index      = 1
2520
2530 DIM name$( max_number_of_voices ), index%( max_number_of_voices )
2540 DIM voice_data voice_data_size * max_number_of_voices
2550 PROCclear_arrays
2560
2570 control_reg  = &FCFC
2580 status_reg   = &FCFC
2590 transmit_reg = &FCFD
2600 receive_reg  = &FCFD
2610
2620 ?control_reg = &03:REM Reset ACIA
2630 ?control_reg = &15:REM Configure ACIA
2640
2650 DIM buffer voice_data_size - 1
2660 buffer?0 = &FF:REM Mark buffer as empty
2670
2680 FOR pass%=4 TO 7 STEP 3
2690   P%=&C00
2700   [ OPT 0 : put pass% instead of 0 to see assembl. listing
2710
2720 .disable sei              \ disable IRQ interrupts
2730          rts
2740
2750 .enable  cli              \ enable  IRQ interrupts
2760          rts
2770
2780 .RXbyte  lda status_reg   \ receive a byte from MIDI IN
2790          and #&01
2800          beq RXbyte
2810          lda receive_reg
2820          rts
2830
2840 .TXbyte  pha              \ transmit a byte to  MIDI OUT
2850 .TXbytlp lda status_reg
2860          and #&02
2870          beq TXbytlp
2880          pla
2890          sta transmit_reg
2900          rts
2910 .RXvoice jsr RXbyte       \ receive one set of JUNO-106 voice data
2920          cmp #&F0         \ Exclusive
2930          bne RXvoice
2940          jsr RXbyte
2950          cmp #&41         \ Roland ID
2960          bne RXvoice
2970          jsr RXbyte
2980          and #&30         \ Group, Bank or Patch Change OR Manual
2990          cmp #&30
3000          bne RXvoice
3010          jsr RXbyte       \ Ignore Channel Number
3020          jsr RXbyte       \ Ignore Program Number
3030          ldx #voice_data_size
3040 .RXloop  dex              \ 18 bytes of voice data
3050          jsr RXbyte
3060          sta buffer,X
3070          txa
3080          bne RXloop
3090          jsr RXbyte
3100          cmp #&F7         \ check at End of Exclusive
3110          bne RXvoice
3120          rts
3130
3140 .TXvoice lda #&F0         \ transmit one set of JUNO-106 voice data
3150          jsr TXbyte       \ Exclusive
3160          lda #&41         \ Roland ID
3170          jsr TXbyte
3180          lda #&31         \ Manual
3190          jsr TXbyte
3200          lda #&00         \ MIDI channel 0
3210          jsr TXbyte
3220          lda #&00         \ (confirms Manual)
3230          jsr TXbyte
3240          ldx #voice_data_size
3250 .TXloop  dex              \ 18 bytes of voice data
3260          lda buffer,X
3270          jsr TXbyte
3280          txa
3290          bne TXloop
3300          lda #&F7         \ End of Exclusive
3310          jsr TXbyte
3320          rts
3330   ]
3340   NEXT pass%
3350
3360 ENDPROC
3370
3380 DEF FNfind_voice( voice_name$
3390 LOCAL bottom%, top%, pointer%, data_pointer%
3400 IF number_of_voices = 0 THEN =0
3410 bottom% = 1:top% = number_of_voices
3420 REPEAT
3430   pointer% = ( bottom% + top% ) DIV 2
3440   IF name$( pointer% ) < voice_name$ THEN bottom% = pointer% + 1 ELSE IF name
$( pointer% ) > voice_name$ THEN top% = pointer% - 1
3450   UNTIL name$( pointer% ) = voice_name$ OR top% < bottom%
3460 IF name$( pointer% ) <> voice_name$ THEN pointer% = 0
3470 =pointer%
3480
3490 DEF PROCinsert_voice( voice_name$
3500 LOCAL pointer%, data_pointer%
3510 IF buffer?0 = &FF THEN PRINT '' NO VOICE DATA IN BUFFER TO STORE '':ENDPROC
3520 IF number_of_voices = max_number_of_voices THEN PRINT ''"NO MORE ROOM FOR ONS
FRIONS : VOICE CAN NOT BE INSERTED '':ENDPROC
3530 IF number_of_voices = 0 THEN number_of_voices = 1:name$( 1 ) = voice_name$:po
inter% = 1:GOTO 3600
3540 number_of_voices = number_of_voices + 1
3550 FOR pointer% = number_of_voices - 1 TO 0 STEP -1
3560   IF voice_name$ < name$( pointer% ) THEN pointer% = pointer% + 1:name$( point
er% ) = voice_name$:GOTO 3600
3570   name$( pointer% + 1 ) = name$( pointer% ):index%( pointer% + 1 ) = index%(
pointer% )
3580   NEXT pointer%
3590
3600 REPEAT
3610   last_data_index = last_data_index MOD max_number_of_voices + 1
3620   UNTIL voice_data?( last_data_index * voice_data_size ) = &FF
3630 index%( pointer% ) = last_data_index
3640 FOR data_pointer% = 0 TO voice_data_size - 1:voice_data?( last_data_index * v
oice_data_size + data_pointer% ) = buffer?data_pointer%:NEXT data_pointer%
3650 ENDPROC
3660
3670 DEF PROCcontinue
3680 LOCAL dummy$
3690 REPEAT
3700   PRINT ''TAB(3)"Press the SPACE BAR to continue.
3710   dummy$=INKEY$(2500)
3720   UNTIL dummy$=" "
3730 ENDPROC
3740
3750 DEF PROCclear_arrays
3760 LOCAL pointer%
3770 FOR pointer%=0 TO max_number_of_voices
3780   name$( pointer% ) = "                    ":index%( pointer% ) = 0
3790   voice_data?( pointer% * voice_data_size ) = &FF
3800   NEXT pointer%
3810 ENDPROC
```

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alternatives

As hardware innovation grinds to a halt and designers turn their attention to software, E&MM looks at a new programming language that could be more than a little useful to the computer musician. *Ed Stenson*

A version of PROLOG is available for the Sinclair Spectrum at only £24.95.

The electronics industry is only just beginning to realise that the 'leaps-and-bounds' progress it has become used to over the last few years cannot go on indefinitely. Certainly, computer hardware will get a good deal more powerful over the next 20 years as new theories (like concurrency) become reality, but the end, as far as conventional techniques are concerned, is in sight.

The reason is that, as computing devices get both faster and smaller, the laws of nature come into play and designers find themselves up against a brick wall, and there appear to be two possible ways around this.

The first is to admit that present techniques will be inadequate for the 1990s and to pursue new ideas such as the Josephson junction (which operates at very low temperatures to increase electron mobility and hence speed) or a computer that sends signals by means of pulses of light (since photons are rather more fleet of foot than electrons). However, such research would require a budget of similar magnitude to the GNP of a small country.

The second, and seemingly more immediately viable possibility is to channel a large proportion of the research effort into the development of clever software that makes the most of the latest machines. The Japanese are already saying that while the seventies were the years of hardware innovation, the nineties will see the same advances in the area of software: the eighties are described, perhaps rather cautiously, as the years of transition. The so-called 'software crisis' has arisen because computers have been too difficult to program quickly, so that any bespoke software (made to measure for a particular task) is simply too expensive for many companies to afford. Today's technological outlook puts the emphasis on user-friendly systems designed to overcome some of these problems. Lest anyone doubt the opportunities even the humblest of micros can provide, compare the games software currently available for a machine like the Spectrum with the quality of the product available shortly after the machine came out. The immense improvement amply demonstrates what can be achieved if the incentive is sufficient. And business being what it is, that incentive is inevitably financial in nature.

Prolog

It's interesting to reflect that the best ideas are also often the simplest. A piece of software called Prolog, currently receiving a good deal of publicity, must rank as one of the simplest and yet most elegant of ideas to have emerged in recent years.

The current interest was triggered by the Japanese – a surprising move from a country not particularly noted for its computer industry *despite* its undoubted expertise in the field of electronics – when the so-called Fifth Generation project was announced three years ago. (For those unfamiliar with computer generations, the Fourth Generation refers to the super-micros currently being developed using 32-bit CPUs, while the Fifth Generation refers to the machines to follow.) Now, Fifth Generation computers are likely to abandon the traditional approach to computing (it's called Von Neumann architecture) in favour of a system of parallel processing: that is, doing several things at once. And amongst other things, the new computers will allow direct access using natural language, enabling users to issue commands in everyday English or, indeed, Japanese.

The field of Artificial Intelligence (AI) was investigated for the Fifth Generation project and a programming language called Prolog, much favoured in AI circles, was adopted as the one most suitable for use. Overnight, Prolog rose from almost complete obscurity to gain a considerable share of the limelight.

In fact, Prolog was first introduced in 1972, (around the time that the ubiquitous teaching language Pascal emerged) and has therefore had plenty of time in which to make its impact. The important point is that the language has a lot to offer many different fields of interest, including music, and deserves a wider exposure than that afforded by research establishments alone.

Not surprisingly, Prolog's sudden burst of popularity has been accompanied by a series of implementations on cheap home micros: there now seem to be almost as many versions of Prolog in the pipeline as there are versions of Forth, and what's more, they're reasonably priced. A copy of Prolog for the Spectrum costs just £24.95 – remarkably cheap for such a sophisticated piece of software.

Philosophy

To understand Prolog, it's important to appreciate that it's a 'descriptive' language rather than an 'algorithmic' one. Most common programming languages in use today are algorithmic – BASIC is a typical example. A BASIC program consists merely of a list of instructions that the computer executes to solve a particular problem. The list may contain jumps to other parts of the program, but in general the instructions are executed in more or less the order in which they were written. On the professional front, machine code is preferred for various reasons, particularly speed, but is in fact very similar to BASIC in that it also requires a list of instructions, albeit at a much simpler level. To produce a program, the user must still write a sequence of commands, type them into the machine and then go through the all-

too-familiar process of debugging.

At this point, we can begin to see just how dim most computers really are. If a programmer expects a machine to solve a problem, he or she must tell it precisely what it should do and in what order. In fact, the programmer doesn't need a computer at all: a BASIC (or machine code) program can be executed perfectly well using no more than a pencil and paper, since the program is simply a list of steps showing how to solve the problem. All the computer does, in most cases, is to execute the code quickly. It neither knows, nor cares, what it is really achieving.

The list of commands (the program) is known as an algorithm, and hence BASIC. Fortran, Algol (which actually stands for algorithmic language), Pascal, COBOL, machine code and so on are *all* algorithmic languages.

Prolog, in contrast, takes the bold step of abandoning the above approach altogether. It doesn't actually require an algorithm of any sort, so that a programmer need never sit down and write a routine to tackle the problem in question. The reason for this is quite simple – Prolog does the thinking itself. All the programmer need do is tell the computer everything he or she knows (or more accurately, everything he or she *wishes* the computer to know) about the problem. The computer then uses Prolog to find one or more solutions consistent with what it has been told. Precisely how it achieves this need not concern the programmer particularly: that can safely be left to the machine.

Of course, life is seldom that easy, and it's generally necessary to know the workings of a Prolog system in some detail before successful programs can be written.

The information given to Prolog is held in a database that's accessed by the program as it runs. This data details the environment or 'universe' in which we wish to place our problem. For instance, if we were considering a problem in dynamics where balls were travelling over a surface and colliding with each other, our universe might be a snooker table. Alternatively, if we wanted a program to lay out the offices in a new building so as to minimise wasted space, comply with fire regulations, and ensure adequate power supplies in each room, we might define the universe as the floor space of the building. If we were considering a musical problem, the universe might be the chromatic scale, or indeed any other scale, for that matter. In such a definition, it's important to remember that Prolog will consider only the information it's given. Anything that leaves the universe (a ball that falls off the snooker table, say) will cease to exist as far as the computer is concerned, and this can lead to unexpected results. It should therefore come as no surprise to know that considerable care is sometimes necessary whenever you describe a problem.

The information you place in the database (which is actually the Prolog program itself) is a description of the problem you wish to solve. This explains the term 'descriptive language' used earlier, since the language is really just a formal way of describing a problem. The Prolog interpreter consists of a series of searching and matching routines that are employed to search the database and find a suitable solution.

Prolog is far less restrictive than an algorithmic language. When information is placed in the database, it's not always known exactly (or even roughly) what questions will be posed later on. The user might ask almost anything and the language is expected to cope. This highly flexible approach is absent in BASIC, where the programmer must have a fairly good idea of what has to be done before coding begins.

Unfortunately, nothing is quite as straightforward as we'd all ideally like. The idea of a language that can apparently think for itself and look for the correct answer to a problem *sounds* wonderful, but Prolog (for the time being at least) does have certain drawbacks.

First, it's rather inefficient in its use of memory. This may not seem much of a problem when the language is run on something as powerful as a minicomputer, but if it's implemented on a home micro, 64K suddenly becomes surprisingly restrictive, especially when a large part of it is taken up by ROM. The language isn't particularly fast to run, either, since a complex task can require a large number of successive searches through the database before all the required answers are found. And although new computers are appearing with 16-bit or even 32-bit architecture which makes the processor considerably more powerful than current devices *and* allows easy addressing and fast access to much more than 64K of memory, a somewhat limited subset of the language is all that most users can hope for at present. This is perfectly sufficient to give a taste of Prolog, however.

Symbols

In common with other AI languages, Prolog is a symbolic code rather than a numeric one. It's ideally suited to the manipulation of complicated structures (such as lists) that are necessary for many AI problems. On the other hand, Prolog is relatively poor at handling numbers, though fortunately, AI problems are rarely soluble by number crunching alone.

A typical example of an AI task is the understanding of natural language – English as it is spoken in conversation, for instance. In this case, a lot of meaning is implied, with context serving to resolve ambiguities. The human brain can generally cope with this problem quite easily, but most *computers* are totally baffled; after all, the days of machines like HAL are still some way off. The reason for the great interest in this problem is simply that traditional ways of communicating with a computer are poor; some people cannot or will not use a typewriter keyboard, and many more shudder at the prospect of sitting in front of a VDU for long periods. Wouldn't it all be so much easier if we could talk to a computer and if it in turn could 'tell' us the answers? Decoding of the spoken word *is* difficult, but can still be performed – even today – with some measure of success. However, decomposing sentences in order to extract their precise meaning is a very tricky task, because as any journalist will tell you, there are all manner of different ways of saying the same thing. However, the problem can be resolved down to the manipulation of symbols (letters or words) and is well suited to Prolog. In contrast, such a task in BASIC would be rather frightening, to put it mildly.

Applications

So, to come to the really important question, what impact is Prolog likely to have for the computer musician?

Well, if a system can be developed to analyse notation in English, it should equally well be able to deal with musical notation, since the latter is also symbolic and concerned with lists of things.

Next, the analysis of a score could be performed to assist with the interpretation of a difficult piece. This could include various facilities such as pinpointing the introduction of themes (a base of pattern recognition if ever there was one) or, for the more technically minded, a frequency scan to delineate the harmonic structure of a piece. Mozart, with his *penchant* for strings, produced music with a high-frequency component significantly greater than average, so perhaps other composers have unwittingly left a musical 'fingerprint' behind in their orchestrations to identify themselves. Prolog would tell us who they are and what they've done.

Automatic composition is a slightly more obvious application. It would certainly be interesting to produce a system that could hold samples of a composer's work in its database and then produce music in a similar style.

Unfortunately, none of the above examples could be achieved in real time, since Prolog is far too slow at present, but the results could always be saved (to disk, tape or RAM) and inspected later at leisure.

The suggestions I've made are somewhat tentative, I admit. However, some are being actively considered as you read this, even if others may as yet be a little out of reach. All I can say is that it's unfortunate that no implementation of Prolog currently available can drive a micro's sound generators, meaning that the language cannot actually produce any audible results.

Still, the version of Prolog for the Spectrum can be highly recommended, since it includes a fairly substantial paperback book explaining the language in detail. For anyone seeking further information, the standard textbook on the subject is *Programming in Prolog* by Clocksin and Mellish, published by Springer-Verlag. It's occasionally heavy going but covers the language in great detail with plenty of explanatory examples. ■


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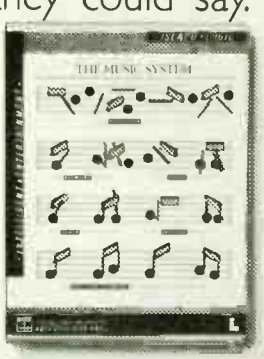

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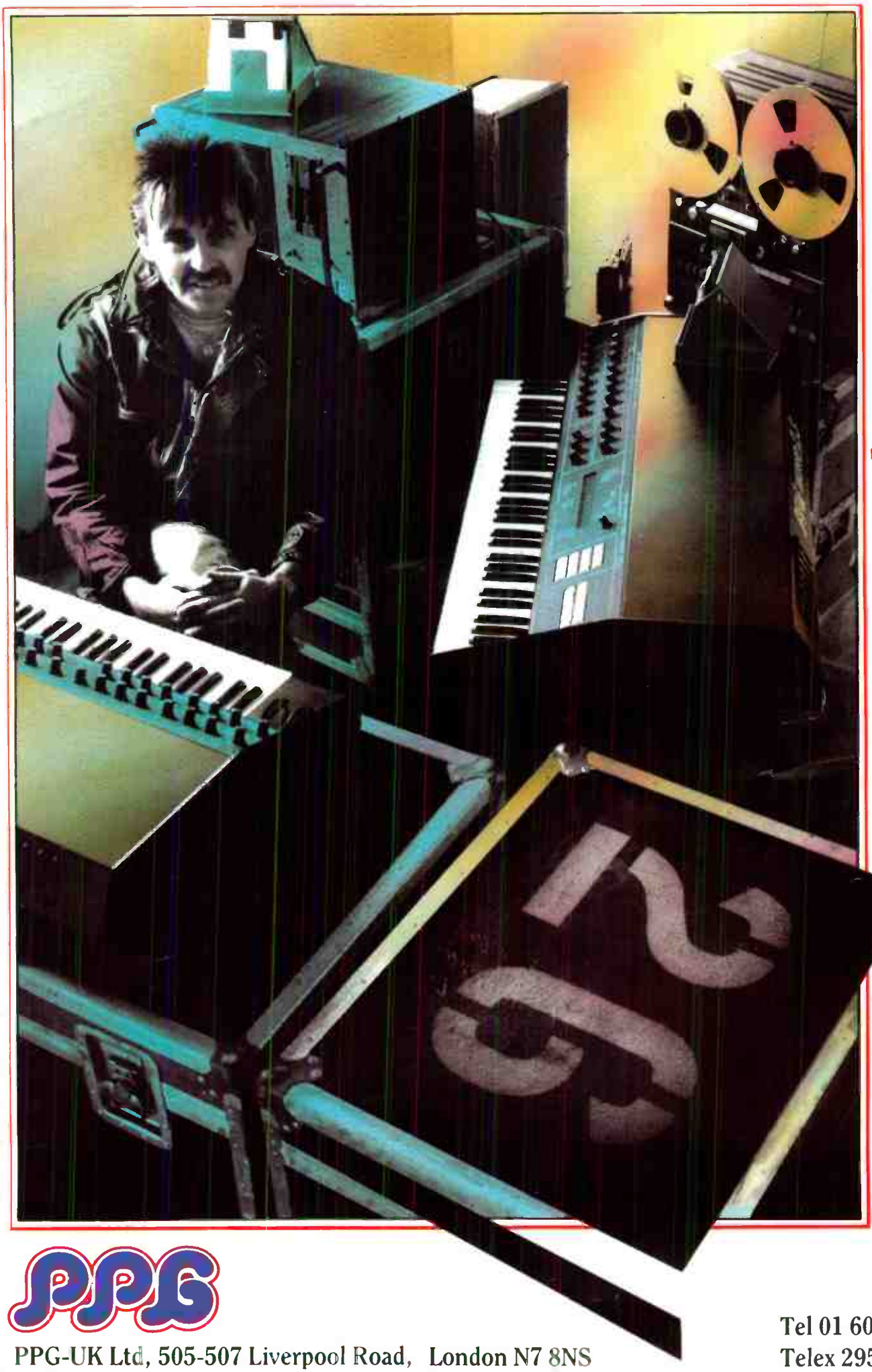

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