JUNE 1984 95p

Electronics & Music Maker

INCORPORATING COMPUTER MUSICIAN

OMD

MIDI

PART 2: THE TECHNOLOGY

REVIEWS:

JEN MUSIPACK SIEL EXPANDER BOSS DD2 PEDAL

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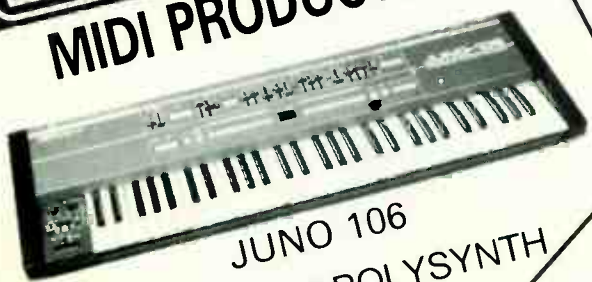

JUNO 106

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Electronics & Music Maker

June 1984 Volume 4 Number 4

CONTENTS

SPECIAL FEATURES

The Guitarist's Revenge 10
The all-but-forgotten guitar synth is due to return to music shops with a vengeance this summer, in the shape of Roland's GR700/G707 system and a breathtaking new British design, the SynthAxe. Paul White puts both instruments through their paces.

Junk Culture 28
Synth-pioneers Orchestral Manoeuvres in the Dark talk to Dan Goldstein about the twists and turns in their musical development, and how they managed to make their new album, Junk Culture, sound more acoustic through the use of computer instruments.

State of Independence 74
Dan Goldstein sifts through the stack of independent vinyl that landed in the E&MM offices following our appeal, and finds each record has a different tale to tell.

INSTRUMENT REVIEWS

Boss DD2 Delay Pedal 18
Boss have finally managed to get a fully-fledged digital delay unit into the compact dimensions of a pedal. Paul White finds out if the reduction in size has had any side-effects.

Jen Musipack 1.0 20
David Ellis and the sad tale of an Italian computer music add-on that bears more than a passing resemblance to established designs from the States.

MFB 512 Digital Drum Machine 24
An RRP of under £300 makes this German-built unit the cheapest source of sampled rhythm patterns on the market. Review by Paul White.

Siel Expander 26
Geoff Twigg takes a look at this MIDI-standard synth-without-a-keyboard.

SCI Model 64 Sequencer 33
Sequential Circuits' MIDI sequencer for the Commodore 64 looks like a bargain at only £185. David Ellis checks out the reality.

Understanding the DX7 70
Part three, and a second look at a Yamaha factory preset. Jay Chapman takes you through it step by step.

The SynthAxe

MIDI SUPPLEMENT – PART TWO

Technical Introduction 38
Paul White outlines the theory behind the new interconnection standard.

Inside MIDI 39
And following on from that, David Ellis takes an in-depth look at how the MIDI system works, and the sort of potential it encompasses.

MIDI and the Micro 46
A complete guide to all the hardware interfaces for home micros available so far, plus the software that goes with them.

BeeBMIDI 52
Designer Jay Chapman describes the construction of E&MM's own MIDI interface for the BBC Model B home computer. There's also a test program to check your interface is working as it should do.

WORKSHOPS

Editing on the Model 64 35
A simple program that extends the on-screen editing facilities of SCI's MIDI sequencer, with a description by the author, Billy Cowie.

Patchwork 73
Readers send in their own favourite synth sounds and details of how to generate them. Synths featured this month are the Yamaha DX9 and Roland JX3P.

Modular Synthesis 66
Woodwind sounds – from both the Western and non-Western worlds – are the subject of this month's missive from Steve Howell.

COMPUTER MUSICIAN

Editorial 79
More MIDI meanderings . . .

Rumblings 81
Music Mate, Mainframe's Apple sound sampler and updates for the Synergy.

The Gentle Art of Transcription 82
David Ellis concludes his survey of music-transcribing devices. Among the products featured this month are units from Fairlight, New England Digital, Con Brio and Xerox.

E&MM Digital Music 86
Some typical applications of the Programmable Digital Sound Generator, outlined by its designer, Alan Boothman.

PROJECTS

The Syndrom 90
PCB overlay and pricing details, plus apologies for the gremlins that crept into part one of David Ellis' description of this digital percussion sampling device.

Multi-waveform LFO 92
A useful add-on for signal processors having an external modulation input. Design and presentation by Paul White.

NEWS

Comment 4
Readers' Letters 6
Newsdesk 9
Back Issues 61
On Cassette 62
On Record 64
Talking Shop 76
Subscriptions 88
Classifieds 95

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Comment

Thanks for the Memory?

Ever since its inception, E&MM has included the musical applications of computers as part of its editorial content. And in the time that's passed since E&MM was first launched, there's been an enormous increase in the numbers of people using computers as an aid to making music, largely as a result of the enormous recent boom in the sales of home micros and the widespread installation of computers in educational and research establishments.

Perhaps the biggest boom is still to come: the advent of MIDI and the appearance of the world's first computer specifically designed as a musician's tool (the Yamaha CX5) will more than likely introduce even greater numbers of music students, composers, performers and researchers to the musical potential of the microcomputer.

However, what is becoming readily apparent is that not every musician is interested in making the micro work for him. And, seeing that quite a bit more work is needed before computers' power can be used to the full (witness the problems with sound-sampling systems), it's perhaps not surprising that there are still plenty of people who remain unconvinced as to the power of the QWERTY keyboard as opposed to the C-to-C variety.

We at E&MM can see their point. Which is why we still include practical projects whose applications are totally unconnected with computers, and why *Computer Musician* is a supplement to E&MM, not the other way around.

Then again, there do seem to be a few people who have taken it upon themselves to promote the idea of computers and music almost to the point of saying 'buy a home micro or you'll be left behind'. Frankly, we consider such an attitude to be more than a little irresponsible, especially when you realise that computers (and their accompanying software) have still got a long way to go before they become really musician-friendly.

After all, what's the point of insisting that a keyboard player become involved with computers, when all his micro can do for him is act as a flexible – but difficult to program – sequencer? And as *Computer Musician* Consultant Editor, David Ellis, points out elsewhere in this issue, the degree of software and hardware duplication between rival manufacturers is rather too high for comfort at present: it seems that very few people responsible for developing music-related computer products have an original idea in their heads. . . .

So, if you feel you're not ready for the computer, don't worry. You won't start losing hair, you won't go green, and your teeth won't start falling out. You'll just be able to sit back and relax while other musicians – those who have a genuine interest in micros and music – do the pioneering work.

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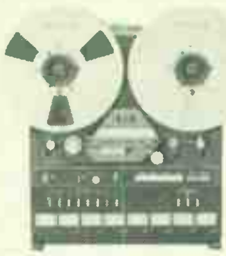

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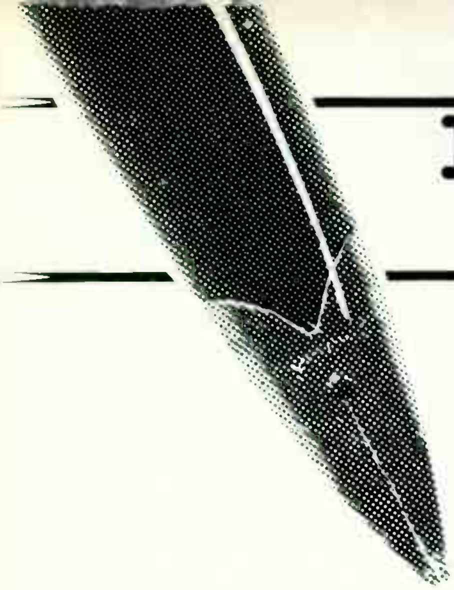

READERS' LETTERS

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

Greek Connection

Dear E&MM,

Thank you for a very useful and invaluable magazine; E&MM has a lot of readers out here in Greece as it's really one of the only ways we can keep in touch with the electronic music and synthesiser scene. As I have only been reading E&MM for a few months I'm a bit confused by all these A/D converters and MIDI. I'm a Commodore 64 owner and would like to be able to control a synthesiser with it and make it into a sequencer: is there any unit available to interface my computer and synth? As yet there are no MIDI synths in Greece – only instruments with the control voltage and gate system.

Two further questions that I would like answered are; do companies producing hardware and software respond to orders from overseas, and how do you go about obtaining back issues of E&MM outside of the UK?

George Giannopoulos
Athens
Greece

To our knowledge, there are no interface units available which allow you to control your synthesiser with the Commodore 64 computer. Sequential Circuits produce the 64 Sequencer but this unit is for control of MIDI synthesisers: the sort of unit you require is a Digital to Analogue Converter. Many designs for these devices have appeared in E&MM over the years, but it should be remembered that designs are specific to each different make of computer and that if you are unable to write your own software, none of these will be of any use to you. Perhaps readers of E&MM who have successfully designed such a unit or the Commodore 64 may like to inform us.

Finally, the answers to your last two queries. Most companies in the UK are quite happy to deal with overseas customers though they normally prefer payments to be made by banker's draft and in Sterling. Don't forget to add the postage cost to your order. If no indication of overseas postal costs is given, go to your own post office and find out the cost of sending a similar object to the UK: this should give you some sort of guideline.

Overseas readers can obtain back issues of E&MM by writing to the Back Issues Department at the normal address. Each issue costs £1.10 (Europe) and £2.00 (Overseas).

Musicsoft

Dear E&MM,

Thank you for the review of our program *Keyboards* in E&MM April. We are of course highly delighted by the complimentary remarks and general tenor of the article.

The reviewer mentioned that notes may be sounded by using keys other than those designated as the playing keyboard. This is not generally possible as only the relevant keys are scanned, all others being inoperative.

Having said that, if you search the keyboard outside of the correct area, and carefully choose certain combinations of three or more simultaneous keys, you *can* get an extraneous note!

The BBC Micro is designed as a single entry key system and there are very rare cases where the simultaneous decoding of three or more keys will cause the generation of an apparently unrelated code. To our knowledge there is no way of avoiding this.

As the reviewer pointed out, *Keyboards* is a utility music program for use as it is or for alteration by the user. We hope that these comments will help your readers to understand the program more fully.

David Tate
Musicsoft

E&MM Mixer

Dear E&MM,

I have recently completed building your 8-4-2 mixer project. My problem is that I wish to expand the number of channels and would therefore like to know whether you can buy the PCBs, and whether the power supply will be able to handle the extra channels.

Robin Frith
Shirley
Southampton

The E&MM 8-4-2 mixer is indeed capable of being expanded to take additional input channels. The extra channels may be added by extending the bus bars and mounting the channels onto a new piece of metal. Alternatively, you could buy another 8-4-2 mixer front panel and cut four input channels off it, make a new case and produce a really professional looking mixer!

You shouldn't have any problems with the power supply, but the bad news is that E&MM can only supply complete sets of PCBs for the mixer project. If you can't afford to buy another set, consider building the additional channels on veroboard.

That Syncing Feeling

Dear E&MM,

I read with great interest your special MIDI feature in E&MM May. Unfortunately I have no knowledge of computers and need some advice on how to set up my MIDI equipment, which includes a Yamaha DX7, Sequential Circuits Prophet 600 and Drumtraks.

Problem: No matter how I plug the 600 and Drumtraks together, I can't get the 600's sequencer in sync with the Drumtraks. Can you help?

David Milne
Sidcup
Kent

It would seem from your comments that you possess one of the early Prophet 600 synthesisers. As you no doubt read in the introduction to the MIDI feature, the 600 was the first synth to incorporate MIDI, and in common with many different makes of synthesisers from the 'pioneering days' it did not incorporate the full MIDI specification. We would suggest that you contact the retailer who supplied your model and ask him to fit the new updated MIDI EPROM: this should solve the sync problem. If they cannot do this, contact Sequential Circuits (Europe), Nijverheidsweg 11c, 3641 RP Mijdrecht, Netherlands.

Commodore Prophecies

Dear E&MM,

I have a Prophet 600 and I wish to interface it with a Commodore 64 micro. You report that SCI have started marketing such an interface – where could I get one, and would I be able to program the Prophet in step time from the micro, as opposed to real time? Also, would it be possible to interface/sync a Roland TR606 to the Prophet's onboard Sequencer?

Michael Palin
Crewe
Cheshire

Sequential Circuits' Model 64 Sequencer is available from any authorised SCI dealer (Syco Systems, Chromatix, etc.) and programming is possible only in real time. See elsewhere this issue for a full review.

Roland's MSQ700 Digital Keyboard Recorder features both Sync In and MIDI connectors, and should synchronise the Prophet 600 and Roland TR606. Unfortunately, there is no easy or cheap way (yet) to link MIDI and non-MIDI products together, and the Model 64 operates on the MIDI principle only.

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Yes, the amazing new DDL from Bel Marketing is expandable, with optional cards from 2 to 8 seconds at 15kHz bandwidth (16 secs 7.5kHz).
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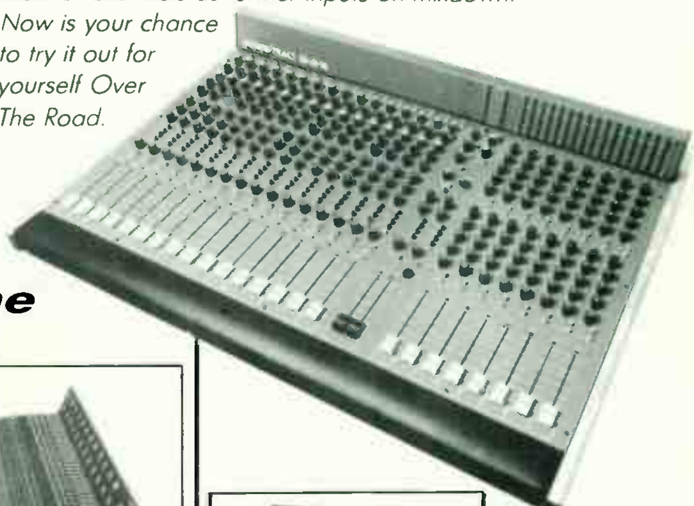

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The Soundcraft Series 20 Stereo Mastering Machine takes the concept of conventional analogue tape machines into a new era. The Series 20 meets the highest professional standards at a very competitive price. The end result of this revolutionary design is a very impressive product indeed. You could be one of the first ever to push the switches on this machine Over The Road.

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Casio MT800.

Micro Musical are soon to release their Microlink 2 system: this will allow users to link together two Casio keyboards with the Sinclair Spectrum computer. The software and interface board enable you to link the MT800 and PT80 Casio keyboards to provide a music system that features melody storage and replay commands. The computer graphics and menu-driven display make the composition of complex musical scores much easier and quicker, allowing synchronisation of melody, harmony and chords. Preset voices and auto-rhythm selection are also under software control, and the system is expected to be particularly popular in the music education field.

Information from Micro Musical Limited, 37 Wood Lane, Shilton, Coventry, CV7 9LA. Tel: (0203) 616760.

The long-awaited **Hot Licks** Synthesiser Tape is now available. This instructional course consists of six one-hour cassette tapes, recorded by T. Lavitz, an American keyboard player who has been nominated for no less than four Grammy Awards.

The Synthesiser Workshop deals with the following areas: producing lead sounds, using delay and reverb, pitch bending scales and modes, improvisation,

T. Lavitz.

arranging, and programming drum machines. A wide range of musical examples are also covered, and these include rock, country and jazz styles.

Further information may be obtained from Labtek International Limited, Music Products Division, 257 Middlewich Road, Northwich, Cheshire CW9 7DX. Tel: (0606) 48684.

E&MM is sad to announce the recent death of **Charles Blakey.** Well known to regular readers of the magazine through the articles he wrote on syntehsisers and computer controlled music, Charles contributed on a regular basis to this and many other publications. Through his own company, Digisound, he produced a variety of synthesiser and electronic music-related kits that became well respected in the electronic music field.

Digisound would like to inform readers' that the company will continue to sell the existing range of established kits and will in fact be developing new kits in the near future. E&MM would like to send its condolences to Charles Blakey's family and wishes Digisound continued success in the future.

Readers interested in the full range of Digisound synthesiser kits should write to Digisound Ltd, 14/16 Queen Street, Blackpool, Lancs. FY1 1PQ.

British Music Strings, UK distributors of the **Londoner** amplification, have announced the following specifications for the new Londoner Amp. The L100AC is a 120 watt combination amplifier with two 12" speakers, built in reverb and a parametric equaliser.

The amp is divided into two sections. The Lead/Rhythm section features bright and normal jack input sockets, while the Bass/Organ section features bright and normal input jack sockets and rotary controls for volume and presence. Jack plug sockets are provided for connection to a slave amp and to external speakers. The cabinet is covered in black heavy-duty vinyl with chrome metal corners for protection.

Further details are available from British Music Strings, Bedwas House Industrial Estate, Bedwas, Newport, Gwent.

Don Larking Audio Sales' **Over the Road Show** will be held at Kensington Town Hall on June 13 to 15, to coincide with the 'official' APRS recording exhibition. Wednesday from 1.00pm to 6.00pm, Thursday and Friday 10.00am till late.

Admission is free, and E&MM will have a stand at the show, where back issues, PCBs, sweatshirts and T-shirts will be on sale, and of course many of our staff will be available to chat and answer your questions.

Exhibitors at the show will of course include Don Larking with an extensive range of equipment from Fostex, Soundcraft, Bel, Soundtracs and Trident, plus many others. Applied Microsystems will be demonstrating their range of digital tape recorder counters and autolocators, and also present at the show will be the Britannia Row 46-track video post-production suite; a full demonstration of their facilities will be given and visitors will be able to have a go at mixing a video tape themselves.

Finally, our sister magazines *Home Studio Recording*, and *Guitarist* will also be in attendance.

See you there!

Kensington Town Hall, Off Kensington High Street, London.

At last! The long awaited results of the **E&MM readers' poll**. Most of the categories produced a clear winner, with the Eurythmics featuring in several sections. The winners of each section are as follows.

Band of the Year	Eurythmics
Solo Artist	Howard Jones
Brightest Hope	Ian Boddy
Keyboards	Klaus Schulze
Guitar	Stuart Adamson
Bass	Tony Levin
Percussion	Phil Collins
Vocals	Annie Lennox
Songwriter	Vince Clarke
Composer	Jean-Michel Jarre
Album	*Touch* (Eurythmics)
Single	*Mama* (Genesis)
LP Cover	*Oil on Canvas* (Japan)
Video	*Thriller* (Michael Jackson)
Live Act	Ultravox
Best new keyboard	Yamaha DX7
Best new other item	Roland MC202
Innovation of the year	MIDI

E&MM hope to secure interviews with several of the winning artists from this year's poll, and so as not to disappoint readers who voted for artists that didn't win, we shall also be trying to feature some of the better runners-up.

Marshall (Products) Ltd., well known for their range of valve amplifiers, have recently received the Queens Award for Export. Marshall, who are based in Bletchley, Milton Keynes, have been manufacturing their famous amplifiers and speaker cabinets for some two decades.

Owners of any of the EMS range of synthesisers may be interested in the services offered by **Brookside Electronics.** Brookside provide a full repair and conversion service on all models of EMS synthesisers, and the type of work carried out includes the modification of oscillators for stable tuning and the addition of trigger inputs. Besides providing a comprehensive repair service, a custom-built electronic musical instrument service is also available.

Further information from Brookside Electronics, 3 West Street, Winterborne Stickland, Blandford Forum, Dorset DT11 0NT. Tel: (0258) 880732.

THE GUITARIST'S REVENGE

As little ago as last August, the guitar synthesiser appeared to be something of an endangered species, with few models available and little enthusiasm for them on the part of manufacturers or designers. Now the MIDI interface has changed all that, with two such-equipped variations on the guitar synth theme – one the product of a Japanese music industry giant, the other the invention of a dedicated band of British enthusiasts – scheduled to appear on the market by the summer. Paul White, **a self-confessed guitar synth addict, takes us through the background to each instrument's development, and attempts to put their enormous potential into perspective.**

Roland GR700 Guitar Synth

and G707 Controller

The GR700 guitar synth may be controlled from any Roland G-Series guitar controller, but the new G707 model is recommended as its unique design reduces unwanted harmonics which would otherwise play havoc with the pitch to voltage circuitry.

The 700 is the third guitar synth to be produced by Roland, its predecessors being the GR500 and the GR300, both of which had their own strengths and weaknesses. As I own both previous models, I was particularly interested in seeing how this new model compared in terms of facilities and playability.

Before starting the review, it's worth going over the operational principles used by the Roland guitar synths and the reasoning behind them. In order that normal playing techniques may be used (including string bending and vibrato), Roland's engineers decided that the synthesiser circuitry should follow the pitch produced by the guitar strings, and this approach instantly raises some serious design problems.

First, a vibrating guiitar string produces not only its fundamental frequency but also a complex series of harmonics which shift in amplitude as the note decays. These harmonics have to be stripped away from the signal before conversion, otherwise the pitch to voltage converter becomes hopelessly confused. Secondly, a guitar has six strings, and in order to separate the notes produced, an individual pickup is needed for each string. Roland have solved this particular problem by means of their hexaphonic pickup, which has six individual magnetic circuits within a single pickup housing. This is mounted very close to the strings, near to the bridge, in order to eliminate crosstalk from adjacent stringsLastly, a guitar's signal gets weaker as each note dies away, and some system has to be devised such that the note shuts off gracefully rather than gargling into obscurity as the pitch to voltage converter loses track.

Roland's previous guitar synths solved this last problem in two different ways: the GR500 had an electromagnetically induced, infinite sustain system so that the situation never arose, while the GR300 coupled the string amplitude to a voltage controlled amplifier, so that as the guitar note decayed away, the amplitude of the synth note decayed with it.

The GR700 utilises two different approaches so that different types of sound are treated in different ways.

A system known as quantisation is available, and this rounds off the note being played to the nearest semitone. The beauty of this system is that, for the first time in Roland guitar synth history, a note can be made to sustain after releasing the string. If this was attempted on the old GR500, the pitch would become indeterminate at the instant of release, and an unacceptable amount of pitch droop was therefore evident during the release period. With quantisation, this droop is rounded up to the nearest semitone so that the pitch during the release period remains precisely in tune. Of course, this system restructures any attempt at string bending into semitone steps, and as a result should only be used on voicings that have some sort of release period, or those for which pitch bending effects would be inappropriate.

The alternative system, suitable for voices with no release time or for those where string-bending exists as a viable musical proposition, revolves around letting the synthesiser amplitude die down as the string amplitude decays, and allowing it to cut off instantly when the strinq is released.

The G707 Guitar

The controller is more than a little unorthordox in its aesthetic design, bearing as it does a closer resemblance to a Dalek's handbag than to an electric guitar. Instantly noticeable is the black bar joining the headstock to the body: this innovation is intended to cut down unwanted neck vibrations which would

otherwise produce mischievous harmonics, thus causing dead spots at certain points on the neck.

Apart from this damping bar and the rather extrovert shape, the guitar looks and feels reassuringly ordinary, and indeed, it's one of those guitars that feels instantly familiar as soon as you pick it up.

The two pickups are fairly standard humbuckers and these are selected by means of the usual three-way switch, a single volume and tone control being provided for modification of the conventional guitar sound. The hexaphonic pickup is discreetly positioned next to the bridge and the guitar connects to the floor unit *via* a 27-way multicore cable terminated in locking multipin plugs. The guitar is also fitted with an efficient vibrato arm which produces the minimum of tuning problems, due to the roller bridge design.

Controls

Apart from the conventional guitar controls, the volume control of which acts as a master for both guitar and synth, there is also a balance control which permits the mix of guitar and synth sounds to be varied. The three-position mode switch cuts out the synth sound in position one, while in the other two positions, both guitar sound and synth sound are available but with differing picking thresholds, position two being the most sensitive.

In much the same way as the GR300 system, vibrato may be introduced by means of two touch plates near the treble pickup, one to activate the vibrato and the other to either switch it off or to enable momentary vibrato to be applied. Vibrato parameters such as speed and delay are decided by the programming of the sound currently being used. The vibrato depth knob gives further control and may be turned down to prevent accidental switching of vibrato when not desired.

Two further knobs are provided, these being labelled cutoff frequency and edit. These controls are only operative in edit mode, the cutoff frequency controlling the filter and the edit knob being assigned to other parameters as required. If an earlier G-Series guitar controller is used, the resonance knob is used as the edit control.

The Floor Unit

The voice circuitry of the GR700 is essentially that of the Roland JX3P, a versatile six-voice polysynth featuring two DCOs per voice and enough memory to store 64 user-programmable sounds. Like the JX3P, the GR700's sounds may be set up by editing one parameter at a time or, by using the optional PG200 programmer, you can twiddle all the knobs at once, just like a conventional analogue synth.

On encountering the GR700 for the first time, the things you notice initially are the large footswitches and the huge numeric LED display. There are eight numbered footswitches which, in conjunction with the 'bank' switch, can be used to access all 64 stored patches, configured as eight banks of eight sounds.

A hold pedal is provided which causes any sound in progress to be held indefinitely at its programmed sustain level, and this facility may be programmed to operate on any or all strings for a gven patch. The edit switch may be used during programming or, alternatively, to enable the cutoff frequency control on the guitar to be used during performance.

In addition to the 64 patches stored in memory, a non-volatile RAM pack is available, and this permits virtually instant storing and loading of a further 64 sounds, enabling a permanent library of patches to be built up. The numerical indicators show the patch number currently in use and, in edit mode, they indicate the parameter number and its data value.

There iss also a further bank of small pushswitches which would normally be used during programming or editing patches, and include settings relating to memory, string selection and dynamics.

Both synth and guitar voices have separate outputs and the synth output is in stereo so that the built-in stereo chorus can be used to full effect. These outputs are available on both standard jacks and balanced XLR sockets, and an extra jack is provided so that a volume pedal can be connected to control the filter cutoff frequency.

The GR700 can be used to control other MIDI synths *via* its own MIDI connection: this transmits note on/note off and dynamics information, hold on/off and patch selection. MIDI channel number is fixed at one. Because keyboard information is chromatic by nature, normal string bending effects are not possible using the external synth. If this is attempted, semitone steps will result. In order to get the GR700 to send more than note and dynamic information, various function keys must be held down as the unit is powered up, and this procedure is described in detail in the owner's manual.

Playing Test

It transpired that the new unit which we unpacked and subsequently played had not been set up correctly: our musical efforts were transformed into something resembling the Grimethorpe Colliery Brass Band being tickled during rehearsals.

The hexaphonic pickup was mounted too far away from the strings and, when this was corrected (as shown inn the Roland handbook), things began to improve. Once this adjustment has been made, it is then necessary to set the sensitivity for each string using six preset pots, accessible by means of a panel on the rear of the guitar.

Once thus set up, the guitar responds reasonably well to normal playing, though sloppy fingering or fret buzz is rewarded by Grimethorpe Revisited. However, it's quite reasonable to expect to make some concessions when playing this instrument and, having tamed the infamous GR500, I think I could live with the GR700 after only a short rehabilitation period.

I think it goes without saying that these sorts of sounds have never been available to the guitarist until now, and even by keyboard standards, the JX3P voicings used are very impressive.

Conclusions

This instrument makes it possible for the guitarist to produce sounds hitherto inconceivable but, in return, he must play cleanly, thoughtfully, and above all, ensure that the pickup spacing and string sensitivities are always optimised. It's no use setting the synth to a violin sound and then playing Van Halen riffs, and still expecting to sound like Paganini! If on the other hand, you set up a brass sound and play the part of a brass section, then you'll be rewarded by a pretty convincing musical impression.

Finally then, it would seem that in spite of the initial difficulties, the GR700 represents significant progress in the field of affordable guitar synthesis, and I'd say that any guitarist wanting to expand his horizons should give it a try. Remember though that it takes some getting used to, so sit down in the shop with one for at least an hour or two (assuming they'll let you. . .) before making up your mind.

Roland have informed us that all GR700 guitars will be checked at the factory before being despatched to dealers, and that a new tuning routine has also been included.

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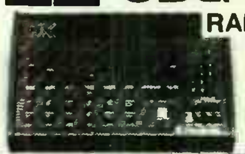

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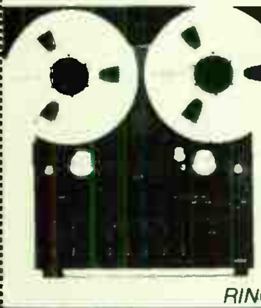

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The SynthAxe

Although its appearance is pure science fiction, the SynthAxe has been under development since 1978 and is the product of thousands of hours of research. During that year, BBC music producer Bill Aitken and engineer Mike Dixon stopped merely talking about the possibilities of controlling a synthesiser from a guitar-like instrument and set about turning their ideas into reality. A first-rate digital designer was needed and Tony Sedivy accepted the challenge, largely because the task was considered to be impossible (!)

One of the first requirements was a polysynth to control and Bill found a Yamaha CS80 at a giveaway price, the latter being due largely to its unscheduled descent down an elevator shaft. Unfortunately, the ground broke more than just its fall and Mike and Tony had the rather thankless task of rebuilding it.

Before deciding on the way in which the instrument should operate, the playing technique of a wide range of guitarists was studied, and various parts of the instrument were then built in the form of test jigs to test system and transducer designs.

At this stage, a Data General Nova mini-computer was used to control the system but this was later to be replaced by onboard microprocessors. However, finance was beginning to become a problem, and this was only resolved when Virgin Records agreed to invest in the project.

As the SynthAxe team worked on, the Fairlight CMI gradually became better and more widely known, and turned out to play quite a big part in the SynthAxe's development. During a trip to Australia, Bill Atiken met Fairlight's Kim Ryrie and the SynthAxe project generated such interest that Fairlight actively encouraged development by supplying special circuit cards and a PROM blower, along with the CMI purchased by SynthAxe. The outcome of this is that the CMI system doubles as both a musical instrument and a 6809 development system.

By October 1983, the various test jigs had been bolted together into a playable form and this has since been used as the development prototype.

Frankenstein

Because of its ungainly appearance (and the bolt through the neck), this was nicknamed Frankenstein, resembling as it did a pile of computer cards bolted to the end of a very odd guitar neck. Although difficult to play, it gave the designers a good measure of moral support by virtue of the fact that it was playable at all.

Several top guitarists secretly tried Frankenstein and their comments were analysed before the final production design was finalised. Although the first production model is not yet complete, E&MM staff have seen the improved features in the form of test jigs, diagrams and sub-assemblies, and we are optimistic that the production SynthAxe will live up to or exceed most expectations.

Presentation

The layout of such a radical instrument is all-important, and mercifully the long two-octave neck provided few headaches: as the higher frets are more widely spaced than those on a conventional guitar, the scale length is rather great and so the angled neck was developed with ergonomics – as opposed to appearance – in mind. As the strings produce no note as such they are not tuned, and a completely separate set of strings is used for the left and right hands in order that the maximum amount of pitch and dynamic information may be interpreted by the electronics.

The body is a rigid foam moulding which combines physical strength with light weight, and the complete SynthAxe is expected to weigh no more than a standard Fender Telecaster. Getting all the complex electronics into the body was no easy task and Ken Steel, the mechanical designer, had to resort to five-layer computer-designed PCBs to make everything fit.

The Neck

Unlike conventional necks, this one is of a constant cross-sectional profile and is fabricated from an aluminium extrusion. The frets look normal, but close examination reveals that they are made from several segments so that the strings can make electrical contact only with that part of the fret. Electrical contact between the strings and the frets produces a unique digital code which is interpreted by one of the onboard 6809 microprocessors dedicated to scanning the fingerboard logic. String-bending is detected by moving-coil angle transducers at the end of each string and then fed information to the microprocessor, which calculates the required pitch change for each fret position, while the degree of pitch-bend itself is variable, enabling dramatic effects to be produced without slicing your finger ends.

In order to simulate left-hand damping, each string is connected to a touch sensor which utilises two different electronic principles simultaneously to ensure foolproof operation.

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The Body

Mounted on the body are the trigger strings, an electronic vibrato arm and the trigger keys. The trigger strings are sensitive to picking dynamics, thanks to a novel hall-effect transducer system and, like the neck strings, they are also responsive to damping. The trigger strings are normally used to trigger sounds that have a rapid attack and a natural decay, pianos, glockenspiels and other percussive sounds being included in this category. Sounds having a slow attack and long sustain are triggered from the six trigger keys which are velocity sensitive and have an aftertouch pressure system. Although these keys are a radical departure from guitar or guitar synth design, they are both useful and surprisingly easy to live with.

The Group and Master Trigger Keys are conveniently located near to the six trigger keys and enable either the bottom three or top three strings, or all six strings together, to be played simultaneously and sustained indefinitely. There are also two Auto Trigger Keys, one by the trigger strings and one by the trigger keys, and depressing either one of these permits playing to be carried out entirely by the left hand. Thanks to these some very fast runs are possible, and by using these switches in their locking rather than momentary modes the neck may be played two-handed, rather like the Chapman Stick.

Pedal Unit

The SynthAxe connects to its pedal unit *via* a 14-way cable and three major functions are made available: Automatic Hold, Automatic Capo, and left-hand String Damp Disable. Depressing the Hold pedal sustains any note combination currently being played. This allows entirely new and quite fascinating drone effects to be combined with melodic playing, and it's easy to envisage new performance styles emerging from this feature.

The Automatic Capo Pedal permits the positioning of a purely electronic capo at any position on the neck and furthermore, the capo isn't limited to a barré – it can also be chord shaped. To exploit this feature further, it's possible to play both above and below the capo, opening up yet further avenues for new playing techniques, while by using the Left Hand String Damp Disable, it's possible to play a chord and then, whilst it continues to sustain, play a completely different chord or series of notes on top of it.

The SynthAxe works *via* a MIDI interface, and while this opens up a number of interesting possibilities, limitations could be imposed by an inappropriate choice of synthesiser. For example, choosing a synth with no keyboard dynamics would preclude the use of the dynamic facilities of the SynthAxe. Because of these limitations, SynthAxe are compiling a list of suitable MIDI synths for use with the system and this will be updated as new models become available.

Console

An optional control console is being made available which can link up to eight synths to the SynthAxe and provide instant switching from one to the other. The console will also permit various transposition effects to be implemented and stored in semitone steps. Up to eight transpositions or capo settings may be stored in this way and it's also possible to change tuning with the synthesiser being controlled simultaneously.

And as if all these facilities weren't already mind-boggling enough, there is a proposed expander pedalboard under development, to control further effects such as pitch glide.

Conclusions

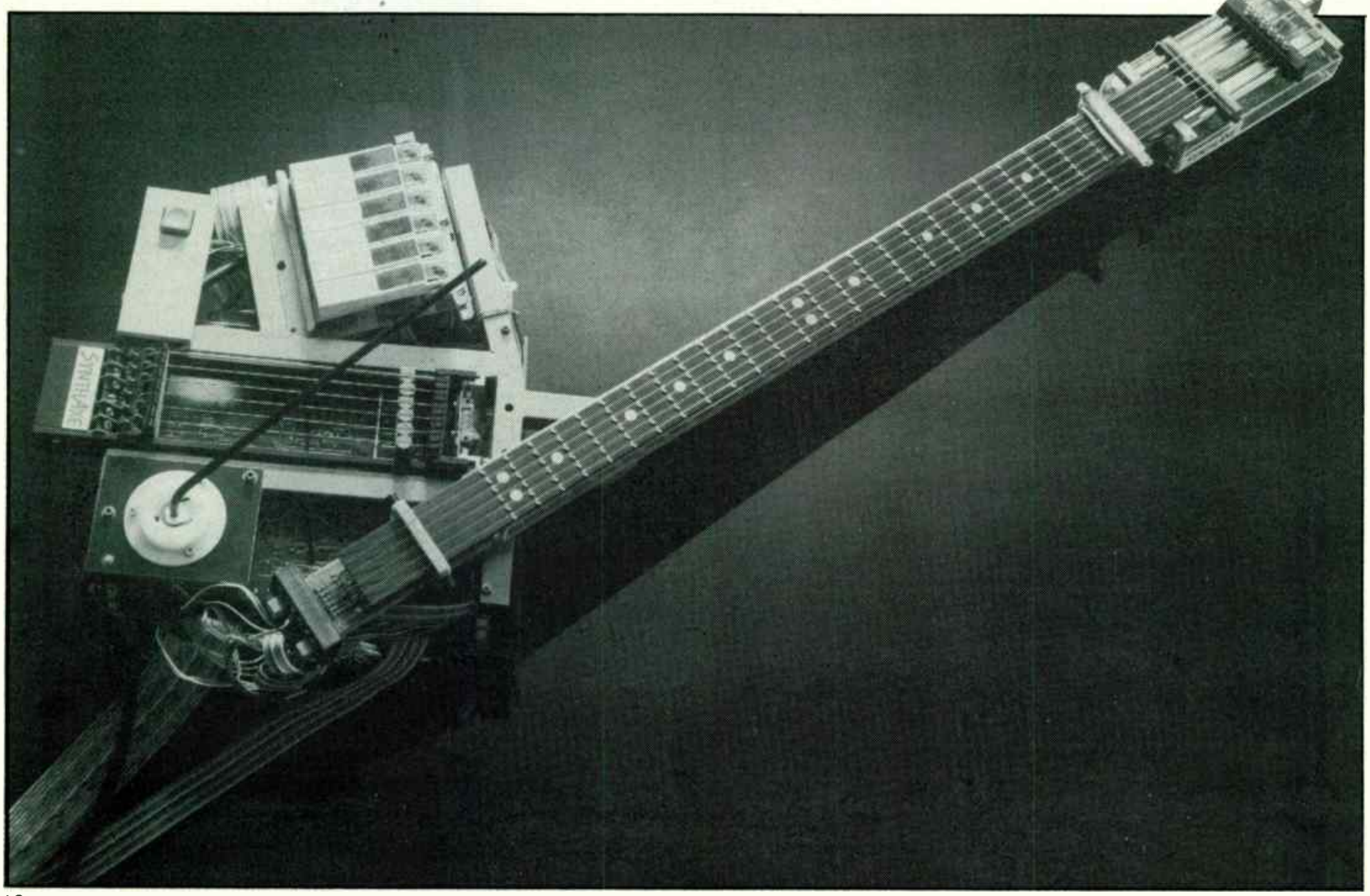
Although the first SynthAxe production model is not expected to be available until June of this year, what we saw was enough to convince us of the enormous potential of this remarkable instrument. To be able to fingerpick a grand piano or apply a bit of vibrato arm to a string quartet is certainly a novel experience, and as already mentioned, the unique facilities offered by this system could well foster a variety of new and exciting playing styles.

Before you reach for your Access card, it's only fair to warn you that the price will be in the order of £10,000, though a less sophisticated version is scheduled to appear in a year or so which may retail for as little as £3000, this price to incude a suitable synthesiser for sound-generation.

There are bound to be one or two Luddites who will point out that you can buy an awful lot of piano lessons for £10,000, but the SynthAxe is capable of producing music that would be impossible on either a guitar or a keyboard, lifting it well above such considerations.

The first models will be available this summer and will be distributed in the UK by Syco Systems.

Paul White **E&MM**



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Boss DD2 Digital Delay Pedal

Rack-mounting digital delay lines are now more common than ever before, but it's taken some clever technological space-saving by Roland's Boss division to produce a pedal-based alternative. Paul White **weighs up the pros and cons of the new format.**

Digital delays have been with us for quite some time now, but this is the first one I've come across that actually fits into a pedal. Boss pedals have a reputation not only for quality but also for their small physical size, yet even so, it was hard to believe that anyone could squash the relatively complicated circuitry of a digital delay into such a tiny volume.

Featuring a maximum delay time of 800ms, the DD2 has a bandwidth of 7KHz – rather better than most comparably priced analogue units – while the residual background noise is a staggeringly low −95dBm.

Construction

The DD2 is identical in shape and size to the rest of the Boss range, and is finished in an attractive metallic pearl effect with blue legending. Like all Boss pedals, the battery fits under the footswitch and can be changed easily in a matter of seconds, which is just as well because the circuitry consumes 55ma and so gobbles up batteries even faster than Bruce Grobbelaar gobbles up Liverpool's opponents' crosses. Because of this unavoidable shortcoming, the Boss PSA power unit is recommended and this will run the unit all week for about tenpence, I should think. Internally, the pedal is surprisingly uncluttered due largely to the use of a custom IC which replaces a lot of conventional circuitry.

Controls

Apart from the pedal itself which turns the effect on and off, there are four rotary controls which regulate the relative levels of direct and delayed sound, the amount of feedback used, the delay time and the delay range. This control sets the range over which the delay time control will operate, the maximum delay times being 50ms, 200ms and 800ms, with a fourth position dedicated to the hold function. When hold is selected, the pedal becomes non-latching so that no effect is heard unless the pedal is held down. Depressing the pedal causes the previously played phrase to be repeated continuously until the pedal is released, the length of the phrase depending on the setting of the delay time control.

An extra socket is provided for stereo use which enables the direct and delayed sounds to be routed to different destinations, and the usual LED indicates effect status and battery condition.

In Use

Although there are digital delay units with a wider bandwidth than the DD2, tests with electric guitar and synthesiser produced clean echoes that were virtually impossible to distinguish from the original sound. One of my personal quibbles with many digital systems is the inordinate amount of quantisation noise they produce. This can usually be heard on low frequency sounds and takes the form of a background sizzling noise, but in the case of the DD2, I could not detect any noticeable problem in this area, probably due to the 12-bit conversion system which utilises an analogue companding technique to make efficient use of the available dynamic range, without having to match the input level to the circuitry.

Another absent nasty was aliasing on high frequency signals. This unpleasant side effect is produced when harmonics of the input signal, not fully removed by the input filters, beat with the clock frequency of the delay circuitry and produce sum and difference frequencies, the lower of which may fall into the audio band and manifest themselves as non-harmonically related distortion.

Try as I might, I could find no fault with the DD2's sound quality, and any criticism that can be made of the unit must be levelled at its design philosophy, which forces the user to bend down to adjust the controls: it can look a mite unprofessional at gigs. I particularly like the hold effect which tempts the user to indulge in Fripp-like excesses with the minimum of required effort, the pedal system being ideally suited to the control of this function.

Conclusion

At a recommended price of £175, this is quite frankly the cheapest and most vice-free digital delay I have yet encountered in the under £300 range.

Having said that, the DD2 provides no modulation facilities or external modulation input, making chorus and flanging effects out of the question. Additionally, there is no facility for storing and triggering sounds, but at this price, I am neither surprised nor disappointed at this omission.

The pedal format *does* make it difficult to alter parameters in a live situation, while the tiny control knobs can make precise setting a fairly tricky operation but, on the other hand, the pedal is easy to use in the hold mode and costs about half the price of a comparable rack-mounted unit.

Although the DD2 is obviously intended for live use, its low price and high sound quality will undoubtedly attract users from the home studio fraternity as well as beyboard players, guitarists and PA operatives. It seems that Boss have done it again, and it will be interesting to see how long it takes rival manufacturers to follow suit.

Paul White **E&MM**

RRP of the Boss DD2 is £175, including VAT. For further information, contact Roland UK, Great West Trading Estate, 983 Great West Road, Brentford Middx. TW8 9DN. Tel: 01-568 4578.

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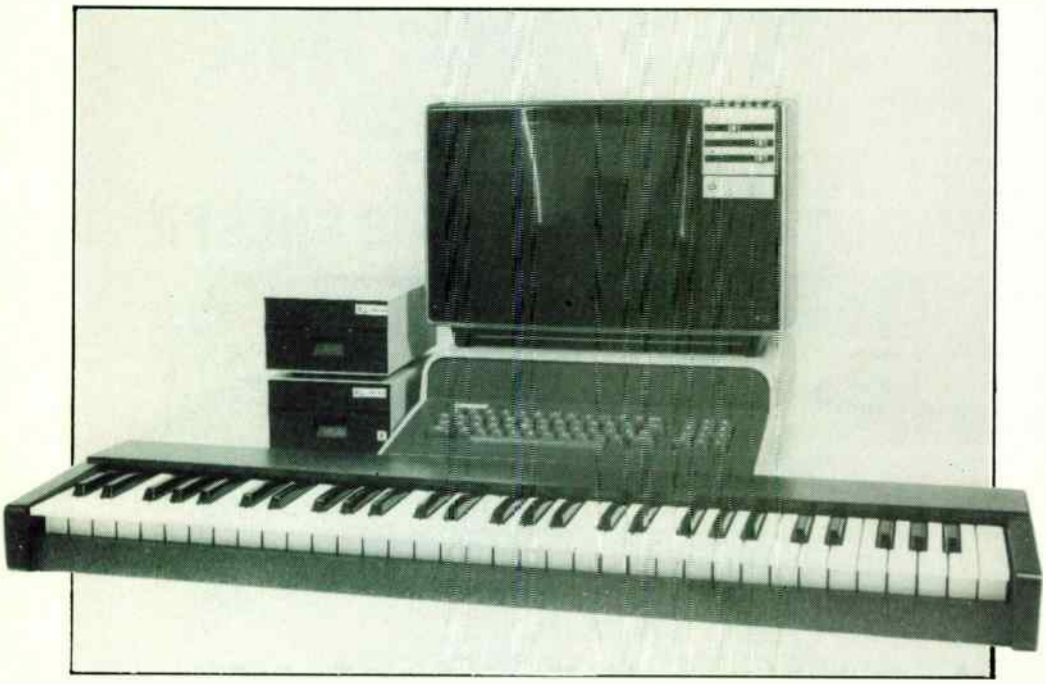
The Jen Musipack 1·0

The Musipack is the first micro-based musical add-on package of European origin to reach these shores. In common with its counterparts from across the Atlantic, it works with any Apple-compatible computer but, as David Ellis **discovered, the similarities don't end there. . .**



Jen aren't the sort of company that you'd expect to come out with anything of a hotly contentious nature. After all, they've carved themselves a nice little niche in the area of low-cost monophonic synths, electronic pianos, and organs. The trouble, of course, is that the microprocessor revolution has signalled a make or break situation for such companies, and what used to be considered a 'safe' product has been ousted in favour of the higher-tech polyphonic synth with programmability, sequencing, LCD displays, and the MIDI.

Jen have been fairly astute in recognising that the sensible replacement of the electronic piano of old is the keyboard and sound synthesis add-on to the personal computer. Provided the hardware delivers the goods, the system can be upgraded simply by running it with new software: the logic of that philosophy has been amply demonstrated by two other companies predating Jen's entrance into the micro add-on arena – Syntauri and Passport Designs, makers of the alphaSyntauri and Soundchaser systems respectively.

Both of the American systems use the Apple II or IIe for the processing side of their action, together with four or five octave keyboards of their own design that plug into the Apple *via* an interface card, and the Mountain Computer MusicSystem digital synthesiser boards that get fed with musical instructions and waveforms from the micro's motherboard. Jen, on the other hand, have elected to go for supplying their own micro, keyboard, and synthesiser boards. Highly laudable, you might think.

Well, not quite. The micro, called the Lemon II, is an Apple II lookalike that adds little to its sweeter predecessor other than a numeric keypad, a feature which is hardly of momentous import to musical applications of micros. Talking of 'import', it's highly unlikely that the Lemon will ever appear in this country, as Apple's busy band of lawyers have served an injunction on the manufacturer of the Lemon II. So, the fact that the Musipack can be run on 'any Apple-compatible computer' is rather fortunate for Jen.

However, the lookalike factor goes a good deal further than the micro. The Jen synthesiser boards (called the DSG10) are actually exact replicas of the Mountain Computer Cards – right down to the layout of tracks, identity of ICs (though numbes have been scrubbed off in a vain attempt to divert overeager scrutiny), and value of components. Very curious.

Now, bearing in mind that the Mountain Computer boards are five years old and showing their age, you'd have thought that Jen would have taken the opportunity to improve on the original. Not a bit of it. They're still on the noisy side, rather deficient at the top end, and lacking in punch. Ironically, Passport Designs, the other company to enter into Jen's frame of reference (so to speak), have actually re-designed Mountain Computer's synthesiser boards onto just one card (the MX5 – with Mountain Computer's blessing, of course), giving improved bandwidth, reduced crosstalk, and an onboard keyboard interface and drum sync to boot.

And Jen's own IKB10 keyboard interface? Well, surprise, surprise, it's a direct copy of the interface card that Passport Designs produced for their earlier Soundchaser system. At least the five-octave KBD10 keyboard looks a little different to the Soundchaser (it's five octaves rather than four), though that woodwork and case style does look a little familiar. . .

Software

According to the Musipack manual, this was 'conceived by the Edgar Varese Studio of Computational Sonology, Pescara', and the one (partly) listable program on the software disk informs us that one Piero de Berardinis owns the copyright on it.

The opening pages of the manual introduce the user to one original feature of Musipack – that of a disk-operating system that date-stamps the disk. Personally, I find this of more annoyance than value – date-stamped disks get a little wearisome when you're copying from one disk to another. Like the rest of the Musipack's operations, the opening pages of the software are menu-driven. That on booting-up includes an option marked 'E›nd'. Keying this displays the message, 'end pack (y/n)?'

Keying 'D›igitrack', on the other hand, loads up and runs the various routines needed to get the keyboard inputting notes and the synthesiser boards outputting sounds. Like most menu options, this takes time (getting on for two minutes, in fact), and you're then greeted by a further menu. '1' puts you and 'Gestast' (whatever that is) into the picture by providing a display of all the parameters that make up each of the ten instruments loaded into the memory. The keyboard also becomes active at the same time.

Operations

The way the software operates is to configure two of the 16 oscillators on the synthesiser boards for each note played on the keyboard. These come in pairs of eight, one set going to the left output and the other to the right. The nearest traditional equivalent to these oscillators is the type of DCO found in the OSCar or PPG Wave. That's because they're waveform-programmable, courtesy of a continuous stream of numbers from appropriate waveform tables in the computer's memory, with one chosen waveform going to the first oscillator and another to the second.

However, unlike the OSCar and PPG Wave 2·3, there aren't any VCFs to play around with on the Jen, so the only modification to the sound of raw waveforms is envelope shaping (the ADSR

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parameters shown for each oscillator) and LFO modulation (the FREMOD parameters shown underneath). The nice thing about the LFO is that each of the ten instruments can have their own waveform (which can be anything you like as opposed to the usual sine, square, sawtooth, etc.), and different modulation levels can be assigned to the two oscillators. So, by putting the right parameters in the right places, you can get delayed vibrato, reversed vibrato, and a whole host of other modulation possibilities.

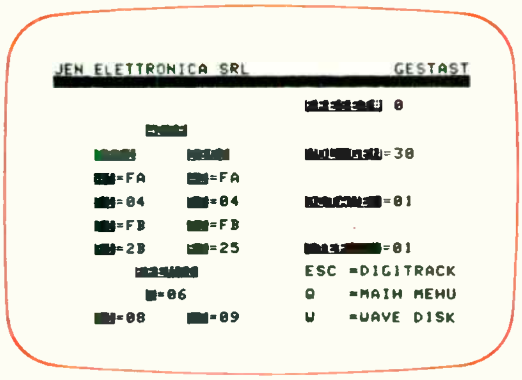
As the display indicates, these parameters appear as hexadecimal values (counting 0 through F), so a maximum value appears as FF rather than 255. Not very friendly, really. I mean, would you buy a keyboard that told you *via* its LCD that you'd just punched up preset number 7F? So why, then, have Jen insisted on using hex values when there's ample space in the display for normal base 10 values? Well, this is where the lookalike story re-surfaces. It just so happens that Passport's Soundchaser also uses hexadecimal for its representation of parameter values, though this time for the good reason of wanting to squash a lot of data into a small space. However, the similarity between the two systems goes a good deal deeper than that. In fact, all the parameter names for the ADSRs, LFO, volume and octave settings show a remarkable degree of concordance between the Jen Musipack and Soundchaser. To cap it all, the Musipack software turned out to be perfectly happy running my Mountain Computer boards rather than Jen's own lookalikes – even when using the Soundchaser keyboard instead of the Jen variety. Indeed, with the same preset parameters on-screen, there was actually no difference between what the two systems were doing and what sounds emerged.

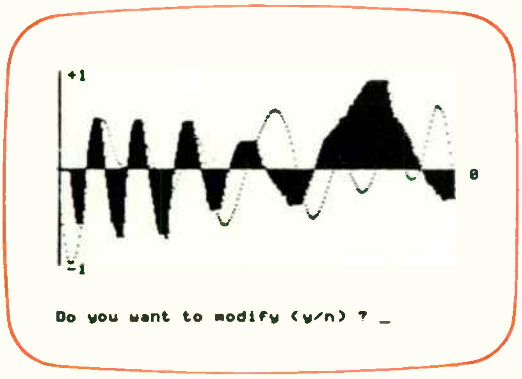
Sequencing

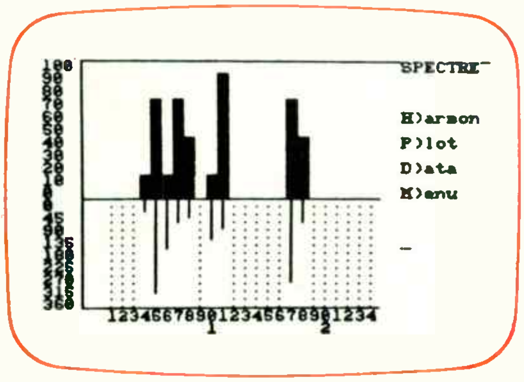
More fuel was added to my suspicions when I looked at the sequencing side of the Musipack software. To get into this from the preset display, you simply key the Escape button and a different display materialises. The sequencer works in either of two ways. First, as a one-pass polyphonic sequencer of 4400 notes (the 'Mono' mode); and second, as a four-track sequencer with space for 1100 notes per track (the 'Track' mode). Recording is accomplished by keying in the track number you want to record onto ('R' for Record), and pressing the space bar to start. At the end of recording, the space bar is pressed again, and keying in the same track number and 'P' (for Play) provides the proof of the playful pudding. To record on the other tracks, you simply play along with the first whilst recording on another, and the whole lot should be in sync on playback. Then, with all the notes in place, you can start assigning different preset instruments to each of the tracks: you can even go back to the preset display to change parameters in real time as it's playing.

I say the tracks 'should be in sync' because one slight problem is encountered if you try changing the playback speed (with the left and right cursor keys on the computer) whilst it's doing its thing – namely that it gets out of sync. Hmm, that rings a bell. Strange that that was also one of the bugs in the Soundchaser software. Come to think of it, the entire sequencer has a more than faint resemblance to Passport's offspring – even down to the 'bleep' that accompanies the pressing of the space bar.

Taking a four-track sequencer note file (BOP.TRAKS) that I'd created with the Sondchaser sequencer, altering it to meet the disk filing conventions of Musipack (to SYST.BOP), and then loading it into the Apple for playback by the Jen







'Digitrack' sequencer demonstrated that there was actually no earthly difference between the two. In other words, it would seem that the sequencer side of the Musipack software has also been purloined from Passport Designs.

Waveforms

The final part of the Musipack software concerns the actual construction of waveforms for consumption by the 16 digital oscillators. Thankfully, the 'Spectre' program does apear to contain a vestige of original programming. The lazy way of constructing waveforms is to ask the user to input harmonic numbers with relative amplitudes and then let the computer generate a 256-byte waveform table from the data – the approach taken by both Passport and Syntauri with their systems. However, a fact of life is that the harmonics constituting a complex waveform don't always tow the line when it comes to digging their feet in at the starting grid. Putting this into a mathematical perspective, the best sort of waveform synthesis needs to consider not only the number and amplitude of each harmonic but also its phase, ie. where it starts off from zero amplitude in relation to its neighbours. Unfortunately, this takes time, and entering values for all 24 possible harmonics occupies four minutes of computer (and user) time before they can be displayed and auditioned. Still, this is a step in the right direction. The other side of the coin is the 'Grafond' program, a draw-your-waveform-with-game-paddles approach. This is familiar Soundchaser territory, and there's nothing in Jen's implementation that even hints at originality.

Conclusions

By now, you may be wondering what the hell is going on. Frankly, so am I.

It's quite clear what's been going on in the Edgar Varese Studio. The original Soundchaser software comprised a machine code program for scanning the keyboard and running the synthesiser hardware, plus a BASIC program for setting up screen displays and interacting with the user. The bald fact of the matter is that Jen's machine code routines are identical to Passport's. The BASIC program, on the other hand, has been taken apart to make up the various separate Musipack programs, altered to suit Jen's own display requirements, and then compiled into machine code – effectively hiding all of Passport's original work from all but those with a *penchant* for machine code.

If this reads like a detective story, I'm hardly surprised. The unnerving point is that Jen have infringed copyright in four areas – the computer itself, the synthesiser boards, the keyboard interface, and the software. Unlike the reviewer in another magazine with a not altogether dissimilar acronym to E&MM, I don't feel that it's responsible journalism to write about something in glowing terms if it owes its existence to plagiarism on such a grand scale.

Unfortunately, things are unlikely to stop here. Jen have promised future updates along the lines of 16-track sequencing with drum sync and a music transcribing option. Passport also produce a 16-track sequencer with drum sync (Turbo Traks – reviewed in E&MM November 83) and a music transcriber (Notewriter).

What more can I say?

David Ellis **E&MM**

Prices and availability: the Jen Musipack 1·0 is distributed in the UK by British Music Strings, Bedwas, Newport, Gwent NP1 8XQ (Tel: 0222-883904), and the £900 price tag includes the KBD10 five-octave keyboard, IKB10 interface card, DSG10 synthesiser boards, and 1·0 software.

MFB Digital Drum Machine

Syco Systems' German-built 512 looks on paper to be a major breakthrough in electronic rhythm machines – a fully-programmable device with digitally-sampled drum sounds for only £299. Paul White **finds out if the reality fulfils the promises made by the MFB's paper specification.**

The first thing you notice when you encounter the 512 for the first time is its small physical size: 19½×13½×7cm equals easily the smallest unit on the market with these sorts of facilities. Its overall appearance is somewhat uninspiring – it reminded me more of an electronics magazine project than a modern musical instrument – but as in so many other walks of life, drum machine appearances can be very deceptive.

Although tiny, the machine's plastic casing houses no fewer than 53 microchips, eight transistors and 21 diodes, though needless to say, internal packaging is more than a little on the tight side in order to accommodate all this technology.

The unit's nine different sampled sounds are all stored on one EPROM, which means, sadly, that individual voices cannot be altered by swapping chips as they can on the Linn or Drumulator models, for example. It is possible, however, that replacement EPROMs may become available in the foreseeable future.

Power is provided by means of an external 12V power supply which plugs directly into the AC mains and delivers 120ma.

Sockets are provided on the rear panel for the connection of footswitches for remote starting and stopping of the chosen rhythm pattern, and for selecting fill-ins. The panel also houses the trigger in and out jacks and the main outputs (mono or stereo), as well as DIN sockets that enable the individual voices to be processed separately: alternatively, a master tune control that affects all voices simultaneously is also provided.

Front Panel

This is where we find the programming controls, the tempo control and the all-important start button. Because the MFB is so small, these can be more than a mite fiddly to use – programming generally involves picking the unit up in one hand and operating the controls with the other.

Pattern control switches F to A select the memory bank to be played or programmed, and these operate according to the binary system, which may be a little confusing for some users. To make things even more obscure, binary zero is equivalent to bank one, while binary one stands for bank two (are you following this?).

In conjunction with the measure switch, 64 different rhythms and 64 different fill-in patterns may be assigned to the memory banks. These may be combined into up to eight chains, the total storage capacity being 2048 measures. The record switch is a three-position toggle and is used either for programming rhythm patterns, ordering chains or playback, depending on its position.

The multifunction switch has five different functions, these being Play, Chain Select, Instrument Select, Accent, and Reset or Erase. Meanwhile, the measure switch decides whether a rhythm or fill-in pattern is to be programmed and, during playback, is used to select playback of rhythm pattern only, alternating rhythm and fill-in, or playback of three rhythm patterns followed by one fill-in. If you're programming chains, this switch determines whether a rhythm fill-in or pattern will be entered.

The voices available on the MFB are bass drum, snare, three toms, handclaps, cymbal, and open and closed hi-hats. A pair of pushbuttons (one black, the other red) are used to enter instruments, accents and rests in the record mode: the red switch programs voices and the black selects rests.

I feel an in-depth description of the MFB's programming procedure would be a little pointless in this context, since it would probably entail reproducing most of the owner's manual, a copy of which is, of course, enclosed with each example of the machine.

Suffice it to say then that the programming technique employed is a bit like that used by the original Boss DR55 Dr Rhythm: my overall impression is that to get the best out of this machine, you need to be able to think logically and to write down all the steps in order to avoid interminable programming confusion.

One of the main areas of compromise inherent in the MFB's design lies in the voice generation circuitry, where all the tom sounds have been derived from one sample. This means in practice that two toms cannot be played simultaneously, though whether or not this is as big a disadvantage as it sounds will depend to a large extent on the individual user's applications. What is potentially more serious is that the hi-hats and the cymbal operate in much the same manner, so that the decay of the cymbal is cut short by a hi-hat on the next beat, for example.

Conclusions

The MFB comes supplied with a useful set of rhythm patterns, an onboard Nicad battery being employed to keep the contents of the memory intact when the unit is powered down. Up to 16 beats per measure are available, although measures may be doubled up to facilitate programming of more complex rhythms, and unusual time signatures may be readily programmed.

So far so good, then.

On the debit side, the multifunction control panel (a necessary compromise in view of the MFB's record-breaking price) is far from being completely user-friendly, while it is also a little unfortunate that voices cannot be triggered externally from pads.

As with so many things, you pays yer money and you takes yer choice. The single EPROM means that, for the time being anyway, you're pretty much stuck with the factory voices, but it must be said that most of these are of an extremely high standard at any price, let alone the budget category in which the MFB finds itself.

Will anybody buy it?

Well, my guess is that an awful lot of people will be prepared to live with the machine's ergononic shortcomings for the sake of the sheer quality of the percussion sounds on offer – they really do make the MFB one of the drum machine bargins of the year.

Paul White **E&MM**

The MFB 512 carries an RRP of £299, and further information should be obtainable from the importers, Syco Systems, at 20 Conduit Place, London W2. Tel: 01-724 2451.

MARTIN RUSHENT FIRST MADE HIS NAME WITH THE STRANGLERS AND THE BUZZCOCKS. THEN WITH PETE SHELLEY ON 'HOMOSAPIAN' – ONE OF THE FIRST ALBUMS TO USE COMPUTERS. NEXT CAME 'DARE' BY THE HUMAN LEAGUE. AN ALBUM THAT SPAWNED SO MUCH OF TODAY'S MUSIC. AND SO MANY OF TODAY'S PRODUCTION TECHNIQUES.

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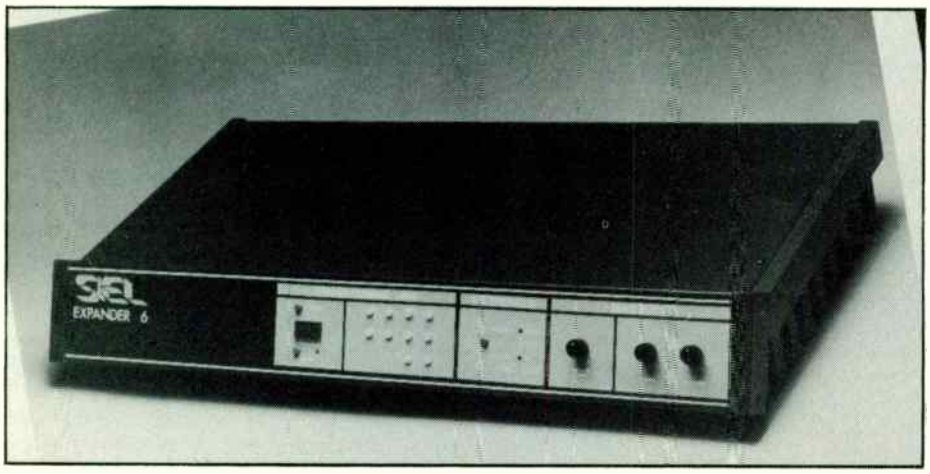
Siel MIDI Expander



The Expander is a modular add-on unit for MIDI synthesisers, containing the same internal features as the same company's Opera 6 polysynth. Geoff Twigg **broadens his horizons.**

Basically, it's another Opera 6, without keyboard or parameter controls. The Expander is housed in a smart grey box incorporating the now customary Siel livery of pale blue outlines and red and white switches on the control panel. As you switch the power on, a set of LED indicators signal that the unit is ready to listen, *via* MIDI, to whatever the governing Opera 6 tells it to do – or what you indicate using its own calculator-style panel.

The Expander is the same internally as the Opera 6, and its voices are created and edited using the same controls. Each of the six voices has two digitally controlled oscillators, which in turn may be modulated by three LFOs. Each voice has a separate filter and VCA, with standard ADSR envelope shaping. All in all, then, nothing particularly unusual in the synthesiser department: like the Opera, the Expander omits many of the most recent analogue synth innovations such as reverse or inverted envelopes, arpeggiators, sequencers and so on.

The oscillators can produce either ramp or pulse waves (or both), and the pulse width is fully variable, being modulated by LFO 3 – different degrees of modulation for each oscillator give an unusual phase sweep effect when you play chords, for instance. The filters (low-pass 24dB/octave) are impressively clean, with an even effect over their entire range, and what's more, they're refeshingly easy to adjust accurately. There's also a keyboard tracking option that opens the filters progressively the higher you play up the keyboard, so that the timbre of your playing remains relatively constant.

Velocity Sensing

Perhaps the most impressive feature of the Opera 6 is its velocity sensing keyboard, and the ability to direct that control parameter to override the attack time or control the overall ADSR level. This dynamic control applies to the Expander as well, of course: if the envelope shaper is not directed to the VCA, it reverts to an 'organ' envelope, ie. full volume as soon as a key is depressed and no release time.

The sounds from both the Opera 6 and the Expander are of uniformly high quality, and in general they follow the Mediterranean fashion of string and brass-like textures. The ramp and pulse waves provided enable the user to create a considerable variety of different accompaniment colours, and with filters of this quality, you can alter the sound drastically without blurring the underlying texture. However, the Siel isn't quite so good at punchy, lead-line sounds. The only way you can get close to them is by hitting the Opera keys really hard to open up the VCA and VCF.

Following on from that, one thing I did miss was a monophonic option to lend strength to lead sounds. Since this is such a notable omission, I assume Siel must have considered it and subsequently decided against including it, making the Opera and its accompanying Expander module chordal accompaniment machines only, albeit very good ones.

As well as the 95 presets available, it's possible to direct the Expander's operating system by selecting numbers 95 to 98. 95 enables you to record the preset voice; 96 selects the MIDI channel; 97 is the split-keyboard option; and 98 enables you to change the velocity sensing response, four level options being available.

In Action

The Expander is connected *via* a single standard specification MIDI cable, and will respond to key information from the controlling MIDI keyboard. The Expander enables you to change preset voices remotely from the controlling synth, or change the synth preset from the Expander, should you wish. It works like this. On each of the Siel units there's a control panel which doubles as an interface controller for tape or MIDI. Selecting Internal on this panel means that any numbers you key into the preset selector refer to the unit you're working on – selecting External means that the selection of presets is sent down the MIDI link, and the host machine is unaffected. This process can be controlled from either the Expander or the Opera 6, while it's also possible – if a little expensive – to stack several Expanders on top of one another and address them individually by giving them separate channel numbers (preset 96).

In order to alter the Expander's presets, you have to download the voice onto the Opera 6, edit and re-record the preset, and then reverse the process to get it back into the Expander. The ability to edit voices within the Expander direct from the Opera keyboard is a provision Siel have promised but which is not yet available – it would certainly make the system an awful lot more usable.

Another slight design deficiency lies in the fact that performance controls – mod wheels and pedals – do not affect sounds from the Expander. This is despite specific provision for a control code dedicated to pitch bend in the MIDI specification, but then again. . .

I understand Siel are about to introduce a split-keyboard facility (as preset 97) in the new EPROMs soon to become available. Position of this split is fully programmable, and is directed so that one half operates the host instrument, while the other half is directed to another synth on the MIDI bus.

MIDI Connection

I connected the Expander to a Roland Jupiter 6 *via* MIDI, and, as you might expect from an Italian, it behaved impeccably. Sounds that existed previously as extensions of the Opera 6 were transformed into a flowing accompaniment for the Roland's bright, percussive voices – it followed the controlling Jupiter's keyboard without so much as a hiccup. The sonic worlds of these two machines are so utterly different – yet contrast each other as beautifully – it's almost tempting to surmise that they were designed for each other.

Not all in the MIDI garden was rosy, of course. There was no response to the Roland's arpeggiator or mod wheels – the Expander not being capable of receiving this information – and only a change in patch preset number (voices A1 to D8 on the Jupiter) brought about a corresponding change in the Expander's presets.

In practical terms, this brings us back to the fundamental problem mentioned earlier: if you want to alter the factory presets on the Expander in any way, you have to use an Opera 6, which means that buying an Expander simply as an add-on for a JP6, DX7 or whatever isn't really on. This is a great shame, though on a slightly brighter note, I undersand that Siel are considering marketing a software equivalent to something like the Roland PG200 programmer, which would work in conjunction with a MIDI interface (such as Siel's own) and allow you to alter the Expander's internal parameters using the keys on a microcomputer, without having to pay out for an Opera 6.

Conclusions

After an entire afternoon spent playing the Expander, Opera 6 and Jupiter 6 in conjunction, I can honestly say that my confidence in MIDI has been restored considerably: I was still investigating new sound possibilities when the time came to write this review, and that was *without* any form of sequencing facility. Quite what I would have got up to had I access to a MIDI sequencer heaven knows. Let me just say that this Expander really does live up to its name, and should do so even more in the future.

Geoff Twigg **E&MM**

The Siel Expander retails at E&MM including VAT, and further details are obtainable from Siel (UK), Suffolk House, Massetts Road, Horley, Surrey RH6 7DT.

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JUNK CULTURE

History will probably remember Orchestral Manoeuvres in the Dark as being the first of many synthesiser-based duos that helped shape British popular music in the late seventies and early eighties, but there has always been more to OMD's repertoire than a narrow vocabulary of electropop love songs. Dan Goldstein **spoke to the band's founder members, Paul Humphreys and Andy McCluskey, about their musical techniques, attitudes and influences, and about the making of their recently-released fifth album, *Junk Culture*.**

Think back, if you will, to the summer of 1978. A time when almost all of Europe's popular music was still largely dependent on the standard guitar/bass/drums/vocals line-up for its instrumental arrangement, and when the cheapest polyphonic synthesiser would still set its purchaser back rather more than £1500.

Into such an environment step two young Liverpudlians, disillusioned with the standard 'rock band' format and all the limitations it imposes. Their line-up: a bass guitar, a half-working electronic piano and a tape recorder called Winston. In keeping with their lack of affinity for rock music's conventions, they choose for themselves an obscure and immemorable name, 'Orchestral Manoeuvres in the Dark,' and begin to write original material in each other's homes, only later branching out into the world of playing live.

'I know it sounds like a dreadful show-business cliché', says Andy McCluskey, one half of the duo. 'But we really had no intention whatsoever of becoming successful in the music business. Our music represented a complete break from what most successful bands were doing at the time, our songwriting was abstract in the extreme, and the idea that two musicians and a tape recorder could capture an audience in punk clubs around Liverpool and Manchester seemed absolutely absurd.'

Yet that was precisely what did happen.

After gaining a not inconsiderable following among the patrons of new wave clubs such as Eric's in Liverpool, OMD landed themselves a recording contract with indie label Factory Records and released their first single 'Electricity' to enormous media acclaim. Radio 1 DJ John Peel took an interest and asked McCluskey and Paul Humphreys, OMD's synth player, to record a session for him – Virgin Records liked what they heard and immediately licensed 'Electricity' to their newly-formed DinDisc subsidiary.

The Gramophone Suite

DinDisc offered the band an advance that allowed them to set up their own studio – The Gramophone Suite – in Liverpool, but as Andy recalls, owning their own studio had never been particularly high on OMD's list of priorities.

'We never had grandiose dreams of having our own studio complex, if that's what you mean. It was only when the finance was offered to us that we began to see the possibilities of having somewhere we could record at our leisure. You see, I've always found recording at a commercial studio to be less rewarding than working at your own place. At a commercial studio you tend to spend all your time looking at the clock and thinking "That's another £35 we've just wasted. . .", but when you've got your own studio you can work at your own pace, and we were very much attracted by that idea at the time.'

As things turned out, The Gramophone Suite became the recording venue for four OMD albums: *Orchestral Manoeuvres in the Dark*, *Organisation*, *Architecture and Morality*, and *Dazzle Ships*, released last year.

Of these, the first two are quirky, idiosyncratic works of great charm and enthusiasm, the third represents the height of OMD's commercial success (with hit singles such as 'Souvenir' and 'Joan of Arc'), while the last, *Dazzle Ships*, signalled a reaction by McCluskey and Humphreys against the traditions of the pop world into which – however unwillingly – they had stumbled.

Perhaps significantly, it was the first OMD album to be almost universally panned by the critics. On the one hand, there were those who claimed the band had ducked out of their responsibilities as leading electropop creators and opted instead for the soft, comfortable world of scientific experimentation, while on the other there were those who appreciated OMD's change of artistic heart but who disliked *Dazzle Ships* for its more than passing resemblance to Kraftwerk's *Radioactivity*, itself released some seven or eight years before.

Not surprisingly, McCluskey is quick to deny both charges.

'I think it was inevitable that at some stage we would have a drastic re-think

OMD

about what we were trying to do. There was bound to be some sort of reaction to the success we were having and *Dazzle Ships* was it. Having said that, I don't think that musically it's so different from what came before it: there are some very good songs on there that I still like a lot. What had changed was that we felt – more or less for the first time – that it was possible to put some sort of political or social message into the songs we were writing. We realised that a lot of people were listening to our music and that we might as well try and say *something* to them. We released 'Genetic Engineering' as a single because we wanted people to think about the implications such developments might have. Unfortunately for us, neither the single nor the album were successful, partly because they weren't musically quite as accessible as something like 'Joan of Arc'.

Fairlight at Montserrat

Yet if external musical influences were responsible for much of the change in OMD's character, technological updating also played its part. The band had used a computer instrument – the Emulator – before on *Dazzle Ships*, but their visit to Air coincided with their purchasing a Fairlight CMI, a different kettle of fish altogether.

Paul Humphreys takes up the story.

'We'd been interested in getting a Fairlight for a while, and eventually we got one just as we were about to start recording the album. Syco Systems flew a man out to Montserrat with the machine, and he spent about a week taking us through the instrument and showing us how to get the best out of it. From an operational point of view, it's not nearly as complicated as it might be, because it's basically got a user's manual built into it – if you get stuck at any point, you just key 'Help' and 'Return' and the Help page comes up on the screen. Something like that is of enormous value if, like us, you tend to get a little bit impatient with instruments that won't do what you want them to at the touch of a button.

'One thing we did find was that because the Fairlight has got such an enormous library of factory samples built into it, we spent quite a while simply exploring them before we got down to the business of actually sampling our own sounds with it. Our model Fairlight was made before the most recent modifications like the new voice cards and so on, but we still found it an invaluable aid – even without its sampling capability!

'We did start sampling with the Fairlight eventually, but for some reason, probably because we're more familiar with the way it functions as an instrument, we're still tending to get better samples using the Emulator. We used that to create choral effects using samples of our own voices – the same sort of thing we tried on *Dazzle Ships*, but much more sophisticated.

Andy also has his own ideas regarding the Fairlight and its role in a recording situation. . .

'Like so many other people, we tended to use Page R a lot, sampling other synthesisers and drum machines so that they could all be controlled from one point. The bass on 'Locomotion', for instance, was sampled and sequenced all in one go on the Fairlight. In the final analysis, though, I don't think we used Fairlight sampling any more than Emulator or AMS. What I personally found more interesting were things like the CMI's Page 6, which gives you complete control over the envelope of a sound. It gives you a tremendous sense of power, knowing that you can increase the level of the first few milliseconds of a sound by about 300-fold, and surprising though it may sound, some of the effects you can generate by that sort of manipulation are quite musical and usable.'

Given the magnitude of their technological leap-forward (remember that much of OMD's early recording relied on nothing more glamorous in the keyboard department than a Korg Micro Preset monosynth) it's surprising that *Junk Culture* emerges as being more obviously *played by a band* than any previous album. Paul Humphreys describes the new LP as 'the most acoustic-sounding album so far' and he isn't bluffing. So how did they manage it? Andy McCluskey has the answer.

'I don't think we ever consciously had to fight against the technology to try to get the album to sound acoustic, because to a large extent it was instruments like the Fairlight that enabled us to create some of the acoustic colours we wanted. We did do some things to make the overall sound more dynamic, though. One example that I think worked very well was using the LinnDrum as the basis for the main percussion track, with the odd snare drum roll from Malcolm to stir things up a little bit. It certainly makes the rhythm track more exciting; there you are listening to a fairly average drum machine pattern when suddenly – bang! – in comes this acoustic drum roll at about twice the sound level.

'I'd also say that, in general, this was the easiest album to record for quite a while. For the first time we found ourselves with a whole stack of material – probably about two albums' worth – and it was really just a process of elimination that pared down what was eventually going to appear: the music that found its way onto the album is what fits in most with the overall feel of things. There was quite a bit of material – like '(The Angels Keep Turning) The Wheels of the Universe', the free single – that just wasn't right for the concept of the album as a whole.

inspired Kraftwerk to record *Radioactivity*, but whereas that album is in more or less blind praise of things like technology and telecommunications, *Dazzle Ships* puts a bit of a question mark up against them, and that's a pretty fundamental difference, I think.'

But if *Dazzle Ships* represented a reaction, the band's new album, *Junk Culture*, marks an even stronger one. Musically, lyrically, and technologically, it's a fresher, more immediate statement than none of OMD's previous works could possibly have aspired to be. The reasons for such a drastic – and positive – change are many, but Paul Humphreys put the most significant ones into perspective.

'The first thing that comes to mind is that we recorded away from our own studio for the first time, which really was a big step in the right direction, and that

Tony Visconti

'There was the odd occasion when we got stuck – when things weren't quite flowing properly – but we usually got over them. The only real trouble spot came just before we started mixing. It was decided to get Tony Visconti in to help out on the production side, and just before he was due to appear we took a break for about three weeks or so just to clear our minds. When we came back we didn't need him at all! He contributed a couple of brass arrangements, but that was just about it. The rest of the mixing was done by ourselves and Brian Tench, and it all went pretty smoothly.'

The final difference between *Junk Culture* and its immediate predecessors is a lyrical and conceptual one, for although OMD's approach to songwriting appears to have remained in the main fairly abstract, much of the new album's lyrical content is in keeping with the atmosphere created by the music – fresh, optimistic and above all, entertaining. Andy again.

'The idea behind the album's title is quite a simple one, really. We began to appreciate that it wasn't enough to simply dismiss popular culture as being worthless, that there is some merit in almost everything; video, computer games, junk food, pop music, and so on. The lyrics reflect a sort of loss of inhibitions – the idea that you don't have to think something is artistically right in order to enjoy it.'

'I suppose you could say we had the same sort of scientific fascination that

in turn came about because we'd been living more or less out of a suitcase for the past six months, visiting new places and absorbing new musical influences.'

In fact, *Junk Culture* was recorded at three different studios – Air Montserrat, ICP in Brussels, and Wisselord Studios at Hilversum in Holland. The album was co-produced by OMD and Brian Tench – who's helped out on a number of previous occasions – while personnel-wise, McCluskey and Humphreys were assisted not only by Malcolm Holmes and Martin Cooper (both of whom have been in some way involved with OMD pretty much from the start) but also by, among several assorted (non)musicians, a Dutch brass section.

'The idea of a brass section appearing on an OMD record would have been unthinkable even a year ago', Andy admits. 'But it's a reflection of how much we've liberated ourselves from the little musical world we used to inhabit. I think it's probably true to say we'd always been pretty much wrapped up in our own little environment – a bit like being cooped up in a laboratory all the time. We were open to *some* different influences, but only so long as they weren't along the lines of conventional rock or pop music.

'One thing we were exposed to for the first time last year was soca – the soul-calypso music of places like Montserrat. Going along to a disco there and listening to it was a totally new experience for us, and it definitely influenced the way we approached recording *Junk Culture*.'

On Tour

So, with a year's musical and philosophical transformation behind them, OMD are now ready to take their show on the road. Perhaps not surprisingly, this aspect of their work will not escape the wind of change, as Paul explains.

'We're going to be playing more as a band than ever before. As well as Andy, Martin, Malcolm and myself, we'll also be using two brass players, Graham and Neil Weir, who'll be doubling on guitar and keyboards respectively.

'We'll also be using the Fairlight live, which I don't foresee as being a particular problem except, perhaps, that it might take too long loading up between each song – we shall have to see. In a way we're in a strange situation, because our main motivation for getting something like the Emulator in the first place was that by sampling all our other synths into it, we could reduce the number of keyboards we needed to use on stage. But as things have turned out, we're still going to end up using something like a Jupiter 8 in addition to the Fairlight. Oddly enough, the big Roland's not an instrument we were previously all that aware of until Howard Jones – who was supporting us on a tour at the time – introduced us to it. We were amazed at the way it could produce very deep, cutting low-end sounds, which is something I've always felt Roland synths are good at, as well as sparkling string sounds. We'd been using a Prophet 5 as our main polysynth at that time but the bass end of the Jupiter was a real revelation to us.

'We're still not going to have as many synths on stage as we used to, though, because to a large extent we've eliminated the little monophonic synths – like the old Korg and the Roland SH2 – that we used to rely on for a lot of our melody lines. Still, I imagine things will get pretty hectic all the same.'

With so much to look back on – and so much to look forward to in the immediate future – neither Paul nor Andy has much idea of what may happen musically to OMD in the long-term and, strangely, it's a situation both of them have got used to fairly easily.

'Each year of our musical existence seems to follow a similar pattern', comments Paul, presumably not intending to imply that life within OMD is becoming monotonous. . . 'We spend a certain amount of time thinking about our next album and taking in new influences, the next few months after that putting our ideas into practice in a recording studio, a little while promoting the finished album, and a rather longer period touring around the UK and Europe, where we have quite a following.

'Then we get back to thinking and planning again, and that's just the stage we haven't reached yet, which is why neither of us really know what form OMD's next musical output is going to take.

'We definitely took our blinkers off this year, but as for what next year might hold, I really couldn't say.'

Dan Goldstein **E&MM**

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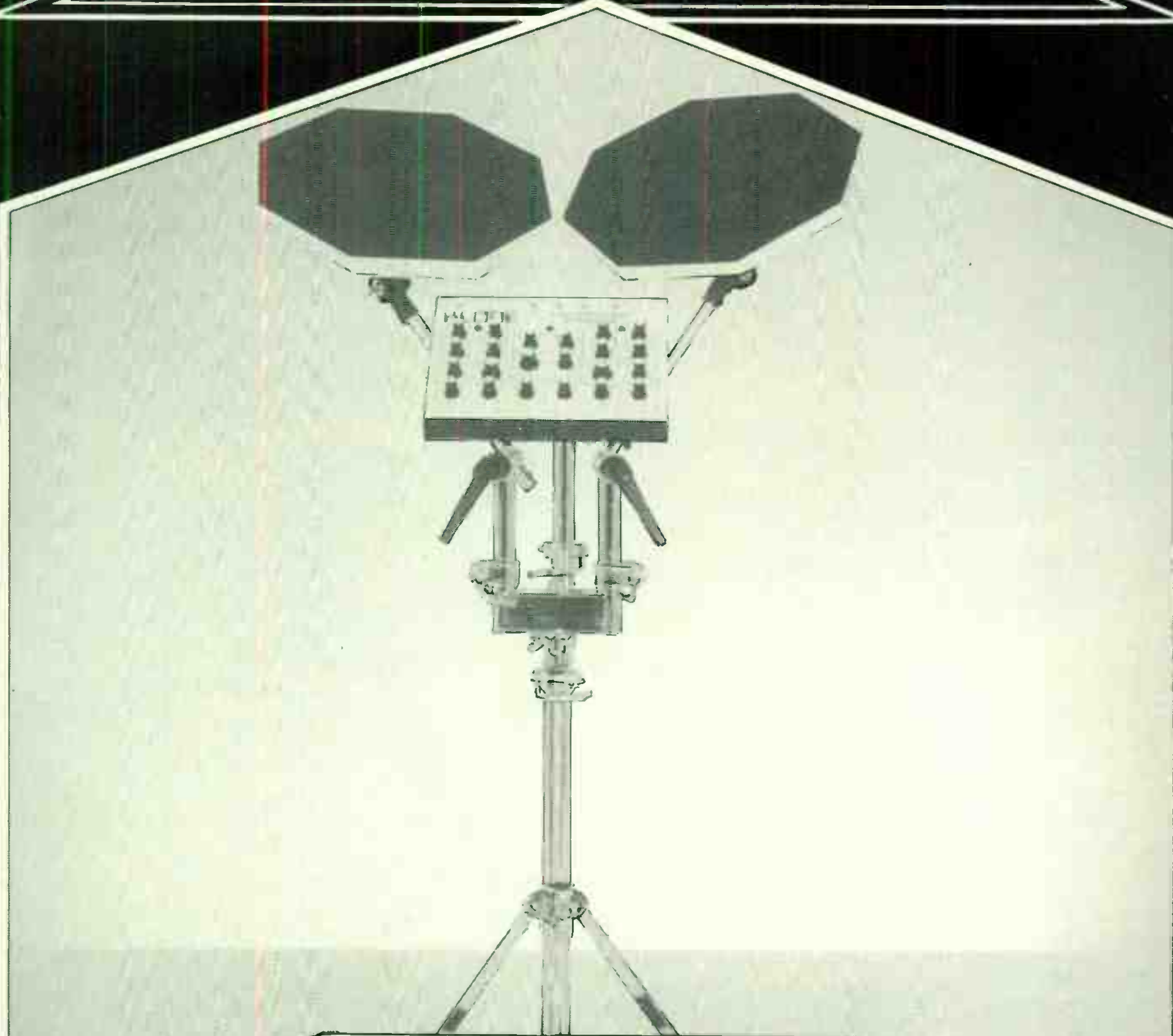

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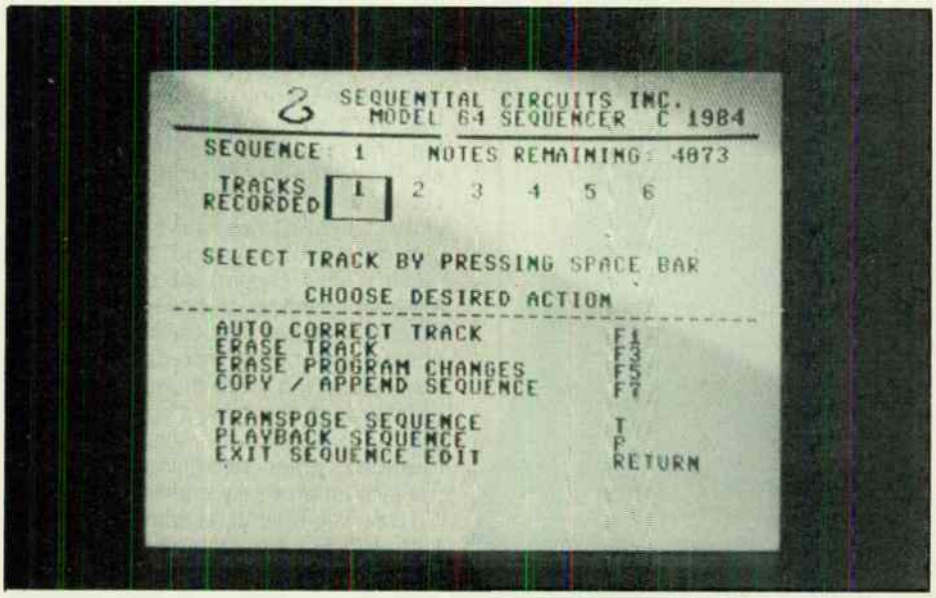
SCI Model 64 Sequencer

Sequential Circuits' Model 64 is one of the first MIDI-compatible sequencers to link directly to a home computer, in this case the popular Commodore 64. David Ellis **recently took a sample home for review and here reports his findings, beginning with a hardware rundown.**



The Model 64 Sequencer cartridge that the RRP of £185 (or, alternatively, $199) buys you certainly stands out from the crowd, and there's really a mixture of good and bad points in that. The Model 64 is specifically designed for the Commodore 64 micro (hereafter abbreviated to C64) or its all-in-one travelling companion, the SX64. Whereas the C64 costs under £200 in most High Street purveyors of micro fun, the SX64 is much more tastefully packaged, and comes complete with a built-in 5" colour monitor, 5.25" disk drive, and (trendily) detachable keyboard. It'll even sit quite happily on top of a Prophet T8, assuming you can afford one after you've parted with £800 for the computer. The other difference between the two Commodore stablemates concerns the position of the cartridge socket – the way and means of turning the micro into a more or less dedicated games machine, or, in this case, a multitrack, real-time sequencer.

On the plain C64, the cartridge socket is to be found at the rear of the machine. The SX64, on the other hand, puts it on the top, partly protected by some hinged flaps. Now, both of these sites create problems for the Model 64. In the case of the C64, the LEDs on the top of the cartridge tend to be less than conspiciously obvious if a monitor is placed in the position shown in SCI's adverts. In fact, anyone seeking to prove the company's advertised point that the Model 64 Sequencer is designed for use 'with or without a monitor' may have a tough time deciding who's flashing at what (or vice versa). On the other hand, the SX64, sites the cartridge in the firing line for any inadvertent knock to sever its relationship with its host.

Anyhow, design sidetracks apart, the cartridge includes sockets for MIDI in and out, clock in, and a start/stop footswitch. The aforementioned LEDs (ten in all) give a cunning readout of status (record, playback, and overdub), the nature of the sequencer's current preoccupation (sequence or song), the corresponding number (1–9), and whether or not there's an ongoing interactive situation with a cassette recorder. Finally, there's a series of four DIL switches that allow selection of the number of clock pulses-per-quarter-note from a drum machine.

Software

The major advantage of having software in ROM is that the system's ready to do your bidding practically as soon as you switch on. In fact, if the software that's contained within the 16K ROM in the cartridge had to be loaded up from cassette every time you powered-up, you'd be kept waiting for minutes rather than a second or two. So be grateful for SCI's small mercies.

Everything is menu-driven and generally well protected from user error. The only occasions I managed to crash the system were when attempting to load a sequence without giving it a file name, which necessitated switching-off and starting all over again, or when using the Model 64 with a Roland JX3P, but more

a moderately long polyphonic sequence would fill the screen many times over.

The confusing set of resulting numbers can easily be clarified. A small subroutine (nos. 500-550) is run by pressing 'D' (for Display) and strips away the numbers concerned with the sequence name, its length, and so on, arranging the information remaining in eight rows corresponding to the information required by each note. The sequence in Figure 2 now looks like Figure 3.

The third and seventh numbers in each column refer to the patches of the notes stored (in the example given, A=69 and G sharp=68), while the fourth and eighth numbers are the dynamic values of the notes preceding. A 'D' dynamic indicates end-of-note, so each pitch value must occur twice, a start-up and a stop. The other pairs of numbers determine the timing of the events following them – the second of the pair refers to the beat (beginning at 'D') and the first to the fraction of that beat (if 24ths is your chosen resolution the figures will start from 23 and work down to 0).

In Figure 3, the first note begins at the start of the first beat (23 0) and ends at the beginning of the third (23 2); the second note begins halfway through the third beat (11 2) and ends halfway through the fourth (11 3). This will probably appear a bit complicated initially, but once you've run a few sequences through you should start to see the patterns easily.

Pressing 'E' (for Edit) takes us to 300-330, a simple routine for altering the numbers stored in the array. For example, to change Figure 3 so that the first note is Middle C, adopt the following procedure:

Press 'E'.
'CHANGE NUMBER'.
Input 'B'.
'INTO'.
Input '60'.
Press 'E'.
'CHANGE NUMBER'.
Input '7'.
'INTO'.
Input '60'.
Press 'D' for display to see the alterations on screen.

Don't forget that you must always change two values to alter a pitch – one for the beginning of the note and one for the end. Dynamics and timing of each note can be altered in a similar fashion.

Once you've edited or corrected your sequence to your satisfaction, pressing 'S' (for Save) takes us to 400-460, a routine that erases the original file and puts the rew, edited one in its place. The SCI sequencer cartridge can then be reconnected, and the new sequence loaded as normal and then replayed.

Once you've tried a few monophonic sequences, it should be possible to take the step up to polyphonic ones.

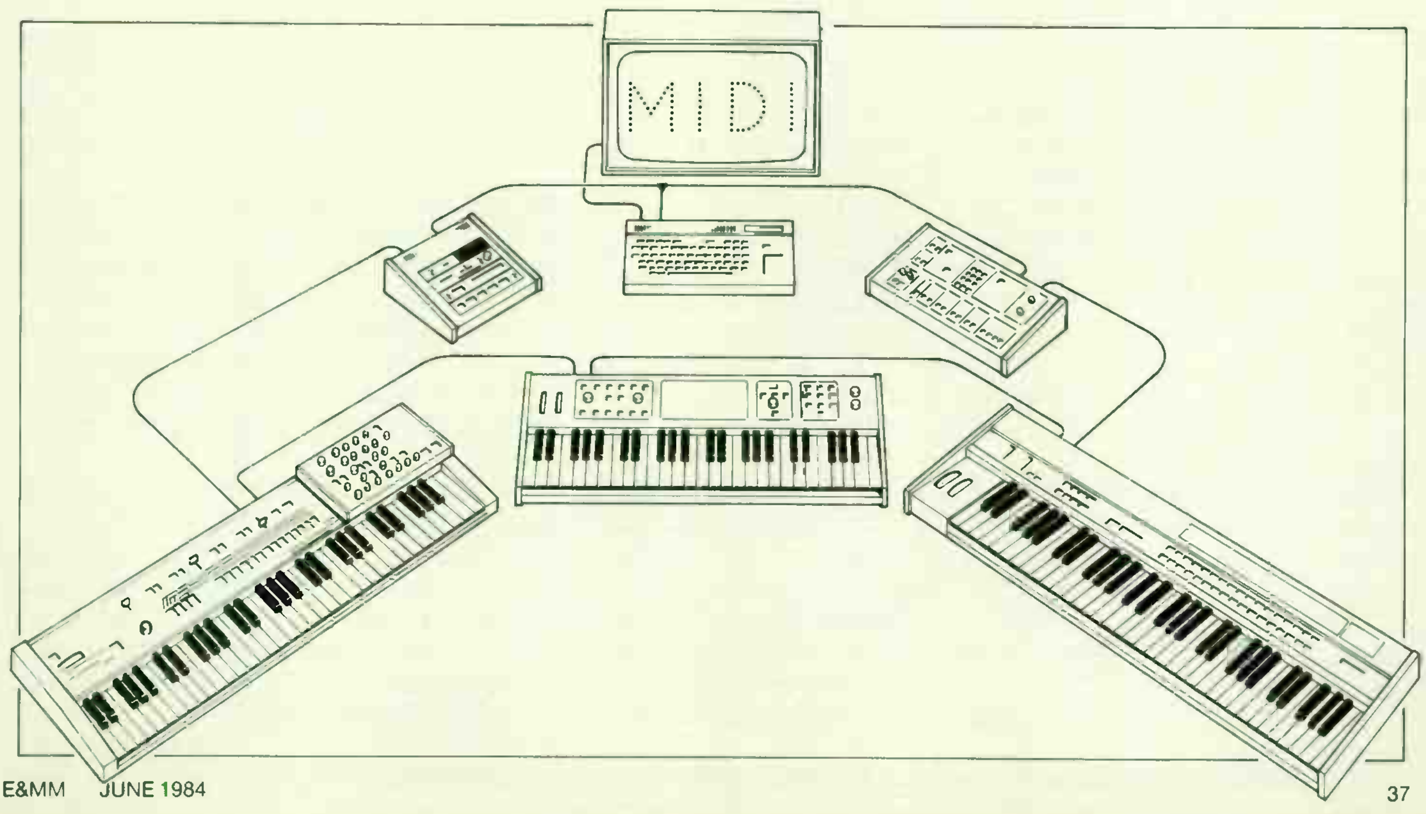
Lastly, a word of warning. The information in this program is stored as a series of on/off events, so that if you want a note to begin before the previous one has ended, its start-up information must occur before the first note's end information.

Billy Cowie **E&MM**

PART TWO

MIDI

An Electronics & Music Maker Special Supplement



INTRODUCTION

We hope that the reasons for MIDI's existence and some of the mysteries surrounding its operation are a bit clearer after the first part of this supplement, published last month. This month we continue with a more detailed look at the more technical aspects of the system, and there's also a constructional feature by Jay Chapman that not only describes the building of a MIDI interface for the BBC Model B computer, but also explains the operation of the circuitry in such a comprehensive way that it cannot fail to be of great educational value to those interested in the workings of computer peripherals.

David Ellis takes us 'Inside MIDI' using various analogies to British Rail to explain an otherwise complicated concept in terms that most readers will be able to understand. On the other hand, it must be said that if the analogy was carried too far, some notes would not arrive at all or would turn up half a bar late!

Also by David Ellis this month is a comprehensive look at a considerable slice of the available MIDI software for popular home computers, including the Commodore 64 and the Spectrum, and this round-up should be of particular interest to anyone who is currently undecided on which computer to buy.

The BeeBMIDI interface project will be concluded over the next couple of issues, when Jay Chapman will be presenting a software package that'll enable the interface to be used as a multitrack, polyphonic sequencer with considerably greater operational capabilities than any commercially available alternative.

MIDI Confusion

When MIDI was first announced, it's probably fair to say that the lack of readily-available, updated and accurate information caused many people to expect far more of the system than was actually possible. This unfortunate state of affairs led to early disappointment when systems of interconnected MIDI products failed to behave as predicted, and this feeling of anti-climax was compounded by the sad fact that most early 'compatible' machines deviated from the agreed MIDI standard in a variety of ways.

The good news however is that as of March of this year, all MIDI machines will conform to the same specification, though that's not to say there won't still be old machines on some dealers' shelves. This is not quite so serious as it might at first appear, since most manufacturers are offering a software update service to bring older machines into line with the current MIDI specification, though this will of necessity cause some inconvenience to the unfortunate musician.

As we explained last month, you can only expect to make the fullest use of MIDI if all your machines are made by the same manufacturer, but the MIDI specification does state that a number of functions will be compatible on all MIDI keyboards, including the essential information that allows one machine to trigger the corresponding notes on another machine. In many cases, this information will be entirely adequate, though it's not inconceivable that 'specmanship' will dictate the buying habits of many users. Much the same thing has been observed in the home computer and pocket calculater markets, where the machine capable of doing complex differential equations is only ever used to add up the grocery bill.

One other slight problem that is coming to light is that designers of many MIDI-equipped instruments have forsaken conventional synchronisation facilities, meaning that many of the latest products can now be addressed only by the MIDI bus. This was true of the SCI Drumtraks, but Sequential are now providing a separate clock output in response to market demand. MIDI is undoubtedly a powerful aid to the musician and is likely to become more so in the future, but we should recognise that there is still a lot of useful non-MIDI equipment that is likely to be in circulation for some time, and my feeling is it would be wrong to cut short its life by discontinuing sync trigger facilities on new MIDI machines.

Paul White

Inside MIDI

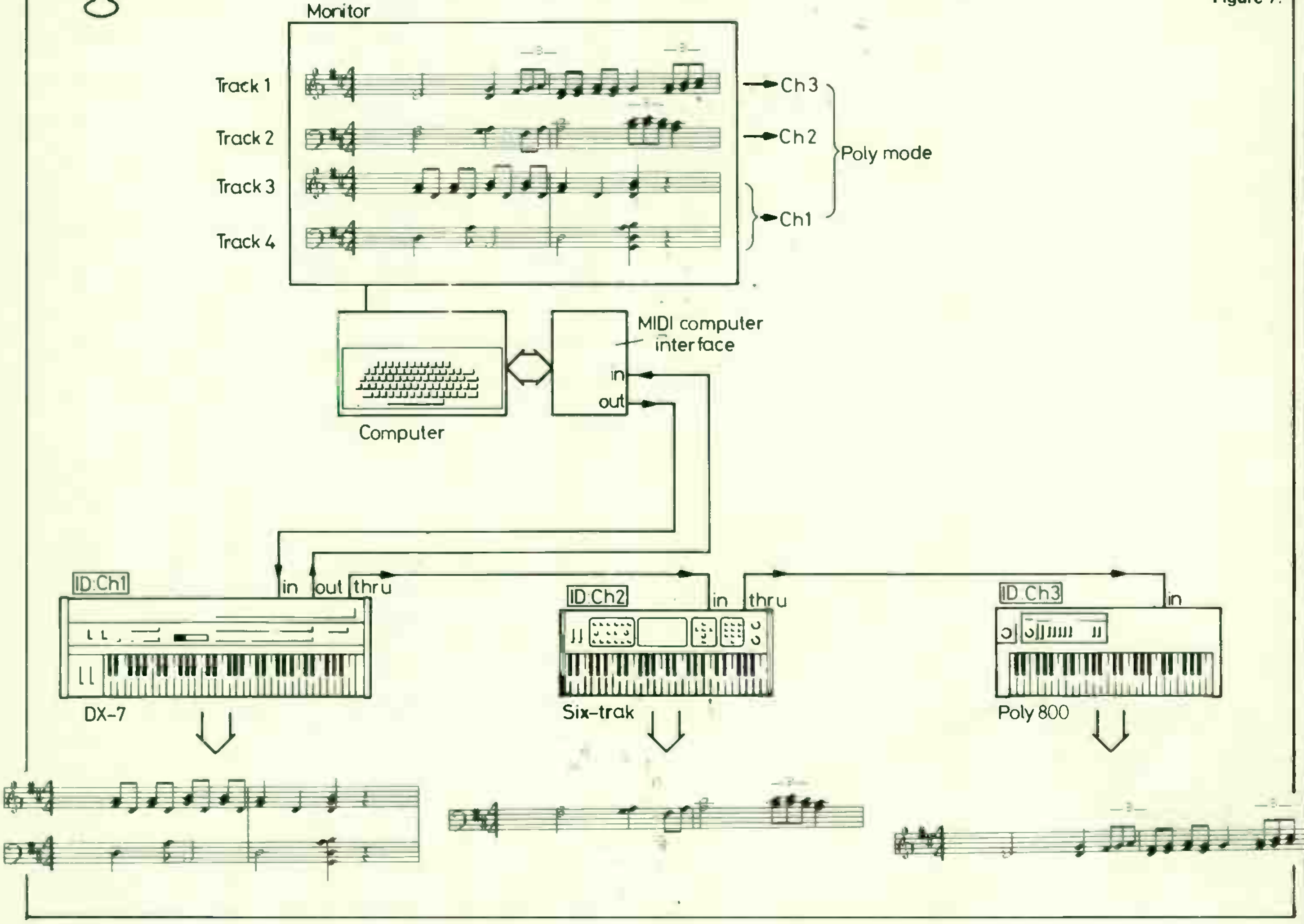


Figure 7.

Like it or not, MIDI looks set to become the universal synthesiser catch-phrase for the eighties. But why has so little effort been made to inform musicians of what they'll realistically be able to get out of it? *Inside MIDI* attempts to redress the balance, with what we hope are straightforward explanations of what MIDI is, how it works, and what you should be able to do with it. Educational text by David Ellis.

MIDI is a communications link. Baldly stated like that, it sounds about as interesting as any other bit of abstract computer jargon, but MIDI stands for 'Musical Instrument Digital Interface', which implies that the link must be such that the necessary ins and outs of hi-tech musical instruments and micros are efficiently communicated.

Efficiency is a tricky thing to specify from a musical point of view, but the main aim of MIDI is to get all the necessary information across to the right place in and at the right time. Imagine the following situation: a station platform full of prospective passangers, all seeking information on departure times and destinations of trains. There are two alternative methods of presenting this information. First, by having the traditionally misunderstandable station announcer read out the list of destinations, letter by letter and place by place, of, say, the 4.40 from Paddington, over an equally misunderstood Tannoy system; or secondly, by displaying each destination in turn on the destination board. Clearly, the first approach is tantamount to useless (the train will probably have left before you've finally interpreted what was being said), whilst the second stands a good chance of getting the message across.

Musically, things are pretty similar. For instance, one way of recalling a particular synth patch would be to have someone read out the parameters for multiple VCOs, ADSRs, VCFs, *et al.* as a long stream of numbers, whilst you do your best to update the controls as and when a relevant item in the stream breaks through the surface of your consciousness. Another way would be to record all the parameters on a sheet and then read them off and change controls at your own speed. The second would doubtless be more efficient, but both are painfully slow in comparison to what could be achieved by interfacing the synth sections with a processor and some memory, so that patch information can be stored in RAM and then retrieved at will to effect a change of voice immediately.

The problem with the human approach to re-patching a synth is that there tend to be a lot of controls and a lot of parameters, and that tends to conflict with our rather poor ability when it comes to putting the right object in the right pigeon-hole. The micro control approach, on the other hand, positively delights in making sure that the right parameter update goes to the right module in the synth, and is therefore a good deal more efficient. In this sort of computerised environment, efficient communication of data needs the right sort of labelling to ensure it gets to the right address, and as we'll see shortly, this forms the fundamental basis of MIDI's communication skills.

Serial v Parallel

As the last few paragraphs have been putting across with all the subtlety of a wet fish smacked around the face, there are two basic ways of passing on information: serial and parallel. The point about the serial method is that words get chopped up into their constituent bits, while the parallel method, on the other hand, makes sure that the entire word is presented all at once. Human beings are pretty serial when they're speaking, but from a musical point of view, we're a good deal more efficient. After all, when we play a chord on a keyboard, we don't finger one note at a time in a Chico Marx arpeggioed fashion; instead, we play all four or five notes at once. That's parallelism in a musical context for you.

Fortunately, computers don't really have any particular predilections one way or the other; they're quite happy to be employed to send out and receive information in either serial or parallel forms. However, both these alternatives need some way of connecting the sender with the receiver, and that invariably comes down to common-or-garden wires. Parallel input and output needs a separate wire to carry each part of the word that's being communicated (just like needing a number of fingers to play more than note at once), but because micros operate digitally, the talk is of '0' and '1' rather than the 'O', 'X', 'F', and so on of the railway station announcer. These parts of the word are what we mean by 'bits'.

Now, unlike the many lengths of words found in the English language, the words zooming around the wires in the average home computer and most micro-controlled synthesisers are all of one length – eight characters or bits – and it's this word of uniform length that's termed a 'byte'. So, parallel communication needs a cable containing eight wires at the very least if it's to accomodate the whole length of the byte-size chat that micros are so fond of.

Serial input and output, on the other hand, adopts a more economical approach, and chops up the bytes into a stream of bits that, after sending down the serial line, then get reconstituted into their original format. Because we're now only concerned with sending one bit at a time, the original eight-lane information freeway gets reduced down to just a single lane. In practice, the communication needs to be bidirectional, so the single lane for serial traffic gets doubled up, but it's easy to see that the end result of a five-pin DIN plug at either end of a serial link is nothing like as troublesome (or expensive) as the 25-way 'D' connector needed with a bi-directional parallel link. The big problem with the serial approach is evident from the highway simile: one-lane traffic is going to be a damn sight slower and more frustrating than an eight-lane freeway if you're an important bit of information trying your darndest to get from A to Z. On top of that, there's still the small matter of processing the information to and from a bit stream at either end of the serial link, and that takes time, too. . .

Figure 1.

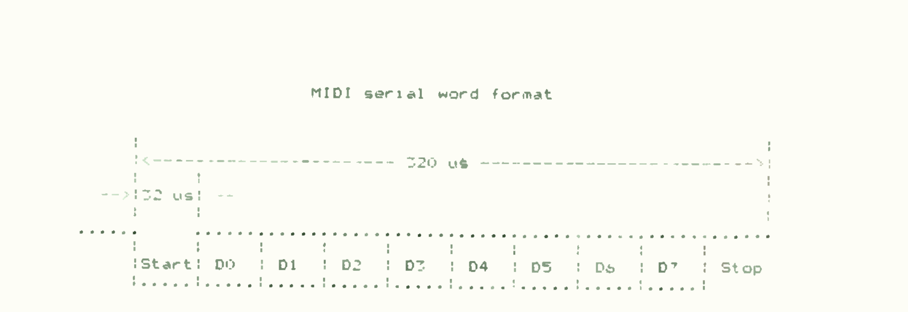
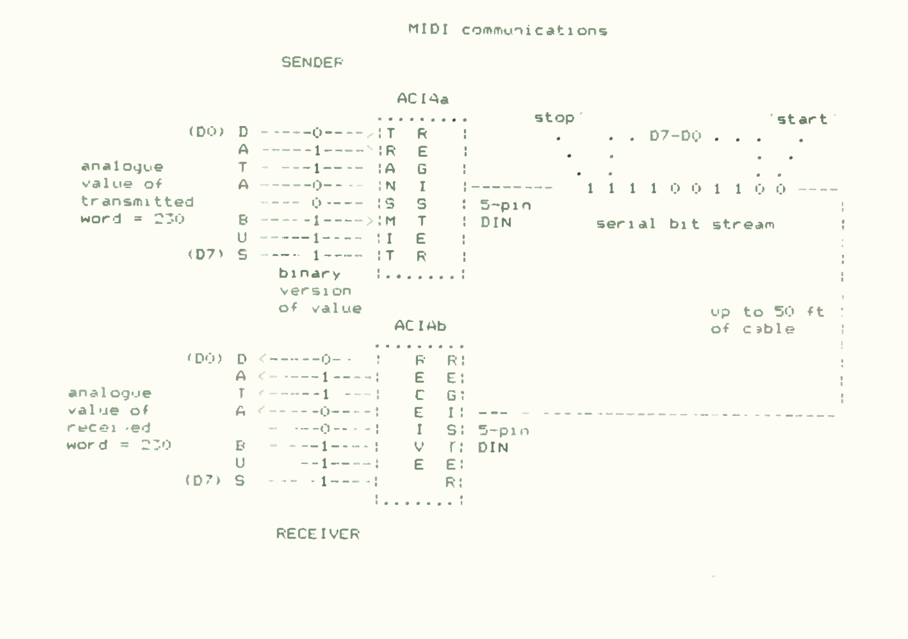


Figure 2.



Speed

Now, serial communications links were flitting bytes around the computer industry for a considerable while before the music industry cottoned on to the possibilities of computers and, not surprisingly, the other side have hit upon their own set of standards. The one that may ring a few bells, even if only because it's often included in the wording of adverts for micros, printers, and so on, is 'RS232'. Like most standards, RS232 has a particular way of approaching life: in a nutshell, it likes life in the fast lane. Speed in the serial communications business is described as having a certain 'baud rate' (meaning 'x' bits/sec), where, very roughly, the baud rate divided by ten equals the number of bytes being sent per second. The RS232 standard operates at 19.2kBaud, which is equivalent to a byte communication rate of about 2K per second. So, if your own particular idea of amusement was to send *Hamlet* (around 50,000 words, which would take up about 300K of storage space) from one micro on one side of a room to another micro on the other side *via* an RS232 link, the serial transfer would take around two-and-a-half minutes. Pretty quick, really: bet our Will would have been tickled pink. . .

So where does the MIDI standard fit in as far as parallel vs. serial and speed considerations are concerned? Well, there's good news and bad. The bad news is that the link is serial. The good news is that MIDI is a right old Speedy Gonzales, with a 31·25kBaud rate for both receiving and sending musical data.

Words

Earlier on, I said that the baud rate divided by ten equals the number of bytes being sent per second. But hang about. If the serial link is sending bits down the line at a certain baud rate, and eight bits make up a byte, surely the divider should be eight rather than ten? Well, in reality, serial communication isn't simply a matter of chopping up bytes in an electronic mincer and hoping that they get to their right destination. Actually, they're in desperate need of some help, which is where the two extra bits come in.

Returning to the railway analogy, catching the right train would have been much easier if the station announcer had been able to signify in some way when a particular word stopped and started. For instance, if the 4.40 from Paddington stopped at Reading, Didcot, and Oxford, her serial bit stream would have appeared as something like READINGDIDCOTOXFORD. The last thing you or your micro want is having to sort out where words begin and end, so the conventions of serial data transfer insist on a couple of extra bits at the beginning and end of every eight-bit word to signify 'start' and 'stop'. If British Rail serial transfer used '‹' to start a word and '›' to stop it, then our long-suffering announcer would have had a much easier time, as she'd then have been able to come out with ‹READING› ‹DIDCOT›‹OXFORD›.

And like any other serial link, MIDI is based on words. What's more, these share in common with the RS232 standard a word length of ten bits, with the first and the last signifying 'start' and 'stop', respectively. See Figure 1.

Well, at first glance that all looks a bit frightening, but don't give up yet! First, the format diagram tells us that each serial word takes 320us to be transmitted. That follows directly from the 31·25kBaud rate that MIDI operates at, ie. 31·25kBaud = 31·25kbits/sec = 3125 words/sec = 320us/word. Still clear as mud? Oh well, work it out on your calculator. Then, since each serial word has ten bits to it, the TX time of 320us/word is divided ten ways, giving each bit a duration of 32us, and that's just as true for 'start' and 'stop' as it is for what comes in the middle. Note also that 'start' must be low (or '0') and 'stop' must be high (or '1') for words to flow smoothly.

So what's with the wadge of D0-D7 in the middle of the MIDI word? Well, each of these parts of the word constitutes a bit of data – eight bits in all. The numbering from 0 to 7 is a convention for setting the order of significance of the bits in a word, with D0 the least significant bit (LSB) and D7 the most significant bit (MSB). You can see what this means by taking a number – 100, let's say – and then altering one or other of the digits. Changing the last digit to '1' changes the number to 101, and value-wise that's not much different to the original number. Changing the second digit from '0' to '1' gives 110, which is a more significant change, and, obviously, doing the same with the first digit is even more significant still. Apologies for the return to kindergarten, but it's worth making the point.

Where those bits eventually go in the synthesiser or computer that's involved in the MIDI link is a 64,000 dollar question that we'll get to later on, but we've also yet to consider how the serial bit stream gets converted into a suitable state for consumption at either end of the chain: this is where the hardware side of MIDI comes into play.

In fact, everything is taken care of by a special chip called an Asynchronous Communications Intrerface Adaptor, which turns data into serial words, and vice versa. When the micro or synth wants to transmit a byte of data, it makes its wishes known at the 'transmit' part of the ACIA. The chip then produces the requisite serial word, complete with 'stop' and 'start' bits, ready for sending down the line. When that word reaches the ACIA at the receive end, the chip automatically converts the word back into the original byte of data, whipping off the 'start' and 'stop' bits in the process. See Figure 2.

This hardware is built into every synth that comes ready-equipped with the MIDI, but there are also a few additional bits and pieces built into the interface. First, some dividing circuitry to convert the micro's clock into a pulse that'll give the required TX/RX rate of 31.25kHz; and second, a device called an opto-isolator, that's inserted into the path of the incoming bit stream in order to prevent ground loops from rodgering the data, or the rather expensive ACIA chip from being accidentally treated to a dose of the National Grid. Not that it's occurred to me that a DIN socket is where the mains goes, but, then again, there are some right wallies around. . .

All in all, then, Sequential Circuits seem to have done a pretty fair job on the hardware side of the interface, though that doesn't mean to say you can afford to push your luck with the nice new MIDI synth you've just acquired. Remember also that as far as the micro side of the serial link is concerned, SCI haven't yet managed to get the necessary bods around the table to accept their standard. Come to that, not even all the synth manufacturers are going along with SCI (CBS/Fender being the main thorn in SCI's flesh), so it's hard to see micro manufacturers adopting MIDI with anything like equanimity, which is a pity.

So, unless the name on your new micro is Yamaha (the excellent new CX5, for instance), you'll have to add on extra hardware to do the other half of the interfacing job.

Fortunately, there are plenty of options in this direction. If you want something ready-built, there's the growing marketplace discussed in our *MIDI and the Micro* section later on, while for DIY fanatics, there'll soon be E&MM hardware designs for the Spectrum and BBC Model B home micros. Happy interfacing!

Destinations

Returning to our harrassed station announcer, let's suppose she had to announce the destinations of three different trains waiting at platforms 1, 2 and 3, as in Fig 3.

Well, if everything was working tickety-boo, those are the destinations that'd go up on the indicator boards. But let's suppose there's a panic on in the control room (the station cat's threatening to jump onto the tracks, for instance). Given that, it'd hardly be surprising if the announcer mixed up the routing of the destinations to be platforms, as in Figure 4.

What's happened, of course, is that the six crucial words intended for transmission to the waiting public on the platforms have done a bunk and gone off in the wrong direction. Not a happy state of affairs. The point is that those words would normally have a marker attached to them, so that when the instructions were sent off down the cable to the indicator boards on the different platforms, the markers would make sure that the destinations cliked with the boards they were intended for. In fact, if we were able to peer into the station announcer's serial bit stream, it should have gone something as follows:
‹1›READING‹1›OXFORD‹2›ROYSTON› ‹2›CAMBRIDGE‹3›LEEDS‹3›GLASGOW›

Platform 1	Platform 2	Platform 3
Reading	Royston	Leeds
Oxford	Cambridge	Glasgow

Figure 3.

Platform 1	Platform 2	Platform 3
Royston	Glasgow	Cambridge
Leeds	Oxford	Reading

Figure 4.

What's happening here is that each word is prefaced with a tag to ensure that the right word goes to the right platform. If you'll pardon the analogy, that's precisely what happens with MIDI communications; like the average train passenger, MIDI banks on knowing where it's heading.

Channels and Notes

OK, let's switch tracks to the nitty-gritty of musical exchanges *via* MIDI. We're going to start off by considering the simplest and most essential side of musical life – notes. For the sake of argument, let's assume we've got three MIDI monophonic keyboards capable of velocity-sensing both on attack and release (an entirely theoretical beast, in fact!), to which we want to communicate the necessary info for the simple triads in Figure 5.

Figure 5.

To make things more interesting, we'll give each part of the chord to a different synth programmed with a different voice – a Moog-type bass on the bottom, slapped bass in the middle, and a cello on top, for instance. The MIDI words required for this reasonably simple task come under the heading of Channel Data, and for each note event going to a particular keyboard, there are actually three words involved. First, there's a word that defines the nature of the command and to which piece of MIDI equipment it's directed; second, there's the note value itself; and third, the attack velocity of that note. So, starting with the inverted B major chord, the words that'd be transmitted are illustrated in Figure 6(a).

There's quite a lot that's noteworthy in this example. First, the verbal words of the announcer have been replaced by the numeric words of binary code. After all, there's nothing like honest-to-goodness numbers to avoid confusion and get the message across. Secondly, each word is still enclosed by 'start' and 'stop' signals, making up the 10-bit package that whizzes down the MIDI line every 320us. Taking a closer look at the first group of words aimed at producing a B on the cello-patched synth, we've got the parameters in Fig 8(a) to play around with.

Now, it's the first word ('1001 nnnn') that's responsible for making sure there aren't any cock-ups on the routing front, and is known in MIDI parlance as the Status Byte. Make sure that's engraved on your cranium, because these tend to crop up with monotonous regularity! Such crucially important bytes need to be distinguished from their plain old data counterparts, and the way the MIDI communication protocol goes about this is by setting the MSB to '1' for a status byte and '0' for a data byte. So, by coming first in the MIDI data stream, status bytes make sure that the right command ('note on', in this case) gets directed to the right piece of MIDI equipment, and then the subseqsuent data bytes determine how that command is interpreted.
Let's continue from where we left off with a few more words (Figure 6(b)).

This introduces the next command in our whistle-stop tour through the MIDI protocol – that for switching notes off – and the parameters are shown in Figure 8(b).

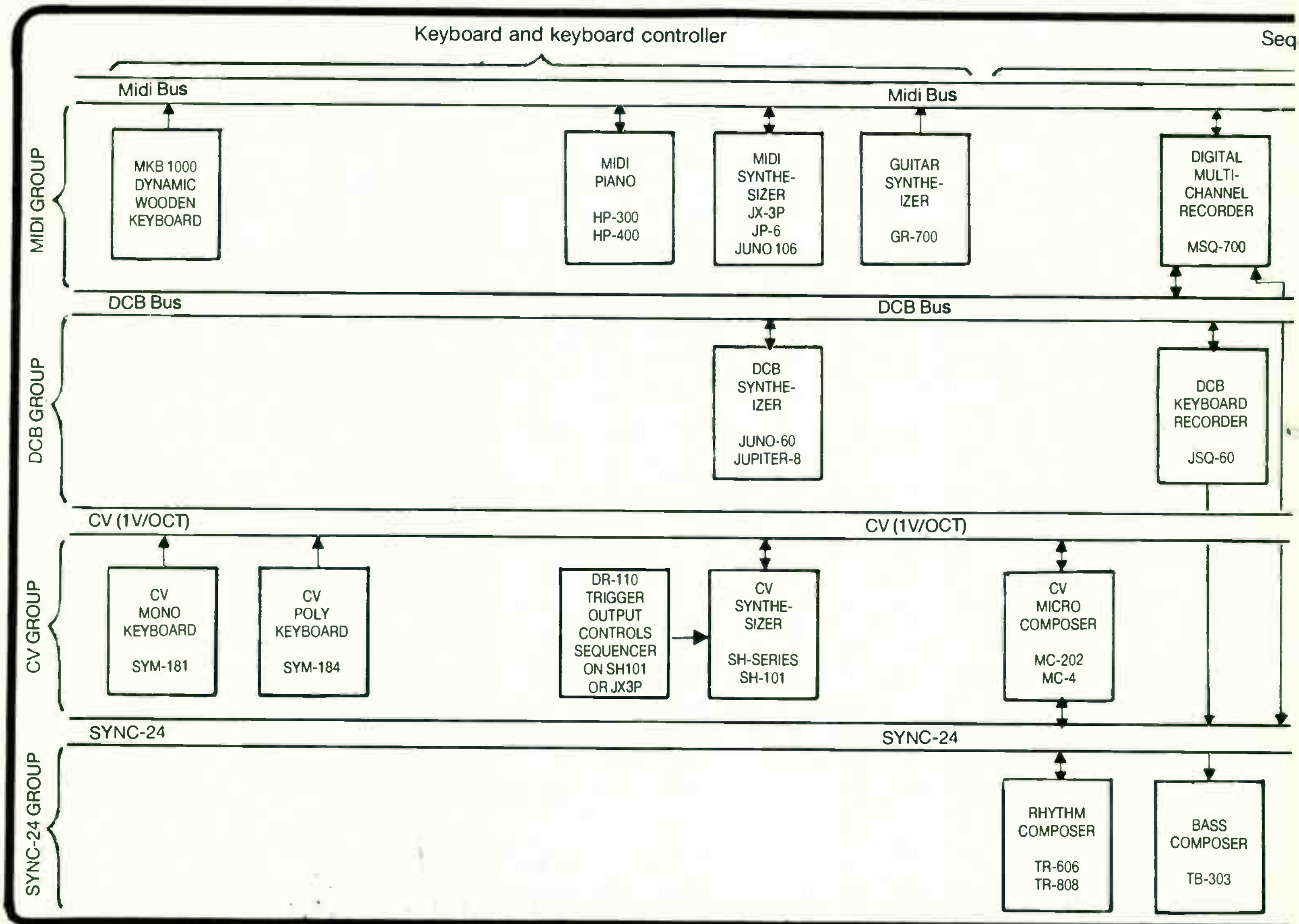
Touch, Change and Mode

Next in the line-up of musical exchanges is that delicious bit of icing on the cake – after touch. The MIDI protocol includes two varieties of this: first, one that's note specific; and second, one that affects all the notes that are still on in a given channel. So, whereas the first enables subtle balancing acts in a held chord, the second treats all the notes equally. Their MIDI phrases are illustrated in Figures 8(c) and (d).

Now, touch is all very well if you're into physical contact and that sort of thing, but most of us hae been weaned on bending control wheels, and fortunately MIDI provides plenty of potential in this direction, as illustrated in Figure 8(e).

128 theoretical controls, each with 128 theoretical values, seems like an awful lot to

Roland THE SY

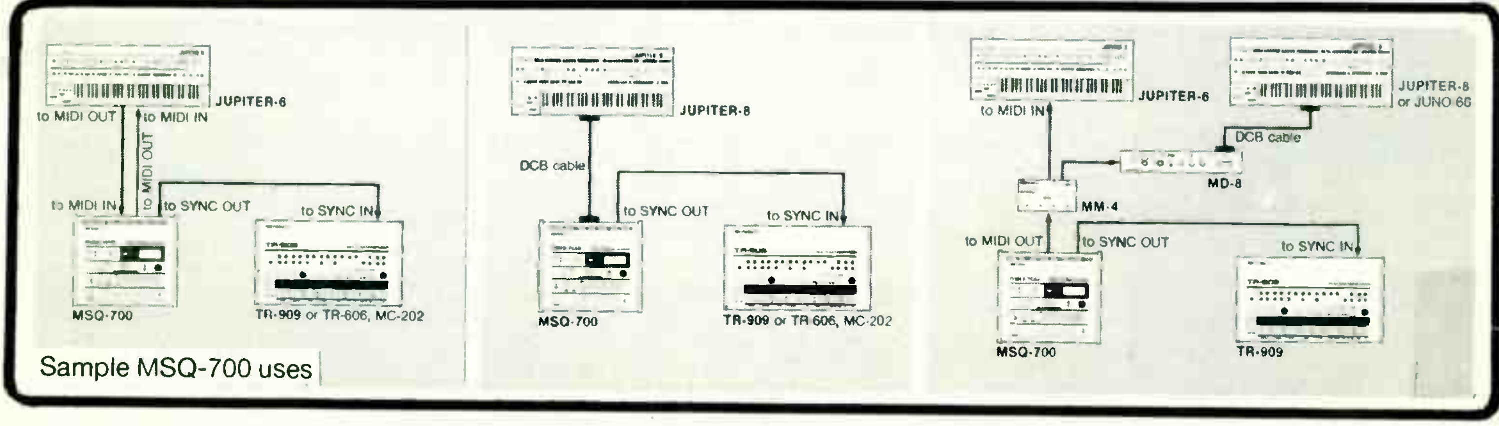


The sound sources of the TR-909 can be played using the keys of the PIANO PLUS 400. The volume changes depending on how forcefully the key is touched.

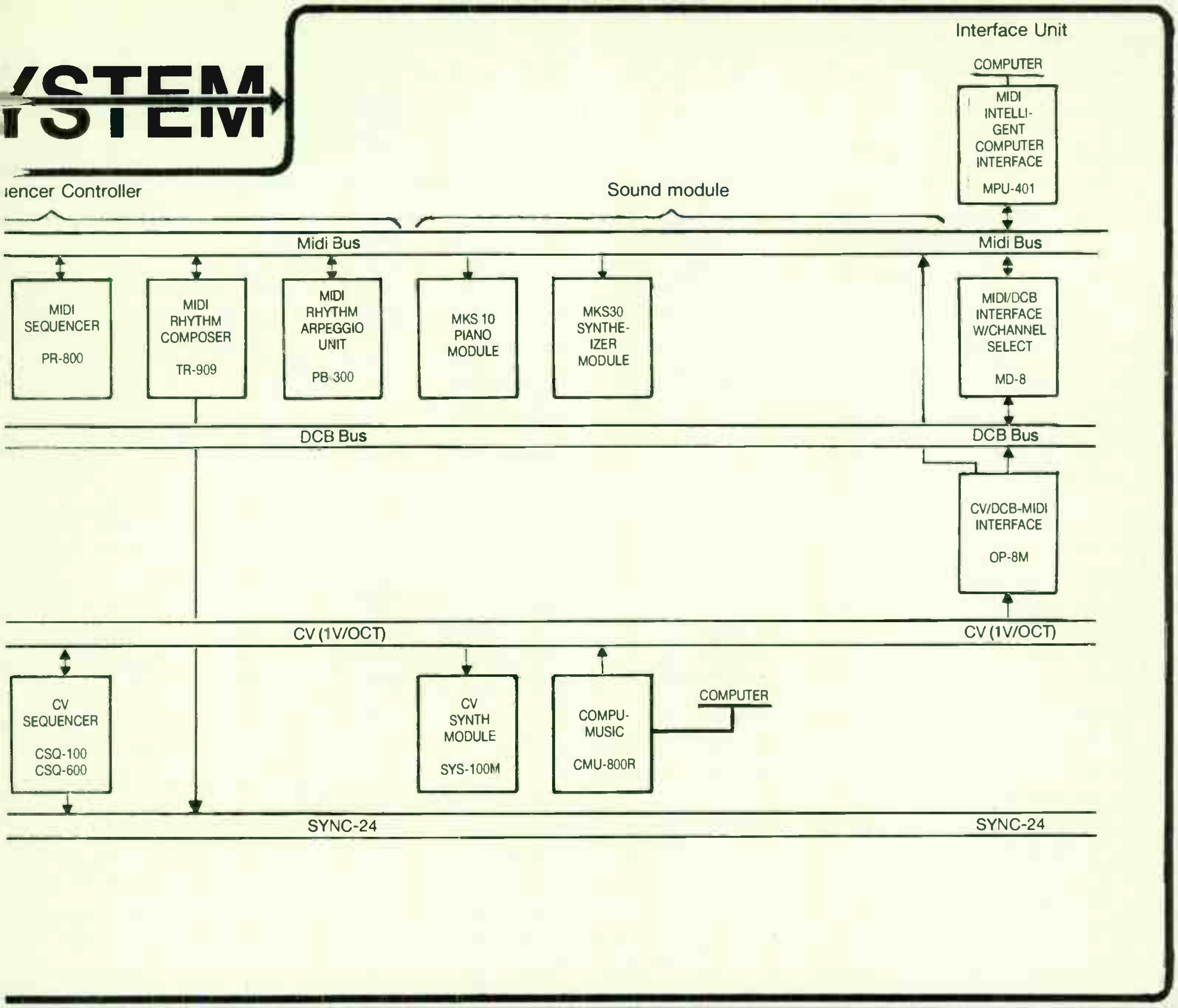
The data of the MSQ-700 synchronizes with the TR-909. It is also possible to control external sound sources, such as the PC-2 percussion synthesizer, using the TR-909's trigger signal.

The MC-202 data controls th

Sample TR909 Uses



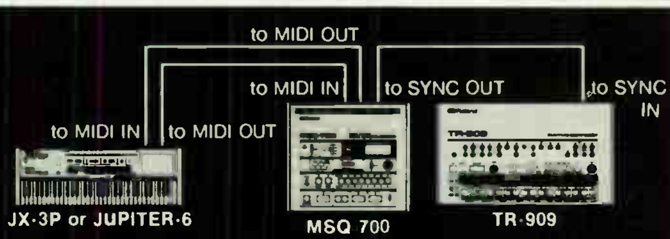
Sample MSQ-700 uses



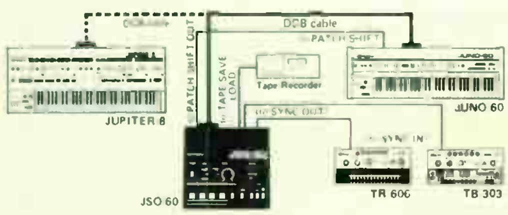
to SYNC IN

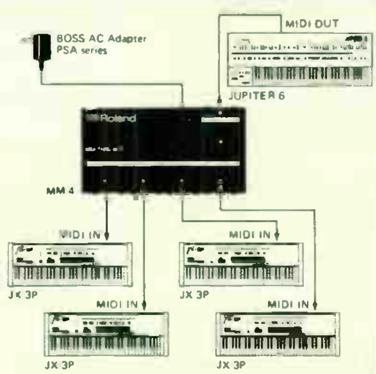
TR-909.

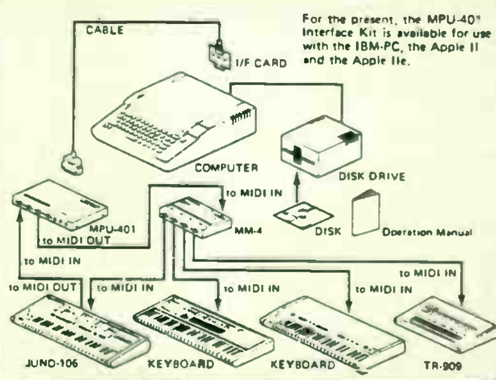
The PIANO PLUS 400 MIDI information controls both the MSQ-700 and TR-909. Turn the Mix Out switch of the MSQ-700 on to control the volume of the TR-909.



The MSQ-700 controls both the JX-3P and TR-909.







Sample Working Systems

swallow, but in fact it's nothing like as complicated as that – they're just options available to the manufacturer of a MIDI instrument, and far fewer are used in practice. For instance, the SCI SixTrak makes use of just 37 controls, of which nine simply toggle something on or off and the rest actually make some sort of graded change in the direction of coarse and fine VCO frequencies, filter cutoffs, and the host of other parameters deeply engrained in each and every synthesist's brain.

In addition, some of those 128 potential control points are kept for specific purposes such as Mode messages. 122 = keyboard control (which simply switches a synth's keyboard on ('local') or off ('remote')); 123 = all notes off (a command which many keyboards don't obey!); 124 = Omni off; 125 = Omni on (which results in a keyboard losing its ID and responding to the events on all 16 channels at once); 126 = Mono on/Poly off (where a monophonic line on one channel is played by the specific keyboard voice assigned to it, and the value of the second data byte sets how many monophonic channels will be received by a particular keyboard); and 127 = Poly on/Mono off (where the keyboard responds like a normal polyphonic synth to the notes on its assigned channel).

Two important points emerge from the 'Control change' aspect of the MIDI protocol. First, there's ample opportunity for expanding the current range of control options; and second, there's little likelihood (since the MIDI standard doesn't lay down the law on this count) that manufacturers are going to agree on which control is given which address. So, if you've plans to equate real-time changes in cutoff frequency on a Prophet T8 with the decaying modulation index of a DX7, and all from a non-specific sequencer running on the Spectrum, best of British luck!

So, continuing with the other two chords (Figure 6 (c)) and after a quarter-note's duration (Figure 6(d)), we move on to the end of the piece (Figures 6 (e and f)).

OK, that's a fairly simplistic example, but it goes to show how you can make dynamics work for you with MIDI – in this case, moving the cello line up in level against a *diminuendo* in the other two parts. The other point is that, by requiring both 'note on' and 'note off' commands, the protocol makes nuances of articulation quite straightforward. For instance, a *staccato* passage of quavers could be achieved by sending the 'note off' command after just a semiquaver duration and then leaving a gap of a further semiquaver before sending the 'note on' command for the next note in the sequence. Just like what's been going on for donkey's years in the way of 'gap time' on MC4s and the like.

On the other hand, if you want a *legato*, where one note replaces another without any intervening gap, it's clear that having to switch a note off before switching the next one on isn't going to be quite like the real thing. Fortunately, there is a way of getting a *legato* out of the MIDI protocol, but this involves going into a special mode of operation aimed more specifically at monophonic lines (and therefore called 'Mono' mode). The point about this mode is that it allows a note value to be changed without obliging you (or, more likely, the equipment) to send 'note off' commands – *legato*, in other words. We'll come back to the various MIDI modes shortly.

IDs

Having spent some time talking about the MIDI words needed to send playing instructions, we've still got to address (and I use that word with purpose) ourselves to the problem of making sure that the notes we've tagged with a status byte actually get to the synth they're intended for. Without that, it's a bit like getting off a train to meet someone you've never met before. The solution is to make sure that the person you're meeting is clearly identifiable from the crowd – a prior instruction to wear a red carnation, for instance.

MIDI does much the same by insisting that all the equipment on the receiving end of a MIDI transmission should have their own identification codes. Thus, a DX7 could be assigned the Channel 1 ID code, a SixTrak Channel 2, and a Poly 800 Channel 3. A '144' status byte zooming down the MIDI pipeline would then automatically get routed to the DX7 and effect a 'note on'; a '145' would go to the SixTrak, and a '146' to the Poly 800. I've chosen those three keyboards wisely, because they and the DX9 are the only keyboards available at the moment that allow the user to set the MIDI channel ID himself. The majority of the others are preset to Channel 1, a point that makes them incompatible (though not, of course, unusable) with sequencing software that allows individual tracks to be assigned to particular MIDI channels and, therefore, played with different voice programs (see Figure 7).

Now, the daisy-chained example in the illustration isn't quite as straightforward as you'd imagine. For some reason or other, SCI saw not to equip the SixTrak with a MIDI Thru socket, so the Poly 800 isn't going to get its slice of action from that source (the same's also true of the Poly 800, as it happens). Instead, you're obliged to use one of the extra MIDI Outs on the computer interface (assuming there is more than one – again, SCI make life difficult by providing only one on their Commodore 64 sequencer) for this purpose. Or, failing that, there's always Roland's MM4 box of tricks to turn one MIDI Out into four MIDI Thrus.

Bending and Programs

Finally, to cap the essentially musical side of MIDI relations, there are two more phrases to be encountered, one for pitch bending and the other for voice program changes. (Figures 8(f) and (g).

By now, you should be getting the gist of the MIDI language, but take your time; savour those words and bounce them around until status and data bytes gel into a nice, ordered queue. Because that really is the whole point – those bytes are being squirted down the MIDI pipeline like some endless tube of toothpaste with different flavour stripes for each of the 16 channels, and the whole success of their mission depends on everything going off in the right direction.

Well, that's not 100% true. Sometimes you might feel like mixing all the stripes up and consuming a nice, homogeneous whole – like putting all 16 MIDI channels in a food processor and dishing out a portion to each open-mouthed synth – and that's what the Omni mode is there for. Any item of equipment that's given the OK to go into Omni mode will then take in and digest note on/note off events sent in all 16 channels: just the thing if you want to parallel one keyboard with another and get a super-thick sound.

On the other hand, if you want your computer to control lots of synth voices with rather more in the way of individuality, then the Mono or Poly modes are where you should be heading. Poly is ideal for the sort of situation where you've a number of polyphonic parts that you'd like played by different synths (as in Figure 7, for instance). In contrast, Mono is ideal for those musicians of a more finickety bent who are after individual lines on individual channels being sent off to their own special voices.

System

How about the other side to MIDI's character – the System data? Well, there are really three sides to the system coin, namely System Exclusive, System Common, and System Real Time. System Exclusive is what you hear muttered about most of the time by the big manufacturers, as this provides the means of a more direct lifeline to the insides of MIDI equipment. For instance, on the SixTrak, SCI use this for loading and dumping stack and program data. There's also a particular System Exclusive instruction available which enables a MIDI transmitter (a computer, for instance) to actually switch the SixTrak to a particular ID channel, thereby freeing the musician from that irksome responsibility.

So, if every manufacturer followed suit, you might in the future be able to enter your parts into the micro, assign them to particular

<144><59><80>	<145><54><80>	<146><51><80>
4th octave B to channel 1 with mf attack	4th octave F sharp to channel 2 with mf attack	4th octave D sharp to channel 3 with mf attack

Figure 6(a).

<128><59><80>	<129><54><64>	<130><51><64>
Channel 1 B off with mf release	Channel 2 F sharp off with mp release	Channel 3 D sharp off with mp release

Figure 6(b).

<144><59><92>	<145><56><64>	<146><51><64>
4th octave B to channel 1 with f attack	4th octave G sharp to channel 2 with mp attack	4th octave D sharp to channel 3 with mp attack

Figure 6(c).

<128><59><92>	<129><56><48>	<130><51><48>
Channel 1 B off with f release	Channel 2 G sharp off with p release	Channel 3 D sharp off with p release

Figure 6(d).

<144><59><108>	<145><54><48>	<146><51><48>
4th octave B to channel 1 with ff attack	4th octave F sharp to channel 2 with p attack	4th octave D sharp to channel 3 with p attack

Figure 6(e).

<144><59><108>	<145><54><32>	<146><51><32>
Channel 1 B off with ff release	Channel 2 F sharp off with pp release	Channel 3 D sharp off with pp release

Figure 6(f).

channels, and then enter the type of keyboard you want to play them. The micro would then recognise the keyboard and automatically instruct it to switch to the relevant ID channel. No longer would you be forced to search through the instruction manual to find out how to change IDs, or, horror of horrors, realise that you're stuck with the manufacturer's pre-assignment of IDs. Until then, though, we're obliged to wait patiently for manufacturers to release their System Exclusive data (though that for the DX7 and SixTrak is already available) in order to see what surprises (if any) they've got in store.

Finally, System Common and System Real Time are really for the live musician. The former includes such commands as Song Position (meaning measure number), Song Select, and Tune Request. System Real Time, on the other hand, is pretty important, as its' data bytes provide the wherewithal for keeping things in sync with a 24-pulse-per-quarter-note clock.

Conclusions

So, after all these words, we're still left with the major question of what MIDI will do for the average musician.

If you're using MIDI simply as a means of syncing a keyboard with a drum machine and playing a couple of keyboards in parallel, you're likely to benefit greatly. MIDI is well suited to that purpose – provided, of course, that the manufacturers can get together to agree on what basic information should be sent and received. Moreover, once you get down to using the MIDI as a pipeline for the rather more ambitious and complex instructions encountered in a multitracked piece, put together with the assistance of some software running on a MIDI-equipped micro, the window opens to an exciting future of multi-timbral arrangements. However, that's not without some problems of inception.

For starters, New England Digital, Oberheim, and CBS/Fender weren't out of order when they criticised the slowness of MIDI – note events do take a finite time to get to where they're being directed. Try a simple bit of maths with the 320us that it takes to send each word of the phrase to switch a note on or off. Three words = 960us, or about 1ms. Switch on eight notes at once, and that takes 8ms. Not too bad, but remember that's without adding on the frills and fancies of after touch, pitch bending program changes, or whatever.

In fact, there also appears to be a measure of unwanted delay creeping into the proceedings even when a relatively small number of note events are being sent between keyboards in a daisy-chain situation. For instance, one experiment I've tried involved a SixTrak transmitting *via* two DX9s to a DX7. Since Yamaha's keyboards sensibly incorporate MIDI Thru, and since MIDI Thru is claimed to be a carbon-copy of what's presented to the keyboard at MIDI In, you'd expect a straight-down-the-line transmission from the SixTrak to the DX7. But far from it. To be fair, all the notes *were* there, but there was a quite noticeable delay between what was played on the SixTrak and what emanated from the DX7. Worrying. So, why do Yamaha keyboards add a delay factor between MIDI In and MIDI Thru? Confusing, isn't it?

But let's not carp too much at this stage. MIDI is still young and innocent and just waiting to be taught a trick or two. Personally, I think most of that's going to emerge once people start using computers in a big way with MIDI. There's no doubt that the MIDI language provides enough finesse to make some very interesting and powerful musical statements, but it has to be used intelligently – and that's where you come in!

David Ellis **E&MM/MIDI**

Figure 8(a).

```
Note on event (3 bytes) = 1001 nnnn + 0kkk kkkk + 0vvv vvvv
-------------------------------------------------------------

    Binary value of example    1001 0000    0011 1011    0101 0000
    Numeric value of example      144          59           80

meaning: "Play a 4th octave B on channel 1 with an attack velocity of 80".

where nnnn = channel code (0-15), corresponding to channel number (1-16).
      ----

      kkk kkkk = key number (0-127), where middle C is 60 and steps are
      --- ----
      in semitones.

      vvv vvvv = attack velocity (0-127), where ppp = 1 and fff = 127.
      --- ----
```

Figure 8(b).

```
Note off event (3 bytes) = 1000 nnnn + 0kkk kkkk + 0vvv vvvv
-------------------------------------------------------------

    Binary value of example     1000 0000    0011 1011    0101 0000
    Numeric value of example       128          59           80

meaning: "Stop the 4th octave B on channel 1 with a release rate of 80".

where nnnn = channel code (as for 'note on').
      ----

      kkk kkkk = key number (as for 'note on').
      --- ----

      vvv vvvv = release velocity (0-127), where ppp = 1 and fff = 127.
      --- ----
```

Figure 8(c).

```
Key after touch (3 bytes) = 1010 nnnn + 0kkk kkkk + 0vvv vvvv
-------------------------------------------------------------

    Binary value of example     1010 0000    0011 1011    0111 1111
    Numeric value of example       160          59           127

meaning: "Add after touch of 127 to the 4th octave B on channel 1".

where nnnn = channel code (as for note events).
      ----

      kkk kkkk = key number (as for note events).
      --- ----

      vvv vvvv = key after touch value (0-127).
      --- ----
```

Figure 8(d).

```
Channel after touch (2 bytes) = 1101 nnnn + 0vvv vvvv
------------------------------------------------------

    Binary value of example         1101 0011    0111 1111
    Numeric value of example           208          127

meaning: "Add after touch of 127 to all the notes on channel 4".

where nnnn = channel code (as before).
      ----

      vvv vvvv = channel after touch value (0-127).
      --- ----
```

Figure 8(e).

```
Control change (3 bytes) = 1011 nnnn + 0ccc cccc + 0vvv vvvv
-------------------------------------------------------------

    Binary value of example     1011 0001 + 0000 0000 + 0010 0000
    Numeric value of example       177          0           64

meaning: "Change setting of modulation wheel to 64 on channel 2".

where nnnn = channel code (as before).
      ----

      ccc cccc = address of control change (0-127), where '0' is usually
      --- ----
      the modulation wheel.

      vvv vvvv = value of control change (0-127).
      --- ----
```

Figure 8(f).

```
Pitch bending (3 bytes) = 1110 nnnn + 0vvv vvvv + 0vvv vvvv
------------------------------------------------------------

    Binary value of example     1110 0011    0111 1111    0000 0000
    Numeric value of example       224          127           0

meaning: "Pitch bend on channel 4 with a value of 127".

where nnnn = channel code (as before).
      ----

      vvv vvvv = bend value, where the two data bytes together make up a
      --- ----
      14-bit value (0-16,383).
```

Figure 8(g).

```
Program change (2 bytes) = 1100 nnnn + 0ppp pppp
-------------------------------------------------

    Binary value of example     1100 0010    0101 1011
    Numeric value of example       194          91

meaning: "Change program to 91 on channel 3"

where nnnn = channel code (as before).
      ----

      ppp pppp = program number (0-127).
      --- ----
```

MIDI and the Micro

Ever since MIDI first appeared, researchers the world over have been developing means of using it to link electronic musical instruments with home micros. Some of the fruits of their research are now beginning to manifest themselves in the form of MIDI-equipped hardware interfaces and the software to go with them. David Ellis **rounds up what's been announced so far.**

The problem facing MIDI's incursion into the hallowed territory of a computer's motherboard is that, as a pipeline aimed specifically at musical functions, it's a lot more than just a means for the serial transmission of data.

The fact that MIDI also lays down a precise protocol as to the ways and means of communication between synthesisers and their controllers means that the standard is also laying down the law on something as fundamental as a programming language – the difference being that MIDI concerns itself exclusively with musical exchanges. Unfortunately, this doesn't fit in too well with the track record for programming languages in the micro industry, where idiosyncratic variations on a BASIC theme are par for the course, though invariably mutually incompatible – a state of affairs that would be anathema to MIDI and the musicians using it.

The way MIDI gets around this potential personality crisis is to make provision for System Exclusive data, so that a manufacturer can address his own synthesiser specifically without actually breaking the general MIDI rules. However, before we get to the niceties of direct programming of DX7s and the like, there's still a rough patch to be got over whilst different manufacturers ensure that they're all interpreting the MIDI protocol to the letter.

This, of course, is where the consumer can step in by making sure that the manufacturer is made aware of his shortcomings. The microcomputer industry is notoriously intolerant of bugs and glitches, and there's no reason why the music industry shouldn't be made just as accountable. The best way to view the next year's development of MIDI is to be really critical of it: if you encounter problems using any combination of MIDI keyboards, software, or micro interfaces, let us know and we'll pass your comments on to the respective manufacturers.

Options

Remember that adding on a micro to a synthesiser *via* MIDI should mean that ooptions open up rather than close down. If a real-time MIDI sequencer program from one firm doesn't quite meet your requirements, you shouldn't have any problem finding an alternative that does, *and* still lets you use the same synth. Above all, linking a micro into the system should give you access to all the processing, display, and input/output options that computer enthusiasts have come to expect as a matter of course. If you pass by a shop selling word processing software, pop in and try to envisage doing the same sorts of operations on musical data – MIDI and a decent micro should be quite capable of giving you the step-time sequencer to top them all.

Moving down a peg or two, it's clear that a common format for encoding music and programming its synthesis could mean as much to the entertainments industry as it will to the professional musician. Indeed, it might even be seen as a natural progression to the manic automatism nightmare of the portable keyboard. If a manufacturer has added so much in the way of auto-play facilities that a keyboard virtually plays itself, the obvious next step is to let it do precisely that, courtesy of a MIDI-encoded score, and then add programming features that allow the user to interact with the performance to alter, say, instruments and their orchestration, timing or rhythm, or even the notes themselves. Well, at least the keyboard would then be playing from a real musical score instead of some R&D engineer's algorithmic conception of harmonic structure burned into EPROMs. . .

In fact, some Japanese companies are clearly doing a lot of crystal ball-gazing in this direction, and the activities of Rittor Music seem certain to cause a good deal of inscrutable head-banging. Aside from their activities in the publishing field (eg. the American magazines, *Keyboard* and *Guitar*), they're also a publishing house for sheet music, which undoubtedly gives them a fair degree of clout when it comes to implementing MIDI-encoded music for the masses and their micros. Whether or not this should be restricted to the soul-less regurgitation of pop 'classics', as the following Rittor selections suggest, is a moot point.

Collection of Baroque Masterpieces
The Best in Pops
The Best of Richard Clayderman
The Best of the Beatles
Collection of Movie Music Masterpieces
The Best in Japanese New Music

Let's hope that the implementation of MIDI-encoded music doesn't pander to the lowest common denominator so long as it's capable of being one of the brightest hopes for the micro industry in usurping the position of *Manic Miner* and the like at the top of the micro applications ladder. One micro magazine recently came out with the comment that 'the adventure game is the most creative thing that can be done on a home computer'. Like any musician who's made the move to the micros, I'd strongly contest that, and I'm sure that MIDI will provide the necessary ammunition!

One point to bear in mind when looking at MIDI software is that the price of the micro has absolutely no bearing on the musical potential of the software. Unfortunately, many musicians have become conditioned to expect that a 6000-note sequencer with step-time programming is going to cost well in excess of £1000 – the Roland MC4, for instance. Well, all that changes totally once you start using a micro with MIDI. A 48K Spectrum should be just as capable of accurately controlling four synthesiser voices *via* MIDI as an MC4 and its CVs. Indeed, the insides of the two machines are all but the same apart from fine print detail (Z80, 48K RAM, etc.). The big difference, of course, is the 15:1 ratio in cost, and that's because the Spectrum has sold a million whereas the MC4 only trickles in by the hundred.

In fact, the MC4 is nothing more than a standard eight-bit micro with some additional CV-producing circuitry, though without either a proper QWERTY keyboard or a video interface for a TV or monitor. The same is also true of the first stand-alone MIDI sequencer, the Roland MSQ700. So, if value for money is of prime concern, the conclusion is obvious: go for the package that adds on any manufacturer's MIDI software and hardware to a standard micro like the Spectrum or Commodore 64, rather than the hard-wired approach that obliges you to limit your diet to a pre-programmed menu of rather fixed MIDI options.

THE LIST

What follows is a list of all the MIDI software that has made it into E&MM's collective consciousness in one way or another. Please remember that many of them are sight-unseen, so, as they say in the small print, no responsibilities can be taken for injury to man or machine. . .

Sinclair Spectrum

The major drawbacks to the Spectrum are its dreadful keyboard and the idiosyncratic approach of using schizophrenic split-function keys for programming. It's beyond me that Sinclair afficionados swear by the latter, but I guess you can't teach an old dog new tricks. Anyway, aside from all that nonsense, the Spectrum is undeniably good value, has

plenty of memory, uses a good BASIC, and its graphics are eminently pleasurable if you take the trouble to machine code them. In addition, the advent of the Microdrive makes storage and retrieval of note files a good deal less painful than the previous wearisome cassette.

Upstream

Upstream's MIDI offering seems to be the first totally UK-grown product, which makes for welcome news in these days of balance of payments deficits. The Spectrum interface itself includes both a trigger output for drum syncing and a MIDI Thru socket. Software is provided on cassette and provides 3500-note real-time or step-time entry on up to six tracks, with the options of a graphics display of dots and staves plus full editing facilities. Other software under development by Upstream includes a DX7 sound programmer, and the Spectrum interface includes the facility for adding this as a retro-fit. The combination of hardware and software is currently retailing for £179. However, to coincide with this MIDI supplement, it's available at the special offer price of £139 from Upstream, 49 Bransgrove Road, Edgware, Middlesex HA8 6HW.

Heart

Heart's ARTEC interface and software looks to be one of the more advanced MIDI products appearing on the market, in that it goes a few stages further than just having a single MIDI bus. However, probably because of this, release of the system has been held up somewhat. Anyhow, the basic plan of action is a 16-channel sequencer that works in both real-time and step-time, with timing resolution down to 64ths, a display of scores three staves at a time, lots of editing facilities, the option of 'arbitrarily planked repetition signs', and also the ability to print out parts or full scores. Well, that's what we're told in advance of its actual appearance.

Where ARTEC makes a great deal of sense (and what should make it worth waiting for) is in the outputs department, since not only does it have a couple of MIDI buses (two lanes of traffic being faster than one), an analogue I/O sync-to-tape, and a couple of trigger outputs in the basic version, but there'll also be an additional analogue interface for providing eight channels of CVs and gates, and a two-channel eight-bit parallel interface that gets to the parts of a synth that others can't – the memory map of the CPU.

Precisely in what form ARTEC is going to appear is uncertain at present, as the original idea of a plexiglass box housing the interface plus a lot of extra stand-alone processing power (the idea being to make ARTEC a unit that can run under its own steam away from the Spectrum home-base – rather like the MPC Percussion Computer and its link with the ZX81) is being re-thought. So, bearing that in mind, the originally quoted price of DM 1680 (around £420) may be a little off the mark. For more information and an anticipated release date, try contacting Heart at 47 Chemnitzer Str., D-4000 Dusseldorf, West Germany (Tel: 0211-273605), or their prospective UK agents, Ultra Design, 408 Richmond Road, Kingston-upon-Thames, Surrey KT2 5PU (Tel: 01-549 9310).

XRI Systems

Another indication that the British software industry is eagerly taking MIDI under its wing is suggested by XRI Systems' Micon MIDI Controller for the Spectrum. Software provides both real-time (with a typical capacity of 8000 notes) and step-time (eight tracks, each with 3000 events) options, extensive editing possibilities – including a display of entered notes – plus repeat and track merging facilities. The hardware provides MIDI In, Out, Thru, and a trigger output. The complete Micon package sells for £108 and is available direct from XRI Systems, 10 Sunnybank Road, Wylde Green, Sutton Coldfield, West Midlands (Tel: 021-382 6048).

Jellinghaus Music Systems

The MIDI Computer Interface that JMS produce for the Spectrum goes under the tag of 'the big interface', big in this instance implying versatility rather than any quality that might tickle Mae West's fancy. The nice thing about this interface is that it's designed to be pressed into service for any 6502 or Z80 micro provided you've got access to expansion connectors, and includes a MIDI In, three MIDI Outs, and an external clock facility. Software available for the Spectrum includes three types of sequencers, two of which operate in real time (Einspiel Sequenzer and Live Sequenzer) and the other in a combination of real time and step time (Multitrack Composer). The Live Sequenzer claims 9000-note capacity (surely the Spectrum doesn't have room for all those, five bytes a time?) and will record dynamics, pitch bend, sustain, after touch, and program changes, with the option of looping on playback. The Composer software, on the other hand, offers eight channels for note entry, with a maximum capacity of 8300 notes, including velocity, gate length, and program changes. JMS also produce a DX7/9 Cassette Interface and software that provides '128 new sounds for the DX7'.

Outside Germany, prices are still under discussion, so the following country-of-origin prices should be taken with a pinch of silicon dioxide: MIDI Computer Interface – DM330 (£90), Einspiel Sequenzer – DM90 (£25), Live Sequenzer – DM180 (£150), Multitrack Composer – DM200 (£55), and DM50 (£14) for the DX7 Cassette Interface. Contrary to what was reported in *Rumblings* in E&MM April, JMS (formerly Music Center) products will not after all be distributed by Digisound. Instead, they're being distributed by Rosetti Ltd., 138 Old Street, London EC1 (Tel: 01-253 7294). Alternatively, contact JMS themselves at Martener Hellweg 40, 4600 Dortmund 70, West Germany (Tel: 0231-171921).

Commodore 64

In many ways, the Commodore 64 is a real gift of a micro for MIDI activities. It's cheap (and getting cheaper all the time), compact (you don't really want an IBM-sized machine perching precariously on top of your keyboard stack. . .), well-endowed with memory (64K, though not all of this is directly addressable), reasonably cheerful when it comes to graphics (there's nothing to stop you from using the 'sprites' to produce music notation), and has a keyboard that's a good deal more responsive than the Spectrum's. However, against these plus points is the fact that writing your own software on it can be a pain because of its exceptionally deficient BASIC.

For serious use of the 64 as a compositional/performance tool, you're more or less obliged to use a disk drive rather than cassette for storage of note files. However, it has to be said (and moaned about) that the disk drive that Commodore supply for the 64 is diabolically slow at getting its act together. This is a pity, as quite a few companies seem to be directing their attention to this micro: perhaps some enterprising firm will come up with a way of improving this aspect of the Commodore's performance? There are actually a couple of other disk drives now available for the 64: the MSD SuperDrive (only available in the States so far, at around $350) and the Commodore SFD1001 (1 meg of storage for £570, but also needing an IEEE interface).

Sequential Circuits

SCI's Model 64 MIDI Sequencer provides over 4000-note real-time storage, multitrack overdubbing, some editing facilities, autocorrection (if you want it), transposition, song construction from sequences, footswitch control, and the provision for an external clock input. A software extension coming shortly will add step-time input and full control of the SixTrak polysynth from the micro – including mult-timbral sequencing and assignment of tracks to specific MIDI channels and keyboards. The hardware plugs into the Commodore 64's cartridge connector and contains software in ROM, which means that the program doesn't have to be loaded up every time you want to use it – a particularly important consideration if you're using an £80 per hour studio! In addition, the unit can be used without a monitor by keeping a close eye on the various status-indicating LEDs strategically sited on the top of the interface. The suggested retail price is £185 ($199). For more info, contact Sequential Circuits Inc., Nijverheidsweg 11c, 3641 RP Mijdrecht, Netherlands (Tel: 02979–6211), or Rod Argent's Keyboards, 20 Denmark Street, London WC2 (Tel: 01-379 6690).

Jellinghaus Music Systems

JMS provide two versions of interfaces suitable for the Commodore 64, one specifically for the 64 (the Mini Interface) and one general type for both 6502 and Z80 micros. Whereas the former has just two MIDI Outs and a MIDI In, the latter also provides a MIDI Thru and a drum sync facility. The Multitrack Composer software gives 9000-note storage onto a maximum of six tracks. Aside from step-time programming of pitch and duration, the software also makes provision for the specification of staccato or legato articulation, dynamics, and program changes.

JMS have also developed an intriguing Sound Editor program that makes use of a light pen to program new sounds into the DX7 (and the poor, left-behind DX9) *via* the cassette interface. UK prices are stil being finalised for these products, but to give you some sort of guideline, JMS prices in Germany are DM99 (equivalent to £27) for the Mini Interface, DM330 (£90) for the MIDI Computer Interface, DM170 (£45) for the Multitrack Composer, and DM (£50) for the DX7/9 Sound Editor. For more info on these products, contact either of the addresses given above in the Sinclair Spectrum section

Passport Designs

Passport's MIDI card for the Commodore 64 comes with MIDI In/Out and drum sync sockets. With their MIDI/4 software, up to 16 real-time tracks can be merged into each of four channels to give what they claim is unlimited overdubbing ability. Each track is said to be fully independent, with its own selectable MIDI channel (1–16), preset number (1–128), and user-definable instrument name. In addition to picking up pitch and duration for each track, the software also registers velocity, pitch bend, preset changes, and after touch data. Editing is limited at present to a punch in/out facility for correction of goofs. A drum on/off option gives real-time control of drum machines by sending clock and stop/start data. Other features include sequence looping, real-time transposition, and a click-track. The RRP for the 64 version of the MIDI card is $195, while the MIDI/4 software goes for $99. For more info, contact Passport Designs Inc., 625 Miramontes Street, Half Moon Bay, CA 94019, USA (Tel: 415-726-0280); or Syco Systems, 20 Conduit Place, London W2 (Tel: 01-724 2451).

Siel

Siel's MIDI/Computer link includes two MIDI Outs, a MIDI Thru, a clock input, and the

Continued

capability to control a chain of their Expander modules, since each can be allotted its own identification code. In fact, the Siel interface was originaly designed by German firm Music Center, and is now made under licence from Jellinghaus Music Systems. Software has yet to be released, but provisional details suggest that there'll be both real-time and step-time sequencers available for this micro. However, the MIDI/Computer link is available now and carries an RRP or £99. For more information, contact Siel UK, Suffolk House, Massetts Road, Horley, Surrey (Tel: 02934-76153).

Moog Music

Moog Music are another of those firms that have been showing off prototype MIDI software at shows around the world, but so far little has been revealed about release dates. Anyhow, we do not know that they're working on a prototype system called The Producer (any votes for 'Springtime for Hitler' as one of the demo pieces?) that runs on the Commodore 64 and is capable of controlling MIDI synths, producing CVs for monophonic synth control, and towing along the odd drum machine or two. Moog Music are also showing considerable enthusiasm in the direction of educational applications of MIDI. For more information, contact Moog Music Inc., 2500 Walden Avenue, Buffalo, NY 14225, USA, or Moog Music, Waalhaven ZZ 48, Rotterdam 3088 HJ Holland.

BBC Model B

As micros go the BBC is still a youngster in the global popularity stakes, which means that its potential delights have still to enter the frame of consciousness of most R&D departments indulging in MIDI. Time alone will rectify this situation, and, apart from EMR below, companies known to be thinking seriously along the Beeb's low profile lines include Roland DG and Siel.

Indeed, given that MIDI is a fairly labour-intensive activity for any make of computer, the BBC should have a positive advantage in this respect, on account of its 2MHz 6502A (the Commodore 64 and Apple II both make do with a processor running at half that speed). On top of that, the BBC B has a reasonably fast disk system (in contrast to the Commodore 64) that's also reasonably cheap (in contrast to the Apple), and, to put the icing on the cake, the graphics capabilities are excellent.

Electromusic Research

So far, EMR are the first British (or any other nationality) company to bring out MIDI products for the BBC Micro. Their MIDI computer interface unit connects to the 1MHz Bus of the Beeb and provides MIDI In, MIDI Out, and an internal sync input of the five-pin DIN variety. EMR's first item of MIDI software goes by the name of MIDItrack, and, unlike most sequencer programs being produced at present, uses step-time input only on up to six tracks, with a total capacity of 7500 events. Each track stores details of pitch, duration, dynamics, and what EMR call 'style' (gate length, perhaps?), as well as program changes. Editing facilities are provided to optimise a musician's interactions with the Beeb's QWERTY keyboard, and any combination of track and channel assignment may be selected to control up to six MIDI instruments.

The BBC Micro interface unit retails for £64·95, and the MIDItrack software for £55: EMR are offering the two together for a special price of £109·95. For sales and further information contact ex-E&MM editor Mike Beecher at Electromusic Research, 14 Mount Close, Wickford, Essex SS11 8HG (Tel: (03744) 67221).

Apple IIe

The Apple II only benefits MIDI applications in one major respect – namely its now infamous expansion connectors. That said, the Apple has a nice homely quality about it (you feel that it's never hiding anything from you – a point which could never be said to be true with the BBC and all its *FX secrets) which encourages a good working relationship. And even if the recommended retail price of the Aple IIe makes you see red, you could always give a thought to the various low-cost lookalikes that are constantly springing up with wild abandon from Taiwanese and Arabian production lines.

Passport Designs

As in the case of their hardware for the Commodore 64, the MIDI card that Passport produce for the Apple has MIDI In, Out, and drum sync. The MIDI/4 software would appear to have the same specs as that for the Commodore 64 (see above). However, Passport also have a piece of MIDI software specifically for the Apple, namely the Polywriter transcription program. This transcribes in real-time from any MIDI keyboard onto screen-displayed staves. Timing resolution extends from whole notes to triplet 16ths, and up to twelve voices per stave can be accomodated. Extensive editing is possible from the QWERTY keyboard (including the addition of text above and below the stave), and the printout formats extend from single parts to full-blown, 40-part orchestral scores. Recommended retail prices go as follows: $195 for the Apple MIDI card, $99 for the MIDI/4 software, and $299 for Polywriter.

Syntauri

Syntauri is something of a dark horse when it comes to MIDI products. They've already done a good deal of the groundwork when it comes to interfacing keyboards, micros, and synthesisers with human beings by virtue of their three-year-old alphaSyntauri system, and they were also one of the manufacturers who met around the table in the early days of drawing up the MIDI specs. However, their interest seems to lie only with the Apple II, and the MIDI products that are expected 'in a few months' time' will be specifically for that machine. Apart from the suggestion that the software will be in the Metatrak format, ie. real-time sequencing onto 16 tracks, that's all they're saying at the moment. For more info (nearer the time perhaps?), contact Computer Music Studios, 62 Blenheim Crescent, London W11 (Tel: 01-221 0192), or Syntauri Corpration, 4962 El Camino Real, Suite 112, Los Altos, CA 94022, USA (Tel: 415-966-1273).

Roland DG

The MPU401 MID Processing Unit is one of the first MIDI/Computer links to be produced by one of the Japanese giants (or, in this instance , their American off-shoot, Roland Digital Group), so there's a good deal of anticipation surrounding its release. The basic unit has the usual MIDI In, Out, and Thru, but also adds sync out, tape in/out, and metronome out. Roland label the MPU401 as an 'intelligent interface' because it's able to keep the bits streaming down the MIDI bus whilst the micro gets on with such housekeeping chores as note file saves and loads. So far, there's no clear indication what the software that goes with the MPU401 will do, but the metronome facility is a pretty clear indication that it's probably angled in the real-time direction.

One encouraging move that Roland DG have made is to release the communications protocol used by the 401 so that others can get in on the software act. So, just because you bought their interace, doesn't mean you're obliged to buy their software too. A gold star for Roland DG, then. The projected retail price of the MPU401 is 'under $200', while the software is expected to go for 'around $100'. For more information on Roland DG's MIDI products and a copy of the MPU401 programming specs, contact Roland (UK) Ltd., Great West Trading Estate, 983 Great Weset Road, Brentford, Middlesex TW8 9DN (Tel: 01-568 4578), or Roland DG Corporation, 7200 Dominion Circle, Los Angeles, CA 90040, USA (Tel: 213-685-5141).

LEMI

This Italian firm has recently entered the MIDI arena with a MIDI card that plugs into one of the expansion connectors in the Apple and two items of software for the aforesaid. First is AMP 83, a polyphonic sequencer of

joint American/Italian authorage that's mainly in real-time but includes sophisticated editing and transposing facilities, variable quantisation levels, sync to and from tape, a software-simulated digital delay, and a sort of automated split keyboard feature whereby programs are changed according to the note being played. The Italian retail price for the package of the Apple MIDI card and AMP 83 software is 600,000 lire (around £240).

Next, there's the intriguingly-named Future Shock, a combination real-time and step-time sequencer that's ambitiously intended as the MIDI sequencer to end all. This is still under development, but it does sound very much worth waiting for. Other software that they're working on includes a DX7 programmer (yes, another one). In fact, LEMI were demonstrating this on the SCI stand at Frankfurt, and very impressive it looked, too. Other plans include adapting their software for the Commodore 64. No UK distribution details are available at present, but LEMI can be reached at Corso Matteoti 37, 10121 Turin, Italy (Tel: 011-541654).

Syn-Comp

Syn-Comp's MIDI Sequencer provides 4500-note real-time storage and multitracking up to 16 tracks. At present, the software supports only pitch, note on, note off, and program change, and included with the Apple MIDI card are cables and documentation. Since the software was written by one OZ Hall, who's work on controlling the Prophet 5 from an Apple II was greeted with a good deal of enthusiasm from certain sectors of the synthesiser fraternity in the States, his MIDI Sequencer may well be worth looking out for. However, no price details are known, and, as far as we know, no UK distribution is planned. For more info, contact Syn-Comp, 2654 Beverly Drive, Birmingham, AL 35223, USA (Tel: 205-879-1518).

Rittor Music

Like other Japanese firms concentrating on their own market, most of what Rittor are doing seems angled at micros more or less peculiar to Japan – the various NEC models, Fujitsu's FM7 and a whole host of MSX machines that the Japanese seem to be consuming like sake and puffer fish. And, even though they are now thinking beyond insularity towards the Western environs of the Apple IIe, MIDI products for this micro are in the main 'projected' (interesting how often that word crops up with MIDI software. . .) rather than existing in a current space-time dimension. Furthermore, Rittor don't seem to have any plans for making an Apple MIDI card available. That said, they do seem to be making up for this shortcoming with a plethora of projected MIDI software that leaves one gasping for breath (not to mention another slug of sake).

Their Music Player software allows step-time entry of up to six tracks using the QWERTY keyboard. Enterable data for each event includes pitch, duration, dynamics, sustain, and pitch bend. A wide range of editing functions is also provided, including copying and moving of measures. The suggested retail price is 9800 yen (around £30), but no UK distributor has been appointed yet.

Next, the Sound Creator software provides direct programming *via* MIDI of the DX7's FM synthesis parameters by interaction with a screen display. Other functions include 'the simulation of sound waves using 3-D graphics' (presumably a simulation of the Fairlight) and 'random voicing' for the Yamaha DX7. Versions for other MIDI keyboards are also planned, once other system exclusive data formats have been released. . . The retail price is undetermined both in the Land of the Rising Yen and over here.

Other software products include the MIDI Song Album series mentioned in the introduction and the Multi Recorder (a real-time sequencer that's only available for NEC and Fujitsu micros at present). For more information, contact Rittor Music Inc., 7th Floor, Shin Yotsuya Ekimae Building, 1–5 Yotsuya, Shinjuku Ward, Tokyo, Japan 160 (Tel: 03-359-0266).

Yamaha CX5

Yamaha were showing some MIDI software for the Apple II last year (dancing bar graphs and so on), which basically just churned out pre-programmed pops in a Rittor-like way for the purpose of catching eyes and ears at music fairs and the like. However, all those plans have been largely superceded by the launch of the CX5, Yamaha's own MSX-standard micro incorporating MIDI and an FM synthesis module. And although the CX5 will function like a DX7 itself, it's the MIDI connection that's the pipeline to its future.

The range of software being produced includes a multitrack composing program, with the option of either real-time or step-time entry, a DX7/9 sound programmer, and various programs with an educational flavour. But the major point to bear in mind is that this software runs either the built-in FM synthesis module, a MIDI-connected DX7, or even a gaggle of FM chips in the shape of the soon-to-be-released T8PR rack-mounting unit.

Perhaps it's somewhat impudent to include in this survey a micro that's not actually available, but Yamaha's entire design concept is so tight that the CX5 must be a surefire success. Aside from the inclusion of MSX (which turns out to be rather better than one was led to believe) in the CX5, the micro also includes a MIDI link as standard. Although some micro magazines have been reviewing a Yamaha MSX micro called the YIS503 (which also includes an FM synthesis module), it's important to realise that this machine was intended only for the Japanese market. This probably explains why the music software released with the YIS503 was of the auto-accompaniment/pre-programmed instruments variety, and therefore not as exciting as we'd been led to believe from advance publicity for the CX5.

In fact, the only MSX/MIDI/FM micro that Kemble-Yamaha will be importing into the UK is the CX5. That's definite. System prices for the CX5, FM module, keyboard, and software are predicted to start at around £500, but nothing is expected to appear on the market before the late autumn. For more info, contact Yamaha Special Products Division, Mount Avenue, Bletchley, Milton Keynes, Bucks (Tel: (0908) 71771).

Conclusions

Just from this brief survey of MIDI software, it's become abundantly clear that lots of people are busy doing virtually the same thing. Indeed, looking at the specs for different real-time and step-time sequencers, it's hard to avoid a nagging feeling that we're going to see another cycle of the clone-like proliferation that hit the software industry with games like Space Invaders and Pacman. In some ways this could be a good thing, because going over the same ground time and time again will eventually clear away the debris to reveal the real McCoy, while at the same time forcing software prices down. On the other hand, it's also a bandwagon that any Tom, Dick, or Harry in the music business can jump on, which could mean all the attendant problems of software piracy and variations on a theme that look all too lacklustre.

It doesn't take a lot of imagination to envisage someone taking the critical machine code routines for MIDI transmission and receiving from one manufacturer's software, tagging these on to some different graphics on the same or a different micro, and then reselling it under a different name in the hope of making a fast buck from the MIDI-seduced public. Just as worrying is the increasing tendency for small *ad hoc* companies with limited finances to pre-advertise their products so that demand can be judged before actually supplying the goods. After all, if someone like Sinclair can get knighted despite such a hit and miss approach to consumer relations, why shouldn't Joe Soap with his do-everything MIDI software?

So, there are really two messages to get across. First, to the software developer, please use your imagination to develop MIDI software in a way that'll maximise what can be got out of the standard. Second, to the musician, don't part with your hard-earned cash until you've got an absolute assurance that the product is fully-developed and available.

David Ellis **E&MM/MIDI**

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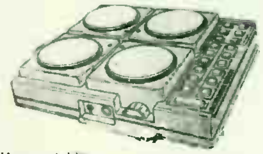

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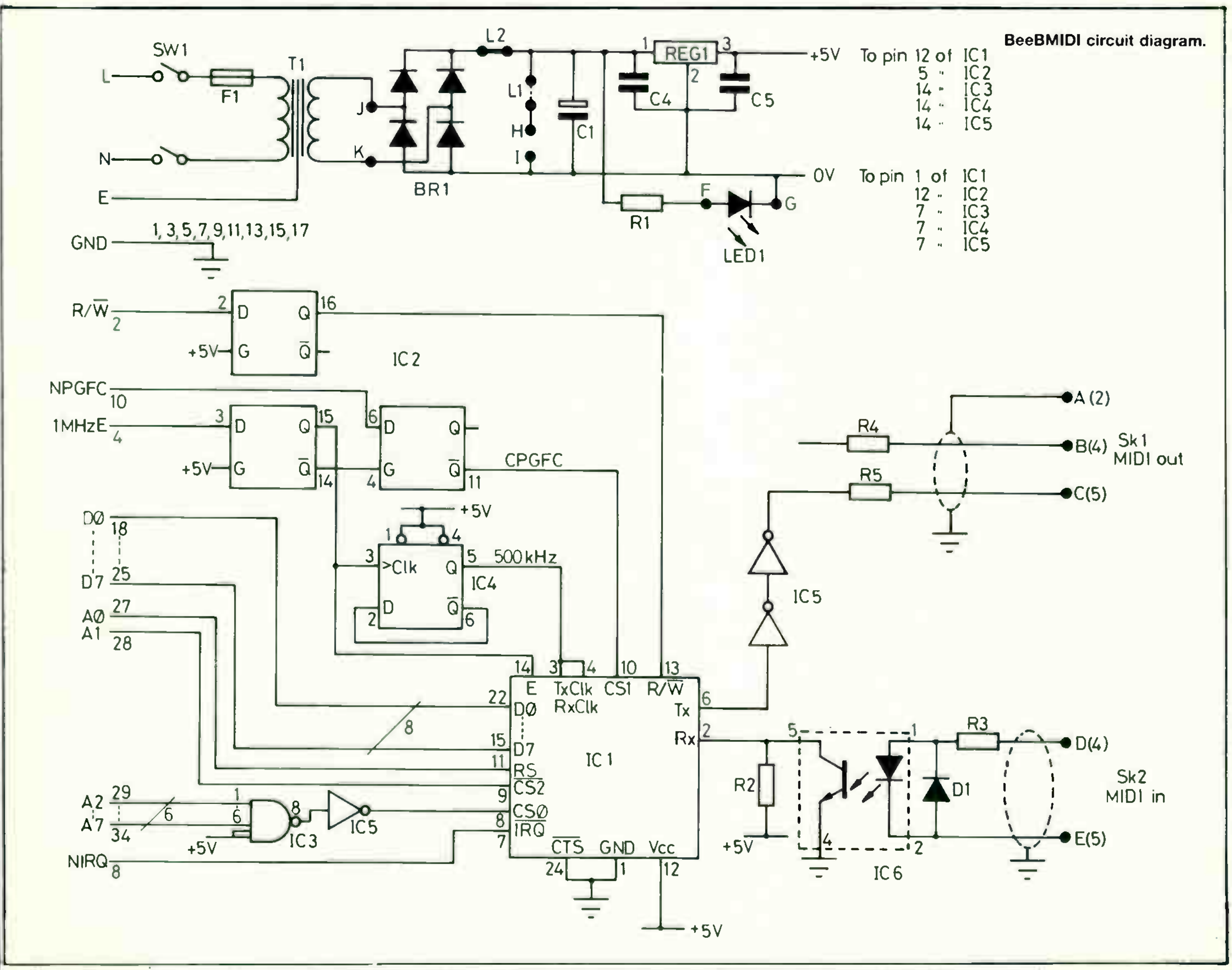
It is worth pointing out at this stage that most designs for microcomputer to MIDI interfaces are going to look very similar for two reasons. First, they should all be derived from the circuit specification given in the document MIDI Specification 1·0 published by the International MIDI Association (IMA) and reproduced in the first part of this supplement. Secondly, the basic requirement is to convert serial information on the MIDI connections into bytes of data understandable by the micro – as ACIA chips such as the 6850 do all the dirty work very nicely they tend to get used!

The serial to byte conversion, including the necessary timing, is handled by the Motorola 6850 Asynchronous Communications Interface Adaptor (ACIA). As far as the BBC Micro is concerned, the control and data registers associated with this ACIA are accessed as though they were ordinary memory locations – the ACIA is 'memory mapped'. The



BeeBMIDI circuit diagram.

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operation of this chip will be discussed a little later.

Hardware

The 6502 CPU's data bus is connected straight through to the ACIA, and data can thus be sent to or from the ACIA as eight-bit bytes along lines d0 to d7, which are connected to pins 22 to 15 on the ACIA chip.

The ACIA chip is enabled by a combination of decoding address lines A0 to A7, and using the 1MHz bus NPGFC (Not PaGe FC) signal which goes low whenever memory page &FC is addressed (the '&' indicates hexadecimal). The NPGFC signal is cleaned up, giving CPGFC (Clean PaGe FC, would you believe?) by one quarter of IC2, a 74LS75 four-bit bistable latch. This is required to avoid address decoding glitches caused by the difference in speed between the CPU bus (normally 2MHz timing) and the 1MHz bus when the latter is not being addressed.

Having selected page &FC, the addresses within the page are decoded by IC3 (74LS30 eight-input NAND gate) and one of the inverters in IC5 (74LS04 hex inverters). These two gates, and the fact that pins 7 and 8 of the NAND are both fed logic 1's (ie. five volts), combine to give a six-input AND gate. This means that CS0 (Chip Select 0) will only be high if address lines A2 to A7 are all high, and as A1 is directly connected to NOT CS2, it must be low to enable the chip. A0 is connected to the Register Select (pin 11) so the bit pattern of the low order address byte is 1111110?, where ? selects between two registers in the ACIA (but see the full story in the software section!). The 'read/write' line is buffered by another IC2 bistable and enters the ACIA on pin 13.

For anybody feeling a bit confused, the previous paragraph means that you end up with the 6502 CPU seeing the ACIA as the two addresses &FCFC and &FCFD, and being able to specify whether a read or write is required.

Acorn Bus Spec

The addresses chosen are within the 'User Applications' space allocated by Acorn in FRED (the Acorn name for the memory mappd I/O page) and this should ensure compatibility with their future products. Note that Acorn specify that any devices on the 1MHz bus should provide a 'through' connection of the bus so that further devices can be connected – this connection has not been provided in order to keep down cost and complexity. When you spend a couple of hundred pounds on a 1MHz add-on you can make sure it does have a 'through' connection and connect BeeBMIDI at the end of the chain...

Note that the NIRQ line of the bus has been connected to the ACIA (pin 7) so that advanced users can take advantage of interrupt handling. This might be particularly useful if several BeeBMIDIs were to be used at the same time.

Timing

One advantage of using the 1MHz bus instead of a user port is that we do not need to generate our own 31·25kBaud clocking for the MIDI serial data on-board, since this can be derived from the 1MHz signal available on the bus: the correct MIDI frequency is derived by dividing the 1MHz clock by 32.

The 1MHz clock signal connects to another of IC2's four-bit bistable latches, the latter being used as a buffer so that only one TTL load is driven by the bus line. The 6850 needs to synchronise with the 6502 CPU's memory accesses, so the buffered 1MHz is fed into pin 14 (the 'Enable' pin) of the 6850. This is actually to do with the Motorola 6800 series component timing and need not concern us here. The same signal is divided by two by one of the D-type flip-flops in IC4, a 74LS74 dual D-type flip-flop package. The resulting 500kHz clock is fed into the receive (pin 3) and transmit (pin 4) clock inputs of the ACIA. This 500kHz clock is divided by 16 in the ACIA to give the time-per-bit, therby giving the required MIDI serial data clock rate of 31·25kBaud.

The transmitted serial data from the ACIA is sent *via* the two inverters (part of IC5) providing sufficient drive current for the MIDI Out connection. The MIDI In connection is fed into the receiver side of the ACIA, following what is effectively a current-to-voltage conversion provided by the optoisolator, which also prevents the formation of ground loops.

Power Supply

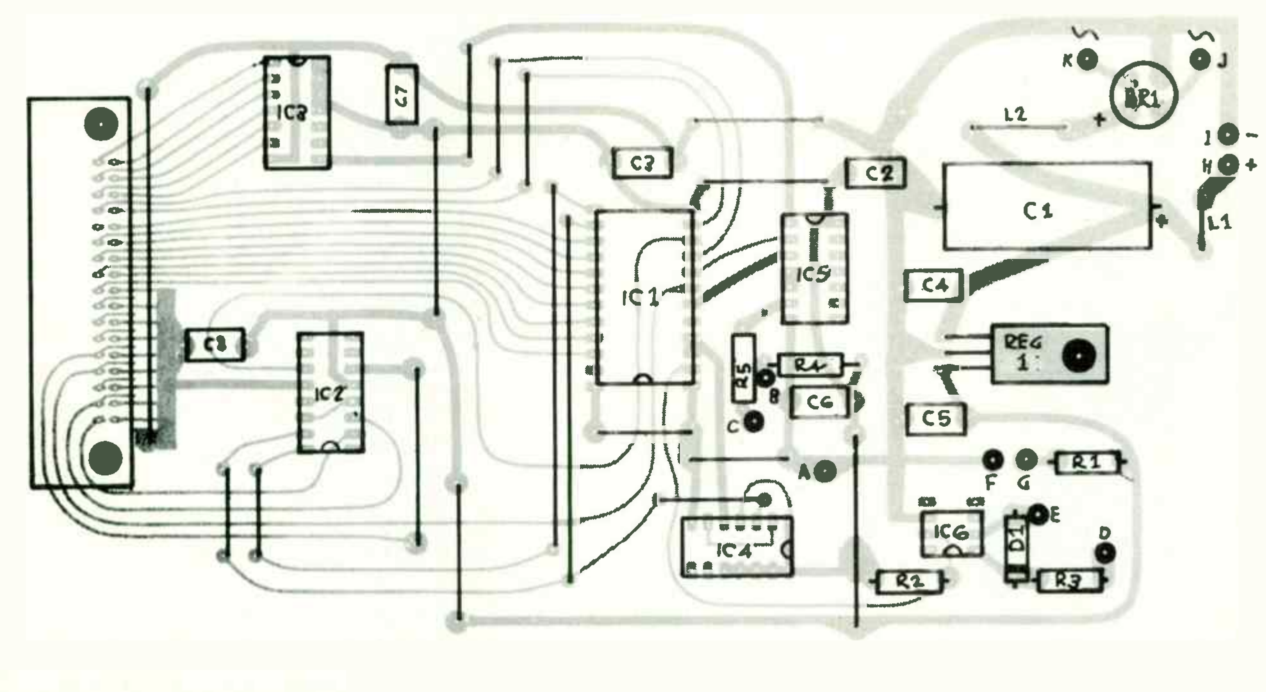
The power supply will not be described in detail since it really is quite straightforward. Links have been provided so that either six volt AC or nine volts DC can be used to power the board. Note that the power has *not* been taken from the BBC micro as this is contrary to the 1MHz bus specification. If you have no disk drives, ROM boards, etc., you could dispense with the power supply and use the BBC's five-volt supply connected in place of C5. If you wish to use six volts AC, link L2 should be made and link L1 broken. Otherwise, link L1 should be made, L2 broken and nine volts DC connected across pins H and I (H is positive).

Construction

Construction is fairly simple.

A single-sided board is used to keep the cost down, hence the usual problem that connections need to be made across the 'bus' tracks on the board. This problem is solved by extensive use

BeeBMIDI PCB component overlay.



of links which are easily made by using insulated single-strand copper wire. Vero pins, shown lettered A to K on the drawings, should be fitted at this stage. Once these are in place, the diode, decoupling capacitors and resistors should be soldered in place, observing correct polarity for the diode.

Next, the sockets are added, followed by the electrolytic capacitor C1, the regulator, and the bridge rectifier – all of which should be connected carefully, preserving orientation.

The MIDI In and Out DIN sockets can now be connected. Note that the MIDI Out socket has pin 2 connected to pin A on the board *via* the shield of the connecting cable: this latter can be any shielded cable with a minimum of two cores. The MIDI In socket does not have any shield connection to the board, as any cable connecting to it will be shielded from the far end.

The power supply should be tested before the ICs are inserted, to see that the voltage is correct and that power is available at all the IC sockets. The ICs can now be inserted again, paying attention to the orientation in each case as well as the position in the eight-pin DIL socket of the six-pin optoisolator.

Connection from the BBC Micro's 1MHz bus to the board is made with a 34-way ribbon cable, fitted at both ends with 34-way female header Insulation Displacement Connectors (IDCs). On the board a male right-angled PC-mounting IDC is used. These connectors can be fitted to the cable with the help of a vice and a little care – when making up your cable, make sure the polarising bumps (if any) match, otherwise the cable will always be twisted when in use. A cable length of no more than one metre should be used.

Once built, the board can be tested with the 'Exerciser' program discussed below.

Software

At this point you should type in and save a copy of the 'MIDI Interface Exerciser' program. We'll use this program to test the interface and to explain the basic software techniques employed in driving the interface.

Testing

Connect the BeeBMIDI Interface to the BBC Micro's 1MHz bus socket and to whichever form of power supply you're using. Use a suitable DIN-to-DIN cable to connect the MIDI In and MIDI Out sockets on the interface. Switch on the computer and the interface and load and run the MIDI Exerciser program.

The program transmits the full sequence of possible bit patterns in a byte (values 0 to 255) *via* MIDI Out, and after each byte is transmitted waits to receive a byte *via* MIDI In. Having connected MIDI Out to In we should find that the byte received is the same as the last byte transmitted.

If the two bytes are *not* the same then there is something wrong with the interface. When this happens to me it's

```
 10 REM ============================
 20 REM = MIDI Interface Exerciser =
 30 REM ============================
 40
 50 REM ACIA Register Addresses.
 60 REM ------------------------
 70
 80 control%   = &FCFC :REM write
 90 status%    = &FCFC :REM read
100 transmit%  = &FCFD :REM write
110 receive%   = &FCFD :REM read
120
130 REM Reset the 6850 ACIA.
140 REM --------------------
150
160 ?control%   = &03
170
180 REM Configure the 6850 ACIA.
190 REM ------------------------
200
210 ?control%    = &15
220
230 REM Exercise the Interface.
240 REM -----------------------
250
260 Tx_byte% = 0
270
280 REPEAT
290
300   REM Wait for 'Transmit Register
310   REM Empty' status bit to be ON.
320
330   REPEAT
340     UNTIL ?status% AND &02
350
360   PRINT "----------------------"
370   PRINT "Transmitting ";~Tx_byte%
380
390   REM Transmit current byte%
400   ?transmit% = Tx_byte%
410
420   REM Wait for 'Receive Register
430   REM Full' status bit to be ON.
440
450   REPEAT
460     UNTIL ?status% AND &01
470
480   Rx_byte% = ?receive%
490
500   PRINT "Received     ";~Rx_byte%
510
520
530   FOR I=0 TO 300:NEXT I:REM delay loop
540
550   REM Calculate next Tx_byte% but keep it
560   REM in the range 0 .. 255 i.e. one byte
570
580   Tx_byte% = ( Tx_byte% + 1 ) MOD 256
590
600   UNTIL FALSE
610
620 END
```

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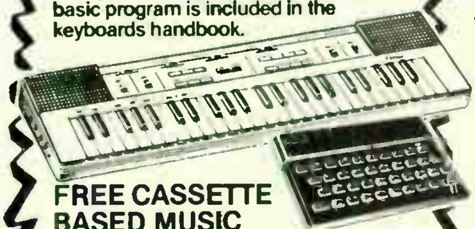

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usually because (a) I forgot to turn the interface power supply on or (b) a wire has pulled off one of the MIDI sockets because I haven't boxed the interface yet and the wires aren't supposed to take the strain!

If the Exerciser shows that the interface *is* working but you still have no luck making it talk to your synth, make sure you haven't wired the MIDI In and Out sockets up 'mirror image'. If you have, they'll still talk to each other with no problems but they won't be able to talk to the rest of the MIDI world...

Exerciser Program

The subject of what information you should be transmitting to and receiving from your MIDI instruments is covered elsewhere in this supplement. Here we are concerned with the basics of simply transmitting and receiving over MIDI – in other words, how we drive the 6850 ACIA.

You'll recall from the Hardware section above that the connections between the BBC Micro's 1MHz bus and the 6850 give essentially two locations (&FCFC and &FCFD), that we can read and write and a 500kHz timing signal. What follows is a description of how the software makes use of these hardware facilities.

Lines 80 to 110 of the program set up some names for the four registers we use in the 6850 ACIA. Although the control and status registers are addressed at the same location (&FCFC), they are really two different registers – the read/write line is used to select between them. In other words, we *get* the contents of the status register when we *read* from &FCFC and we *set* the contents of the control register when we *write* to &FCFC. Location &FCFD is treated in the same manner to give a write-only transmit register and a read-only receive register.

Control Register

Various bit patterns are written into this register to do different things. The pattern '00000011' (hexadecimal &03) causes the ACIA to perform a 'Master Reset': the chip stops whatever it was doing and goes into a stable 'clean' state in preparation for being configured by the controlling CPU. In the Exerciser program, &03 is written into the control register in line 160. The Acorn BASIC syntax is a little diffemt from Microsoft-type BASIC, so perhaps I should explain that '?address = number' is the equivalent of 'POKE address, number' on some other micros.

Following the Master Reset, we configure the ACIA by writing the pattern '00010101' (hexadecimal &15) into the control register in line 210 of the program. The sets of bits that interest us here are the two low-order bits CR1 and CR0 ('01') and the next three bits CR4, CR3 and CR2 ('101').

As we have already seen, CR1 and CR0 can be used to specify a Master Reset when they are both on (ie. '11'). Otherwise they are used to specify by what factor the incoming transmit and receive clock frequencies should be divided before being used. In our case we have an incoming frequency for both transmit and receive of 500kHz. We require division by 16 to give the MIDI specified 31·25kHz, so we choose pattern '01'. Patterns '00' and '10' would have given divide by 1 and 64 respectively.

Bits CR4, CR3 and CR2 are used to specify the Word Length, the Parity and how many Stop bits are to be used. To cut a long story short, the MIDI specification insists on one start bit – which the ACIA assumes anyway – eight data bits, no parity bit (we haven't time to go and ask for the byte again if we get a bad one) and one stop bit. The configuration pattern '101' in CR4, CR3 and CR3 does the trick.

Status Register

Four of the bits in this register are of direct interest to us: SR0 (Receive Data Register Full or RDRF); SR1 (Transmit Data Register Empty or TDRE); SR4 (Framing Error or FE); and SR5 (Receiver Overrun or OVRN).

SR4 and SR5 are both concerned with errors that have occurred whilst trying to deal with incoming data bytes, so it may be important to check these bits in any programs you write. Notice that there are no error bits associated with transmission. Provided your program handles the byte transmission in the proper maner (see under *Transmit Register* below) the byte will be transmitted correctly.

A Framing Error (FE) occurs when a start bit is noted coming in (from MIDI In in our case) and the corresponding stop bit is not found immediately after the end of where the ACIA times the data bits to be. Typical reasons for FEs would be that the transmit speed of the remote ACIA and the receive speed of this ACIA don't match, or that bits are being corrupted somehow during transmission. In general, though, you shouldn't be greatly troubled by FEs.

Receiver Overrun (OVRN) errors, on the other hand, are something you may very well need to worry about. What happens here is that the ACIA receives a byte before your program has managed to pick up a previously received one: the original byte is overwritten and you've lost it! The usual reason this occurs is simply because your program has taken too long over processing a particular received byte. In fact, this is precisely why BASIC is not used to write MIDI input software (eg. for real-time keyboard input or program dumps), as there is only about 0·0003 of a second, on average, to deal with each byte received in the worst case, and interpreted BASIC just isn't fast enough. The Exerciser program leaves long gaps between each byte and so sidesteps this particular problem.

Transmit Register

In line 400 of the program, the byte to be transmitted is 'poked' into the transmit register. Immediately the write into the register is finished the ACIA transmits the byte serially at 31·25kBaud to MIDI Out.

Of course, it takes time to transmit the byte – one start, eight data and one stop bit at 31·25kBaud need 320 microseconds – so we must be careful not to try to transmit another byte until this one has gone (corresponding to the OVRN error on receive). To be completely accurate, it's important not to 'poke' another byte into the Transmit Register until the current contents have been transferred to the Transmit Shift Register inside the ACIA.

Once there is one byte starting transmission and a second byte in the Transmit Register, the process has to wait: Program Lines 330 and 340 are responsible for waiting if it is necessary. The program will loop at this point until '?status% and &02' is non-zero. '?address' in Acorn BASIC corresponds to 'PEEK(address)' in other BASICs, so '?status%' is reading the contents of the ACIA status register. &02 is the bit pattern '00000010', so the 'and &02' isolates the SR1 bit for us. In other words, the result of '?status% AND &02' is '00000010 if SR1 is set ('1') and '00000000' if SR1 is off ('0').

So, if SR1 (the Transmit Register Empty status bit) is set, we can go ahead and poke the next byte to transmit into the transmit register. If SR1 is zero – and therefore '?status% &02' is zero – we must wait.

Receive Register

Lines 450 and 460 organise the waiting if the 'Receiver Register Full' bit, SR0, is set. The &01 is the bit pattern '00000001' and the '?status AND &01' works in a similar manner to that described above. Once the Receive Register is known to be Full we 'peek' the byte held therein into the integer variable Rx byte% in line 480.

The program goes round in a nerver-ending loop from line 280 to 600. Line 260 starts the value of the byte to be transmitted (held in the integer variable Tx byte%, off at 0), and line 580 increments this byte value. The MOD 256 ensures that the value stays in the 0 to 255 range. Lines 370 and 500 tell you what was transmitted and received respectively on each trip round the loop. The delay loop in line 530 is there so that you've got time to read the program output!

What Next?

Having connected BBC Micro, BeeBMIDI Interface and MIDI-compatible synth(s) – what next? Well, you need some software to drive all the hardware!

The July issue of E&MM will feature an article on some elementary BBC BASIC routines that should get you interested in the idea of doing your own programming, as well as ensuring that your interface starts getting used as soon as possible after you've constructed it. A little later on, we'll also be presenting an E&MM exclusive software package that'll enable you to use BeeBMIDI as a fully-polyphonic, eight-channel MIDI sequencer. Until then, happy MIDI soldering....

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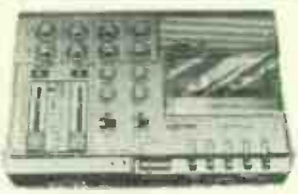

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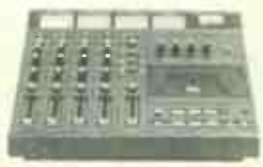

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1981

AUGUST PA Signal Processor ★ Powercomp ★ Hexadrum ★ Matinée ★ Resynator/Casio VL-Tone reviews ★ Irmin Schmidt

OCTOBER Harmony Generator ★ Securigard burglar alarm ★ Effects Link FX-1 ★ Music at City University ★ dbx noise reduction & Blacet Syn Bow reviews ★ Micro interfacing ★ Disco equalisation

NOVEMBER Landscape explored ★ Casio MT-30, Roland GR-300 Guitar Synthesiser, Roland CPE-800 Compu-Editor reviews ★ Melody Making on the Apple ★ Phasing ★ Auto Swell – Electric Drummer – Soundbooster – Toneboost projects

DECEMBER Rick Wakeman in 1984 ★ Orchestral Manoeuvres in the Dark ★ Bio Music ★ Yamaha CS70M, Vox Custom Bass & Custom 25, Roland CR5000 & CR8000, Alpha Syntauri, Fostex 250 ★ Synclock project ★ ZX81 music

1982

JANUARY The New Tangerine Dream ★ Japan Music Fair ★ Fact File ★ Guitar Workshop ★ Reviews: Casiotone 701, Teisco SX 400, Aria TS 400, M.C.S. Percussion Computer, Soundchaser, Beyer Mics. TC Effects Boxes, Tempo Check ★ Projects: Spectrum Synthesiser, Electric Drummer, Volume Pedal

FEBRUARY Ike Isaacs ★ Digital Audio Discs ★ Yamaha GS1 & 2 ★ Reviews: Korg Trident, AKG D330BT & D202 Mics, Menta Micro, Roland TR606 Drumatix, JHS C50PM & C20B amps, Fostex A-8 8-track Recorder, Tokai ST50 & PB80 Guitars ★ Vocal PA ★ ZX81 Music ★ Projects: Digital Delay Effects Unit, Spectrum Synth, Percussion Sound Generator ★ Resonant Filters

APRIL Martin Rushent, Human League in the Studio ★ Cardiff University Electronic Music Studio ★ Reverberation explained ★ Reviews: Korg Mono/Poly Synthesiser, Fostex 350 Mixer, Roland TB-303 Bass Line Sequencer ★ Projects: MF1 Sync Unit, Multireverb

MAY Holger Czukay ★ Depeche Mode ★ Keyboard Buyers Guide ★ The Peak Programme Meter ★ Reviews: Moog Source and Rogue Synthesisers, Suzuki Omnichord, Acorn Atom Synthesiser, Calrec Soundfield Microphone ★ Projects Soft Distortion Pedal, Quadramix

JUNE Jean-Michel Jarre ★ Classix Nouveaux ★ Studio Sound Techniques ★ Making Music with the Microfan 65 ★ Reviews: Carlsbro Minifex and E-mu Systems Emulator ★ Projects: Panolo and Multisplit.

JULY Ronny with Warren Cann and Hans Zimmer ★ Drum Machines Buyers Guide ★ Jean-Michel Jarre Music Supplement ★ Reviews: Roland Juno 6 Synthesiser, Peavey Heritage Amplifier, Steinberger Bass Guitar, TI-99/4 Music Maker Software ★ Projects: Universal Trigger Interface, Electric Drummer

AUGUST Kitaro ★ Spectro Sound Studio ★ Jon Lord Interview & 'Before I Forget' music to play ★ Reviews: The Synergy, Korg Polysix, Tascam M244 Portastudio, Shergold Modulator 12-String Guitar, Yamaha Professional System Effectors ★ Warren Cann's Electro-Drum Column ★ Projects: 8201 Line Mixer, Guitar Buddy practice amplifier.

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1983

JANUARY Richard Barbieri of Japan ★ Ultravox Music ★ Patrick Moraz ★ Ars Electronica ★ Reviews: Westone Bass Guitar, BGW 750C Amp, Korg EPS-1 Keyboard, Clef Band Box, Zildjian Cymbals ★ Projects: Synblo, The Transpozer, Amdek Compressor

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MARCH Klaus Schulze ★ Michael Karoli ★ Francis Monkman ★ Bernard Xolotl ★ Chris Franke ★ Frankfurt ★ Reviews: Jen Piano 73, 5 Casio keyboards, RSF Kobol Expander, Korg Poly 61, Aria Mics, BGW 7000 Amp, Ibanez Effect Pedals, Tokai Flying V Guitar, Oric-1 Microcomputer ★ Projects: The Shaper, 842 Meter Bridge, Amdek Rhythm Machine Kit

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ON CASSETTE

Paul White takes charge of our bi-monthly examination of E&MM readers' musical offerings. If you've made a recent demo recoding you'd like him to hear, send it in a padded envelope – accidents do happen – and with as many personnel/equipment details as possible. A recent photo would also come in handy. The address for all submissions is E&MM, Alexander House, 1 Milton Road, Cambridge CB4 1UY.

TAPE OF THE MONTH

3D FICTION (Rotherham). Orb Marfin: vocals. Fiona Palmer: vocals. Carl Hough: keyboards. Andy Stevenson: keyboards/drum machine.

Three tracks recorded in an eight-track studio using a wide variety of keyboard instruments, including a Yamaha DX7, Korg Polysix, Roland Vocoder and Mellotron. Entitled 'Sometimes', 'China Garden', and 'A Day in the Pleasure Garden', the songs are competently recorded – if a little overlong – and are let down only in the percussion department, where the band's Roland TR808 (just) fails to deliver the punch required for this sort of material.

The entirely synthesiser/rhythm machine line-up gives 3D Fiction an entirely modern if occasionally inhuman sound, the arrangements hinting at influences such as Depeche Mode, Japan, or perhaps The Stranglers.

'China Garden' is a slow, haunting piece throughout which the drum machine is thankfully absent, which makes this just about my favourite of the three compositions on offer: the DX7 lends a convicing acoustic-type feel to the track's arrangement. 'Pleasure Garden', on the other hand, uses flanged drum machine snare and tasteful incidental synth phrases to create an intriguing aural effect: simultaneously both driving and soporific.

3D Fiction are a young band with a strong sense of purpose whose unfaltering production style adds interest and variety to what is really some pretty lengthy material. Although not staggeringly original, their music is up-to-date and intelligently constructed, and should stand them in good stead for the months to come.

3D Fiction.

DANGEROUS SHIRTS

(Stafford). Three tracks by solitary shirt Graham Exfon, the other two band members being detained elsewhere at the time of recording. Titled 'Love Or Something', 'I'm Not Dead', and 'Turtle Rap', all three pieces were recorded on a Tascam 244 Portastudio/4RX set-up, utilising among other things a Roland SH101 monosynth, Korg KPR77 rhythm machine, guitars from Ovation and Aria and various assorted kitchen utensils.

Despite the use of synthesisers, the first two songs are essentially guitar-orientated and appear on first listening to be a curious blend of Elvis Costello, Gerry and the Pacemakers, and Squeeze.

Although limited to a degree by the recording equipment available, the overall sound is bright, well balanced and reasonably produced, the only real headache being the inevitable drum machine with its sneezing electronic hi-hat. The vocals have been treated – though not to excess – with an Evans Echopet, and sit quite nicely in the mix.

Track three, 'Turtle Rap', is an off-the-cuff, synth-based rap number with curiously treated vocals and a manic backing arrangement reminiscent of somebody jamming with TV game sound effects.

The songs presented here are far from being entirely commercial, but if the Shirt(s) can iron out their line-up problems and collar a record company, they may be able to press them into giving them a deal and thus button up a contract.

A BETTER MOUSETRAP

(St Helens). Three offerings from Brian Hulse, a songwriter who turned solo after his original band split up. Again recorded on a Tascam 244, the tape features a Korg Polysix, Drumulator, Ibanez analogue delay and various guitars.

Marred only by some minor tuning discrepancies, the songs – entitled 'Come The Morning', 'The Random', and 'Something That You Said' – are yet further evidence of the sort of recording quality that can be achieved using only the humble Portastudio. The Drumultor's punchy, dynamic voices impart a solid, professional feel to all three works, while Hulse's vocals blend in well with the textural atmosphere of the backing, even if they're a little too recessed in the mix to be as clear as I would like.

Although the instrumental backing is predominantly played on synths, these are used manually (you know, pressing the keys) as opposed to being pre-programmed, and the music is therefore devoid of the pitfalls suffered by so many sequencer-based compositions.

The songs on offer here may not be outstandingly commercial, but they are quite original, and it is to the composer's credit that they do not betray his influences too heavily.

PAPERWORLD

(Banghurst, Hants). A musical compilation by Mark Griffiths, recorded on a hired Portastudio and using a Roland SH2 and digital sequencer. Later tracks were recorded on a Tascam 34, while the whole tape was mastered on a Revox B77.

The material on offer is entirely instrumental in nature and sounds to these ears as if it was written as part of a complete audio-visual production rather than as music in its own right. But that's not to say that in isolation it is musically weak – far from it. Griffiths seems to have coaxed a surprisingly wide range of sounds from his humble set-up, while I don't think it would be an exaggeration to say that much of the music shows real compositional flair.

As a sort of quick musical reference point, I'd say the tape is slightly reminiscent of Vangelis working on a fictitious David Attenborough TV series, but then again, such a description could appear quite damning to some listeners!

The composer informs us that it's taken him the best part of a year to pluck up sufficient courage to bring his music out into the open, so this current offering has appeared not before time.

I like this tape very much, and wouldn't be at all surprised if, given wider exposure, its creator did not become the recipient of a number of commissions for film, television and advertising work.

Paul White **E&MM**

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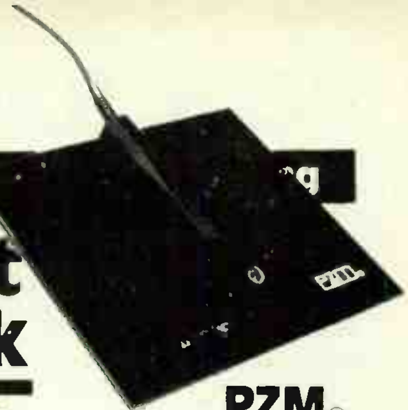

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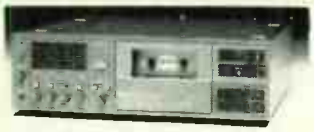

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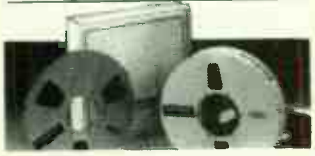

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ON RECORD

Dan Goldstein looks at the latest vinyl releases on labels big and small.

You
Wonders from the Genetic Factory

Rock City RCR 88004

Hideous title apart, this is an album of almost inspirational quality from the German synthesiser duo of Albin Meskes and Udo Hanten. While undeniably derived from the Tangerine Dream/Klaus Schulze school of synthetic thought, *Wonders* succeeds in creating for itself an individual character that, for this writer at least, has restored some faith in the current wave of German electronic music.

Side one consists of five shortish pieces that contain some delicate (Novatron and Memorymoog) atmospheric touches and some mildly wonderful drum machine programming, using Dr Bohm's ever-popular 'digital drums'. Only the gimmicky 'Sampling Dance' (presumably a reference to the number of sound-sampling devices used on the track) seems ill-conceived or awkwardly constructed.

Sadly, though, side two of *Wonders* consists of one lengthy, pseudo-improvisational track – 'Yourovision' – which, seeing as it appears to be the band's flagship, comes as something of a disappointment after the innovations of side one. Instrumentally, this track sees older devices such as the Minimoog and ARP sequencer come further to the forefront, and in the area of composition also, 'Yourovision' appears more dated than its shorter, more disciplined counterparts on the flip-side.

This is still good music, however, immaculately played and recorded with great clarity (if not a staggering degree of imagination), and should prove to be the starting-block for a fine synthesiser band indeed.

Echo & The Bunnymen
Ocean Rain

Korova KODE 8

In these days of MIDI polyphonic sequencing and Fairlight sampling, it's refreshing to see an established band take the opposite direction and choose instead to work with a string section to add another dimension to their instrumental line-up. Echo & The Bunnymen have done just that, and certainly on a purely textural level, they've managed the transition extremely well. I don't know whether it's the skill of Adam Peters' orchestral arranging or whether there was a general empathy between band and men-with-bows, but there is a certain 'togetherness' about the playing on *Ocean Rain* that was lacking in the days when it was just guitar, bass, drums and so on.

Alas, good playing and sympathetic arrangements do not a good album make: you also need some decent, memroable melodies, the odd cannily-phrased lyric or two, and a reasonable singing voice to link the two together. *Ocean Rain* has none of these things. True, 'Nocturnal Me' has a gorgeously hummable hook-line and clever lyrics to boot, but that's only one track out of nine, which really isn't good enough.

Frankly, after several attentive listens to *Ocean Rain* I cannot for the life of me see why Echo & The Bunnymen are lauded and pandered to as much as they seem to be. It's a pleasant enough album, but Ian McCulloch should by now have come to terms with the fact that he can only really sing one octave, and that there's a limit to how much lyrical arrogance most people can take.

I'm going to play 'Nocturnal Me' again when I've finished writing this review, but woe betide me if I select the wrong track.

Sal Paradise
Shimmer

Arista 206 156

I have to confess that I know next to nothing about Sal Paradise, other than that it's the name of the main character in Jack Kerouac's autobiographical *On The Road*. I can't for one moment imagine that the Sal Paradise on this record is the same one, but whoever he is, he's made quite a debut with *Shimmer*.

A collage of drum machines, acoustic tribal percussion, strong-ish acoustic synth sounds and forceful but rather insecure vocals, this LP does for traditional West African music what Japan did for the music of the Orient – put it in a modern, popular context by fusing its instrumentation and construction with those of the contemporary electronic/dancefloor idiom. Add some sensitive, thoughtful lyrics and 'dry-as-we-could-get-it' recording and you've got a recipe for transcontinental success, as Japan proved.

Since there's no mention on the sleeve of any other musicians, I'm assuming Paradise plays all the instruments, as well as writing all the songs, co-producing them and, of course, singing them. In which case, *Shimmer* has got to go down in my book as one of the most pioneering works of the year.

If only I could find out who he is. . . .

MODULAR SYNTHESIS

Woodwind Sounds

Steve Howell on how to synthesise both conventional orchestral wind sounds and their rougher, less refined counterparts from the non-Western world.

The principle behind most woodwind sounds is that air is passed down a resonant tube whose apparent length is varied by opening and closing holes along its' length. There are, therefore, two elements to most woodwind sounds – the tone and the breath. This is particularly true of overblown instruments, though on double reed devices such as the oboe and bassoon the breath element is not so prominent.

Oboe is actually one of the most difficult sounds to synthesise accurately, though it is quite easy to recreate the effect of the instrument's reediness. This is done by using as the basic waveform a pulse wave whose pulse width (or mark/space ratio) is asymmetric, ie. in the region of 10:90 (or vice versa), though the actual ratio can be varied according to taste. This should help capture the acoustic sound's inherent thinness. The VCF should be set quite resonant – about halfway – and the cutoff frequency fairly high according to taste. The EG should incorporate a softish attack (not too slow, though) with full sustain and a short release.

Slow (around 4Hz) vibrato can be added if so desired. Experiment with introducing the effect gradually if you wish, though personally I prefer leaving a moderate amount of vibrato on all the time. This should give you a pretty good oboe effect, especially if you smother it in reverb and keep it back in an orchestral mix. Take it down an octave, with suitable tweaking of the VCF cutoff frequency and EG attack, and you should have a reasonable approximation of a bassoon.

If, on the other hand, you feel like being a bit more adventurous, you could try the patch given in Figure 2. Here, a footpedal is used to control the tone of the sustained sound by altering the cutoff frequency and the pulse width slightly as the pedal is moved. If a footpedal is not available, then any DC voltage supply routed *via* a conveniently located control can be used. You will see also that a sinewave (tuned about two octaves above the pitch of VCO1, with a very rapid attack/decay and no sustain) is used to modulate the VCF very slightly. This element introduces the 'squeak' at the front end of a double reed instrument. You can also, if you wish, sweep the width of the pulse very slightly with the output from a spare EG, as this can create the illusion of reeds 'energising'.

As an option for both of the patches given, you might like to try routing the whole thing through a parametric equaliser with a narrow 'Q' and frequency set around 3K or so. In the absence of a parametric, a graphic equaliser with all but the middle frequency sliders at minimum will perform much the same job, as will the EQ section of your mixer. Finally, if you want to hear an excellent example of a synthesised oboe, have a listen to *The War Suite* by Gino Vanelli. . .

Flutes and Clarinets

Clarinets are relatively easy to synthesise, since a straight square wave with a softish attack should get you close to the acoustic sound without too much trouble. Filter cutoff frequency and ADSR times can be adjusted to suit, and again you could consider the addition of some vibrato. In general, though, all you really need is a good, symmetrical square wave.

The flute, on the other hand, is a different kettle of sonic fish altogether. Whereas oboes and clarinets are shoved in the mouth and blown down, a flautist has to blow over his instrument in much the same way as you or I would blow a bottle. The result is a much more 'breathy' sound, and it's necessary to set up your synth patch in a slightly different way if you wish to recapture that element. Figure 3 gives a patch that can be used to create an effective flute sound: there are two channels – one for the tone and one for the breath. Many people attempt to synthesise the breathiness of a flute simply by mixing a noise generator in with the VCO *via* the VCF but frankly I've never been a fan of this method: it rarely sounds particularly convincing, due in part to the fact that without splitting the two sound elements into separate parts, complete control over the synthesising process is well-nigh impossible.

The pitched tone portion of the sound is derived from a symmetrical square wave, passed through a VCF whose cutoff frequency is adjusted so that the sound is fairly pure. A triangle wave can be used as an alternative, but steer clear of using a pure sinewave, as it's usually too lacking in harmonics to be heard amongst other instruments. There is a very slight EG sweep of the VCF – just enough to open the envelope a bit at the front end of the sound. The EG controls are set to give a 'blowy' sound, with attack, decay, and release times of about 500ms or thereabouts and the sustain set about half-way. This introduces a subtle touch of harmonic movement, making the overall sound more interesting.

The 'breath' channel is derived from feeding a white noise source (it *must* be white noise for optimum effect) into a low or band-pass filter which, in turn, is shaped by EG3. The filter can be set more or less as required, with the cutoff frequency and resonance adjusted to suit, while the EG controls can be set to give either a short burst of breath at the front of the note or, with the sustain control up, a hint of 'blow' throughout. Vibrato can be added as desired.

Ethnic Woodwind Instruments

The patches outlined above should give you a fair approximation of orchestral wood-

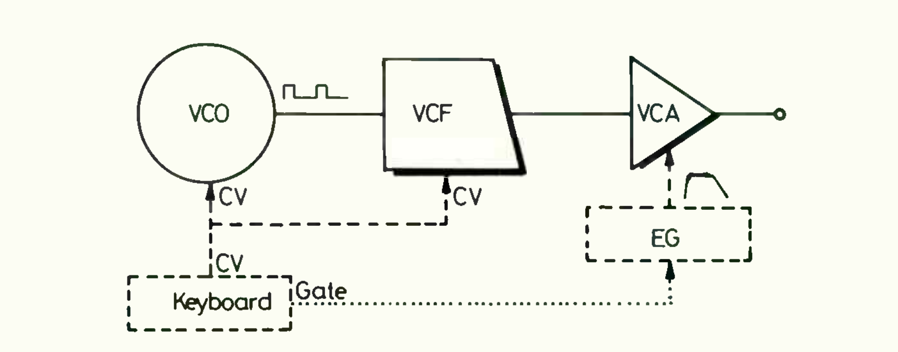

Figure 1. Simple oboe patch.

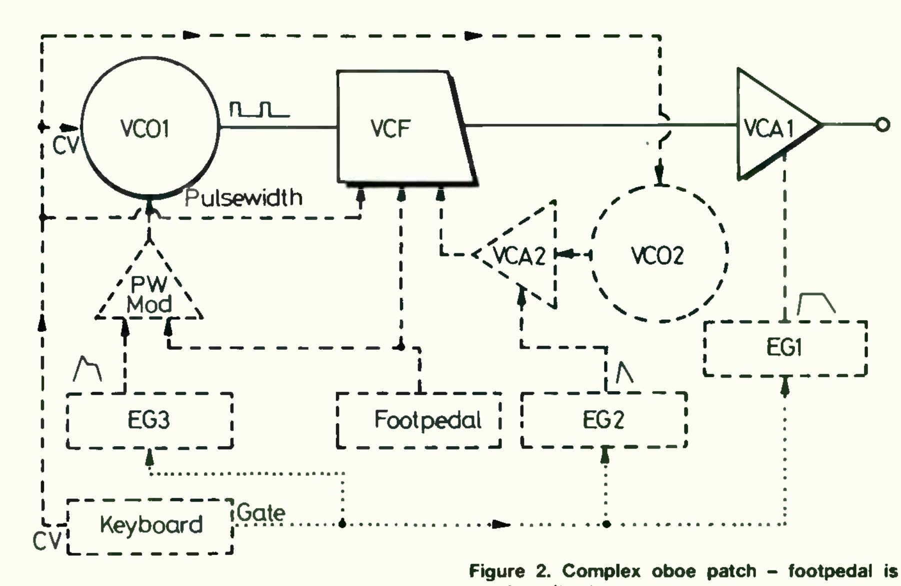

Figure 2. Complex oboe patch – footpedal is used to alter tone.

wind sounds, and can sound effective either back in the mix or as melody lines.

Other cultures also use similar instruments as a part of their traditional music but, whereas Western civilisations have refined their instruments and accompanying playing techniques, the wind instruments of some ethnic societies have not evolved to such a degree. What this means for the average synthesist is that whilst the wind patches remain essentially the same, variations in some control settings and playing techniques are necessary if these less conventional wind instruments are to be synthesised accurately.

The major difference between the two generations of instruments lies in pitch stability. Arabian, African, and Oriental musicians – without the advantages (?) of a Royal Academy training – place rather less emphasis on holding stable notes for any length of time, with the result that pitch is given more than a passing opportunity to 'wobble'.

To emulate this effect, we can use sample and hold, as patched in Figure 4, instead of a symmetrical sine or triangle wave output from an LFO. In this case, the CV output is routed *via* a lag time integrator which acts as a slurred, random modulation source. When applied to a VCO in small amounts, this makes the sound more unpredictable and therefore more ethnically realistic and 'human'. Modulation levels are quite critical – make sure you don't go over the top and introduce an effect that's too extreme.

It's worth mentioning at this point that a woodwind player cannot, in fact, actually create true vibrato – the effect produced is amplitude modulation, or tremelo. Having said that, however, when it comes to *synthesising* wind sounds, pitch modulation is extremely effective, if not absolutely authentic.

Non-Western players often lack the highly-developed embrouchure possessed by orchestral players, and their instruments tend to be more 'breathy' as a result – this is especially true of pan-pipes and African flutes. Adjusting synth patches with this in mind, the most effective modification you can make is to adjust the resonance control so that the filter is almost on the verge of oscillation. You should also try tuning the cutoff frequency so that it bears some relationship to the pitch of the tone. You can adjust the balance between tone and breath to suit the effect you require. Finally, you can experiment with various sets of ADSR times for different effects, though make sure things don't end up sounding utterly unmusical!

Non-Western read instruments can be quite a bit more screechy than our oboes, so some adjustment of the filter controls is necessary for faithful reproduction, along with changes to your EQ settings. You might like to try routing the output of a sample and hold into the pulse width CV input for random pulse width changes at each note: the S/H must be stepped through by the trigger output of the keyboard.

Note-sliding

Many non-Western folk musicians employ a lot of sliding between notes, so portamento can be used in small doses. This should be of the temporary type, provided either by an auto-glide facility on the keyboard (played legato) or by swiching it in manually with a pushbutton or footswitch.

Lastly, the music of many non-Western cultures can be quite a bit more dynamic than that of their Western counterparts, so it can be a god idea to route the whole synth sound through a master VCA whose output level is controlled by a footpedal or similar controller. You could even try this technique in the context of Western woodwind sounds as well – and play wind parts with a dynamic range rather wider than that produced by the average Berlin Philharmonic Orchestra flautist!

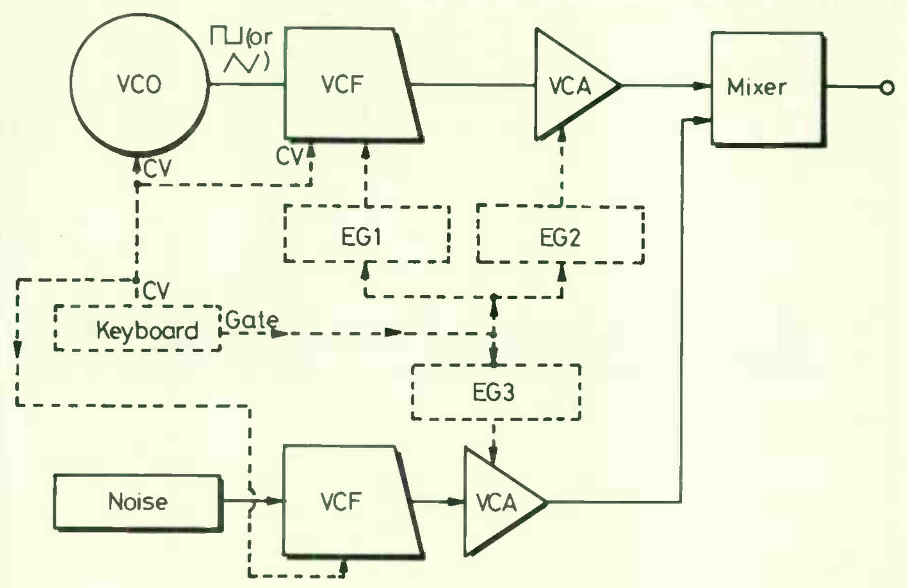

Figure 3. Flute patch. This can also be used for pan-pipes etc – see text.

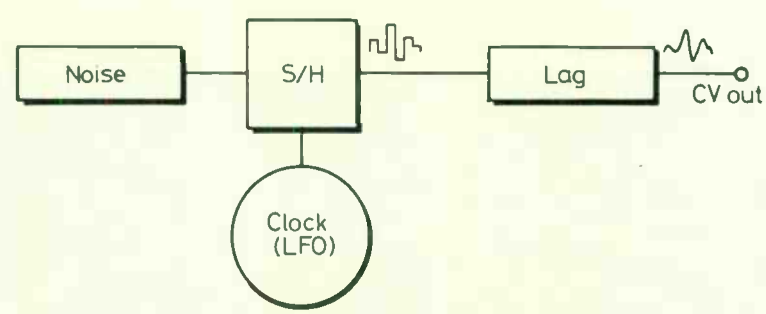

Figure 4. Patch for 'slurred' sample and hold, to introduce random vibrato.

Putting all these techniques into practice can be something of a headache, requiring as it does a great deal of rehearsal and careful listening to the music of different cultures. It's interesting to note that what a traditional peasant folk musician does almost instinctively requires not only a lot of technology but also a great deal of advance planning and thought on the part of the modern synth player. So much for the wonders of science...

Phrasing

Even though all the points mentioned above should put you on the road to successful wind sound synthesis, your efforts will be all but wasted if you don't pay a reasonable amount of attention to phrasing. Remember, a woodwind player has only a finite amount of breath, so if you start playing very long notes, they're more than likely going to diminish the authenticity of the sound. Try to arrange your synth parts so that there is time for your wind soundalike to 'take a breath', and try to keep them within the range of the instrument you're basing your sound on. Of course, part of the beauty of synthesisers as instruments is that you're rarely restricted by such mechanical considerations, but if realism is your aim, the rules outlined above are simply impossible to ignore.

All wind sounds are essentially monophonic and are therefore best suited to a single-trigger monophonic system – a polyphonic synthesiser might not be capable of creating the sound you want. With the possible exception of the flute, it's pretty rare for woodwind instruments to go *divisi*, and they're best recorded line-by-line on separate tracks of a multitrack tape. During recording, reverb can be applied as necessary, as can repeat echo if you're looking for a useful special effect. Personally, I find chorus, flanging, and phasing render the sound too 'electronic', though this may of course be precisely the effect you're after – feel free to experiment.

Before we finish, there is one playing technique that can be usefully applied to all the above sounds (or indeed any with a moderately slow attack) and that is pseudo-touch-sensitivity. If a note is played *staccato*, the attack doesn't have sufficient time to reach its full output level: holding the finger on the key a little longer enables it to do so. So, altering the way you touch the keys can give you quite a wide range of control over the sound's output level, depending on the attack time set.

That, then, concludes our excursion into the world of woodwind sounds. I feel quite strongly that these forms of sound texture are rather underused in much of modern music. Western wind tones can be used as a string section alternative for synth players wanting orchestral size without orchestral clichés, while more exotic sounds can lend a piece of synth-based music a more than welcome 'acoustic' flavour.

Steve Howell **E&MM**


Dawn of a new technology
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Towards Perfection
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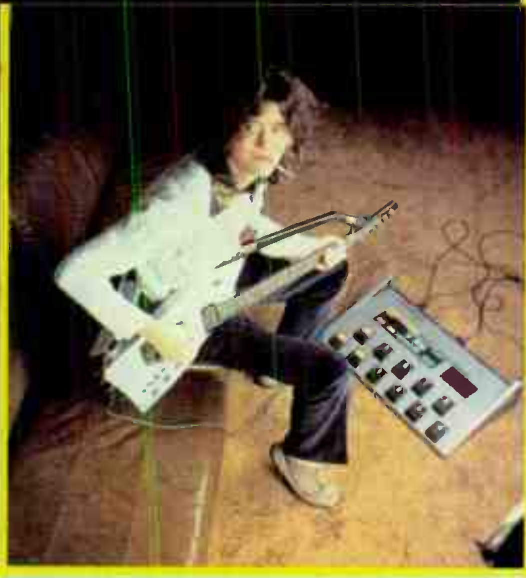


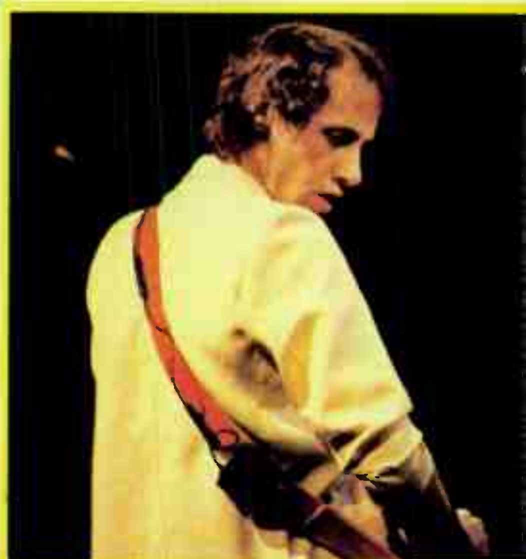


Understanding the DX7

The second of two examinations into the synthetic make-up of DX7 preset voices. This month, the program under scrutiny is 'Train'. Your conductor, Jay Chapman.

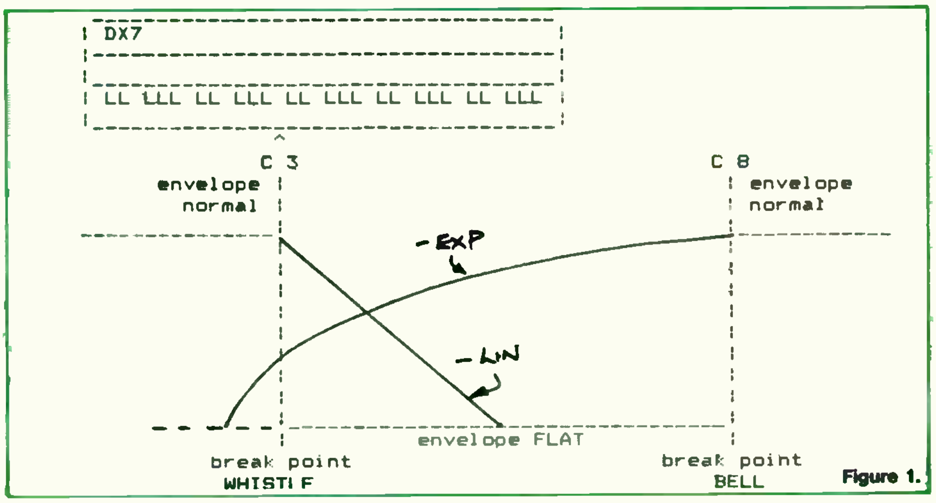

Figure 1.

Having been led gently by the hand through the internals of E. ORGAN 1 you should now have a set of incredibly experienced digits (that's fingers, not numbers) and hopefully I can drop some of the more laboriously detailed descriptions of my keypad fumblings.

'TRAIN' has three components – the Whistle, Bell and Steam sounds. As algorithm 5 has only three carriers it's not difficult to work out which is doing what. How? Turn off each of the carriers in turn and see which part of 'TRAIN' goes away. You should end up with:

Operator 1: Whistle
Operator 3: Bell
Operator 5: Steam

Whistle

Let's deal with the interesting parts of the whistle sound. The pitch of the whistle is related to the keyboard position (as we will see, that of the bell is not) so the carrier, Operator 1, is in frequency ratio mode. The ratio is 1·64, which means that the whistle is not going to play in concert pitch but, seeing as it's a fairly unmusical sound, that doesn't matter all that much. It's when we look at the frequency ratio of Operator 2, the modulator, that some light begins to emerge, if only because it is also a bit strange at 3·03. What we are seeing is similar to the effect of a ring modulator: we can create more or less discordant sounds by modulating a carrier of a given frequency with a more or less unrelated frequency.

Confucius he say, 'one practical demo worth a lot of theoretical mumbo jumbo', so try varying the frequency ratio of Operator 2 with only Operators 1 and 2 turned on. When you get to 1·64 (remember Operator 1?) the sound becomes quite musical again. For experience you might try to get the same type of sound starting with Operator 1's frequency ratio set at 1·00. If you can't work out in advance what value Operator 2 should have for its frequency ratio parameter, just fiddle about until you get there!

On the envelope generation side of things, the carrier EG is nothing unusual. The modulator's EG has a slowish peak on the front which causes the modulated carrier's timbre to 'come and go' giving a longish 'wah' at the start of every note.

Bell

A very simple sound to make! Both carrier and modulator EGs come on like a switch and die away slowly, independently of key release. In fact, the shape of these envelopes is the same simple one used for Operator 6 on 'E.ORGAN 1' – the difference is that the Rate 2 slope is much more gentle, ie. there is a much greater time gap between leaving Level 1 and arriving at Level 2 which is zero in both cases.

The frequencies of the two Operators are *not* related to the keyboard. You get the same bell pitch anywhere on the upper part of the keyboard because the Operators are in fixed frequency rather than frequency ratio mode. You'll find that the frequency produced by the carrier is 371·5Hz, while that of the modulator is 977·2Hz. If you play around with the modulator frequency you'll come across lots of bell-like sounds, some of which seem more 'pure' than others. The purity, or lack of sideband frequencies, for some modulation frequency values is due to the mathematical relationship between modulator and carrier frequencies. Examples of pure and impure tones can be found with modulation frequencies of 741·3Hz (= twice 371·5Hz) and 631·0Hz respectively.

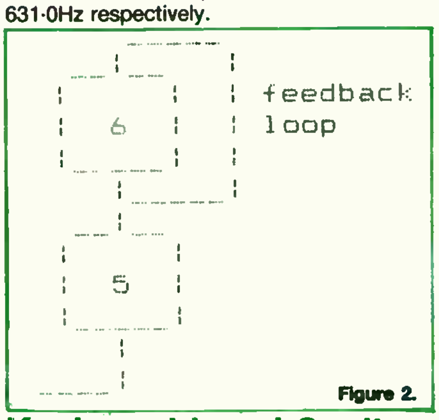

Figure 2.

Keyboard Level Scaling

Well, well, well . . . I bet you had your suspicions that this subject would turn up eventually! What follows is a brief look at what keyboard level scaling is all about. The keyboard level scaling paramaters allow us to specify how we want the output levels of

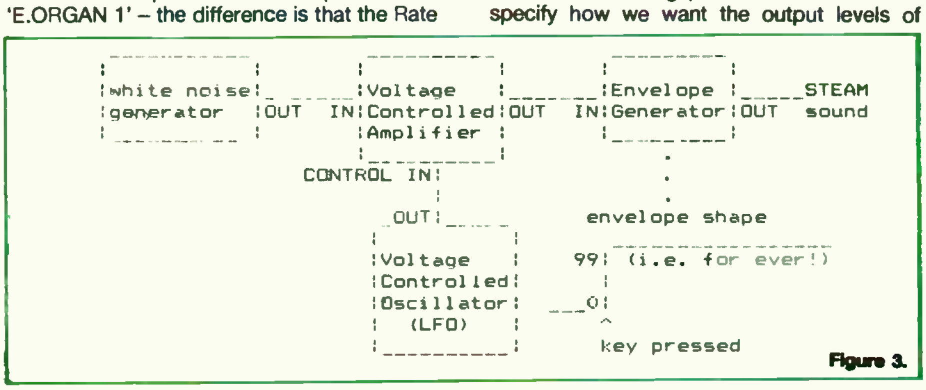

Figure 3.

envelope generators compressing or expanding depending on the position of the key being pressed. We'll leave sophisticated use of this feature to a much later article although it's worth noting that it is one of the DX7 features that permit such accurate synthesis of acoustic instruments. For 'TRAIN' the feature is used very crudely to compress the whistle envelopes so that at the upper end of the keyboard they are completely flattened – they remain at zero and we hear nothing. The same thing is done for the bell at the lower end of the keyboard.

To use keyboard level scaling we must supply five pieces of information for *each Operator* to be affected. For 'TRAIN' we wish to affect the amplitude output by the bell and whistle components, but as we are not attempting to affect the modulation of these components (the more normal use of keyboard level scaling in imitating accoustic instruments) or the amplitude of the steam component, we need interest ourselves only in the relevant carrier Operators: 1 and 3.

Our first piece of information is related to the feature found on some synthesisers which allows the keyboard to be split into two parts. On some the split point is fixed, but on others you define it by choosing the key (or pitch) at which you wish the split to occur – the latter method is used on the DX7. In edit mode, with only Operators 1 and 3 turned on ('101000'), observe this value for each Operator by pressing the green Break Point keypad and then using the purple Operator Select keypad to view the value of each Operator in turn. You should have:

Operator 1 – Break Point = C3
Operator 3 – Break Point = C8

Whatever we do with the components, the bell's scaling will centre to the right of the top end of the keyboard and the whistle's around the bottom. Note that C3 is middle C – two octaves up from the bottom end of the keyboard – and C8 is actually three octaves above the highest C on the keyboard.

The next two pieces of information are concerned with the way the effect of scaling varies to the left and right of the break point. To understand what is going on we need to refer to the keyboard level scaling diagram Yamaha provide on the top right of the DX7 front panel.

The first thing to realise is that the vertical line marked 'Break Point' represents the key selected by the 'something like a keyboard split' choice we have just looked at. When we are deciding what to do to the left and the right of the break point key we choose from the left or right side of the vertical line, ie. we choose a 'left curve' or a 'right curve' respectively. Note that in this context a 'straight line' is just a particular type of curve, so both the LIN and EXP shapes can be referred to as curves.

When we consider left or right curves we have two more decisions to make. First, do the envelopes get compressed or expanded as we move further away from the break point? And second, is the change proportional to how far away we've moved from the break point or does the rate of change increase? The former is represented by the curves marked LIN (for linear) in the diagram and the latter by the curves marked EXP (for exponential).

A discussion of why we would choose LIN or EXP will have to wait until a later article, but suffice it to say for the moment that both the amplitude and timbre of a sound produced by an acoustic instrument have components related to the pitch of the sound, and such relationships can be approximated by the linear and exponential functions provided.

Having decided which curve to use on the left and right we must also tell the DX7 by how much each cuve is to be applied, ie. their individual depths, and these are the final two pieces of information.

So to recap, the five pieces of information for keyboard level scaling are:

1) the Break Point – where left and right curves meet.
2) the left curve's Shape.
– expand or compress
– linear or exponential
3) the left curve's Depth.
4) the right curve's Shape.
– expand or compress
– linear or exponential
5) the right curve's Depth.

Let's have a look at how 'TRAIN' uses this feature. Turn the six Operators on and press the green Depth keypad. We look at the depth before the curve type because if the depth is zero the curve is not going to have any effect and we can therefore ignore it. The display looks something like:

```
ALG 5 111111 OP6
L SCALE DEPTH= 0
```

You may not have the same Operator selected (OP6) and you might have an 'R' for right instead of an 'L' for left – hitting the Depth keypad will toggle between 'L' and 'R'. By using the Operator Select keypad, cycle through the six Operators, looking at their L Scale Depth and R Scale Depth values, and you should discover that all the depth values are zero, except that Operator 1 has 'R SCALE DEPTH = 98' and Operator 3 has 'L SCALE DEPTH = 98'.

Operator 1 is the carrier for the whistle and as only its right scale is affected we hear it normally at the left-hand end of the keyboard, ie. to the left of its break point. Select Operator 1 and press the green Curve keypad until your display shows:

```
ALG 5 111111 OP1
R KEY SCALE=-LIN
```

Looking back to the keyboard level scaling diagram, you'll see that the envelope for the whistle carrier will be more flattened the further you play to the right of its break point. If you turn on only Operators 1 and 2 – to give you the whistle on its own – and play up the keyboard from bottom to top, you'll hear the volume of the whistle stay steady until you reach middle C, after which it gradually fades the further you move up the keyboard. Figure 1 is a simplified diagram to relate the curves and their effects to the keyboard for the whistle and bell sounds.

The method used for the bell sound is very similar. However, the volume of the bell drops off rapidly as you progress down from the top of the keyboard – if you consider the shape of that part of the left curve of the bell's carrier Operator that's effective you should be able to work out why.

Steam

A train's steam sound shouldn't pose too many problems – we want some white(ish) noise delivered in short bursts. We already know that Operators 5 and 6 are the culprits, so let's sort them out.

Turn Operators 5 and 6 on, the rest off. Press down the green Feedback keypad and you'll see that 'FEEDBACK = 7' which is the maximum value possible. The relevant part of the algorithm diagram is shown in Figure 2.

The feedback loop around Operator 6 allows it to modulate itself, which will probably make its eyes water no end . . . In any case, it's very useful from our point of view as it allows us to make noise (!) To see the process in action, try varying the data slider so that the Feedback level moves from 7 to 0 and back again, and listen to the sounds produced. I'll leave you to play with the levels and frequencies at your leisure.

The last item we have to look at is how the short rhythmic 'chuffs' (note the highbrow technical terminology) are organised. Press the Speed keypad under the LFO legend. By varying the data slider you can change the frequency of the Low Frequency Oscillator (LFO) and thereby the timing of the steam sound. The LFO is used in a similar manner to most other synthesisers, so that, for example, it can provide vibrato by modulating the pitch of carrier Operators. For the steam sound, the amplitude – rather than the pitch – is modulated.

Press the green Amplitude keypad under the Mod Sensitivity legend, turn all the Operators on and select them one after the other. You will see that Operator 5 is the only Operator with a non-zero value for its Amplitude Modulation Sensitivity – in fact it has the maximum value of 3. The display showing this looks like:

```
ALG 5 111111 OP5
A MOD SENS.   = 3
```

What this means is that if there is any amplitude modulation going on, this Operator is going to respond to the full. The LFO is one of the amplitude modulation sources (these include the Modulation Wheel, would you believe!) so it will affect this Operator. The LFO parameter responsible for the depth of LFO amplitude modulation sent out to the Operators is shown by pressing the green AMD keypad under the LFO legend – the display looks like:

```
ALG 5 111111 OP5
LFO AM DEPTH =99
```

So, we have the final link in the chain producing the steam sound – with an Amplitude Modulation Depth (AMD) of 99, the LFO is modulating away at full blast. The shape of the LFO wave is a triangle (press the Wave keypad for this parameter), giving the 'chuff' we require. Try the different waveforms available by using the data entry controls.

Figure 3 shows how the steam sound would be generated using the various components of a traditionally-configured analogue synthesiser. The only thing that really changes on the DX7 is the way the white noise is produced – the VCA and EG in the diagram form part of Operator 5.

Puzzle Solution

Earlier on I pointed out that the steam sound didn't go away when its carrier was turned off unless 16 more keys were pressed. You can see in Figure 3 that the envelope for Operator 5 stays on forever – this is because its envelope Level 4 has a value of 99. When a key is pressed, one of the DX7's 16 voices is assigned to that key. Since the note never finishes (because the Level 4 value won't let it) you can turn Operator 5 off and no change will occur on the voice because Operator on/off changes cannot take place on an assigned voice. When you hit the next key, a new voice is assigned which doesn't have operator 5 on and therefore has no steam sound. The original voice still hasn't stopped, however, so you still hear the steam.

The same thing happens until you have all 16 voices assigned by hitting one key (for the original voice with steam), and 15 keys more for voices without steam – 16 keys in all. When you hit another key the DX7 has a problem because it has no voices free to assign to it. It therefore decides to reassign the voice it used furthest in the past, which, in this instance, is the one still Steaming. Between the old assignment and the new, Operator 5 is set off and the steam at last runs out of puff . . .

Jay Chapman **E&MM**

PATCHWORK

This month's MIDI supplement has meant that *Patchwork* has had to be reduced (temporarily) to just one page, despite our receiving more patches than ever before! Feedback from readers indicates that not only are the patches published proving useful in their own right, but that they're also being used as building blocks for creating new sounds or being modified to suit another synth. If you'd like to share a gem with readers, send your submission (preferably on 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.

ROLAND JX3P/PG200 — 'Bells' — Roger H. Knott, Hertfordshire

General Notes:
1. The patch may be achieved either with the PG-200 programmer, switched to manual, or by using the JX3-P edit facility.
2. The indicator column refers to the bank buttons A to D or, where appropriate, the Tone Selector indicators 1 to 16 which are set using the sens knob.
3. DCO-2 tuning (elements A-8 and A-9) is best accomplished "by ear".

			PG-200	JX3-P Edit Element	JX3-P Edit Indicator
DCO-1	Range		8'	A-1	B
	Waveform		⊓⊔	A-2	C
	Freq Mod:	LFO	OFF	A-3	A
		ENV	OFF	A-4	A
DCO-2	Range		8'	A-5	B
	Waveform		⊓⊔	A-6	C
	Cross Mod		OFF	A-7	A
	Tune		Tune to	A-8	Tune to
	Fine Tune		DCO1	A-9	DCO 1
	Freq Mod:	LFO	OFF	A-10	A
		ENV	OFF	A-11	A
Freq Mod	LFO Depth		N/A	A-12	N/A
	ENV Depth		N/A	A-13	N/A
	ENV Polarity		N/A	A-14	N/A

		PG-200	JX3-P Edit Element	JX3-P Edit Indicator
VCF	Source Mix	5	A-15	8
	HPF Cutoff freq	0	A-16	1
	VCF Cutoff freq	5	B-1	8
	LFO Mod	0	B-2	1
	Pitch follow	4	B-3	7
	Resonance	0	B-4	1
	ENV Mod	2	B-5	3
	ENV Polarity	⎍	B-6	B
VCA	Mode	ENV	B-7	B
	Level	5	B-8	8
CHORUS		ON	B-9	B
LFO	Waveform	N/A	B-10	N/A
	Delay time	N/A	B-11	N/A
	Rate	N/A	B-12	N/A
ENV	Attack	0	B-13	1
	Decay	5	B-14	8
	Sustain	2	B-15	3
	Release	6	B-16	10

YAMAHA DX9 — 'Chinese Bells' — Steve Howell, Cardiff

We managed to 'extract' (!) some DX9 patches from regular contributor Steve Howell, which should help to break the DX7 domination in Patchwork (though DX7 owners should be able to make use of these patches also).

'Chinese Bells' was originally set up to re-create 'glass' from Peter Gabriel's 'San Jacinto'. Steve comments that 'the sound utilises heavy key-rate and level scaling for drastic tonal change over the keyboard. At the upper end the sound is very delicate, whilst at the bottom range it could be described as 'clangy'. Note also that Operators 1, 2 and 3's envelopes are 'copied' with only a small adjustment.'

YAMAHA DX9 VOICE DATA LIST

VOICE NAME: 'Chinese Bells'
DATE:
VOICE NUMBER: Group, No.
PROGRAMMER: Steve Howell

Algorithm	Feedback	LFO Wave	LFO Speed	LFO Delay	PMD	AMD	Mod Sens Pitch	Mod Sens Amp
5	0	SINE	35	0	0	0	1	/

Poly/Mono	Pitch Bend Range	Portamento Mode	Portamento Time
Poly	/	/	/

OP	Frequency Coarse	Frequency Fine	Detune	Sync	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 Scaling Rate	Keyboard Scaling Level	Operator Output Level	Key Transpose
4	11	/	4	ON	60	99	99	47	99	99	99	0	4	67	85	C3
3	7	/	-7		91	53	99	45	99	0	0	0	1	0	95	
2	16	/	+7		99	53	99	45	99	0	0	0	5	82	66	
1	8	/	0		99	53	99	45	99	0	0	0	1	0	75	

Mod Wheel Range	Mod Wheel Pitch	Mod Wheel Amplitude	Mod Wheel EG Bias	Breath Control Range	Breath Control Pitch	Breath Control Amplitude	Breath Control EG Bias
70	ON	/	/	/	/	/	/

STATE OF INDEPENDENCE

Our appeal to readers who'd made their own electronic music record prompted a far greater response than we'd even dared imagine. Dan Goldstein **selects six notable submissions and finds that each disc has its own tale to tell. If you're thinking of making your own record in the near future, this is one feature you can't afford to miss.**

It goes without saying that almost everyone who reads E&MM is actively involved in writing, performing, and recording their own music. And while there are some musicians for whom nothing but major chart success will suffice, the vast majority harbour ambitions of a rather less grandiose nature, and are more interested in creating music for its own sake as opposed to fame or great financial reward.

However, what also goes without saying is that very, very few artists of any sort are content to let their work remain forever within the confines of their own environment: for most people, sharing their artistic output with as wide an audience as possible is almost as important as generating the artistic material in the first place.

In the field of modern music, the two media most widely used by little-known artists wishing to reach more people than is possible through simply playing music live are the cassette and the vinyl record. Cassettes have the advantage that they are far easier to produce in small quantities, but, on the other hand, it's because of this versatility that almost every musician and his pet dog has made a demo cassette at some stage – E&MM's own richly-populated *On Cassette* page is testimony to that. And the problem with a medium that's as popular as the cassette is that only a minority of the people who use them actually get noticed, making the whole process a somewhat fruitless exercise for all but the lucky few.

On the other hand, artists wanting to get their music onto vinyl have in the past been forced to lay themselves open to the whim of the major record companies, a prospect few people who've ever got more than one rejection letter from such labels are ever likely to relish.

Fortunately, the changes in musical and commercial values that occurred in the late seventies have altered that state of affairs. It's now possible for anybody with sufficient capital to record, cut, press, and market their own independent record, thereby taking the major step up from demo cassettes without having to go through the tedious (and often entirely futile) process of trying to secure a recording contract.

The Start

As with a demo cassette, there's no point producing a record if you don't have a worthwhile recording to put on it. So it makes sense to go about recording in as logical and professional a fashion as possible, whether you're recording at home using your own or hired equipment, or paying out X-pounds-per-hour in a professional recording studio.

Blackpool band **Sensible Shoes** opted for the latter course of action, recording their debut single 'A Game' at a 16-track facility near their home town, this despite having their own Tascam 38 eight-track recorder on which they'd previously done demos. The Shoes' guitarist, Nigel Bernstein, informs us that the band saved on studio costs by recording percussion and melody parts onto a Korg KPR77 and Roland MC202 respectively, even though they eventually overdubbed a hired Simmons kit in place of the Korg's pre-programmed rhythms. Nigel rounds off the recording side of things by commenting that 'everything went well in the studio and we were very pleased with the way the songs came out'. However, not everybody has the same good fortune when it comes to getting their music down onto a master tape good enough to form the basis of an independent record release.

Nottingham's **None So Blind** seemed at one stage to be further along the trail to success than many bands even dream of, when they won a competition in the now defunct *Musicians' Weekly*, the first prize of which was two days' recording with Dave Stewart, one half of the Eurythmics. However, NSB's good fortune turned out to be rather ill-timed, as their first meeting with the man himself coincided with the release of 'Love is a Stranger', the Eurythmics' first major hit. From that moment on, Mr Stewart became more and more elusive, though on the rare occasions when the band succeeded in making contact with him, the noises he made were generally of an encouraging nature.

Eventually, DAS put None So Blind in touch with one Adam Williams, who engineered the *Sweet Dreams* album and who was at that time (early 1983) in the process of turning the Eurythmics' old studio site into a recording facility of his own. On February 6, NSB recorded their single's A-side – 'My Favourite Eyes' – at Williams' studio, with the help of a MkI Movement Drum Computer, an Oberheim OBXa and a Casio MT30 for 'the basic keyboard sound'.

Dave Stewart was presented with None So Blind's mix of the track and described it as 'phenomenal', but he wasn't altogether happy with the sound balance the band had achieved, and consequently, NSB ended up with two separate rough mixes – theirs and Stewart's.

Almost six months passed while the band waited for Dave Stewart to bring them with news of when they'd be able to carry out a master mix of 'My Favourite Eyes', but he never came back to them and, eventually, the band re-booked the studio and remixed the tape, adding some double-tracked vocals in the process. Perhaps not surprisingly, None So Blind recorded the single's B-side ('The Virus') on a hired Fostex A8. . .


None So Blind.

Tape-to-Disc

Once you've got a master tape you're happy with (and nothing less than this will do – there's nothing worse than spending a lot of time, money, and energy on making your own record and then realising that you're not 100% pleased with what's contained on it), your music then has to be cut onto a master acetate, which is in turn processed into a 'mother' from which each individual disc is pressed. All three of these stages are significant (ie. they all play a major part in determining how close the finished records will sound to your original master tape) but it's the first that's perhaps the most critical.

Steve Hartwell of indie label Peeved Records discovered that the hard way by failing to attend the cutting process and discovering countless EQ and distortion problems on a finished disc by Southampton electropop band **The Primary**.

Perhaps because of the uncertain nature of some of the problems that can be caused by incompetent disc-cutting, many people opt for package deals, whereby one company handles cutting, processing and pressing for you.

However, as **Joanathan Moss** discovered, such packages are not always the bargains they appear to be. After scanning the ads in the music papers, he decided on an all-in-one deal from May King Records in London to handle the manufacturing of his 'Laboratory Breed' single. To start off with, ambiguous advertisement wording resulted in Jonathan having to find extra finance for the cutting stage he originally thought was part of the May King deal, but things didn't stop there.

MK charged him an additional 10% on top of their advertised pressing rates 'in case we press 10% too many': as things turned out, they did nothing of the kind, though Jonathan received not a penny back in compensation. Then, on taking delivery of the finished 'Laboratory Breed' singles (Moss had actually arranged to pick them up himself, but May King delivered them to his door and charged him for it) he found his master lacquers were conspicuous by their absence. On enquiring as to their whereabouts, someone at MK let slip that they'd actually had the record pressed in France and that his master lacquers were probably still over there – it was going to cost Jonathan an additional £40 to get them back.

Meanwhile, None So Blind – as if they hadn't had enough problems already – were also faced with pressing plant obstinacy, though in their case it was because the company in question – SRT in Cambridge – was on the verge of going bust. The company gave NSB a new deadline every time they managed to get through, but each deadline came and went with monotonous regularity, until last October when copies of 'My Favourite Eyes' (100 short in number and nearly six months late, it must be stressed) were finally delivered to the band. On this latter point, Rob Williams of None So Blind comments that if you can't get your independent record out by early to mid-autumn, you might as well wait until spring, since few people in the music media seem to have much time for indie releases when the Christmas spirit is in the air. . .

Distribution

If it's taken a long while for your musical creation to get from master tape to finished disc, there's a temptation to sit back and relax with the records in your hands, thinking all the difficult work is over.

It isn't.

Quite apart from the fact that a record that fails to reach any potential customers is unlikely to allow you to even dream of breaking even financially, it should be pretty obvious that a record that isn't distributed properly simply isn't going to get your message across to sufficient numbers of people. In other words, you might just as well have stuck with cassettes.

Yorkshire synth band **1-Syntax-1** were lucky enough to secure distribution deals with two of the UK's biggest outfits, Red Rhino and The Cartel, though for some obscure reason, Rough Trade still a leading-light in this field – refused to take their single. Unfortunately, deals of this nature are becoming harder and harder to come by as distributors become more and more reluctant to comit themselves to a record unless they feel that, musically, it has real hit potential. Still, as Jonathan Moss points out, it's worth sending your master tape round to distributors before you begin the process of committing it to vinyl, for two reasons. First, because if none of the distributors

take much of a liking to what you've produced, it gives you the opportunity to reconsider your position before you waste a lot of money on making a record nobody wants to sell; and second,

because if you can get one of the major distributors interested, (and get that interest in writing) you can print the fact that they're dealing with the record on the sleeve – it makes a useful reference point for consumers and retailers alike.

But no matter how hard a struggle it might seem to be to get British distributors to give your record a fair hearing, spare a thought for musicians like **Howard Ingram** of Belfast. The lack of record labels in Northern Ireland forced him to set up his own company, Blue Rhythm, in 1982, and after several cassette-only releases, Howard branched out into the world of vinyl, despite the problems of shipping his finished records over from England (there is only one – expensive – pressing plant in the whole of Ireland).

Once he had the records in his hands, Howard was faced with the unforeseen problem of almost total apathy on the part of local distributors. No company in Ulster (and only one – Spartan – in the Republic) showed the slightest interest in Blue Rhythm's activities, and this despite BR offering them records on a sale or return basis. . .

Assuming that you press somewhere between 500 and 1000 records (that's just about the minimum quantity most pressing plants will handle, and that goes for albums as well as singles), it makes sense to assign at least 100 of them to promotion. This may seem like a lot at a time when you've just spent almost all your worldly savings yet haven't seen a penny back on record sales, but it's a fact – brought home very forcibly by our contributors – that media coverage sells records. None So Blind, for example, sent well over 100 singles just to radio stations (21 of those being to Radio 1 alone), but as a result, they received enquiries from all ends of the country.

Send as many records as you can to music papers and magazines as well, and don't confine yourself to the UK – there's a thriving independent label scene in most countries of Western Europe (particularly Belgium, Holland, West Germany) not to mention the US, which is really where it all started.

Assuming that you also play music live from time to time, you'll probably find gigs as good a place as any to sell off any surplus records you might have after you've exhausted all the distribution and promotion possibilities. On the other hand, if your record has sold extremely well (and if it has, you might be hovering around the break-even point financially) bear in mind that many pressing plants offer credit facilities on repressing. This means that you can have another batch of records pressed (usually fairly swiftly) before you've got all – or any – of your money back on the first lot.

And Finally. . .

If, after reading this feature, you feel that making your own record sounds as if it's not too far removed from an assault course, you're right – it is. However, of all the musicians who replied to our appeal, not one said that they regretted their first venture onto vinyl, and almost all of them felt that making a record had been of considerable promotional value, and that's something that can't always be said of the humble cassette.

As a (very) rough guide, the prices below – supplied by Sensible Shoes – should give you some sort of idea as to how much making an independent single can come to: albums cost rather more, both in cutting and pressing costs and, of course, in studio time.

Dan Goldstein **E&MM**

Recording time (2 days)	£220
Pressing 1000 singles	£420
Picture sleeve (1 colour)	£130
Inner labels	£25

Contact addresses

Sensible Shoes, 232 Hornby Road, Blackpool, Lancs.
None So Blind, 1 Beaconsfield Street, Nottingham NG7 6FD.
The Primary, 37 Pointout Road, Bassett, Southampton, S01 7DL.
Jonathan Moss, 8 Starmead Drive, Wokingham, Berks RG11 2HX.
1-Syntax-1, 76 Ravensthorpe Road, Thornhill Lees, Dewsbury, West Yorkshire.
Howard Ingram, 5 Pirrie Park Gardens, Belfast BT6 0AG, Northern Ireland.

TALKING SHOP: HOLIDAY MUSIC

Continuing our trek around London's suburban perimeter, we came upon Leytonstone-based Holiday Music. The shop has been in existence for the best part of 13 years, and at its present location for nine, making it one of the oldest-established shops in East London. While still not all that mighty a stone's throw from the West End, Holiday Music have the advantage that, unlike so many of their counterparts in the centre of the metropolis, they have enough space to carry a large range of secondhand equipment, and are therefore almost always open to suggestions on the part-exchange front.

The shop is run by owner Steve Jolly, with the help of Rob Hinton (shop manager), Pete Dudley (keyboardist and chief coffee maker), Steve Piert (drums) and Dave Wilk (repairs). Together they form a fine crew, able to deal with most of the technical enquiries that come in (and believe us, they get enough of them: while we were there the phone seemed to be ringing at least every 30 or 40 seconds).

Amplification equipment takes up most of the space at the front of the shop, with names like Fender and Peavey well to the fore, not to mention HM's own Tek cabs, of which more later.

Behind the stacks of amps lies the home recording department, rather sparsely-occupied at the time of our visit but more usually bristling with gear from names such as Tascam, MXR and JBL. The booth in which the multitrack equipment is contained is acoustically-treated so that prospective purchasers can test the equipment without having to stand in the direct line of fire from marauding guitar amps.

And that was where the shop – as it used to be – came to an abrupt halt. However, some careful wall-removal has now almost doubled Holiday Music's length, which is probably just as well, as the rear half of the shop has to house a mountain of drums, percussion, effects, guitars, and finally keyboards.

Effects

The effects department is the best-equipped we've come across for a while. Holiday Music seem to stock product from just about FX manufacturer around: Boss, Pearl, MXR, Loco, Ibanez, DOD, and Ross – you name it, HM stock it.

The guitar department is similarly well-endowed, the names available including Westone, Squier, Fender, Ibanez, Aria and, just arrived as we appeared on the doorstep, Kay. Plus, of course, a bewildering array of secondhand guitars and basses, most of them at pretty fair prices.

It's worth mentioning at this point that Holiday Music insist on obtaining some form of identification from anybody who offers them equipment, whether it's on a cash or part-exchange basis. It's certainly a responsible attitude that's saved them getting their fingers burnt on a number of occasions, and has also seen more than a few thieves being marched over the road to the local police station!

The keyboard department is located at the extreme rear of the shop, with several new models from Siel, Korg and Yamaha on display, plus some ageing Moog and Roland monosynths in a secondhand 'bargain basement' section. As with all other areas of the shop, all the gear here is thoroughly set up and tested by HM's technical department before it goes on display. They even set up cheap copies as well as the 'name' guitars – a refreshing socialism.

'We've always maintained', comments Steve, 'that a shop is a showroom as well as a sales point. So the instruments we have on show have to be not only representative of their manufacturers, they have to be representative of us, as well. We take a lot of pride in what we show and what we sell, and I think that's the sort of attitude that has to pay off in the long run – the size of our regular custom proves that.'

The eastern side of London has become something of a haven for live musicians in recent years, with a whole host of good venues both large (a few) and small (a great many!). It's to the latter that Steve Jolly and company have aimed their attentions with the introduction of their own range of Tek cabs.

These are 1×10 or 2×10 cabinets made from polypropylene, a material that's virtually unbreakable due to the fact that it bends under pressure instead of cracking. We were a little sceptical of this at first, but Steve soon changed our minds by turning the front panel right over as we stood back, aghast. Both cabinets come complete with 10" drive units of Celestion manufacture, and would seem capable of forming the basis for a neat, compact, but nonetheless quite powerful PA system.

Finally, and continuing our quest for regional music hardware favourites, it would seem that the most popular product at Leytonstone at the moment is Carlsbro PA equipment (especially the power amps) and Westone guitars, while the usual DX7 supply and demand story is repeated there also. . .

Tim Oakes **E&MM**

Holiday Music

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TASCAM	LIST £	IIFC £
M244 Portastudio	—	675
M234 Portastudio	—	549
34	—	995
38	—	1,899
2A Mixer	—	233
M35 Mixer	—	1,389
YAMAHA		
MT44	399	368
MM30	199	184
JBL		
8216 – Pair	—	179
4401 – Pair	—	378
2312 – Pair	—	895

KORG	LIST £	IIFC £
Poly 800	635	569
Poly 61	985	775
Poly Six	1,260	949
Trident II	2,999	1,739
Super Section	449	325
KPR 77 Rhythm Unit	449	325
SIEL		
Mono	249	229
Cruise	649	598
Opera 6 Poly	1,298	1,198
Piano PX	749	690
Expander	699	644
YAMAHA		
DX9	899	829

SHURE	OUR LIST £	PRICE £
SM58LC	245.98	114.00
SM57LC	190.72	89.00
PE86LC	187.16	88.00
PE66LC	163.09	76.00
545DLC	182.70	85.00
AKG		
D12E	159.85	140.00
D190	63.25	55.00
D80	33.35	29.00
D330EBT	143.75	126.00
AUDIO TECHNIC		
PRO1	26.00	21.00
PRO2	21.00	17.00
PRO3	39.00	31.00
PRO4H	54.00	42.00
PRO4L	54.00	42.00
PRO5	75.00	59.00
ATM41	87.00	69.00
ATM11	62.00	49.00

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Pair 2 × 10	—	165.00
1 × 10 Monitor	—	65.00
Pair Stands	—	75.00

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CARLSBORO	LIST £	IIFC £
Marlin 6-150	295.00	253.00
Marlin 6-300	392.00	337.00
Cobra 90PA	196.00	168.00
2 × 12 + HRN + Bullit	360.00	309.00
Cobra 90 Bass Combo	237.00	204.00
Cobra 90 Lead Combo	237.00	204.00
Cobra 90 Keyboard Combo	289.00	248.00
ADI Echo	151.51	130.00
FENDER		
Sidekick 20	166.00	152.00
Sidekick 30	194.00	179.00
Sidekick 50 Bass	271.00	250.00
Super Champ	297.00	246.00
Deluxe Reverb II	516.00	428.00
Studio Lead 1 12	415.00	345.00
Showman 2 12	830.00	689.00
Twin Reverbs II	845.00	702.00
Montreaux	553.27	434.00
Harvard	229.00	179.00
Yale	322.36	253.00
Stage Lead 1 × 12	460.90	361.00
Princeton II	396.73	329.00
SESSIONETTE		
75 112	265.00	244.00
75 210	291.00	268.00

MXR	LIST £	IIFC £
Mains Flanger	176.00	59.00
Micro Flanger	94.00	35.00
Mains Limiter	117.00	42.00
Phase 100	132.00	34.00
Phase 90	99.00	27.00
Dynacomp	71.00	34.00

BOSS

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IBANEZ	LIST £	IIFC £
SD9 Sonic distortion	49.00	37.00
AD9 Echo	133.00	99.00
CS9 Chorus	85.00	64.00
TS9 Tubescreamer	49.00	37.00
FL9 Flanger	69.00	52.00
FRONTLINE		
Distortion	—	22.00
Super Distortion	—	27.00
Super A/B Box	—	29.00
Delay	—	69.00
Stereo Chorus	—	49.00
Stereo Flanger	—	57.00

FENDER	LIST £	IIFC £
Standard Strat inc trem, inc case	549.00	455.00
Elite Strat inc trem, inc case	767.00	637.00
Standard Precision Bass inc case	512.00	425.00
Squire '62 Strat	283.00	248.00
Squire '57 Strat	274.00	240.00
Squire '57 Precision	262.00	229.00
Squire '57 Telecaster	243.00	213.00
Squire Popular Strat	200.00	185.00
WESTONE		
Thunder 1	149.00	130.00
Thunder 1A	189.00	165.00
Thunder 1 Bass	159.00	139.00
Thunder 1A Bass	179.00	157.00
Thunder III Bass	349.00	306.00
Rainbow 1 Semi Acoustic	259.00	227.00

PEARL	LIST £	IIFC £
Export Deep Shell	568.00	428.00
705 Maxwin	379.00	276.00
TRACK		
205 Kit, System Two	429.00	395.00
405 Kit, System Four	685.00	632.00

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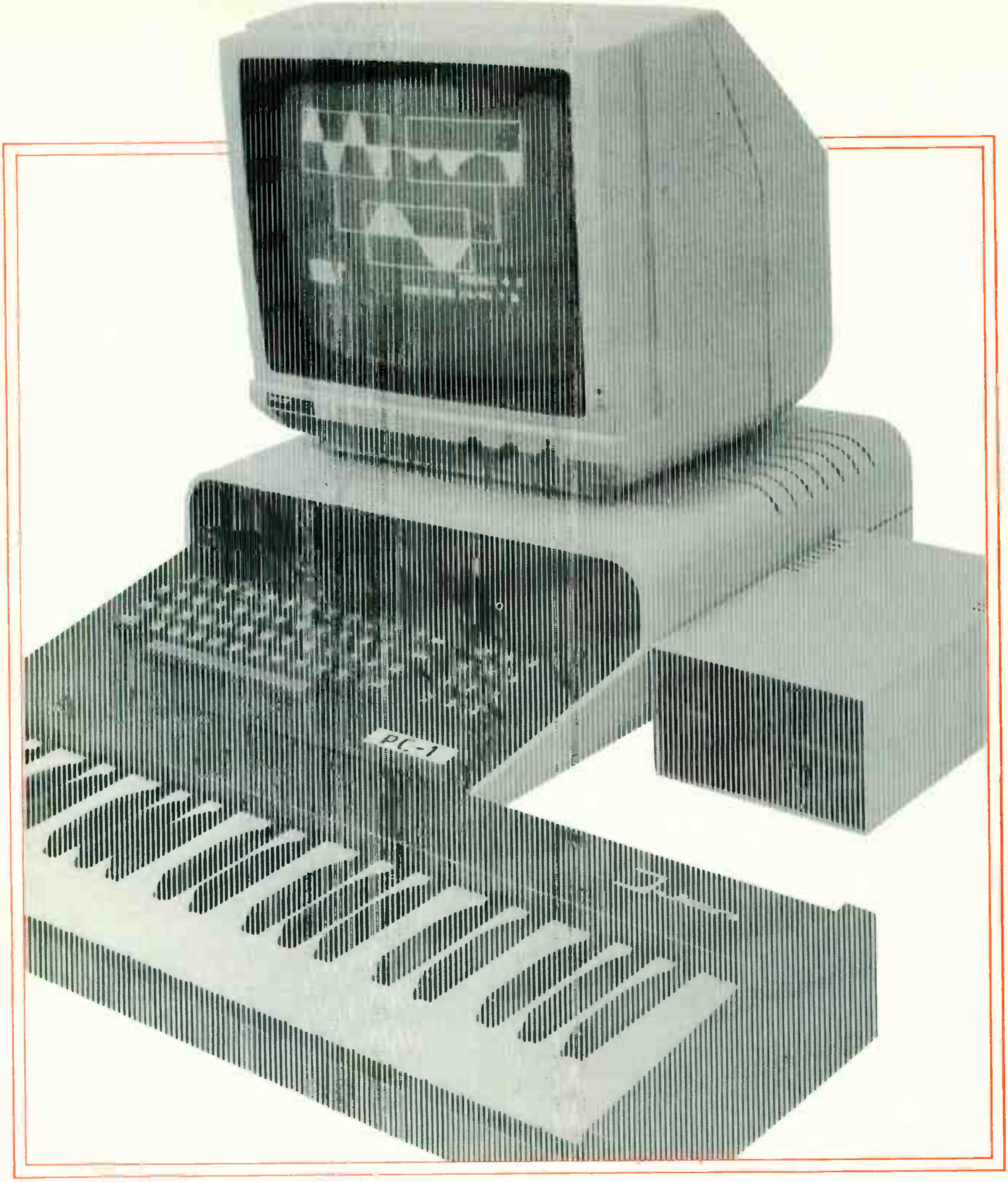
PC-1

COMPUTER MUSICIAN

All right, devoting this month's Editorial to the subject of MIDI when there's already the second part of a major supplement on it contained elsewhere in this issue *does* look a little bit like technological overkill, I'll admit, but there are one or two points I'd like to think are worth making within the context of *Computer Musician*.

What worries me is far removed from what happens to your music when too many events are vying for the attention of one MIDI pipeline. If you choose to send 16 notes at once you're asking for trouble, and that's true of a lot more than just MIDI. No, my concern is with the fact that MIDI equipment is being produced with pre-programmed limitations. Note that term 'pre-programmed'. This is all about software and, therefore, of direct concern to the computer musician.

At the present time, there are around a dozen polyphonic keyboards available with the MIDI as standard. However, only one of these (the SixTrak) is capable of playing all six channels of monophonic MIDI data with different voice programs. Now, I admit that there are a few others (the Prophet T8, for instance) which allow split points to be set up and, therefore, the potential of using two different programs on incoming data, but the fact remains that the vast majority of MIDI keyboards can't see beyond their feet when it comes to escaping from the limitations of mono-timbral polyphony.

In fact, there's no earthly reason why any polyphonic synth shouldn't be capable of software modification so that it'll play each voice with a different instrument when instructed to by MIDI data. Similarly, I find it maddening that just because most keyboards aren't touch-sensitive, their designers prevent incoming MIDI data, complete with velocity bytes, from having the requisite effect on their machines. Again, it's the same old story about software limitations. If MIDI is really to come of age, then manufacturers must wake up to the fact that its users aren't fools. I mean, who in their right mind would be prepared to daisy-chain four £1000 polyphonic synths together just so that they can play with four different timbres at once?

Well, it seems that people will do that, and no doubt some manufacturers are patting themselves on the head for thinking of ways around allowing the MIDI to encroach too much on their 'give them enough to keep them happy, but don't give them everything' design philosophy. Fair enough, they've got to make an honest living just like everyone else, but spare a thought for those musicians and programmers who are trying to get the most out of the standard that we've been landed with. Until the designers see sense and expand their conception of what a polyphonic synthesiser should be doing with MIDI, or until someone comes out with a modular voice unit for MIDI, we're stuck with a pretty frustrating situation. Polyphonic sequencing with just one timbre isn't my idea of what MIDI should be about.

Still, there is a solution: the add-on that sits directly within the memory map of the average home computer. None of this nonsense about sending serial data down the line – it's the direct register read/write approach that makes the real sense! And that, of course, is where something like the Programmable Digital Sound Generator project steps in – a general-purpose sound synthesis unit that can be used however you want, whenever you want, right up to the limits of whatever micro you're using. No problems about MIDI computer interfaces, no time delays between converting data to and from the bit stream, and no problems about protocol misinterpretations.

Sanity, at last!

David Ellis

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DIGITAL DELAY LINE

Digital delay circuitry is an absolute necessity for high quality studio work, but usually comes with a four-figure price tag.

Powertran can now offer you digital quality for the price of a high analog unit. The unit gives delay times from 1.6mSecs to 1.6 secs with many powerful effects including phasing, flanging, A.D.T., chorus, echo and vibrato. The basic kit is extended in 400mSec steps up to 1.6 seconds simply by adding more parts to the PCB.

Complete kit (400mS delay) **£179**

Parts for extra 400mS delay (up to 3) **£19.50**

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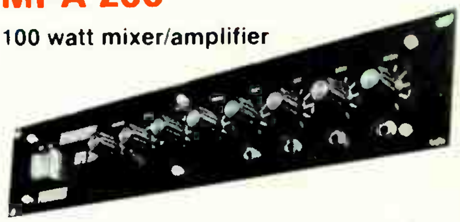
100 watt mixer/amplifier



Here's a rugged, professionally finished mixer amp designed for adaptability, stability and easy assembly. Using new super-strength power transistors and a minimum of wiring, it offers a wide range of inputs (extra components are supplied for additional inputs), 3 tone controls, each with 15dB boost and 15dB cut, and a master volume control.

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This professional quality 3-octave instrument is transposable 2 octaves up or down, giving an effective 7-octave range.

There is portemento pitch bending, VCO with shape and pitch modulation, VCF with high and low pass outputs and separate dynamic sweep control, noise generator and an ADSR envelope shaper. Other features include special circuitry with precision components to ensure tuning stability.

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ETI 5-channel lighting effects system

Many lighting control units are now available. Some perform switching and others modulation of light output according to musical input. The Chromatheque combines both functions. It controls 5 banks of lamps up to 500W each in either analog or digital mode. And the 5 channels give more colours and more exciting linear and random sequencing than is possible with 3 or 4-channel systems. Versatile light level controls enable the lights to be partially on to suit the mood of the occasion. Wiring is minimal and construction straightforward.

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The SP2-200 uses two of the power amplifier sections of the MPA 200 (above), each with its own power supply. A custom designed toroidal transformer enables both channels to simultaneously deliver over 100W rms into 8 ohms. Each channel has its own volume control, and a sensitivity of 0.775mV (OdBm) makes this amplifer suitable for virtually all pre-amps or mixers.

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RUMBLINGS

Music Mate

The title conjures up visions of yet another monophpnic bleep program on the Spectrum, but this is rather unfortunate, since this composing software from Microcomputer Products International is actually a rather clever 'music processor' running on micros a lot larger and more expensive than Sinclair's money-spinner.

Anyway, the idea behind the software is to produce something that's as near as damnit an alternative to the pen-and-paper approach that's blotted the copybook of composers for centuries. Notes are entered using a fairly straightforward MCL and then displayed on the screen. Up to 14 parts can be accommodated at once, though larger score formats can be achieved by layering sets of parts once they've been printed out. Music can be printed out as individual parts or as a full score on any Epson printer with graphics capability. As the example shows, the condensed text mode used produces a very neat result, even if the contrary alignment of part names and staves is somewhat bizarre.

An intriguing feature that's built into the software is the ability to use probabilistic (try saying that when you've had one too many. . .) techniques to generate either single parts or entire scores. The program constructs a number of probability matrices from whatever values the user enters for certain parameters, and the program then churns out notes accordingly in the shape of glorious hard copy. Although no transition rules are involved (meaning that every note is chosen without regard to what came before), it's encouraging to see this facility in a commercial package, and it's ideal for adding that soupcon of aleotoric excitement here and there, if not going the whole hog with Cage-like notational free-for-alls. (Readers are invited to submit their interpretation of the vocabulary in this last sentence to the Music Editor. Free dictionary to the sender of the most imaginative version.)

Of course, the problem with Music Mate is that you can't actually hear anything until you've got some musicians together to play the Epson-generated score. If only the Music Mate note files could be piped via MIDI to a waiting synth or two. (Nudge, nudge. . .). Another slightly tricky area is that Music Mate only runs on CP/M or MS-DOS operating systems. This means that the software won't run on a BBC Micro until you've got the Z80 80-column cards. Still, at £150, Music Mate seems like a good investment if you're in the business of serious compositional activities and want a less messy alternative to Rotring pens and dyeline paper(!) For more information, contact Microcomputer Products International Ltd., Central House, Cambridge Road, Barking, Essex IG11 8NT Tel: 01-591 6511.

Mainframing Music

The interview with Mainframe in E&MM February provoked lots of interest on account of the mention of an Apple-based sampling system that Murray Monro and John Molloy had had built for them. Well, since then, things have been moving apace at the Mainframe HQ, and the system (called the 'Enterprize') has been appearing on the box in all its polyphonic, keyboard-controlled glory. The original version of the system comprised a four-voice card, using the Apple's memory for sound storage, that could be played either by jabbing the QWERTY keyboard in real time (hairy), or from a simple sequencer (hopeful). That's all old hat now, because a keyboard interface has been added so that your digits can get at the digits (if you see what I mean), and the sequencer features cover the full range of possibilities from real to non-real time.

At present, production is being geared up to produce the system at the very reasonable cost of £250 for the four-voice Apple board and software. To add the luxury of keyboard control, Mainframe are providing a board and software for £100 to interface with any scanned keyboard of the Casio variety. They'll also be bringing out their own keyboards sometime in the near future. The system will run on a 48K Apple II or IIe, but, seeing that more memory means more sample, adding on a 16K RAM card to give 64K total is definitely advised. Because the four voices use the Apple's memory rather than their own dedicated memory (the Fairlight approach), each has equal access to all of the four samples that can be stored at any given time. A further useful point is that both triggers in and out are provided.

For more info on the Enterprize, contact mc2 Music at 24 Missden Drive, Hemel Hempstead, Herts HP3 8QK. Tel: 0442-3496.

Synergy

There's nothing quite as fickle as the music business, and Digital Keyboards Inc. experienced a pretty heavy dose of that fickleness when it came to their Synergy keyboard. The problem with this machine was that it promised a lot but missed the boat in certain areas, but fortunately, its makers don't take anything lying down, and they've now come up with a package of updates which makes rather interesting reading.

The first upgrade is wholly software-based (a question of exchanging a few ROMs in the machine for 'just a few dollars') and improves the keyboard response speed by 50%, increases the sequencer's capacity to 2160 events, improves the S/N ratio, and adds built-in diagnostics. Next, there's a package of additional hardware and software for opening up the Synergy to communications with a micro via an RS232 serial link.

Wot, no MIDI? Yes, quite.

Anyhow, this link should give the user the much-needed ability to store voice alterations and sequencer contents on disk and then recall them as and when they're needed. In addition, this package will also add an MCL option, enabling the creation and editing of compositions using what DKI call 'intermediate notation'. All very interesting.

Finally, the real biggie: an interface network which turns the Synergy into a General Development System, much beloved by Klaus Schulze and Wendy Carlos, to name but two. This will allow the user to create his own voices (at last!), burn-in ROM cartridges, and interact with all manner of displays. Plus, coming shortly. . . a Synergy slave processor which will allow the control of 512 oscillators. Phewee!

For more on the visual/auditory input front, there's a brochure and 'DKI News' ($3), owner's manual ($15), and voice cartridge cassettes ($10) as tasters of the Synergy's delights. These are available from Digital Keyboards Inc., 105 Fifth Avenue, Garden City Park, New York, NY 11040, USA.

David Ellis

CM

The Gentle Art of Transcription

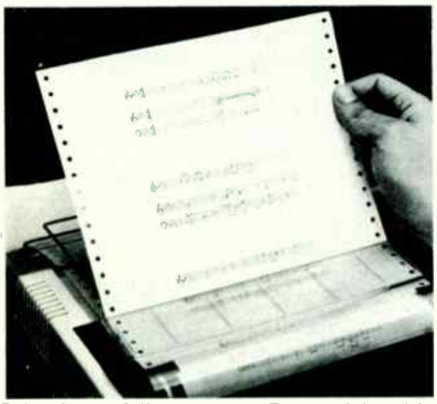
Part 2: Printing the Part

David Ellis **concludes his survey of machines that turn a musician's performance into traditional musical notation.**

One consequence of postponing last month's episode of this transcriptional saga is that it gave me a chance to dig a little deeper than I might otherwise have been able to do, and as a result, I was able to discover a good deal more about Passport Designs' Polywriter transcribing program.

Passport Designs Polywriter

The first point is that unlike the Notewriter software, Polywriter is fully polyphonic. Secondly, whilst Passport have retained the Apple II or IIe as the transcribing tool, keyboard input isn't restricted solely to their



Polywriter printing out on Epson dot-matrix printer.

Soundchaser keyboards: the good news is that any MIDI keyboard can be used, provided that there's also the necessary interface card in the micro. The not so good news is the cost: $495 for Polywriter and $195 for the Apple MIDI card. Still, if you've already got MIDI software for the Apple and want to add on the sort of transcribing facilities that Polywriter provides, the price might not seem such a heavy cross to bear.

As with Notewriter, the program works only with real-time input (with timing resolution down to triplet 16ths) played in time with a variable click track. Editing facilities are pretty comprehensive (they'd need to be with real-time polyphonic input) and include the option of adding text and lyrics above or below the stave.

Where Polywriter really comes into its own however is in the printout department. Not only are there eight ways of having the music formatted – from single treble or bass clef lines right up to 40-part orchestral scores – but the program also tracks and adjusts accidentals, adds proper beaming and flagging, auto-justifies rests and spacing, and creation of orchestral socres is being a mite optimistic given the keyboard technique of most composers I know! It's good to see that the software doesn't require anything more grand than an Epson dot-matrix printer for the

Polywriter's orchestral score format.

prints out parts with automatic transpositions.

Polyphonic transcription is an order of magnitude more complicated to put into effect than its monophonic version, so life is hardly all sweetness and roses when it comes to fitting in your own notion of an accurate polyphonic keyboard performance with what the computer perceives as such. As with Notewriter, a lot of editing is required to get the printouts looking as good as the examples shown, a fact that begs the obvious question of whether it wouldn't be more efficient to make more use of the QWERTY keyboard in entering the notes in the first place, ie. use the music keyboard for pitches and the QWERTY keyboard for everything else...

All in all, though, this is a very clever bit of software, even if the insistance on real-time printing-out operation, because there's a lot of snobbery attached to the ultra-high quality of daisy wheels, plotters, and the like, and the quality of the Polywriter printout is a convincing demonstration of what can be achieved with a sub-£300 printer.

Con Brio Scorewriter

Aside from the ADS200R's 16-track polyphonic digital memory that stores 80,000 notes and allows automated mix-down and editing, the 16-bit stereo or quadraphonic outputs with a 96dB S/N ratio, and the Music Programmer, which allows the musician to edit a keyboard performance by interacting with a conventional music score displayed on a built-in monitor screen, the Con Brio system also has a Scorewriter option, which enables the printing of a conventional music notation from either a keyboard performance or the Music Programmer.

So why, oh why, isn't the ADS200R more widely known?

Well, to start with, there's the price: $20,500 for a single keyboard, 32-voice model with stereo outputs, $9300 for an extra 32 voices and the quad outputs, and $4000 for the Scorewriter option, including the printer as well as the software. In addition, of course, there's the fact that Con Brio, like a few other American manufacturers I could mention, seem to produce their extraordinary equipment more for their own enjoyment than for greater glory in the commercial synth world.

Con Brio ADS200R digital synthesiser.

On the subject of Scorewriter, which does look very interesting, the closest I've got to it is a murky photo showing music emerging two staves at a time from a printer. It's a great shame when such interesting systems hide their light under a bushel. . .

Fairlight Stavewriter

Stavewriter is a new addition to the growing software library of the Fairlight CMI, aimed at providing a high quality printout of musical notation from either MCL or the Real-time Composer (Page R). At the moment, the software prints only a part at a time from MCL (though this is expected to eventually extend to four parts), but it will print the whole eight parts of Page R, using what Fairlight call 'a simplified notation', while four complete patterns can be fitted on a 11"×17" page.

Printing options include adjustable stave width, length, spacing, number-per-page, proportional spacing, transposition, and automatic computing of irregular rhythm groups. Unfortunately, the high quality of the example shown carries a weighty price tag because of the tailoring of the program to a specific X–Y plotter – the Hewlett-Packard 7475A (a cool $1895). And then there's the cost of the software – unknown as yet. Personally, I don't quite see the point of using a six-colour plotter for music printing, but no doubt Fairlight have multi-coloured plans in store for their customers. . .

Fairlight's Stavewriter indulging in some *chinoiserie*.

The pitfalls of transcribing Bach with Synclavier's Script.

Synclavier Music Printing

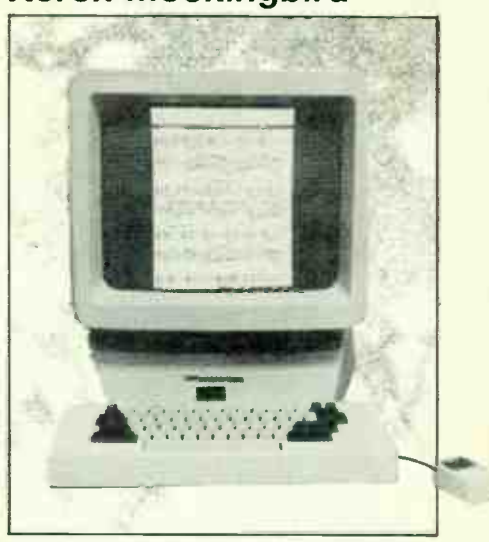
Synclavier's Terminal Support Option with tuneful display. . .

Whether or not it's 'every musicians dream . . . to have his or her music printed out in real notation after it has been recorded' is a moot point. Personally, I'm just after the sounds. Anyhow, given that you've added the Terminal Support Option (around $10,000) to the basic (?) Synclavier system, an extra $3000 or therabouts will purchase the means of that quoted writer's nirvana, the Music Printing Option. Life's all about options over in the Land of NED, it would seem, but if you asked me, I'd say Terminal Support Option sounds gruesomely reminiscent of institutionalised medical care for AIDS patients or a scene from the film *Coma*.

New England Digital's printing program takes Script (the Synclavier's version of MCL) files for input and produces hard copy on a Prism dot-matrix printer, included in the £3000 for the Music Printing Option. If you're after real-time transcription in its true sense, you're in for a slight let-down, as recorded pieces have to be reverse compiled into the Script format before they can be displayed, edited, or printed. Doing this to the start of a performance of Bach's Third Brandenberg Concerto demonstrates the major problem with all transcriptional programs – the annoying tendency of all computers to go one better than their masters when it comes to accurate timing. What the example shows is how easy it is for Bach's sublime counterpoint of quavers and semiquavers to be transmogrified into a syncopated nightmare, and all because of a slight timing discrepancy on the F sharp in Part 1 making the computer add on a semiquaver more than there should have been. That's where the editing process steps into the picture with a vengeance, turning a base performance into liquid gold.

What's more, parts generated from the Music Printing Option can include all manner of n-tuplets and odd tempo divisions, dynamic markings, articulation markings, instrument names, text, and even page and bar numbers. In short, the printed output from the Synclavier is just about as good as anything that can be generated from a conventional printing press.

Xerox Mockingbird



Mockingbird's display, keyboard, and mouse.

Recipe for Mockingbird *à la* Xerox: take one Dorado computer with a 60ns instruction cycle, eight megabytes of RAM, an 80Mb hard disk, an A4-size, high-resolution, bit-mapped display, a Yamaha CP30 keyboard with computer interface, a high-resolution, computer-driven, raster-scan laser printer, and simmer gently with a mouse and a couple of humans for a year or so at Xerox's Palo Alto Research Centres.

Mockingbird is 'an interactive music notation editor', or , in more traditional parlance, an honest-to-goodness composer's scribe. The purpose of Mockingbird isn't to invent new music, or to suggest variations to the composer, but simply to aid him in recording his own ideas by speeding up the notational process. Fair aims, indeed, so how do you go about using it?

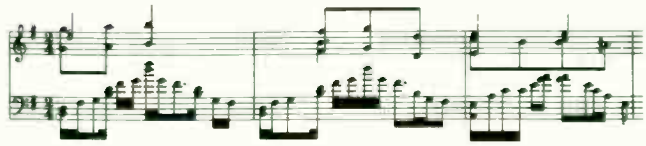
Well, unlike the Polywriter or Synclavier programs, Mockingbird doesn't attempt to cover the area of automatic transcription. Instead, it takes in a performance as a series of unadorned events as a 'piano-roll input' from the CP30 keyboard. Editing can then be applied to turn the raw notes into a form that's typical of a completed piano score. In fact, this scribe is a lot more interactive than the foregoing might suggest, because not only is the display updated according to what editing actions are performed with the mouse, but the CP30 will also then play back the new note, bar, or entire score. So, if the user puts a trill marking on a note, Mockingbird will trill when playing it.

Unfortunately, Mockingbird is a research prototype, and there's not much chance that it'll ever see the light of day outside the protective wings of the Xerox Corporation. The problem, of course, is that the technology it uses is prohibitively expensive, but if anyone's interested in knowing the full story, the January 1984 issue of *Byte* magazine carried a very complete account of the project by its designers, John Maxwell and Severo Ornstein.

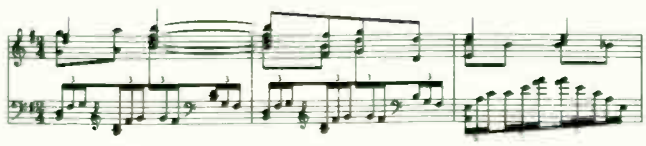
David Ellis **CM**

Mockingbird Example 1: piano-roll input directly from CP30 keyboard.

Mockingbird Example 2: with key and time signatures, voicing and measure lines inserted.



Mockingbird Example 3: results of timing and beaming modifications.



Mockingbird Example 4: after final touch-up from the user.

The Programmable Digital Sound Generator

Part 2: Applying the PDSG

Alan Boothman of Clef Products outlines some possible uses for this new add-on music system for home computers, and explains why the PDSG design should remain well ahead of the commercial synth field for some years to come. . .

The first point to note is that the PDSG is very dumb, and once programmed to make a set of sounds, it will continue to do so as long as the CEGB's energy supplies last out. However, an intelligent host computer can, in a very short space of time, write numbers to the PDSG to change its course into more productive territory. The 2ms interrupt period within the PDSG is the shortest time interval between any parameter changes for a logical oscillator, and within the BBC Model B, which uses a 6502A Microprocessor operating at 2MHz, some 1000 computer instructions could be executed in that time. In general terms, the following activities can be carried out by the host computer.

Define Frequency

The PDSG requires two eight-bit numbers for each logical oscillator, as described last month. Probably the most efficient way to provide the numbers is to store them in tabular form to be accessed as required, but an alternative is to calculate them and then use a combination of the two techniques for creating glides or vibrato. Chorus can be created by the use of multiple tables based on small differences in frequency between each table corresponding to the same nominal note, even to the extreme where each oscillator has its own table. In practice, three tables have been found to give rich ensemble effects, while a table containing slightly sharp frequencies adds an effective attacking sound to many percussive instruments.

Define Envelope Shape

The area of dynamics is likely to be the one which takes up the highest percentage of available computer time, since updating, particularly for percussive sounds, has to occur frequently. Tables are of minimal help when touch response is included in the system, so mathematical operations following both logarithmic and linear procedures are essential. ADSR requirements can vary between different types of instruments and methods of playing, and this is therefore an area which can benefit from flexible programming by the user. Within certain limits, envelope control is arguably more important than wave shape, and the software developed for the system for far has adopted this approach.

Define Spatial Position

Apart from the ability to pan sounds for special effects, the means to direct sounds through separate loudspeakers, combined with frequency separation as outlined last month, results in a chorus effect that avoids the deep electronic phasing produced by direct electronic mixing, leaving the ear to interpret the subtler presentation typical of conventional musical instruments. The definition of spatial position for a particular oscillator is usually a fixed parameter within an Instrument Specification (typically 80-100 numbers stored in the host), but can be enhanced by calculation.

Define Tonal Quality

The PDSG allows synchronous transfer of waveforms from the host. Due to

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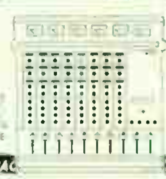

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the large amount of data involved this is likely to take at least 1.2ms, but in some applications it could be of such importance that the rest of the workload on the computer could be minimised. The alternative approach is to utilise envelope control to define which of the large number of waveforms always available on the board is to dominate the overall sound from moment to moment, resulting in dynamic tone changes.

Read a Source of Musical Data

The most obvious source is a musical keyboard which can be scanned under control of the host computer to determine the position of every key at a given time. As a simple on-off activity, this takes little time to process in the computer and could occur, say, every 10-20ms. However, for a velocity sensitive system (where the practical range of time taken for a key to travel from the up to down position varies typically between 2ms and 32ms) the required touch resolution can only be achieved if the scanning interval is 2ms maximum, giving 16 points which can be weighted to give a non-linear energy characteristic in order to simulate a conventional keyboard action. The software required for this activity can become very time consuming, so efficient programming is essential and more details of this will be given when the keyboard unit is described.

It is desirable to have a number of touch tables in the host, with differing characteristics to be used by individual oscillators within an Instrument Specification, and the tables offer a level of output corresponding to the number of sweeps of the keyboard; these are counted between the detection of a key commencing to move and its achieving the fully depressed position. Utilising a combination of multiple touch curves with oscillators of different harmonic and envelope content, a wide range of instant dynamic tone can be applied to the system in its response to keyboard activity.

Key movement can be translated *via* software into a series of events which can be temporarily stored in memory and then transferred to other storage media, for later use as raw digital music data capable of playback with the same or different instrumentation. This real time sequencing activity can be either overdubbed or multitracked, depending on the software adopted.

Music Data – Non Real Time

The users likely to benefit from non real time activity range from qualified composers to people who have a depth of musical feel but lack any instrumental technique with which to express it. Since hardware to translate musical ideas into realistic sound has not previously been generally available, it seems certain that not all possible methods of entering musical data have yet been found. A number of programs are available which use the capabilities of various home computers, with or without simple peripherals, based on the input of standard music notation or simulation of music keys on the computer keyboard (see *The Gentle Art of Transcription* elsewhere this issue), but it is expected that since the PDSG without keyboard leaves a considerable amount of spare computing power in the host micro, a number of alternative music programming techniques will evolve.

Other Host Activities

The list of possibilities extends to the processing required for auto-chording, harmonising, keyboard splitting, adaptation to teaching aids, lighting control, and so on, but it's hardly likely that all the required software will become available overnight. The important point is that a sophisticated music generation peripheral, based on the flexibility of home computers, has considerably wider capabilities than the units produced for the traditional musical instrument market. The whole character and mode of operation of the system can be quickly altered by feeding in new, relatively low-cost programs as they arise form a wide range of sources, and due to this flexibility, it is expected that such a unit will outlive the lifetime of many of the dedicated digital synthesisers now appearing on the market.

An important motivation in publishing this article in E&MM is to encourage readers to apply their thoughts to the potential of the system, and those with programming skills can put their personal ideas into practice and offer them to others sharing a similar interest.

Alan Boothman **CM**

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THE SYNDROM

David Ellis **continues our percussion-sampling project. This month, full constructional details, pricing and availability, and details of a cassette that demonstrates the Syndrom's sonic capabilities.**

Part 2

Getting it together

The first thing to do this month is to correct a few errors that crept into Part 1. First, in the paragraph at the bottom of page 91 that relates to using the switch to play just half of the contents of a 2732, the line should go: 'only as far as the first 2K. . . .' Silly us. Next, on the circuit diagram front, the only real blunder is the value of the +/− supply going to IC7, but this is probably self-evident, ie. for '−7V' and '+7V', it should read '−9V' and '+9V'. Not our fault, m'lord. Honest.

The other point of errata is that a couple of blobs got lost in the circuit diagram wash, and these should be at the junction of C3, C4, −9V, and pin 3 of IC7, at the junction of C5, +7V, and pin 13, and at the junction of the common connection of IC9 with ground. Obvious, but worth pointing out all the same. On the subject of components, life is easier pitching-wise if a linear rather than log 25K pot (R2) is used. The ideal is the anti-log variety, but that's about as common as life on Mars. The same's almost as true for the 330uF (C6) electrolytic capacitor used for smoothing the 5V output from C9, but a 470uF (either tantalum or normal type) won't mind being substituted instead. Lastly, we've replaced the original 100m 78L05 regulator (IC9) with a 1A 7805, for the simple reason that it's better to be safe than sorry.

Construction

The PCB is quite straightforward to put together, but it helps to have a narrow-tipped soldering iron wherever closely-packed tracks are concerned. The best plan of action is to start by inserting the resistors, then the capacitors, and next, D1 (the positive end is indicated by the black circle at the end of the body), the sockets for IC1-8, and IC9. SW1 can be fitted quite happily on the board, as shown in the photo, ready to do the master of ceremonies bit and switch between the acts of the two sorts of EPROMs. If you've plans to use Syndroms *en masse* in something like a rack-mount unit, then both the trigger and output jack sockets should be mounted on the baord together with R2, so that all three can merrily poke out of a front panel and secure the PCB at the same time.

Having connected up a couple of 9V batteries *via* some appropriate connectors, and made sure that the 'out' side of IC9 is indeed delivering +5V, it's now time to disconnect the batteries and insert the ICs. Because the TTL and ROM are fairly profligate consumers of electrons, the battery on the positive side of the business has a habit of doing a disappearing trick that'd put Mr Marvel to shame. For the record, the +9V rail takes about 125ma, and the −9V around 15ma. So, for starters, see how you get on with a big butch PP9 on the positive side and a PP3 on the negative. And remember to disconnect them when not using the thing! However, if you're going to use the Syndrom seriously and/or intensively, a power supply is an absolute must, and we'll be putting forward some sensible recommendations (including a design of our own, the RackPack) in next month's E&MM.

To actually make the Syndrom speak to you, you'll need some sort of trigger to set the sound regurgitation into motion. We'll be covering the possibility of making drum pad transducers next month, but for initial experiments, there are two ways of going about making Herr Schmitt do his thing.

(1) Using the +5V trigger from any pre-existing drum machine or sequencer – the simple option.

(2) Wiring in any push-to-make switch between the trigger input and the +5V power rail – the more complicated option.

In the latter case, don't be surprised if anything other than a quick jab at the button produces a sound more reminiscent of a roll than a single sound. Remember that as long as the trigger input remains high (the situation when your finger's on the button), the counters will cycle till kingdom come, and you're therefore repeatedly yanking the sound out of the EPROM – hence the roll effect.

The Sounds

Now, sampling a sound is easier said than done. To be perfectly frank, there's a pretty complex equation at work that's doing its best to make a pig's ear of a mess if you don't use the right sound source with the right sampling rate. The thing you have to keep utmost in mind is that there's no earthly point in sampling a sound with masses of high harmonics into just 2 or 4K of sample space. The technique we developed in putting together the initial set of samples was to perform a constant juggling act between sampling rate, input level, and input low-pass filtering until we felt that the situation had been optimised. The 21 sounds break down into 2716 (2K) and 2732 (4K) types as follows:

2716: Kick drum, Snare, Hi-hat (closed), High tom, Low tom, High Bongo, Low bongo, Cabasa, Guiro, Handclap (multiple), Explosive finger click, Dog bark, David's aaah, Door slam, David's burp.

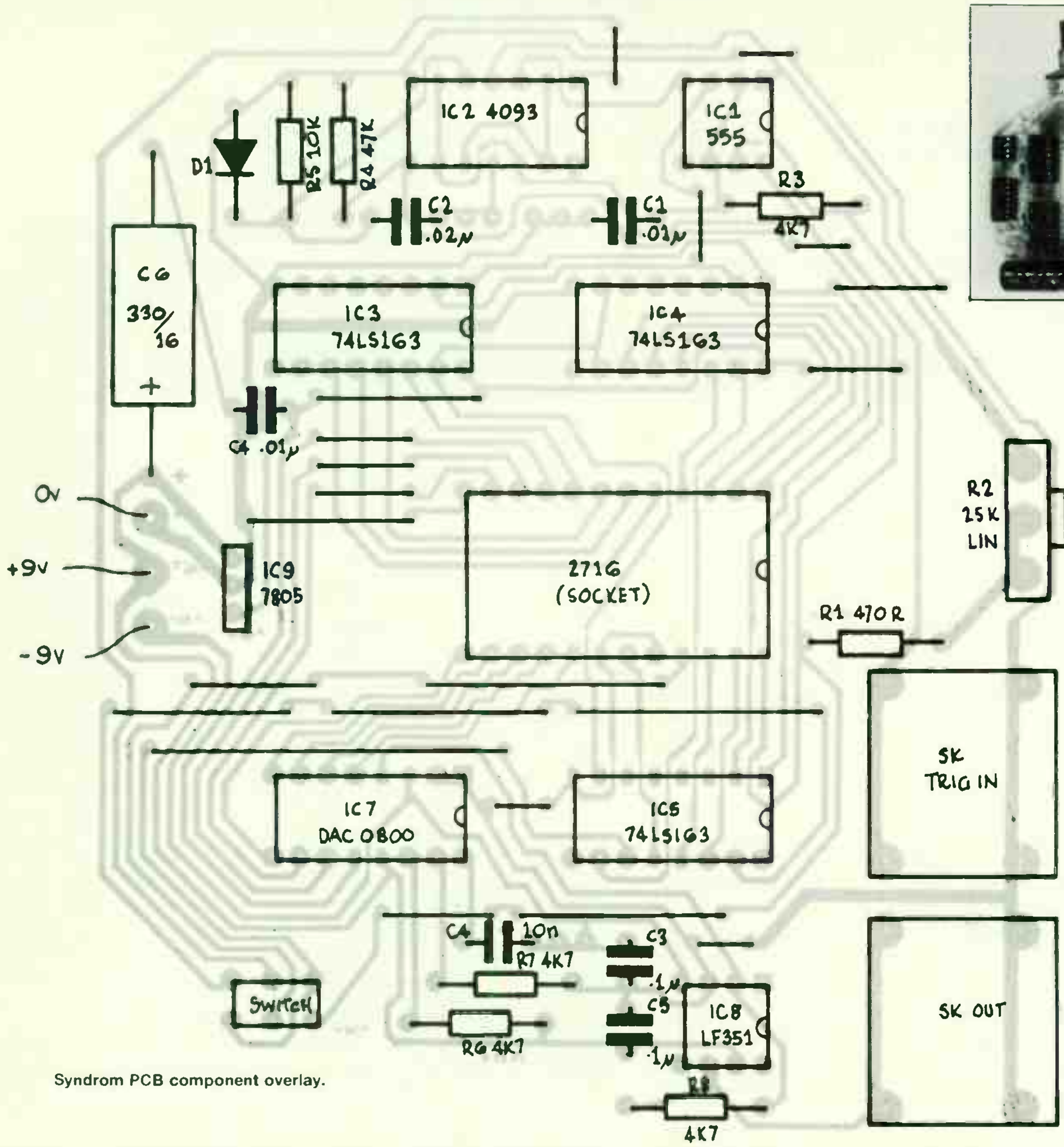
2732: Hi-hat (open), Crash cymbal, Orchestral thump, Brassy, Squawk 1, Squawk 2.

Now, a few of these sounds proved problematic because of the difficulty in obtaining a really clean sound source. We considered C-ducing the dog, but thought better of that in view of the RSPCA's stance on the abuse of animals. That left boring old microphone techniques, but old Fido proved implacable when it came to performing on cue: so what we're left with is a rather noisy bark taken from one of Auntie's sound effects discs. It's hardly like howling at the moon, but we're getting there, and it'll be updated as and when we get our hands on a Great Dane that doesn't suffer from stage-fright. In the meantime, take a listen to the 'Explosive finger click' and 'David's burp' for a more objective view of what a sample of life and the Syndrom can do together.

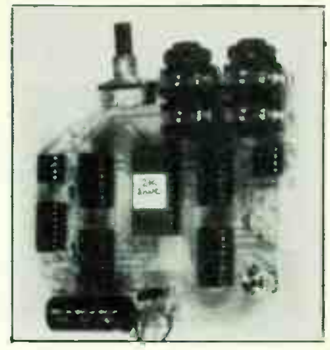
The Demo Cassette

Of course, the inevitable problem with buying a sound EPROM is that until you try them out you've no idea of what they sound like. You might hit lucky and get a sampled bass drum that has a kick like a mule, but, on the other hand, you might get something that's more reminiscent of a thwack around the ear with Lady Bracknell's handbag. So, to add a bit of sonic assistance we've produced a 15-minute demo cassette that includes examples of all 21 sound EPROMs, played both individually over a four-octave range and together in rhythmic patterns. Note however that the latter effect was achieved by simply switching a solitary DAC input from one sound to another in quick succession. In reality, you'd use multiple Syndrom boards to get overlaid percussion tracks, but that's a story for the future. . . By the way, there's a free EPROM of your choice for anyone who can guess the source of 'Orchestral thump'!

The sounds on the cassette are arranged in three groups, with sounds appearing in the order shown, and these



Syndrom PCB component overlay.



are followed by rhythmic patterns using combinations of the sounds in those groups.

Group 1: Kick drum, Door slam, Explosive finger click, David's burp, Handclap, Dog bark.

Group 2: High tom, Low tom, High Bongo, Low bongo, David's aaah, Snare, Hi-hat (closed), Cabasa, Guiro.

Group 3: Hi-hat (open), Crash cymbal, Orchestral thump, Brassy, Squawk 1, Squawk 2.

The Syndrom demo cassette is available for £1.00 (inclusive of VAT and postage) from E&MM's editorial address, payable to Glidecastle Publishing Ltd. Once you've decided on the sound that you'd like to try out on your Syndrom board, the appropriate EPROM can be ordered (£6.75 for a 3K 2716 or £7.75 for a 4K 2732) from Silicon Sound, 20 Bolton Street, Swanwick, Derbyshire, DE55 1BU, and cheques should be made payable to the same. If at any time you want to change the sound in an EPROM, we're also offering a 'burn it again, Sam' option, whereby an EPROM returned with £2.50 will be burned in with a new sound of your choice.

E&MM

Syndrom Parts List

Resistors (all ¼W, 5%)

R1	470R
R2	25K linear pot (or anti-log)
R3	2K2
R4	47K
R5	10K
R6, 7, 8	4K7

Capacitors (all disk ceramic except for C6)

C1, 4	0.01uF (10n)
C2	0.02uF (20n)
C3, 5, 7	0.1uF (100n)
C6	330uF (or 470uF) 25V

Semiconductors

D1	IN4148
IC1	555
IC2	4093
IC3, 4, 5	74LS163
IC6	2716 or 2732 (supplied separately)
IC7	DAC0800 (or DAC0801)
IC8	LF351 (or TL071)
IC9	7805

Miscellaneous

PCB
IC sockets: 2×8-pin, 1×14-pin, 4×16-pin, and 1×24-pin
2-pole, 2-way sub-miniature toggle switch
2 PCB mounting jack sockets
PP3 and PP9 battery connectors

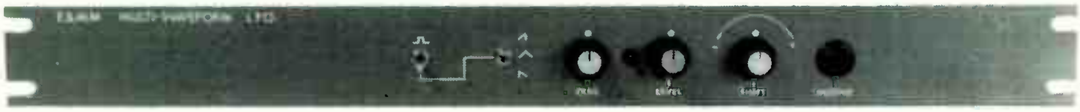
All parts are available from Maplin or Technomatics, except for the sound EPROM (IC6), which is burned to order and available from the address given in the text.

PCBs are available from E&MM at the editorial address, price £4.95, payable to Glidecastle Publishing Ltd. A kit of parts is also available from E&MM for £24.95, exclusive of the sound EPROM, but inclusive of the PCB, all electronic components, and the miscellaneous items. Alternatively, you can buy your Syndrom ready-built for £29.95.

DO-IT-YOURSELF

Multi-waveform LFO

Paul White **introduces a simple design providing a versatile modulation source for digital delay units or modular synthesisers.**



This month's project was designed to provide a modulation source compatible with any digital delay unit having a voltage-controlled modulation input.

Units such as the Maxim 1500H (reviewed in *Home Studio Recording* March 84), the Evans digital delay and other budget processors provide excellent results at an affordable price, but in doing so sacrifice the facility of an on-board modulation oscillator. Fortunately, there is usually a rear panel input which allows an external oscillator to be simply connected, and for maximum effect, an oscillator capable of producing a ten-volt sweep is required.

The oscillator described here can produce four different waveforms with variable amplitude and in addition, a DC offset is provided so that the delay time may be modulated – useful for pitch change effects when in Freeze or Hold mode.

Circuitry

The basic oscillator circuit consists of ICs A and B, generating under normal conditions a triangle and a square wave output simultaneously. The charging time of C1 and C2 is dependant on the combined value of R4 and VR1 so that the frequency may be changed simply by altering the setting up VR1.

In addition, placing a diode across VR1, R4 enables the charge and discharge rates to be different, the charge current flowing through VR1 and R4 and the discharge current flowing through R5 and D1 in addition to VR1 and R4. This simple modification enables a ramp waveform with a fairly rapid discharge to be produced and, by reversing the polarity of the diode, the inverse waveform can also be generated.

S2 selects square or ramp waveform outputs, whilst S1 selects the type of ramp or triangle wave to be produced. When the square wave output is selected, S2B removed the diodes from the circuit so that a symmetrical square wave output will be produced regardless of the position of S1. IC2A amplifies the resulting waveform to approximately ten volts peak to peak, and also drives the LED *via* the BC107 transistor. The LED varies in brightness in accordance with the frequency selected and the waveform chosen, sweep rates of between 0·1 and 30 seconds being possible.

VR3 allows an offest voltage of up to plus or minus 10V to be produced at the output of IC2B and, if the DC shift is used without any modulation level (VR2), a change of delay time may be produced without pitch modulation. On the other hand, if a sound is captured in the Hold mode, the offset facility may be used to change the pitch of the stored sound.

The LFO unit is best powered from a dual-rail 12V power supply such as the Twinpack (E&MM Sept 82) although two nine-volt batteries may be used providing that the reduced output level is acceptable. Conversely, if you have several rack mounted projects that need powering, you could wait until next month's E&MM when we'll be publishing the design for our RackPack, which will provide plus and minus 12V at one amp.

Construction

Fit all the components to the PCB, taking care to fit the electrolytics, diodes

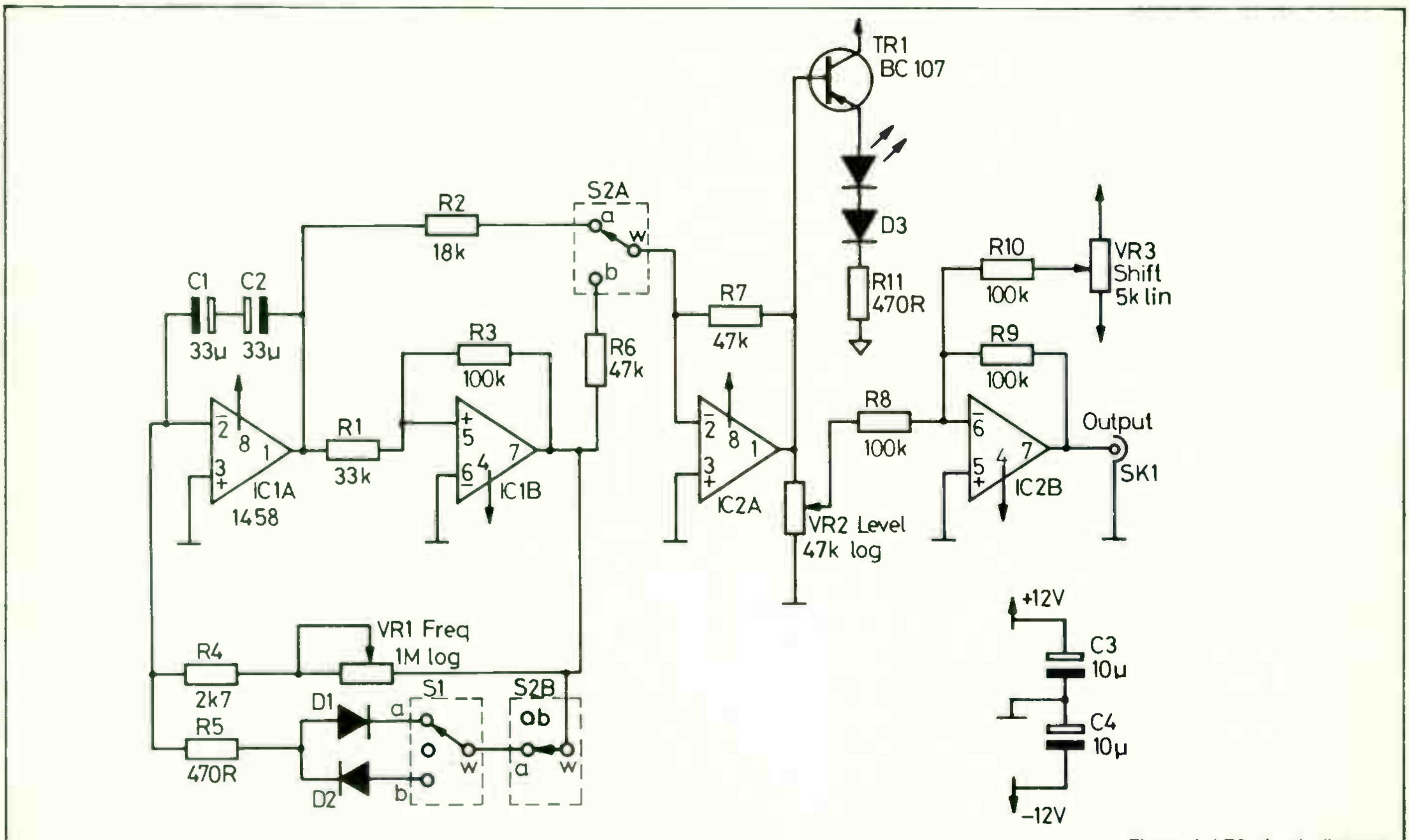


Figure 1. LFO circuit diagram.

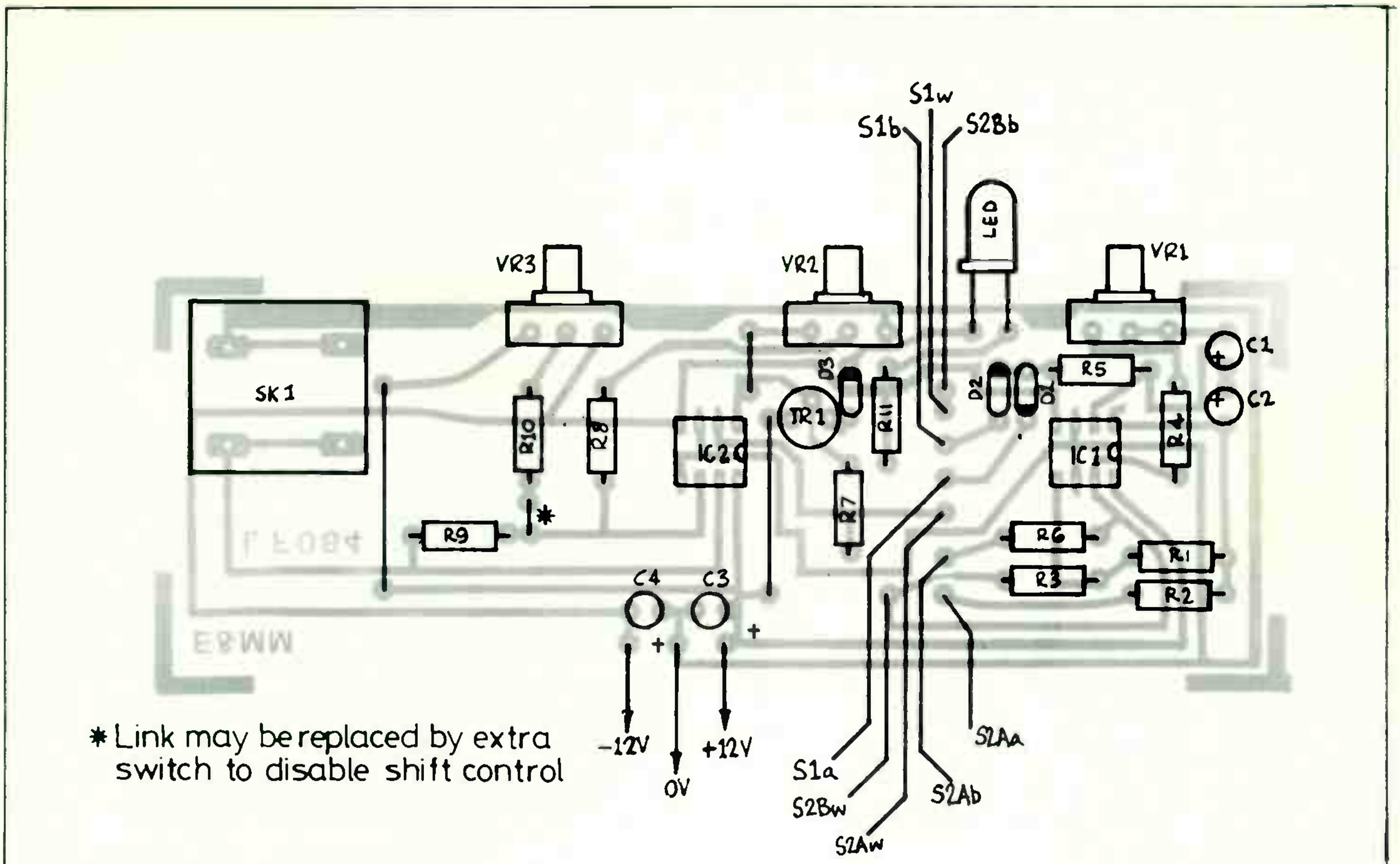


Figure 2. Component overlay.

and semiconductors the right way round. The wiring for the switches is shown on the layout diagram and should present no great problem, providing that you double check everything before you switch on.

The prototype was built on a 1U rack-mounting panel, the PCB being supported by means of the pots and the jack socket. A complete case is not essential providing precautions are taken to prevent the circuitry from shorting out to nearby metalwork.

Once completed, the unit is ready to test, and no setting up is required. If a voltmeter is available, the output may be verified providing that the frequency is set fairly low, thus enabling the needle to follow the contours of the output waveform.

In Use

To produce chorus effects, a triangle wave would normally be used to modulate a delay of several tens of milliseconds, using little or no feedback. The LFO level will affect the chorus depth and, in general, a modulation frequency of 2-3Hz will be a good starting point for experimentation.

Different effects may be produced by using the other waveforms and, by increasing the feedback on the delay unit, typical flanging may be produced. Try freezing a sound in the Hold mode and then, using offset control to change its pitch, add a little LFO level to modulate the sound.

One limitation must be remembered, and that is that the output capability of the circuit is about ten volts. It follows

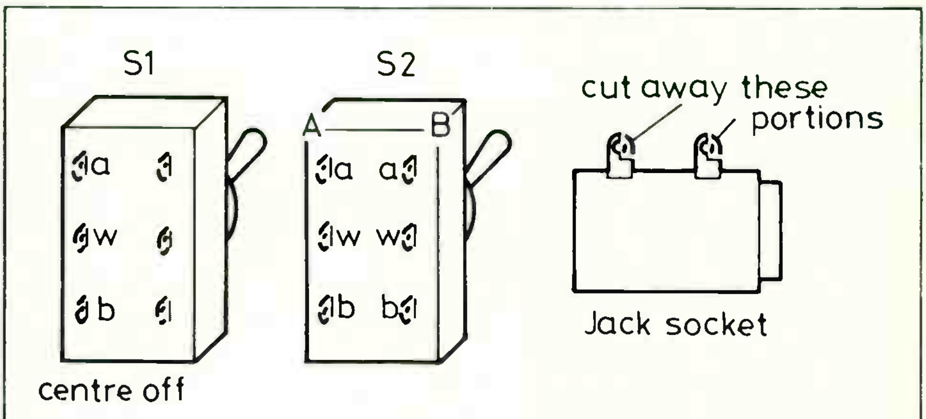


Figure 3. Switch and socket configuration.

therefore that if you use the full ten volts of offset and full level on the LFO, the output waveform will be chopped off as it attempts to cross the ten-volt line. This *can* be used to produce interesting waveforms which may be used to create imaginative effects but, to prevent this happening by accident, an extra switch may be fitted as indicated in the layout diagram to disable the offset function when not required.

A square wave modulation may be used to produce trill-like sounds, whilst a slow ramp will produce a gentle pitch sweep followed by a more dramatic effect as the ramp resets.

Paul White **E&MM**

LFO Parts List

Resistors (all ½w metal film)

R1	33K
R2	18K
R3,8,9,10	100K
R4	2K7
R5,11	470R
R6,7	47K
VR1	1M log
VR2	47K log
VR3	5K lin

Capacitors

C1,2	33u 16v
C3,4	10u 16v

Semiconductors

TR1	BC107
IC1,2	1458
D1,2,3	1N916

Miscellaneous

S1	dpdt centre-off mini toggle
S2	dpdt mini toggle
SK1	¼" jack socket
PCB	
LED	
19" 1U panel	

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CLASSIFIED ORDER FORM PAGE 96.

Advertisers' Index

ABC Music ... 15
A1 Music ... 87
Allan Gordon Studios ... 85
Argents ... 2
British Music Strings ... 78
Cass London ... 93
Carlsboro Sound Centres ... 17
Chase Musicians ... 1
Clef Products ... 93
Computer Music Studios ... 60
Craftmaster UK ... 6
Digisound ... 23
Digital Fantasia ... 59
Don Larking ... 8
Dougies Music ... 60
Dr Böhm ... 55
Eddie Moors ... 23
ESSP ... 23
Fane Acoustics ... 68
Freedmans ... 49
Future Music ... 12/13
Gigsounds ... 5
Hammond UK ... 27
Hobbs Music ... 55
Holiday Music ... 77
Honky Tonk Music ... 31
London Rock Shop ... 96
Magic Music ... 64/65
Michael Stevens & Partners ... 87
Micro Musical ... 57
Monkey Business ... 53
Musicians Direct Supply Co ... 89
Music Village ... 19
Oxford Synthesiser Co ... 84
PPG UK ... 72
Phonosonics ... 93
Powertran ... 80
RS Keyboards ... 93
Roland UK ... 42/43/IFC
Sackville Sound ... 87
Sequential Circuits ... 32
Siel UK ... 36
Simmons ... OBC
Soho Soundhouse ... 51
Stix ... 59
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