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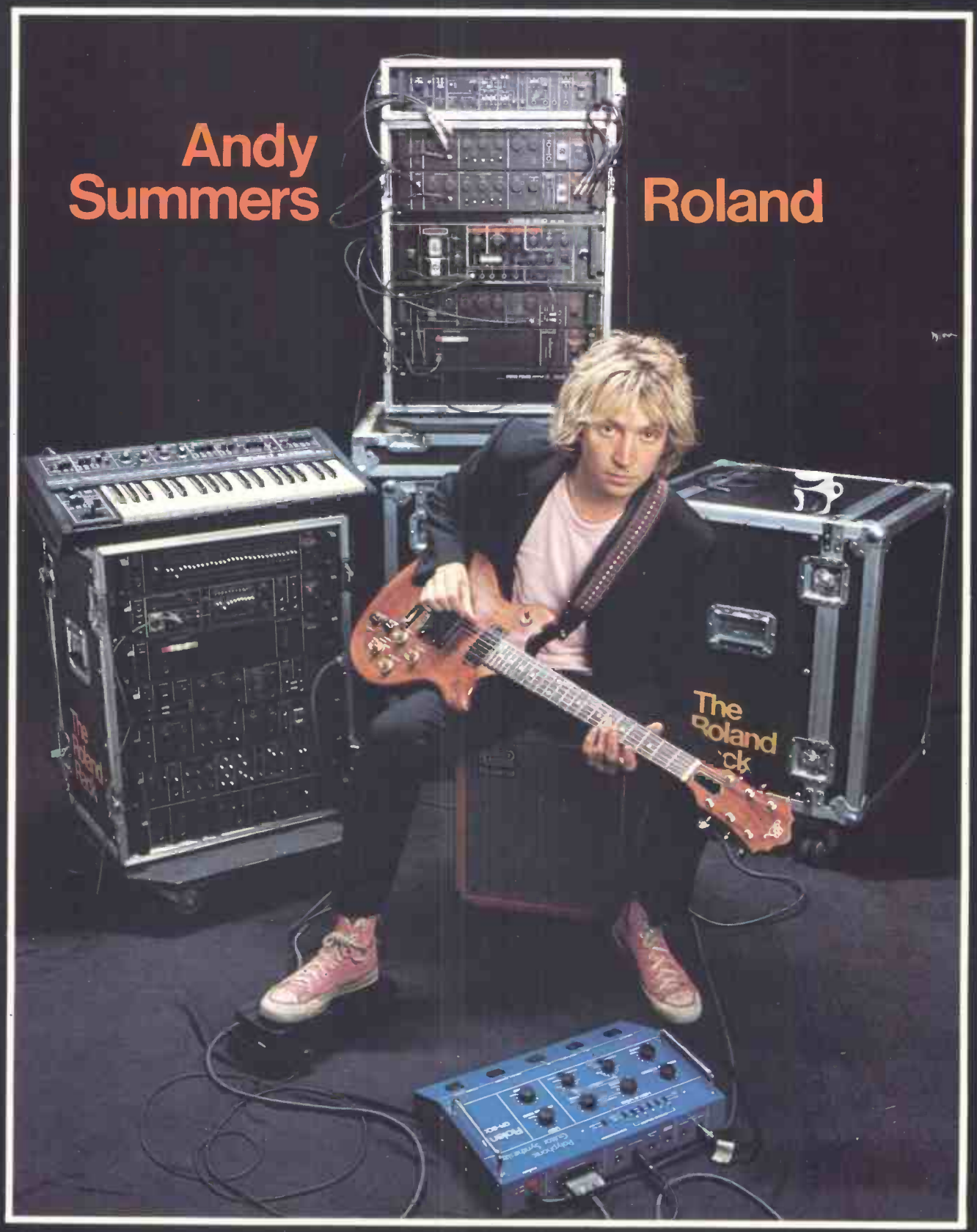

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The Crumar Stratus polyphonic synthesiser has facilities for layering three separate sounds, (1) polyphonic synthesiser sounds, (2) organ sounds and (3) string sounds. All these sounds can be varied, mixed and played at the same time.

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CRUMAR STRATUS POLYPHONIC SYNTH

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There are other noteworthy qualities to the Stratus, like two independent oscillators, continuously variable and invertible envelopes and polyphonic resonances.

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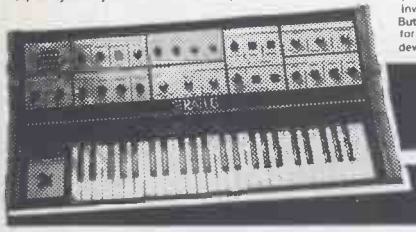

RRP £900
CHASE PRICE £499

CRUMAR TRILOGY POLYPHONIC SYNTH

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Crumar's Trilogy combines polyphonic synthesiser, strings and organ sounds in one instrument, then lets you combine them in any proportion for limitless creative potential.

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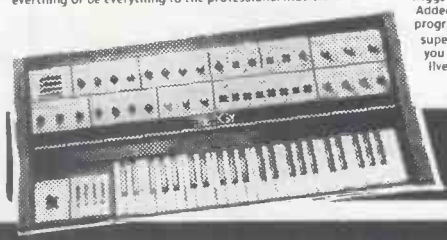


RRP £1300
CHASE PRICE £799

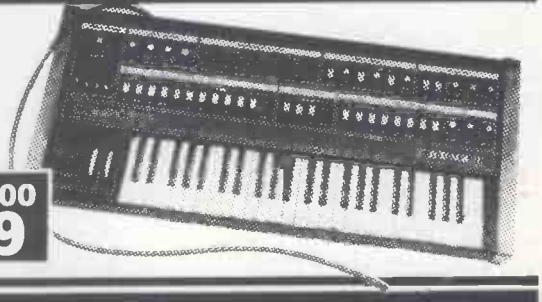
CRUMAR COMPOSER POLYPHONIC SYNTH

The Crumar Composer polyphonic synthesiser has four separate sections which can be used at the same time (1) The lead line solo synth section, (2) The polyphonic synthesiser section (3) The organ section and (4) The String section. All the sounds in these sections can be varied, mixed and played at the same time to give multi-layering of sound effects. THE LEAD LINE SOLO SYNTH section has facilities to create your own sounds together with seven presets which can be altered. The Free section includes an envelope generator. Attack – Decay – Sustain – Release Filter, Envelope Amount – Cut off – Resonance This section also has a split keyboard facility and a lower or upper note parity together with a pitch wheel to bend notes up or down. Other facilities include pitch tuning, footages range from 32 to 4 – five separate wave forms, saw tooth – Triangle Portemento Touch sensitive keyboard – Solo breath control allowing the player to control the envelope and the filter by blowing technique.

THE ORGAN SECTION has four separate organ sounds. Separate volume and decay controls for percussion on 4 foot and/or 2⅔ foot Separate sustain length control Also has a built in Rotary Sound System with slow or fast selector.

THE POLYPHONIC SYNTH SECTION Fully polyphonic programmable synthesiser, which includes preset sections and free sections. Free sections include Envelope generator, Attack – Decay Sustain Release Filter, Envelope Amount – Cut off Resonance Oscillator 1 Transpose (1 octave down) Wave form selector (saw tooth – square) Oscillator 2 Transpose (1 octave down) Waveform selector (saw tooth square) Detune Cancel Poly Modulation controllable by wheel Poly Breath Control: Allows the player to control the Envelope and filter by blowing technique.

THE STRING SECTION has 16 feet and 8 feet sound which can be played individually or mixed Tone of strings can be varied from Timbre controls Separate variable controls for Crescendo and Sustain for phasing in effects. OTHER FEATURES include separate outputs for each of the four sections. A voice mixer section consisting of separate volume controls for Solo synth, Poly synth, Strings and Organ sections together with a Master Volume control Instrument comes complete with carrying case.



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See page 5 for Crumar Pianos, Keyboards Strings (Organ) Synths

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Personal Multitrack

Electronics & Music Maker

February 1983 Volume 2 Number 12

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E&MM's Biggest Issue Yet — 116 pages!

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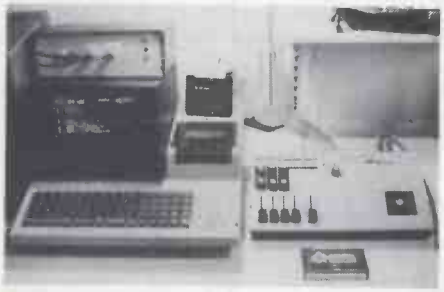

INSTRUMENT REVIEWS

Drum Machine Supplement *including 1st U.K. reviews!*

PROJECTS

NEWS

The Hands On Show 1982

Turnkey's Hands On Show in the Clive Hotel, London on December 4th and 5th 1982 proved a resounding success. Musicians, engineers and music-lovers from all corners of the globe came to see displays of home recording equipment, professional multitrack machines, mixers, studio effects and accessories.

One of the highlights of the show was undoubtedly E&MM's own electro-music display, featuring much of the latest musical technology. E&MM projects such as the Digital Delay, Transpozer, ElectroMix 842 and Spectrum Sequencer Interface vied for space with the Elka Synthex, Roland Juno 60 and MC4, the alpha Syntauri, Korg Trident 2 and Memorymoog.

Mike Beecher's lectures made full use of all these, with the help of Assistant Editors Ken McAlpine and Mark Jenkins along with studio technician Glenn Rogers. Various guest artists also appeared on each day, with Dave Bristow playing the Yamaha CS-01, Pat Moraz on Minimoog and CS-01 and Rick Wakeman on almost everything!

Warren Cann of Ultravox, John Walters and Richard Burgess of Landscape and Richard Elen of Studio Sound dropped in for conversations, and Terry Lloyd demonstrated the alpha Syntauri computer instrument. Large and enthusiastic audiences attended each show, and a statiscal analysis indicated that over half were regular readers.

We'd like to thank everybody who attended the Hands On Show for their support, and look forward to giving more electro-music exhibitions in the future.

Text and photos: Mark Jenkins **E&MM**

E&MM AHB MIXER COMPETITION WINNERS

★★★★★★★★★★★★★★★★★★

We're pleased to announce the winners of our first major competition. Although we received hundreds of entries that were very near to winning, Simon Jones and Conrad Wagner of Allen & Heath Brenell Ltd. finally decided on the closest entries taking into account their comments on possible uses of the mixer. The winners are published below.

1221 Mixer

Ian R. Frost	Stockport

E&MM Subscriptions for 1 year

A. E. Mason	Birmingham
Steven Baron	Blackburn
A. Horrell	Macclesfield
Rob Johnson	Herts
P. Fitch	Wimbourne
A. Isaac	Leicester
Miles Peters	Isle of Man
G. Timms	Saffron Walden
Mr. Ellwell	Kinver
Paul White	Malvern

E&MM T-shirts

Ray Anderson	Co. Derry
Ian M. White	Stone
Laurie Cornish	Tunbridge Wells
Richard Rix	Norwich
Gair Carson	Manchester
Paul Conlan	Torquay
Alec Hay	Edinburgh
Martin Rider	Rugby
D. Smith	Dunstable
Andy Blunt	Caversham

Publisher Terry Day

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Assistant Editor (Music) Mark Jenkins
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Keyboard Patrick Moraz, Rick Wakeman, Dave Bristow
Wind Bruno Spoerri
Guitar Peter Maydew, Adrian Legg
Percussion Warren Cann
Organ Ken Lenton-Smith
Stage Equipment Ben Duncan
Projects Robert Penfold, Paul Williams
Microprocessors Peter Kershaw
Hi-Fi Jeff Macaulay
Studio Technician Glenn Rogers

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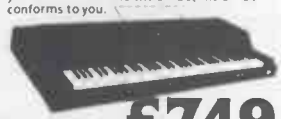

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Crumar Keyboards Strings (Organ) Synths

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The Performer is priced just right for the working musician. Get your hands on one today.
Crumar's completely new Performer is a professional quality strings and bass synthesizer at a not so professional price. You could pay much more and still not get all the features the Performer offers: two distinct 8- and 16-foot string voices, an on-board graphic equaliser, variable crescendo, full brass filter and envelope controls, delay modulation, a 4-octave range keyboard and trouble-free LED switching.

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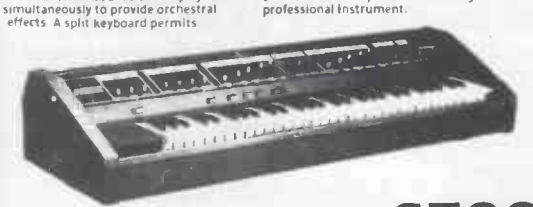

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Constructive Criticism

With reference to the article 'Electronic Music — A Philosophical Defence' in E&MM, October '82, and also recalling current critics of synthesisers.

I feel (as a music student) that music has become classified today — there are (as Steve Moore says) 'classical' music lovers; then 'pop' music fans, 'jazz' enthusiasts etc. Also within these circles are smaller divisions — classical — some love the Baroque period, others the 'Romantic' era etc. and these sub groups to a small degree criticise the areas which they don't like!

Even with modern music e.g. synthesised, folk like their own styles — as Steve Moore admits himself — saying it's his "personal view".

But having 'personal likes' is no reason to be critical of such artists/musicians as Tomita — if you wish to criticise such a musician you should give *real* reasons. It is my experience from music tutors who teach 'classical piano' that such people dislike such interpretations as those of Walter Carlos and Tomita — and I'm sure that Beatles fans don't like 'Penny Lane' played by a brass band!! I suggest that we all should choose what we listen to — I don't listen to what I don't like (well, sometimes I have to as a music student)!

I notice that classical composers from J. S. Bach to Liszt rearranged other composers works — it was usually considered a compliment. I think that Tomita's interpretation of Ravel's works *adds* a dimension — and I enjoy the orchestrated version too — I recommend listening to 'Daphnis & Chloe' by Ravel through Tomita! Quite moving...

So, if any contributors have a criticism — which isn't just an opinion — then give us reasons. The early composers didn't have the range of sound that we have today — and hearing the 'classics' on synthesisers often demonstrates interwoven themes hitherto unnoticed (to all but the 'specialist' ear). I look forward every Christmas to hearing 'The Messiah' performed by a Baroque ensemble and a small number of voices — that's how I like it — others like later versions for massed choirs and orchestras; but I can and do enjoy Tomita, Jean-Michel Jarre, Schroeder, Neuronium, etc.

May all today's variety of musicians keep on at their specialised interest — perhaps those, with rather narrow concepts of how 'music' should sound, who don't like a particular style, will make CONSTRUCTIVE COMMENTS.

Phil Brown
Newquay
Cornwall

"The Rich Get Richer... and the rest of us get left behind"

Maybe, if you've thought about it at all, you think we're entering a 'golden age' of synthesiser music. If you own a Fairlight you might have a point. If you're only dreaming about those wonderful gadgets you see on TV you may find that the next few years will bring the worst disease that electronic music has ever had to suffer. Far worse than a general shortage of funds. It's the disease of *class difference*.

More than ever the prize goes to the richest. The pursuit of excellence has never before cost this much. A cheap Les Paul copy offers the same control facilities as a rare vintage original; a good player will easily get around its limitations. With the new generation of top-flight synthesisers you can get a definite increase in musical potency and expressiveness in return for folding money. Lots of folding money.

Throughout 1981 and 1982 there has been a steady increase in the number of polyphonics available from the American and Japanese manufacturers at around £3,000. A musician can now choose between synths with radically varying design philosophies and specialised facilities. Perhaps I should say attempt to choose. Not everybody can afford the expensively gained experience needed to appreciate the full possibilities of these keyboards and sort out which of the options are for him and which are not. Most people have never had the options, even in a limited form.

Over and above mere Prophets and Jupiter 8s is an even higher form of life. Computer controlled devices from the Rhodes Chroma/Apple II combination to the Fairlight CMI and the Synclavier II present the same problems in greater proportion, you could even say with an added dimension. A short review of an instrument like this has a far smaller function than it does for a conventional instrument. No assertions can readily be made about the performance of a device so extensively equipped, nor about the personality of an instrument designed for utmost flexibility. Even if a reviewer felt he could size the machine up, it's not like a guitar, say, where you can toddle down to your friendly music shop and try it out, see if it gives you a thrill or not (definitely the best way to buy a guitar).

Anyone who is in a position to make the sophisticated decisions needed to buy the right tool and then stretch it to its limits will have musical firepower undreamt of until a couple of years ago. No one can seriously doubt that computerised polyphonic music systems will carve a revolutionary path through composing and recording techniques through the whole field of electronic music, starting . . . now.

How many of us can shell out enough to equip a complete five-piece band with respectable professional gear and instead take delivery of one keyboard instrument? It's no good proffering the (dodgy) opinion that a computer controlled mega-synth will probably do a lot more than the average band with a few grand's worth of gear between them because it doesn't end there. That equipment came from five people's hard-earned, not one poor man's H.P. contract, so all the costs of rehearsing, recording, presenting and promoting their musical wizardry are also split five ways. If you're not making a very comfortable living as a synthesiser player — no, me neither — will you ever get enough time with the beast to realise even a fraction of its potential? Will you be able to afford the studio time to do it, and yourself, justice? Will you be able to afford anything?

What all the pessimism adds up to is this: the hazards of laying down a huge sum of money for something that could be obsolete before the guarantee runs out, which might present unnerving repair and service hassles, which is probably going to depreciate by hundreds of pounds per year, these are just part of the job to the upper crust, maybe just a tax loss. For the rest of us down here it's personal. For once that really means something to the cause of creativity. You are definitely under a creative handicap if you can't afford thousands of pounds for a synthesiser. Definitely.

The crystal ball clears. The whole back-scratching in-crowd scene of cheap studio time, record company indulgence, cheap/free instruments, etc., ad nauseam in which the securely contracted can bask takes a giant leap forward. Forget the argument that creativity will shine through, the tired old A&R department cliche about how they'll listen to a good melody no matter how rough the presentation because a) It's a lie; and b) It's irrelevant; of two players with, hypothetically, the same gifts, one's work will suffer if he's 'struggling' and the other's affluent. Fact of life. Oh, by the way, we haven't forgotten that the well-heeled musician can do most of his work back at the penthouse, thus carving chunks out of the studio bill, have we? Or that his floppy disks full of sound setups and sequences will do the same? No.

Microchip technology, which could have been, could still be, the great leveller might prove to be the most conclusively divisive force in music in the last two decades.

So, can we look forward to a divided State for the future of electro-music? The privileged, digital few holding sway in one territory, monopolising sessions and remunerative contracts: talented people frustrated by lack of funds, music biz. complacency and incestuousness, strengthening the existing electronic music "underground" elsewhere, heard only by a few, no chance of general recognition? Is this what you want?

Stuart Lambert
Shaftesbury
Dorset

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In April 1982 we examined Martin Rushent's production work with the Human League and noted the ways in which electronics — from the relatively simple Casio VL-1 to the versatile MC-4, Fairlight and Wave computers — have begun to figure strongly in the pop charts. Now the Human League have new single releases and an album forthcoming which integrates even further the use of conventional and electronic instrumentation. Songwriter and guitarist Jo Callis explained to us what the League have been doing, how they organise their work on tours and in the studio, and what plans they have for the future.

We toured America, Australia and Japan starting last April, with very brief stops in Canada and Iceland. 'Don't You Want Me' was starting to break in the States, partly as a result of our TV and radio appearances which seemed to help as much as the live concerts. That was a very exciting time for us; our earlier US single 'Love Action' didn't really do much over there.

We got back from the tour in mid-June and started to write new material almost immediately. We'd already managed to work two new songs into the set, one of which was 'Mirror Man'. We called this one 'Can't Get To Sleep At Night' in concerts but we changed the chorus. There was also another one that isn't completely recorded yet called 'Don't You Know I Want You', and apart from those two we didn't really have anything else fully finished.

Phil Oakey plays a little synthesiser live but he's more interested in the programming side that takes place before the concert, such as the chains in the Linn drum machine. After seeing one at Martin Rushent's studio we saw the advantages of using it live, in addition to the MC4. Phil's the only one of the band familiar with programming that also.

Adrian Wright plays some synthesiser but he's mainly involved with the visual side and still provides a very extensive slide show. On the tour he used whole banks of slide projectors, about 17 machines in all, which provide back projections from a gantry behind the stage. The slides are sequenced to fit in with the songs in most cases.

We don't use backing tapes, although the Linn and TR808 are pre-programmed of course, and beyond that it's difficult to break

everything down and say once and for all who plays what. On tour, we have a Roland Bass Guitar Synth for Ian Burden, who also plays some conventional bass and a Yamaha monophonic synth. I've played some keyboards with the Human League including live work, but I'm basically a guitarist and have been using a Roland Guitar Synth on the 'Mirror Man' single and on the new album. Mike Douglas, who's played with Orchestral Manoeuvres, helped us out on the tour with a Prophet 10 and later a Jupiter 8; the group now has its own Jupiter 8, and also its own Linn which we bought just after recording 'Dare'.

In the studio we also use Martin's Fairlight, a Roland 700 system, a Wave 2 and so on. If we know there's a good patch on the Jupiter 8 we'll tend to try that first, but we like to give everything a try and used the Wave and System 700 quite a lot on 'Dare'. The Fairlight has only been added recently; Phil's just got his own MC4 so he's been doing a lot of programming, and we use it in conjunction with the Jupiter 8 via an interface. Ian plays some keyboards as well as a lot of bass.

Martin's contribution, or any producer's contribution, is very important of course. For instance, after having used the Linn on Dare we found you can become aware of what it sounds like — after all it plays the recorded sounds of one particular drum kit with the basic set of chips — and short of reverb and EQ you can't do a lot to it. We wanted at least to make it different; we used the AMS delay a lot, including making short samples of riffs and repeating them.

We had one guitar synth piece which was very difficult to play as a repeated riff, partly because it was complicated and partly because the other strings tend to pick up a lot on a guitar synth. Martin managed to record it in two parts on the AMS and trigger it every time we wanted it.

The Human League also have their own studio in Sheffield which is like a little workship for demos and rehearsals. It's in a derelict building, we keep the synths and an 8-track there. Phil has a Fostex 8-track at home and Adrian makes up his own demos on a Portstudio or in the 8-track studio. At some stage we'll need to expand to 16 track — 8 track is OK until you start wanting to record time codes, for instance to trigger the AMS with a sampled snare sound to replace the Linn sound. 16 track gives you more space to develop your ideas, it allows you to slot in little pieces which can be taken out if they don't work but often turn out better than you'd ever expect.

When we're recording songs in the studio that use the active bass or the bass guitar synth, Ian might find himself developing a particular style, but that's not to say that he's limited to playing the bass or that he can't play some keyboards. I play all the guitar synth pieces but we still want to develop and use new instruments, and new ways of working.

The basis of the group is now song-writing rather than sounds; the song is the backbone. We've developed a good clean sound, but every song still seems to come together in a different way. The B-side of 'Mirror Man' was written entirely by Phil and demoed on his Fostex 8-track at home, but that's a departure because up till then most of the songs have been collaborations. On Dare the people who wrote the song tended to play most of it, but having played them all live it's a bit different now.

It's difficult, for instance, for 3 people to work on a demo of a song — 4 is impossible! On Dare it was usually done in two's, one person would have a basic idea and somebody else would develop it. 'Don't You Want Me', for instance, was like a chain reaction of ideas, ending up with Martin's ideas on the production side.

The single 'Mirror Man' is my music and Phil's words and melody. I had the music in my head and bought a Yamaha Portasound to go with the Casio VL-tone I always carry with me. The Portasound is good for checking up on a tune just before you go on stage, because we don't write anything down, it's either in our heads, on tape when we've finished an album or inside the Linn as a chain of numbers. Sometimes I write down chord names, but none of us can read or write music as such. Martin does that sometimes when he's producing, but I think the first rule of music is that there are no rules. Anything should go, and if something's good it will shine through whether it's based on classical training or not. I've seen a lot of bands who I've enjoyed although they were almost incompetent on their instruments, because they obviously had good ideas.

We're not particularly worried about improving our musical technique. The only thing that would worry me is if I went for three months without being able to write a song; it would never worry me that I couldn't play a Jimmy Page guitar solo!

When we're writing we get influences from everywhere. 'Mirror Man' is very much Tamla Motown influenced, nearly everyone in the group likes Soul, things like Chic for instance, and you get to the stage where Soul records begin to sound as if they're influenced by the Human League. A friend of mine introduced me to the guitarist of Chic in New York and I was knocked out. I was explaining to him how much they'd influenced the sound of the Human League. At the same time he was saying Chic had been listening to us to get a few ideas!

Hopefully the girls (Joanne Catherall and Sue Sulley) will get into writing before too long. At the moment they put a lot into the group in terms of spirit and chemistry, which is important in modern music; and also in terms of objectivity, for instance they can listen to an idea and say they like it or they don't like it, and know a good song when they hear it whether they could write one of their own or not. To me it's very important to have objective viewpoints, to have the opinions of people you can trust. You can lock yourself in and record for a month and at the end of it you don't really know if it's any good unless you play it to someone.

Ian's been in groups before, and I've been playing for 14 years now, since I was 17, and making a living out of it for most of that. Keyboards and synthesisers are new to me, so I'm still learning a lot. I used to play guitar with the Revillos, going back a few years now, and I often find myself thinking back to an idea I had maybe six years ago and finishing it off. If an idea's good, it stays in your head, even if it means taking years on and off involve the group but just their production on a Portastudio or in the 8-track studio. At records, one from one of Ian's old groups and one from one of mine.

On the other hand I think pressure can sometimes be a good thing, although the Human League have always tried to avoid being forced into a situation where they had to write songs when they didn't want to. It's been a year since the last record came out, so we obviously haven't been forced into anything before we're ready. By rushing something out the career of a group can only suffer; now we've got an abundance of ideas for the LP.

We don't like to make too many future plans, but at least part of the year will be spent touring to support the new LP when it's released. Usually we don't use film of live

concerts for TV; Adrian did a film course and I did some TV work at art college, Phil's interested as well, and so when we do videos for Top of the Pops or if we ever do a special videotape we'd prefer to do something that's more of a marriage between music and visuals. Possibly the images wouldn't even involve the group but just their production and direction.

In the old days on Top of the Pops some people sang live, and even nowadays a few re-record their backing tracks and sing live over them. We prefer to re-record everything if necessary. The music's still developing and we want to try to get as much light and shade, as much variety as possible. There's a lot more going on in the rhythms, and using bass guitar more than keyboard bass we can get a high slap sound, a much more fluid rhythm. In addition to using the Ibanez active bass we usually take the Linn's snare sound out into the studio to give it far more ambience.

For live vocals we usually use Shure SM58's, which seem to be the standard for any rock musicians once they're on a reasonable budget. The backing vocals are usually there from the very first stages of writing a song; for instance when we were writing 'Don't You Want Me' Phil thought it would be a good idea to have the first verse from one point of view and the second verse from another, so Sue sings the second one from a girl's point of view.

When we're recording now we have to do bar counts and things as well as writing down the lyrics and the music (which Martin usually does) because we're using machines as well as live musicians. To be honest, I prefer to just dabble with machines to get the basics, and find out the details as we're using them. I find reading manuals really hard graft, but Phil on the other hand will get a new piece of equipment such as the MC4 and sit with it and the manual until he's learned it all, even if it takes him a month!

The Human League have been very successful in the UK and in Europe, Iceland and Finland, and increasingly so in the US. I've worked up through various bands from rock bottom, had some success and gone right down again. But I think that's been a valuable experience and I'd still be doing what I'm doing now even if I was getting nowhere and we were all broke. I'm happy doing this because I do it for the love of it — we all just want to be able to go on doing what we're enjoying doing. **E&MM**

Human League

STUDIO SOUND TECHNIQUES

Part 4

by P. A. Becque

Even more about Mixing Consoles

Every console has linear faders of some kind and these are particularly vulnerable to dirt, dust and general abuse. There are three basic types: carbon track, conductive plastic track and voltage controlled. The latter type is used extensively in so-called computerised mixing consoles and has built-in electronics (VCA, Sample & Hold, etc). As might be surmised from the name, the resistive element feeds a DC voltage to control the amount of attenuation required. A disadvantage of many of these faders is that when control is handed over to the computer the fader knobs fail to move, so one has no clear idea of where the electrical setting is. VCA fader manufacturers are looking at ways of overcoming this with various types of displays.

Another type of automated fader uses a small servo motor mounted in the fader so that the knob actually moves in the automatic mode. Apart from the obvious visual advantage, the system also offers the facility of being able to grab hold of the knob, which disconnects the servo drive, and set the fader to any desired point. This is very useful in mix-down when quite often you spontaneously decide to adjust a setting.

The chances are that your console will have standard faders with either carbon or plastic resistance elements. Generally speaking, the longer the faders, the more possible it is to exercise control over the signal. Faders which can be taken apart for servicing are a big bonus. Since they are basically mechanical devices, naturally parts wear out. It is, therefore, cheaper in the long run, if you intend keeping a console for any length of time, to have removeable, easy to disassemble, faders. Carbon track faders can be cleaned as outlined in part 3 with contact cleaner. Conductive plastic faders are better washed in slightly soapy water, rinsed and left to dry. Any residue can be wiped off with a dry lint free cloth.

Level Matching

Most consoles have inserts or points in the signal line (see Figure 3, part 2) where auxiliary equipment may be used (eg. parametric equalisers, compressors, digital delay line, etc). Since these have to match to a wide range of units, a few parameters are important. In general, one feeds from a lower impedance to a higher impedance (15 to 20 times), although maximum efficiency is obtained when the impedances are equal. This latter point is only of real consequence in AC power distribution systems so as such it has little bearing on our subject matter. However, a quick look at the ideas involved should enable you to resolve any doubts you may have about compatibility in your system.

The circuit in Figure 6a shows a theoretical output ie. an AC voltage source in series with a fixed impedance Z_1. It follows that if we were to terminate it with an impedance equal to Z_1 (Figure 6b) we would make a potential divider where half the original EMF (6dB) is dropped across Z_1 and the other half is dropped across Z_2. So if the EMF across points A, B was 10V AC without Z_2 (unloaded) it would drop 5V AC when we connected Z_2. If we added another load, ie. Z_3, the EMF would drop still further. This is obviously not the best situation.

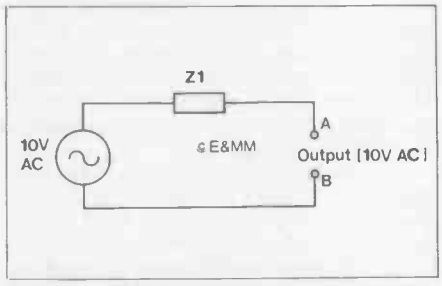

Figure 6a. AC voltage source with series impedance.

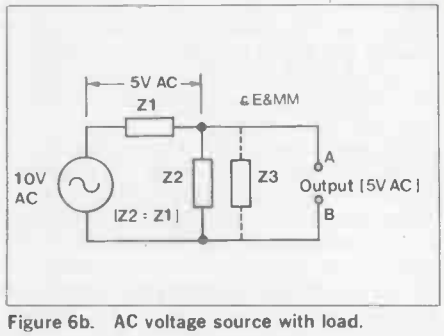

Figure 6b. AC voltage source with load.

In most sound systems the signal is considered to be an alternating EMF. It is for this reason that audio console manufacturers and others mutually agreed to introduce the dBV (decibel Volt). Before that the standard was the dBm (decibel meter) which is referenced to 600 ohm. Since different manufacturers provided different input and output impedances, confusion on specifications abounded. The main requirement though is that several inputs can be connected to a single output without a significant drop in signal level. This is why input impedances are generally between 10k ohm to 100k ohm and output impedances lower than 50 ohm.

Coupling with Transformers

There is still an abundance of secondhand equipment available at reasonable cost, so it is worth briefly looking into the history of the 600 ohm termination. This is still used by the BBC and others as far as I know. The need for a 600 ohm balanced termination arose when audio signals had to travel down long lengths of cable without degraded frequency response or unwanted electro-magnetic interference. Figure 7 shows the basic scheme, which you would do well to make a note of for those odd occasions when this is necessary.

The advantage of this system is that since the impedance is low on the long section, the signal is not unduly affected by the shunting effect of the cable capacitance at high frequencies. Also any stray alternating electromagnetic fields will impinge equally on both conductors, inducing the same EMF in both conductors. This will not form a potential difference across the windings of the transformer, so it will not be coupled to the secondary of transformer. Hence this balanced, floating configuration is largely immune to interference. Some equipment will have transformer coupled outputs which have to be correctly terminated, usually with a 600 ohm load, to prevent the transformer from ringing (ie. making unwanted harmonics, see Figure 8b).

Correct termination is mandatory with transformers. The best way to check this is by running a 1kHz square wave through the equipment and observe the output on an oscilloscope. Any deviation from the input waveform should be thoroughly checked out. Don't expect too much from your tape machine in this respect. Recent advances in technology have enabled manufacturers to provide machines with virtually ideal transient response. However, most ordinary machines are quite poor (we will be looking at tape machines in greater detail later on). All other ancilliary equipment and the mixing console should be able to handle a square wave without any side effects.

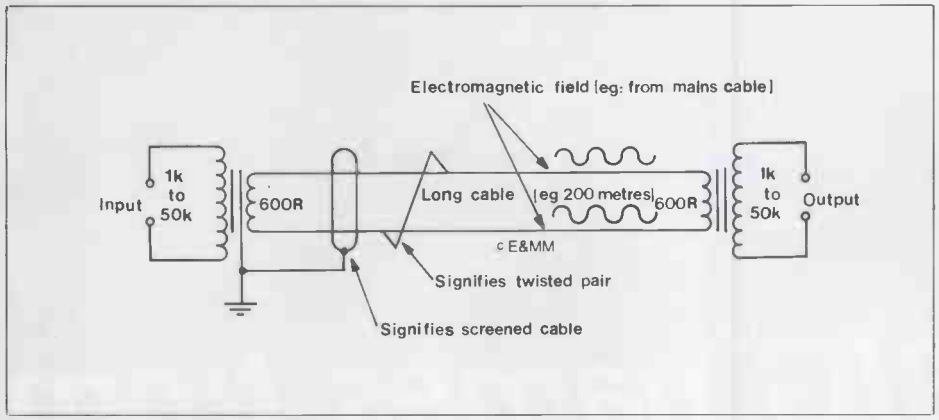

Figure 7. Transformer coupling.

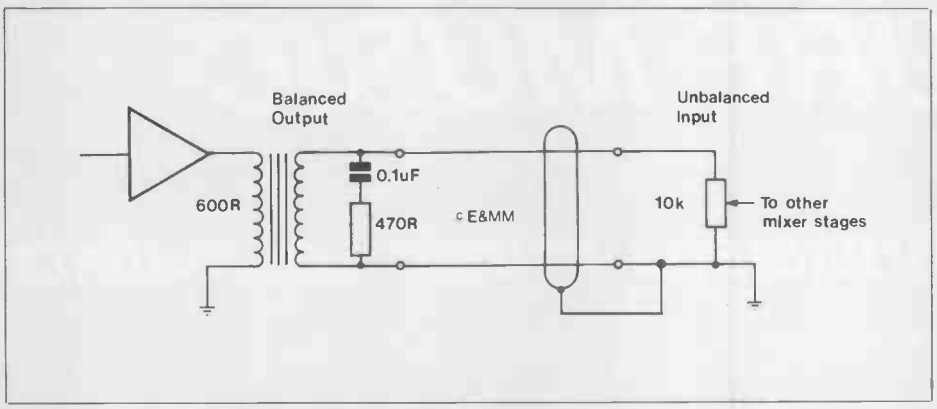

Figure 7b. Loading an unterminated transformer.

An output obtained similar to Figures 8c, d, e or f would show up as poor frequency response on a sine wave test. However, the chances are that 8b would go unnoticed because of its dynamic nature. Many synthesiser sounds have a high transient content so the ability to handle these is very important. Figure 7b shows how the situation arises in the first place and how it can be resolved. An unterminated 600 ohm transformer feeds a 10k ohm fader. Since the transformer should see a lower impedance ie. 600 ohm it produces a waveform similar to Figure 8b. If the unit is provided with a switch to drop a 600 ohm resistor across the output all well and good. Otherwise a resistor and capacitor in series across the output (0.1uF and 470 ohm) should do the trick. The precise combination of resistor and capacitor will depend on the characteristics of the transformer, which you probably won't have, so some experimentation may be required. Once you have obtained a good square wave (Figure 8a) check for flat frequency response using sine waves, from 30Hz to 15kHz, as outlined in the next section.

Checking Frequency Response

Flat frequency response, or the ability for your system to handle all audible frequencies equally, is vitally important for correct reproduction. To check this you will need: a sine wave generator, an AC millivoltmeter, and if possible, an oscilloscope. You may be able to borrow or hire some or all of these. If you are in any doubt about using them it is best to seek advice from someone who has done it before.

There are several waveform generator chips available for less than £4 so a complete oscillator with buffered output could be built for about £10. Similarly it is possible to use a VU meter in place of a millivoltmeter provided you know the calibration is good, but beware of multimeters with decibel scales. Most of these are only accurate up to about 200Hz so you will certainly get misleading results if you try to measure 1 Volt rms or so at 15kHz. On the other hand you may have access to a high quality DVM. Providing the instrument has adequate frequency response (check the specification) you should get accurate results. The difference between two voltages can be expressed in decibels by:

$$\text{Diff. in dB} = 20 \log \frac{\text{(Measured Voltage)}}{\text{(Reference Voltage)}}$$

So if for instance we apply 1.5V RMS at 1kHz to the line input of our mixing console or auxiliary unit, and set the output for any convenient reference point eg. 0.775V RMS or 0dBV or 1.228V RMS for 0VU (ie. + 4dBV), then by adjusting the input frequency over the desired bandwidth ie. 30Hz to 15kHz in octave steps (2kHz, 4kHz etc, 500Hz, 250Hz etc) we can ensure the output stays within certain limits. Under normal circumstances it is only the extremes that droop, hence the common way of specifying equipment is "plus 0dB, -1dB: 20Hz to 20kHz".

In our example let us assume we've set the output for 1.228V RMS at 1kHz (0VU) and at 15kHz we measure 1.094 V RMS, then by our equation:

$$\text{Diff. in dB} = 20 \log \frac{(1.094)}{(1.228)}$$
$$= 20 \log 0.8909$$
$$= 20 \times -0.0502$$
$$= -1.0036 \text{ dB}$$

The negative sign indicates that the measured voltage is less than the reference voltage.

Similarly at 30Hz we measure 0.9209 V RMS then:

$$\text{Diff. in dB} = 20 \log \frac{(0.9209)}{(1.228)}$$
$$= -2.5 \text{ dB}$$

You can see now why meters in audio are scaled in decibels rather than volts! The important thing to remember is that a rise or drop of 'xdB's' is the same relative amount (ratio) irrespective of the actual level. Twice or half as loud is equivalent to saying +6dB or -6dB (remember part 2?). Hence it is a relative rather than an absolute description. Later on we'll be talking about adding or subtracting 'xdBs' at 'xkHz' or, losing or gaining 'xdBs' overall etc, so make sure you've got this relative aspect clear in your own mind.

The DI box

Many electric instruments have high output impedances and relatively low level. This is where the Direct Inject box (DI box) comes in. Most DI boxes are, in fact, only a transformer with a 50k ohm input impedance and a 600 ohm output. By connecting the 50k input to the guitar and the 600 ohm to the mic input, the problem of interfacing is solved. The transformer turns ratio will reduce the EMF from the guitar though this is not normally a problem because of the high gain available in the mic amp. **E&MM**

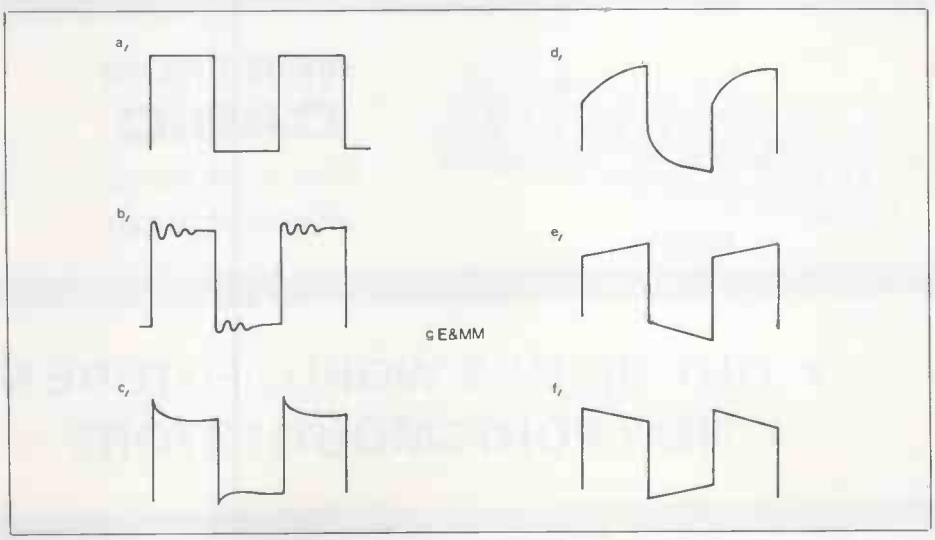

Figure 8. Typical output waveforms.

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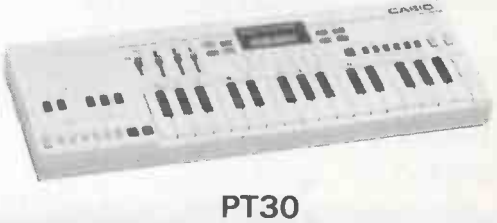

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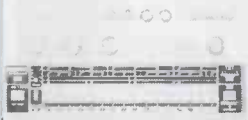

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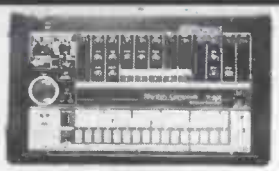

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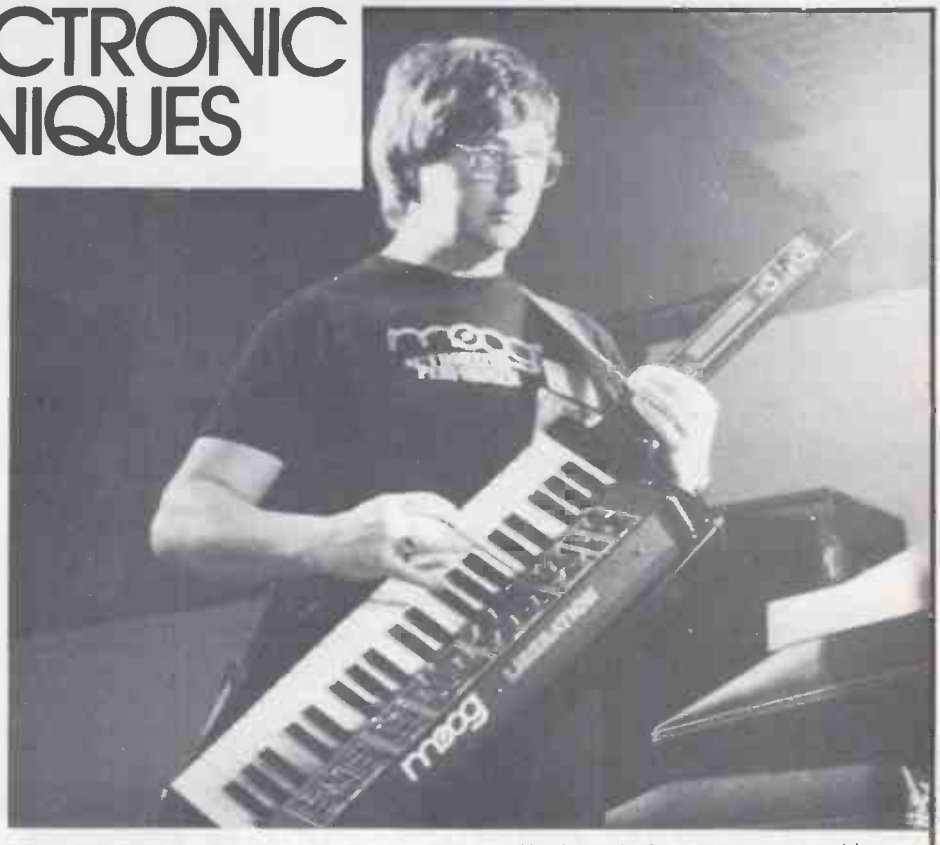
GUIDE TO ELECTRONIC MUSIC TECHNIQUES



Part 3 *by Dave Crombie*

Technique

At the risk of seeming somewhat obtuse, I'd like to start by considering some performance control techniques that don't rely on any performance controls; figure that one out!

Well, there are ways in which you can control certain parameters purely by the way in which you play the keyboard. The most immediate example of this is the use of the delay vibrato feature, which is fitted to several popular synthesisers. By holding a note, the delay circuitry will eventually start to introduce the LFO modulation in a manner similar to that of a violinist who will often apply a degree of vibrato to a sustained note. By playing the keyboard in a less legato manner (i.e. not holding on to any of the notes) then the vibrato has no time to 'appear'. This is an elementary method of controlling a parameter by means of playing style.

A more advanced method of using your playing style to determine a facet of the sound uses the envelope generator. Figure 1 indicates what is going on. If we have the controls set as shown, it is possible to completely change the envelope of the note depending on how we play it. The attack time is set very short, as is the decay; the sustain level is zero, and the release time is set long. If we release the note during the Decay part of the envelope, the generator assumes the value set by the Release

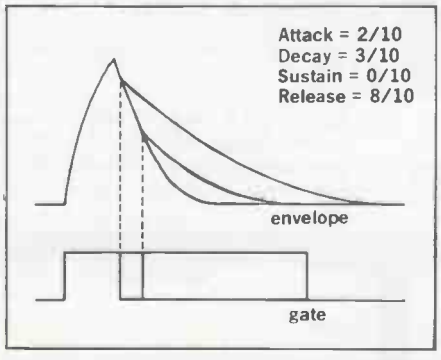


Figure 1. Use of gate pulse to control envelopes.

control and thus we have introduced a long release time. So, by playing in a staccato manner, the envelope adopts the long release characteristic, whereas by holding down the note, the envelope is cut off after the decay part. Furthermore, if you can gauge the point of release on the decay slope, you can control the level from which the note will attenuate and hence vary its apparent amplitude. This trick will work for both the VCF and VCA envelopes.

Another way of controlling the amplitude of a note using your playing style utilises a slow attack section. This effect is more straightforward, and essentially sets the maximum amplitude of the note from the point during the attack time you release the key. This can be seen quite clearly in Figure 2. It is possible to make a pseudo-combination of these two different effects, for even greater control/flexibility.

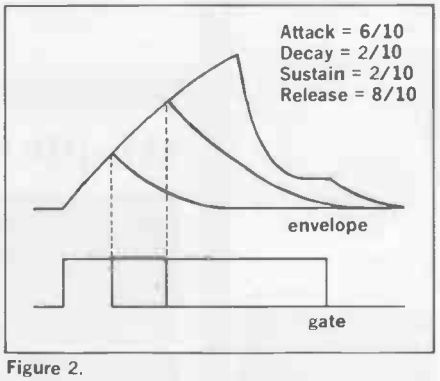


Figure 2.

Now, let's get onto improving our pitchbending and modulation technique. Probably the most common problem with using the pitchbender is that players tend to over use it, both in terms of frequency and amount. If you bend every other note, the effect becomes monotonous and looses its impact. Similarly, if you persist in bending notes a fifth (say) the effect becomes dissipated and starts to sound more like portamento. To get the best out of a pitchbender you should remember that it is an expressive device - don't dilute the expression. If you are using the synthesiser in a rock environment, it is a good idea to listen to a few guitar solos in order to get the feel of expression in this kind of music. You will notice that because of the inherent design of the guitar it isn't possible to bend a note very far, and that most guitarists stick to a 'bend' of one or two semi-tones. This is the best type of bend to practise on your synthesiser.

Keyboard players may spend hours each day getting to grips with scales etc. (you mean you don't either?), but very little time is spent improving pitchbend technique. The secret is to be able to bend exactly the amount you want to, and to be able to do it smoothly and confidently. Synthesiser controls obviously vary from machine to machine, so you have to 'know' your instrument. A useful exercise is to play a note C (say) then bend up to C sharp then play a B so your synth should still be sounding a perfect C. Similarly you can play a C, bend up to D, then play a B flat and see if you are back to C. This can be repeated for various keys and intervals until you can be sure that you can bend exactly the right interval. You will 'feel' the bend both by the amount you have to move the controller and by listening to the change in pitch.

There are various other little exercises for improving your competence with any form of pitchbender - I'm sure you can devise your own. Using the modulation wheel/lever/joystick, or whatever is more a matter of when not how. This, I'm afraid is up to you - it cannot really be taught. However, it is a good idea to listen to other instruments and see how they naturally add vibrato or tremolo, and to bear it in mind when simulating them.

I hope that I have brought home the importance of the synthesiser performance controls. A synthesiser without these devices is like a ship without a sail - it'll float, but won't go anywhere. A synthesiser isn't a musical instrument (to my mind) unless there is a method of injecting some kind of emotion into the pieces being played - with these controls, far from the synthesisers being a clinical, mechanical machine, it becomes one of the most expressive and sensitive of all musical instruments. **E&MM**

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Moog Memory

No one can deny that the name of Moog has held a long standing position of importance in the electronic music field, with classical music and popular music alike utilising the creativity of the first large '53' and '35' voltage controlled modular systems as well as the rich 3 oscillator/filter sound and pitchwheel performance qualities of the Minimoog. Whilst a steady production of monophonic synthesisers included the Multimoog, Micromoog, and the portable Sonic Six and Synthesiser XII, the one major polyphonic achievement was the Polymoog synthesiser/keyboard. Its fully polyphonic touch responsive keyboard, program and controller functions set the path for future developments.

Now the scene has changed dramatically, with the new range of Moog instruments including the Opus, the Source (with its touch sensitive/single wheel pane control combination), the Rogue (replacing the very successful Prodigy), the Taurus II Pedal synth (which allows you to control other synths as well), the portable Liberation and, completing the line up, the long awaited Memorymoog polyphonic.

The Memorymoog is a voice assignment polyphonic synthesiser with programming for up to 100 sound patches. Following the trend of several polyphonic instrument manufacturers, it is 6-note playable but with the obvious advantages of these six independent voices having 3 VCOs, low pass VCF, 2 ADSR contour (envelope) generators, linked to numerous modulation facilities. Control of these facilities is in the usual way, with one main set of panel controls acting on every note played.

The key to the instrument is its *System Controller* — a keypad/display that offers multi-function control assignments through a Z80 microprocessor.

Presentation

The Memorymoog is finished in light brown wood with brushed aluminium trim. The main panel has a black flexible plastic finish like the Moog Source with neatly inset red LED indicators for all switches. Synth sections are clearly marked and all control knobs on the sloping panel are black with silver trim, with strong, firm touch, grey switch buttons (except for light grey octave and system controller buttons). The latter has a 2-digit ¾" high LED display for programs and ¼" high alphanumeric LED display for instructions and settings.

The instrument is sturdily constructed, if a little heavy for one person to lift with a large flight case for safe transit. Control knobs operate smoothly, although the two dual concentric pots for Osc 2 and 3 frequency control are possible weak points. At the front right of the keyboard is located an 8 ohm mono headphone jack socket. At keyboard left are +1 and −1 octave buttons and the familiar Moog Pitch and Modulation wheels, with Pitch having a solid centre-stop position and Modulation moving freely — neither being spring-loaded. An electric cooling fan is fitted in the cabinet and operated on switch on.

The keyboard has 61-notes from C to C with a novel switch contact system under each removable sprung key. The latter goes on top of a conductive keypad that makes push contact link with two adjacent etched circuit tracks, all enclosed in a sealed rubber mould. This new design is cost saving and minimises noisy operation in the long term, although it does give a slightly 'spongy' feel.

At the rear are power switch and Euro-socket for separate mains cable, plus 15 in/out sockets as follows: XLR and unbalanced standard jack high level line out, 2 foot pedal inputs (0-5V range) for various panel functions; CV out (1V/octave) and two types of Trigger out: V-Gate (0 to 15V swing), S-Trig. (15V to 0 swing) — most synths will operate from one of these triggers; footswitch inputs for control of Contour Release and Hold, Program selection 'advance' and 'back'; Glide, External Clock In replacing internal LFO clock (for arpeggio control via drum machine etc.), and Cassette Interface Save, Load and Remote sockets.

Four rubber feet and a large rear plate name logo complete the instrument.

System Controller

The expansibility and versatility of a synthesiser's functions are obvious criteria in choosing a relatively expensive machine. Moog provide their own solution with the System Controller, which enables multiple operations from a straightforward keypad containing 0-9, A-D, Record Interlock and Enter keys. The program display and the a/n (alphanumeric) display give you a constant visual check as you change programs, store patches, change keyboard modes, use the cassette interface, alter arpeggiation modes or set up program sequences.

Once the synthesiser is switched on, program '1' is indicated and ready to play. At any time, one of the 100 factory (or your own) pre-programmed sounds can then be dialled by keying a number from 0 to 99 followed by 'Enter'.

Since manual tuning of all six voices (i.e. 18 oscillators) would be impractical, an Auto Tune button does this in some 10 seconds, after which the display reads '6 Tuned' (a lower figure indicating a possible fault).

Another important feature is that after a program is selected, any of its parameters can be altered by means of the control panel switches and knobs in the other sections. The moment you press a switch the a/n display reads 'Edit' and when a control knob is turned, two sets of three numbers appear instead, to show a value for the control as it is in the memory (on the left), and the current value (on the right). Getting back to the existing program is easily done by pressing the 'Enter' key.

The two buttons A and B on the controller allow you to advance to the next program or go back to the previous one. Holding down either button continues the stepping automatically with looping from end to start numbers (99-0). Footpedal control of these functions is also provided.

One of the most useful performance features of this section is that up to 10 'Program Sequences' can be prepared, to enable you to instantly select 10 sound programs for a piece in the correct order using Key 'D' plus the sequence number 0-9. 'A' & 'B' keys will step through the sequences one after another.

The 'C' key followed by a number 0-9 (and Enter) has various functions. C1 to 3 Save, Load and Verify your programs with a standard mono cassette recorder so that you can build up your own library of sound programs (100 at a time).

C4 will turn off voice channels that did not autotune correctly; C5 gets you out of tuning difficulties by putting all oscillators in unison, regardless of your manual settings; C6 and C7 are servicertuning aids; C8 is a useful protection function that puts the instrument into Enabled or Disabled states (shown on the a/n display). A unique security code of 4-digits can be assigned so that only you can record new programs or use the cassette interface; C9 puts the front panel into 'Live' mode and overrides memory settings for creating your own original sound; and C0 flashes on and off all LEDs as a service check.

A nice extra has been provided whilst you create a new sound using the live program function C9, or start from an existing program 0-99. At any time you can press the 'Record Interlock' key to temporarily 'Lock' these front panel settings into a buffer memory space. Then the existing program (or one of the others) can be dialled up, using the 'Enter' key alone, to make comparisons.

Storing a new program is easily achieved by holding the Interlock key, followed by Enter. This loads the front panel settings into the current memory place shown on the display. The controller's a/n display indicates 'Recorded' as your new sound is loaded (virtually immediately). Obviously, a little care has to be taken otherwise you may erase a patch you wanted to save.

Oscillators

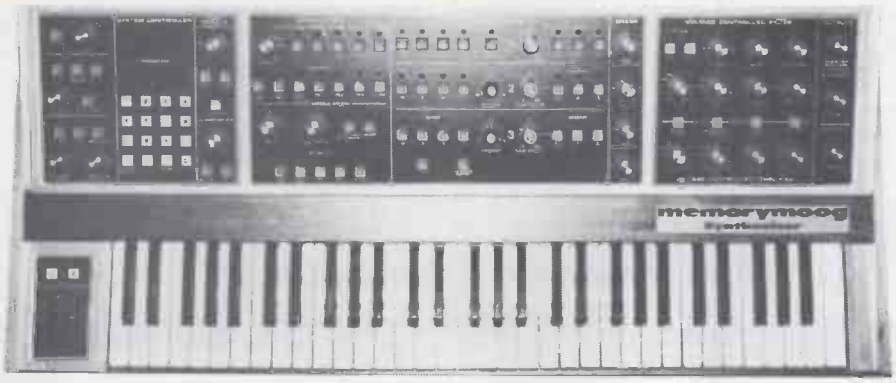
At first glance at the panel, it may appear that the oscillator pitch range is only from 16' to 2'. In fact, the octave switch and pitchwheel together can increase this upwards or downwards by a further two octaves. Also the footpedals, LFO, filter shape and Oscillator 3 can all affect oscillator pitch. Each of the notes played on the keyboards can use Oscillators 1-3. These have separate switch buttons for alternating between 16', 8', 4' and 2' pitch ranges and can use a mixture of pulse, sawtooth and triangle waveshapes (LED indicators show your selection). Pulsewidth can be set from 0 to 100%, producing a wave that becomes square at 50% and turns off at both ends. I would have liked the square wave to be at control centre rather than appreciably off. In practice, there is little benefit from mixing these waveshapes together except as an unusual modulation source on Oscillator 3.

A Sync switch locks Oscillator 2 to Oscillator 1 in 'hard' synchronisation. This means that Osc 1 controls Osc 2 by causing it to reset to the beginning of its cycle, which is dependant on the time Osc 1 starts its own cycle. At studio frequencies this produces interesting and unusual tonal changes; at low frequencies it can make complex rhythmic patterns.

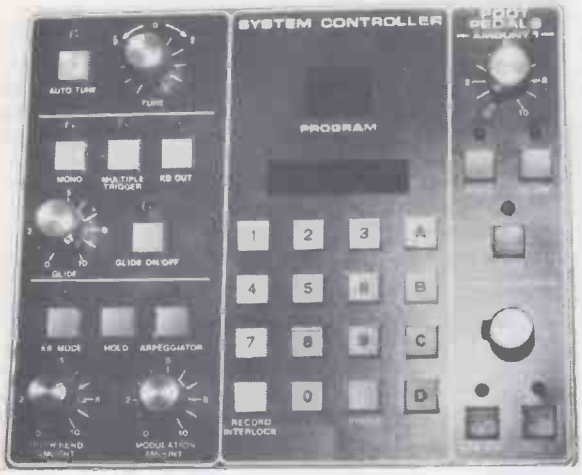
It is worth remembering that although the frequency still remains under the control of the keyboard and other modulation sources, the tonal changes are completely unlike normal filtering or modulation. With Osc 2

moog

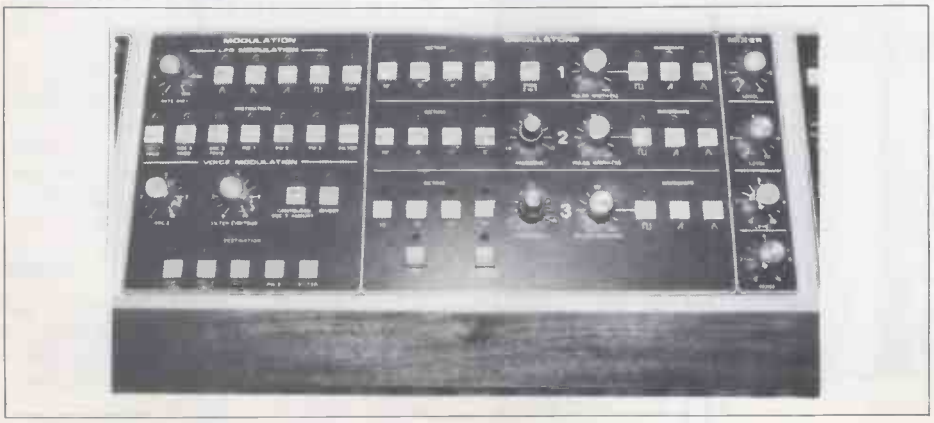
RECORDED ON DEMO CASSETTE No. 9



Above: The Memorymoog opened up.



Left: The System Controller and extra controls.



Bottom: Modulation, Oscillator and Mixer sections.

running faster than Osc 1, more coherent waveforms result than vice versa, and a particularly distinctive timbral effect is heard when Osc 1 remains at a fixed frequency whilst Osc 2 is modulated. (Soft sync simply holds the two oscillators together without producing odd waveforms).

Both Oscillator 2 and 3 each have dual concentric pots for coarse and fine 'Frequency' tuning up or down a minor Sixth. Oscillator 3 can also become a versatile LFO with its 'Low' switch on, dropping the pitch around 5 octaves, and the Frequency control range becomes 2½ octaves. Some very interesting percussive effects are then produced with the oscillator modulating Osc 1 and 2 pitch — tinkling marimbas and bells that speed up or slow down over the keyboard! You'll hear this on E&MM Demo Tape 9. For complex, but regular rhythmic pattern making, the keyboard control can be switched off. If you keep the oscillator in normal pitch, the latter control still increases the Frequency dual pot range to 2½ octaves for large manual sweeps of pitch during performance. It's use as a modulation source also gives an extremely large sweep range.

A mixer section then has separate level controls for Osc 1-3 and an additional pink noise source prior to entering the filter. The controls are designed to produce slight clipping distortion of the signals at high settings. As well as adding more 'bite' to the sound, this changes triangle waves to approximate sine wave shapes.

VCF and VCA

At this point, some mention of the circuitry would be useful, as the filter is the original 24 dB/octave low pass type designed by Dr Robert Moog, while most of the sound processing is done with the popular Curtis chips. The Z80 micro runs at 4MHz, using 3x2532 EPROMs for 12K of control logic, and 3xTCC5517APL-2 for RAM program storage. The whole base of the Memorymoog is packed with circuitry that is double-layered and has a large number of presets for precise calibration at the factory. Battery back-up is provided for the memories and a large rear panel heat sink runs quite hot during operation. There are two large empty IC sockets for further developments (although the review instrument was one of the early production models), and two cut-outs in the aluminium rear panel are for future connection to an Apple II, Roland MC4 Microcomposer and the Oberheim DMX drum machine.

Coming back to the filter section, there is surprisingly no high pass or band pass provision, although despite this omission the huge variety of sound treatments available more than compensates for this. The filter contour generator has the standard ADSR controls with specified times of A(1ms to 10S), D and R (2ms to 20S). These were approximately correct but the timing marks shown on the panel for these controls were unfortunately widely inaccurate. While the Edit a/n display does show a precise figure for knob settings, it would have been useful to have real time settings as well.

Other filter controls are Cut-Off Frequency, Emphasis, (or Resonance, with

VCF and Output sections.

oscillation on high settings), Contour Amount (or depth of contour effect on Cut-Off) and two Keyboard Track switches that select 0, 1/3, 2/3 or all of the key voltage for Cut-Off control. The latter is useful for maintaining a reasonable sound shape over the whole range for presets like piano or strings.

The VCA has a similar ADSR to the filter and there are also four switches that affect both contour generators. These are: 'Return to Zero' for reset of Attack on new keys; 'Unconditional Contour' enables the entire Attack phase to be completed before going onto Release, instead of jumping to Release as soon as a key is lifted; 'Keyboard Follow' gives the interesting effect of extending or reducing the ADSR times as you play over the keyboard; and 'Release' simply turns off the Release segment specified (overriden by the Release footswitch for piano-like sustain).

The final audio signal goes to the Output Section which has both programmable Volume (for matching levels of each sound you've stored), and Master Volume (to set final output to mixer, amplifier etc.). There's also an independent Headphone level as well.

Modulation

This is one of the most versatile modulation sections you'll find, offering the possibility of LFO as well as Voice modulation.

Five switches select either triangle, positive or negative sawtooth, square or sample-and-hold waveshapes, with frequency set by a Rate control (.1 to 100Hz). Another LED here gives a useful visual aid for slow rates. Up to seven 'destinations' can be selected for modulating Osc 1, 2 and 3 pitch or pulse wave shape, and the filter.

The Voice Modulation is a special feature of the Memorymoog and uses the filter contour shape or Oscillator 3 for control of up to five destinations — Osc 1 and 2 pitch and pulse wave shape, and the filter. These sources affect each voice independently and therefore help create a freer control modulation that's not found on many synthesisers. It is however, a very desirable function, and, as you'll hear on the demo, makes real woodwind, string, and brass ensembles (without a touch of 'chorus') that's as authentic as you'll get.

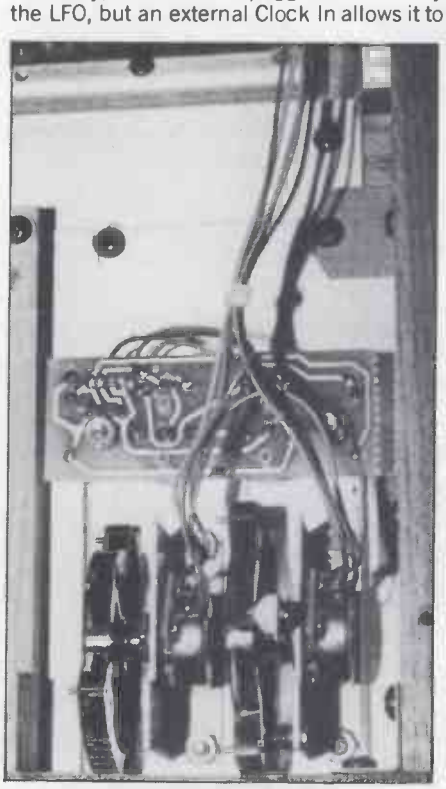
As well as separate amount depth controls for Osc. 3 and Filter Contour, you can either send the normal or the inverted filter shape to vary Osc 3's amount of modulation with time (for delay vibrato simulation and other 'moving sound' effects). On the review instrument, the Filter Contour did not trace pitch jumps in tune for all the voices (a possible preset misalignment may have been the cause).

Beside the Autotune facility, there's a fine tune control for 3 semitone pitch change up or down (non-programmable). The instrument can play in monophonic as well as polyphonic modes, and in mono mode powerful single note melodies can use from one to six of the voices — 18 oscillators per note!

The Keyboard Mode Switch also affects the keyboard priority for both mono and poly playing. For mono it sets last note, lowest note, or highest note priority; for poly, it sets cyclic and 'reset to voice A' (both with or without memory). When using the external synth CV out, it's obviously affected by your choice to send bass, lead or exotic cyclic lines. You can also have your external synth linked up and only bring it in when you want by pressing the Keyboard Out switch — a good idea! Multiple or single trigger can also be selected. Linear Glide (or portamento) works for mono or poly playing, with maximum time over the keyboard range taking about 10 seconds.

Two amount controls vary Pitchwheel range at least up or down an octave, and give a programmable 'initial' modulation amount for the LFO — then the Modulation Wheel adds to this setting for performance effects.

A versatile Hold function allows chords to be played (even ones you couldn't possibly stretch over the keyboard) and memorised. Consequently any note played will neatly transpose the chord to the new basic pitch — this is really an exciting effect to use as it plays normally difficult pitch mixtures from your solo lines. You can even put your held chord to use with the Arpeggiator! Switching in this function gives 8 different arpeggiation effects that continuously trigger notes played on the keyboard: from bottom to top, top to bottom, bottom to top and back, top to bottom and back, all notes at once; then any of these with memory (so you can remove your fingers). The only control missing appears to be 'random note selection'. Normally, the rate of arpeggiation is set by the LFO, but an external Clock In allows it to operate in sync with a drum machine or sequencer — an essential requirement.

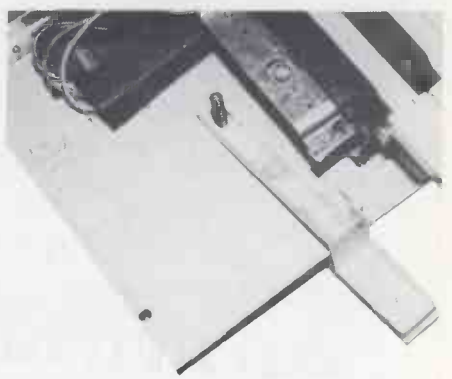


Inside view of the modulation and pitch wheels.

Footpedals

More emphasis is placed on footpedal control these days and the Moog scores well here, with a complete panel section devoted to various control possibilities. Unfortunately, footpedals are not supplied with the instrument (imagine buying a portable organ without a swell pedal!). Since two inputs are available, each is 'cross-coupled' to enable full operation from either input. Normally, Input 1 can control overall oscillator pitch, volume, and/or filter cut-off. Incidentally, all these functions are programmable as well. Input 2 controls the LFO modulation amount and/or Oscillator 2 pitch.

Rear connections.



The novel key contact mechanism.

Conclusions

The Memorymoog retails at £3,100 (including VAT) and for its price does offer sound synthesis at an advanced level in a format that's ideal for performance. The system controller is a sensible update to micro-age technology that has great potential for further expanding the instrument's functions.

The general presentation is good, with solid switches and flush mounted LEDs and displays, although there are small points that I've noted in the review already. The keyboard is not touch or pressure sensitive and the output is mono. The noise generator output in use with the oscillators really would benefit from a white noise output as well as pink. Nevertheless, the potential for making music with the Memorymoog is enormous — from as powerful a solo line as you'll ever get in mono mode, subtle modulated polyphonic sounds, to its exceptional sync timbral effects — and the demonstration tape for this instrument includes 10 minutes of one distinctive sound after another. Like other big polyphonics, it is aimed to be totally expansible through the system controller and possible computer link, whilst retaining all the features of a good analogue instrument.

Mike Beecher **E&MM**

The Memorymoog for this review was kindly loaned by The London Rock Shop, 26 Chalk Farm Road, London NW1. Please contact them at this address or telephone 01-261 5381 for further details.

News & Events

Publications

The end-of-year update to **CLEM**, the worldwide Contact List of Electronic Music, is still available in addition to a few copies of the May 1982 master list. CLEM contains hundreds of contacts in electronic music for tapes, LP's, books, magazines and radio stations. Payment should be made by money order, or in the case of artists by exchange for their records or tapes, as follows: May '82 $2.50 (Canada) $3 (U.S.A.) $4 (all other countries). 1982 update: same prices. Subscriptions (length depending on size of subsequent issues): $7 (Canada) $8 (U.S.A.) $12 (all other countries). Send to CLEM, P.O. Box 86010, North Vancouver, British Columbia V7L 4J5, Canada. **Mirage 5** is expected shortly; the latest edition of this well-produced e-m fanzine is available from Martin Reed, 614 Southmead Road, Filton, Bristol BS12 7RF, England. The third edition of cassette magazine **Inkeys** is due on February 1st. Featured will be Bernard Xolotl, Ian Boddy, Neil Ardley and all the usual news and information. Available price £1.99 from 50, Durell Road, Dagenham, Essex. An extensive list of books on rock, pop, video and movies can be found in the **Goldmine Bookshelf** Catalogue, available from Goldmine, Box 187, Fraser, Mi 48026 USA. They promise 24-hour despatch from their large stock. **John Wiley** have a new catalogue to herald their Computer Book month; copies from Baffins Lane, Chichester, Sussex PO19 1UD.

Instruments

Fairlight Instruments have announced the long-awaited new options for the Fairlight Computer Musical Instrument, the Rhythm Sequencer and the Analogue Interface. The Rhythm Sequencer, Page R of the software display, allows real time composition of complex rhythmic phrases, up to 250 of which may be chained to form a complete song. The Analogue interface is a hardware and software package which allows the CMI to control or be controlled by up to eight 1 volt per octave synthesisers, guitar synths, lyricons etc. Further details from Syco Systems, 20 Conduit Place, London W2. Tel. 01-724 2451. **The Syntauri Corporation** of California have introduced the Composer's Assistant for their Apple 2-based alpha Syntauri synthesiser. Up to 16 separate polyphonic tracks may be viewed, printed on paper, adjusted for timing variances and edited. Now, they say, "anyone who has an alpha Syntauri can quickly turn it into an intelligent electronic transcriber". Contact Syntauri Corporation, 3506 Waverley St, Palo Alto, California 94306 USA. Rumours from **Chase Musicians** about another new introduction from America, Oberheim's OB-8 synthesiser, expected by February.

Musicians

Further news from **Chase** is that they've gone into music management. First act to break is **Deluxe-A**, a Shrewsbury duo consisting of Laurence Parry (synths) and Mandy Davies (vocals). Their EMI single 'Boys on TV' features a complete Oberheim synth/sequencer/drum machine set-up and is expected to chart with a little help from a neat production job by Classix Nouveau's Sal Solo. Watch out for other Chase artists. EMI also expect to release a new **Kraftwerk** LP soon. Warren Cann and Hans Zimmer of **Helden** have rescheduled their London Planetarium concert after a fire destroyed a large amount of Fairlight hardware and software. The new date is Tuesday, March 1, at 7.30 and 9.30 p.m., and tickets are available from the London Planetarium, Marylebone Road, London W1, priced at £4.00 each and note that an sae should also be sent.

Video

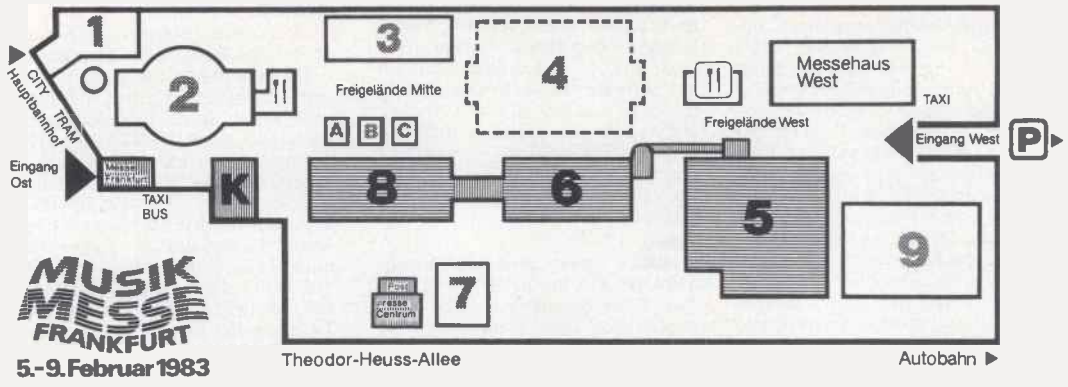
GML's latest broadcast equipment includes the 101S PAL/SECAM Sync Pulse Generator and the 8500 Digital Slide store, claimed to have infinite capacity. Further information from Planform PR's Chris Smith or Colin Harding, Fleet (02514) 29455. **RCA's** TC 1700 CCTV control system is a micro-based unit capable of handling 16 to 32 cameras and 2 to 4 monitors, with keyboard programming for sequences of shots, 'quick looks' and prepositioned scenes. Further information from Norbain Imaging, 0734 864411.

Dates

Frankfurt Music Fair, 5-9 Feb, last day open to the public. **ASCE Sound 83 Exhibition**, Cunard Int'l Hotel, Hammersmith, London, 22-24 Feb. **Music Industries Conference,** Melia Don Pepe Hotel, Marbella, Costa del Sol, Spain, 21-25 April. **Nor-Com** Civil & Military Communications, Oslo, Norway, 3-7 May. **Nunsuch Guitar Festival,** Ewell Court House, Surrey, 13-14 May. **SIM HI-Fi Ives,** Milan Fair Centre, Italy, 9-14 June, last two days trade only. Nat'l Assoc. of Music Merchants **(NAMM)** Show, Chicago, U.S.A. 18-21 June. **Electronic Organ & Piano Trade Show,** Connaught Rooms, London, 31 July-3 August. **British Music Fair,** Russell Hotel, Bloomsbury Centre, London, 31 July-3 August. **Printed Music Fair,** Waldorf Hotel, Aldwych, London, 31 July-3 August.

In Brief

A correction to last month's guitar review: the **Westone Concord Bass 1** costs not £199.95, but an even more reasonable £119.95. JHS will distribute a new **Audio-Technica** gooseneck mike, the ATM83G designed for mixing console use and retailing at £49.00 inc. VAT. JHS, Salem House, Garforth, Leeds LS25 1PX. Tel. 0532 865381. An export drive is planned by **Acorn Computers** to make their models educational standards during 1983, with particular reference to the BBC Micro to be used in the second TV 'computer literacy' series. **Thandar Electronics** have taken a £100,000 export order for logic analysers to go to Japan, a major coup in their view for the TA 2080 model. Thandar, London Road, St Ives, Huntingdon, Cambs PE17 4HJ. Tel. 0480 64646. The carbon/glass fibre **Steinberger** Bass guitar has won yet another US design award, this time a top five 'Award of Excellence' from Materials Engineering magazine. **Thorn EMI** have slashed the prices of several music video cassettes, including E&MM reviewed tapes by Kate Bush, Hot Gossip and Genesis, to £19.99. **Stereo TV** may become commonplace before long as the BBC investigates the possibility of adding an additional sound channel to their transmissions. **Ian Boddy** is composer in residence for a week at **The Triangle Sound Workshop,** a new Arts Lab based in Birmingham intended to give cheap and easy access to electronic instruments, studio equipment and PA information. A demonstration/concert will take place on Feb 19; several educational courses are planned for the first quarter of 1983 and application forms can be obtained from Jill Pope, The Triangle, University of Aston Arts Centre, Gosta Green, Birmingham B4 7ET. Tel. 021-350 2320.



Frankfurt Music Fair 1983

Frankfurt am Main, 5-9 February

More than 700 exhibitors from 32 countries will attend Frankfurt's Music Fair 1983, with impressive contingents from Great Britain, France, Italy and the Netherlands in addition to Japan and the U.S.A., and even from China, India, Mexico and Luxembourg.

The first four days of the exhibition are limited to trade dealers and professional musicians, but the last day (Wednesday 9th February) will be open to the public. Attendance figures have been rising since the fair became independent in 1980; in that year, 29,300 visitors from 64 countries attended. By 1982 the number had risen to around 40,000 and this year a further increase is expected.

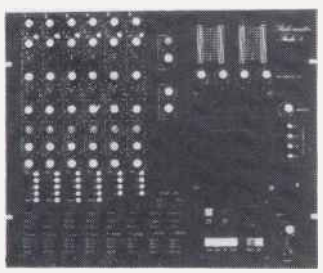
Over half the visitors to the Fair are buyers from the music trade and related industries, with another third being musicians and music teachers. The event is truly international, not only in terms of exhibitors but also in terms of the interest generated in the world-wide music business.

The Fair is intended to be a showcase for new products as well as for long-established and traditional instruments. Each year the Third World contributes an increasing number of small instruments, and in 1983 there will be exhibitions of string, wind and percussion instruments from China, Korea and Taiwan.

The impressive complex of exhibition halls in Frankfurt give a total floorspace for the show of over 60,000 square metres. As usual there'll be an active musical fringe programme, and the exhibition organisers hope that "The Frankfurt Music Show will again exercise an intensive effect on the world market of those interested in music in 1983 and, it is to be hoped, provide powerful stimulation for successful business in that year".

Further details are available from the organisers, Messe-und Ausstellungs-GmbH, Frankfurt am Main, Ludwig-Erhard-Anlage 1, POB 97 01 26, D-6000 Frankfurt am Main 97 Germany. Tel. (06 11) 75 75-1. Below we've listed some of the British contingent at Frankfurt, supported by the British Overseas Trade Board and sponsored by the Association of Music Industries, 62 Park View, Hatch End, Pinner, Middx HA5 4LN. Tel. 01-428 4700, and the Piano Manufacturers' Association, c/o Ramsdens, 22 Beech Road, Lowestoft, Suffolk. Tel. 0502 62819.

C-ducer pickup.



RSD Studio 4.

Adam Hall Supplies Ltd Southend-on-Sea. Hardware & Electrical Supplies for Sound Equipment and Allied Cabinets. New range of handles & corners, aluminium extrusions and Fane loudspeakers.

Canary Ltd Southend-on-Sea. Canary Mixing Desks. New versions of the 16.2 and 10.2 mixers and 200/400W stereo amps. Prices stable or reduced over last year.

Carlsbro (Sales) Ltd Kirkby-in-Ashfield. Bass & PA Sound Equipment. Eight new models including Hornet 45 lead, bass & keyboard, Cobra 90 bass, bass combo & lead. AD 1 analogue delay.

C Audio Ltd Stretham. Professional Amplifiers and Mixers and Electronic Crossovers.

Cerebrum Lighting (Sales & Hire) Ltd Surbiton. Stage & Effects Lighting Systems. Starblazer Autoscan Motorised Spotlights, Pulsar lighting desks, Gamma control disks, Powerdrive stands, Minimist smoke machine, Cloud Nine smoke machine, Astro-floor disco floor light modules.

Cliff Electronic Components Ltd Caterham. Jack plugs and sockets and cabinet accessories and control knobs.

Colin Barratt (Exports in Sound) Ltd Cheadle. SMS Amplification, SMS Drum Cases, Lew Chase Guitar Strings Accessories and Straps, Fibre Instrument Cases, Overwater Guitars; Lion Amplifiers.

C P Cases (Manufacture) Ltd Brentford. PA Systems and Installations and all Components. Mini Compact PA system, Micro Compact system doubling as wedge monitor.

C-Tape Developments Ltd Aldershot. Microphones & Mixers, C-ducer pick-ups, a range of flexible contact microphones for wind, string and percussion instruments.

Cymbals & Percussion (UK) Ltd Leicester. Drum cases, sticks and heads, tuned percussion instruments, other drum and percussion accessories, Viscount Tuned Percussion, Pro-Tip and Tri-Sti sticks, Nomad cases.

DSN Marketing Ltd London. Loudspeaker cabinets and components, including Thunderbolt 2-way cabinets.

Fane Acoustics Ltd Batley. High power sound reproducing equipment, including Studio 200W speakers, HF250 tweeter, Disco 200 full-range driver, Colossus 15 x 18 bass drivers.

Futuristic Aids Ltd Leeds. Sound amplification equipment and loudspeaker systems.

General Music Strings Ltd Pontypridd. Musical instrument strings, for all instruments from guitar to harp. Range of Jen Synthesisers, mike stands and speaker stands.

Hiwatt (Biacrown) Ltd Surbiton. Amplifiers & speaker cabinets, from the comprehensive Hiwatt range.

EMI/Chappell Ilford. Sheet music and books.

Hornby Skewes Leeds. Musical instruments, amplifiers and accessories and educational instruments, Teisco synths.

James How Industries Ltd Bexleyheath. Rotosound and other strings for acoustic and electric guitars.

Jim Marshall (Products) Ltd Milton Keynes. Amplifiers and combos. The usual range of Marshall stacks, the combo range and new 5506 60W 1x15 bass combo and 5305/5306 1x12 combos. Two new amp heads based on the successful split channel reverb amp, demonstrated in a large soundproof booth.

Klark-Teknik Research Ltd Kidderminster. Sound processors.

Leech Manufacturing Co Ltd Salford. Comprehensive range of loudspeaker enclosures, from 1x10" to 100W handling models.

Martin Audio Ltd London. Monitor loudspeakers and horns and loudspeaker systems.

McKenzie Acoustics Ltd Barnsley. Loudspeakers for the professional.

MTR Ltd Bushey. Public address equipment, musicians, recording and other electronic equipment. ACES range of graphics, crossovers, power amps and desks, tape recorders including 16 and 24-track 2" machines, Badger practice combos, Vesta Fire modular effects, CUTEC mixer and 4-track cassette, TC equalisers.

Nashville Music Strings Ltd Rhondda. Musical instrument strings, speaker, keyboard and associated stands.

Nemesis Loudspeaker Technology Ltd Knutsford. Chassis loudspeakers, full range of ohm amplification, featuring as star product a new 12W practice combo. New 125W head amp available as 1x15" keyboard combo with 4 channels.

Novello & Co Ltd Sevenoaks. Music publications.

Ohm Amplification Ltd Knutsford. Amplification equipment, dust covers, loudspeaker enclosures and accessories.

Oval Audio Equipment Ltd Lancing. Mixing decks, power amplifiers and guitar amplifiers, Series 3 range of mixers, including a 16.4.2, a range of loudspeaker cabs from Audio Electronic, MOSFET power amps, graphics and limiters.

Oxford University Press Oxford. Music publications.

Peters Edition Ltd London. Music publications.

Project Electronics Ltd London. Serious Lighting —"Great West Lighting".

Recording Studio Design Ltd Luton. Power mixers, amplifiers, range of speaker cabinets and accessories. Two new mixers, a 16.4.2 and a 16.8.2, the very successful Studio 4 and MOSFET amps.

Re-an Products Ltd Dartford. Electronic hardware.

Rhino Music Spares Dartford. Musical accessories.

Soundcraft Electronics Ltd London. Mixing consoles, including the Series 2400 28/24 mixer, and tape recorders including the new SCM762 24-track. New Series 200 portable mixers, Series 400B modular consoles. Also the Stagesound Series touring 'mega-console'.

Soundtracs International Ltd Surbiton. Discotheque equipment and band amplification.

Superwound Ltd Bexleyheath. Strings for acoustics.

Terry Gould International Northampton. Musical instrument accessories.

Tyneside Leathercrafts Ltd South Shields. Accessories for all musical instruments, military and marching bands.

Zero 88 Lighting Ltd St Albans. Theatre/live music lighting console and other lighting equipment.

Laney Amplification Ltd Cradley Heath. Sound amplification equipment and loudspeaker systems.

Pulsar Light of Cambridge Ltd Cambridge. Stage lighting systems.

Rose-Morris & Co Ltd London. Vox amplification, Berg Larson mouthpieces, James Galway tin whistles, other musical instruments and accessories. New Vox Climax combo endorsed by UFO, Vox guitars, Limpet drum pads.

Vox Ltd.

Berg Larsen Ltd (sharing stand with Rose-Morris).

JVC UK London. KB500 stereo keyboard, G250, G350 and other organs, new range of electronic keyboards.

Custom Sound London. Custom Sound, Roost and Trucker Amplification.

Casio UK London. Casio keyboards, including the new PT-30 and 405.

Cliff Electronic Components Caterham. Electronic components, plugs, sockets and connectors.

Roland UK Brentford. Roland, Boss and AMdek keyboards, effects and peripherals.

Musimex London. Accesit, Alembic guitars, Burns guitars, Great British Spring Reverb, Strata guitars, Trace Elliot amps, Seck mixers, Tubby drum.

Yamaha UK Milton Keynes. Yamaha drums, amps, keyboards and synthesisers.

White Amplification Sunderland. Transistor PA amps, slaves, mixers, speaker enclosures and a new keyboard amp. Little Rock range of value amps, new bass and lead head amps.

Premier Drum Company Leicester. Percussion and accessories.

The music press called it 'Real Magic'

The Casiotone 701 has received a great deal of critical acclaim from the music press. Music World, for example, from whom we took our headline, also called it 'the most talked about new instrument of the year.'

Why? There are a good many reasons, but as Organ Player put it 'there is so much to take in with the 701 . . . it is going to be very difficult to cover the whole instrument in the space available.'

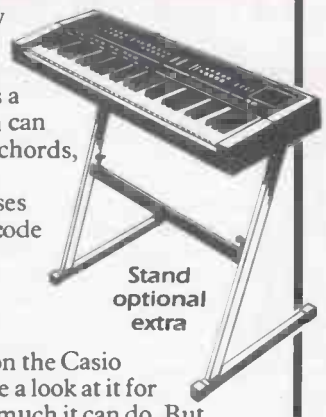
So let's just talk about the main points. Basically, the Casio CT701 is an eight note polyphonic keyboard covering five octaves, and featuring 20 preset voices, complemented by 16 drum rhythms.

20 preset voices

It also features the Casio Chord System which can be programmed to sound any of the 20 voicings, which don't have to be the same as that of the melody line 'so a nice split function here' (Music World).

The CT701 also features a Memory Play function which can store up to 345 notes and 201 chords, to play back along with you.

One more feature that uses the memory is the MS-1 bar code scanner which actually reads bar coded music and stores it in the memory to play whenever you want.



Stand optional extra

In fact, there's so much on the Casio CT701, that you'll have to take a look at it for yourself to discover just how much it can do. But for now, let's leave the last words to the music press. 'I can think of no better all round keyboard' Music World. 'A tremendous addition to the range of Casio Keyboards . . . it will lead the way' Organ Player.

See the Casio Keyboard range at your local music shop or fill in the coupon below.

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Please send me details of the CT701 and the Casio keyboard range, together with the name of my nearest Casio dealer.

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2/E&MM/83

The complete Sharp/Compu Music system.

Micromusic

Enter the Compu-Music Age!

Now your home micro can become a complete musical band

We test the Amdek Compu Music system linked to the Sharp microcompute

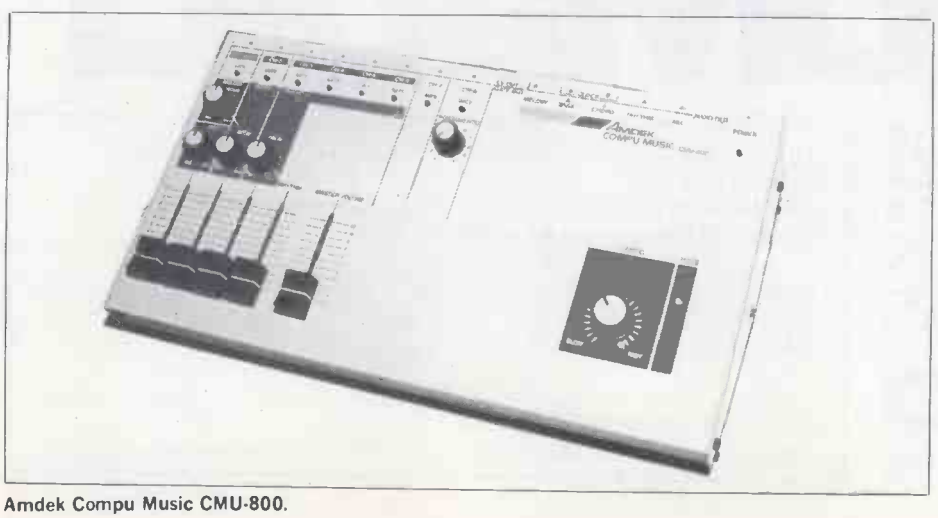
The Roland Corporation's research with microprocessor based musical instruments has set its own innovative course of development with the early MC-8 Micro-Composer, followed by the MC-4 and synthesisers with digital oscillator control, such as the Juno 60 and Jupiter 8. With the Amdek Compu Music system, Roland have introduced a means of creative music making at low cost. The general concept of Compu Music is to allow musicians to use their existing home micro with the Amdek unit, CMU-800, to generate a fully polyphonic music score, complete with percussion rhythms if desired.

At the present time, the software has been prepared for three micros — the Apple II (using a disc based system), the Sharp MZ-80K (using cassette storage) and the NEC PC-8001. Both the Sharp MZ-80K and the Apple have their merits; the Sharp is considerably cheaper, whilst the Apple is being used with several makes of new instruments. Despite the very low price of the Amdek peripheral, it offers more facilities than currently available in one unique unit for micro control.

The sound sources for melody, bass, 4-note chords and 7 percussive sounds are generated in the Amdek unit, simply requiring an amplifier to complete the signal chain. In addition, control voltages and triggers for up to eight channels are available for driving 1 volt/octave synthesisers directly. To complement the well designed hardware, the software must be capable of adequately exploiting its potential, and here again the Amdek 'Soft-Package' is everything it should be: maximum user friendly, having minimum learning requirement, virtually crash proof, with music storage via cassette dump or disc boot.

No doubt the Roland research team collaborated with the sister Amdek company to impart some of their experience with the MicroComposers, as much of the MC-4 format is utilised. There is a possible added advantage that the VDU display offers — of *analysing* complete (screen) pages of music an instrument at a time. All that is required to connect the CMU-800 to a micro is a small interface accessory that has the necessary routing of signals to your micro's bus lines. Eventually, we should see many popular micros supplied with a suitable interface together with its software package.

E&MM are also researching the possibility of using the MZ-80A in place of the MZ-80K. Details will be published shortly. I am informed by Roland (UK) that variations in the software presentation may appear on other micros e.g. the Apple II, and it's quite likely that in a few months the name of Amdek will be changed for Roland on this and other products.



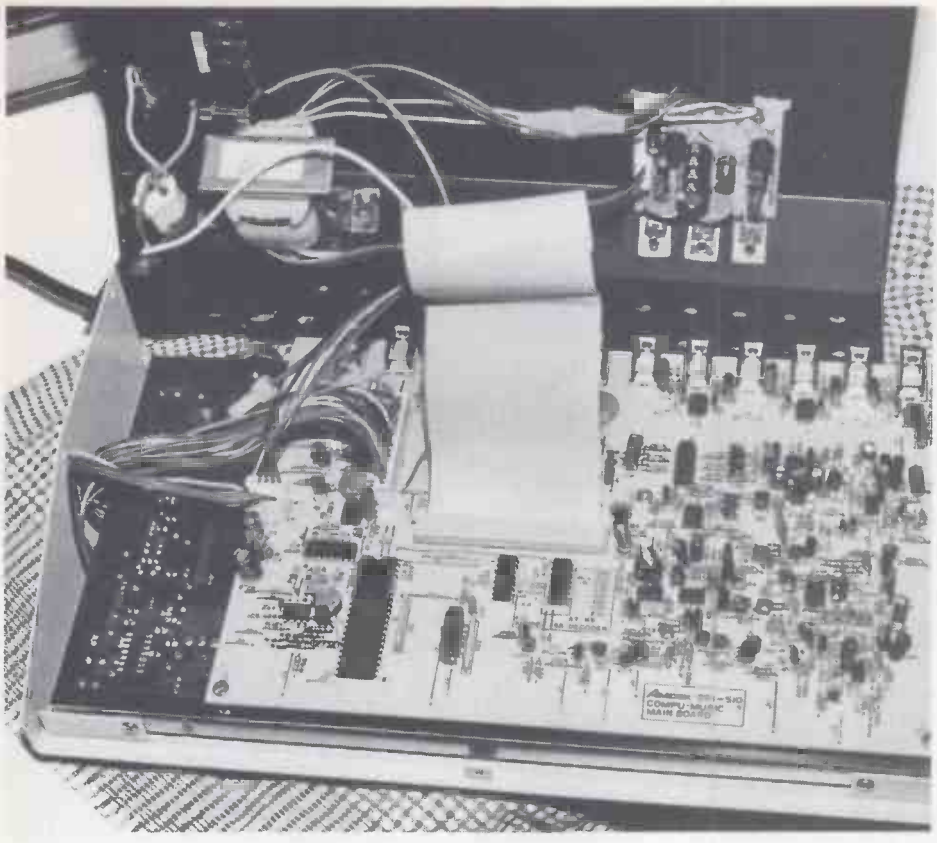
Amdek Compu Music CMU-800.

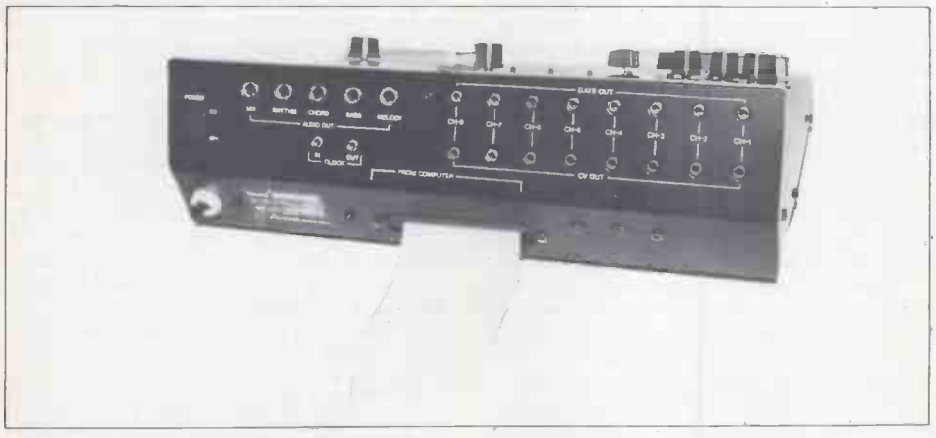
Setting up the System

Like most micros, the Sharp MZ-80K has a main bus output with address, data and special command lines. Normally this feeds to an interface unit that in turn allows connection of a printer, dual disc drive and other peripherals. The Amdek CMU-800 has a built-in ribbon cable that plugs directly into the supplied interface for the Sharp (IF-80C), and the ribbon cable attached to the latter plugs into the main bus socket at the rear of the micro.

When using the internally generated sound sources, 5 standard sockets offer a choice of a mono Mixed line output, plus separate Melody, Bass, Chord and Rhythm outputs for use with a mixer or tape recorder. Five sliders provide volume control of each output.

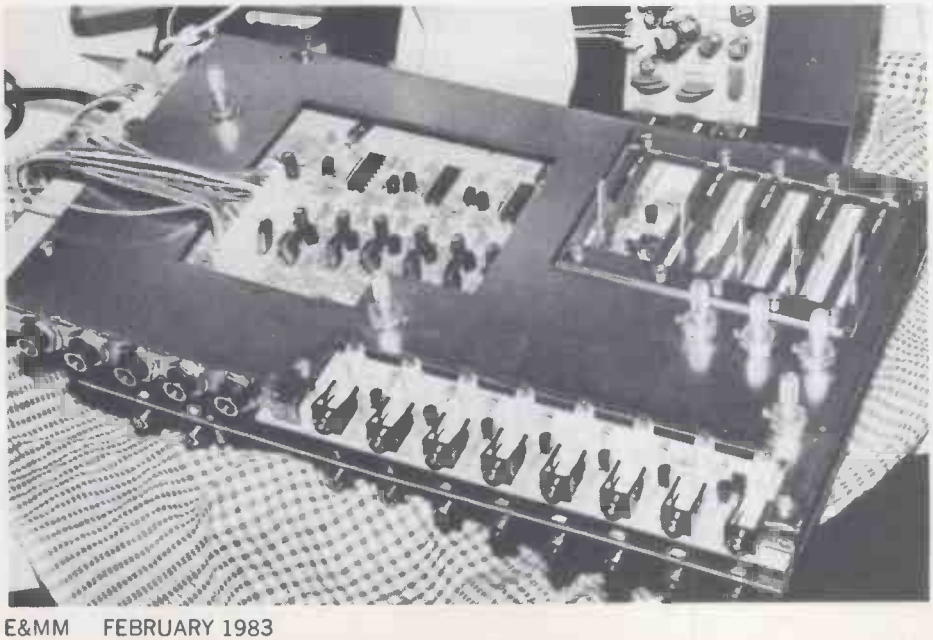
Each of the parts are termed 'channels', so we have Channel 0 = Percussion Rhythm patterns, Channel 1 = Melody, Channel 2 =





CMU-800 main board and PSU.

CMU-800 panel board.



Bass, Channel 3, 4, 5 and 6 = the independently programmed lines making up the 4-note chord, Channel 7 = Extra external CV + trigger output, Channel 8 = Second extra external CV + trigger output, with portamento control. Channel 9 provides a storage area for putting rhythm patterns created in Channel 0 in the correct order for your piece of music. Channels 1 to 6 also have alternative CV and trigger outputs. The 8 channels in all increase the scope of the Amdek system immensely, as your own 1 volt/octave synths (or Yamaha/early Korg synths via Korg MS-02 interface) can be connected and running alongside the internal sound sources! Further refinements exist — more of which later.

Other controls on the main panel are Melody 'sustain' and 'decay', Bass 'decay', Chord 'decay' that allow slight adjustment of gate times you've programmed. There's also a 'tempo' control that runs the completed piece over a wide range of speeds. In other words, the software in the MZ-80K receives interrupts from an oscillator in the CMU-800. If you prefer, a Clock In socket enables you to drive the whole system from an external source. For example, the E&MM Synclock is suitable or the E&MM MF1 Sync Unit (for tape recording sync). A Clock Out socket lets you synchronise another Amdek unit or sequencer.

Construction

Don't let the heading put you off — you can't build the Compu Music unit yourself! Having become convinced by all the publicity that the Amdek name stands for 'music kits', you'll now have to get used to another sphere of ready-made computer peripheral products (see last issue for further details).

The CMU-800 all metal case is extremely compact, with a smart sloping front in light beige with dark grey legending secured to a black base with 4 large rubber feet (measuring 333(W) x 108(H) x 193(D)mm and weighing 3Kg).

The base plate rear holds the PSU board, transformer, 80mA mains fuse holder, power switch and direct coupled mains cable, giving +5V, ±15V.

Two large boards occupy the underside of the front panel of the instrument, with the top being the 'main board' containing processor logic, including an 8255 programmable peripheral interface, 2 x 8253 programmable interval timers, 74LS138 and 74LS139 for address decoding, some 20 or so transistors and discrete components, plus 'width' and 'offset' presets. All sound generation is done here for the rhythm unit — the digital melody and chord lines give approximate square waves, whilst the bass is more triangular in shape. No tonal changing can be done, except through an 'external signal' input on a synth or by using a sound processor at the output. Eight CV outs are produced on this board, with Clock In/Out (all through 3.5mm PCB mounted sockets), and the computer ribbon cable (via Interface box) secured onto the board. All ICs, sockets and ribbon are direct soldered, with connectors only used to link upper and lower PCBs.

The second PCB 'panel board' is mounted back to back, with 8 PCB mounted 3.5mm 'trigger' sockets plus 5 chassis mounted standard jack 'signal output' sockets. As with all Amdek products, the construction is first class, a separate metal chassis prior to the front panel providing a very sturdy support. Signal mixing and red LED indication of power on and gating operation is also done here.

Screen Software

Having switched on the CMU-800, the MZ-80K is then powered up and the special 'Soft Package' cassette supplied is loaded

direct from monitor since it is in machine code. This takes just over a minute (it's quicker than loading Basic!) and immediately runs the program to give a screen menu as follows:

```
Ø STEPS USED   AMDEK COMPU-MUSIC
13618 STEPS FREE          CHANNEL Ø
Ø-9 : EDITOR
E   : POINT EDIT
P   : PLAY
O   : LOOP PLAY
T   : TUNE
B   : CHANGE PLAY BIAS
C   : CHANGE CV BIAS
L   : LOAD FROM CASSETTE
S   : SAVE TO CASSETTE
V   : VERIFY WITH CASSETTE
?
```

Incidentally, before we discuss the above, it's worth pointing out that the program itself cannot be listed and is virtually impossible to access, since all the micro keyboard buttons respond as the program requests while others are ignored.

Most of the menu is self-explanatory, but if in doubt you could load the sample 'Lady Madonna' program from the cassette supplied to help familiarise yourself with the commands. Pressing 'L' key, you are requested for a File Name which can be overridden by the 'CR' (Carriage Return/Enter) key, and the file loaded. This piece used 2025 steps and lasted about 2 minutes (dependent on Tempo setting), taking 45 secs to load that's indicated by a return to the screen menu. All you have to do to play the piece is press key 'P' for once through or key 'O' for continuous repeat. At any time you can stop the music by pressing 'Q' and the tempo can be changed during the piece.

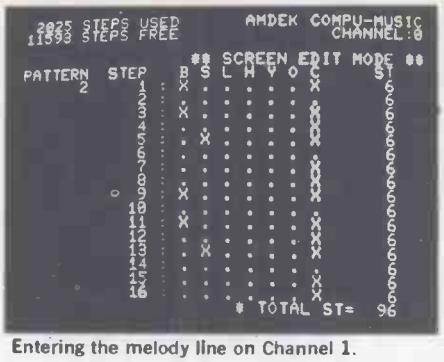
Channel Ø Rhythm programming.

If you've external instruments playing with the Amdek sounds, a press of the 'T' key gives A=440 (+10 cents). To transpose the whole piece into whatever key you fancy, simply type 'B' and enter the semitone bias from +24 to -24 (away from middle C). Another interesting feature is the ability to change the CV bias. Typing 'C' and entering from +24 to -24 will change the external synth pitch, but will keep the Amdek channel as normal, so you can put external sounds at other pitches for further harmonic effect. Saving on cassette is as easy as loading, and a Verify operation makes sure all is well. During all screen calls, the display changes and tells you what is happening, prompting you at various points for more information.

Composing with the Editor

The Editor Ø-9 indication on the menu provides the screen pages to compose your music. If you're starting from scratch, you'll have to load the master program again, otherwise your last program's still in memory with no way to clear it in one operation. The Editor code numbers refer to the Channel numbers as explained earlier. Since those are printed left to right across the Amdek front panel, it is easy to remember which channel to select.

Selecting the Ø key, you are asked for a Pattern Number. By the way, if you fail to give



Entering the melody line on Channel 1.

a number, the software provides a 'default' number itself (usually whatever was last chosen, to be sensible). The display then changes to show a 'dot' grid 16 x 7 steps long that lets you place an X where you want one of the seven percussion sounds to play. These are Bass drum, Snare drum, Low tom, High tom, Y=long cymbal, Open hi-hat, and Closed hi-hat. A flashing cursor can be manipulated in various ways over the grid, and the Step time can be inserted. The total step time is automatically calculated and a default step of 6 is given initially for 16 steps, totalling up to 96. Of course, any length of measure (bar) can be made simply by inserting Ø step times after the last step required.

In this Screen Editor Mode, all the keys move the cursor in a downwards loop over the grid, jumping back to the top for repeat, while the cursor direction keys jump over inserted X's and dots. Typing 'C' gives a copy function of any previous pattern entered, and 'M' gives instant play of the rhythms as it stands. If you ask for a new pattern number to work with, you always get the next one available, with a maximum of 240 possible rhythm patterns to make (each one uses up 17 steps!) provided you've enough memory left. Switching back to menu (typing 'Q') you can then enter channel Ø and specify the order you want your rhythm patterns played. You can do a sound check to confirm the order and at any time you can put the other parts with it by getting back to the screen menu with 'Q' and then using 'P' or 'O' to play.

Entering the notes is done with channels 1-8 and since it's really the same for each of these, we'll look at Channel 1. As with Channel Ø, if you are entering information in a completely new measure, the screen automatically goes into 'Insert Mode', instead of Screen Edit mode. Information is entered by any number of steps in each measure with you inserting CV, Step and Gate time for each step. The semitone pitch of each note is set by a number from Ø (for C two octaves below middle C) to 102. It's unlikely that your external synth will go up to this range (normally the 'footage' takes care of pitch range). Default figures make it hard to make mistakes, provided you keep the total step time of each bar the same length for consequent channels you prepare — that is, unless you want melody in 3/4, bass in 4/4 and so on!

The cursor controls are most useful and jump from CV to Step to Gate line by line. At the same time a set of Screen Edit control keys is available for:

```
*  : Measure End
[  : Repeat Top
]  : Repeat End
.  : Copy Last Step
I  : Insert
F  : Next Screen
B  : Last Screen
C  : Copy
T  : Transpose
D  : Delete
=  : Sound Edit
M  : Measure Play
P  : Point Play
Q  : Quit
```

Taking these in order, the comprehensive screen editing allows a Sound Edit (=) at each step, at each point a full play of all parts can be done (P) or a single bar with the channel displayed only played (M). The Insert command enables you to drop into any step of a measure and alter the pitch, step or gate. Measures can be copies from one channel to another any number of times with a semitone bias (transpose) up or down. This will also put existing measures one measure on. Individual steps can have the same treatment with the Transpose function. Any number of steps from the first in a measure can be deleted, or specific steps can be altered. A full stop (dot) simply copies the previous step wherever you've located the cursor. The repeat signs are inserted as immediate 'before' and 'after' repeat markers — this was the only command that didn't appear to be executing correctly — it kept on repeating! It also stops 'looping' taking place in the other parts. The measure end is made by typing the 'asterisk' key instead of a CV number and you 'quit' your entry with 'Q' to jump to the menu again.

So that's it — a remarkable little package that offers a lot of scope for the musician that could well prompt a new interest in the home micro, especially at its low price of around £400. The in-built sounds are fine for use as accompaniment, although the optional CVs to external synthesisers will be something you'll want to use, especially for melodies and solo counterpoints. This facility also puts the instrument into the professional user market. The percussive sounds are pretty good, with a full bass drum 'click', a snare drum that has a slightly high basic pitch, two different pitched toms, and three metallic cymbal sounds which range from 1½ seconds to a short tap. I would have liked preset adjustment for these individual sounds and an accent control. You'll also have to check your earthing with the computer to minimise background noise — then acceptable recording levels can be reached. Although no realtime keyboard to micro record facility is used, this system may well be a viable alternative because of its versatile 'sound editing' through the screen pages — you can *hear* your composition grow as you play the keys. *But in the Compu-Age the keys are on the micro!*

Mike Beecher **E&MM**

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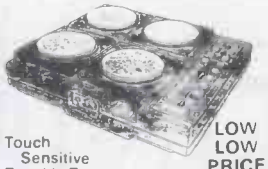

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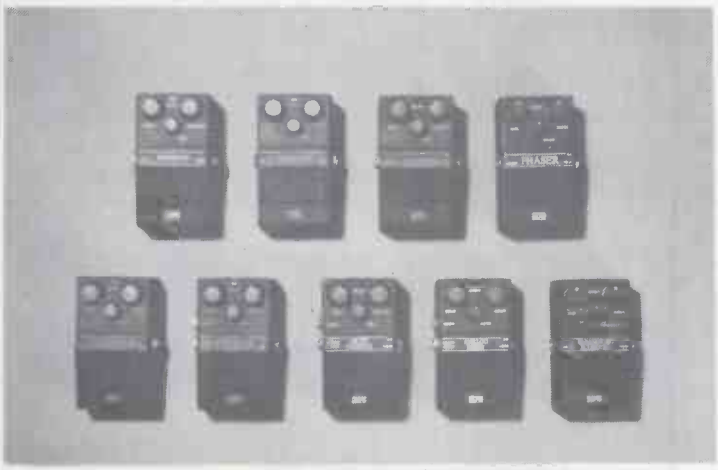

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BOOK REVIEWS

Synthesisers: An Easy Explanation
Dave Bristow
Published by Yamaha

Dave Bristow's handy booklet is intended for use with the Yamaha CS-01 Breath Control Synthesiser, but could with a little imagination be used as a basic instructional booklet for any monophonic synth. This is largely because the CS-01 has a simple, left-to-right, 'one-of-everything' layout, and the book follows this format in discussing the individual sections of a synth.

There's an opening glossary which helps to relate the terms used in the book to other technical and musical sources of information. This is followed by a short explanation of the way in which synthesiser functions relate to the characteristics of other musical instruments; pitch bend to string bending techniques on guitar, for instance. Then the main functions are investigated individually, first the high-note priority keyboard and then the performance controls, filter and envelope generator.

Bristow's approach to 'finding a sound' is highly practical, emphasising the fact that exact imitation is difficult and a reasonable impersonation coupled with appropriate expression is much easier. The breath controller is used in producing Saxophone, Trumpet, Whistle and Lead Guitar sounds, and there are some sensible hints for further experimentation. The overall approach is practical, informal and pictorial, with useful musical examples, and while the book's a must for CS-01 owners it should be of interest to many others with an interest in playing technique and expression.

Kemble Yamaha, Mount Avenue, Bletchley, Milton Keynes, Bucks MK1 1JE. Tel. 0908 71771.

Introduction to Electro-Acoustic Music
Barry Schrader
Prentice-Hall.

Barry Schrader's comprehensive manual dwells not so much on the technology of electronic and tape music as on the musical content itself. After vigorously defining the areas he intends to discuss, Schrader begins a survey beginning with Music Concrete and Tape Manipulation, covering several practical techniques of cutting and splicing, goes on to early electronic instruments and voltage controlled synthesisers and briefly discusses digital keyboards such as the Synclavier, and computer composition techniques.

The final section of the book comprises an analysis of several recordings of electronic pieces and a set of discussions with their composers. These include Luciano Berio ('omaggio a Joyce'), Morton Subotnick ('Until Spring') and Gordon Mumma ('Cybersonic Cantilevers'). It's fascinating to gain an insight into the compositional principles of what can be relatively inaccessible pieces, and Schrader's strengths lie largely in such areas rather than in discussions of live electronic music or fields other than the classical.

Basically the book concerns classical electronic music, with a noticeable bias towards the US and relatively obscure designs such as the Buchla synth and the Synket. Given these limitations, and a very careful awareness on the part of the reader of the American tendency to over-generalise (for instance in stating that digital reverb is rather too expensive to be in general use) the book makes a satisfying and informative read.

LinnDrum

As the successor to the very successful Linn LM-1 Drum Computer, the new Linn digital drum machine has a lot to live up to, in addition to the manufacturers' claims that it's smaller, cheaper and more efficient than its predecessor. However, since the volume of orders for the new machine has been so great that the LM-1 can no longer be produced, the LinnDrum remains the top of the market in self-contained drum machines and it's only fair to regard it as such.

As most people will be aware, the Linn uses EPROM's to store sampled acoustic sounds from genuine drum kits, and triggers these sounds from a sophisticated chainable memory matched with a miniature stereo mixer and a comprehensive set of inputs, outputs and trigger options. The LinnDrum comes in a 22" x 12" x 4½" case with wooden end cheeks, a black metal panel slightly angled, and white lettering, and weighs 22lbs.

The control layout has been changed considerably as compared to the LM-1, allowing space for stereo panning sliders as opposed to the left/right switches of the older model, and for a more comprehensive programming display. There are three types of control, sliders with small plastic caps reminiscent of ARP synthesisers for mixing and panning; rotaries with knurled-edged knobs for Tuning, Volume and Tempo; and large square tablet pushbuttons with a slight indentation for Play/Stop, individual voices and all the control functions.

Using the Linn

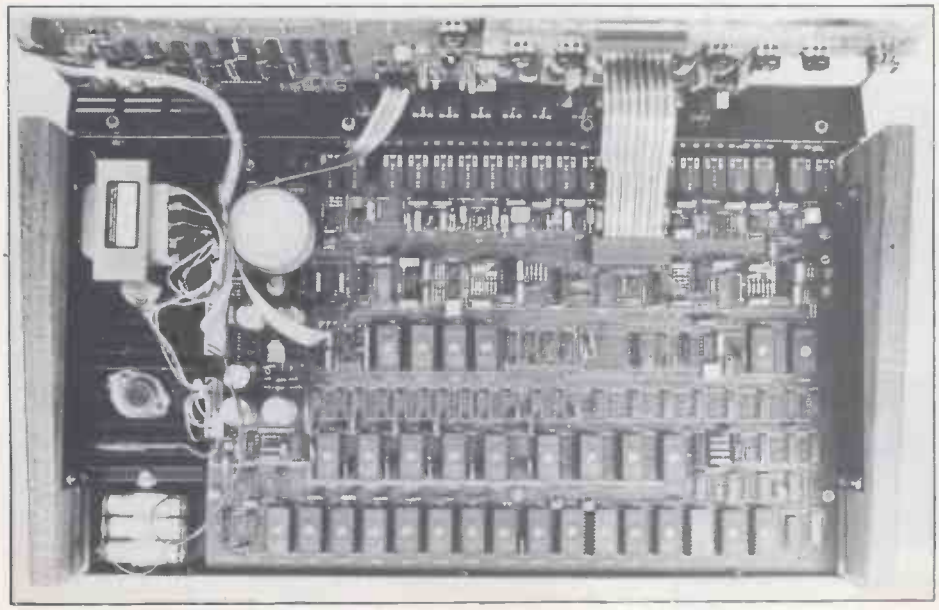
The simplest way to use the machine is by simply pressing the individual pushbuttons. Some instruments have more than one button, referring to the same sounds being played at different volumes and so enabling dynamics to be programmed. Snare has three; Bass, High Hat, Cabasa, Tambourine and Ride Cymbal each have two. High Hat also has two options, open or closed. Some of the buttons programme two sounds according to a selector on the bottom row; this doesn't mean that Clap and Ride Cymbal, or Conga and Low Tom, can't occur simultaneously in a programme, but simply that they have to be programmed in separately.

While playing by hand or during automatic playback some of the drums can be tuned; in each case this involves clocking through the EPROM at a faster or slower speed, resulting in a shorter or longer sound in addition to a shift in pitch. The snare drum in particular sounds very strange at its lowest tuning due to this 'time expansion' effect. There's also a control to adjust the decay of the closed High Hat.

The basic sounds and dynamics can be arranged in up to 49 separate rhythm patterns, numbered 1.1 to 7.7. The first 35 patterns contain preset rhythms loaded at the factory which can, of course, be erased. These can be called up easily by pressing two of the seven 'Select Rhythm Pattern' buttons to produce the correct two digits on the LED display, and pressing Play/Stop. If another pattern number is typed in, the new pattern begins playing at the end of the bar in the previous pattern.

Programming new patterns takes a little skill, but this is quickly acquired. Pushing Record and Play starts a metronome click (which has a volume control on the mixing section), every eighth click being slightly louder and representing the downbeat of a two-measure, 4/4 time repeating loop. If required, the time signature or length can be changed before programming by using the length function and cutting the loop to a new length, counting the number of clicks desired. In fact this can also be done to existing programmes, for instance turning a two measure 4/4 loop into one measure of 7/8 by keeping only the first seven one-eighth notes and permanently chopping off the rest. Once the metronome is running the instruments are tapped in individually or together until the complete pattern is built up, the loop continuing in the record mode until this is done. If a mistake is made an individual sound can be removed and reprogrammed using the Erase button.

Tempo can be displayed in Beats Per Minute simply by pushing the BPM button whether playing or stopped. It's also possible to gain a readout of the amount of memory still available (remembering that this depends on the complexity of the patterns programmed rather than just the number of them used) by pressing Record alone. This gives a percentage readout from 0 to 99%.



EPROM voice board.

Cassette Interface

If the memories are full, it's possible to dump their contents onto cassette tape simply by connecting a tape recorder to the rear panel In/Out sockets via a Speaker or Headphone output (line level being insufficient) and Aux In socket, starting the tape and pushing Store. It's possible to load the entire contents of the Memory, or only certain chains of patterns or 'Songs'. It's also possible to copy from one LinnDrum to another, to completely erase the memory contents, or to copy a pattern from one memory location within the machine to another in order to rearrange Rhythms according to performance order, perhaps.

A 'Song' is defined as a list of rhythm patterns to be played in sequence. These could represent an introduction, verse, chorus, fill, solo and coda. Various songs come pre-set at the factory, and can be called up simply by switching from Pattern to Song and pressing Play.

To construct a song, the upper row of control buttons are switched to their alternative functions and the required patterns are entered in order. Up to 99 patterns can be entered; after the last one, the Song is terminated by pushing End. Interestingly enough this doesn't actually stop the Linn's clock, but returns the machine to the start of the Song. In practice it will be found necessary to enter a few empty bars therefore, to allow time to stop the machine before it begins to play the whole song again.

Various Editing options are of course available; Step Up and Step Down buttons allow a Song to be scanned and individual patterns moved or removed, and in the pattern mode individual instruments can be erased and repositioned. Up to 49 songs can be held in the memory, each consisting of up to 99 steps or patterns. A Song can be played starting at any step by repositioning the starting point.

Extra Features

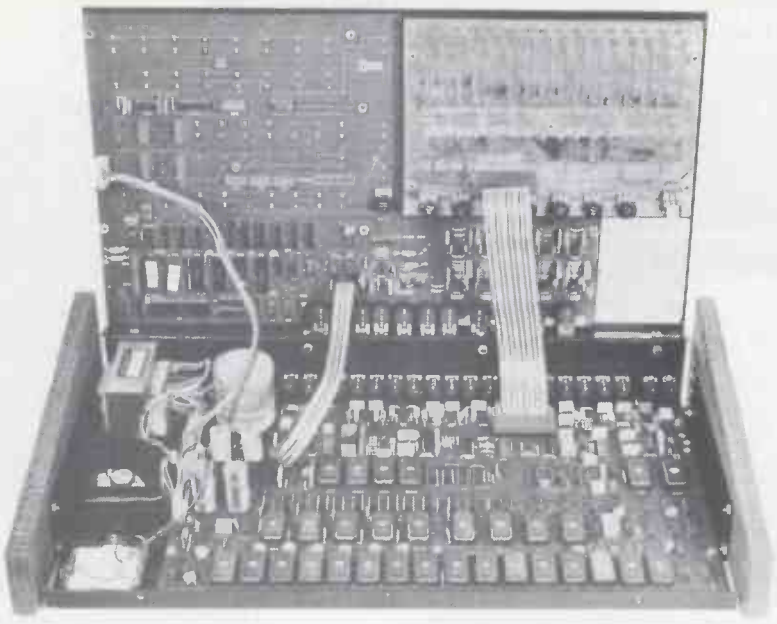
The LinnDrum has several other features intended to make it 'user friendly' to musicians. It can be programmed either to correct errors in timing during programming, by assigning a sound to the nearest metronome beat; or to artificially induce errors in playback, giving a 'human feel' with a variable amount of offset from the correct beat. This can vary from 'straight' to 'shuffle' or 'swingtime' in 6 increments, A to F.

In addition it has a trigger output to drive sequencers or arpeggiators at 5 volt level, programmable to operate on ⅛ notes, ⅛ note triplets, 1/16 note triplets, 1/32 notes, 1/32 note triplets, or on every repetition of the cowbell. The BPM/Trigger display can indicate which setting has been chosen.

Five trigger inputs are assignable to any of the LinnDrum's sounds, but normally refer to Bass, Snare, High Hat, Low Tom and Crash Cymbal. Each input has a sensitivity control and so can operate off a wide range of audio or click inputs, including click tracks which make it possible to replace poorly recorded sounds of conventional drum kits with Linn sounds. One possible application is to install crystal or piezo pickups in a set of practice pads and to 'play' the Linn manually by way of a change.

Two control voltage inputs at 0-5 Volts DC level allow variation of the Snare and Tom pitches, for instance by a control voltage pedal or a synchronised or random sequencer pattern. A rear panel socket allows connection of a Start/Stop footswitch, and every instrument has its own audio output for individual equalisation or effects.

Internally the Linndrum is a superb example of electronic engineering. All of the components, apart from the transformer, 5V regulator and battery back-up are mounted on three PCB's. The main board mounted in the base (see photograph) holds all of the power supply components, voicing circuitry, DAC's and output mixing circuitry. The Z80 CPU, Firmware EPROM's and CMOS program memory are mounted on the front panel PCB along with the pushbutton keys, LED displays, trigger, sync. and cassette interface circuitry. The third board holds the mix and pan sliders as well as the timing and volume controls.



Internal construction.

Connections between the boards are made in usual computer fashion using DIL headed ribbon cables, apart from the power supplies.

Despite the data compression techniques used the huge amount of memory required to produce the voicing can be seen from the close-up of the voice board; in fact 124K of EPROM is used.

The Bass drum, Snare, Sidestick, Cabasa, Tambourine, Cowbell and Claps are each contained in one 4k x 8 memory; Tom-Tom and Conga use two 4k x 8; Hi-Hat requires four 4k x 8; while the Ride and Crash cymbals each need eight 4k x 8 chips! The IC's surrounding the EPROM's are mainly counters, used to clock through the memory data for each voice. The clock rate can be varied for the Snare, Tom-Tom, Conga and Hi-Hat according to the controls on the front panel.

Note that there is only one Tom-Tom voice which can be programmed to run through at different speeds to simulate 3 Toms therefore they cannot be played simultaneously. The same is true for the 2 Congas.

The Linn's EPROM's can be exchanged for any of those on a sample recording available from Linn. The dealer installs a low insertion force socket which allows the user to change chips simply and easily himself; alternatively, Linn can prepare a set of chips from a tape provided by the user, so theoretically the LinnDrum could be used to produce any percussion sound, or for that matter any short sound effect to order.

Clearly the LinnDrum is in a class of its own in terms of sound quality and user options. Already well-established is studios and groups throughout the world, it's now become clearly identifiable on several successful recordings, and musicians are starting to investigate the ways in which its various options can be used to maintain the same sort of flexibility that has always been associated with conventional percussion. For those who can afford it, the LinnDrum remains for the moment unequalled.

E&MM

The LinnDrum is available from the UK distributors. These are: Scenic Sounds, 97-99 Dean Street, London W1V 5RA, Tel. 01-734 2812, and Syco Systems, 20 Conduit Place, London W2. Tel. 01-723 3824/44. Recommended price is around £2,650 including VAT, dependent upon the dollar exchange rate.

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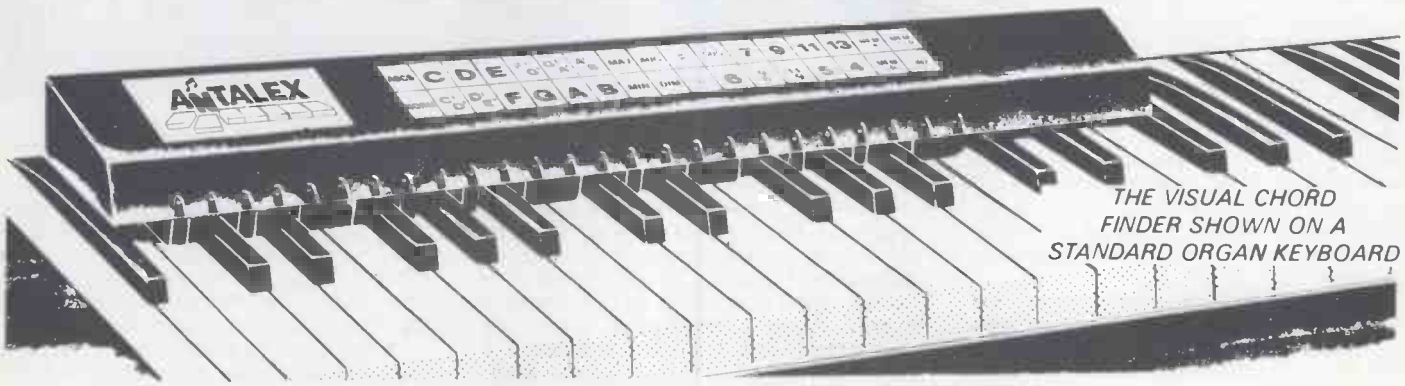

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Godwin Drummaker 32P

The colourful and well-constructed Drummaker is more than a drum machine, it's a complete accompaniment section with rhythms, arpeggios, chords and bass. Although this specification would tend to bring to mind the home organ market, the unit is by no means limited to such applications and the quality of the sounds is such that many keyboard players and instrumentalists could find it attractive.

The basic unit is a wooden-cheeked box sixteen inches wide and seventeen inches deep, with a sloping front panel and a flat top which would allow stacking of other units. Two sets of footswitches and a volume pedal connect to the back panel, and in addition there's a 20-way connector and a selection of audio outputs. The 20-way connector is used either for a set of foot pedals or for a small free-standing keyboard either of which transpose the bass, chords and arpeggios as desired.

The model we examined was provided with the pedalboard option, and so comprised two fairly hefty packages, the main unit being provided with a folding handle which could be concealed underneath the body of the unit. Audio connection was initially to the General Output jack socket on the back, which gives a combination of all four accompaniment sections. The Volume control is on the right hand side of the upper part of the control panel, and working from right to left is the mixing section for the percussion sounds, the On/Off switches for each of the four sections (each with an LED indicator), the mixer for each of the four sections, and an overall tuning control giving a total range of a semitone.

The mixer sliders aren't arranged in the same order as the control sections on the lower part of the front panel, so these may just as well be looked at from left to right. The first control section is for Tempo, with a black knob and a 21 position rotary scale; Start/Stop, an orange tablet pushbutton with a red LED indicating the downbeat on each bar; and Key, a smaller yellow tablet with a green LED showing it's switched on, which means the unit only operates when a pedal or key is held down. This section is marked Timing.

The next section is marked Rhythms. There are 16 rhythms, each with a small square tablet switch coloured according to style; green for slower dance rhythms such as Waltz and Tango, brown for Latin rhythms such as Samba and Mambo, orange for alternative timings such as 5/4 and 6/8. A twin 7-segment LED display shows which pattern is playing, while a small push switch gives a variant of each pattern. A larger switch gives a fill-in or an alternative intro to each pattern.

The percussion voicings themselves are extremely good. The bass drum is a satisfying thump, the snare adequate although the tuned portion of the sound is a little too high-pitched. The cymbal is excellent, with an initial click, multiple detuned analogue sounds for a metallic effect, and a little white noise. The overall effect is of something like an 18" ride cymbal.

High-hat is shorter and higher pitched but just as good; it shares a mixing control with Maracas, which appears on Mambo and Bossa and consists of a chiff of white noise which isn't very closely imitative. Tom-Tom is a higher pitched version of the Bass Drum, without the sort of skin bend which is now becoming common, and shares a mixing control with Conga, which is a little higher pitched still.

The final pair of sounds are Claves and Cowbell, which are very good with a convincingly wooden feel in the case of the former and a good combination of initial click and metallic effect in the case of the latter. Use of the Variation button tends to bring in increased use of the cymbal, Tom-Tom offbeats and rapid accompaniment by the Conga, Claves or Cowbell as appropriate.

Most of the rhythms are well composed, the variations often being more complex although the basic patterns are by no means sparse. Foxtrot has a Shuffle on the Variation, Disco is simple but powerful with cymbals on the offbeat and High-Hat triplets, and the 6/8 and 5/4 patterns are an unusual and welcome inclusion.

The Intros and Fills are imaginative and varied, but while the rhythms themselves are latched so that they only change over at the end of a bar, this doesn't apply to the Fills and so these have to be activated at exactly the right time. This can be done with a front panel control, or with the footswitch unit containing controls for Stop/Start and Intro/Fill. Intro has to be switched on before Start is pushed, and this again can be done by hand or by footswitch.

The next front panel section is marked Mode. Small green tablet switches with associated green LED's select Memory Bass and Memory Chords, which maintain the selected key although no pedal is held down, and a larger yellow tablet switch marked OFC gives the equivalent of 'Single Fingered Chord', deciding whether the full chord or only the root note needs to be fingered. Musicians with more than two feet will find it's possible to play chords on the pedalboard as well as the keyboard.

To the right of Mode is the Bass Section. A horizontal slider varies the tone of the Bass sound from Contrabass to Bass Guitar, which is slightly sharper. Unfortunately it's not possible to vary the decay length, or indeed to apply a simple on/off organ envelope which would make the unit compete with the Eko or Taurus bass pedals. Apart from the Manual/Pedal mode, the bass sound can be played automatically when the rhythms are running in Walking or Alternating modes, which produce respectively complex patterns of fifths and octaves from the root note together with a general rising/falling pattern, or much simpler alternations of Tonic and Dominant.

The next section, Chords, offers four

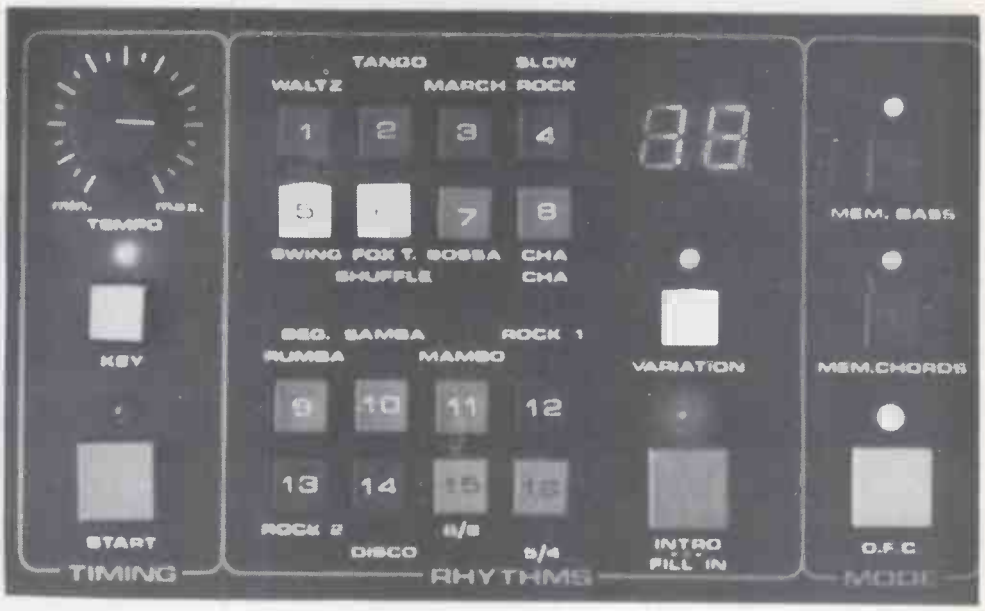
Drummaker pedals, swell and footswitches.

sound, Brass 1, Brass 2, Piano and Guitar. The former pair are short wah sounds with a relatively high degree of resonance, 2 being slightly brighter. The latter pair have the option of a brief period of Sustain, which is useful in filling out the sound, and changing from one pair to the other gives a different pattern of chords. The sounds are reasonable: Piano is a passable electric piano effect, whereas guitar sounds more like a synthesiser filter closing effect.

Lastly Arpeggio, a very versatile section which weaves intricate patterns around the other accompaniments. Again there are four sounds, Piano (as on the Chord section), Guitar (as on the Chord section), Spinet (a slightly weak but interestingly imitative sound) and Synth, which is a very powerful, phased version of Spinet and typical of the sort of sounds Jean-Michel Jarre uses.

Four different arpeggios are available, with different sets of four assigned to each of the sixteen rhythms. In addition the Arpeggio function has three Notes available, produced by different free-running oscillatory and so building up to give a powerful detuned chord effect; each Note plays a slightly different tune. The arpeggios typically range from simple runs to very complex double speed patterns.

In operation the Drummaker is efficient, colourful (with all those LED's!) and expensive-sounding. Each of the four sections can be taken out of an individual socket for equalisation, and there's a 5 volt positive going trigger to run sequencers or synthesiser arpeggiators. Use of the footswitches to start and stop the rhythms, or to convert the chord and arpeggios to minor or seventh chords, is simple and efficient, and the pedalboard is easy to use. One point is that, because the keyboard runs almost 2 octaves from F to E, the pitches available on the 1 octave C-C pedalboard have had to be rearranged slightly; at A they drop an octave and proceed upwards so that the pitch of the top C is the same as that of the bottom C.



Construction is to very high standards, with 7 easily removable circuit cards internally and a wide use of LSI chips to provide microprocessor control. Perhaps this hasn't been fully exploited, as some form of programming or chaining would have been welcome, but the functions that are included are all useful.

The Drummaker 32P replaces the successful Drummaker 30, having a slightly greater specification particularly in the ability to recognise inverted chords played on the keyboard and assign the correct root note. It's to be incorporated into several of the new generation of Godwin organs such as the SC 85 and 95, but it's worth stressing again that it's not limited to this application. For solo guitarists, keyboard players, synthesists in need of a control unit for a set-up of sequencers or arpeggiators, or many other types of entertainer, the Drummaker may be an ideal accompaniment unit.

E&MM

The Godwin Drummaker 32P is available from Sisme UK Ltd, Wembley Commercial Centre, Unit 3-8, East Lane, Wembley, Middx. Tel. 01-908 2323, priced at £598.00 including VAT and either pedalboard or keyboard.

DRUM MACHINE SUPPLEMENT

Wersimatic CX1

Wersimatic CX1.

Wersi have been supplying modular electronic organs for over ten years now. From the outset, the object was to design and manufacture circuits which could be successfully assembled by the home constructor to produce a professional quality instrument.

To prevent the customers finished unit becoming obsolete as new advanced circuitry was developed, Wersi make all new additions or conversions compatible with their earlier models.

The new Wersimatic CX1 is such a development which can be used to replace current Wersimatics or is available as a 'stand-alone' unit with an integral keyboard. Basically it is intended to be a complete, computer controlled, rhythm and auto accompaniment unit.

The instrument circuitry can provide percussive voicing, bass chords and arpeggios. The percussive voices for rhythm are: Bass drum, Snare, Hi-hat (long and short), Cymbal, Tambourine, Brushes, Maracas, Cowbell, Claves and Synthedrum. Bass can be any one of three voices; Guitar, Tuba and Synthesised Bass. Chords can have Electric piano, Guitar, Wah Guitar, Strings or Organ voicing, complemented with arpeggios of Brass, Clarinet, Banjo, Bells or Strings.

The front panel of the stand-alone CX1 is split into two sections; one for instrument programming/playing, the other for rhythm selection and control functions. Two dual-concentric knobs are provided on the control panel for tempo fine/course and volume/balance adjust. A four digit LED display in the top right hand corner of the unit can be used to display tempo (BPM), tuning of the accompaniment section (A-440) and programming location along a measure. The downbeat is also displayed, when running, with a four segment square on the fourth digit.

Each switch on the panel has a built-in LED showing exactly the machine status during programming.

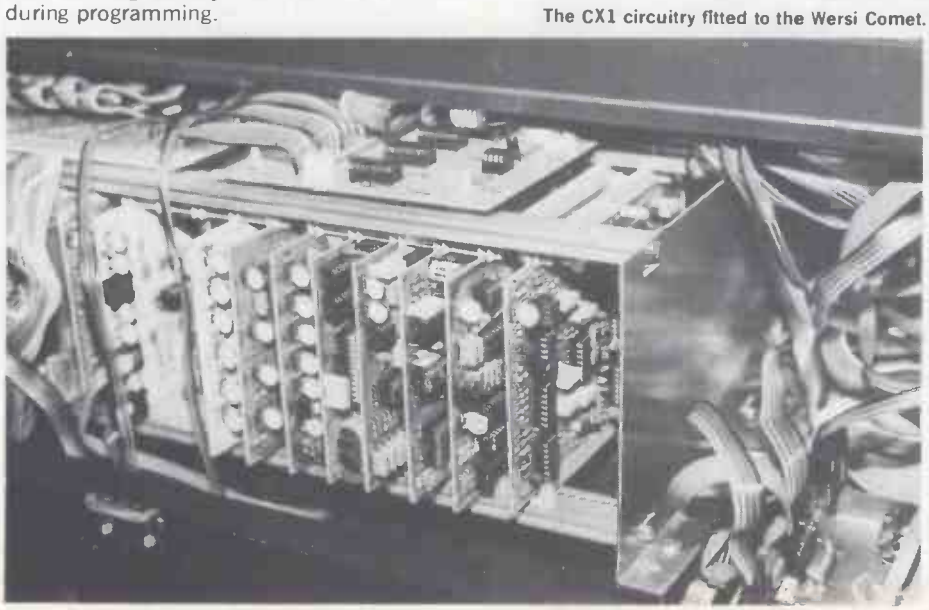
Programming

In total 48 rhythms of 32 beats are provided. The first 32 of these are factory preset, but the last 16 are user programmable. These are selected by pressing one of the 16 rhythm keys and one of the 4 rhythm banks: 1, 2, 3 or Composer. The selected rhythm is loaded into a buffer memory which allows it to be edited and then stored if required as another rhythm in the composer bank. Intro's and breaks each of 16 beats are also available for each rhythm and can be brought in at any time.

A rhythm can be programmed in two ways; Dynamic and Static. The 'Dynamic' mode allows the rhythms to be entered in real time with a metronome guide, entries being made on the instrument programming panel. A roll can be produced for any voice by pressing 'Roll' and the instrument. Beats can be erased by pressing 'Erase' and the required voice.

The 'Static' mode allows entries to be made step-by-step in beat/rest fashion, from a score. A combination of these can be used to program a shorter bar for complex timing by entering the Bass in Static mode and pressing End Set at the required position. The other instruments can now be added in the Dynamic mode with the shorter bar length.

The CX1 circuitry fitted to the Wersi Comet.



Level dynamics are only provided for Bass and Snare programmed by using a '+' for loud and a '-' for soft.

Up to 16 sequences of 32 rhythms can be preprogrammed and stored using the 16 rhythm keys in the sequence mode. A 'Super Sequence' mode can be used during playing which runs through all of the stored sequences (which could be up to 512 bars) lasting possibly 20-30 minutes.

The tempo is also stored for all of the 48 rhythms.

Accompaniment

The accompaniment section can also be programmed to complement the rhythms.

A similar memory arrangement applies; the first 32 are factory preset and the remaining 16 user programmable.

Bass, Chord and Arpeggio information is entered via the instrument panel with the notes entered from the lower manual of an organ or, in the case of the stand-alone unit, the built-in keyboard.

Memory Storage

All of the programmed information; rhythms, accompaniment, tempo and sequences can be saved or loaded on cassette. Wersi do, in fact, supply tapes to assist the user create his own library. A 'check' function allows the load to be verified. The memory also has battery back up which allows user programmed rhythms to be retained when the power is switched off.

Voicing

Wersi have spent many years perfecting their voice cards. The instruments provided are preset, as is the stereo panning, but the sounds are certainly convincing.

The instrument programming panel can be 'played' when the unit is running which allows extra percussion to be inserted between the programmed beats.

Circuitry

The circuitry for the CX1 under review was fitted into a Wersi Comet organ, as shown in the photograph.

All the circuitry is mounted on eight PCB's which slide into a mother board.

The microprocessor is a Z80 which is used to control analogue percussion voices and standard organ type generators for the accompaniment.

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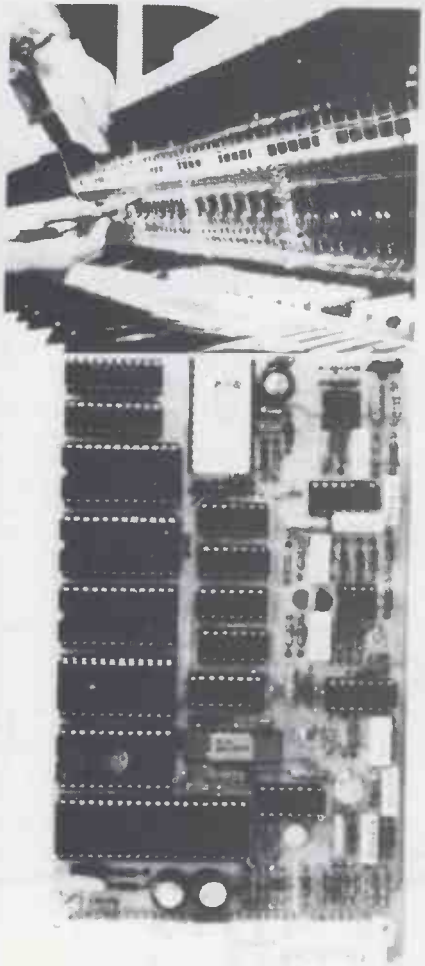

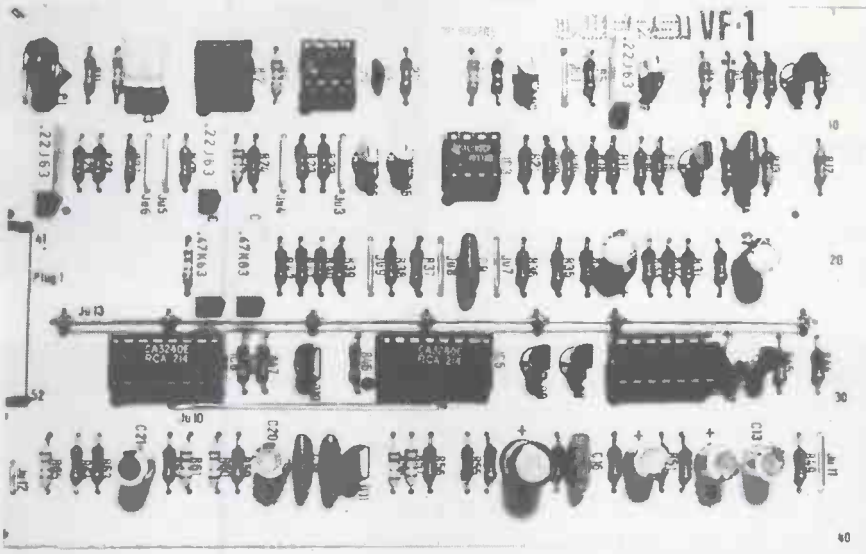

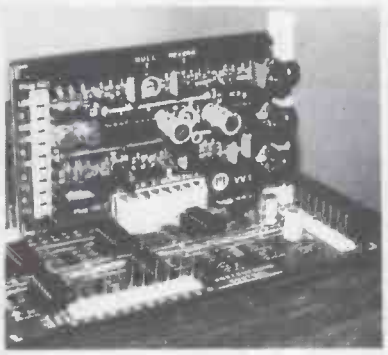

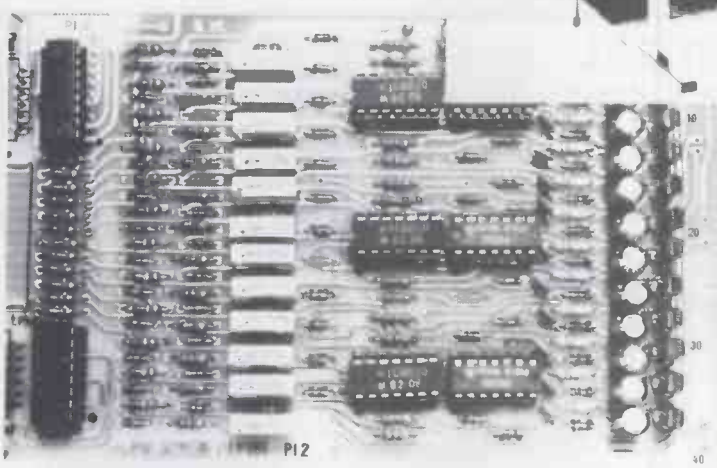

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E&MM/2

In the Comet version of the CX1 the panel was split into two sections; the control panel to the right of the lower manual and the instrument programming panel which protrudes from beneath the organ body on the far left (allowing 'live' left handed additions to the programs).

The stand alone unit differs from the organ version by the inclusion of a power supply, an integral keyboard, tuning control and two switches which allow minor and seventh auto chords to be selected, all housed in a very attractive case.

Conclusions

The CX1 certainly offers a comprehensive range of accompaniment. Complex sequences of rhythms, bass, chord and arpeggios can be programmed with ease due to the power of the internal processor. The preset rhythms provide a useful library with which new rhythms can be created and stored in composer memory or dumped onto tape.

CX1 control panel.

Instrument programming panel.

The voicing is varied and comprehensive complementing the rest of the Wersi range. Indeed, the quality of Wersi kits is extremely high. All of the circuitry is held in a card rack with gold-plated connectors and the wiring is supplied in pre-formed looms ready for connection.

The kit price of the CX1 circuitry which can be fitted to an existing organ varies between £527 and £627 depending upon the host model, while the stand alone unit, also available as a kit, comes at £1,177 or ready built at £1,782 including VAT.

Kenneth McAlpine **E&MM**

For further details contact Arthur Griffiths of Aura Sounds, 14-15 Royal Oak Centre, Brighton Road, Purley, Surrey. Tel: 01-668 9733. Please mention E&MM when doing so.

DRUM MACHINE SUPPLEMENT

Mattel Synsonics

RECORDED ON DEMO CASSETTE No. 9

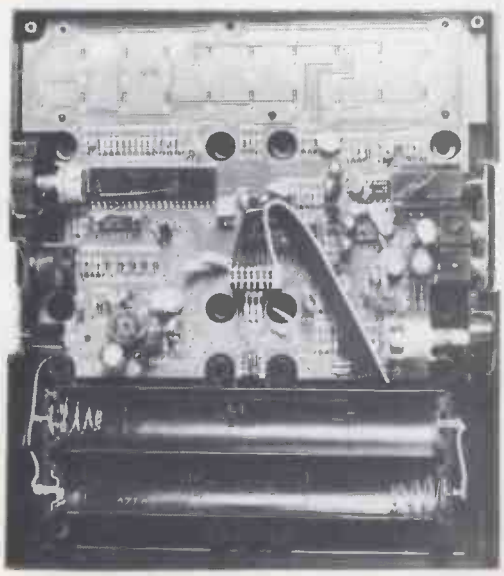
The latest example in what seems to be a new trend in miniaturised manually-operated drum kits is the Synsonics from Mattel Electronics. Although usually thought of as a toy manufacturer, Mattel have in recent years been expanding into digital electronics and computers. Despite this fact, some people are bound to see the Synsonics as a toy just as the EDP Wasp was seen as a toy on its first release.

Physically this interpretation is understandable, although in fact as was the case with the Wasp, nothing could be further from the truth. The Synsonics has a black plastic case measuring 8 inches by 9 inches by 2 inches high, with four grey 3 inch rubber pads taking up most of the top surface and a panel of 19 pushbuttons accounting for the final inch or so. A domino display of 5 LEDs occupies the centre of the playing surface and each side of the casing has a selection of controls and sockets.

On the left hand side a recess contains a minijack 9V DC power input and a 5-pin Din accessory jack, above which there is a thumbwheel tuning control for Tom Tom 1. On the right hand side a similar recess contains a stereo headphone quarter inch jack socket and two phono line out sockets marked left and right, above which is the thumbwheel On/Off volume control.

A sliding panel underneath the instrument allows installation of six HP11 batteries.

The Synsonics is specifically designed to be played using a pair of drum sticks: we used Premier military sticks which are reasonably short, to compensate for the small size of the pads, of an average weight, and lacking a plastic tip which isn't necessary for this application. That's not to say that the Synsonics has no 'feel' at all; the pads give a slight bounce-back, but not sufficient for rapid rolls or repeated flams.



Internal circuitry.

This deficiency is largely compensated for by the automatic controls described below.

Although the Synsonics uses standard piezo pickups beneath the pads, the construction of their mounting is much sturdier than first appearances would indicate and the whole unit can withstand very heavy treatment. This was amply demonstrated at the recent 'Hands On Show' by multikeyboardist/percussionist Patrick Moraz, who laid into the unit with a vigour which led the audience to look out for flying pieces of plastic; in fact the pads were not even marked.

Manual play is only one of several modes in which the Synsonics can operate. The four basic sounds in this mode are Tom Tom 2, a lowish pitched syndrum sound with a slight downward bend; Snare, a reasonable combination of an oscillator thump and a chiff of white noise; Cymbal, a slightly overlong burst of high-pitched pink noise; and Tom Tom 1, which is tuneable over a range of five octaves. This facility can take it through very high bird-call effects, disco drums and boobams down to an almost subsonic bass sound on which the built-in bend is less significant.

The final sound is Bass/Metronome, a fairly undistinguished thump which isn't really long enough to simulate a bass drum effectively. This can play automatically, the speed being set by two buttons which also serve to synchronise the unit to the same tempo as a piece of music. This is achieved by pushing the buttons together in time to the music; after a few repetitions the microprocessor takes an average of the times between beats and resets the clock to the appropriate speed.

While the bass drum can only play single strokes on every beat, the other sounds can be programmed to repeat two, four or eight times on any of the 16 beats in a bar. This is achieved by putting the Synsonics into record mode and using any of the three buttons assigned to each pad, which automatically produce these repetitions; if pushed in combination the buttons produce an assortment of rhythms on each sound including Rock (by pushing slow and medium) Waltz (medium and fast) Offbeat (slow and fast) and so on.

Within the limitations of the number of fingers the player can persuade to fit onto the control panel, these buttons in combination can produce some very useful patterns. The cymbal can be changed to a closed high-hat using the 'Accent' button, and this change is remembered by the microprocessor if desired. The three cymbal repetition buttons double as memory buttons, and the user can skip from one memory to another while playing; one difficulty is that no back-up is provided for the memory, whose contents are lost on switch-off.

All functions of each pad are indicated by the appropriate LED, the centre LED referring to the bass drum. If required the bass drum can be switched off during playback, and Tom Tom 1 used on a very low tuning. The bass drum can be played manually, but only with some difficulty, as the playback tempo tends to change if this is done.

After about half an hour with the Synsonics, the following modes of use become clear; Manual Play with sticks, Manual Play with Repeat Buttons, Unaccompanied Memory Play, Accompanied Memory Play with sticks or Repeat Buttons, Additive Memory Play (where the memory is left running and subsequently played strokes are added to the pattern) using sticks or Repeat Buttons, with in every case the option of using or not using the automatic Bass drum.

Clearly the possibilities are enormous. There are some problems — the cymbal sound is too long and blurs if repeated, the fastest Bass tempo is too slow for many applications, and there's no clock output for sequencers or arpeggiators. Unfortunately it's difficult to make modifications because almost all the work takes place inside what looks like a custom LSI chip, and there are no presets internally or externally to alter the sounds. However, if the basic electronic sounds, which clearly aren't intended to closely simulate an acoustic kit, appeal to you, the Synsonics gives as wide a range of operating modes as you could hope for. Whether it's interpreted as the first rhythm machine you can play along with, or the ideal aid in striking Kraftwerk-type poses, the Synsonics may be just what you've been waiting for.

E&MM

The Mattel Synsonics is available from various retailers, including the London Rock Shop where it is priced at £99 inc. VAT. Contact LRS at 26 Chalk Farm Road, London NW1. Tel: 01-267 5381.

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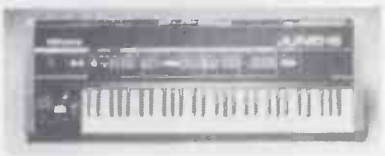

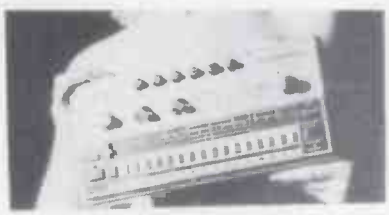

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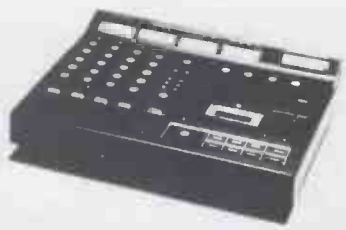

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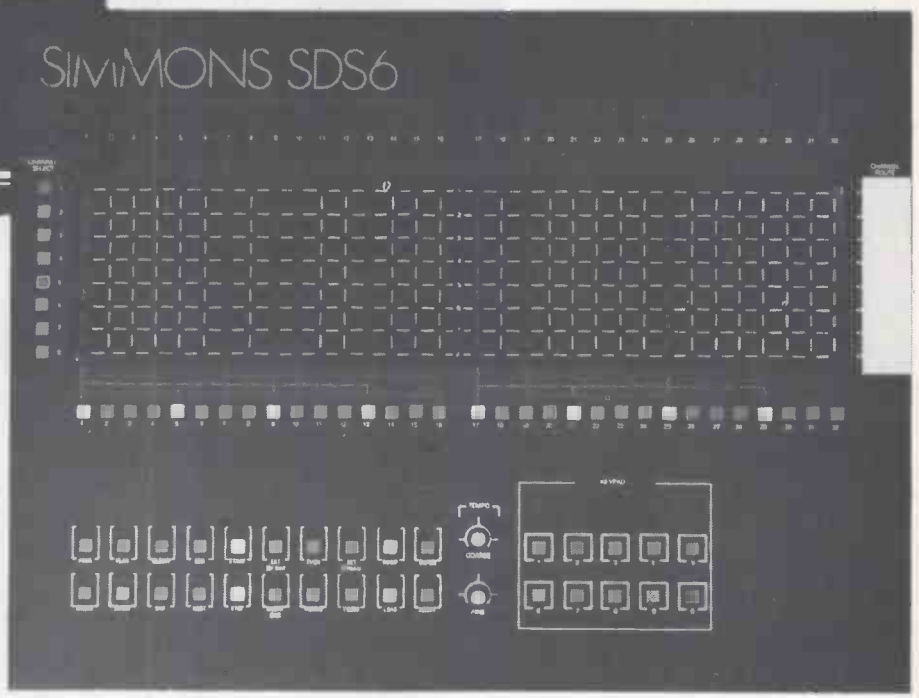
DRUM MACHINE SUPPLEMENT

Simmons SDS6 Sequencer



Abbey Mill, in the heart of St. Albans, is the home of one of the most innovative British companies involved in the production of electronic musical instruments. Simmons, who manufacture the Clap Trap and SDS5 electronic drums are poised to release their latest product, the SDS6, a fully programmable 8 channel sequencer, designed to be used with their SDS5 modular drum synthesiser.

There cannot be many readers who have not heard the stunning sounds of a Simmons kit, on albums such as Jean-Michel Jarre's 'Concerts in China, or seen the futuristic hexagonal drum pads played on programmes such as 'Top of the Pops'. However, for those of you who are not familiar with the SDS5 system a brief summary follows.

Up to seven playing surfaces, which can be mounted in conventional drum positions, provide trigger pulses to the voice modules. These modules are fitted into a 19" chassis with a built-in seven channel mixer. Normally a full kit would comprise of a Bass drum, Snare, three Tom-Toms, Hi-Hat and Cymbal, but being a modular system any combination of voicing can be supplied.

Trigger inputs are normally from the drum pads but sockets are also provided for 'Synth' inputs from an external controller such as a click track or sequencer — this is where the SDS6 comes in (no pun intended!).

The SDS6 is packaged in an attractive matt black all-steel casing. All the programming controls are situated on the sloping front panel with connections to the outside world being made on the back. A 6502 microprocessor is used with 8k of CMOS memory. Battery back-up is included to retain programs when the power is off.

Controls

One of the most novel features of the SDS6 is the unique visual 32 x 8 display matrix. This represents a 32 step measure for each of the 8 channels, and will be referred to as a 'bar'. Trigger points or 'hits' are programmed using the small, calculator like, push button switches along the bottom and left-hand edges of the matrix. An LED at the crosspoint indicates the selected 'hit'. When the unit is running a moving column or 'scan line' runs across the matrix triggering the respective channel when it crosses a 'hit'.

Below the display is a bank of 20 push buttons. These are used to input commands to the machine in a logical fashion. After entering a command the subsequent switches which can be used are indicated by a green LED, while the previous step is indicated by a red. This 'machine intelligence' allows the user to see where he is going and know where he has been, therefore programming quickly and efficiently.

Numerical data is entered via another bank of 10 push buttons with a two digit display indicating the selection. Mistakes can be corrected by re-entering the number, which shifts the display contents left.

Between the two banks of switches are two rotary tempo controls; Coarse and Fine.

Bars

Programming a rhythm is made very simple with the logical command language and matrix entry.

To program a bar the user simply selects PROG followed by BAR, then enters 'hits' by selecting the channel, with one of the 8 vertical switches, and step in the bar, with one of the 32 horizontal switches. The LED beneath the crosspoint will light indicating the 'hit'. If a mistake has been made the 'hit' can be removed by re-entering the selections. When the first entry is made the 'scan line' starts to move across the matrix with a speed set by the tempo controls. As the line crosses the programmed 'hits' the respective channels will be triggered. In this way rhythms can be built up on the matrix by listening to the drum outputs as it is programmed.

Once the rhythm has been entered it can be stored as a 'bar' in any one of 99 locations. To do this the selection is STORE BAR, a number on the keypad from 1 to 99 and then ENTER. The selection will not be stored until ENTER is pressed which allows errors to be corrected before the command is carried out.

Although now stored in memory the programmed bar is still displayed and playing! This is another novel feature of the machine. Since drum rhythms are variations of a basic pattern the rhythm can be 'played with' on the display and stored in memory when required. This allows banks of similar rhythms to be stored quickly without entering the same basic bar each time.

To re-program an existing bar the selection PROG BAR is made, followed by a number from 1 to 99 on the keypad and ENTER. The bar will be brought from memory and displayed on the matrix to be modified or listened to. 'Hits' can be inserted or deleted as before and the bar stored under the same number or as a new bar.

If at any time the user wishes to get out of the programming mode the selection ABORT is made, which returns the machine to its 'switch on' state.

Any of the bars in memory can be played by entering PLAY BAR, then the number of the bar and either START or SHORT BAR. If START is used the stored rhythm will be played once, whereas if SHORT BAR is used the bar repeats continuously.

Sequences

Bars can be linked or chained as a sequence and up to 99 sequences can be stored. For example, to play Bar 1, followed by Bar 2, followed by Bar 3, select — PROG SEQ PLAY BAR1 BAR2 BAR3 then STORE SEQ 1 ENTER. Bar numbers are only stored away when the following instruction is typed so wrong entries can be corrected on the keypad before being committed to memory.

To play a stored sequence the selection PLAY SEQ 1 ENTER is made along with either START or SHORT BAR. If START is pressed the sequence will play once and stop whereas pressing SHORT BAR plays the sequence continuously. The bars are displayed as they are played.

The tempo pots normally have no control over the sequence playing speed. When a sequence is programmed the tempo set on the controls is also stored. The tempo stored in memory can be overriden during play by entering PLAY SEQ TIMING 1 ENTER SHORT BAR. The tempo controls are now operative and the new timing can be restored.

The sequence can be stopped in four ways: firstly if START was used; secondly if a STOP instruction is encountered in a bar; thirdly, by pressing STOP which stops the sequence at the end of the current bar, and lastly, by pressing ABORT which resets to the 'switch on' condition.

When building up large sequence strings it would be time consuming to enter these one by one e.g. 12 of bar 1 and 4 of bar 2 would be entered by

The Simmons kit.

BAR1 BAR1 BAR1 etc. These can be entered by PROG SEQ PLAY BAR1 ENTER 12 TIMES BAR2 ENTER 4 TIMES STORE SEQ1 ENTER. Multiple entries can be grouped together, e.g. to play bar 1 bar 2 bar 3 ten times press: PLAY BAR1 BAR2 BAR3 ENTER 10 TIMES. Any one sequence can contain up to 255 bars but is obviously limited by the remaining memory.

Nests

A nest or 'song' is a chain of sequences entered in the same way as a sequence and containing up to 255 sequences, again limited by remaining memory. To program a nest chaining sequences 1, 2 and 3 the commands PROG NEST PLAY SEQ1 SEQ2 SEQ3 STORE NEST1 ENTER would be pressed. Up to 99 nests can be stored. Since the tempo is stored with each sequence the nest can contain sequences of different tempos and time changes. Again timing can be overriden by PLAY NEST TIMING 1 ENTER START. The panel controls now alter the timing.

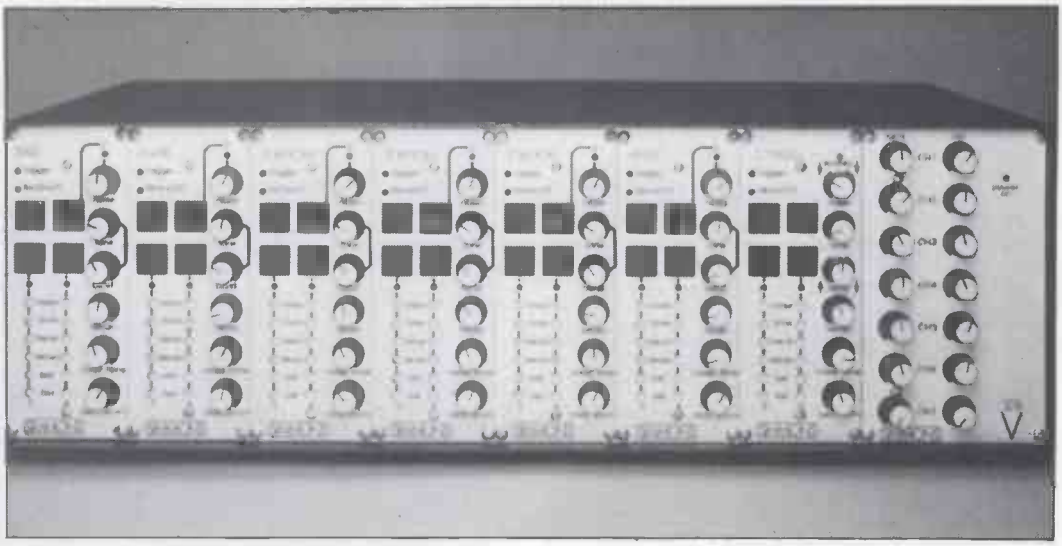
Features

Another command, sensibly called SHOW, can be used to indicate how much of the internal memory has been allocated. Pressing this switch in the start up state provides a display of the percentage of memory used. The first 99 cross-points on the matrix are used for the display. If the BAR switch is pressed LEDs corresponding to the bars stored in memory will light. To look at the information in any one bar, the number of that bar is entered on the keypad. Similarly, entering SHOW SEQ will indicate the sequences allocated and stored. To see the bars in a sequence enter the sequence number followed by THEN, the first bar is displayed. Subsequent presses of THEN will step through the sequence displaying each bar.

All the bars so far considered have been 32 steps in length, however bars of any length can be programmed. To do this the command SHORT BAR is used while programming the bar. The reset point in the bar can now be selected by pressing one of the horizontal matrix switches. A steady column of LEDs indicates the selected point and the 'scan line' now travels between step 1 and this line. The reset point can be defined anywhere while the rhythm is playing or it can be removed by CLEAR. If the bar is stored it will be stored as a shortened bar and any information to the right of the reset line will be lost.

One problem which can be encountered when chaining bars of different lengths is that each one will take a different length of time to run since the clocking rate is normally the same for each bar. This problem can be overcome using the SHORT BAR EXTENDED mode. When this command is entered during programming it has the same function as SHORT BAR except that the processor calculates a new step period which plays the shortened bar in the same time as a 32 step bar. This means that a bar shortened to 24 steps will play in the same length of time as a 32 step bar allowing pieces mixing 4/4 with triplets to be played!

When composing a rhythm indiscriminately it may become apparent that the down beat or start of the bar does not occur at the first position and therefore would not fit into a chain of bars. To correct this the bar could be noted down and reprogrammed with the downbeat starting at the first position, obviously a time consuming task. Simmons have already thought of this and provide another useful function. Using START in the program mode, followed by one of the horizontal matrix buttons, rotates the memory replacing the selected column at location 1. A series of bars can be stored with the downbeat incremented one step each time to provide an interesting 'moving' rhythm.



The Simmons SDS5 Drum Synthesiser.

Human Feel

One of the most exciting features of this instrument is the ability to program dynamics. Unlike other drum machines, which supply a set trigger voltage to the instrument voice resulting in a similar sound. each time, the Simmons SDS6 can be programmed to provide 9 different levels of trigger voltage to the SDS5 voices. If no dynamics are programmed the processor sets an output default level of 6. However, when programming a bar the SET DYNAMICS switch can be pressed and a number from 1 to 9 entered on the keypad. This dynamic value can now be assigned to any 'hit' on the matrix with up to 45 dynamics per bar. A level of 1 is equivalent to lightly tapping the drum pad whereas level 9 would be hitting the pad with full force. Thus, the rhythm takes on a whole new 'human' feel allowing the most intricate drum patterns to be stored and replayed.

A small switch on the rear panel can also be used to inject more 'feel' into the rhythm. The 'Humaniser' switches in two delay circuits which delay the triggers from channels 2 and 4 slightly and 6 and 7 even more. The overall time delay being varied randomly but with a level ranging from subtle to ridiculous, set by a small knob beside the switch. This can be used to great effect to create a 'flam' on Snare or Tom-Toms.

Interfacing

The SDS6 also has, what Simmons believe to be, some of the most versatile syncing options. Tape sync IN and OUT using FSK (Frequency Shift Keying) is provided, either normal or ÷ 6, to facilitate click track syncing for 4/4 or 3/4 timings. Synthesiser type gating is also provided which outputs or accepts a positive going +15V gate. A selection of 10 gate outputs can be made using a rotary switch next to the socket. This allows one gate every 1, 2, 3, 4, 5, 6, 8, 10, 12 or 16 steps to be output enabling complex patterns to be built up between the SDS6 and an external unit such as another sequencer.

Sockets for footswitches (supplied with the unit) are also provided, one to start and another to stop the machine. Nests can actually be programmed to be played in a sequence, moving to a new nest each time the relevant foot pedals are operated. This allows the user to move to a new song on stage, without touching the control panel.

Although the instrument output channels are meant to control the SDS5, you can of course use one of these to trigger an external unit, programmed to occur anywhere in a bar. Each channel output has a control knob situated beside the socket to calibrate the output voltage. As mentioned earlier the programmable dynamics level is provided by altering the output voltage of the trigger. The calibration knobs can be used to set up the level out or threshold of the default value of 6 or to completely override the programmed dynamics and trigger all of the voices at full level.

Since there are only 7 voice circuits in the SDS5 module the eighth channel of the SDS6 has an extra cannon connector which allows it to be used in two ways, either as a normal trigger, for an external unit, or to control Hi Hat open and close. If the latter set up is required the cannon socket is used and a connection made to the cannon socket on the rear of the SDS5, normally used for the Hi Hat footpedal.

Channel 6 also has an extra switch which is used when connected to a cymbal module.

The new cymbal has two piezo pickups mounted internally, one in the 'bell' of the cymbal and the other in the body. Channel 6 can be used to trigger both the bell and the body of the cymbal if the switch is in the 'Normal' position, otherwise only the cymbal 'body' is triggered.

Memory Dump

Most large computer composing machines, such as the LinnDrum and the Roland MC4, use cassette tape as storage medium for internal memory which although works well, is slow and prone to errors.

Simmons have again decided to take a different approach and provide a plug in CMOS memory pack with battery back up to provide a cheap, quick storage medium which will retain programs for around 4 years. The memory pack has the same capacity as the SDS6 ie 8k, but when 64k CMOS RAMs are available at a reasonable price the pack will be able to store 8 full SDS6 memories!

The pack plugs into a Euro connector on the back panel and using the LOAD and DUMP commands can transfer the entire memory in a matter of seconds.

Conclusions

As a programmable unit the SDS6 is a dream to use. A rhythm or bar can be built up audibly and visually before committing it to memory. The displayed rhythm can then be further arranged to create as many variations as are required. Command strings being entered in logical 'English' fashion making programming straightforward and simple.

Undoubtedly the feature which sets this unit apart from most other drum machines currently on the market is the facility to program dynamics. Coupling the SDS5 voices to the SDS6 can provide some of the most 'human' drumming sounds created by a percussion sequencer. This does not mean that the drummer is now obsolete, in fact, the SDS5 is designed to accept both pad and sequencer triggers allowing human and machine inputs.

As the machine under review was Simmons only prototype, with various additional loose veroboards around the PCB's, no internal photograph has been shown. However, suffice to say that the construction of the final production models will be up to Simmons usual high standards.

With a price tag of around £1,200 plus VAT the SDS6 is definitely aimed at the top end of the market but considering its powerful programming facilities combined with the versatility of the SDS5 voicing, it provides an exciting, infinitely creative, compositional tool.

Kenneth McAlpine E&MM

Rear view of the SDS6 showing connections.

PERFECT PERCUSSION

From Simmons Electronics, the company that revolutionised drums, comes the SDS 6. A computer sequencer dedicated specifically to triggering existing Simmons modules, it can boast some very impressive facilities. Such as the capacity to store 99 user programmed bars in any time signature which are displayed in "drum music" format as they are created and can be strung together to form complex rhythmic compositions.

And true to the Simmons philosophy of always maintaining the "human interface", every single drum beat can be assigned a "dynamic level" from 1 to 9, making the SDS6 a drum machine with a unique feel. Couple this truly creative composition tool with the incredible sounds of Simmons electronic drums and you have the worlds most complete electronic percussion system.

For further details contact

SIMMONS

Simmons Electronics Limited, Abbey Mill, Abbey Mill Lane, St. Albans, Hertfordshire. Telephone: (0727) 54601

Klone Kit

At last someone has taken the obvious step of installing a set of pickups in a full size drum kit, and connecting these to an inexpensive analogue voice board to produce a budget-priced electronic drum kit. In this case the kit is a Remo RPS-10 practice set and the design is by Richard Straker of the music shop — turned manufacturing company, Honky Tonk Music.

The Remo Kit has of course been available for some time, generally used together with the foot pedal and cymbals from a conventional kit for purposes of (relatively!) silent practice. It consists of five pads on metal brackets, each screwed to a central vertical pillar having a wide base for balance. The 'bass drum' pad is a little smaller than the others and attached to the pillar itself, whereas the four horizontal pads represent low (floor) tom, snare, high tom and mid tom. On an additional central support intended for cymbals sits the electronic module itself, in a box about 10 inches across. This contains the voice circuitry for the five basic sounds.

Each of the five pads contains a crystal pickup connected via a 3 way locking socket. The matching plugs are attached to colour-coded leads, White for Bass, Red for Low Tom, Green for Mid Tom, Blue for High Tom and Yellow for Snare Drum; the leads feed directly into the electronics module so there's no chance of connecting up the pads in the wrong order.

The pads themselves use tuneable drum heads which in this context don't affect the pitch of the sounds (which is done electronically) but do allow variation of stick response. This gives a wide selection of possible playing 'feels', making use of the Klone Kit seem natural and easy for the conventional kit player.

In fact the electronics of the kit do respond in terms of volume and pitch bend to the velocity of the drum stick. Each of the five instruments can be tuned using the top row of five rotary pots, while the middle row controls damping or decay length. This allows variation, as the instruction sheet points out, from "synthesiser drum sounds achieved by reducing the damping effect (turning clockwise), to natural acoustic drum or solid studio sounds produced by increasing the damping effect (turning anti-clockwise)". Obviously the longer the decay, the further the latitude available for the force-sensitive pitch bend to operate.

The exception here is the snare drum, which instead of a damping control has a mix control for the amount of snare sound (treated white noise) added to the basic skin sound. If no snare sound is added, the Snare Drum becomes another tuneable Tom-Tom.

The bottom row of controls are individual level controls for the five sounds. To the right of the main rows of controls there is an On/Off Volume rotary and an LED mains on indicator.

Inside the control box is a single PCB holding all of the discrete components. The drum voices are based around Twin-T oscillator circuits with 'sensitivity' presets for each, to allow the response of the pads to be adjusted.

Noise is generated by a reverse biased transistor, gated by a transconductance amplifier and added to the snare tom sound.

The pots are hardwired to the PCB but the internal construction is fairly neat and should be reliable in operation.

The final major feature is an individual audio output for the Bass drum, which is not affected by the overall volume control. This obviously gives wider possibilities for EQ'ing and effects, although the basic sound is a good heavy thump which doesn't require much treatment beyond reasonable amplification.

Pete Brewer of Honky-Tonk explains that various options were taken into consideration during the design period. The sounds are intended to be a compromise between synthesised effects and an accurate imitation of acoustic drum sounds. If the former are required, use of an envelope follower, octave divider, flanger or chorus are recommended, in which case the bass drum sound can be taken off separately so that it need not be affected. If the latter are required, use of EQ and reverb together with the existing control functions can help. It's emphasised that a full-range amplification system, designed for keyboards or bass guitars and therefore able to cope with verylow frequencies, is preferable to do full justice to the Klone.

It's good to see an inexpensive, good quality product being developed and manufactured not by a giant corporation but by an independent and imaginative retail concern. The Klone Kit is going to fill in a lot of gaps in a market which is expanding in many directions simultaneously, because it can cheaply fulfill several functions — practice , studio work and live performance, for instance — with equal ease.

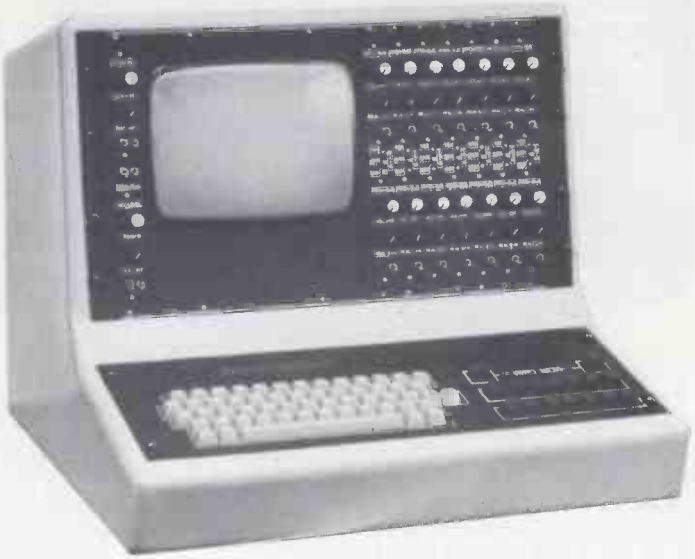
E&MM

Klone Kit control module.

The Klone Kit is available via Brian Butcher, Manufacturers Agent, 51, Glenview, Abbey Wood, London SE2. Tel. 01-310 4034. Suggested retail price including VAT but excluding the Bass Drum pedal is £299.

DRUM MACHINE SUPPLEMENT

MCS Percussion Computer



RECORDED ON DEMO CASSETTE No. 9

Movement computer systems have just brought out an updated version of their versatile percussion computer (which was reviewed in E&MM Jan '82). The original version was based around a Nascom Computer which controlled a range of synthesised and digitally sampled percussion voices. A standard QWERTY type keyboard was used to enter commands and allowed Basic along with wordprocessor software to be used. Voicing controls and trigger switches were provided above the keyboard. Information was output to the user by a separate TV monitor which sat on top of the MCS casing.

The new version has been configured to be a sophisticated studio rhythm unit rather than an add-on for the Nascom II computer, but Basic and Wordprocessor software can still be supported. The casing is moulded in glossy finish fibreglass with a rack mounted section in the top half and control keyboards in the bottom half.

The rack section contains 9 modules consisting of a master clock module to control tempo with sampled hi-hat and cymbal voices, a VDU monitor module and 7 voice modules each having 2 sampled sounds and 2 synthesised sounds.

The lower section has a QWERTY type keyboard along with 16 keys for voice and accent programming, and reset.

On the rear panel, sockets are provided for direct instrument outputs, mix outputs, cassette interfacing, video and VHF signals, trigger inputs and outputs, RS232 link for a printer and PIO for connections to the computer.

Voicing

In a program, up to 14 voices can be triggered on any one beat (or step), but each voice card contains 4 voices making 28 sounds available. The voice panels are split into two halves, the top half representing 'metallic' sounds, such as cymbals, while the bottom half represents drum sounds. Both types of sound can be 'real' or synthesised, selected by a switch beneath the volume controls. The knobs above the volume controls have two functions depending on the selection; in the 'real' mode they control pitch, whereas in the synthesised mode they control sustain.

The 'real' sounds are provided using digital sampling techniques where up to 16K bytes of memory, stored in EPROM, are used to hold the whole sound. Pitch changes are made by changing the rate at which data is read from the memory.

'Rotating' Hi-hat and Cymbal samples are also available from the first four metallic 'synthesised' voices. In this case only a short sample of the sound has been recorded in memory but is read out continuously, envelope shaping being carried out by further analogue circuitry. These short samples are stored in two EPROMs on the clock module, to the left of the monitor. Separate controls are provided to alter the pitch of these waveforms. None of the voices are labelled on the modules or the programming keys, presumably so that the user can configure the system as he or she requires. It would have been useful to provide writing space by the modules and keys for user labelling.

The sounds supplied with this machine were as follows:

Top 'Real' — Hi-Hat close, Hi-Hat open, Bell tap, Cymbal, Short Cymbal tap and Cowbell.

Top 'Synth' — The first four use digital 'rotating' samples, shaped with analogue circuitry, allowing pitch and decay to be adjusted. The first two being Hi-Hat and the second two Cymbal. Sounds for the last three modules are: resonant downwards noise sweep, resonant noise with fixed pitch and clave.

Bottom 'Real' — Bass drum, Low, Mid and High Tom-Toms, Snare short and long, and Tambourine.

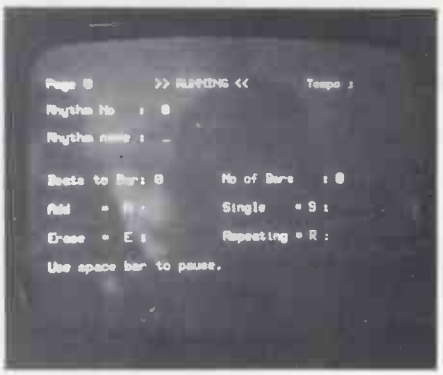
Bottom 'Synth' — Bass drum, Low, Mid and High Syndrum, Snare with high and low white noise, and a high pitch 'tweak' (to indicate steps when programming).

Percussion Machine options.

Operation

When the machine is first switched on, a 'menu' of 5 system options is displayed on the screen. The options are: D for drums, that is, rhythm machine; T for track sheet, which can be used to enter and store studio information such as titles, recording levels, invoicing etc; V for verify tape; E to enter Basic and Y to enter the wordprocessing mode which can be used to write lyrics and output them to Imp or Epsom printer.

Normally D would be entered which brings up a second menu for command entries: C to continue, H for high resolution start, and N for normal start. Entering normal start displays another menu. For most compositions, the normal start is used, and high resolution simply runs the system faster to accommodate precise rolls, flams and complex paradiddles. The choices are: C to compose, P to play or modify, E to erase, T to transfer, R to run assembly, A to assemble rhythms, I for Information Sheet and S to save on tape. One of 10 possible page numbers is entered (0-9) and the selection made.



Composing page.

Compose — The rhythm number (0-9), allowing 10 rhythms per page, can now be entered along with a name for the composition. Once the beats per bar (really total pulse or step count) and number of bars have been entered, the machine's metronome will start using channel 7 sounds — the upper voice triggered on the down beat and the lower voice triggered on each main step. The tempo is now displayed on the screen, ranging between 0 and 99, and can be adjusted with a control on the master clock module. A fine control tempo switch is also provided. Voices are added by pressing the appropriate voice trigger buttons on the required beat. To erase, pressing selection key E followed by the appropriate voice trigger button on the beat will erase the sound. To program multiple beats, R (repeat) can be pressed and a voice key held down so that the voice will now be triggered on subsequent steps.

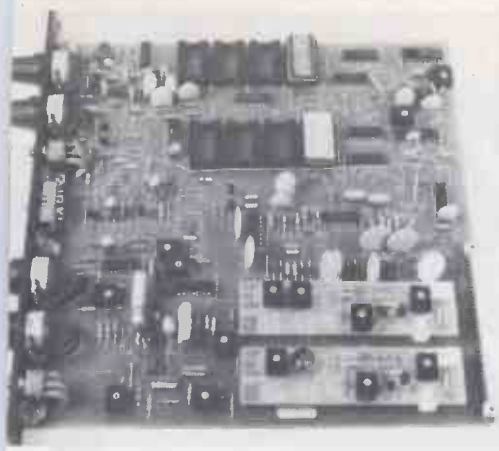
The space bar stops the rhythm and displays the compose options. These are: O for off-beat; S for shuffle; D to clear all lower row voices (drums); C to clear all upper row voices (cymbals); I to insert metronome; K to kill metronome and M to multiply bars. When a selection has been made the display returns to 'running'.

Rolls and flams can be entered by setting the off-beats to x2, or x4; beats can now be entered between the main steps.

Play — Will play through the selected page.

Erase — Complete pages can be erased but with a check entry to make sure you think twice before erasure.

Transfer — One page can be transferred to



One of the seven voice boards.

another with a new name allocated if necessary.

Run Assembly — Will play an Assembly of pages. Pressing Res-Go key will pause the selection or display page assembly prior to running, continuing on alternating depressions.

Assemble Rhythms — Sequences of pages can be strung together using Assemble.

Information Sheet — Used to retain your own typed in notes about the program you're creating.

Save on Tape — The total pages used must be specified, 0-9, which is then dumped on tape when T is pressed. A Load is automatically operated when the unit is switched on from an external mono cassette recorder.

Circuitry

The computer used as the basis of the system is a NASCOM II with a Z80 microprocessor. Up to 48K of dynamic RAM can be supported for programmes, with 32K supplied as standard. The Track Sheet and Wordprocessor firmware are available as options costing £27 each.

Internal construction is neat as can be seen from the photograph. The voice cards (far left) plug into computer grade Eurosockets, wire-wrapped together. Situated next to the voice boards are the VDU driver and the clock/rotated-voice card.

Beneath the VDU is the NASCOM II board and the 48K dynamic memory card. The power supply board is mounted on the rear panel, which acts as a heatsink for the 5V regulator. Two transformers are used, one for logic supplies and the other for the voicing.

All of the voice cards are similar, with space for up to 16K (4 x 4K) of EPROM for both 'real' sounds (see photo) and plug in boards to configure the analogue sounds.

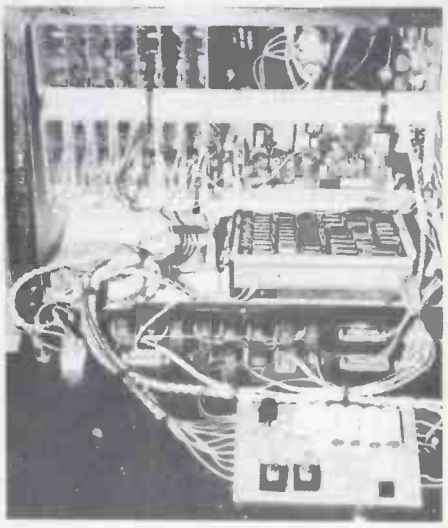
Conclusions

MCS have now provided the hardware to make their percussion computer into a more viable music-making machine. When you purchase the MCS, you can have your own drum samples installed free. Your own choice of 'real' voicing can be digitised, at £22 a sound at a later stage and plugged into the voice cards, although development is under way for a plug-in 16K CMOS RAM card, with battery back-up, which would allow any sound to be sampled by the user and triggered when required.

Another interesting development, which is on the designers' drawing boards, is the ability to program the sounds from drum pads, which will also allow dynamics to be stored.

The exciting thing about computer-based systems is that software can always be updated. MCS have provided some great sounds together with versatile open-ended hardware which ensures that the machine will not be obsolete in years to come.

At £2,300 inc VAT, the MCS II is an interesting contribution to the growing field of computer musical instruments. **E&MM**



Internal construction of the MCS II.

For more details contact Movement Audio, 61 Taunton Road, Bridgwater, Somerset, TA6 3LP. Tel: 0278-424560.

RECORDED ON DEMO CASSETTE No. 9

DRUM MACHINE SUPPLEMENT

Korg KPR-77

Previewed as long ago as December 1982's Music Maker Equipment Scene, the KPR-77 is at last in this country, if only in prototype form. Widely available in March along with the SDD-3000 Digital Delay, this fully programmable rhythm machine featuring tape dumping facilities will retail for around £400. As Korg's first attempt at a programmable, it seems to be intended to fill a gap in the market somewhere between Roland's TR-606 Drumatix and the larger TR-808, having several of the better features of both.

Basically the KPR-77 offers three modes of use, Training, Write, and Play. In the training mode, the square tablet buttons for each sound can be operated by hand to create patterns — there are two identical buttons for most of the sounds to make this easier.

In the Write mode, and LCD display on the top left hand corner indicates the state of the program. A moving cursor can be set to scan the desired number of beats with any degree of resolution from 16th notes to 32nd note triplets available. Programming can be achieved in real time, with the cursor moving slowly along the display and the ability to put in any number of sounds on a given beat if they are struck simultaneously; or in step time, with each instrument being programmed individually with the use of the 'Step Up' button for spaces.

In the Play mode, the KPR-77 skips from one memory to another only at the end of a bar, indicating before it does so which pattern number is 'Next'. Pattern changing can be done manually, or by arranging the individual patterns in chains as described below. At all times the LCD display indicates the Group letter, Chain number (I or II), Basic Mode of operation, Pattern Number and Bar Number in a Chain. It's a pity that a digital readout of tempo wasn't also included, although obviously this would have been an added expense; as it is, the usual Tempo knob and flashing LED will have to suffice.

Most of the controls on the KPR-77 are multi-function. The instrument buttons are numbered 1 to 16, indicating 16 patterns in each of three Groups A, B and C, for a total of 48. All 16 patterns in each Group can be combined for longer rhythms; the maximum length in Chain Mode is 512 measures of 4/4. There are 6 Chain Banks in fact, each holding 256 measures of 4/4, but these can be paired if desired.

After chaining the basic patterns, a Da Capo or Del Segno function can be used to restart the total pattern. Alternatively it's possible to skip to another entire chain or a basic pattern while playing. The entire memory contents are stored during switch-off, or can be dumped to cassette simply by enabling the function using a rear panel switch and pushing 'Group A', which doubles as the Save control. 'Group B' activates Load and 'Group C' gives Check, or verify. Each function takes about a minute to operate.

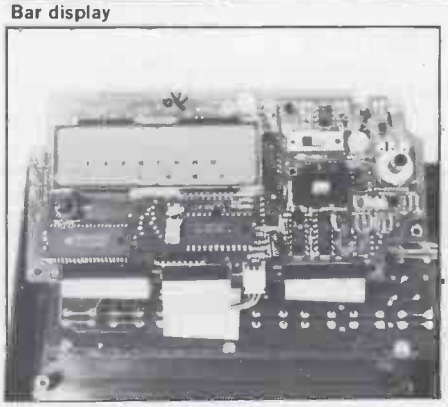
Other back panel controls are DC9V in, Tape In and Out, Sync In and Out on a 5-pin Din socket (as on the Drumatix) High and Low Tom-Tom triggers out, Footswitch Start/Stop (shorts to ground), Headphones, and three audio outputs. The first of these is Mix: the second Stereo, which spreads the instruments over an internally preset stereo spectrum; and the third Snare Drum/Clap for individual equalisation or reverb.

Internally, the analogue voice card sits in the base of the unit, above which is the input/output interface board (see photograph).

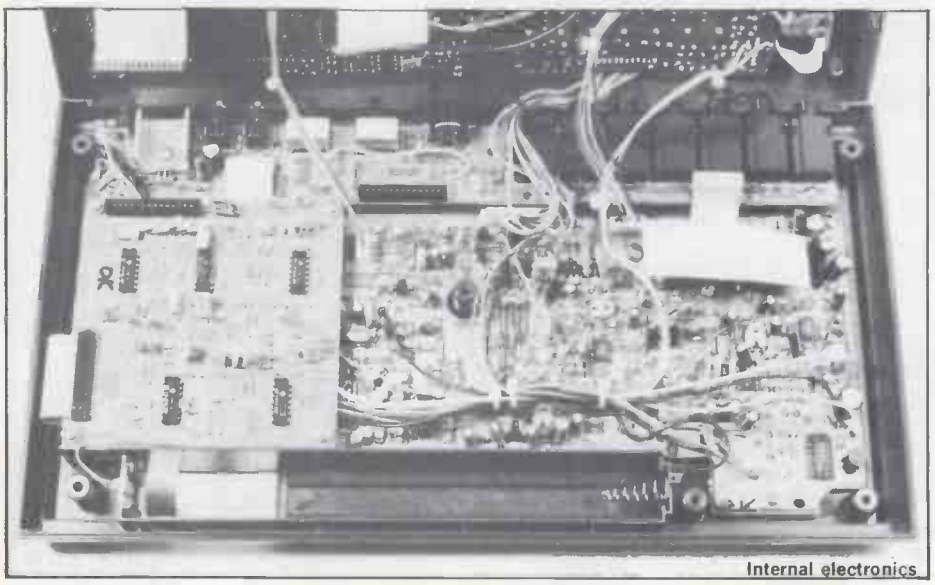
The microprocessor (a TMS 1025), CMOS memory, flat-pack LCD driver and display are mounted along with the clock control circuitry on a single PCB. Connections between the boards being made with flexible in-line PCB connectors.

As this model is a prototype some of the boards may change for production versions. However, the quality of construction is up to the usual high Korg standards; the design of the control section puts the KPR-77 almost on a par with the vastly more expensive LinnDrum.

Bar display



Control Board



Internal electronics

The sounds aren't up to this level of course, but without digital sampling that's only to be expected. The new sounds, handclap and Tom Tom flam (a fast double stroke) are excellent, and so disco rhythms at least are powerful and convincing. Bass drum, Toms and Snare are adequate, although it would have been interesting to have a Snare flam available; the Cymbals and Hi-hat are faintly metallic, with good differentiation between open and closed positions on the Hi-Hat but no really convincing decay characteristics.

Obviously a lot of thought has gone into the design of the KPR-77, and ergonomically and mechanically it's a great success, the controls being pleasant to use and precise in operation. The recommended retail price is around £400 including VAT; exactly what portion of the market the Korg will capture is unclear, but as a first attempt at a programmable rhythm machine it's certainly an interesting new product that's well worth looking at.

E&MM

The Korg KPR-77 will be available via Rose-Morris, 32 Gordon House Road, Kentish Town, London NW5. Tel: 01-267 5151. The RRP will include a tape containing the factory rhythms.

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Isao Tomita

Born in Tokyo 1932. Studied music at Keio University with Kishio Hirao and Kojiro Kubone. Started composing at school and later wrote music for commercials, films and TV.

Gained major recognition with first album 'SNOWFLAKES ARE DANCING' using Debussy's music, released in 1974.

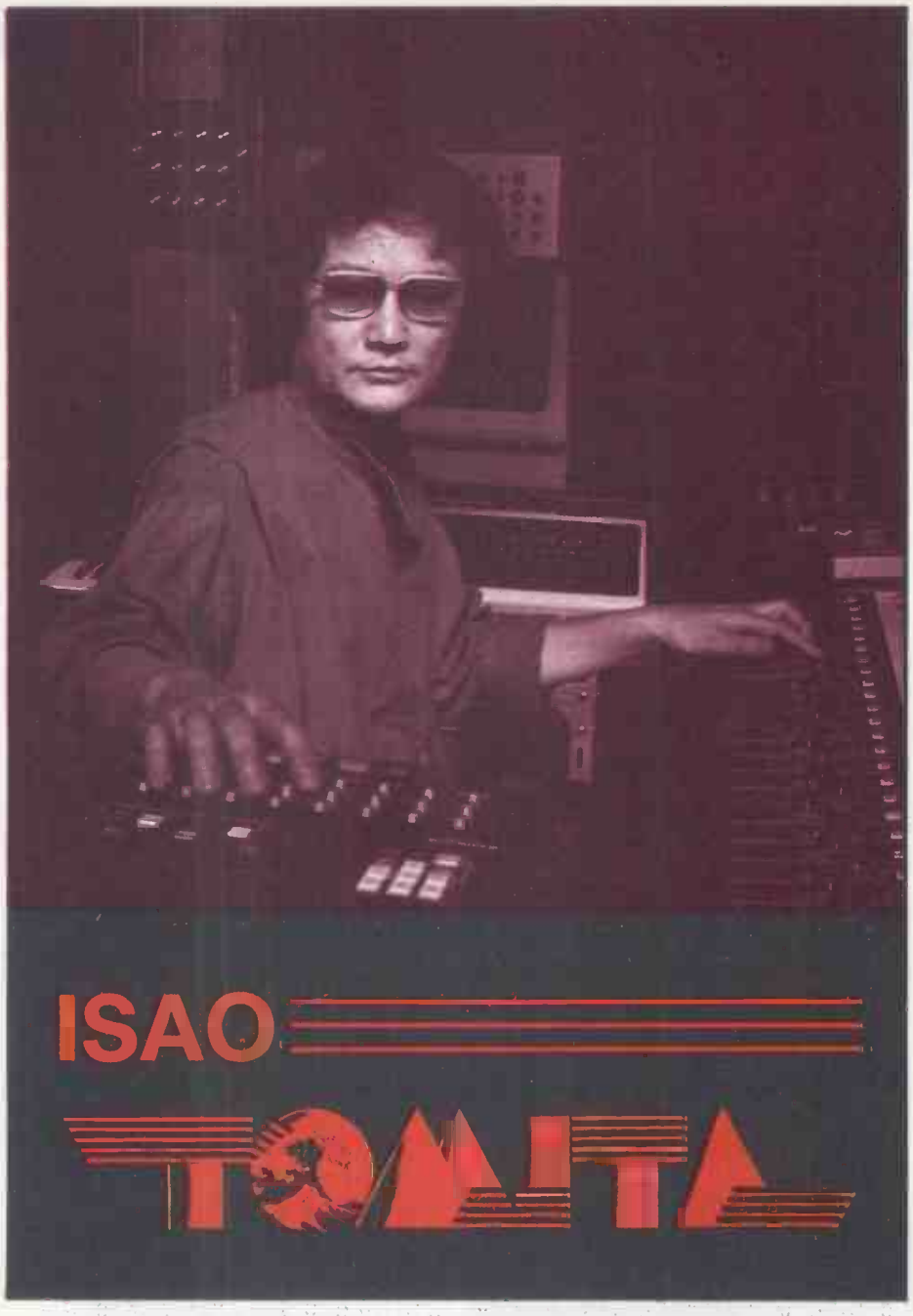
This received Album of the Year (1975) and 3 other Grammy Awards (first time for a Japanese), as well as Best Classical Record of 1974 by N.A.R.M.

Other successful LP's followed, including 'PICTURES AT AN EXHIBITION' and 'FIRE-BIRD' in 1975.

In 1977 his interpretation of Holst's PLANETS gave Tomita his biggest success and utilised a special recording effect 'Biphonic Sound' to produce sounds 'outside the speakers'. The space trilogy was completed with KOSMOS and BERMUDA TRIANGLE in 1978.

This latter album was nominated the 'Best Engineered Classical Record' in 1979's Grammy Awards. Also in 1979 came DAPHNIS & CHLOE.

Tomita has now sold over million LP's in Japan as well as in many other countries. His latest LP is THE GRAND CANYON SUITE.



Isao Tomita and the Plasma Symphony Orchestra:

Conductor: Isao Tomita
Assistant conductor: Roland MC-8/MC-4
Concert Master: Moog III
1st violin: Moog III/Moog System 55
2nd violin: Roland System 100
Viola: Synclavier II
Flute, Piccolo: Moog III/Synclavier II
Oboe, English Horn: Prophet 5/Synclavier II
Clarinet, Bass-Clarinet: Prophet 5
Bassoon: Moog III/Yamaha CS 80
Horn: Synclavier II/Moog III/Emulator (Mute-Roland GE-810)
Trumpet: Synclavier II/Prophet 5 (Mute-Roland GE-810)
Trombone: Moog III (Mute-Roland GE-810)
Tuba: Moog III
Percussion: Linn LM-1 Drum Computer/Roland Rhythm-Composer TR 808
Timpani: Emulator
Harp: Yamaha CS 80/Roland Jupiter 4
Guitar: Synclavier II
Piano: Yamaha Automatic Piano/Synclavier II
Celesta: Prophet 5/Synclavier II
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An exclusive interview with the world famous synthesist of classical music and an exploration of his science fiction fantasy, The Bermuda Triangle

One of the most exciting musical events at the last Ars Electronica in Linz, Austria was the sound performance of Isao Tomita's 'The Bermuda Triangle' in collaboration with the film visuals of Ron Hays. For both of the celebrated artists, 'outer space' and science fiction had already become a challenge, notably for Tomita in his electronic music interpretation of John Williams 'Star Wars Theme' at a gigantic presentation in Budokan, Japan and for Ron Hays' through his own 'Star Wars' concerts seen by over a hundred thousand spectators.

At last year's Ars Electronica, the main concert hall of the Brucknerhaus was turned into a giant 'space' auditorium with Tomita's special pyramid sound system created for the occasion. This consisted of large speaker stacks positioned at the four lower corners of the auditorium, plus an additional fifth stack mounted above the audience. Tomita's idea was to create a four-dimensional soundscape for the audience as they viewed the large screen video projections of Ron Hays.

Tomita did not perform the music live, but sat at a large mixing desk, with his engineer by the master tape deck, on the left-hand side of the stage (next to the screen).

From this position he mixed his front and back stereo images, as well as the overhead 'flying UFO' images. He was grandly dressed in his komono and this month's specially painted cover by artist Stephan Suchomski shows him wearing it in the 'Bermuda Triangle' which he personally visited for ten days. This was his first performance in Austria and his first use of the pyramid system. In earlier years, he used a quadraphonic system: in 1972 with 'Renaissance', and during an RCA promotional tour (1976) in Germany, the Netherlands and England.

The Bermuda Triangle

A Science Fiction story in sound by Isao Tomita

Recorded on RCA Red Seal RL 12885 and based on the music of Prokofiev, Sibelius and John Williams.

Tomita: The arrival of a UFO. A storm rages in the ocean near Bermuda — the area of mysterious disappearances of many ships and aircraft, the dreaded Devil's Triangle. In the midst of the storm a UFO approaches from the sky guided by an eerie signal below the water. Sea waves and wind of white noise announce a deep note and moving wind resonances, followed by sounds inside the nearing UFO — a computer message is briefly transmitted over the spaceship's buzz and gentle oscillator ripples. Strange voices talk in filtered snatches, and then the seascape returns.

Prokofiev's 'Romeo & Juliet' Suite No. 2. The silvery twinkling lights of the UFO move closer and the vessel descends through a falling polyphonic cluster across the stereo field. Panned bubbling notes over sustained vibrations float into the sea's roar, and intensified organistic sounds create one of Tomita's stunning momentary silences.

We gently fade into **Sibelius' 'Valse Triste'** with sustained string chords and layered Novatron voices with quasi-tape reversal effect bringing a rich reverberating organ chord that turns into a dry tremolo fade. Stereo strings wash the sound away and the melody takes on a voice-like quality at centre, whilst high-pitched oscillations sweep gently upwards left and right. A new sound floats in and fades out with the other sounds.

Prokofiev: Scythian Suite — The Adoration of Veles and Ala. At the bottom of the ocean, strange swimming creatures emit eerie cackles round a huge pyramid structure. [From this Tomita takes his idea of a sound system that is four dimensional.] A super-civilised race of ancient people entombed inside have made contact with the UFO from outer space. Bells and high-pitched glockenspiel notes jump onto Prokofiev's music, and brass interjections lead to a swirling ritualistic theme with its electronic adulation and grandeur increased by synthesised timpani and strings. The organ takes over amidst the slow bubbling and continued noise swirls to repeat ring modulated chords that sink into the Deep.

The typical filtered Moog sound used by Tomita calls out over slow moving parallel augmented 4ths and a happy conversation begins between visitors and pyramid people. Strings bounce their ideas about and the music takes on a more concerned tone, with moving bass notes and a repeating 4-note motive using triangle wave with portamento.

The 'Adoration' theme is reflected on briefly and as sequences gently flow, two rich brass notes close the conversations on interesting ring modulated falling harmonies. A peaceful calm is felt as we wait for the space creatures to enter the pyramid.

John Williams: Close Encounters of the Third Kind. A fantastic sustained crescendo transmits the visitors through a huge beam of fluorescent light to the pyramid entrance. Vibrations surround them and suddenly John Williams' recognisable theme: C'-D'-Bb'-Bb-F communicates, first by a filtered 'wah' piano sound, echoed by snorts from the UFO, and then the space creatures tiny vocoded snatches.

The pitch moves to A-B-G-G-D and the snorts jokingly pick Debussy's 'Golliwogs Cake-Walk' amidst laughs, before dropping pitch back to key Bb.

Greetings over, polyglides upwards create a sensuous start for a portamento-treated whistling triangle wave melody, bringing **Prokofiev's Symphony No. 5 (Second Movement).** Organ chords establish a climax and tremolo fade again that's exchanged for choral sounds. Three percussive chords announce a bright lively theme as the space children step into the underground pyramid — the kingdom of Agharta. Use of slow 'Leslie' rotation gives a nice movement to the counterpoint, and oboe, brass and strings are synthesised imaginatively. Percussion and brass punch at the rhythmic ideas and voices echo in friendly discussion.

Great depth is effected by careful choice of individual dry and increasingly reverberated melodic lines, as well as exciting dynamic changes.

Back come the percussive chord taps and a slowing of tempo for a grand organ theme played ff. Fast computerised note runs swirl left and right as a brass melody is heard. Strings take their turn and as the music literally bounces quickly along, a tight, reedy solo with tambourine accompaniment leads to more involved counterpoint and a bell/voice sounds fade on each side in stereo.

Tomita provides his own impressionistic music (entitled **'Dororo'**) that recapitulates the 'Encounters' theme, with whistling sounds and sustained bass following. A beautiful brass fanfare (with pitch fall during EG release) echoes at different positions over a slow phased string note cluster, deep bass, and twinkling 'lights' of the spaceship as it takes both visitors and pyramid people on a grand tour of the Earth. Out of the depths it rises, hovering above the blue green, ice cold waves. Side 2.

Prokofiev: Violin Concerto No. 1 (First Movement — Andantino). The atmosphere of the sea sets the background for a favourite Tomita sound, the filtered triangle wave with a touch of portamento, and high harmonic arpeggios bubble downwards. Other sounds join in to create a superbly graceful image of the UFO flying over the ocean, climbing higher and higher towards the upper regions.

An interesting melody with trills takes us to the clouds as dawn breaks over the Triangle. Strings and chorus float us through the stratosphere as a horn plays Prokofiev's Symphony No. 6 (First Movement) theme.

The space visitors view the distant earth with captivation and wonder, and flute-like melodies echo mysterious electric waves in anticipation of a computer communication. [Here is the second coded output that is a message programmed with a Tarbel System computer.]

Falling flute sounds herald a deep modulated bell timbre. Strings immediately lift the music along as the cylinder containing the coded data is ejected into the earth's atmosphere and spins downwards, dazzling in the Sun's rays, until it finally impacts itself in Tunguska, Siberia.

A rallentando has whistling, bubbling strings and a strong bass tuba melody. Arpeggios lead into a swirling panned high-pitched accompaniment for bass tuba and whistle in counterpoint. Voices and piano chords call out from different parts of the globe (across the stereo field) while phased sounds predominate. A rich melodic line on strings and voices leads to a sudden explosion as the cylinder crashes into the Siberian tundra. A second explosion follows as it sends up a fantastic display of flares to signal its position. Phased music sweeps the UFO on its journey around the Earth, gathering information for both visitors and pyramid people.

Prokofiev's Violin Concerto No. 1 (Third Movement) takes us inside the spaceship where celebrations at the cylinder's landing have taken place, and a plaintiff horn melody has pizzicato bass and distant sounds that eventually become choral. Tomita contributes some composing again, with echoed transpozer/harmoniser short notes that bring a UFO 'horn' melody reverberating heavily, then a whistling synth represents the space childrens voices accompanied by the harps of the ancient people.

The soundscape provides another of Tomita's enchanting musical images that dances with the movements of the spaceship. A central synthesiser melody passes to strident organ tones and back. Fast microcomposer runs bring in the voice/whistle, whilst strings enter to accompany as well. The music reaches a peak and soon it will be time for the space visitors to leave. The UFO 'horn' blasts its farewell notes again, making its strong counterpoint with strings and glockenspiel.

Tomita: Departure of the UFO/Prokofiev: Scythian Suite. Amidst central whistling synth melody and stereo arpeggio transpositions, a slow sine modulated note and string passages take the ancient people back safely to their pyramid kingdom.

The surging of the sea below the UFO is gradually diminished by the growing power of the spacecraft, as it finally soars upwards. A huge whirling, bubbling cluster of notes is rotated inside the craft, rising higher and higher into space — towards the 1448 Nebular Group of the Bootes. From deep in the ocean comes strange transmitted cackles of farewell. Floating in hyperspace, the gentle vocal/orchestral fantasy diminuendos to a last whispered message as Yamamoto's vocoder treated noise slowly echoes its ciphers away . . .

Equipment used for Bermuda Triangle

MOOG SYNTHESISER
Moog III p
Moog System 55
Poly Moog
Scale Programmer 950-B
Bode Ring Modulator 6401
Bode Frequency Shifter 1630
ROLAND SYNTHESISER
System 700
Strings RS-202
Revo 30
Stereo Phaser PH-830
SEQUENCER
Roland Micro Composer MC-8
GRAPHIC EQUALISERS
2 Victor SEA-7070
Roland GE-810
Roland GE-820
MIXERS
Quad/Eight Compumix (24 ch)
3 TEAC Model 1 (8 ch)
5 TEAC Model 3 (8 ch)
TAPE RECORDERS
Ampex MM-1100 (16 tracks)
Ampex AG-440 (4 tracks)
TEAC 90-16 (16 tracks)
2 TEAC 80-8 (8 tracks)
TEAC A-3340S (4 tracks)
TEAC 7040GSL (2 tracks)
Sony TC-9040 (4 tracks)
NOISE REDUCTION SYSTEMS
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4 TEAC DX-8
ACCESSORIES
AKG BX20E Echo Unit
AKG BX10 Echo Unit
Roland RV-800 Stereo Reverb
Korg Vocoder
Binson Echorec "2"
Roland Space Echo RE-201
Eventide Clockworks "Instant Phaser"
Eventide Clockworks "Instant Flanger"
Eventide Clockworks "Harmoniser"
Fender "Dimention IV"
Fender Electronic Piano
Hohner Clavinet C
Mellotron
Leslie Speaker Model 147

I interviewed Mr Tomita shortly before the evening concert began. Since he does not speak English, he was accompanied by his agent, Miss Taki Katoh, who kindly interpreted his replies.

How do you feel about the performance?

"I hope that the audience will experience something new with my 5-channel pyramid sound. My music is just one of the elements to enjoy, for there are many other aspects and visualisation effects — together with the audience's imagination!"

Would you prefer to be playing live?

"Yes, of course, but it would be very difficult to realise and the computer controlled visualisation would also have been too costly. First, I would need everything that I have in my studio. But not only that, I would need at least 10 technicians to help. I have already spent over 200 hours in the preparation of the tapes for this performance, which has a lot of new music as well as the Bermuda Triangle pieces. It would not be impossible to play live but it would require much more preparation and a very large amount of equipment, plus the tape recorders, and technicians."

Do you feel that the Pyramid system is necessary?

"My records are always being heard in stereo, through two channels, whereas this performance uses five channels. So, in that sense, I am giving the audience an opportunity to listen to the sound in the way I want them to hear it. It is frustrating that people always have to hear my interpretations just with stereo records."

What were your thoughts about the fifth overhead sound channel?

"As a human being in everyday life, we hear noises and sounds everywhere. Not only do we hear sounds to our left and right, our front and back, but if there is a helicopter flying, we hear some noise and sound from up there also. So that is why we need the fifth one on the top. It's supposed to put the sound into the sky. In this case it represents the UFO.

"I've always been interested in CD4 and SQ quadraphonic sound — but they only work at the centre and sides."

Is this performance of the Bermuda Triangle different from your LP version?

"The extracts from the Triangle are basically the same, although what you hear is totally different. The LP was mixed for two channels so I had to start all the mixing again to get five channels. I've also put new pieces between the Triangle pieces. These included extracts from Bruckner's Symphony No. 4 (3rd Movement), Ravel's 'Ma Mere L'Oye' Suite, Moussorgsky's 'Pictures at an Exhibition', J.S. Bach's 3-Part Inventions, Holst's 'Planets' Suite, and Stravinsky's Firebird Suite."

Do you try and create pictures in your music always?

I do like to create images in sound, but the music should be there for people to listen to, and in accordance with the sound that they hear, they should expand their own imaginations.

"Perhaps there is a new concept: 'Science Fiction in Sound'. Can we overcome through this the realities of everyday life, our time and physical limitations and so contact our fantasy, our imagination? If we can, we are able to reach out into the limitless space, to touch the super-intellect, be any object or being, and cast ourselves, all powerful, into the universe."

With your Plasma Symphony Orchestra, you are creating your own synthesised music and interpretations in one studio, in one environment?

"I am like a painter with a palette. I start my day feeling my way round my palette — my instruments. Many musicians play piano, trombone, drums or guitar but there aren't too many who can do everything. In other words, a musician can write music, can arrange music, but have to hire the best pianist, best drummer, best guitarist, whoever, in order to play his conceived sound and piece. But in my environment I can create everything myself and use my computers like robots to help me do my work."

Do you still feel happy about using classical music as your starting point for compositions?

"The reason why I have achieved my place today is because ever since I was in Junior High School, I always wanted to be a 'maestro' of an orchestra. In order to do so, I studied classical music, but gradually realised that it was very difficult to find musicians to work with that would play the exact way I wanted my music to be played. This is now possible with the equipment that I have.

"However, there are always new possibilities as well. For instance, the visual lighting and pictures of Ron Hays is a new challenge. And it is always possible for me to write, to compose. So basically speaking, yes, I would be very happy to interpret classical music in my own way, but I never know what I may turn to in the future.

"It is very rewarding hearing that my arrangements are accepted as truly expressive and evoke the emotions of a high musical experience. I think we must also make more effort to study electric musical instruments for the future."

Do you have a background in electronics?

"In Keio University I studied Western Art and did not go to any school to study computers, mechanics, electronics or music. I am mainly self-taught and am very interested in all these subjects — by attending events like Ars Electronica I have watched, experienced, and then experimented myself. I did have some music lessons in Japan while at university."

How do you feel about the way music is progressing?

"Generally speaking, I'm happy with the progress in the music scene. Personally, I am always excited when some new instrument is made and like to find out about its possibilities of interpreting music — whether it will play the way I want it to play. I get great joy out of that and, of course, I am influenced by other artists and learn a lot from them. I like to express myself through my sounds. Even though I make music with machines and computers, I have to be there to do so. So the machines are expressing and playing the sound I want. In other words, there always has to be the 'human touch' — not just the electronics."

Do you look forward to the development of performance controls?

"Just as a musician playing an acoustic instrument such as the piano or guitar explores and improves his or her performance techniques, so do the computer music composer and the electronic music instrument player develop their own particular skills. If performance controls allow more human involvement then it will create more enjoyment."

How important has the micro computer as a compositional tool become for you?

"It took me a year to learn to manipulate the computer for the Bermuda Triangle. It was a struggle because a computer is beautifully precise, and I wanted it to produce musical results. But I soon realised that its precision was totally desirable to make almost limitless specification of the characteristics of a sound: pitch, texture, attack time, duration and loudness. It can also work at an incredible speed and control the sound production of a synthesiser. I therefore have to provide coded numbers for my musical images and build up layers of sound through the computer programming. These are then recorded one by one on separate tracks of my Teac multitrack machines and finally all mixed together for the end result.

"I have used the Roland MC-8 microcomposer in creating practically all the pieces on the Bermuda Triangle LP, which was perhaps the best in the world with regard to memory capacity and accuracy at that time. I now also use the Roland MC-4.

"My favourite instrument is my old Moog III system and I use its twelve envelope generators together to create specific sound shapes. It's also useful for treating the computer processed sounds, and even though working with this analogue system takes longer to set up (tuning, patching etc), it gives me plenty of freedom because I can choose all the connections independently — and that's impossible for my digital systems.

"Although I don't have the reward and satisfaction of playing live to an audience, I can strive to build a creative entity that displays my musical personality."

Mike Beecher **E&MM**

Works arranged or composed for synthesiser and performed by Isao Tomita

SNOWFLAKES ARE DANCING — from "Children's Corner" No. 4 (Debussy)
REVERIE (Debussy)
GARDENS IN THE RAIN — from "Estampes" No. 3 (Debussy)
CLAIRE DE LUNE — from Suite "BERGAMASQUE" No. 3 (Debussy)
ARABESQUE No. 1 (Debussy)
THE SUBMERGED CATHEDRAL — from "Preludes, Book 1" No. 10 (Debussy)
PASSEPIED — from Suite "Bergamasque" No. 4 (Debussy)
THE GIRL WITH THE FLAXEN HAIR — from "Preludes, Book I" No. 8 (Debussy)
GOLLIWOG'S CAKEWALK — from "Children's Corner" No. 8 (Debussy)
FOOTPRINTS IN THE SNOW — from "Preludes, Book I" No. 6 (Debussy)
PICTURES AT AN EXHIBITION (Mussorgsky)
Suite from "THE FIREBIRD" (Stravinsky)
PRELUDE TO THE AFTERNOON OF A FAUN (Debussy)
A NIGHT ON BARE MOUNTAIN (Moussorgsky)
Suite "THE PLANETS" (Holst)
SPACE FANTASY (R. Strauss-Wagner)
PACIFIC 231 (Honegger)
UNANSWERED QUESTION (Ives)
STAR WARS THEME (John Williams)
ARANJUEZ (Rodrigo)
SOLVEJG'S SONG (Grieg)
HORA STACCATO (Dinicu-Heifetz)
THE SEA NAMED "SOLARIS" (J. S. Bach)
MONTAGUES AND CAPULETS — from "Romeo And Juliet" Suite No. 2 (Prokofiev)
VALSTE TRISTE (Sibelius)
THE ADORATION OF VELES AND ALA — from "Scythian Suite" (Prokofiev)
CLOSE ENCOUNTERS OF THE THIRD KIND (John Williams)
Allegro marcato — from Symphony No. 5 (Prokofiev)
DORODO (Tomita)
Andante — from Violin Concerto No. 1 in D (Prokofiev)
Allegro moderato — from Symphony No. 6 (Prokofiev)
Moderato/Allegro moderato — from Violin Concerto No. 1 in D (Prokofiev)
DAPHNIS ET CHLOE" Suite No. 2 (Ravel)
PAVANE POUR UNE INFANTE DEFUNTE (Ravel)
BOLERO (Ravel)
MA MERE L'OYE SUITE (Ravel)

America

Jerry De Muth

Crate PS1210 H.

A bass does more than just provide a rhythmic line, it completes a group's sound, adding fullness, richness and depth. The Who would certainly be thin and weak sounding without John Entwhistle's bass. But, of course, the instrument has to be heard and felt and Gallien-Krueger, Randall Instruments, Sunn and Crate all have recently come out with new equipment to achieve just that.

Gallen-Krueger's new 800RB bass biamp combines a preamp, an electronic crossover and dual power amps in one unit which takes only 5¼ inches of rack space and weighs 20 pounds. The low end power amp is rated at 300 watts RMS into 4 ohms, the high end at 100 watts RMS into 8 ohms. Each power amp has its own level control for precise balance of low and high frequency power.

The internal electronic crossover on the 800RB has a crossover point that's continuously variable between 100 and 1000Hz. Preamp controls are input attenuation (-10dB); volume; voicing filters for low, midrange and high frequencies; four bands of active equalisation; and footswitchable boost. A low impedance direct output (XLR) and effects loop are included on the rear panel. The suggested retail price of the 800RB is $899.

Randall Instruments' R-118S is a bass reflex enclosure with shelved port, rated at 250 watts. It features a special die cast frame bass speaker with a 95 ounce high density ferrite magnet and measures approximately 29 inches high, 30 inches wide and 18 inches deep. Randall's R-215 BH is a bass horn enclosure rated at 250 watts. Its two 15-inch special bass speakers are rated at 125 watts each and the horn has a three and a half foot continuous flair. The unit measures 39½ inches high, 32 inches wide and 16 inches deep. Randall also has introduced a new extended range horn, the RH-1, which is die cast with a 40 watt driver, built in crossover and attenuator.

Sunn's SPL 8028 is a two-way bass and mid-bass speaker enclosure that was designed for use as an extended range bass guitar enclosure and for use as the bottom end of a two-way or three-way PA system. It uses a Sunn SPL 918R 18-inch low frequency loudspeaker for a tight, punchy bottom and a Sunn SPL 912E 12-inch extended range loudspeaker loaded into a directional baffle for presence and top end clarity. The suggested retail price is $750.

Crate's CR285-18 150 watt bass amp features one 18-inch and two 10-inch speakers. The preamp section features a primary EQ section with separate low, mid and high frequency controls and a final EQ section with warmth and presence controls. A limiter is also included with a threshold control and a LED indicator to allow the musician to dil out any unwanted distortion. Other features include master volume, line in and line out jacks, external and internal speaker jacks and a convenience outlet.

For keyboard and PA application, Crate also has introduced the PS1510H enclosure which features a 15-inch bass reflex type speaker with a folded port, a 10-inch midrange speaker in a separate internal enclosure and a 4-inch by 10½-inch horn. The unit, which measures 32 inches high by 22 inches wide by 16 inches deep and weighs 80 pounds, is bi-ampable and features a six position high frequency attenuator switch. The suggested retail price of the PS1510H is $450.

Two new flat-front bi-radial horns, the 2380 and 2385, and a new addition to its Cabaret Series, the 4612, have been introduced by JBL. The nominal coverage angles of the 2380 and 2385 are 90° by 40° and 60° by 40°, respectively. Both provide uniform on and off axis frequency response from 500 Hz to beyond 16 kHz in the vertical.

The JBL 4612 is the most compact unit in the Cabaret Series, measuring 18½ inches high, 21½ inches wide and 10¼ inches deep and weighing 45 pounds. The frequency range is 60 Hz to 21.5 kHz and the power capacity is 200 watts continuous sine wave, 400 watts continuous program into 8 ohms. The 4612's high frequency driver is equipped with a miniature bi-radial horn mounted on a ring radiator which provides a flat response from 3 kHz to 21.5 kHz and maintains a tight 100° by 100° dispersion pattern. For low frequency and mid-range reproduction, the system incorporates two newly developed eight-inch low frequency speakers, each capable of handling 100 watts continuous sine wave power. The 4612 will function as either a full-range sound reinforcement system or as a component in more complex multi-way designs.

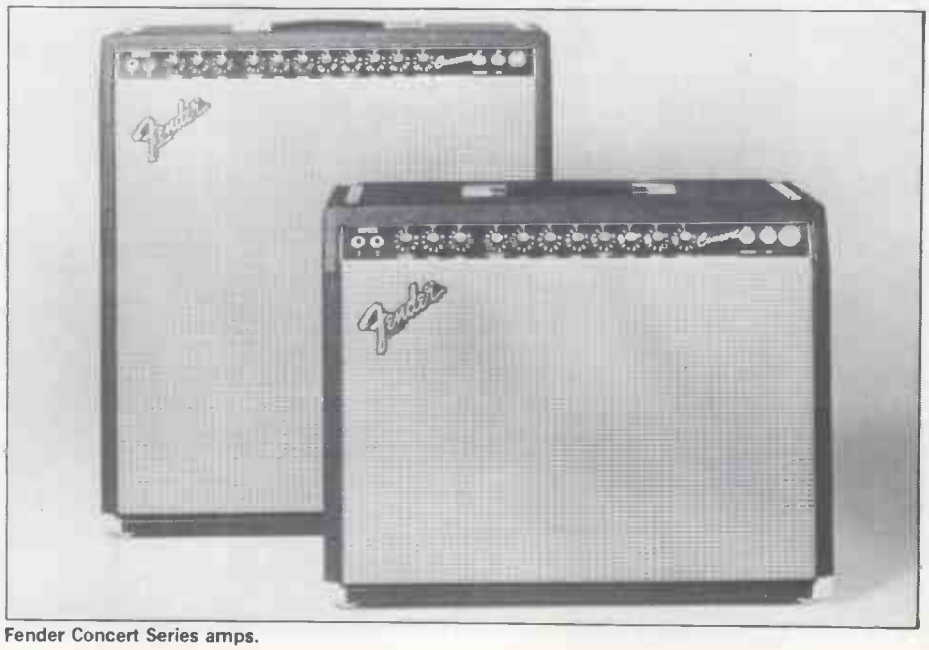
Fender Amps

All of those sound units from Gallen-Krueger, Randall, Sunn, Crate and JBL are new, but sometimes the old sounds are best. With that in mind, Fender, which reintroduced its classic Stratocaster and other guitars last year, has brought back its Concert amp line, but with the use of modern technology so that state-of-the-art circuitry is combined with traditional tube sound. All of the new Fender Concert amps feature an all-tube circuit rated at 60 watts RMS at 5 per cent THD..

An external effects patching loop on all of the new Concert amps provides separate controls for both send and return levels. In addition there are presence and midrange controls, reverb in both normal and lead channels, a two-button footswitch to control channel selection and reverb and a low level line recording output.

"The original Concert was one of the most highly regarded of Fender's early amps so we thought it was appropriate to revive the name for this innovative new series," explained Paul Rivera, Fender's amp designer and marketing manager. "We've given the guitarist a clean channel for rhythm work, plus a switchable lead channel that provides total control of the amp's gain structure. Front-end overload is adjusted with the volume control, and there's a separate gain knob for intermediate stage drive. Finally, the master control sets the signal level delivered to the output stage and speakers."

The external effects patching loop on the new Concert amps provides separate controls for both send and return levels. "The effects loop," points out Rivera, "lets you 'pre-distort' the guitar signal in the amp's front end before sending it to the effects devices. This makes effects much more dramatic and versatile."



Fender Concert Series amps.

Microphones

At the other end of the sound system, new microphones have been introduced by Ibanez, Swintek and Pearl. The Ibanez IM76 is a percussion microphone especially designed for such low frequency drums as floor toms and the bass drum. Ibanez's new IM70 is a cardioid dynamic microphone with a lightweight cartridge diaphragm for fast transient response and accurate reproduction under high sound pressure levels. This, plus its 40 to 16,000 Hz frequency response, makes the IM70 well suited for snare drum, mounted toms and brass instrument applications. Also new from Ibanez is the IM80, a cardioid condenser microphone with a broad frequency response of 30 to 22,000 Hz. Its flat response, according to Ibanez, makes it ideal for overhead cymbals, hi-hat, acoustic guitar, piano and woodwinds while its use of a 9 volt battery provides greater battery life and greater dynamic range than conventional 1.5 volt condenser microphones.

Pearl Mikes CR25, CR45, CR55, CR57.

A new line of wireless handheld microphones from Swintek Enterprises offers a choice of the Beyer M500 ribbon capsule, the Shure SM 57, SM58 or SM78 dynamic capsules or the Shure SM85 electret condenser capsule. The microphones use the VHF/UHF high band to avoid interference from CB and business radio and to prevent the microphone from interfering with video equipment. Use of narrow band transmission enables the use of more microphones on adjacent frequencies without interference. Battery life is typically 10 hours and range is about 1,000 feet. Each microphone features a power on-off switch and a modulation level control.

A new line of four phantom powered electret condenser microphones has been introduced by Pearl International. The four — CR25, CR45, CR55 and CR57 — feature internal amplifiers, 3.5 volts at maximum SPL for the output voltage, less than 3ma for current drain, 0.5 per cent total harmonic distortion at high levels and an internal attenuator switch which increases the maximum sensitivity level. Frequency response extends from 15 to 22,000 Hz. Two of the microphones, the CR55 and CR57, also have a condenser element isolation system minimising both stand and hand held noise.

Effects Units

Pearl also has a new programmable mixing processor, the PM-66, which features four complete sets of volume knobs for mixing a solo or background accompaniment. In addition, the PM-66 provides a means of sophisticated manipulation and assignment of sound processors.

Also for musicians who want to manipulate their own or their group's sounds is a new multi-effects rack unit, the MXR Omni, from MXR Innovations. The unit includes six of the most popular effects — sustain, distortion, equalizer, delay, flanger and chorus — plus external loop capability in a standard 19-inch rack-mount configuration. Two front panel external loop switches allow the user to insert a single external effect or an entire chain of external effects into the MXR Omni at any point, with this function also controllable from the footswitch. The MXR Omni also allows the musician — guitarist, bassist or keyboard player — to select the signal path through the distortion and equalizer sections of the unit, positioning either effect before the other with the push of a single front panel button.

Suggested retail list price of the MXR Omni, including footswitch and 12-foot fully shielded guitar cord, is $725.

A new generation of performance oriented digital delay lines has been introduced by Electro-Harmonix. The first model is an 8 second digital delay with 16 second option and magna storage. The long delay time and a built-in click track permits musicians to lay down multiple tracks and hold them in memory with the infinite hold/repeat function, and already recorded lines can be reversed with a special reverse function. Forward and backward tracks can even be mixed together and lines of differing delay speed can also be mixed together. Other features include digital echo, digital chorusing, digital flanging, double tracking and status indicator LEDs.

MXR Omni Programmable Effects.

The Electro-Harmonix 16 second digital delay is packaged in a foot-controlled floor design for performing convenience and works with all musical instruments in any combination, even with vocals.

Also new for effects devices is the Sanox 98SX Pedal Driver which will power up to four 9 volt effects devices which have AC adapter jacks. The Sanox Pedal Driver, priced at $45, provides a maximum of 200mA current with less than 50mV ripple.

Percussion etc.

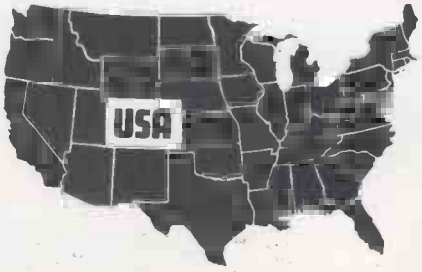
Two new percussion synthesisers, the 71SX Synthe I and the 72SX Synthe II, also come from Sanox. The units clamp directly to any drum rim or practice pad and an internal transducer picks up the vibration caused by striking the drum, pad or the cast metal synth case itself and the vibration triggers the synthesiser. Both units feature controls for master volume, voltage oscillator, frequency modulation, amplitude modulation, decay, sweep and intensity — the degree of vibration needed to trigger the synth. Suggested prices are $99 for the 71SX and $129 for the 72SX.

A new low impedance/high output pickup system from T. W. Doyle Co. offers guitarists 36 different tonal qualities. The Doyle D-1 system utilises dual pickups and a unique Doyle-designed rotary capacitance switch. Either pickup, or a mixture of both, can be used by guitarists to achieve subtle nuances of sound. The D-1 system, which fits any guitar with a standard humbucker configuration, includes two pickups, master volume control, master tone control, ohm selector switch, rotary capacitance switch, output jack and wiring harness.

E&MM

Manufacturers and companies mentioned:

Crate, St. Louis Music Supply Co., 1400 Ferguson Ave., St. Louis, MO 63133.
T. W. Doyle Co. Inc., Box 517, Westwood, NJ 07675.
Electro-Harmonix, 27 West 23d Street, New York, NY 10010.
Fender, CBS Arbiter Ltd., Fender House, Centenary Estate, Jeffreys Road, Brimsdown, Enfield, Middlesex.
Gallien-Krueger, 502-F Vandell Way, Campbell, CA 95120.
Ibanez, P.O. Box 866, 1761 Winchester Road, Bensalem, PA 19020.
JBL, James B. Lansing Sound Inc., 8500 Balboa Blvd., Northridge, CA 91329.
MXR Innovations, Atlantex Music Ltd., 1 Wallace Way, Hitchin, Herts. Tel.: 0462 31511.
Pearl International Inc., P.O. Box 111240, 408 Harding Industrial Drive, Nashville, TN 37211.
Randall Instruments Inc., P.O. Box 10936, Santa Ana, CA 92711.
Sanox, MCI Inc., Box 8053, 7400 Imperial Drive, Waco TX 76710.
Sunn Musical Equipment Co., 19350 Southwest 89th Ave., Tualatin, OR 97062.
Swintek Enterprises Inc., 1180 Aster Ave., Unit J, Sunnyvale, CA 94086.



- 6-voice polyphonic synthesizer (two oscillators per voice) using the same stable oscillators and accurate computer tuning as the Prophet-5, the industry standard
- 100 programs which can be modified or replaced by your own sounds
- New filter circuit which delivers exceptionally full tone colors while maintaining the classic Prophet sound
- Real-time, non-volatile polyphonic sequencer
- Dual-mode arpeggiator: up/down or assignable
- Chord tracking
- Cassette interface
- Computer interface — MIDI (Musical Instrument Digital Interface)

We think you'll agree that th
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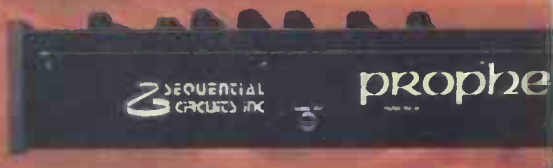

the new

For more information, write to Sequential Circuits,

w Prophet is one hell of an
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Sequential Circuits, in conjunction with several other manufacturers, has pioneered the development of an easy-to-use system for interfacing synthesizers with one another and with home computers. The MIDI-equipped PROPHET-600 can be connected with one cable to any other MIDI-equipped instrument. For example, when two PROPHET-600's are interfaced, either keyboard can control both synthesizers, allowing four oscillators per voice and two different programs sounding simultaneously! The MIDI is also compatible with home computers for program storage, patch print-out, music notation, sequencing, and multi-keyboard orchestration.

SEQUENTIAL CIRCUITS INC

prophet

O. Box 16, 3640 AA Mijdrecht, The Netherlands.

MUSIC MAKER EQUIPMENT SCENE

This month it may be interesting to look at the latest activities of Casio Electronics, who have resolved during early 1983 to change both their business profile and their product line-up.

During 1982 Casio instruments sold in very large numbers, virtually creating their own markets where none existed before. The successful use of their micro- and mini-keyboards by chart bands such as the Human League and Trio convinced thousands of musicians and non-musicians that interesting sounds could be made without spending large amounts of money on equipment. As sales increased, trade prices fell and the only problem in the final analysis was that of some models selling too quickly.

For 1983 Casio promise better records, better administration, and better sales training and showrooms. In addition they are about to delete and update several of their keyboards, with some quite surprising developments in terms of voicing, programming and interfacing to be seen.

The popular CT-403, for instance, is to be replaced by the CT-405. Again a full-size 4-octave instrument, the 405 has twenty preset sounds and is fitted with a 'cross tonal modulation' circuit which, it is claimed, expands these sounds into the realms of both conventional synthesisers and authentic instruments. The effects section includes sustain, vibrato, delayed vibrato and 'simulated reverberation'.

The accompaniment section gives the usual rhythms and choice of one finger or fully fingered chords with manual bass, and in addition four choices of bass patterns, four choices of accompaniment chords and four choices of arpeggios. Recommended price including VAT is £325.

The PT-30 has evolved from the VL-1, and now has two and a half octaves of conventional miniaturised keys together with calculator type keys for accompaniment chords. Its specification is quite astounding for a small instrument — eight preset voices, twelve rhythms, six arpeggios, three chord accompaniments, and an LCD rhythm display indicating the state of the 508 event memory. The memory can be divided into 8 sub-groups which can be chained as required for very long compositions, and all information can be stored on a standard cassette player using an optional interface. Recommended price including VAT is £79.

The MT-41 is a new version of the MT-40 with improved sounds, more versatile bass patterns and a new recommended price including VAT of £99.

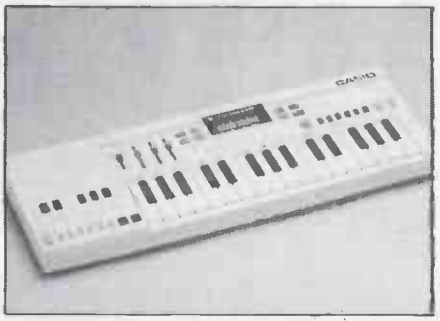
The MT-45 is a more elaborate mini-keyboard, with similar voicings to the MT-41 but with the addition of arpeggiator, choice of bass patterns, rhythm fills and intros. Recommended price including VAT is £125.

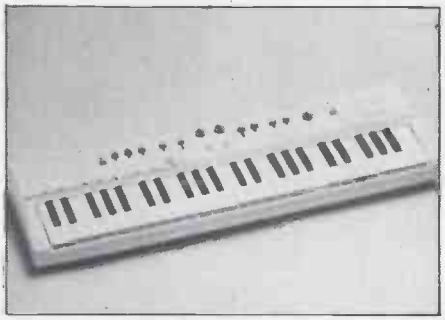
Near the top of Casio's mini-keyboard range is the MT-65, which has four octaves of miniaturised keys and twelve voices with cross tonal modulation and simulated reverberation.

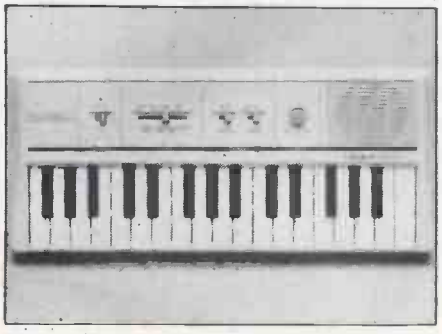
A matrix of switches give a selection of bass voicings, chord accompaniments and arpeggio patterns in addition to the usual easy-play devices. Recommended price including VAT is £175.

Finally the CT-501, a four-octave version of the CT-701 again including the bar code reading features, with 20 preset sounds, 16 rhythms and chord section and smart styling for domestic use. Recommended price including VAT is £375.

Other new products include the CT-602, a simplified CT-701 with 5 octaves of standard keys but without the bar code reader; the MT-11, a compact and simple 8-voice mini-keyboard along the lines of the popular M10; and the TA-1 cassette interface itself, which should give Casio another lease of life and take their compositional abilities into the realms of vastly more expensive microcomposers and similar computers. **E&MM**







Photos l to r and down:
Casiotone CT-405.
Casiotone PT-30.
Casiotone MT-45.
Casiotone MT-65.
Casiotone CT-501.
Casio TA-1 Cassette Interface.
Casiotone MT-11.
Casiotone CT-602.

CASIO

HOME ELECTRO-MUSICIAN

I suspect that it is every electro-musician's dream to own a mammoth studio equipped with massive 'wallpaper-job' synthesisers, 24 track tape machines, goodness knows how many track mixing desks and all kinds of digital doobries with a lovely entangled mess of wires and leads sprouting from every nook and cranny.

For instance, how many times have you picked up a Schulze, Tangerine Dream or Jarre album and turned green with envy at the photos of those almost ludicrous machines. Well - I'll happily admit to being one of those dreamers - and a dreamer I shall remain unless I win the pools (which will be difficult 'cos I don't do them!).

All is not lost for us paupers however - it *is* possible to create music of good sound quality with an absolute minimum of equipment; the artistic quality is, of course, down to personal opinion! I recorded an album called "Thoughts of War" using the sound-on-sound method with the following equipment:

1. Yamaha CS30 Synthesiser - this is an instrument which I would still buy now because of its price, power, quality, flexibility and last but not least, a built-in sequencer. Basically it has 2 VCO's, 2 VCA's, 2 VCF's, no less than 3 EG's, LFO, Noise Generator and one of the most comprehensive modulation circuits to be found this side of a Moog System 55.

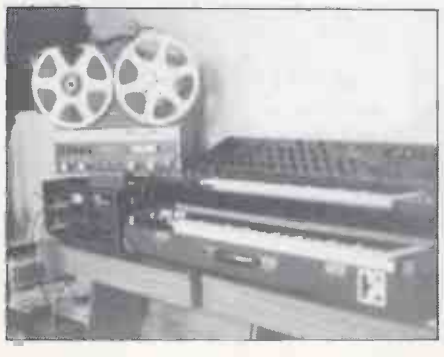
2. Hohner K4 Strings - the cheapest string machine around at the time ('79), it's not too hot by itself but when fed through the external input of the Yamaha, it can be filtered, modulated, sequencer-chopped, etc., etc.

3. Flanger and Phaser - these two foot-operated F.X. units can transform the nature of any sound quite dramatically - especially when the flanger is used on the string machine.

4. "Budget" Hi-Fi system - used as a complete monitoring system.

5. Revox A77 L/S with Dolby - I bought this second-hand four years ago and it is still working perfectly, despite the fact that I haven't had it serviced once - it's some machine! The reason why I opted for the low speed version (3¾ i.p.s. and 7½ i.p.s.) will become apparent later on.

Now to the recording process itself. Well, firstly, you obviously have to have some idea of what you are going to do before you plough into all of that expensive tape! The way I 'compose' (if I may use that word) is purely by 'doodling'; in other words, I just play around on the keyboards until I 'hit' something interesting, be it a rhythm, melody, chord sequence - whatever. I then tend to stick with this idea until I have worked out some suitable sounds to use. Let's say, for example, I find a really interesting rhythm and also a natty little melody - nine times out of ten the rhythm is programmed into the sequencer complete with desired tonal quality. One of the synth's oscillators is now taken by the sequencer, leaving the other VCO free to play the main melody.



At this point the record button of channel one on the Revox goes in - and off I go. The process is similar to a rock band I suppose, in as much as the rhythmic and main melodic sections (i.e. the guts) of the piece are recorded first. From here on the piece would develop something like this - suitable chords plus a second (often harmony) lead line will be recorded onto channel two with channel one being 'bounced' over simultaneously (and you *have* to get the mix right here!). And then channel one is used again for extra chords, lead lines, s.f.x. and general twiddly bits with, of course, channel two being bounced over at the same time.

The completed composition is now on channel one - but it sounds very lifeless - in desperate need of echo or reverb. Here is where the strength of a low speed Revox lies - by using the machine's own internal echo facility at 3¾ i.p.s., a very rich and clear repeating echo can be achieved, which, to my mind, brings the music to life. The piece is now finished, and because of the way in which the echo process works, what you are left with is channel one still 'dead' and channel two being merely channel one echoed. And, at the risk of dropping a trade secret (con trick actually!), this process occasionally gives the impression that the sounds are jumping around within the stereo field.

With careful use of the sequencer clock speed and the tape echo, I am able to make the sequences sound vastly more complex than they really are - after all, the CS30 only has an 8-note sequencer with *no* time spacing facility.

Bearing in mind that when the tape echo is added absolutely *everything* is echoed, one has to allow for this from the start. This sound-on-sound method does need practice, but then so does everything in music. For instance, I have reels and reels of tape with 40 minute epics all over them - you know the type - where the sequencer runs for 39 minutes and never changes key and everything else drifting in and out - sounded great at the time, but now? Oh boy!

I have learnt (slowly) that it is far more effective to get to the musical point than to dawdle around the fringes hour after hour. The masters of electronic music always state the main theme (or 'motif' if you're into Wagner!) very early on in the compositions e.g. Schulze's 'Mirage' or Tangerine Dream's 'Ricochet', and thereby eradicate any irrelevant distractions.

This is what separates the musicians from the technicians and I think it applies more to electronic music than any other kind of music.

The temptation is to leave the machines running, but the experience is gained in the final human control over the machines. Not as easy as it sounds!

I hope that by this article and with my record, I have proved that one doesn't need a studio like Mission Control to produce records or tapes of good sound quality - because if the S.O.S. method works, it is very satisfying. I'd still love to own a 24 track machine though!

In the past few weeks I have been in the process of finalising a new contract with Uniton Records in Norway, which, provisionally, will last for 3 years with a minimum of 3 new L.P. releases during that period. To go along with this contract I have also been offered an advance to enable me to purchase some new equipment. I'll then be in the market for the new Tascam 38 8 track machine, the R.S.D. 8:4 mixer and a high-speed conversion for my Revox so that it can be used for mastering.

The presence of an 8 track system will of course change my whole recording process drastically but it will require a period of intense self-instruction in the art of multi-tracking first!

While I await the arrival of the spondoolicks for all these goodies I have been busily preparing new pieces of music in 'sketch' form for future use. And when I eventually do the final recordings on the 8 track I will, in most cases, forsake my string machine and hire a Prophet V and/or a Roland Vocoder Plus for a couple of days, to take care of the chordal work. Also, very recently, I have acquired a Sequential Circuits Pro-One which will take on most of the sequencer work.

I hope to have some master tapes completed around March 1983 and there's a possibility of concert performances to support the resultant album. This will probably be titled 'Assassin' which, incidentally, has no profound meaning — I just like the word!

Mark Shreeve **E&MM**

Advanced Music Synthesis

by Steve Howell

Oscillator Modulation

This music workshop is aimed at those people who want more out of their synthesiser systems than filter sweeps, assorted spacey sounds or attempts at impersonating acoustic instruments. That is not to say that this column is meant only for the eyes of those people who synthesise with slide rules — its intention is to stimulate musicians to understand their synthesisers more fully and use them more creatively.

It could be argued that Voltage Controlled Oscillators (VCOs) are the most important part of a synthesiser for without them there would be no sound — in the early days of electronic music oscillators were all they had to play with but nowadays, of course, these devices are far more sophisticated and allow a greater variety of sounds and textures to be obtained. The very fact that they are voltage controllable means that their pitch can be manipulated both automatically and manually. This manipulation, known as modulation, could be anything from simple vibrato to computer control. In between these two extremes, however, lie many exciting possibilities, some of which will be outlined here.

One of the simplest forms of modulation uses an oscillator to repeatedly vary the pitch of another VCO. In most commercially available synths this modulating oscillator usually operates in the low frequency range for vibrato and trill effects, filter sweeps and tremolo, but when the frequency of this oscillator is increased so that it is in the audio range, many interesting effects can be obtained as the modulated oscillators output has many of the modulating oscillator's tonal qualities imparted into it. I call this effect 'scrunging' because of the drastic tonal changes that can take place using this technique, especially if the modulating waveform is a pulse or square wave. I won't dwell on this particular use of modulation just now as it has already been covered in E&MM in the March '81 and '82 editions so for further information I would suggest you refer to that.

Let us return to modulation using Low Frequency Oscillators (LFOs). As I just mentioned, using an LFO for vibrato is common practice with nearly every synthesiser, but many more interesting effects can be obtained by mixing two (or more) LFOs together and applying them to the control voltage (CV) input of a VCO. Dependant on the relative levels of the waveforms many varied results can be obtained. Figures 1a and 1b give some examples of the various waveforms that can be produced with this technique. As you can see there are a lot of possibilities for special modulation effects to be had and the permutations (as with all synthesis) are endless.

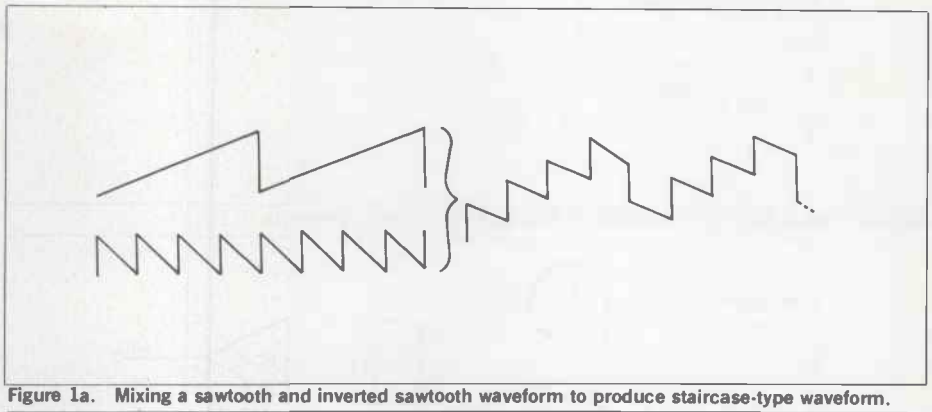


Figure 1a. Mixing a sawtooth and inverted sawtooth waveform to produce staircase-type waveform.

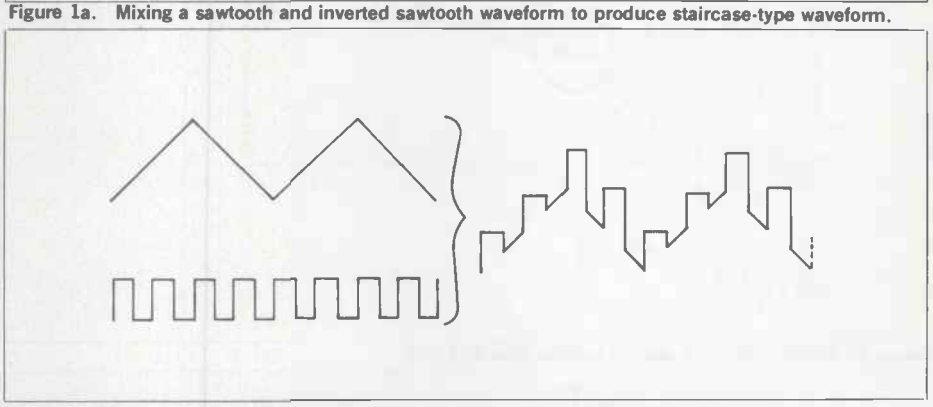


Figure 1b. Mixing a triangle and square wave to produce a rising and falling trill effect.

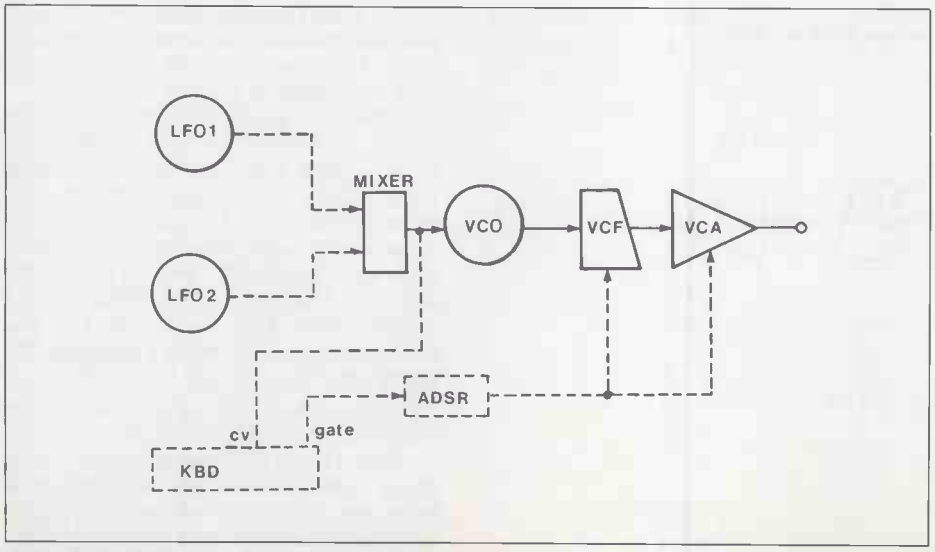


Figure 1. Basic patch for mixing two LFOs.

One interesting effect in particular uses two square waves to give a sequencer or arpeggiator effect. By setting the depth of modulation of LFO1 so that the VCO is made to jump, say, an octave and the output of LFO2 is adjusted to give an interval jump of, say, a fifth, by varying the rate of the two LFOs many interesting rhythmic and melodic effects can be created. I hasten to add that you will have to spend some time experimenting to get the best results but it's worth it.

If the rate of your LFOs is voltage controllable one has even more possibilities available. One could, for example, route the output of an envelope generator to the CV input of an LFO that is set up to provide vibrato so that as the note dies away the vibrato will slow down. If tastefully used this can be an extremely useful method of modulation.

I think it's worth pointing out, though, that the validity of some of these effects in the strictly musical sense is questionable but they do serve as interesting exercises for you to become more familiar with your synthesiser system. Having said that, however, there are occasions when you might be required to produce an effect such as I have outlined above; by being totally familiar with your synthesiser this should be no problem. Also, effects such as these are useful for a tonal Enotype music as a subtle rhythmic back-

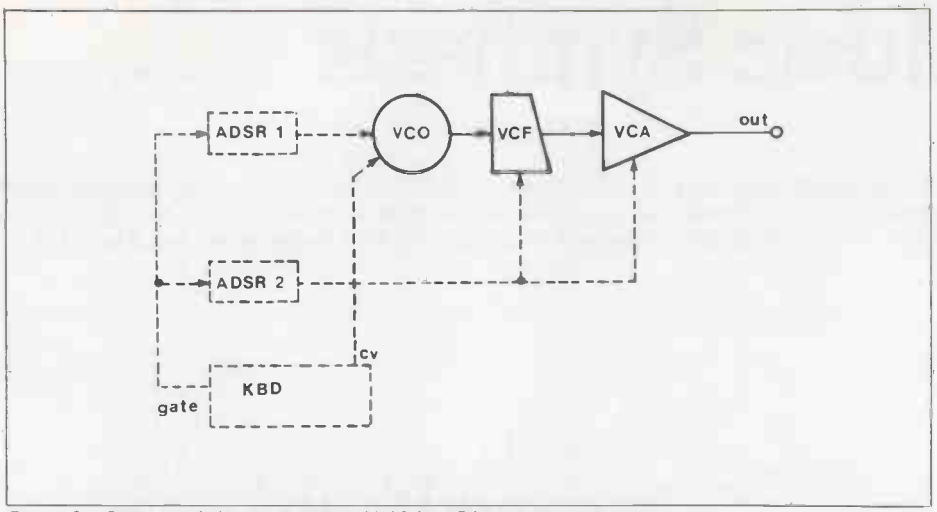


Figure 2. Basic patch for modulation of VCO by ADSR envelope generator.

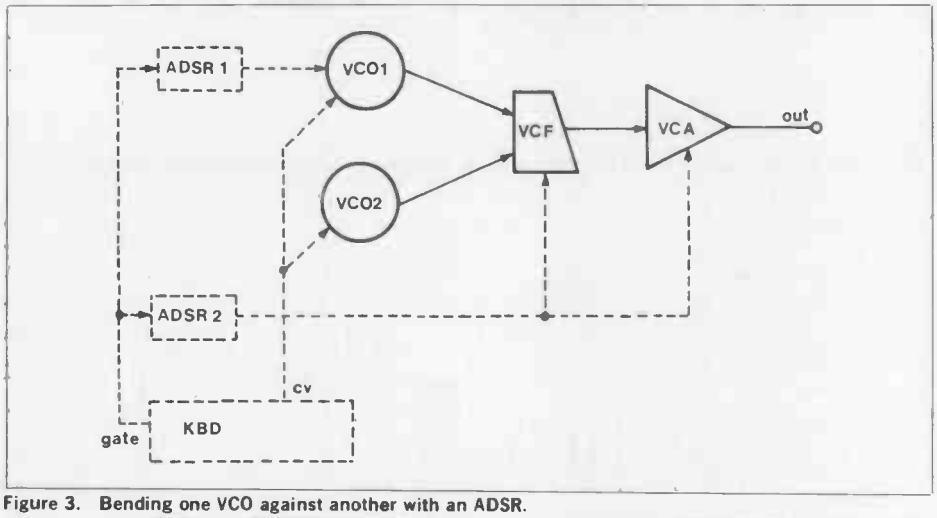


Figure 3. Bending one VCO against another with an ADSR.

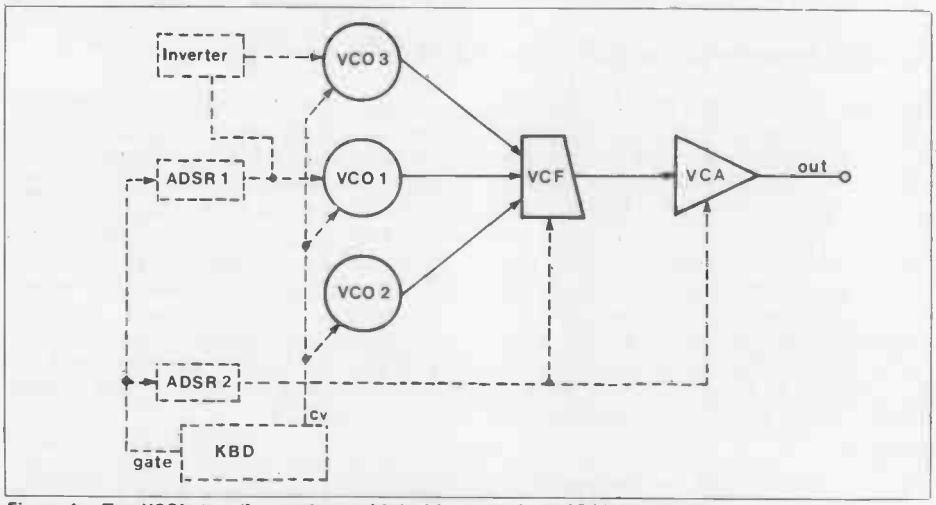


Figure 4. Two VCO's bending against a third with +ve and -ve ADSR envelopes.

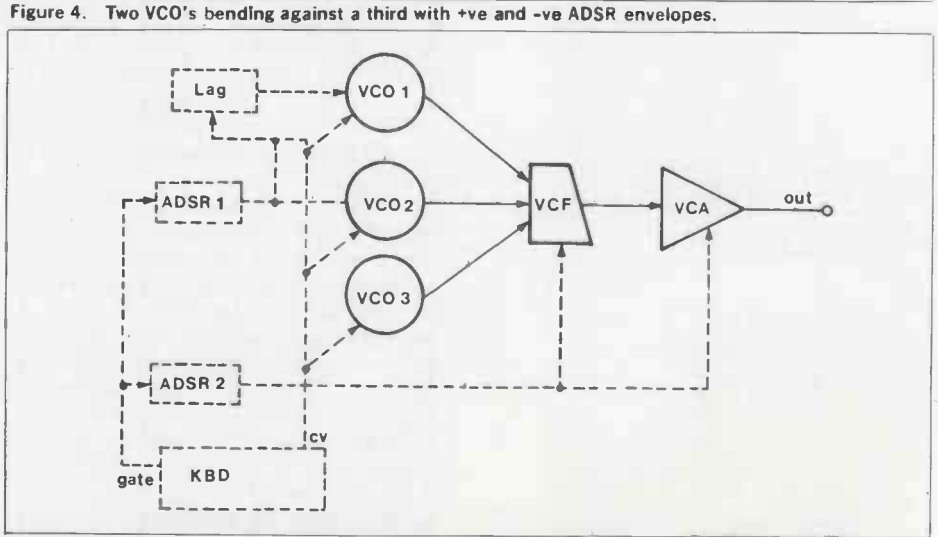


Figure 5. Producing different rise times with one ADSR.

ing. As with all cyclic modulation effects, though, care must be taken not to make the results monotonous because of their inherent repetitiveness.

Another form of modulation is by an envelope generator (EG). We are all familiar with the 'pew-pew' syndrum effect — this is simple modulation of a VCOs pitch with an ADSR-type EG whose attack is almost instant and whose decay/release portion is variable. This causes the pitch to rise immediately and fall as the sound dies away. EGs can be used far more usefully than that, however. Patch an EG to the CV input of a VCO as in Figure 2 and put the sustain level on the EG to maximum (for the time being). Use an attack time of about 500ms and a release of about the same time. Adjust the modulation depth control carefully so that when a note is played it will 'swoop' up an octave in accordance with the attack time and sustain at a constant pitch while a note is held. By using another VCO as in Figure 3 and tuning that VCO an octave up from VCO1's initial frequency, whenever a note is played VCO1 will fly up to meet VCO2 — this is very useful for brass and vocal sounds as well as many synthesiser effects. For those amongst you with fairly elaborate synths you might like to try the patches in Figures 4 and 5. In Figure 4, because the EG is connected to VCO3 via an inverter, that oscillator will move down to meet VCO2 while VCO1 will still 'fly' up to meet VCO2. In Figure 5 where the EG is connected via a lag time integrator (a device that introduces a portamento-like slur to any voltage fed into it) it is possible to have, effectively, different rise times for each VCO.

You might like to try lowering the sustain control on the EG so that a note will rise and fall in accordance with the attack and decay times to a level set by the sustain control (you will have to adjust the modulation depth control to compensate for this drop in sustain level). Dependant on the length of the decay portion, different sounds can be obtained — with very short decay times various 'squags' and 'squeaks' can be introduced to a sound which can be particularly effective for blurting fanfare brass sounds.

Try also experimenting with various release times — many useful automatic pitch bend effects can be produced with long release times.

Finally, it is also possible to use a noise generator as the modulation source. This is handy for synthesising pipe organs and 'breathy' sounds. Try experimenting with different noise 'colours' for varied effects. If you want to hear good examples of this particular technique have a listen to Wendy Carlos — she uses it to great effect in the Brandenburg Concertos (Switched On Bach LP), and her latest contribution, the film music for 'Tron', has some amazing sound effects in it.

Well, I hope that has given you some ideas to play around with until next time when we will be dealing with the application of Sample and Hold devices. Until then . . . happy patching! **E&MM**

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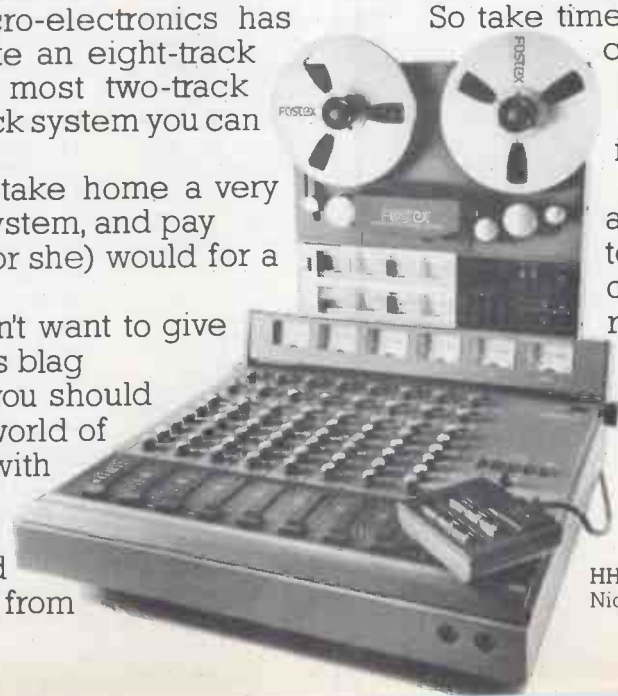

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The complete 'all-options supplied' Synclavier II system.

Synclavier II

Part 1

The reasons that you have for reading this review should have nothing to do with whether or not you can afford this instrument. Not initially, anyway, because as I introduce you to its features you're likely to become more and more attracted to what it offers — a complete synthesis system that is quite different from instruments that most of us have played or listened to over the past twenty years. Rather than a collection of analogue modules — oscillators, filters, amplifiers, envelope generators and so on — the Synclavier II is built up from a high-speed computer which has been developed for musical use mainly through software programming and special hardware for the storage of waveform samples at various rates (minimum 32K).

The power of this computer (called Able) is due to its speed (it is very fast even for a machine in the PDP 11-70 series class) and its architecture. It is a 16-bit machine that has been developed by the makers of the Synclavier II, New England Digital (NED). This company has been making computer musical instruments since 1977 when they produced the first Synclavier system, alongside R&D for other products such as software for speech analysis, noise and vibration tests, etc. The Able computer is a 16-bit machine with access to between 32K and 56K 16-bit words in self-contained memory and almost unlimited access through disk-drives. In addition to 5¼", 8" floppy disk and Winchester hard disk drives, two main peripherals, a computer terminal with VDU display and keyboard (operating in full duplex mode), and a printer, all link to the synthesiser's computer via an 8-bit control bus. The logic employed is extremely fast and enables programs to be executed in real time — an achievement unmatched by the largest early digital synthesisers. The language used to program the system, Scientific XPL, is a high level, structured language. It enables new software sections to be added without the need to reprogram the original operating system.

Despite its high price, from around £14,500 for a basic system to a full peripheral complemented system at £36,000, over 200 Synclaviers have been sold to date, mainly in America — a large proportion to pro-musicians, with the rest to large video/music studios and some universities. Isao Tomita relies heavily on the Synclavier as you'll see from his 'Plasma Orchestra' in this issue; Patrick Gleeson has recorded a vivid interpretation of Vivaldi's The Four Seasons on dbx decoded digital disc (Varese Sarabande VCDM 1000.100), and Californian composer Bernard Xolotl will be discussing his experience of the instrument in the next issue.

Operating the System

The computer is programmed by means of either a terminal or a special keyboard unit with 4 groups of 4 x 8 rows of function buttons on its control panel plus a sprung rotary control knob that allows realtime changes of many parameters for creating or modifying an instrument sound or effect.

The keyboard, therefore, makes the Synclavier II a realtime performance system with the same possibility of controlling parameters as analogue synthesisers. But, as said before, the actual aspects of synthesis involved here are going to be new to many musicians. Just as many of us struggled to understand analogue controls and to grasp computer music programming, the keyboard panel controls must also be learnt and accepted. Development is also under way for a guitar synthesiser link to the main computer. Although conjectured to be a Roland guitar synth, it is more likely to be a standard guitar with modifications.

Between 8 and 32 voices can be played on the keyboard and the unique 'partial timbre' method of synthesis may use up to 4 voices (one for each partial) on every note played on the keyboard. The computer keeps track of your assignments and always gives you the maximum utilisation of the voices available. A chorus effect is made by assigning 2 voices to each partial.

A partial timbre consists of 24 separately adjustable harmonics, a volume envelope generator, a harmonic envelope generator, and a completely adjustable range of keyboards (and separate Morley Pedal) effects from vibrato to portamento. Since there are as many partial timbres as there are voices (e.g. 32 on the 32-voice system we are examining), up to 96 harmonics (using 4 partial timbres) can be triggered from just one key on the keyboard.

16-Track Recording

The keyboard unit also comprises a 16-track digital memory recorder. Complete performances can be created by storing single 'instrument' lines on each track — just like using a studio multi-track recorder — and then played back at the press of a button. A total of 16 instruments may be stored on 16 tracks (really RAM portions of memory). However, this recorder can 'merge' all tracks on to one track and can remember all the partial timbres employed, as well as all programmed effects. And, as with most digital recorders, it has the ability to speed up or slow down your music drastically without any deviation of pitch (as on a normal analogue tape machine).

A click track can be with the output signal for 'metronome' timing of one track with the next, or sent separately to an external tape recorder for large scale multitracking in sync.

At the end of this sophisticated (maximum 10,000 note) recording section is surprisingly, just a mono output! — don't despair though, for a stereo placement module is on its way in '83, and I also know that several Synclav' users have actually made mod's to give separate outputs for normal mixdown. Another method that's easier, but (slightly!) more expensive, is that used by Patrick Gleeson — he prepares his pieces using his own system, and then uses another system to run in sync alongside. By making two tracks identical (in sound and volume) and sending Synclav's to left and right

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The PPG Waveterm System is the new music synthesiser that combines analog and digital technology. The Waveterm system consists of the PPG Wave 2.2 keyboard and the PPG Waveterm terminal. The PPG 2.2 is a self-contained digital synthesiser which offers a wider range of sounds than ever before possible with one instrument. With its 2,000 waveterms, the PPG offers over 100 sounds which can be stored in non-volatile memory, and each of its 8 voices can be processed by a resonating 24dB/oct. filter and modulated in real time with the five octave dynamic keyboard. The Wave 2.2 contains an eight-track polyphonic sequencer. Each track may be edited after recording and with the use of the highly sophisticated digital front panel, the sequencer may then be mixed and stored for instant recall.

The PPG Waveterm, a high resolution graphics computer terminal extends the capabilities of the Wave 2.2. With its additive waveform synthesis and natural sound sampling it gives you limitless sound possibilities. Natural sounds may be analysed by computer and then combined with other waveforms or sampled sounds. These complex sounds may then be loaded into the Wave 2.2 and processed by the front panel controls for real time performance. The Waveterm also allows you to specify whole scores from the terminal. The sound parameters of individual notes are definable.

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stereo channels, a centred instrument will be heard and so on. Many interesting features and control functions are offered in the recorder and we'll examine this part more closely later.

Timbre Display

Coming back to base again, it is also possible to control the computer from an optional terminal. What musicians usually do is start with the keyboard and main computer/synthesiser unit, then purchase the terminal to use its 'Timbre Display System' (TDS). This new addition gives very clear graphic displays on the terminal's VDU of the make-up of every partial in use, along with detailed information of function buttons' settings (called 'coefficients') that are literally changed in real time when you move the control wheel to modify a parameter. Although the keyboard unit has an LED display to indicate settings currently being changed, the TDS makes you feel you're looking right into the heart of the computer to see what its doing. Four different numerical formats and high resolution graphics can also be transferred to your next acquisition, a high resolution printer for keeping permanent records.

Disk Drives

Just as the keyboard unit can store and retrieve whole libraries of sounds (64 at a time) from diskettes (i.e. 5¼" floppy disks in this particular system under examination), so does the TDS operate once its specific system diskette is 'booted' (that means: inserted into the disk drive and correctly loaded into the computer's memory so that the operating instructions for TDS are available). The disk drive is also necessary to set up the basic operating system before anything will work. Once this system diskette is booted you can then put in one of your own 'file' diskettes to recall or store timbres (i.e. your own synthesised sounds containing 1-4 partials) and also recorder 'sequences'. A second disk drive can be added later to facilitate transfer operations.

When you purchase a 5¼" minidiskette drive as part of your system, you are supplied with 5 separate diskettes that each contain 64 timbres, plus an individual 'system operator' (the one that sets the synthesiser ready to operate), and various note sequence sectors (i.e. specific space for your 16-track memory recordings (from 1000 notes to 10,000 notes in length). The 8" Maxidiskette drive is an alternative system (not presently available in the UK) that simply increases all sequence space to 28 pieces lasting 10,000 notes maximum). Even the Minidiskette offers 8 x 10,000 note pieces plus other space, and undeniably represents large composing areas for serious extended composition — not just 3 minute pops or 30 second commercials.

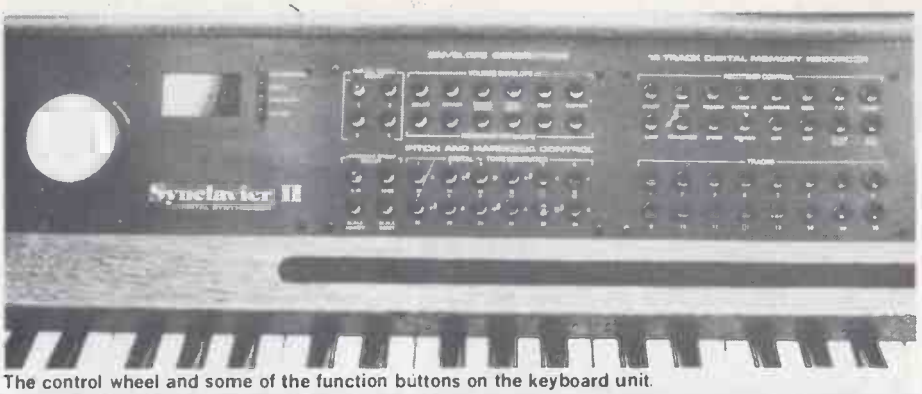
Script

For those avid musicians not gifted with realtime prowess at the keyboard, the terminal could become your ultimate friend instead and, complete with the next software option we'll consider called 'Script', provides a resourceful music notation system that is easily learnt.

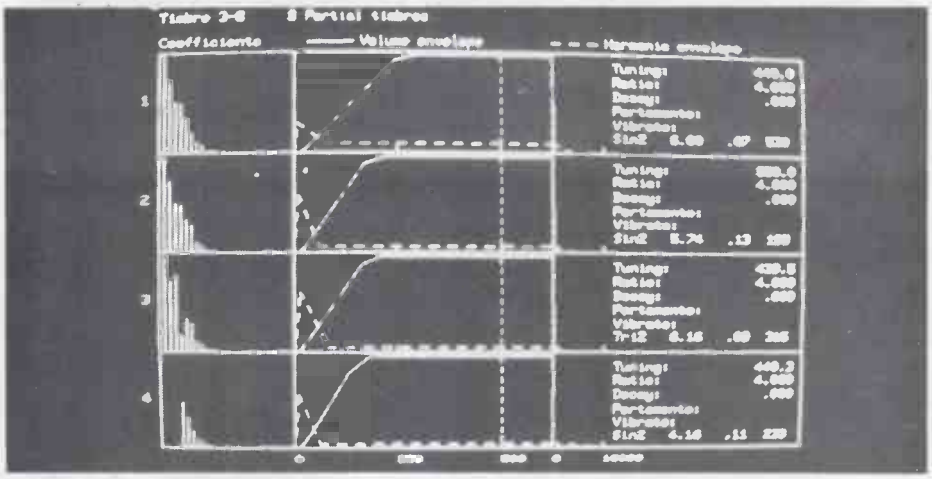
All the elements of a piece — its pitch, rhythm and dynamics etc, may be typed in from the computer terminal. The use of different timbres, repeats, transposition and many other editing functions that are needed to compose a complete piece are all possible.

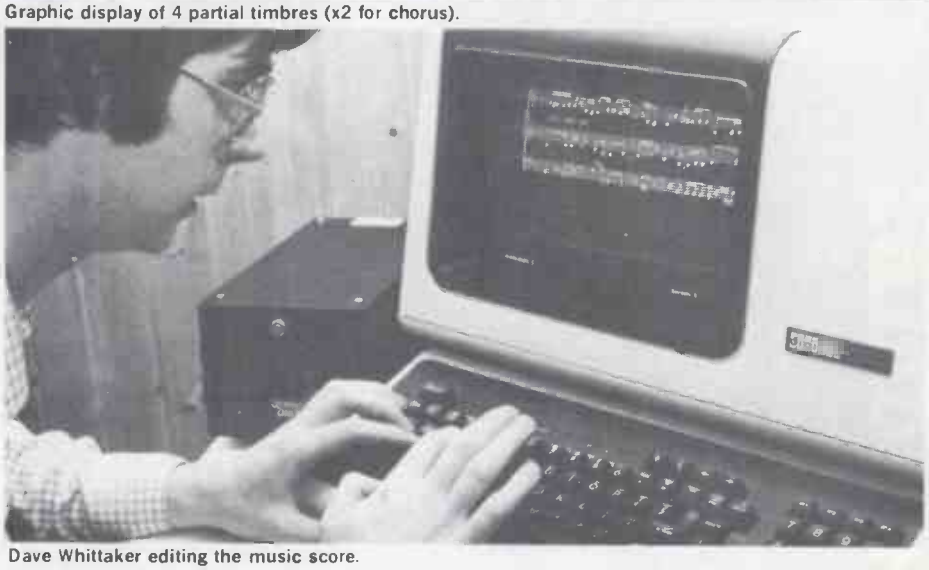
As you would also expect from a system of high calibre, live performance recorded pieces can be 'reverse compiled' into Script's readable format for further editing with the computer terminal. Even the most accomplished keyboardist may be left behind when compared to the programming skills of Script for creating fast, complex polyrhythms.

Film and video music composition is made easier by Script's ability to synchronise musical beats to time or frame cues. Passages can be stated on particular cues and the system will even calculate how fast it should play a section between cues, or whether it should be a gradual or immediate tempo change!



The control wheel and some of the function buttons on the keyboard unit.


Graphic display of 4 partial timbres (x2 for chorus).


Dave Whittaker editing the music score.

Music Printing

Now we come to every musician's dream, the facility to have his or her music printed out in real notation after it has been recorded. Another software option is available to solve this problem. It needs the high-resolution printer, of course (incidentally, it's linked via an RS-232 interface and specified as the Prism 80). I am also told in the mammoth 2,000 page manual that a Script-MAX-XPL software licence is required — no doubt buying the system covers this. More to the point, music printing takes place within the Script program after loading a special Script Level II diskette.

There are untold problems in getting music in printed format from your

recorded efforts. The computer is terribly precise and any laziness on your part with timing will give quite unexpected results — take the sample printout shown as an example. This is the start of J.S. Bach's 3rd Brandenberg Concerto. Part 1 should actually be groups of semiquavers and quavers all neatly tied together, but unfortunately something has slipped fractionally behind after the first note and F# is extended another semiquaver. The computer then really acts intelligently and puts parts 2 and 3 in syncopated alignment underneath! If you listen to the sample of this piece on E&MM Demo Cassette No. 9 you'll hear that all was really as reasonable in performance as it should have been, so where did the recorded composition go wrong?

I confess the system actually fooled me with its skill, and by simply giving it more information, I could have rectified the situation to give me every line precisely as played or even tidied up a little as necessary to make it easier to read. All data is sent from the terminal keyboard and no facility for light pen is presently available. You can also add titles, lyrics and any other text straight on to the screen music. I'll explain more of this in the next part of the review. Meanwhile, perhaps you've noticed another problem that has apparently bemused the computer?

MAX and XPL

Continuing our discourse on the possible 'components' within the Synclavier System, you may have realised that, despite the close proximity of an incredibly powerful micro, you don't have to worry very much about what the computer is really doing when you set the vibrato on a partial, for example. Just as in Basic programming, it is not necessary to know that the command LOAD is possibly doing multiple accumulator to register exchanges, comparisons and jumps in machine language.

Nevertheless, to realise the full potential of the NED system, you have to be prepared to learn the functional distinctions between the computer and the synthesiser keyboard control buttons. As you can see from Figure 2, each of the 32 synthesiser channels, or voices, receives a separate set of parameters, or control code, from the computer. The control code for each voice includes a 24-bit frequency descriptor, an 8-bit volume, 16-bit rates and 8-bit limits for the volume and index interpolators, a 2-bit index shift count, and a pointer to any one of 32 waveform memories which can be loaded with any 256-point waveform.

Normally, you might have to use an assembler language, but this is where MAX, a high-level language provided on optional software diskettes, makes a big contribution in an accessible way.

Imagine re-defining any input or output, any control button on the keyboard unit, any function of the external pedals (these are specifically two Morley Pedals, but other types could be used). This is what MAX can do to make your Synclavier a very personal dedicated system. You choose your own easily remembered names for each function and enter these as 'labels' or pointers to the new function button, and so on.

The MAX language is, in fact, a library of proven Scientific XPL procedures, such as SET FRQ and SET VOL, for instant recall to do a task to help you create music in your particular way.

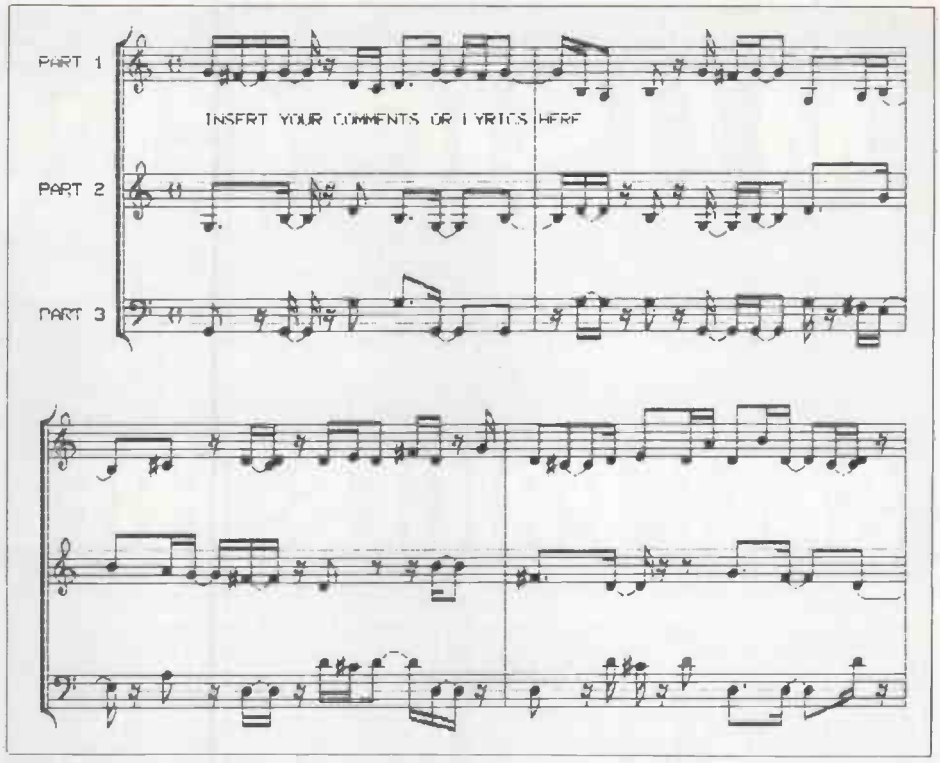


Figure 1. The music printing option (see text).

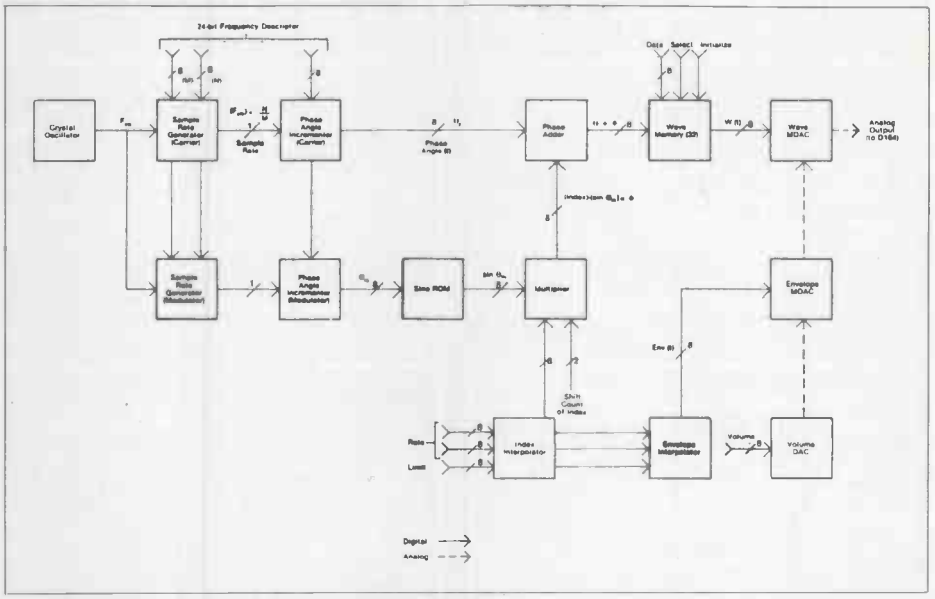


Figure 2. One synthesiser channel of the Synclavier II.

Sound Sampling

This latest exciting development in the Synclavier II System was released in September last year. The Signal File Manager (SFM), as it is called, is part of the new Sample-to-Disk system for recording and recreating sound waveforms. It is an optional package on software diskettes requiring one or more Winchester disks and 16-bit buffered A to D, D to A converters, as well as the main Synclavier II system with keyboard and terminal. Although playback is monophonic from the keyboard, a sampled sound can be shifted up or down 4 octaves and can then be inserted as a track on the memory recorder along with your keyboard or Script created instruments.

It will soon be possible to sample a sound and synthesise it as 4 partials in the Synclavier II so that you can further alter it and play it polyphonically. Samples can last up to 50 seconds each (utilising the 5 MByte capability of the Winchester). Some interesting instrument samples are given on Demo Cassette No. 9 that show the clarity of the sounds. Many editing possibilities are provided and this will be further discussed along with a full review of the keyboard performance unit next month.

E&MM

There are 4 options now being made available in the UK through Bandhive Ltd: 1) Basic 8-voice keyboard synthesiser system, price £14,500; 2) 32-voice keyboard synthesiser system, price £21,900 (both 1 & 2 have road cases supplied); 3) 32-voice synthesiser with Terminal Support Package, music printing option with printer, price £29,000; 4) As 3, plus Sample-to-Disk, with 5 MByte Winchester disk and A to D/D to A module, price £35,900. (Prices quoted are approximate and based on 1.63 dollars/pound.)

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Hot Wiring your GUITAR

Bypass Switching

Peter Maydew

Broadly speaking, most electric guitarists employ two distinct playing modes during a performance: a loud penetrating tone for melody playing and soloing, and a softer less obtrusive one for rhythm and accompaniment. I'm sure I'll get lots of indignant letters now, having suggested that most players are somehow limited, but the design of the hardware will bear me out.

Many guitar amplifiers, for example, have two sets of controls which can be switched between at will; on the guitar front (pun intended!) most Gibson guitars still have their pickup selectors labelled 'Rhythm' and 'Treble'. On these instruments it's evidently intended that the fingerboard pickup should have its controls set for the softer rhythm sound, while the bridge pickup is used for lead playing. As it happens, the fingerboard pickup tends to be the louder of the two because the string vibration is greater at this position, and in the days when I played a Les Paul copy I usually used the pickups the other way around; there's always one who has to be different, isn't there?

The Fender Jazzmaster and Jaguar guitars, currently enjoying a modest resurgence of popularity despite being discontinued, use a slightly different system. Two completely separate sets of tone and volume controls are fitted, and one or the other can be selected with a small switch.

In terms of today's rock guitar styles, the lead setting is often all-out maximum everything, and it's doubtful whether any controls at all (other than self control) are needed for this condition. In other words, a simpler arrangement could be to have a bypass switch which just cuts the controls out of circuit altogether. I first came across this idea when playing a Shergold Modulator guitar which had a bypass switch built into one of its interchangeable control modules. It was interesting to note that even when the volume and tone controls were set at maximum, operating the bypass switch still caused a noticable increase in the volume and brilliance of the guitar. The mere presence of the controls connected across the pickup was loading its output and causing a loss of signal. As soon as I could, I tried the same thing on one of my own guitars, and although the loading effect wasn't so serious, I was pleased to have the ability to switch between full and reduced volume repeatably; no more fumbling with the volume control!

A Bypass Scheme

You can build your own bypass very easily, as shown in Figure 1; often the simplest things are the most effective. If you have one volume and one tone control, you'll need a double pole double throw (DPDT) switch; choose one with a generous toggle if you can, because you'll want to be able to operate the switch unhesitatingly when you're in a hurry. If you have two volume and/or tone controls, or your guitar is stereo, Figure 1 should be duplicated; alternatively a four pole double throw switch will make bypassing more positive, since you won't have to remember which switch is which, or in some cases operate them both at once. 4PDT switches are usually only available in mini-toggle form, however, which makes them trickier to operate in a panic. The choice is yours.

The author's guitar — see 'The Photograph' below. Photo by Chris Richardson.

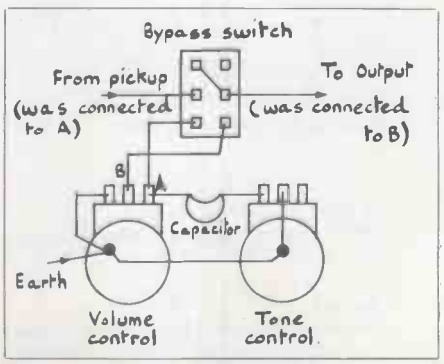

Figure 1. Plans of the proposed bypass.

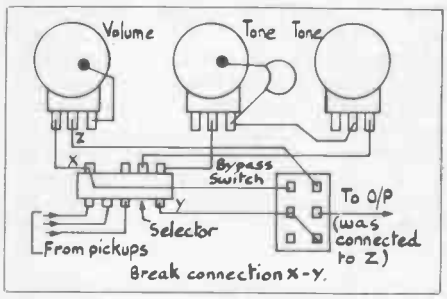

Figure 2. Bypassing a Stratocaster.

Things are more complex when it comes to three pickup guitars. If yours has three volume controls, the virtual non-availability of suitable six pole switches means you're restricted to three separate bypass switches; a messy solution. Stratocasters are a special case, as always; it's a simple matter to cut out all the controls in one fell swoop with a single DPDT switch, and the arrangement is shown in Figure 2. The switch placing is up to you, but it should preferably be in that magical (non-existent?) position that's easy to reach and yet simultaneously difficult to knock accidentally.

The Photograph

The picture shows my favourite lead guitar; I know that if I can't play it on this, I won't be able to play it on anything! Originally a Gibson L6S Deluxe, the guitar has had new Schaller machine heads, a plain ebony fingerboard, new pickups and wiring, a stainless steel scratchplate, a new bridge and tailpiece, and it's been refinished. In a nutshell, there's not much of the original instrument left!

The wiring is a kind of sampler of the techniques covered in 'Hot Wiring Your Guitar' articles since E&MM began. I used DiMarzio Dual Sound pickups with four conductor cables, and the circuitry includes: bypass capacitors on the volume control (April 81), phase reversal (July 81), three way switching on each pickup (October 81), stereo (May 82), an ARP hexaphonic pickup (July 82) and a bypass switch.

I have found the conventional passive sort of tone controls pretty useless on a guitar of this sort, especially with all that switchery available; I didn't want to use active circuitry, so there is just one knob, a dual ganged volume control. The jack socket is fitted to a Stratocaster style recess plate, to stop the plug sticking up in the way, and because I like them. The ARP pickup has its own socket, which feeds a home built six channel fuzz unit; sometime this century I may get round to building a full scale guitar synth, but don't hold me to it!

Incidentally, if you were wondering why the wiper of volume control 2 and stereo output 2 in Figure 1 of May's *Hot Wiring* were connected to earth, puzzle no more; the wiper should go direct to output 2, and neither is earthed. **E&MM**

DISCOTEK

The microphone input stage

Ben Duncan

Thankfully, vocals amplification for discotheque applications is relatively free from the 'catch 22' syndrome inherent in the design of microphone amplification for recording or amplifying live music. To begin with, *Agent Provacateur No. 1* — long cables — is mercifully absent. Additionally, the use and abuse suffered by the microphone at the hands of the average DJ is relatively predictable. Indeed, we can specify order of magnitude SPLs (Table 1) and thereby arrive at approximate figures as to the voltages arriving from the microphone; both sets of figures being based on close miking (at 1") and therefore giving worst-case voltages, in one extreme at least!

Providing you're happy to be restricted to the region of your console when making announcements, there's nothing especially wicked in the use of high impedance microphones, for with lead lengths of 6 feet or less, the usual lack of treble needn't be manifest. But, of course, the inevitably ragged response curve and poorly governed directional properties of low cost microphones are likely to give rise to howlround problems, the picture being complicated by two conflicting factors. Firstly: a DJ's microphone is usually situated particularly close to the speakers, and secondly; in mitigation, voice-over (attenuation of the music to make the vocals audible) is a classic and thus acceptable cop-out. Assuming, then, that you *can* achieve satisfactory results from a high impedance mic, the reward is a delightfully simple input circuit (Figure 1). R1 defines the input impedance, which isn't critical, though higher values will tend to improve the top end response at the expense of extra hiss. The gain of the op-amp is arranged so that the output voltage from a typical high impedance microphone corresponding to the SPLs generated by exuberant DJ's at distances of 1" to 3" (circa 110 to 125dBA) don't cause overload. R4 drains away any residual DC voltages arising from the next stage, so avoiding bangs and clicks when the microphone on/off switch is operated. The latter can either be panel mounted, or in the form of a footswitch, which is helpful if you break your arm or like to gesticulate. Note also the switched lamp, which illuminates a bold legend warning that the mic is 'live' and prone to blatantly broadcast potentially embarrassing comments; alternatively, it saves the humiliation of making announcements over a dead microphone! The lifespan of the lamp is extended by marginal underrunning, this being achieved simply by dropping the voltage to about 90% of the nominal voltage (i.e. 11V) with R1. R2 has the same aim: improving the lamp's reliability by reducing the turn on surge — its job is to maintain a 'tick over' current.

When the shortcomings of high impedance microphones are unacceptable, electret and certain capacitor microphones (notably the Calrec 600 series types) can make use of the same simple input circuitry without significant degradation of their excellent characteristics, and indeed, alternative component values suited to the Calrec microphones are depicted in brackets. Note here the revised input circuit wiring, wherein a non-standard 4-pin socket (e.g. 4-pin XLR) ensures that mics other than Calrec's don't accidentally receive the polarising voltage (45V), so avoiding potential damage. Aside from capacitor microphones, a substantially flat response and well-behaved directional properties usually spell a low impedance dynamic mic, and without the problems of long cables and the necessity to design for the ultimate in low-noise performance, we can again 'get by' with a relatively simple input stage (Figure 2). In this circuit, a transformer provides much of the voltage gain, but more important, it allows both the microphone and op-amp to 'see' load and source impedances respective to their needs, these being commensurate with low noise and good treble response. It *is* possible to achieve good results from a transformerless input stage, but the expense of a transformer is exchanged for an equally expensive op-amp having paralled input devices, not to mention the extra circuit complexity. Returning to Figure 2, low impedance mics have, as a rule, balanced terminations, but the beauty of the transformer input is the ease with which unbalanced mics can be accommodated, simply by shorting half the transformer winding. Sometimes it may be necessary to use long microphone cables, and if this is likely, R1, R2 and C1 can be added to maintain stability under such conditions; their values should be determined empirically with varying cable lengths. Finally, the specified low-noise op-amp can be substituted by members of the cheaper BI-FET species (viz: TL071/LF351N) if a marginal degree of extra hiss can be tolerated. The answer to this question depends largely upon the noise generated by your audience versus the SPL, and hence the degree of amplification of your vocals.

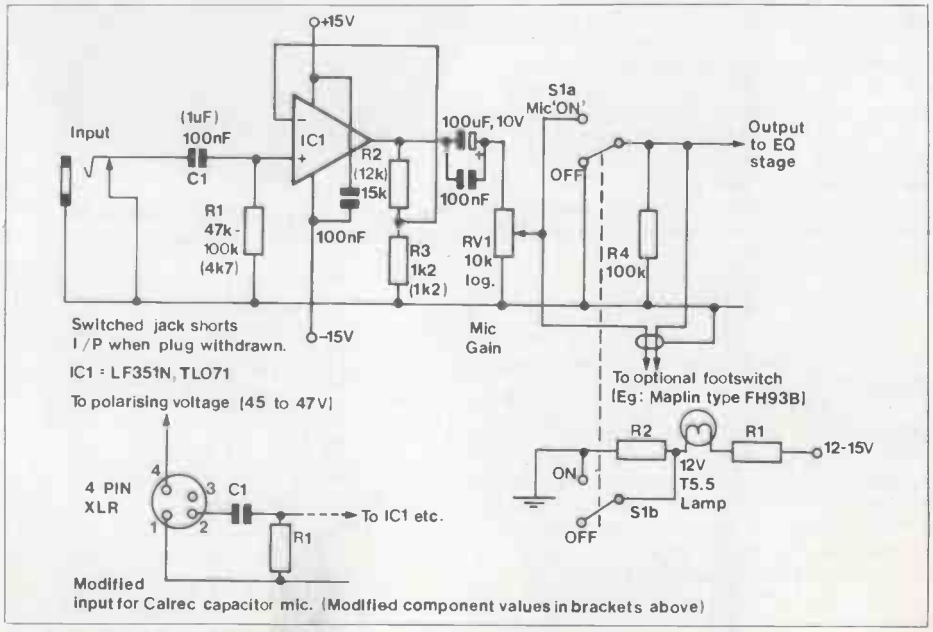

Figure 1. Input stage for high impedance, capacitor and electret mics.

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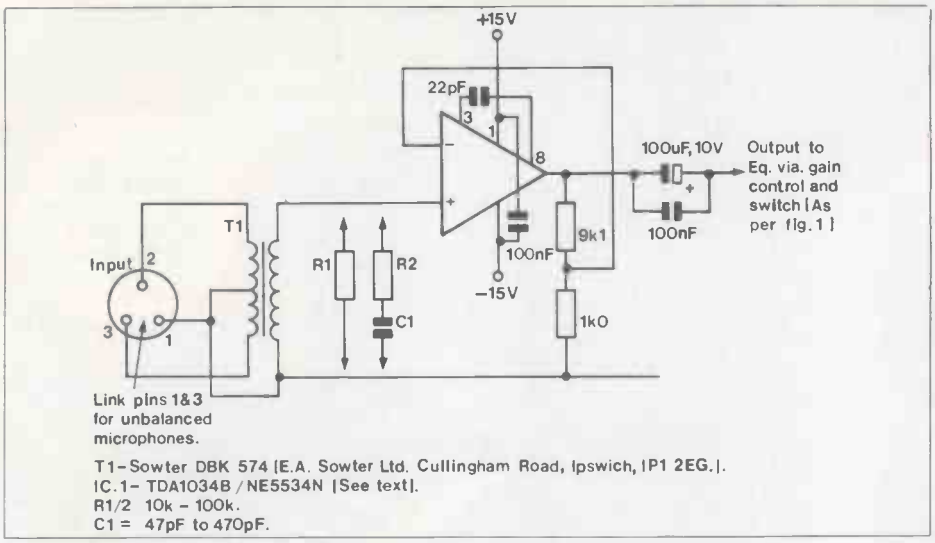

T1 – Sowter DBK 574 (E.A. Sowter Ltd. Cullingham Road, Ipswich, IP1 2EG.).
IC.1 – TDA1034B / NE5534N (See text).
R1/2 10k – 100k.
C1 = 47pF to 470pF.

Typical peak SPLs with close miking

Normal conversational talking	106dBA
Exuberant talking	125dBA
Very loud laugh or shout	130dBA

These measurements taken with the lips 1" from the microphone mesh.

Typical microphone output voltages

Microphone Model	Type	Sensitivity (per uBar)	Nominal Output Voltage @ 110dBA	@125dBA
Shure 515SA	High Imp. moving coil	1.1mV	66mV	390mV
Calrec 654	Capacitor, unbalanced	1.5mV	90mV	532mV
Calrec 1051	Capacitor, Phantom powered	0.8mV	48mV	284mV
ElectroVoice PL80	Low Imp. Moving coil	250uV	15mV	89mV

Table 1. Peak SPLs and output voltages.

Microphone Husbandry

Having purchased an expensive microphone, you should find that the gain you can achieve just prior to feedback will provide ample vocals intensity at a speaking distance of 3" to 6"; with greater proximity, the sound quality will be severely muddied unless the mic has 'vocals compensation' (bass rolloff) and an effective pop shield (see 'Sound on Stage', E&MM December 81). Susceptibility to howlround in a discotheque sound system frequently calls for fastidious mic positioning, largely as a result of the proximity of the speakers. Here, a boom stand (e.g. P+N 139) is an invaluable aid to finding — and maintaining — a trouble free mic position, as well as keeping *both* hands free whilst making an announcement.

Another advantage of boom-mounted mics is the ease with which the directional properties of your voice may be exploited, notably different vocal sounds are available by positioning the mic either above or below the lips.

Perhaps the most irritating aspect of using a microphone stand is the ease with which run-of-the-mill plastic mic clips are destroyed — usually with the aid of clumsy footwork. These are not cheap to replace, and yet a solid-metal spring clamp with rubber pads to provide a secure grip (e.g. Keith Monks 'MC1') will cost only twice the sum and probably last ten years. To end, bear in mind that whilst high-quality dynamic and capacitor microphones are rugged creatures, their unscheduled failure can have unpleasant repercussions; if your mic doesn't have a foam-lined carrying case, an old padded bag is an excellent, if shortlived, means of providing protection in transit.

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RECORD REVIEWS








Neuronium Chromium Echoes Solaris SOL 8201 Another excellent disc from the Spanish duo Michel Huygen and Carlos Guirao, probably the last in that combination as Guirao has now left to be permanently replaced by part-time guitarist Sante Pico. As before the mix is one of cosmic 'floating music' and delicate acoustic guitars and vocals, with string sounds well to the fore (Godwin, Jupiter 4, Elka, Korg Polyphonics) and gentle sequences behind (Korg analogue and MS20).

Side 1 opens with a short 'Prelude', followed by fifteen minutes or so of the title track which builds from gentle chords to a frantic lead line over deeply bending strings. Michel Huygen's use of the harmonic distortion available on the Moog Prodigy is unmistakeable — it's even more over the top live — and is in marked contrast to the many synthesists who seem unwilling to play a simple uncompromising keyboard solo.

Side 2 — 'The Neutron Age' — runs through a wider selection of styles, from ring modulated bell-like effects in the style of Klaus Schulze, to Robert Schroder's syncopated sequences, and back to the Prelude theme, this time overlaid by heavenly choirs (courtesy of a Roland Vocoder Plus) and a typical Neuronium lyric about blackbirds and unrequited love.

Perhaps not a great enough development from their outstanding album 'The Visitor', but nevertheless a genuinely committed attempt to work in a style of synthesiser music which could become very popular, particularly if a British appearance by the band materialises this year.

Review copy supplied by Lotus Records.

Rush Signals Phonogram 6337 243 Rush have made a name for themselves in the world of heavy metal over the last few years with a brand of music which, while resembling Hawkwind in its experiments with electronics and spatial preoccupations, is far more complex technically.

'Signals' represents a return to earth in terms of content, but a further advance in their use of synthesisers and effects. Geddy Lee's unique Taurus/Minimoog/Oberheim polyphonic custom set-up works to good effect here, with expressive Moog solos on the opening 'Subdivisions' and the closing 'Countdown'. Neil Peart's enormous drum kit is played with the usual frightening speed and precision, and Alex Lifeson fills in all the gaps on electric and acoustic guitars and Taurus pedals. The theme now is communication, and so there are hints of all sorts of styles, even a touch of reggae on 'Digital Man'. Another superb example of high-tech heavy metal from Rush.

Marillion Market Square Heroes 12 EMI 5351 A 12" 45 with a total running time of almost 26 minutes, and reviving a style that's been absent for a couple of years — the early Genesis/Camel/UK style of 'pomp rock', with masses of keyboards, orchestral climaxes and impassioned vocals.

The production is a little sparse, but at least this allows the powerful vocals of Fish to stand out over the Minimoogs and Mellotrons. Highlight is undoubtedly the seventeen minute concept track 'Grendel' which alone makes the disc a worthwhile proposition.

Tangerine Dream Logos: Live Virgin V2257 Recorded at the London Dominion date of the recent Dream tour (reviewed in E&MM Jan '83), Logos has been rushed into production by Virgin after recording by the Manor Mobile and a swift (though not major) remix by Messrs Franke and Schmoelling.

As usual of late the set is made up of short disparate pieces, none of which have appeared on vinyl before although some have been played live for some time. Although some of the music is now technically more complex, with three or four sequences linked to the drum patterns in addition to Schmoelling's Jupiter 8 solos and Edgar Froese's PPG sounds, the overall feeling is of sparseness, space and raw power rather than the subtlety of 'Rubycon' for instance.

For every person who finds the current Dream style too conventional there'll be one who finds it irresistibly melodic. There's certainly a dazzling variety of new styles, from waltzes to (almost) funk or straight-ahead blues, some excellent percussion voicings from rock to Latin, and digital vocal sounds from the PPG. A no-prize for anyone who can explain whether the title is 'Low-goze' or 'Low-goss', and why.

Eloy Time to Turn Harvest 1C 064-46 548 Planets Harvest 1C 064-46 548 (Conifer Distribution) A pair of concept albums telling the story of the planet Salta, whose people evolve through civilisation to chaos and new hope. The style is no-nonsense German rock, with vocals in English and generous doses of synthesisers by Hannes Folberth and Hannes Arkona. Many of the tracks open with swirling strings, 'space sounds' and deeply echoed piano, and the distinctive sounds of the Minimoog (again!) dominate.

Powerful without being too heavy, and with an overall air of tasteful and expensive production, these albums should go down well with fans of Pink Floyd, Nektar, Genesis or Gabriel, or with those who haven't yet tapped the rich stream of German rock.

Wendy Carlos Tron Soundtrack CBS 70223 It's exceedingly difficult to tell what's going on here. Wendy Carlos, she of Switched-On Bach and telling synthesised versions of orchestral instruments, has now been let loose not only with Moog synthesisers and the GDS computer, but also with the London Philharmonic Orchestra conducted by Douglas Gamley. The trick is to work out where one ends and the other begins.

Usually it's very difficult, as orchestra and synthesisers play simultaneously. Some sounds — such as bells, percussion and brasses — could be made by either or both, and Carlos' well-known wind instrument voicings become indistinguishable from the flutes and piccolos.

Melodically the album is a little lacking, the music becoming a mere foil for the spectacular computer animated graphics of 'Tron' in much the same way that the allegory of the script also became subordinated to the visuals. However, there are some good guessing games to be played here for fans of imitative synthesis.

Synergy The Jupiter Menace Soundtrack Passport PB 6014 Synthesist Larry Fast has been hard at work with Peter Gabriel recently, but has found time to compose the soundtrack for Peter Matulavich and Lee Auerbach's science fiction thriller which stars George Kennedy and is "coming to a theatre near you in 1983".

Because several of the tracks are edits from earlier Synergy albums, the music works as an excellent sampler, from 'Electronic Realisations' to the recent 'Audion' via 'Sequencer', 'Games' and 'Cords'. Fast is the leader of a field of one, composer of a unique style of classical rock electronics and probably the world's leading expert on digital to analogue interfacing. Although his instrumentation has changed over the years, his incredible sense for semi-realistic sounds has not — his violins are totally convincing until they do something violins shouldn't be capable of doing, his orchestral percussion is unashamedly bombastic, his brasses are by turns harsh and sweet.

His Moog modules, Minimoog and Oberheim synthesisers are now as often as not controlled by PAIA or Apple equipment, but the use of sequencers and computers is carefully balanced with a nimble and intricate keyboard style which holds the listener's attention at all times.

Review copy supplied by Lotus Records.

Wolfgang Duren Eyeless Dreams WPL Records WPL 5768. PPG demonstrator and now company *Geschaftsfuhrer* Duren is no slouch when it comes to taking the PPG computer keyboards through their paces. Although this isn't a demo LP but a very accomplished album, it relies mainly on PPG's own 8-Voice 360A, Modular System 300 and 1020 Synthesizer units, together with a 350 Sequencer and a Micro Moog for some lead lines.

The interesting point is that Duren can do all this in live concert and has done so in Wissen and Bad Breiseg to name but two instances. The title track opens with very fast synchronised sequences and slips into a Jarre-like melody with splashes of percussion and a wailing lead line. 'Phila', '904' and 'Proton' develop the style, with imaginative and gentle changes of tempo, rich digital abstract sounds and expressive chords making full use of delay and keyboard response effects.

The closing 'Eyeless Dream 2' has Bettina Weber's spoken German text over a huge variety of PPG abstract sounds and chords. There's a feeling of tremendous power latent in every track, quite understandably in view of the highly sophisticated and desirable instrumentation involved!

Review copy supplied by Lotus Records

Another no-prize for anyone who can guess the connection between all the LP's reviewed above.

Various Artists Reflections 1 Mirage MR908 The enterprising Mirage Tapes, the music distribution side of Mirage Magazine, have put together the first compilation cassette of their electronic artists. From Rieg and Ariel Kalma to Colin Potter and Carl Matthews, the pieces here cover several countries and even more musical styles. The dominant form is minimal ambient music however, despite the tape being divided into a Dark Side and a Light Side. The Ambient series of Brian Eno is one obvious comparison; Rieg's 'Fermat Voltage', with its sustained oscillator drones and sweeps of synthesiser and harmonium, bring this to mind particularly, while British artist Colin Potter's 'On Entering York Minster' and 'Forest of Galtes' experiment with acoustic sounds and abstract effects to build up almost tangible atmospheres, from the romantic to the sinister.

Carl Matthews, another British artist, opens the Light Side with 'All One World', followed by 'X-Tracks' and 'Gobi' which sparsely explore some carefully voltage-controlled filtered sequences. Ariel Kalma's 'Yogini' closes the tape, with another of his lengthy meditative excursions into gentle Eastern rhythms overlaid by flutes, voices and synthesisers.

Recording quality is extremely high and the cassette comes with a list of other tapes by the same artists and another excellent science fiction cover painting by the talented Wolfgang Fenchel. The cassette makes a very good introduction to the ambient side of Mirage and the sequel will be eagerly awaited.

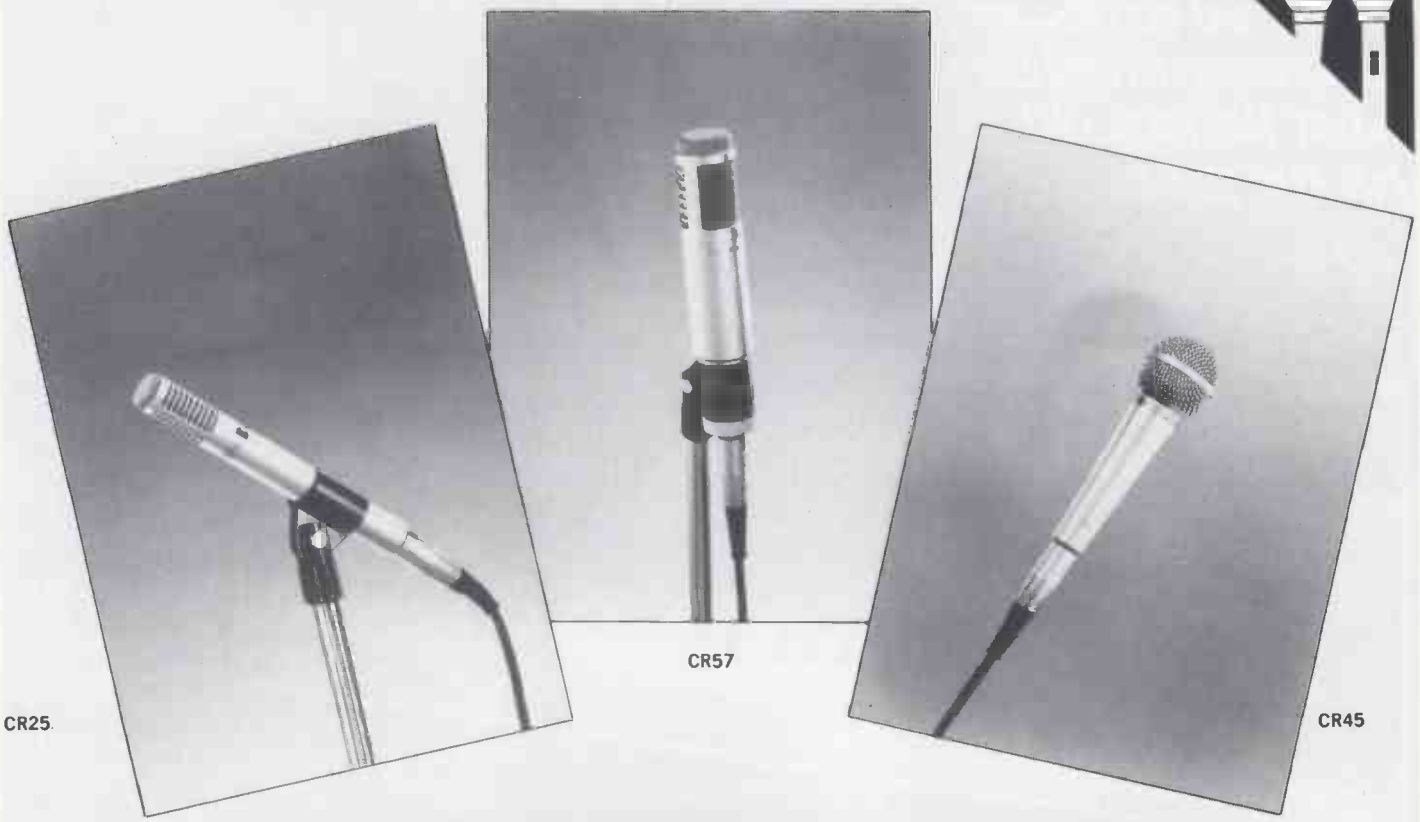
Available price £2.75 payable to M.K. Reed from Mirage, 614, Southmead Road, Filton, Bristol BS12 7RF, England. Add 12p postage Europe, 84p USA, 94p Australia/Japan.

Electro-Music Top 20

1	Chromium Echoes	Neuronium
2	Logos	T. Dream
3	Galaxy Cygnus A	R. Schroeder
4	Wasser in Wind	Roedelius
5	Digital Dream	Neuronium
6	Around the World	Prophets
7	A Fond Perdu	Intence
8	Concerto Pour. . .	P. Guerre
9	Between Flesh. . .	Asia Minor
10	Ki	Kitaro
11	Queen Millenia	Kitaro
12	Eyeless Dreams	W. Duren
13	1st	J-P Rykiel
14	X	K. Schulze
15	Starring Rosi	Ashra Tempel
16	Blackouts	Ashra
17	The Visitor	Neuronium
18	As Falls Wichita. . .	Metheny/Mays
19	Eclipse	M. Garrison
20	Soundtracks	Popol Vuh

Compiled on Mail Order sales by Lotus Records, 23 High Street, Newcastle-Under-Lyme, Staffordshire, UK.

E&MM



CR25

CR57

CR45

Pearl Phantom Powered Electrets

Here is an interesting range of Electret capacitor microphones from the Japanese company, Pearl. They have chosen to make this range of electret mics phantom powered, which is unusual but not unique. Phantom powering means balanced connections to the mic, feeding the powering current to the mic electronics (the capsule is of course permanently charged and does not need external polarizing) along both signal wires in parallel, using the screen as return. The powering voltage needs to be between 12 and 48 volts DC.

True, capacitor mics are nowadays phantom powered with similar voltages, however, DC to DC conversion at the mic is usually employed to keep the working conditions identical from the range of powering voltages allowed. The Pearl mics do not have this compensation, so for maximum SPL use, the full 48V is desirable.

The basic reason for the adoption of phantom powering is to make the range fully acceptable in studios on standard phantom powered mic lines. Avoiding batteries in mics is a good thing — they always fail at the most vital moment!

Three Pearl mics were submitted for survey all with XLR connectors. Two phantom powering boxes were included together with Pearl leads, mic clips and a suspension spider.

Pearl CR57

This has the classic 'studio' upright look and is the flagship of the Pearl fleet. The published curves show a respectable wide, flat response and a good front to back cardioid characteristic, which however, narrows a little at high frequencies and has reduced front to back discrimination at high frequencies.

There is a low frequency cut switch inside the main body together with an 8dB attenuator switch. This operation is performed at the capsule itself by connecting a capacitor in parallel.

The electronics consist of an IC followed by NPN and PNP transistors to provide the symmetrical balanced output. There is no transformer employed. The electronics headroom is determined by the phantom power voltage employed.

This model is the only one in the survey which can be internally powered by a PP3 battery. It is connected via a diode, so it can be be left in situ whilst higher voltage phantom powering is used. One little aspect became evident as one played around with the mic — the body 'rings' if it is hit, less so when the battery is in place! Probably of little consequence in use, but deserving a little attention I feel.

The CR57 is supplied with a stand clip into which the mic is fixed by a large threaded ring. The mic clip, like those supplied with other mics mate with three different stand threads. The description sheet supplied has a curious error concerning the phantom powering, implying erroneously that pin 2 has the +ve voltage and pin 3 has the -ve voltage! In fact it is pin 1 which has the -ve (and described so) with pins 2 and three both +ve. The other mics descriptive sheets also have the same error but it is correctly stated in the battery power unit sheet.

Pearl CR25

This is a stock mic with similar characteristics to the CR57. However, there is no alternative built in battery facility. There is an externally mounted 8dB attenuator switch with similar electronics to the other mics.. Also, like the other mics, the source impedance is around 200R with a minimum intended input impedance requirement of 3k. This is the usual situation for 200R nominal mics.

Pearl CR45

This has a tapered body with ball mesh head and has characteristics suited to vocal use. Curiously the information sheets show identical cardioid curves to the CR25 model. It is obvious in use (see later) that it has different response characteristics — bass roll off to compensate for the proximity effect and a HF 'presence' peak which assists vocal clarity in complex mixes.

Underneath the ball head there is the 8dB attenuator switch built into the other mics. Current consumption is around 3mA at 48V, as it is for the others.

Pearl PW48 Phantom Power Supply

This allows four mics to be powered and connected on to the balanced (or unbalanced) inputs on recorders, mixers or PA gear. XLR connectors by Neutrik are used. The box is powered by 12V DC and a separate mains unit is supplied which feeds the necessary 12V DC. The circuit of the unit is durably printed on the box top and shows the usual DC to DC convertor (oscillator, transformer, rectification, smoothing and regulation) providing 48V DC to the input sockets.

The phantom circuitry is the typical arrangement of parallel resistors for each mic line with capacitors blocking DC from the outputs. There is an on/off switch with LED indication.

Pearl PW18 Battery Phantom Power Unit

This uses two PP3 batteries in series (18V) and powers two mics. A three position on/off switch flashes an LED as the mid position is passed to allow judgement of battery condition. XLR connectors are used and a solid construction is employed as with the PW48. The batteries firmly clip into the battery compartment lid — a nice touch.

Pearl SA1 Spider Suspension

This has a fairly rigid suspension system and therefore it will be the heavier mics which will have the greatest isolation. However, the Pearl mics surveyed do not seem to be particularly prone to stand-borne vibration pickup. (At least the CR25 is around average with the CR57 significantly below average.) Handling noise of the 'vocal' CR45 is also around par for the type. So the improvement with the SA1 is small and in the end it will depend on the particular stage situation encountered whether there is a need for the spider suspension. Four different adaptors are provided to allow the different diameter and tapered body mics to be accommodated.

Performance Aspects

It is not always possible to employ the mics in particular recording sessions for various reasons. The permutations of trying to recommend this or that mic for particular instruments are many and complex. Apart from the actual differences in sound produced in a given situation by a mic, due to its on axis and off axis responses, there is the nature of the monitoring system to consider together with my particular likes and dislikes compared to another users preferences. Publishing frequency curves would not provide any clearer an answer.

So its back to lining up a number of mics with the subject of the survey and hearing if there are any great variations or nasties. The CR57 just had to be compared to an AKG C414 and to relate to the other two an AKG D202 was set up.

The CR57 strikes one straight away as being particularly smooth and refined. Like the others in the range, it takes high levels at 48V powering and has the attenuator to assist at lower voltages. The cardioid characteric is clean and uniform and it certainly produces a very natural type of sound. I think studio engineers should try one or two for various instrumental miking situations or 'natural' vocal miking (solo or chorus) otherwise they are missing a mic with a lot of appeal.

The CR45 is, in the writers opinion, most suitable as a vocal mic. The presence lift is considerable but there could be too much sibilant emphasis in some circumstances.

Interestingly, the CR25 has a similar overall sound quality to the CR57 but perhaps lacking the refinement of its higher cost brother. Again the cardioid pickup seemed uniform giving a respectable sound quality off-axis.

Mike Skeet **E&MM**

PW48 and PW18 Power Supplies.

SA1 Spider Suspension.

Prices	CR57	£128
	CR45	£100
	CR25	£72
	SA1	£28
	PW48	£139
	PW18	£88

Further details can be obtained from Pearl Music Ltd., 11 Garamonde Drive, Wymbush, Milton Keynes MK8 8DS. Tel: 564956. Please mention E&MM when doing so.

Synbal

by Kenneth McAlpine

★ Metallic and Noise Voicings
★ Dynamic Response
★ State Variable Filter
★ Modular Construction
★ Optional Stereo Output

PARTS COST GUIDE with Pre-sets £12.50

Synbal is the first of two modules intended to provide a complete range of electronic percussion. This unit can provide the 'metallic' sounds such as Cymbal, Hi-Hat, Cowbell or Gongs while the next module, the Syntom II, will provide Bass, Snare and Tom-Toms.

The modules can be built up in any combination to provide a custom percussion system, sounds being continuously variable or pre-set.

Background

Synthesising electronic percussion, such as Cymbals, Gongs or Bells, is a fairly difficult task due to the extremely complex nature of their sounds.

Designers have used various methods of synthesis over the past few years including filtered noise, ring modulation and now digital sampling.

Early rhythm machines used white noise passed through filters then gated, to produce Hi-Hat and Cymbal simulations. The sound, however, did not have the 'metallic' edge required, which was later provided by using several oscillators through ring modulator type circuitry.

Currently, there are two ways of producing a realistic Cymbal or Hi-Hat sound using digital sampling. The first, as used in the Linn Drum, is to sample the complete envelope of a real Cymbal and store this in an EPROM (Eraseable Programmed Read Only Memory) via an Analogue to Digital Converter (ADC). The sound can then be reproduced when required by reading out the digital data at the same rate through a Digital to Analogue Converter (DAC). Unfortunately, since the Cymbal has such a large high frequency content and a long decay, a lot of memory is required. The LinnDrum, in fact, uses 262,144 bits of information to store each Cymbal! (see review in this issue).

The second method, used by several manufacturers including Simmons, is to sample a short section of the Cymbal sound and store this in memory. To reproduce the sound the data is read out and converted, in the same way as method 1, but in a continuous loop. Thus a waveform with the required 'metallic' content is produced which can be shaped using conventional analogue circuitry.

The first method is undoubtedly more authentic, but only the clocking rate can be adjusted to change the quality of the sound. With the second method harmonic content, decay and dynamics can be controlled using analogue circuitry. However, both do have the disadvantage of being costly, mainly due to the memory and the DAC's.

Synbal Voicing

The Synbal provides a compromise between sound and cost. Sounds are generated by analogue circuitry to keep the price down but which is versatile enough to allow a large range of convincing imitations to be produced.

The block diagram of the system is shown in Figure 1. Metallic voicing and noise generator outputs are mixed and processed by a state variable Voltage Controlled Filter (VCF), the cut-off frequency of which can be varied manually by a control pot or automatically by the Envelope Generator.

Highpass, Bandpass or Lowpass output is connected to a Voltage Controlled Amplifier (VCA) which varies the level of the output according to the height of the envelope. Controls for Sensitivity and Decay are provided on the Envelope Generator.

An optional panning network also allows the output to be set anywhere in the stereo field.

The trigger input is level sensitive, that is, the higher the trigger voltage, the higher the output level. Triggers can be provided by piezo pickups, crystal mic inserts or by synthesiser/computer type gate signals.

Circuitry

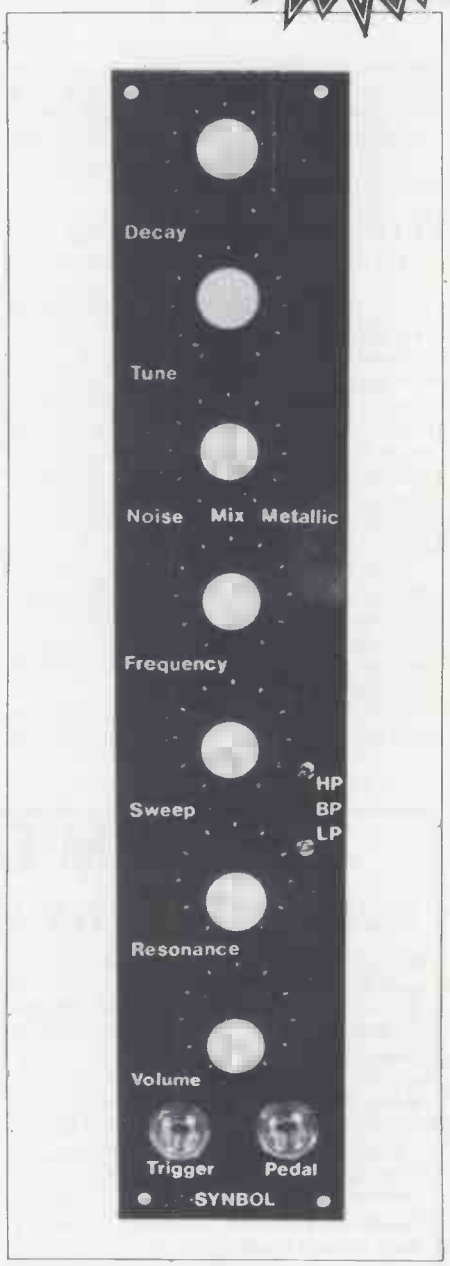
The complete circuit diagram for the Synbal is shown in Figure 2.

Trigger inputs are connected to RV1, which adjusts the sensitivity. The input is differentiated by C1/R1 resulting in a short spike which is amplified by IC1b, and used to charge C2. The Decay pot RV2 and R4 provide a discharge path for the current from C2. The discharge rate or Decay being set by the pot. A foot-operated switch can be connected across RV2 which sets the discharge time to a minimum when the switch is closed. This allows open/close Hi-Hat effects to be played. The resulting Envelope is buffered by IC2a, which drives the LED and provides signals for the VCF and VCA.

The Metallic Voicing section is built around IC5, which contains 6 Schmitt triggers configured as oscillators, and IC6, a quad Exclusive OR package which is used to provide Ring Modulation type effects. A waveform with a very 'metallic' sound quality can be produced with the configuration of oscillators and gates shown. Tuning is accomplished by varying the supply voltage to IC's 5 and 6. This alters the time taken for the oscillators to reach their respective thresholds and therefore changes their running frequencies.

The metallic voicing is mixed, via RV5, with white noise, produced by making TR1 (any standard NPN) Zener and amplifying the resultant noise with IC4.

Filtering is provided by IC1d and dual transconductance amplifier, IC2, which combine to make a state variable -12dB/ octave voltage controlled filter. The three



Suggested modular panel layout.

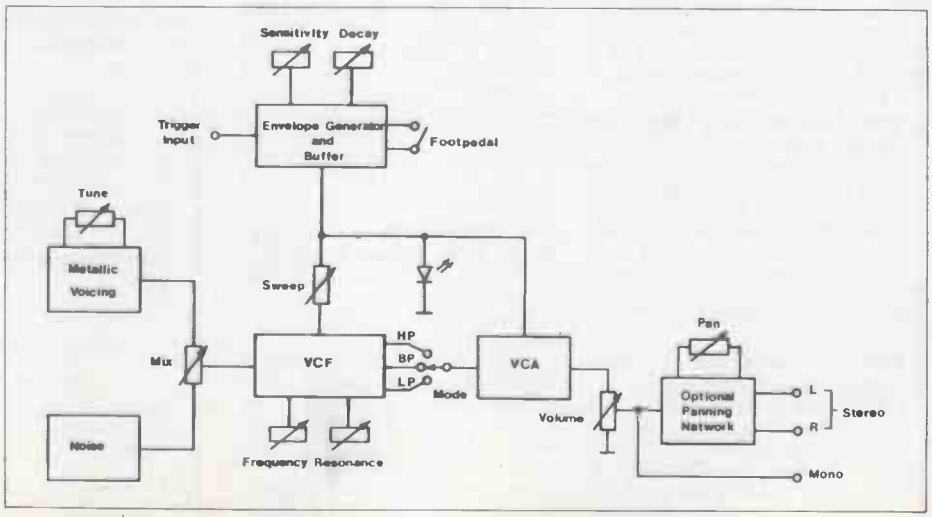


Figure 1. Block diagram of the Synbal.

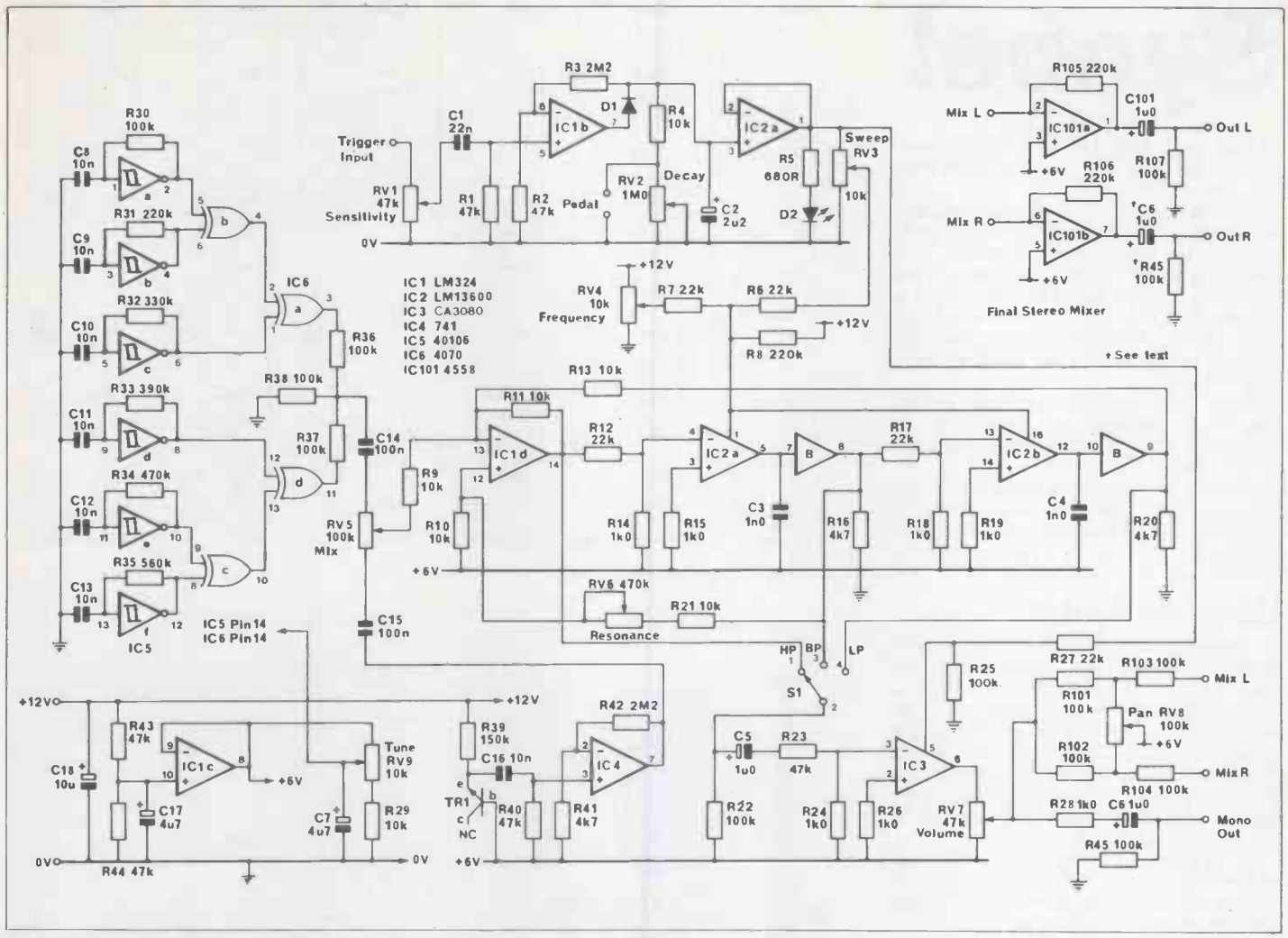


Figure 2. Circuit diagram of the Synbal.

states Highpass (HP), Bandpass (BP) and Lowpass (LP) are selected by S1 and feedback or resonance is varied with RV6. Cut-off frequency is controlled by the amount of current flowing into pins 1 and 16 of IC2. Manual frequency is set by RV4 and sweep frequency by RV3. A slight 'hold-on' bias is provided by R8.

Signals from the filter, via S1, are decoupled with C5 and attenuated to a suitable level for the transconductance amplifier, IC3. The output level is again controlled by a current, this time into pin 5. The voltage from the Envelope Generator is converted to a current via R27, with R25 provided to prevent breakthrough.

One of two output paths can now be followed: the first, for mono output, is through R28 whereas the second, used for stereo output is via the panning network.

Panning works by creating two outputs with R101 and 102, either output being reduced by shifting the wiper of RV8 towards it. This creates a shift between Right and Left channels when amplified by IC101. Note that C6 and R45 are used in both configurations (see Options).

A centre rail of 6V is provided by IC1c to allow the circuit to function from a single 12-15V power supply.

Options

The Synbal PCB has been designed to make the circuit as flexible as possible by allowing for a number of user options.

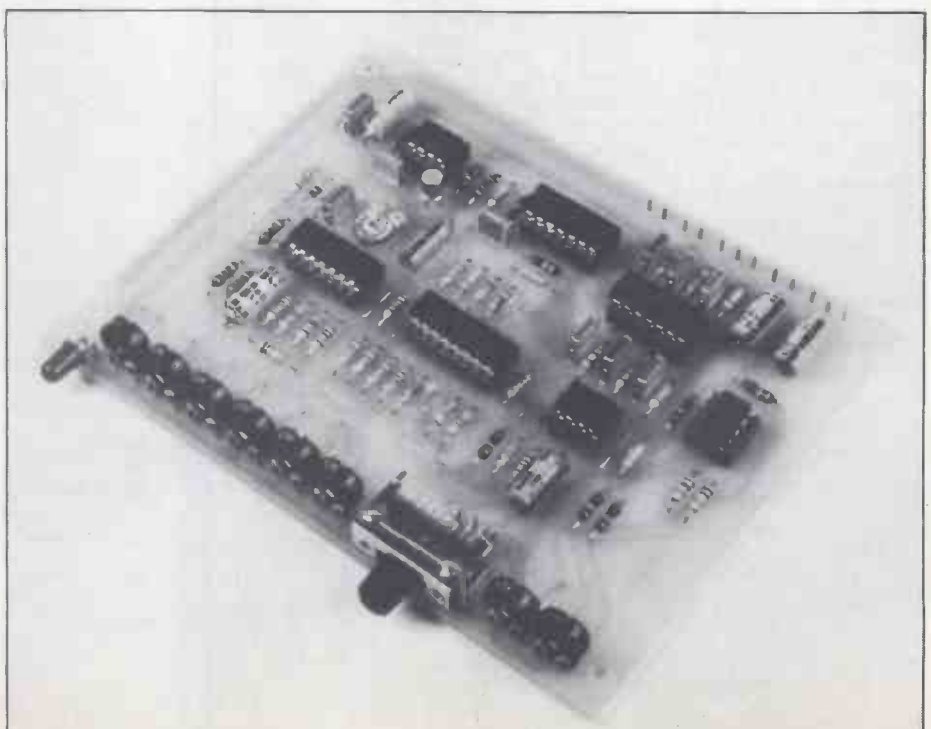
Controls: 1) *Rotary* — The PCB can be mounted on a panel such as the one shown in the photo. All the pots, switch, LED and sockets are hard-wired to the board. This allows the sound to be continuously variable. 2) *Vertical Pre-sets* — The pre-sets can be mounted vertically and the switch horizontally on the PCB, as shown in the photo. An extra 5 links must be inserted if this is the case, shown dotted in Figure 3. Boards can then be slotted into a case with the left hand edges at the front allowing occasional adjustments to be made.

3) *Horizontal Pre-sets* — The pre-sets can be mounted horizontally and the switch vertically, as shown in the component overlay. This allows adjustments to be made to a board mounted horizontally in an enclosure.

4) *Combinations* — Obviously any combination of controls could be used. The most commonly used, such as the Decay and Filter Frequency could be rotary and the rest pre-set. The switch could also be omitted and a link inserted for the required filter state.

Outputs: 1) *Mono* — If mono outputs are required then RV8 and components numbered 100 upwards are omitted. Resistor R28 should be inserted and Out R/Mono used as signal output.

2) *Stereo* — For stereo use R28 should be



PCB for the Synbal.

Synbal

omitted with RV8 and the 100-up components inserted. Outputs are taken from Out L and Out R.

3) *Modular Stereo* — To allow a modulator stereo system to be built up the virtual earth busses of the final mixer are available. Only one of the system boards need contain the final mixer IC101. The rest only have R101 to 104 and RV8 inserted. All of the Mix R and Mix L outputs are connected together and the final output taken from the board with IC101 inserted.

Once the configuration of your system has been decided the parts can be assembled on the board using the component overlay in Figure 3.

Components should be assembled in the following order: Veropins, links, resistors, capacitors, diode, transistor and IC sockets (if required). Controls and LED can then be mounted and IC's inserted last.

Using the Synbal

Triggering can be provided by a piezo pickup or crystal mic connected to the trigger input, the sensitivity control being used to adjust the dynamic response. Pick-ups can then be mounted in existing drums or practice pads. The trigger will accept signals up to about 5V which can be from a sequencer, rhythm machine or computer. Higher voltages can be accommodated by raising the value of R2.

A footswitch, with momentary action, can be connected across the Pedal input and 0V. Closing the switch gives minimum decay, opening retains the set decay.

Six sample settings are provided in Figure 4 to give an idea of some of the possible sounds available from the Synbal.

Details of a power supply and modular construction will be given in the next article, the Syntom II.

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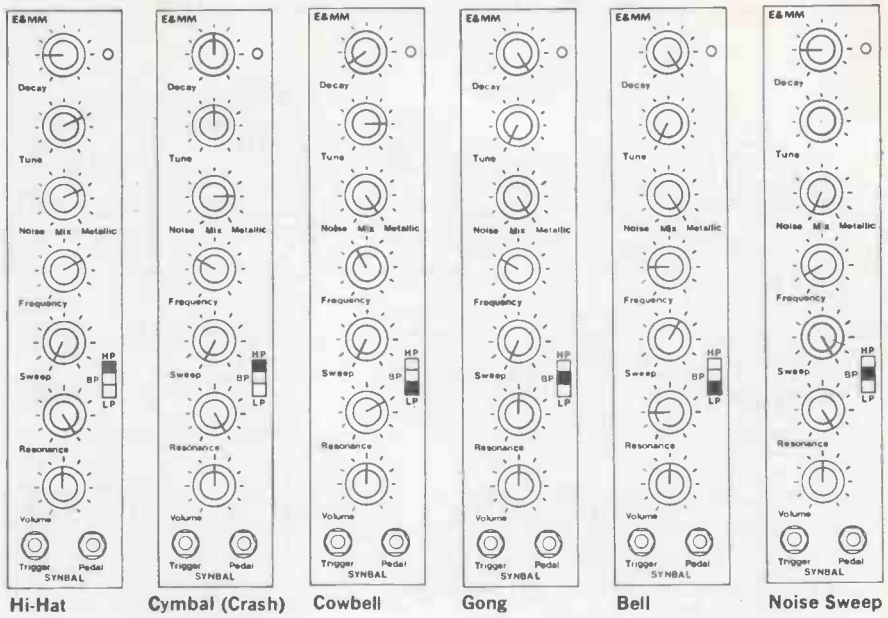
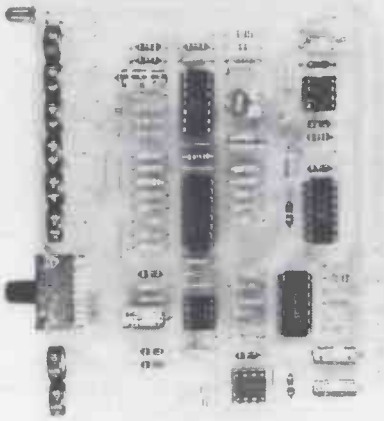


Hi-Hat | Cymbal (Crash) | Cowbell | Gong | Bell | Noise Sweep

Figure 4. Sample sound settings.



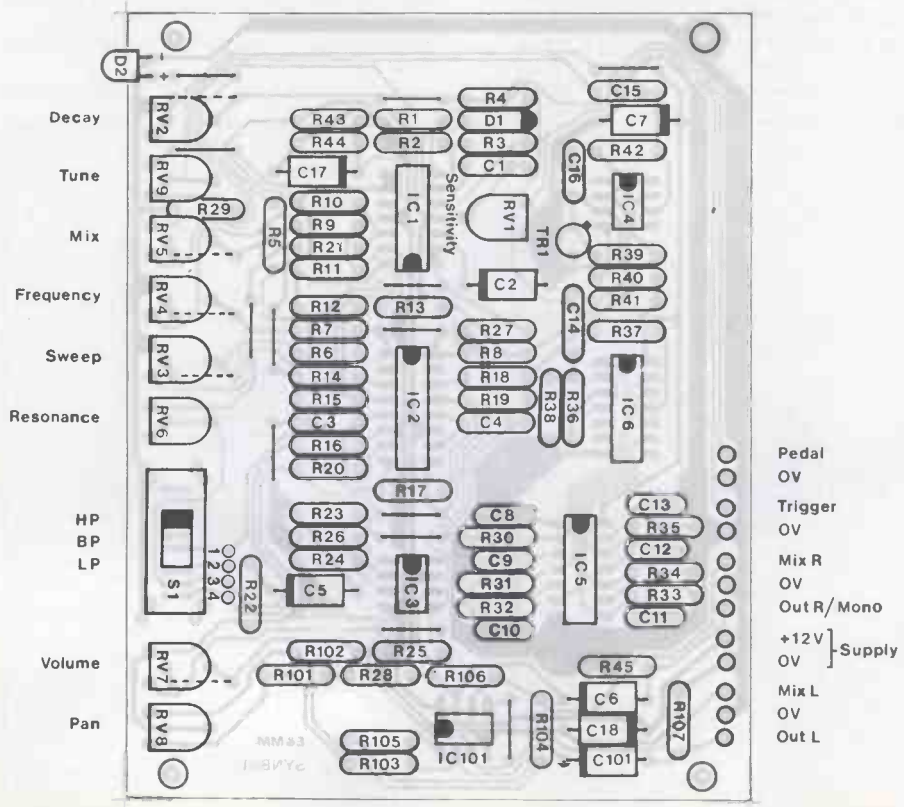


Figure 3. Component overlay of the PCB.

PARTS LIST FOR SYNBAL

Resistors — all ¼W, 5%, carbon film

R1,2,23,40,43,44	47k
R3,42	2M2
R4,9,10,11.13,21,29	10k
R5	68R
R6,7,12,17,27	22k
R8,31,105.106	220k
R14,15,18,19,24,26,28	1k
R16,20,41	4k7
R22,25,30,36,37,45, 101,102,103, 104,107	100k
R32	330k
R33	390k
R34	470k
R35	560k
R38	33k
R39	150k

Capacitors

C1	22nF Polycarbonate
C2	2u2 63V Axial Electrolytic
C3,4	1nF Ceramic
C5,6,101	1uF 63V Axial Electrolytic
C7,17	4u7 63V Axial Electrolytic
C8,9,10.11,12,13,16	10nF Polycarbonate
C14,15	100nF Polycarbonate
C18	10uF 25V Axial Electrolytic

Potentiometers (see text)

RV1	47k horizontal pre-set
RV2	1M
RV3,4,5,8	100k
RV6	470k
RV7	47k

Semiconductors

D1	1N4148
D2	LED
TR1	BC108B
IC1	LM324 or 3403
IC2	LM13600
IC3	CA3080
IC4	741
IC5	CD40106
IC6	CD4070
IC101	TL1458 or 4558

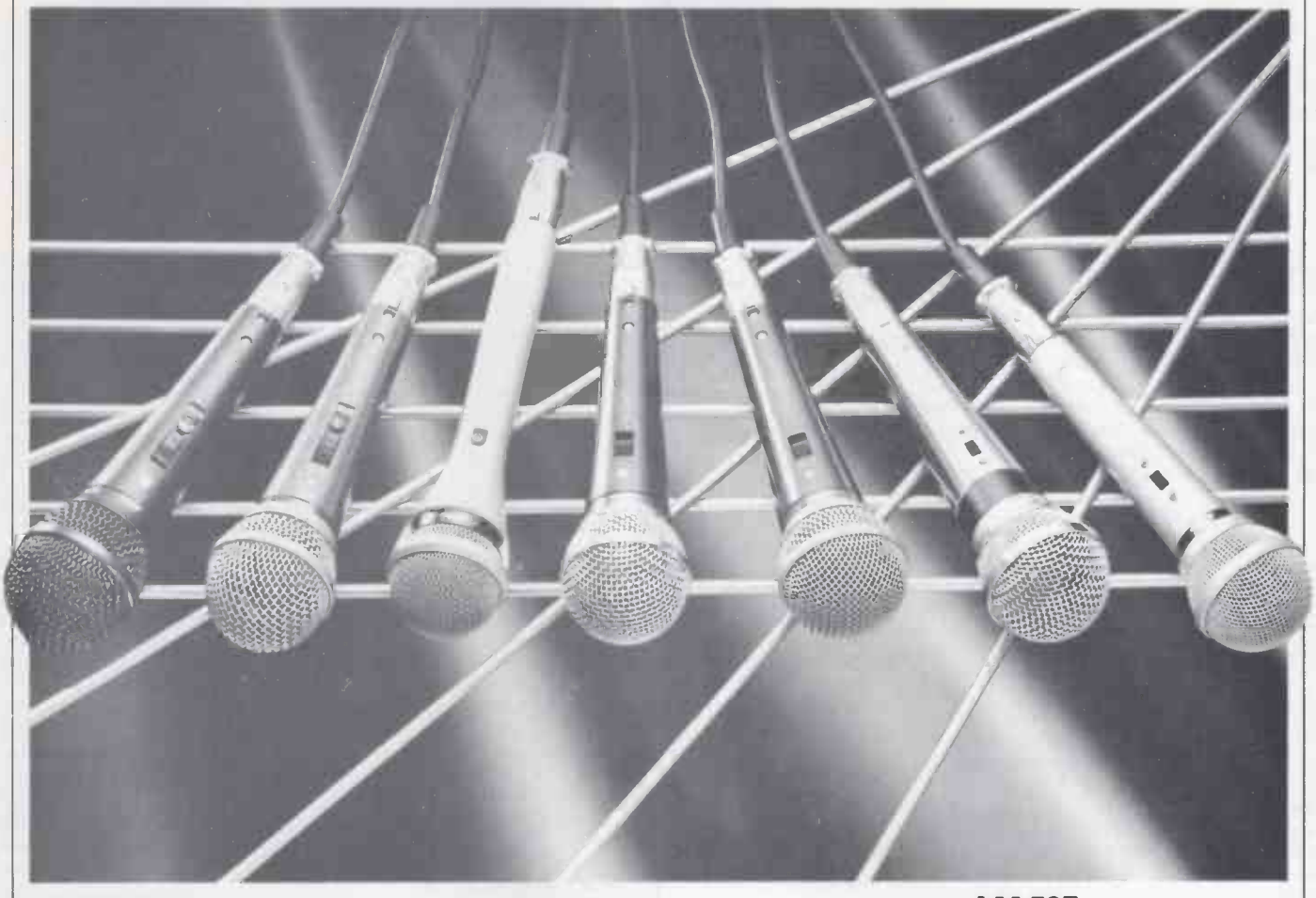
Miscellaneous

S1	3-way 4-pole slide switch (Maplin FH38R)
	Veropins
	16-pin DIL socket (1 off)
	14-pin DIL socket (3 off)
	8-pin DIL socket (3 off)
	PCB

The PCB for the Synbal is available from E&MM, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG at £3.25 inc VAT and P&P. Please order as: Synbal PCB.

Aria®

PROFESSIONAL MICROPHONES



AM-70D

(For Vocal, Instrumental & Recording Use)

This is the top quality model in the ARIA professional microphone line. Featuring newly developed high-compliance edge, superior transient response due to combining hard-dome diaphragm with aluminum voice coil.

AM-60D

(For Vocal & Instrumental Use)

Light weight aluminum voice coil gives this microphone superior transient response. Soft touch on-off switch with lock.

AM-50E

(For Vocal, Instrumental & Recording Use)

Electret condenser microphone with flat frequency response and superior characteristics to prevent overloading and pop noise. Built-in tone selector switch (music/voice) makes this a very versatile microphone.

AM-40D

(For Vocal & Instrumental Use)

A really good all-round microphone. Making use of proximity effect and aluminum voice coil, this model produces thick low range sounds to clear high range sounds.

AM-40DG

(For Vocal & Instrumental Use)

This is an up-market version of the AM-40D. A high quality microphone featuring black metal finish body assembly and gold finish mesh screen.

AM-30D

(For Vocal Use)

Easy-to-use microphone providing well balanced sound throughout the range of low, mid and high frequencies. Compatible to all kinds of PA systems.

AM-20D

(For Vocal Use)

Compact design, modest priced microphone with high-quality performance. Clear and natural sound without distortion. Metalic silver finish.

ALL MIC'S SUPPLIED WITH CLIP, CASE, AND CABLE

TO GIGSVILLE. Please send Aria Microphone Brochure

NAME _____

ADDRESS _____

_____

GIGSVILLE

Phoenix Way, Heston, Middlesex.
Telephone: 01-897 3792

Aria

CALTUNE

Complete kit
less case
£35

by Charles Blakey

- ★ **Calibration and Tuning Aid**
- ★ **Crystal Controlled Reference Oscillator**
- ★ **Ring Modulator**
- ★ **Built-in Amplifier and Speaker**
- ★ **Battery Operation**

CALTUNE has been specifically designed for calibration and tuning of modern synthesisers. It contains a crystal controlled oscillator to generate switched output frequencies of 220, 440, 4400 and 8800 Hz. The lower two outputs are used for scaling the lower frequency end of voltage controlled oscillators as well as providing the normal tuning frequencies. The upper frequencies are for scaling oscillators which have a high frequency trim.

The unit is self contained, having a built-in amplifier and speaker and it may be operated from batteries. Alternatively, it may be run from an external +5V supply or with the addition of a few components from any positive supply within a range of about +7 to above +15 volts.

The output from the oscillator being tuned or calibrated is plugged into one side of a ring modulator contained in the instrument and compared against the internal standard frequencies. If there is a large difference between the two frequencies the sound produced is a complex mixture of harmonics but as frequency matching approaches the overall sound is quieter and there is a very pronounced amplitude modulation which disappears completely at perfect matching. This technique avoids the difficulties experienced by many constructors in using the 'beat frequency' method. Tuning of a synthesiser can be achieved in seconds without any additional equipment.

The calibration method is as accurate as using a digital frequency meter or oscilloscope and has an advantage over the latter in so far as final tuning may also be accomplished.

Circuitry

The block diagram for the calibrator/tuner is shown in Figure 1 and the complete circuit in Figure 2.

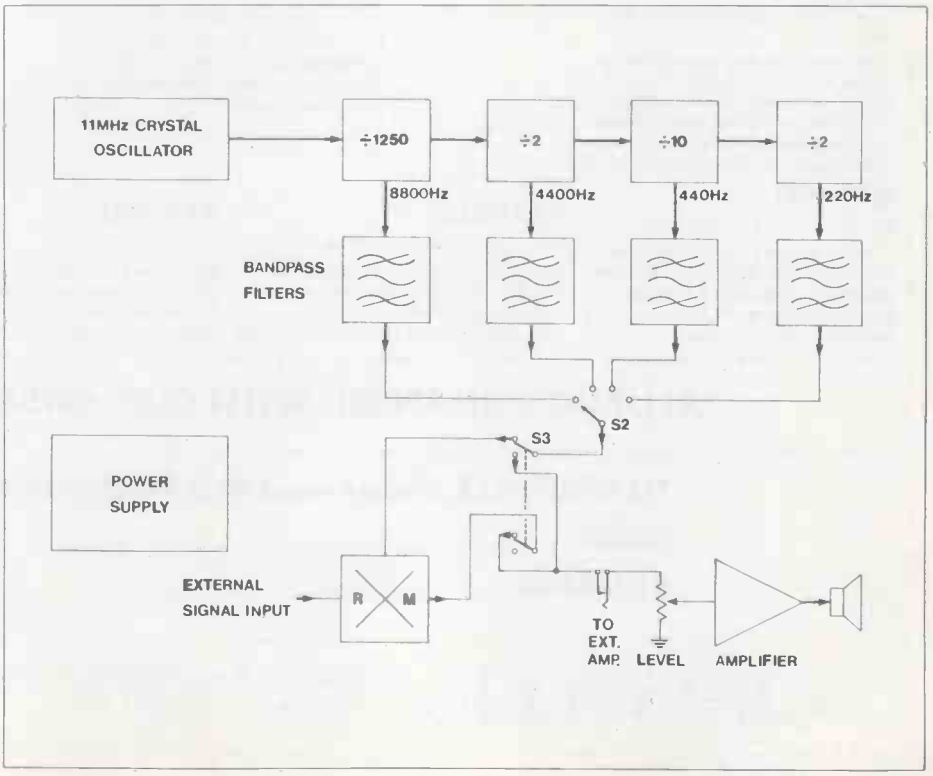
An 11MHz crystal is used for the oscillator built around IC2. The output of which is divided down by 74LS90 decade counters (IC's 3 to 7) which may be connected to divide by two or five, or by two and five to make a divide by ten. The required divisions to obtain outputs of 220, 440, 4400 and 8800Hz are shown in Figure 1. These four outputs are routed to individual bandpass filters in order that the residual signal is principally the fundamental frequency which will approximate to a sinewave. The filters are constructed around IC's 9 and 10. They have a nominal Q of 10 and, to allow for component variations, a trimmer is provided which is subsequently adjusted for peak amplitude which corresponds to the best waveform shape.

Any of the four outputs may now be selected by the rotary switch, S2, while switch S3 is used to channel the selected signal to either one input of a ring modulator or direct to the internal amplifier. Whether the instrument is being used for calibrating or tuning the ring modulator route will be selected. If, however, one is calibrating an oscillator from scratch it is best to set its initial frequency in the region of the required calibrating frequency of, say, 440Hz. This can be done aurally by comparing the output of the 440Hz waveform from the built-in amplifier with the output of the VCO (or synthesiser) connected to another amplifier.

The ring modulator, IC10, is an SG3402 amplifier/modulator. While it is not the lowest cost device it can be operated from a single supply and requires few external components and little setting up. From the filters the signals enter the SG3402 via the attenuator R23/R24. The external signal, which comes from the oscillator or synthesiser being calibrated or tuned, enters via jack socket, J1, into the attenuator R25/R26. The resistors have been selected for a 10V p-p signal to give approximately 60mV at pin 12 of IC10. While the external input signal can be somewhat higher or lower than ten volts a much lower signal will reduce the aural modulation effects. The value of R25 and/or R26 should therefore be altered to suit the signal level of specific instruments. Thus for a 2.5V p-p signal R26 should be reduced to 47R while for a 1V p-p input R25 would be reduced to 12k and R26 to 47R. RV5 is used to minimise the feedthrough of the internal frequency standards. The output of the ring modulator is amplified by IC11 and it is connected by a jack socket, J2, to the driver amplifier, IC12, with volume control RV6 and speaker SP1. J2 allows the use of an external amplifier and in fact the circuit may be terminated at this point if an amplifier is readily available, for example, within the synthesiser so as not to detract from the portability of CALTUNE.

All IC's are operated from a nominal +5V supply and in order to cope with AC signals through the op. amps. A level shifting voltage is applied to their non-inverting inputs, for example, R7/R8 provides the bias voltage for IC8. If an external +5V supply, or a supply consisting of batteries at about +6V, is used for the supply then R1 and IC1 are not

Figure 1. Block diagram of the Caltune.



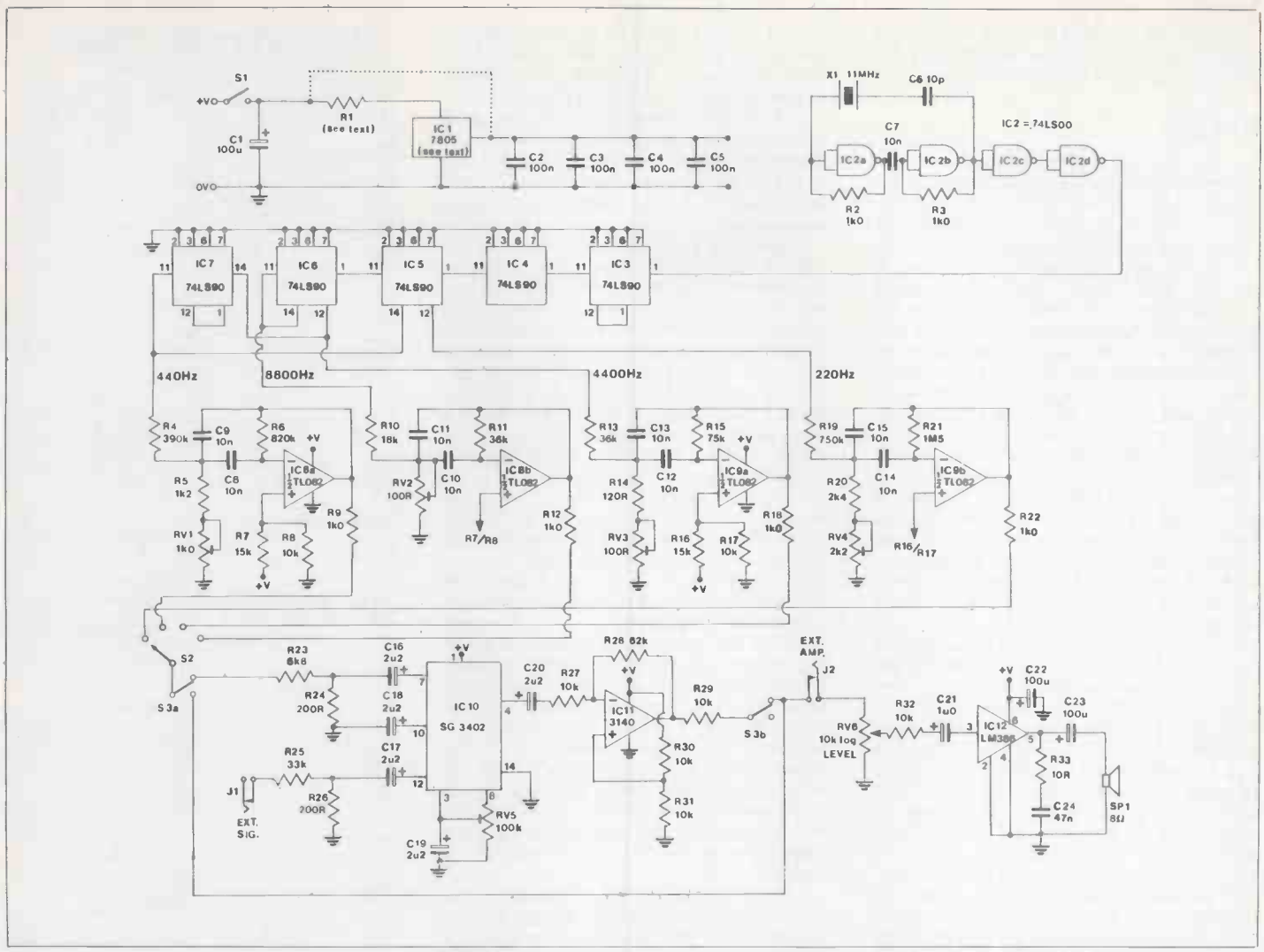


Figure 2. Circuit diagram of the Caltune.

installed and a wire link (shown by a dotted line in Figure 2 bypasses this part of the circuit). The PCB allows for the installation of these components together with a 19°C/W heatsink. R1 is used to reduce the heat generated in IC1 and thus if the instrument is connected to an external power supply the following resistors are recommended:

+15V supply	47R 2W
+12V supply	27R 1W
+9V supply	10R 1/2W

The regulator will not operate with a supply voltage of less than +7V.

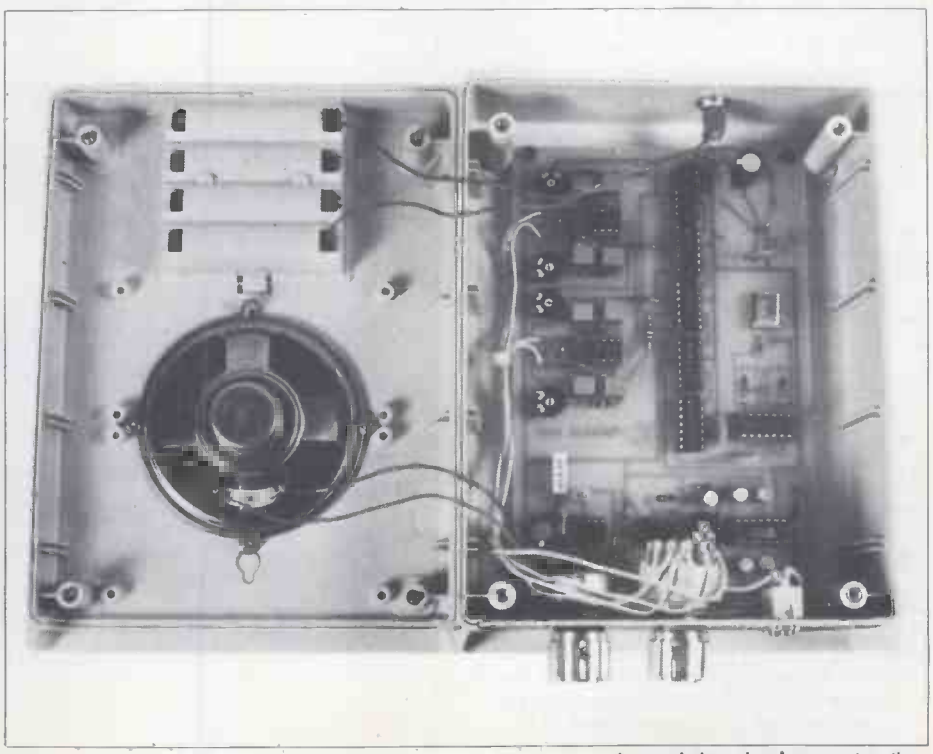
The current consumption of the instrument is quite high, being about 70mA when an external amplifier is used and about twice this figure when the internal amplifier and speaker are operating. The high power consumption is not a problem so long as alkaline manganese batteries are used since these will provide sufficient current to operate the complete unit for over twelve hours which in turn allows for hundreds of tunings or many calibrations. CALTUNE should not be connected to the power supply of the synthesiser.

Construction and setting up

The PCB supplied with the kit is printed with a component overlay and so the overlay is not shown in this article. The PCB is preferred since lay-out of the components is quite critical. On the other hand wiring is not critical and so long as it is done neatly normal connecting wire may be used throughout.

The instrument is shown mounted in a 190 x 138 x 68mm Vero battery case which accepts four 1.5V AA cells. The PCB screws onto lugs in the lid of the case while the speaker is bolted to the base. Five 6.5mm holes are drilled into the base underneath the speaker and the case is mounted on rubber feet so that the speaker will be fully effective.

After wiring up the adjustments required are simple and uncritical. First set S3 to the amplifier position and S2 to 220Hz and adjust RV4 for the purest sound output. The current drain by the amplifier does cause some distortion — it is like many small transistor radios; when the volume control is turned up loudness only increases at the expense of distortion at higher settings. Thus for this step it is preferable to keep the level control, RV6, at a low setting or even use an external amplifier. As stated earlier, however, it is not critical. Repeat the above step for frequencies 440Hz, 4400Hz and 8800Hz and adjust RV1, 3 and 2 respectively.



Internal view showing construction.

Lastly, set S3 to 'R.M.' (ring modulator) and S2 to 440Hz then adjust RV5 for minimum output from the speaker.

In Use

The first step is to ensure that the external input to the ring modulator suits the signal levels of the VCO/synthesiser, as discussed in the circuit description. The normal connection to a synthesiser will be its output provided for an external amplifier. If, on the other hand, there is a direct connection to the VCO then this would be the preferred output since it will not require any alteration to synthesiser settings. The handbook, or construction notes, for the synthesiser (or VCO) will provide information on access and settings for tuning and calibrating and these should be followed.

A. Tuning. Simply plug the output of the synthesiser/VCO into the external signal input, J1, of CALTUNE, set S2 to 440Hz and S3 to R.M., and press A=440Hz on the keyboard. Keep the key held with a high sustain level on the envelope generator or else put the VCA into the 'open' position if one is provided. The writer prefers to use a triangle output from the VCO but again it is not critical. If the synthesiser is perfectly in tune at 440Hz then the sound generated will be predominantly a 880Hz signal. If, however, it is slightly out of tune a distinct pulsing effect will be heard, mostly due to amplitude modulation, and the further it is out of tune the faster the effect and the more raucous the sound. Turn the 'fine' tune control for the VCO until no pulsing is obtained or at least until the effect is only occurring at intervals greater than one second. The actual length of time achieveable between these modulating beats will depend on the stability of the synthesiser/VCO. Now select 220Hz with S2 and press note A=220Hz. What should happen now is that the pulsing should only occur at a similar rate to that achieved at 440Hz. If there is a more rapid pulsation when switching to 220Hz then the VCO requires calibrating.

B. Callbration. The procedures for calibration have been discussed in Nov. '82 and Jan '83 issues of E&MM and instructions are also provided with the kit. For a re-calibration the VCO is going to be near to the correct frequency and thus the procedure is similar to tuning except that the 'scale adjust' pre-set for the VCO is adjusted until the rate of pulsating is virtually the same when switching back and forth from A=220Hz and 440Hz and pressing the appropriate keys. Similar considerations apply when calibrating the VCO using an external voltage instead of a keyboard.

For the situation in which a VCO is being calibrated for the first time using an external voltage it will be desirable to set the VCO near A=440Hz as the starting point. For this situation the output of the VCO is taken to an amplifier and compared by ear with the 440Hz output from CALTUNE. Matching is by no means critical but the VCO should be closer to 440Hz rather than 220Hz or 880Hz otherwise the ring modulator may latch onto one of the latter frequencies. Such a mistake is unlikely to occur to those with any musical ability and even if it does occur it is not a disaster but simply that the VCO may end up being calibrated at a lower or higher range than is usual.

As far as the 4400Hz and 8800Hz outputs are concerned they are mainly provided for bench adjustment of the high frequency trim of VCO's fitted with this facility. If, however, the synthesiser has a one foot range then its high frequency accuracy may be checked by pressing C=4434.9Hz and adjusting the fine tune until a match is achieved with the instruments 4400Hz. Then a note is pressed an octave higher and compared with 8800Hz. Remember, however, that factors affecting VCO stability (power supply; droop from keyboard sample and hold; very small errors in keyboard accuracy; and so on) all become much more obvious at these higher frequencies and so it is preferable to make high frequency trim adjustments in a bench calibrating environment.

There is a distinct difference when CALTUNE is used at higher frequencies. As the external input becomes matched to the internal reference the output will tend to go significantly quieter since the predominant frequency is double the input and as frequency increases the 'loudness' perception of the ear decreases. Nevertheless, there are sufficient harmonics to provide a very audible modulation. Obviously the worst case is at 8800Hz since the predominant frequency of 17.6kHz is too high for normal hearing. If any difficulty is experienced with hearing the amplitude modulation of the harmonics then there are three courses of action available:

(a) Use a square wave input from the synthesiser/VCO which will result in sharper changes in modulation.

(b) Turn RV5 very slightly clockwise which will let through more of the 8800Hz reference signal and aid hearing the amplitude variations. The small adjustment will not lessen the effect at other frequencies.

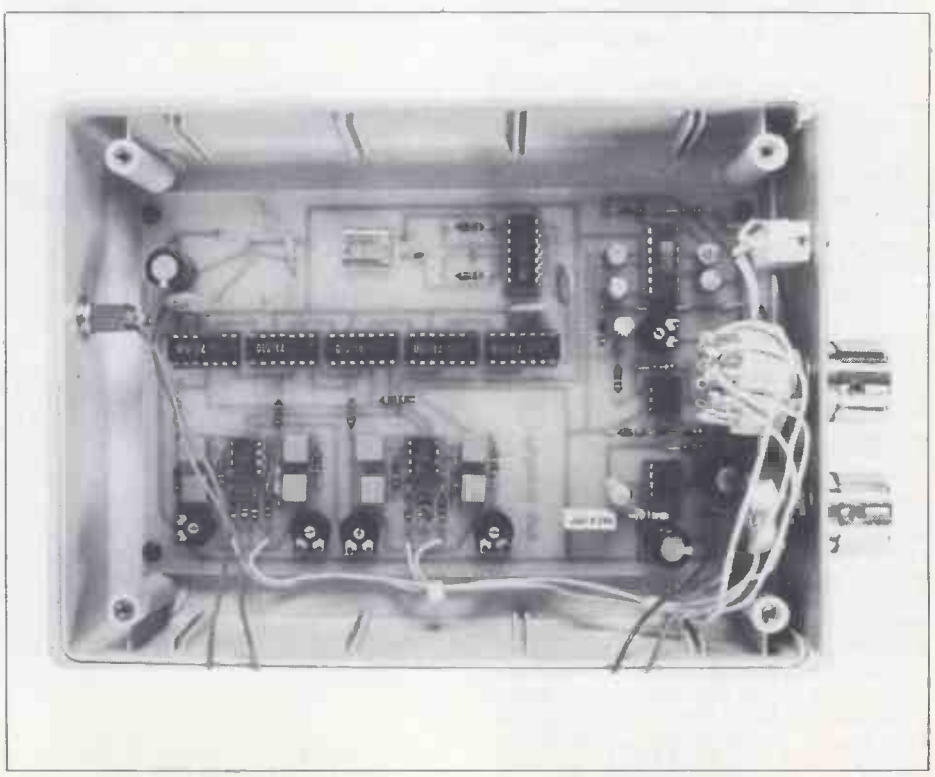
(c) Leave the frequency switch at 4400Hz even though the synthesiser/VCO is increased to 8800Hz. CALTUNE will lock onto a harmonic and the effect of matching is still very clear except that one does not get the significant quietening effect referred to earlier.

The technique utilised in this project is accurate and fast and even though it relies on aural matching this does not require any special skill or ability from the user. **E&MM**

PARTS LIST FOR CALTUNE

Resistors — 1/4w, 5% carbon film		
R1	see text	
R2,3,9,12,18,22	1k0	6 off
R4	390k	
R5	1k2	
R6	820k	
R7,16	15k	2 off
R8,17,27,29,30,31,33	10k	7 off
R10	18k	
R11,13	36k	2 off
R14	120R	
R15	75k	
R19	750k	
R20	2k4	
R21	1M5	
R23	6k8	
R24,26	200R	2 off
R25	33k	
R28	62k	
R33	10R	
RV1	1k0 min. hor. carbon	
RV2,3	100R min. hor. carbon	2 off
RV4	2k2 min. hor. carbon	
RV5	100k min. hor. carbon	
RV6	10k log. rotary	
Capacitors		
C1,22,23	100u PCB electrolytic	3 off
C2,3,4,5	100n ceramic	4 off
C6	10p ceramic	
C7	10n ceramic	
C8,9,10,11,12,13,14,15	10n polyester	8 off
C16,17,18,19,20	2u2 PCB electrolytic	5 off
C21	1u0 PCB electrolytic	
C24	47n polyester	
Semiconductors		
IC1	7805 (see text)	
IC2	74LS00	
IC3,4,5,6,7	74LS90	5 off
IC8,9	TL 082	2 off
IC10	SG 3402	
IC11	CA 3140E	
IC12	LM 386N	
Miscellaneous		
S1	SPST min. switch	
S2	1p 12w rotary switch	
S3	DPDT min. switch	
X1	11.000MHz crystal	
SP1	8 ohm speaker	
J1,2	3.5mm jack sockets	2 off

The PCB and kit of components (less case, knobs and batteries) are available from E&MM, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG. The price is £34.95 including postage and VAT. For those wishing to use an existing amplifier/speaker the relevant components may be omitted (please specify this option) and the inclusive price becomes £29.95.



Close up of the PCB layout.

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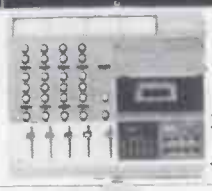
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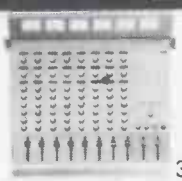
A-8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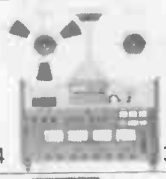
22-4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Model 3
Model 2A

itam


16 channel one inch

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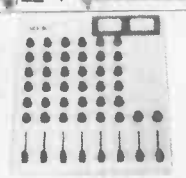
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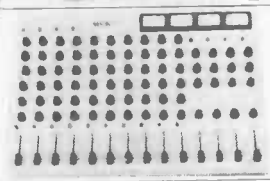
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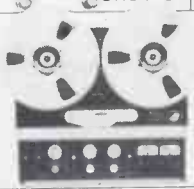
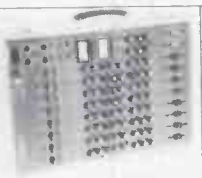
REVOX



The LOCATION MIXER



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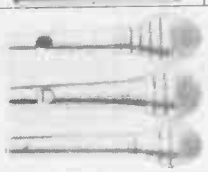


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AMDEK Stereo Mixer Kit

Our Amdek kit this month is the Six Channel Stereo Mixer, a high quality unit, which can be assembled with the minimum of technical difficulty.

★ Six input channels ★ Variable input levels ★ Panning on each channel

★ Built-in power supply ★ Pre-assembled circuit board

★ Complete kit with detailed instructions

PARTS COST GUIDE £74

The mixer must be one of the most important pieces of equipment required in electronic music production, be it in a live or recording situation.

Amdek's stereo mixer has six input channels, each with variable input level and panning controls. The pan controls have centre stops which allows the signal to be centred in the stereo field quickly and easily. An internal mains power supply is also provided alleviating the problems associated with battery supplies.

Providing that you follow the instructions carefully the resultant mixer will be a high quality, well finished, professional piece of equipment.

The Kit

Unpacking the cardboard box provides you with the very attractive, screen printed, case which contains the components, connecting wire, solder and the handy Amdek spanner.

To complete the kit you require a 15-30W soldering iron, cutters (or wire-strippers), crosshead and shorthead screwdrivers, pliers and a crimping tool. The latter is recommended, but you can probably get by with pliers.

Once all of the parts have been checked off on the assembly manual, construction can begin.

The first stage is to fill all the eyelet holes in the PCB with solder. Some of the holes may already have been filled due to the flow-soldering process used during assembly at the factory, but it is best to go over all the connections.

The next stage is to cut, strip and tin four sets of wires ready to be attached to the PCB. These sets are shown separately in the manual but you may wish to do all the labourious cutting and preparing first for all the sets, then make the PCB connections. The sets are as follows: 9 x 60mm (Steps 3+4); 6 x 50mm (Steps 5+6); 6 x 110mm (Steps 7+8) and 4 wires of assorted length (Steps 9+10).

When all the connections to the PCB have been made the slider controls can be fitted to the sub-chassis. Note that the channel sliders have the end with two tags at the bottom, while the master sliders have the end with one tag at the bottom. The sliders are fastened with M3 x 6mm screws and spring washers.

The PCB can now be offered up to the sub-chassis and attached with M2.6 x 5mm screws via the slide switches. The pan-pots are also fastened using a nut and washer for each control (Steps 11-12).

Connections from the slider pots can now be made to the PCB. A piece of white lead, 150mm in length, should also be cut and soldered to the earth bus, which is made using tin-coated wire between the number 1 tags.

When this stage has been completed the mains supply components can be assembled. The mylar capacitor should be inserted through the top four tags of the mains switch but only soldered to the two on the left at the moment. The switch can then be attached to the sub-chassis using two M3 x 10mm screws, spring washers and polycarbonate pipe for spacers (Steps 13-14).

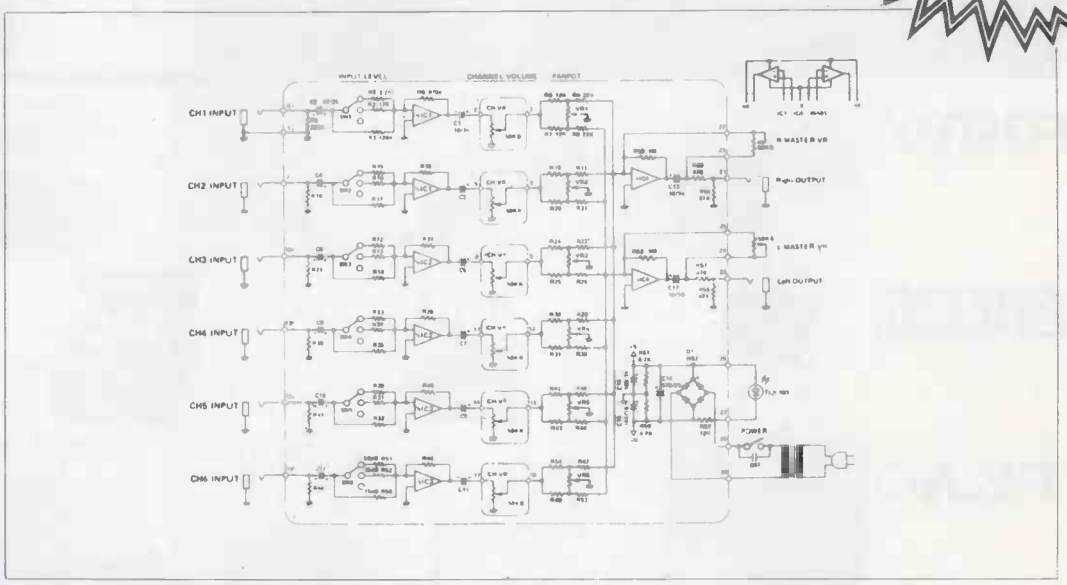


Figure 1. Circuit diagram of the Stereo Mixer.

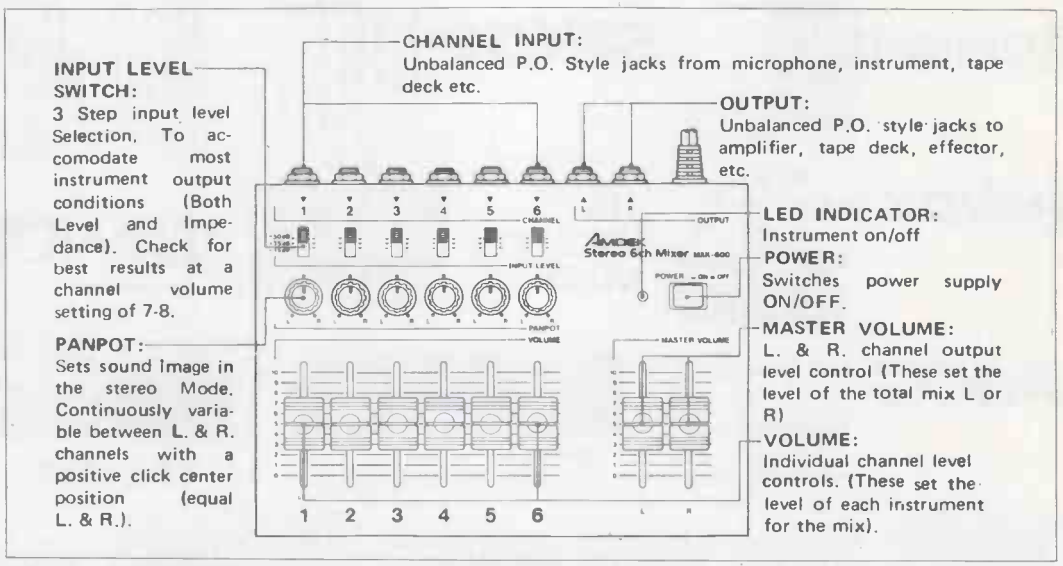


Figure 2. Panel Description.

The transformer leads can now be cut to length and the transformer bolted to the sub-chassis with two M3 x 6mm bolts, spring washers and nuts.

One of the leads from the transformer goes to one of the capacitor tags on the switch, the other goes to the PCB. A piece of yellow wire 60mm in length connects between the other capacitor tag and the PCB to complete the loop.

Once the LED leads have been shortened and tinned, the LED can be mounted in the sub-chassis, with the rubber holder, and connected to the PCB (Steps 15-19).

Masks for the slide switches and pots can now be fitted. The volume mask is shown attached to the sub-chassis but this makes it uneven due to the domed head of the screws. On our unit the mask was fixed to the back of the front panel.

The sub-chassis is fitted by sliding it into the top half of the case and secured using four M3 x 6mm screws — making sure that the LED lines up with the hole in the front panel (Steps 20-22).

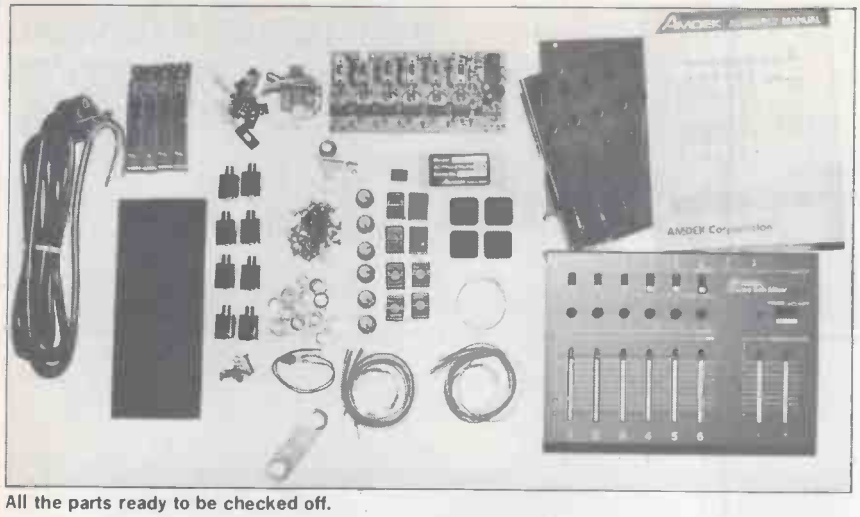
Jack sockets can now be attached to the rear of the case with lock washers, plain washers and nuts, using the Amdek spanner to tighten the nuts. Note that the chassis tags must all be facing upwards.

An earth bus is formed across each tag using another piece of tin-coated wire. The white lead from the sliders and that from the PCB are connected to the last tag on the bus.

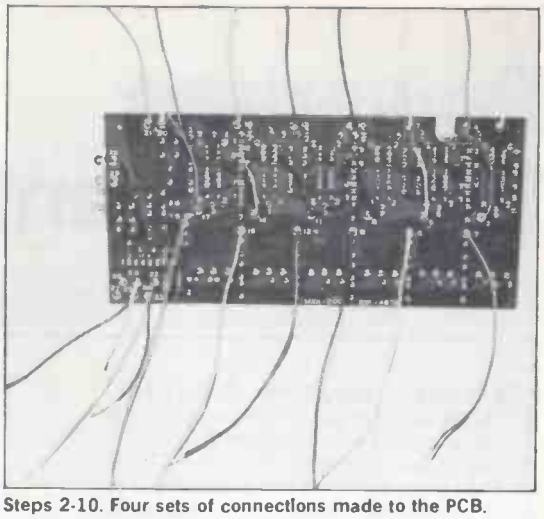
All the input connections to the PCB can now be made from the input sockets. This completes the PCB wiring (Steps 23-24).

The mains cable can now be stripped and tinned, soldering a tag to the earth wire. The lead is inserted through a cord bush, fitted to the rear of the case, and secured using a cord clamp (or cramp according to Amdek!).

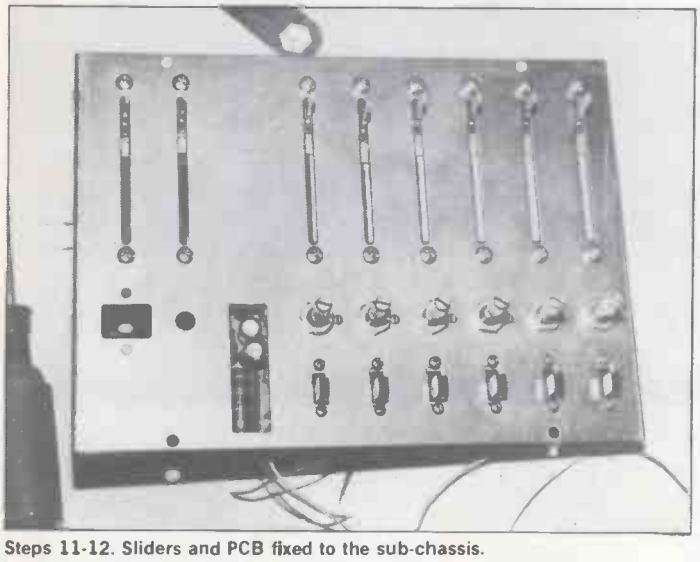
Mains connections are made to the



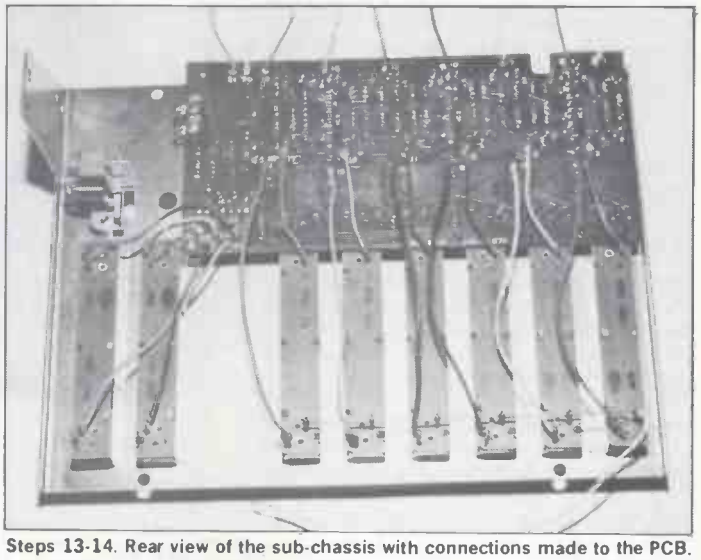
All the parts ready to be checked off.



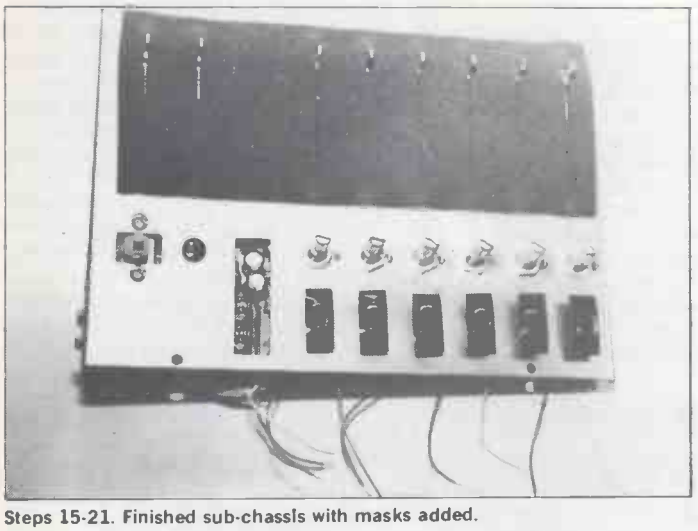
Steps 2-10. Four sets of connections made to the PCB.



Steps 11-12. Sliders and PCB fixed to the sub-chassis.



Steps 13-14. Rear view of the sub-chassis with connections made to the PCB.



Steps 15-21. Finished sub-chassis with masks added.

Steps 22-30. Sockets, mains cable and knobs added to complete the mixer.

transformer using crimp connectors which should be crimped with the appropriate tool. However, pliers can be used to do this, taking care not to leave any bare wires visible which could short against the casing or components. For safety reasons the earth tag is bolted to the casing, next to the transformer (Steps 25-27).

The bottom half of the case can now be attached after all the routing of the wiring has been checked. Wires should be lifted well off the PCB to prevent the possibility of crosstalk between channels. The mains wiring should also be double-checked.

Rubber feet, knobs and serial number sticker can all be fitted completing the unit ready for use (Steps 28-30).

The Circuit

The circuit diagram for the mixer is shown in Figure 1. As each channel is similar it is only necessary to describe the operation of channel 1.

Resistor R5 presents a load to the input signal which is decoupled by C2, then amplified and inverted by one half of IC1. The input level switch varies the amplifier gain between -200, -40 and -4 times, corresponding approximately to -50, -35 and -15dB respectively.

Signals from the amplifier are decoupled by C1 before being applied across the channel level slider pot. The wiper taps off the set amount, which is then passed through a panning network comprising VR1, R4, 6, 7 and 8.

Outputs from all of the networks are connected to the inverting inputs of IC4 creating left and right busses. Due to the virtual earth principal the outputs of IC4 each result in the sum of the inputs, with overall gain set by the feedback resistance of the master gain controls.

The power rails are provided by dividing the rectified 16V supply with R59 and 61, producing a centre rail and ±8V supplies.

Operation

The mixer is very simple to use. Input and output signals are connected to the sockets on the rear panel. The correct input level is then set for the input used; mics, guitars and other low impedance instruments should have a setting of -50dB, while keyboards and drum machines should be between -35 and -15dB depending on their output levels.

After mains has been connected the volume levels can be set and panned as required.

In mono situations one channel can be used as an effect send with one of the input channels providing the return.

If you have any problems with this or any of the Amdek products contact the Amdek 'Hotline' at Roland UK (tel: 01-847 1671).

E&MM's special offer price for the Amdek Stereo Mixer is £74.00 incl VAT and P&P. Please order as: Amdek MXK-600 kit.

Powertran Transcendent Polysynth

RECORDED ON DEMO CASSETTE No. 9

Powertran's top of the range kit instrument offers a relatively inexpensive way for the home musician to make the step up to true polyphonic synthesis. This is an obvious move once the possibilities of string ensembles and portable polyphonic instruments have been exhausted, and there's an added advantage to the Powertran approach in that the number of simultaneously available notes (and thus the cost of the machine) can largely be determined by the constructor. The instrument can be built with a single pair of oscillators (a single voice) and a second, then a third and a fourth voice, can be added as desired.

These additional voice boards, each containing two oscillators, a VCF and VCA, are easily installed inside the machine. The total capability is eight voices; the final four are available in an expander module, which matches the Polysynth in style and sits neatly by its side. Although the two units are controlled by the single four-octave keyboard, their audio outputs are not combined. This simply means that two channels of a mixer have to be used, and gives the possibility of some fascinating stereo placement effects due to the unusual voice assignment system described later.

Styling

The general styling of the Polysynth resembles that of the monophonic Transcendent 2000, which has sold in large quantities and has proved a versatile starting point for many a home musician. The synth is not unattractive, with wooden end cheeks and white legending on a black aluminium front panel, but it is on the bulky side. Controls are a combination of rotary pots, rotary switches and two-position slider switches, with silver caps on the rotaries which also have deeply knurled edges and a white line mark to indicate the setting.

The controls are laid out in a fairly conventional left to right pattern to indicate signal flow, with the exception of the oscillator tuning controls which are on the right hand side on the section marked Voices.

Voice Panel

In the four voice version which we examined, the tuning controls are arranged in four pairs, each with an on/off switch and LED status indicator, with the top banks of controls representing VCO 1 in each voice and the bottom bank representing VCO 2 in each voice. In contrast to the Korg Polysix or Juno 6, which have a single tuning control, all eight controls have to be adjusted independently.

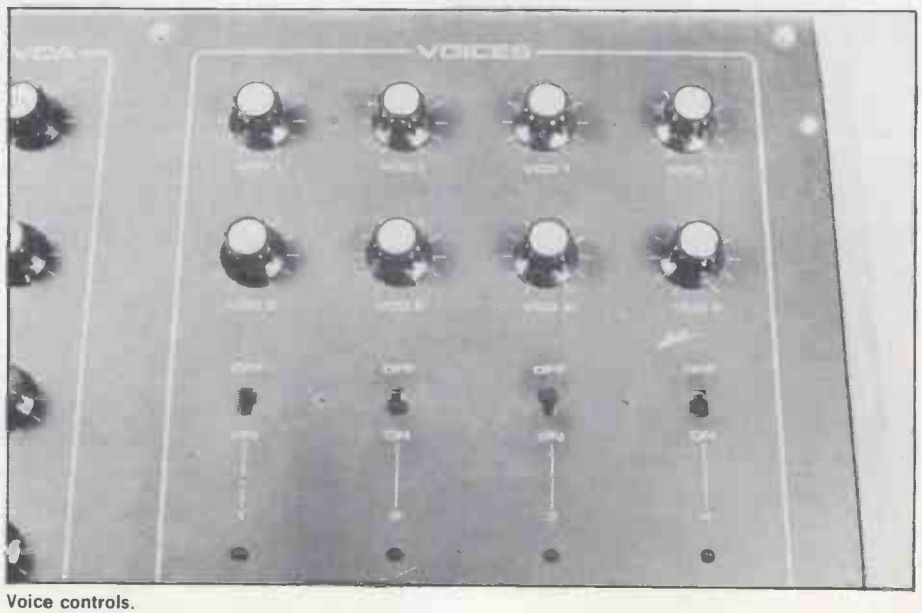
Tuning can therefore become a little laborious; the oscillators need to be locked together and the VCA and VCF held open before this can be done, and although the advantages of being able to obtain unusual interval tunings are considerable these can't be obtained quickly. This brings up the whole question of making instant sound changes on stage, which will be considered shortly.

Controls

On the left hand side of the control panel are the portamento, wave shape selection and synchronisation controls. Each of the two banks of oscillators can be switched to sine, sawtooth or square. On square wave the mark/space can be adjusted manually, or automatically by a slow oscillator operating at a fixed speed of about 5Hz with a choice of sine or square modulation. Use of mark/space modulation thickens up the sound considerably, as of course does a slight detuning of each pair of oscillators. Volume of the two oscillator banks is independently adjustable and Synchronisation locks the tuning of each pair of oscillators together.

It's not possible to produce the kind of harmonic distortion found on the Moog Prodigy by de-tuning when in sync, and in fact a single oscillator alone sounds fairly weak — certainly no better than that on the Transcendent 2000. It's when they're played together that a quantum jump in sound quality takes place, and the sound when all eight are running together with a little de-tuning, pulse width modulation, vibrato and resonance is a revelation.

The vibrato section has its own speed, depth and sine/square controls, and there is a plus and minus one octave rotary switch



Voice controls.

and a Transpose pot. This functions over the rather unusual range of an octave and six semitones and would be useful for deep bending effects were it not for the fact that it doesn't have a dead band and so can only be returned to any given tuning with some care. In the centre of the control panel are a green power LED and the white noise level pot.

Filter and Envelopes

The filter and envelope controls are fairly conventional, but have a couple of interesting extras. The filter is a standard 12 dB/octave low pass type which just falls short of resonating at the highest Q setting, and has a sine wave sweep oscillator with its own speed and depth controls. In addition there's a VCF track switch which opens up the filter as higher keys are played, simulating the response of acoustic instruments.

It's a pity that more treatments aren't available for the filter; the square wave modulation on the pulse width would be better placed here, and since a white noise source is present it seems odd not to include a sample and hold for random effects. In addition a fully resonant filter could provide some interesting sounds.

The VCF can be swept by an ADSR envelope which has positive and negative options and a Track switch on the Release mode. This also exists on the VCA envelope and works in inverse proportion to the keyboard voltage, so that release is longer at the lower end of the keyboard. This is useful in simulating acoustic piano sounds, which can be done extremely accurately on the Polysynth, because lower and heavier piano strings tend to sustain for longer than higher and lighter ones.

The VCA also has ADSR controls and a Continuous switch which holds it at full volume. The state of the gate to the two envelopes is indicated by an LED under each voice, and so a good visual indication of the method of note assignment can be gained during normal playing.

Note Assignment

Note assignment is cyclical, with a single note played continually on the keyboard using each oscillator in turn, two notes or three notes stepping around in order and all four notes using a continuous cycle of assignments. There are two performance advantages to this system; the first is in the stereo placement of the voices if the expander is being used, in which case the stereo picture is always changing. The second is when using the polyphonic portamento; even if the same chord is played continually, the oscillators glide in intricate patterns up and down the keyboard to provide a fascinating overall texture.

Conclusions

The controls, then, are fairly basic, but with a couple of unexpected extras, so that with everything flat out the sound can be quite breathtaking. The Polysynth's problems lie, if anywhere, in ease of use and expressiveness. The pitch bend lever mounted to the left of the keyboard and sprung vertically is pleasant to use, but doesn't cover a great enough range. There is no facility for modulation by foot pedals and although there are two modes of note assignment neither of these offers the New Pitch Detection of the Transcendent 2000, and so new triggers cannot be obtained if four notes are already held down.

Because of the tuning method it's not possible to obtain interval tunings quickly, and many of the controls are very 'toppy', acting only in the highest one-third or so of their travel. A band pass mode on the filter, which again exists on the Transcendent 2000, would have been a useful and inexpensive addition, and the range of speeds available on the filter sweep oscillator, for instance, would benefit from being extended.

Happily, a lot of these problems are the sort of things which can be adjusted to personal taste during construction. The sensitivity of the pitch bender could be increased, and as the panel is generously laid out it should be possible to add controls for modifications to the modulation circuits, such as a simple sample and hold.

As a studio instrument, then, the Polysynth can be extremely powerful and impressive with a little thought applied to getting the best out of it. The keyboard is pleasant to use and the limitations of four notes are far from apparent, while the construction is sturdy enough to ensure long service.

It would be a brave man who would attempt to tackle the Polysynth on a darkened stage under concert conditions. Memory presets may be an expensive facility, but to obtain a given sound on a totally variable polysynth like this requires a good degree of familiarity. On the other hand, there's no denying that some startling sounds can be obtained, including Hammond organ, strings, acoustic piano, clarinet, reversed piano, eight-note monophonic lead and a host of others. Regard it as a challenge — build it, modify it, learn to get the best out of it. **E&MM**

The Transcendent Polysynth is available from Powertran, Portway Industrial Estate, Andover, Hants, SP10 2NM. Tel. 0264 64455

softmuse

Softmuse is the first in a new series of articles using microcomputers in music, simply titled 'Softmusic'. Each article will be supported with the relevant software in the form of a cassette tape available from E&MM.

Introduction

In 1972 two professors of that famous instituion of engineering, the Massachusetts Institute of Technology, developed and marketed an unusual automatic composing aid. they formed a company called Triadex and named their machine the Muse. It offered literally billions of diatonic note combinations ranging from very short sequences to tunes which could last over 4,000 years if played at a rate of 1 note per second!

Unfortunately it never caught on. Very few people have even heard of the Triadex Muse, much less seen one. This was probably due to the type of electronic music that was prevalent in the early seventies. The analogue synthesiser and its marvellous gamut of sounds overshadowed the new techniques that were slowly emerging from the undergrowth of computer technology. It is only recently in the last five or six years that real time analogue and digital processes have become interchangeable or, as in some instruments, come together to form a hybrid such as the PPG Wave. Automatic sequencers and arpeggiators are now standard on many synthesisers (and organs), eg. SCI's Pro One, Roland SH101 and some of the smaller Casio range. The electronic music world is dominated by all manner of rhythm units and bass line sequencers etc, the very environment in which the Muse would have captured interest. Sadly the Muse was before its time and quickly faded into obscurity.

The time is now ripe therefore a new and improved version. Rather than redesign and build a hardware version for economic reasons the whole system is emulated by a program written for the Acorn Atom microcomputer: a Soft Muse.

How it Works

The equivalent block diagram of the Soft Muse is shown in Figure 1. The idea is very simple and would involve nothing more than a few standard TTL or CMOS packages.

A low frequency oscillator clocks a binary counter with divide by 2, 4, 8, 16, 32, 6 and 12 outputs. It also drives a 31 stage linear Feedback Shift Register (FSR). The FSR is simply a 31 stage serial in parallel out shift register, the Data In of which is determined by the Exclusive OR (parity) of the output of selected stages. Thus the input is a linear feedback function and causes the register to circulate sequences of ones and noughts which may be very short or extremely long, depending upon which stages are selected as feedback points.

The longest sequence that can be generated before repetition occurs is given by $2^n - 1$ where n is the number of stages involved. In this case n = 31 and the maximum length sequence would require 2147483647 clock pulses to repeat. This

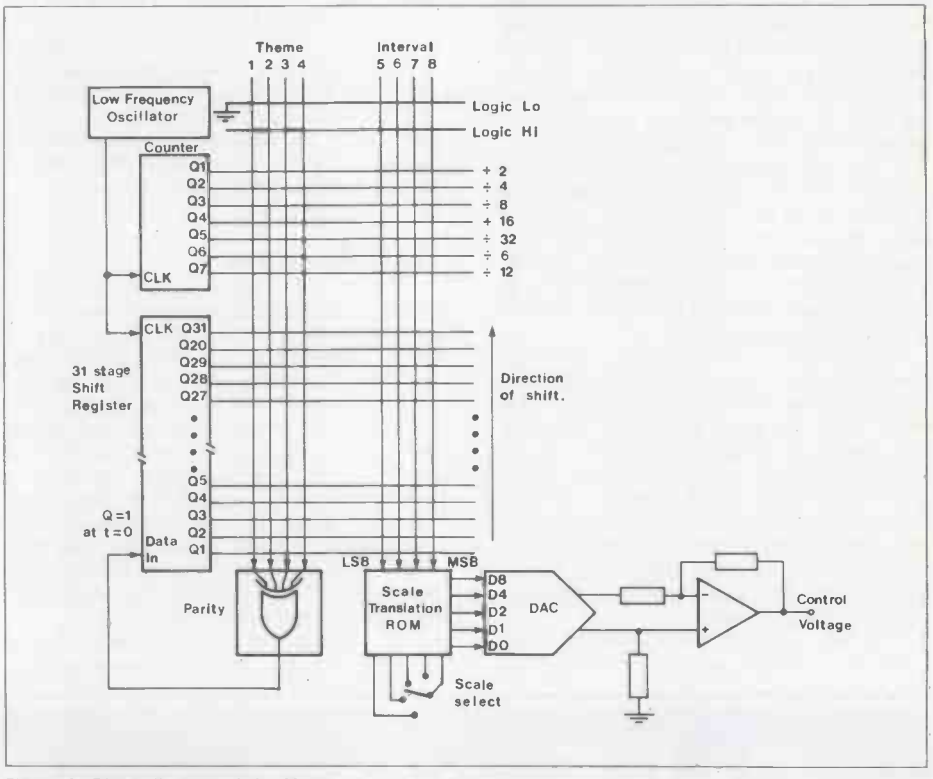


Figure 1. Block diagram of the Muse.

type of circuit is often used for generating random noise since even a few stages will produce a pattern whose sequency is difficult to detect.

The 31 outputs of the FSR, 7 from the counter plus a fixed logic one and zero together form 40 rows of outputs which can be selected by the 8 columns. Each of the 8 columns comprises a '1 of 40' selector switch. Switches 1 to 4 determine the feedback for the FSR and they may be regarded as the inputs of a 4 input EX OR gate whose output is connected to the Serial In of the shift register. The remaining 4 switches determine which note is actually played. The levels appearing at the poles of these switches combine to form a binary address for the note ROM. Table 1 shows the relationship between the address presented by the switches and the note selected for the major scale.

At this point it is worth remembering that the Soft Muse will be connected to a voltage controlled synthesiser and the note ROM will output a binary code which, after digital to analogue conversion, will correspond to a control voltage.

For example, if the switches 5, 6, 7 and 8 at some instant tap off 1 0 0 1 respectively, and the major scale is selected, then the ROM will present the code 1 0 0 0 0 to the DAC. The synthesiser would play E' provided it was tuned originally so that the 0 0 0 0 played C.

In a hardware configuration the logic itself presents no problem. The difficulty lies with the selector switches. These would be difficult and expensive to obtain as would a 40 x 8 patch board. For this reason a software approach was chosen.

Software

The program requires a fully expanded Acorn Atom with the optional VIA and floating point ROM. In addition an external DAC and clock circuit is also required. More about these later.

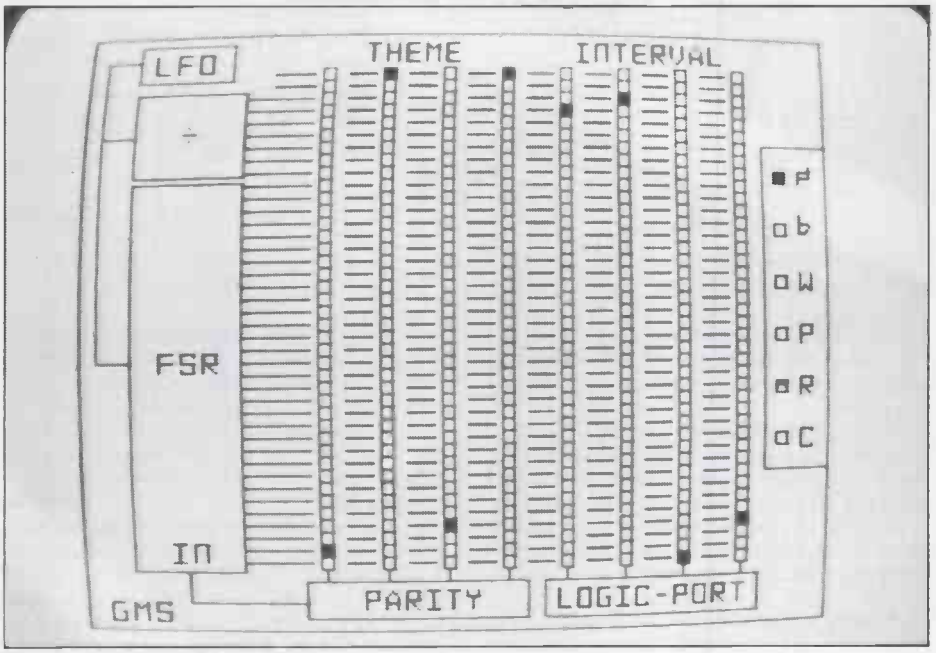
On running the program the Atom presents a 'front panel' using the high resolution graphics. This is shown in the photograph. The graphics represent the important functional blocks and the 8 selector switches are shown as 8 columns each of 40 contiguous boxes. To the right of the screen is a control box containing 6 selectors labelled ♯, b, W, P, R and C. These perform 'management' functions such as scale selection, reset and clear.

Scale ROM Address				DAC Input					Note
D	C	B	A	D8	D4	D2	D1	D0	
0	0	0	0	0	0	0	0	0	C
0	0	0	1	0	0	0	1	0	D
0	0	1	0	0	0	1	0	0	E
0	0	1	1	0	0	1	0	1	F
0	1	0	0	0	0	1	1	1	G
0	1	0	1	0	1	0	0	1	A
0	1	1	0	0	1	0	1	1	B
0	1	1	1	0	1	1	0	0	C'
1	0	0	0	0	1	1	1	0	D'
1	0	0	1	1	0	0	0	0	E'
1	0	1	0	1	0	0	0	1	F'
1	0	1	1	1	0	0	1	1	G'
1	1	0	0	1	0	1	0	1	A'
1	1	0	1	1	0	1	1	1	B'
1	1	1	0	1	1	0	0	0	C''
1	1	1	1	1	1	0	1	0	D''

RECORDED ON DEMO CASSETTE No. 9

SOFTMUSE

by Jim Grant



Pic 1. Front panel of the Soft Muse.

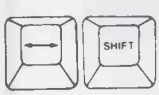
The Soft Muse begins in a clear condition with the 8 selector switches being 'set' at the top of each column, i.e. at logic Ø and the major scale selected (♮) in the control box. Also the FSR is cleared and the first stage Q1 is set at logic 1.

A box which is solid black indicates the 'set' position of the switch in that column. A flashing cursor is presented and indicates the position on the screen at which the next action will take place. For example, if the up command is given, the the cursor will move up one box from the last position.

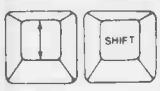
Control over the Soft Muse is simple and easily effected by the two Atom Cursor control keys, SHIFT and LOCK. A list of key commands as entered from the Atom keyboard is shown below:

The cursor will traverse across the columns from left to right maintaining its row position. When column 8 is reached the cursor will jump to the ♮ position in the control box regardless of its row position.

The Cursor will ascend the rows maintaining its column position.



The cursor will traverse across the columns from right to left maintaining its row position. If the cursor is in the control box then it will always jump to the same row about ¾ up column 8.



The cursor will descend the rows maintaining its column position.

This key alters the 'set' switch position in the column that the cursor occupies. The old position is deleted and the box which the cursor is occupying is 'set'.

A few points have to be noted about the command keys:

1) There is no wraparound of cursor movement. For example, the cursor will refuse to move further right than the control box or further left than column 1.
2) The cursor can only move within the 8 switch columns and the control box.
3) The cursor can move to any legal position on the screen without affecting the 'set' state of the Soft Muse. Only the LOCK key alters the set switch positions.
4) The cursor control keys have automatic repeat. Every single key depression does not necessarily mean a cursor movement since the program is not executing a continuous Atom keyboard scan.

The program that maintains the 'Front Panel' graphics and interprets the keyboard commands is written in BASIC. In fact, the Soft Muse has a split personality. There are two programs apparently running simultaneously. The second program is an interrupt driven machine code routine that is the mind of the Soft Muse. The two programs are oblivious to each other, but share a common set of memory locations which the BASIC fills with data for the machine code to use. Even if the BASIC program crashed the Soft Muse would quite happily churn out tunes regardless, using the data from the last 'set' state of the graphics.

This can be shown by pressing the U key which acts as ESCAPE. The Atom reverts back to the BASIC monitor but the machine code routine continues to be invoked by the interrupt as before. Incidentally, it is quite safe to use the BASIC cassette commands such as LOAD and SAVE while the Soft Muse is running since the Atom sets the interrupt disable mask and prevents further interrupt requests ($\overline{IRQ}$) for the duration of these commands.

Hardware

The Soft Muse is in communication with the outside world in 4 different ways. Two of these methods are via graphics and the Atom keyboard and have already been dealt with. The remaining two are the interrupt circuit and the DAC.

Neither circuit presents any problems especially since the DAC, Figure 3, is a modified version of the Spectrum DAC given in the Micromusic article November 1982.

The interrupt circuit, Figure 3, is little more than a CMOS oscillator wired around IC 1a and 1b. The rest of the circuit provides on/off and single stepping of the sequence.

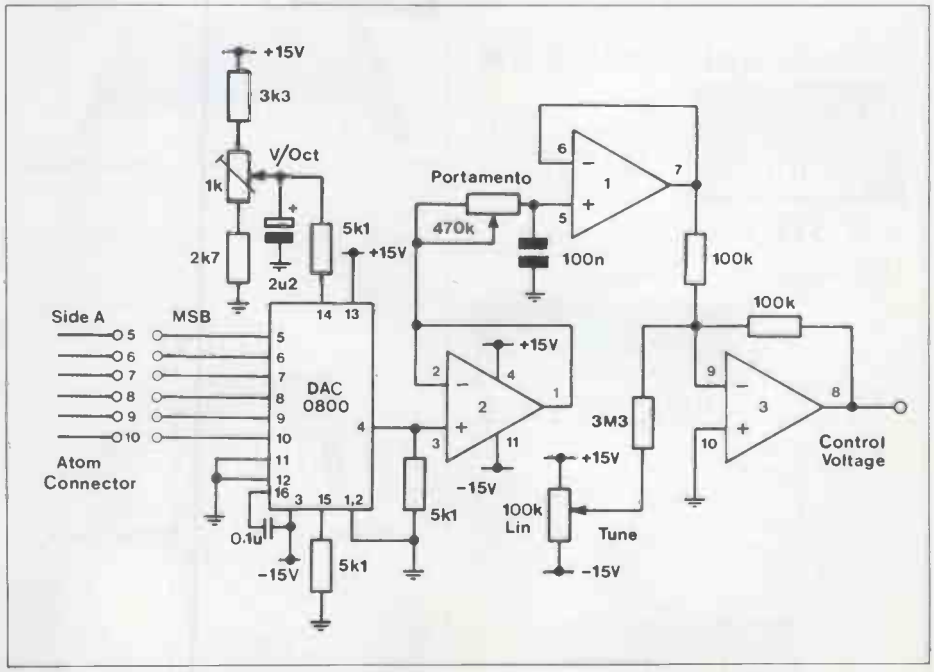


Figure 2. Digital to Analogue convertor circuit.

Four gate out options are available and the ÷2 gate outs are useful for sequences which have many consecutive notes that are the same.

Operation

Although it is not necessary to understand in musical terms exactly what each column does, it helps, in a global sense, to predict the type of sequence that will result from a given setting:

Column 5.....corresponds to a tone interval
Column 6.....corresponds to a 3rd interval
Column 7.....corresponds to a 4th interval
Column 8.....corresponds to a 9th interval

For example, ignoring the theme switches, if the interval switches 5, 6 and 7 (tone + 3rd + 4th) are set to the first row of the counter (÷ 2) the synthesiser connected to the DAC will trill between an octave. Setting switches 6, 7 and 8 (3rd + 4th + 9th) to the same row will now result in a trill of 2 octaves. These are useful settings for calibrating the DAC.

An ascending scale can be produced by setting switches 5, 6, 7 and 8 at rows 2, ÷ 4, ÷ 8 and ÷ 16 respectively of the counter. If the cursor is moved to the control box different scales can be selected:

♯ — major
b — minor (flattened 3rd and 6th)
W — whole tone
P — pentatonic

All that remains is to experiment with the 'Theme' switches. These determine the sequence which will circulate in the FSR.

One possibility is to set 3 of the Interval switches in the counter rows for a repetitive pattern and set the fourth somewhere in the FSR rows. The result is that the repetitive pattern is modified according to the FSR sequence.

To reset the sequence, i.e. start from the beginning by clearing the counter and FSR, move to the control box and set box R. This also puts a 1 in the Q1 position of the FSR and is sometimes necessary when the start up Q1 = 1 has been shifted past Q31 with no feedback selected. Note that R does not alter the set state of the switches.

Setting C (clear) of the control box returns the Soft Muse to its start up condition with all the columns set at row 40.

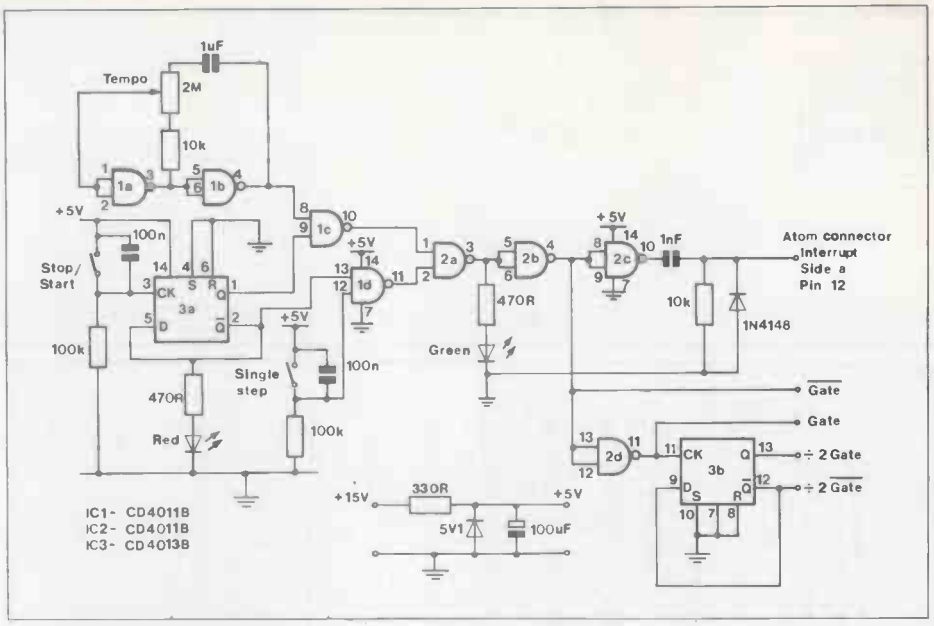
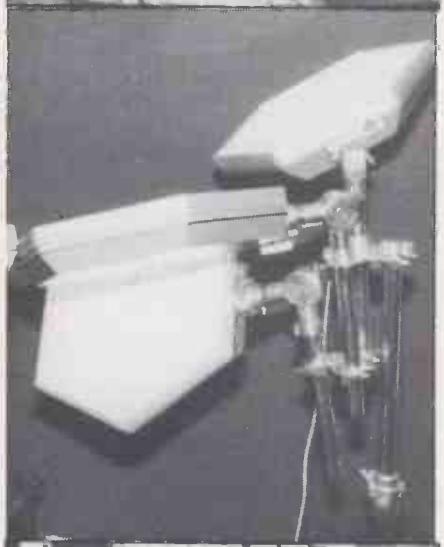


Figure 3. The interrupt circuit.

In general, it is very difficult to predict exactly the effect of a particular switch setting since the number of possible combinations are enormous. The best strategy is to set up a familiar combination and move the switches one by one away from the original setting to observe the effect upon the sequence. **E&MM**

A cassette tape of the SOFTMUSE program for use with the Acorn Atom, is available from E&MM, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG. The tape costs £3.95, including VAT, postage and packing. Please order as : Softmuse Datatape.

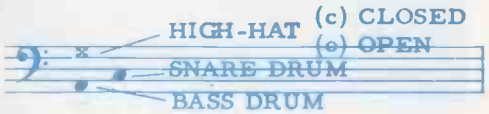


WARREN CANN'S

Electro-Drum Column Part Five

Part Five of our electro-drum column, written by our consultant drummer Warren Cann of Ultravox, continues with some more examples of beats useful to the modern percussionist. As always in this series, the patterns shown are suitable for both the acoustic kit player and the programmer.

"This month we're going to move on to variations that are only possible over the space of two measures. More sophisticated patterns invariably find themselves spread this far and, as for the simpler one measure patterns, the possibilities within this framework are nearly without end."



23. A variation of 21 and 22; keeping the high-hat and snare parts straight while experimenting with bass drum patterns is one of the first and most important exercises a drummer will ever do. The scope here is much greater than you might think.

24. One more variation, but this particular one is very useful to know because it's probably one of the dozen or so most used beats in rock music.

25. Now we move on to 2-measure patterns. The only way to advance beyond this is to juggle entire measures, and by repeating them to form a new pattern. This implies taking any combination of 1 and 2 measure patterns and making a 4 or 8 measure pattern out of them. Try the 8 measure ones only if you're feeling particularly ambitious!

26. A variation of 25 with an additional bass drum beat tucked in. If you're an acoustic player these flicks require quite a bit of practice to do smoothly, or if you're programming it'll help to write this sort of thing at a slower tempo.

27. A good example of what you can achieve with a 2-measure pattern. A large part of playing any instrument lies in having a good memory, and when you start using these patterns you need to keep well on top of what you're doing. This is where the aesthetics and the mathematics of drumming interweave to either fascinate you or drive you to distraction!

28. Back to a one measure pattern with the busiest bass drum part yet scored. It can underpin things too literally if used in the wrong context, but in other applications it can help to pad things out. Whether a programmer or an acoustic player, only your own experience can teach you that sort of judgement.

ELECTRO MUSIC ENGINEER

Wolfgang Palm and Wolfgang Duren discuss the development of their PPG digital music synthesisers

Herr Palm: I'm really both a technician and musician. First my interest grew through music. I didn't learn to play at school, (except in a band like most pupils), but my father was a pianist. From '75 I studied physics and electronics subjects and also had a group and played organ. I remember hearing Keith Emerson on an ELP record use portamento and glide effects ('Hoedown'). I wanted to copy these sounds so I made a simple oscillator with some portamento — it was a frequency to voltage converter and then voltage to frequency, controlled from the electronic organ. By the end of my studies I had built my first modular synth (like the big Moog system). The Minimoog was successful in Germany at the time.

I then started work on developing synthesisers. First a very small monophonic, not unlike the Minimoog, but much cheaper than it cost to buy in my country. These early instruments did not use 1V per octave control for the oscillators, but were linear (under each there was a preset for tuning individual notes in a resistor chain!).

Soon after we started selling some of our synths I met Chris Franke of Tangerine Dream — it was funny because he had bought an old Moog system that he wanted to modify and was advised by Moog in Germany to go to me. We did provide a lot of design projects for them.

Early instruments

The 1020 Synthesiser was our first use of digital circuitry in an analogue instrument, for generating the waveforms. All our systems initially were of course monophonic. In 1978 we started developing polyphonic systems — actually, the first instrument was duophonic with some special 'hold' functions, but it was digital using a lot of CMOS ICs. Next I produced a 4-voice keyboard that only had one trigger output so you could play four simultaneous notes as chords. The circuitry employed keyboard scanning with 'next available' oscillator allocation as well as split-point setting. It was also one fixed connection to each oscillator (from our modular system) rather than the multi-options we now use on the PPG Wave 2.2.

Before the polyphonic microprocessor controlled instruments, there was another instrument — a micro-based sequencer. Klaus Schulze has a lot of our modular sequencers we've designed. The micro we started with was the 6800 because it was quite cheap at the time. It was quite a problem for me to find enough hours to grasp machine code, BASIC and other micro software plus hardware techniques, and like many others, the physics I learnt at school didn't cover this. We considered the sequencer to be very flexible, with its small keyboard that could play in realtime, add loops, run backwards, do auto transpositions, chain sequences etc.

Herr Duren: Many people have tried to build synth related instruments like sequencers without having thought about it before. Consequently, what the engineer may accept is often quite unsuitable for the musician.

Herr Palm: We'd probably sold about 30 or 40 synthesisers by 1979, and 20 or so sequencers, all mainly in Germany with a few in France and Holland. It had become my sole occupation and I just made enough to keep going.

Then some people approached me with a view to making a big firm out of PPG! They tried to get dealers in Germany — they actually got 5 but then it all broke down and I think they went bankrupt. One of the dealer's salesmen was Wolfgang Duren and so that's how we met. Our company had been established in May '78 as PPG (Palm Production Germany). Meanwhile the dealers owed us a lot of money which they couldn't pay and this did cause a setback financially for us.

Computer instruments

We also made a programmable duophonic synthesiser before the sequencer — it was a crazy machine with over 200 CMOS ICs. We did regard it as a flop, but it was probably the first machine to store programs (holding up to 50). Our first sequencer was boldly called the 350 Computer Sequencer — we think we were one of the first to put the word 'Computer' into a musical product title!

It was after the 1979 Frankfurt Fair that we decided to have a go at the polyphonic computer instrument. A lot of attention was being given to Oberheim's multivoice machines. My idea was to make the same functions and sound generation in a digital way. We experimented with various digital filters and so on, and eventually came up with a system using 'wavetables' — 64 waveshapes in each table so that you can move through the waveshapes by using envelope control, LFO and other CV output devices.

There was a problem at first — the prototype machine was virtually all digital — only VCAs after the oscillators but with no filters, because the filtering was done by changing the waveshapes. The sound is different of course — quite sharp and hard, and not as 'fat' as the Moog.

Herr Duren: We did like the sound, so did T.D. and certain musicians. Others said "do a Polymoog"! The Prophet also made it difficult for us to compete in the early days.

Yet we created a lot of interest as the PPG Wave instruments used an analogue interface for their digital system. In the first place we thought we would replace the filter by means of the wavetables, but a filter does put its own non-static character on an instrument's sound. The 64 complex waveforms making up a table are factory-generated and fixed with individual amplitude and shape.

Herr Palm: Then if you call up a wavetable, the computer calculates the waveshapes between two fixed waves. Of course, you can then vary the overall amplitude of the waveshapes selected. Only in the development system can the waveshapes be set up.

Herr Palm: We showed the Wave Computer 360 at Frankfurt 1980 with some slight changes to further production models — some sliders, no special LCD display with 7 segmented LEDs instead, a rather complicated tuning of voices that was slightly awkward to use plus a VDU display.

Herr Duren: Although there was no sequencer in the instrument, there was a facility that enabled clocking or stepping of the oscillators and you could detune each oscillator to make a sequence.

Herr Palm: The response was not so good because of this rather hard, metallic quality of the instrument.

Herr Duren: But always there were just a very few musicians who would use the new sounds, then after hearing their records, people started to take an interest in the PPG machines.

Herr Palm: About 40 of these instruments were sold and at the next fair we brought out the updated version (the Wave 2) with filters and a new display. It still took some time for the strong interest to be created — most people preferred to be able to synthesise

traditional instruments rather than use completely new ideas.

And now we are producing the Wave 2.2. Our business is still very small with only 7 people working on the production as we use local companies to produce major parts for us.

Herr Duren: We feel that the Wave 2.2 is now the result of collaboration with many musicians — the position of controls, how it responds to continuous stage use — all those sort of things. For example, we've added a second wheel controller following people's suggestions.

Herr Palm: One of the big difficulties in producing software for the Wave is that there are many possibilities for wrong moves when positioning the cursor in the large display. To actually debug all these and other things so that the system will not lock up or crash has taken a long time. The development for the Wave 2 and 2.2 was done with a 6809 micro, which is quite powerful in combination with the Wave system. As we said before, we did our own work in Germany more or less alongside systems under development in other countries — mainly USA, and our Wave 2 came out before we even saw the Fairlight.

Herr Duren: One of the first instruments we heard about was the Synclavier.

This situation about analogue/digital choices is that if a musician wants to work on a computer system then he or she moves the cursor on the screen to various points of entry. With our system you have the analogue control panel, moving knobs to synthesise as most musicians prefer.

Herr Palm: There was another design that was not generally known about — it was a large system using 2 microprocessors (called 340/380 system). Thomas Dolby has one and it was a development that allowed sampling of sounds, making original wavetables. It had additive synthesis and a powerful sequencer which we call an 'event generator' because you can define all the time points exactly, as well as having different sound setting for each tone — just after that we heard about the Fairlight. That's really why we didn't make too much of this system.

Wave 2.2

The Wave 2 has since been very successful and is now replaced by the Wave 2.2 and this makes use of special software with the Waveterm VDU display. Most of the software preparation I do myself. I find that Wolfgang helps me greatly with establishing the direction in which we should be going.

Herr Duren: Looking back, the important point for us was our determination to sell our instruments outside Germany once we'd brought out the Wave 2. At that time I was on tour with T.D. and met with Desert Distributors who agreed to start promoting PPG in the UK. We also made contacts in France. One problem with these kind of instruments is that they do require more than just a 'sales' approach because of their complexity. So now we have PPG sold in the UK by Syco Systems. We've now produced a dozen or so of the PPG Waveterm which is an expansion unit for the Wave 2.2 It is a 19" rack system with a video monitor having graphic facilities, 8" floppy disc memory storage and an audio signal processor for recording and treatment of natural and other acoustic sounds.

We've put keys directly under the monitor screen for typing in multi-commands (indicated above keys on the VDU). New sounds can be created by individually programming the amplitude of up to 32 harmonic overtones and screen 'pages' makes specific tasks easy to set up. For example, computing waveforms graphically by additive synthesis (not just with sine waves but also with more complex 'pre-formed' waves); creating wavetables from up to 64 partial waveshapes; inputting transient sounds and then defining start/finish points of the sample to make new sounds — a segment of the waveform can then be inserted into a wavetable; in addition, the Event Generator allows complex sequences to be programmed, edited and recorded.

The new Wave 2.2.

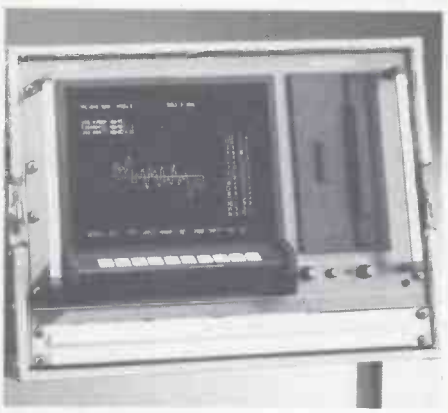
Herr Duren: It is also worth noting that sound samples, like the digital sounds, can be treated using the analogue controls. We've had to redesign the oscillator hardware in the Wave 2.2 to allow this to happen. Normally, the oscillators run in small loops for the wavetables making single periods of the sound. If you move the wavetable the loop changes to another position of the table, but if you playback sampled sounds, it goes through the whole memory in one sweep and therefore requires this new hardware.

Herr Palm: The total sample time at 16K bandwidth is about 1 second in the normal version. But any sample rate can be set to add more time at reduced bandwidth. You could record 5 seconds of speech (but not music) satisfactorily. Virtually anything can be sampled and instruments like the flute can be sampled well; grand piano and strings too; even a funky phrase on the bass! The big advantage of the sampling is not just to copy traditional instruments but that you can 'zoom' on to a part of the sound and then use it. First, you define a loop which is maybe 2 or 4 periods of the sound, then you can analyse this and get 32 overtones. The quality of the analysis means you get virtually the same sound back — of course it's only a static period created without dynamics.

So you could put a guitar attack with a piano decay and so on. By defining loops you can stretch a sound's time parameters. The Wave 2.2 controls can then alter sounds in realtime, while the screen commands may take a second or so to execute. Also specific parts of the keyboard can use different waveshapes. For example, the sound of a choir needs a different waveshape on each key otherwise you get high 'chipmunks' and low 'growls'!

Future developments

Unlike the Fairlight, which has eight voices with different sounds, our system has a larger memory with all oscillators able to select any position of this memory at any time. In other words, up to eight notes anywhere on the keyboard can be set to reproduce the correct sample for that note (or group of notes if a limited number of samples are analysed in the waveterm).



Waveterm VDU display.

It's now 3 or 4 years since we started the polyphonic instruments. I'm now working on a lot more software for the Waveterm and the Event Generator. We're also thinking of doing an extra keyboard with normal acoustic piano keys that are both pressure and velocity sensitive (at the moment the present keyboard is just velocity) with wave control from the keyboard as well as other parameters.

All the new products we'll be bringing out will have a communication bus, a connector for an 8-bit parallel bus, so that a musician can add to his basic system step by step. At the Frankfurt '83 Fair we'll have a 19" rack containing a Winchester Drive where you can sample sounds directly on the disc (like the Synclavier) — even 15 minute sounds! Another part of the Waveterm will be a mixing console where you have 16 sliders, knobs and push buttons for CV in/out controllable through the Waveterm software. So you could have a function like the Linn Drum where you program the rhythms by pushing the knobs or you can do a computer mix etc. Our aim is to produce a range of 'instruments' that must be for all musicians — musicians working in groups can use the Wave 2.2 and maybe the piano style keyboard; people who compose at home could do programming with the Waveterm without the processor keyboard. Each musician can make his own package to suit his needs, and the Winchester disc (6 Mbyte) will give immediate access to 100 sampled sounds, opening up a new sound spectrum for the musician.

E&MM

We acknowledge with thanks the co-operation of Syco Systems Ltd., 20 Conduit Place, London W2 (Tel. 01-724 2451) in the preparation of this article.

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Decide which eight of the sixteen statements are true. Enter them in the lettered boxes on the entry form in the order in which they occur in the list. For instance, if you think all of the statements from 7 to 14 are true, enter 7 under A, 8 under B and so on.

Then state in not more than fifteen words what future project could provide, in your opinion, the same quality and usefulness as the Powertran E&MM Digital Delay Effects Unit.

Complete the entry coupon with your full name and address, and send it to E&MM 'Delay Competition', 282 London Road, Westcliff-on-Sea, Essex SS0 7JG, to arrive no later than the closing date of **Friday, March 18th, 1983.**

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1 The unit will produce real time harmony effects.
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6 The unit will produce an ensemble effect from a solo instrument input.
7 The minimum sampling rate needed is half the highest input harmonic.
8 The modulation oscillator can be used to produce vibrato.
9 The chorus produced is a time modulated version of the ADT.
10 The pre- and de-emphasis chain is to increase frequency response.
11 When freeze is selected a sound may be transposed.
12 The unit can produce a quasi-reverb effect.
13 A quarter of the full memory available gives up to 400 mS delay.
14 Digital design makes the Delay Line noise-free.
15 The unit can produce a tremolo effect.
16 The metal casing of the unit is green.

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E&MM POWERTRAN DELAY COMPETITION

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There is no entry fee but each attempt must be on an entry coupon cut from E&MM and must bear the entrant's own name and address.

All accepted entries will be examined and the first prize will be awarded to the entrant who, in the judges' opinion, has correctly identified the eight true statements concerning the Powertran DDL, and who has made the most interesting or imaginative suggestion for a future project of similar quality and usefulness. Remaining prizes will be awarded for the next best entries in order of merit; no entrant may win more than one prize.

Entries received after the closing date or received incomplete, illegible, mutilated or altered in any way will be disqualified. No responsibility can be accepted for entries lost or delayed in the post. Judging will be by members of the staff of Powertran and Glidecastle Publishing, whose decisions in all matters relating to the competition will be final and legally binding.

Winners will be notified and results published as soon as possible in E&MM. The competition is open to all readers in Great Britain, Northern Ireland, Eire, the Channel Islands and the Isle of Man, other than employees of Powertran and Glidecastle Publishing.

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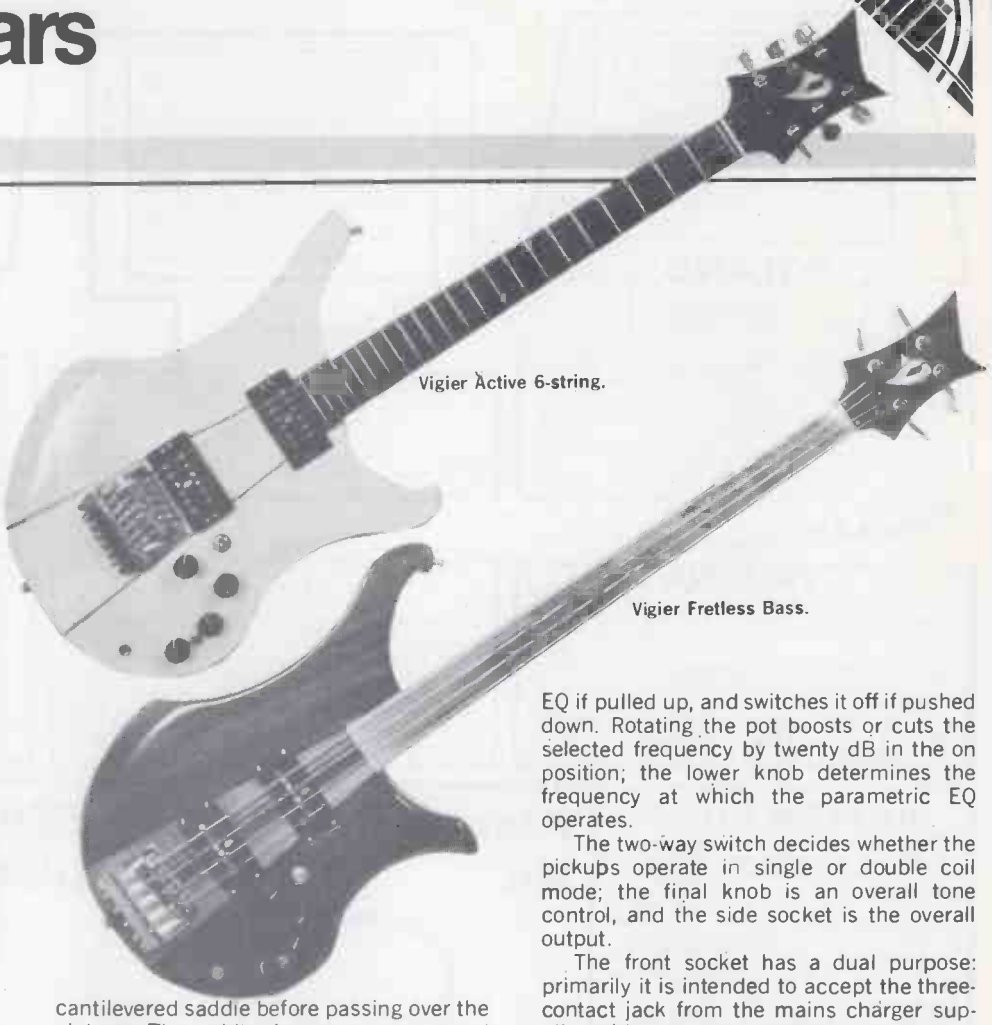
Vigier Guitars



Vigier Active 6-string.

Vigier Fretless Bass.

The trend towards increasingly powerful and compact guitars, using an increasingly sophisticated range of materials, has in part produced the Vigier range of guitars which are now available for the first time in the UK.

For some years Vigier's designs have been popular on the Continent and in America, where they are used by the lead guitarist of the popular rock band Toto. Despite the rock emphasis in the styling of the guitars however, they are capable of a very wide range of sounds due in part to their mechanical construction and in part to their versatile active electronics.

We examined three models — the Arpege six-string Active lead guitar, the Active Bass, and the Fretless Bass with Metal Fingerboard. These are just part of a range developed by Vigier in eight years as a guitar repair specialist and two years as an independent designer; other models include a five-string bass, a vibrato guitar, and a fretless guitar, "a new instrument whose astonishing possibilities are yet to be discovered".

The lead guitar has a 23-fret neck, including a zero fret next to the nut. The neck itself is of an unusual patented design, intended to avoid the potential fragility and tendency to warp of a wooden neck, and the coldness, temperature sensitivity and lack of adjustment of an all-metal neck. To this end it has a sectional Maple and Walnut neck, with a conventional adjustable truss rod topped by a metal 'under-fingerboard' and then the wooden fingerboard itself.

The neck design is unusual in other ways; it has a trapezoidal shape under the body, spreading out towards the output socket and thus, it is claimed, allowing for a more even transmission of vibrations from the fingerboard to the bridge and a consequent increase in Sustain. The body is made of Royal Walnut and can be finished in glossy black, white, clear red, metal chestnut-sunburst, light red, natural, and metallic grey, dark cherry or antique violin.

Our model had a smooth off-white finish with gold ornamentation and pearl dot inlays on the side of the fingerboard. Metal parts were gold and silver, knobs black with a white indicator line but no scale, maroon pickups, no scratchplate but a small guard plate around the output socket. Like most of the other parts of the guitar the metalwork was quite unusual and bears further description.

The dual humbucking pickups are manufactured by M. Benedetti and use a special coiling system, in which the wire is wound directly onto the permalloy pole pieces and a wide response curve at high output levels is obtained. On the basses, the pole pieces are made from Alnico 8, an Aluminium/Nickel/Cobalt alloy long known for its excellent magnetic properties. Pickup height adjustment is by means of two small screws on either side of each pickup.

The bridge is made from Delta metal, having negligible expansivity, and is of a very unusual design. The strings are 'front hooking', the ball end clipping under the bridge and the string passing through a cantilevered saddle before passing over the pickups. The saddles in turn are connected to cylinders which penetrate the base of the bridge, are held in place by grub screws, and provide intonation adjustment using a 2.5mm Hex key (not provided).

The system appears unusual at first sight but helps to give tremendous sustain, with height adjustment of the individual saddles achieved via grub screws again and string changing made easier by the fact that the saddles swing upwards if required.

Access to the truss rod is via a back panel removable again with a Hex key, and it's also possible to gain access to the active electronics by removing four cross-head screws. This shouldn't really be necessary as the guitar comes supplied with dry cells which can be recharged via an external socket as will be described; in case of an emergency however, with flat cells and no mains adaptor on hand, it's useful to know that conventional batteries can still be fitted.

Lastly, the controls. The lead guitar has four rotary knobs, one three-way and one two-way switch and a ¼-inch socket on the front of the body, and another socket on the side of the body.

The first rotary pot decides the function of the preamp. In the down position it converts the output signal to low impedance, giving the potential of using much longer cables or several effects pedals without loss of volume. In the up position it gives up to a ten decibel boost to the output, with the usual benefits of controllable distortion, additional volume and greater tonal range.

The three-way switch is a conventional rhythm/lead/both pickup selector. The central pair of rotary pots operate as follows; the higher knob switches on the parametric EQ if pulled up, and switches it off if pushed down. Rotating the pot boosts or cuts the selected frequency by twenty dB in the on position; the lower knob determines the frequency at which the parametric EQ operates.

The two-way switch decides whether the pickups operate in single or double coil mode; the final knob is an overall tone control, and the side socket is the overall output.

The front socket has a dual purpose: primarily it is intended to accept the three-contact jack from the mains charger supplied with the guitar, which gives the internal cells sufficient charge for 100 hours playing if connected overnight.

Alternatively it can be used as a direct output from the pickups, an enormous bonus if you've ever noticed the degree of tonal cut caused by tone controls even when they're set wide open. Used in this mode the active electronics obviously don't function.

Overall the guitar is a sheer delight to use. The action is low but positive, the truss rod adjustment being made for .010 strings, and there are no appreciable dead spots or buzzes. Although the body is small it is pleasantly weighty, and the action of the Schaller machine heads is up to the highest professional standards.

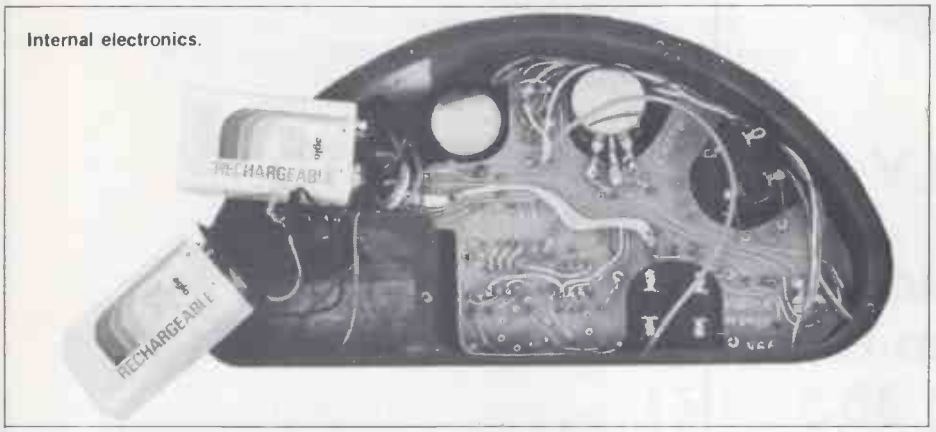
The tonal range available is enormous, from the most piercing and powerful heavy rock sounds to mellow jazz tones often at the flick of a single switch. A strap locking device is included with the guitar, which hangs comfortably or sits across one knee.

The only problems are in the layout of the switches and knobs, which is a little cramped considering they are not labelled in any way and which requires a good degree of familiarity before use can become intuitive. Also the model we examined hinted at problems with the internal grounding, but not in any serious manner.

The standard Bass is a 22-fret model including the zero fret, and has two pickups which can be used in or out of phase. Otherwise controls are similar to the guitar; the machine heads are again Schallers, the strings this time passing through the body for increased stability and sustain.

The fingerboard is extremely smooth, and in combination with the active EQ

Vigier Active Standard Bass.



Internal electronics.

allowed a vast range of sounds and styles from heavy woolly effects to piercing high-pitched soloing sounds such as have become popular recently with the music of Mick Karn and Japan. Again a problem with grounding.

The final guitar on review was the eyecatching fretless bass, in a dark cherry finish but with a delta metal as opposed to an ebony fingerboard. Like the fretless six-string this is really an instrument for the experienced only, when the phenomenal sustaining properties of the delta metal surface can be fully exploited. Apart from the obvious differences in tuning, fretless playing is a whole new discipline having much in common with violin playing. For those who have mastered or feel they could master the technique, suffice it to say that the Vigier fretless may be just the instrument you've been waiting for. The simple effect of a twenty-semitone glissando on a metal neck can be quite breathtaking!

Vigier's range is under constant development, the obvious appeal being to the professional or highly specialised musician but with many aspects of interest to every musician. One new product which should fall under the latter category will be revealed at Frankfurt — it's the Nautilus, an active guitar with 19 digital memories for different tonal settings and pickup configurations which are retained by miniature batteries. The combination of Vigier power and sustain with instant accessibility of a personal selection of sounds should be quite overwhelming. **E&MM**

Approximate retail prices including VAT are £850 for the six-string guitar and fretless bass, and £800 for the standard active bass. Vigier guitars are distributed in the UK by Capelle Music Industries Ltd., 333A London Road, Hadleigh, Essex. Tel: 0702 559383

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The Novatron 400.

THE NOVATRON REVISITED

Digital technology may be the latest musical preoccupation, but it's as well to remember that the pioneers of electronic music used simple analogue units, tape and disc players and electro-mechanical rather than electronic wizardry to achieve their amazing effects. Stockhausen, Varese and many others produced their innovative concrete music by manipulating taped natural sounds, and it was quickly realised that an instrument which could arrange such sounds musically could perform a compositional function for years to come. Thus the Mellotron was born, and continues today under the name Novatron to offer the sounds of real instruments and effects to the keyboard player.

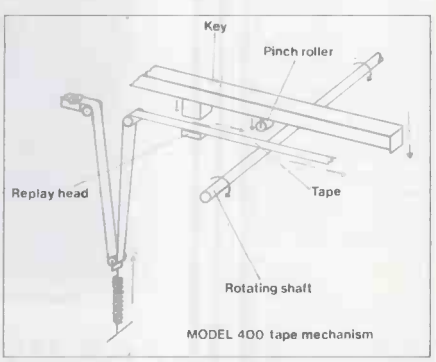
In addition to its rich sounds, the Mellotron offered the only versatile source of polyphonic music other than piano, organ and string synth and so was adopted by hundreds of experimental musicians. Klaus Schulze, Tangerine Dream and Kraftwerk became established not so much on the strength of their electronic experiments as on the way in which these were integrated with the powerful, romantic sounds of the Mellotron.

Adapted for the BBC as a specialised sound effects store with added bands of tape and a dual keyboard, the Mellotron had an important part to play on Radio and TV for many years. Contractors to the BBC during this period were Streetly Electronics, the original designers and manufacturers of the Mellotron and now of the fully compatible Novatron. Leslie Bradley of Streetly summarised the history of the machine and its present applications for E&MM.

"Many people consider the Novatron or Mellotron in a rather jaundiced light today. Comparing it to modern state of the art synthesizers it does at first look that way. Synthesizers are wholly electronic and the only moving parts are keys and controls, whilst the 'Tron is basically mechanical action linked with electronics.

Well, so what! A car is sheer mechanics with more and more electronics hung on to it — fitted with a magneto it will run without any electrics or electronics — the point is today we hang more and more electronics on to them. So, let us examine the 'Tron more closely. Its sounds are derived from special tape of non-standard width, each tape having 3 tracks played via a 35 note keyboard. Virtually any musical instrument can be recorded, thus providing real sounds of instruments, which is the point we hit in our advertisements.

Most readers will know that tapes are mounted on frames which are quickly exchanged in the unit so that many different selections of instruments may be available.



Novatron internal mechanism.

The most popular of all the tracks available are the choirs. Show me the synth. which can give you chords of real voices and at a cost of less than a 'grand'. There is no such animal, and you have to part with a lot of hard earned bread to get a pretty sickly imitation.

We would like to make a further point which many keyboard musicians appear to have missed. When the Moody Blues produced their album Long Distance Voyager several real orchestral passages, bridges and links were recorded and mixed in to great effect. Patrick Moraz, with his broad minded approach, looked for a way to obtain the same mixture of sound during his tour of the U.K. and America. How did he do it — with a Novatron, no less. We transferred the studio orchestral material to sets of tapes and during stage shows Patrick merely had to press the appropriate key at the right moment and 'presto', the L.P. sound was coming from the stage — orchestra and all.

Virtually any sounds, musical or otherwise, may be transferred to the Novatron. Paul McCartney asks us to supply him with recordings of bagpipes, frying chips, excerpts from his albums and other assorted effects. Timed carefully and fitted, the 'Tron gives you instant access to the sounds which come out right on the nose when you bang the key.

Music, sound effects, short jingles, applause, laughter are all the same to the Novatron — it does not mind at all! The

Patrick Moraz at the Novatron keyboard.

Model 400 whether called a Novatron or a Mellotron accepts the same tapes and frames. As mentioned earlier, we use a non-standard width tape on the unit, but we can supply you with tape guide conversion kits which enable you to use 2-track ¼" standard tape at 7½ ips, so you can record your own tracks and instal them.

We are currently supplying a number of units with ¼" tape format to overseas broadcasting corporations for use purely as a sound effects source. By using several keys in sequence complicated multiple effects may be built up as required.

Shall I go on? Who says the Novatron is old fashioned?"

E&MM

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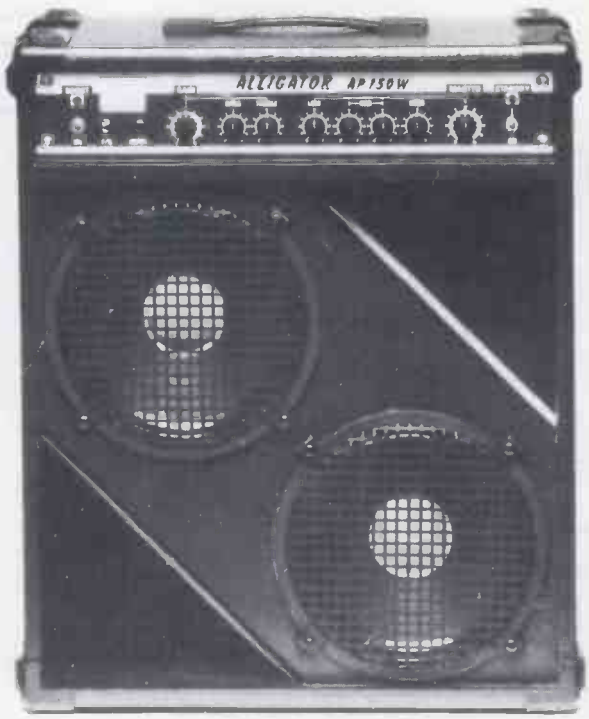

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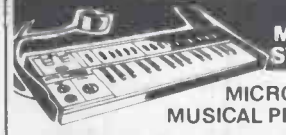

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Tokai TA 35

Tokai's new combo amp is a happy example of reality being far superior to appearances. To be more precise, this excellent unit looks pretty unappealing at first glance, with its yellow and brown diagonally striped cloth covering giving it a definite toy-like feel and its relative lightness banishing all hopes of a robust valve design.

Immediately on plugging in all such illusions are dispelled as the Tokai delivers 30 Watts of warmly distorted sheer power with more than a touch of built-in reverb. This unit is very loud for its size (just a foot tall) and offers many more options than are at first obvious; the construction is in fact quite rugged and the transistor design gives an excellent imitation of valve effects.

Passing over the garish covering, construction is of ½" thick wood (rather than chipboard) with joints largely glued but heavy crosshead screws holding the metalwork in place. There are no corner brackets, but heavy rubber feet screwed to the underneath and a leather handle affixed to the top with metal brackets. The speaker cover is in reddish-brown cloth to match the Tokai nameplate.

The top control panel, in a recess behind the handle, has Low and High instrument inputs on a silver plate together with Input Volume and Master Volume pots, and a Mains neon. The knobs are of the good old-fashioned wedge pointer type, with the Master Volume also acting in a push-pull mode to select Boost, as described below. All the controls are labelled, but the labels face backwards as does the second control panel — obviously this will be either a blessing or a curse depending on whether you're facing the amp yourself or pointing it at an audience.

The rear control panel, in a shallower recess on the back of the amp head, has four smaller knobs controlling Treble, Middle, Bass and Reverb, together with Headphone Out and Line Out metal jacks and a chrome toggle Power On/Off switch. Again, these controls can be easily accessible or rather fiddly depending on where you're standing in relation to the amp. It's certainly not easy to distinguish the four knobs by touch while reaching over the front of the amp, but short of making everything slightly vulnerable by mounting it protruding from the top of the amp head there's no solution to this kind of problem.

Servicing is fairly easy, as the removal of six screws allows the whole amp head to slide out with the exception of its two connections to the 7 inch 8 ohm Japanese speaker and two connections to the reverb Spring line screwed to the base of the unit. The reverb also comes away once unscrewed; it's mounted on a chipboard enclosure and consists of a single 6 inch spring in a standard metal casing. Interestingly enough the speaker connection tags are protected by a thick card enclosure; it's a pity the wires to speaker and reverb aren't terminated by sliding tags to make complete removal of the amp easier.

The amp itself is completely enclosed in a metal box, the top of which can be removed after taking out six small screws. This reveals the power transformer, rated at 30V 1.2A and carefully earthed, and the pre-amp and power amp boards. The pre-amp uses miniature pots in a conventional transistor circuit, while the power amp is based on Sanyo's STK 436 Stereo Amplifier module used in a bridge configuration for mono output. Circuit boards are neat and clearly marked, heatsinking is generous (the back of the amplifier is open in any case) and locking plastic spacers are used throughout.

Returning to the sound of the unit, this can be very impressive as previously mentioned. The guitar used was the Vigier Arpege six-string, using the direct pickup output rather than the active output to equalise tonal properties. The tone controls on the amp can then be seen to be very effective, giving such a degree of boost and cut that if all three were turned down hardly any sound was produced at all; the Middle control is particularly useful and like the others works smoothly and evenly.

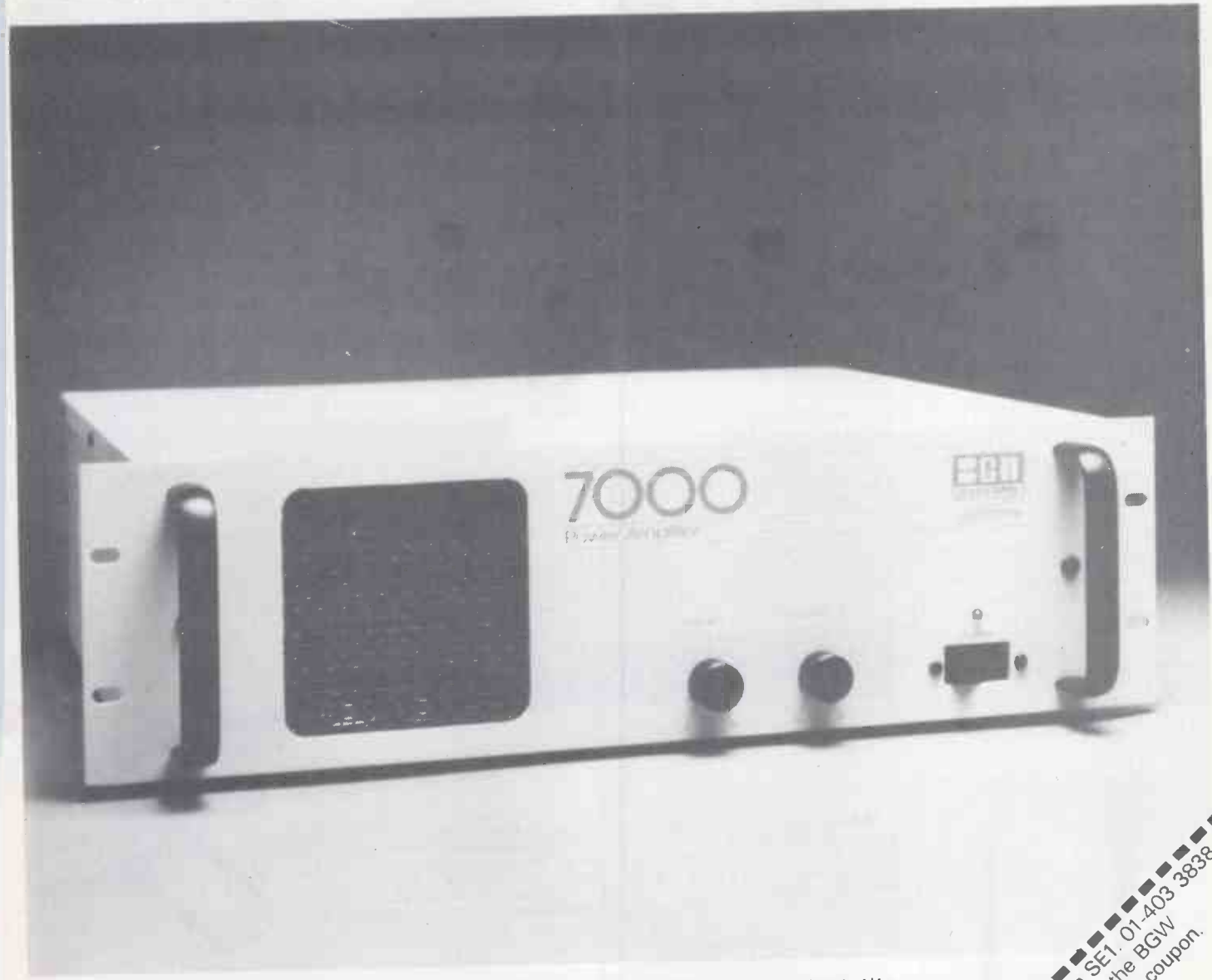
Pulling the Master Volume knob gives a Boost which can produce warm, overdriven valve effects with the correct guitar and input volume settings. Reverb is quite versatile, from sharp buzzy effects to spacious cathedral sounds depending on the other settings; it's most effective on the high input and without the Boost switched on.

Even at high volumes there's no unwanted distortion and no extraneous noises from the cabinet. The overall package is neat and not too heavy, the mains lead fitting inside the body cavity for transportation. This little amp should do as well as the same manufacturer's guitars have done over the last year or so. **E&MM**

The Tokai TA35 is available at £161.20 including VAT from Blue Suede Music, 19 Thomfield, Ashton Road, Lancaster LA1 5AG, England (tel. 0524 36227).

BGW SYSTEMS

The Model 7000 is a 2 channel amplifier, rated at 200 watts average continuous power per channel into 8 ohms, 20Hz-20kHz, at no more than 0.1% Total Harmonic Distortion (325 watts/channel into 4 ohms).



If you demand the kind of performance and reliability essential for live entertainment or recording/broadcast monitoring, yet require a more cost-effective alternative, the Model 7000 is the logical choice.

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MUSIC MAKER EQUIPMENT SCENE

Video

The video scene is on the move again, with new equipment, new compact formats on the way for portable work, and new low software prices. Konishiroku UK have announced what they describe as the world's smallest colour video camera, the **Konica Colour VC.** Compatible with all video deck systems and weighing only 690 grammes including cable, the VC is expected to appeal to a wide range of domestic and commercial users. It's highly efficient design reduces power consumption by 10 to 20 per cent, it is claimed, as compared to conventional portable cameras, and so extends the recording time available on battery-powered video machines.

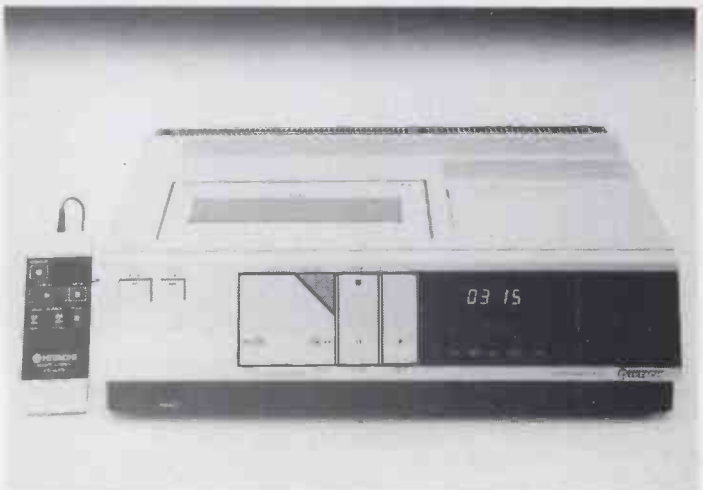
The camera features a ½" electrostatic focusing SATICON tube and an F1.8, 10-30mm zoom lens. There's a built-in electret condenser microphone, and an optional 1" screen electronic viewfinder.

The current model for the Japanese and American markets uses the NTSC 525 line system, and the European PAL system model is expected to become available in June.

Further details from Alastair Sedgwick, Carl Byoir & Associates, 11a West Halkin Street, London SW1X 8JL. Tel. 01-235 9292.

Hitachi have broken another price barrier with the **VT 11E**, a stylish video machine which sells for around £399. Using the VHS format, of course, it has a streamlined front panel with a single large control for Play/Record, F.Forward/Rewind and Search at 4 times normal speed. It includes a test signal generator for tuning the TV, automatic output charge without the need of a TV/VTR switch, a heater to avoid condensation damage, and a corded remote control. There's also a freeze frame facility and a built-in aerial booster; the VT 11E weighs 8.1kg and is only 43.5cm wide.

Further details from IDP Public Relations, 32 Craven Street, London WC2N 5NP. Tel. 01-930 0057/0058.



Instruments

Spector Guitars are now beginning to limit their sub-contracting work after experiencing an upsurge in sales of their own designs. Principal among these is the NS-Bass series, designed by Ned Steinberger (now internationally known for the headless Steinberger Bass) in 1976. All Spector's handcrafted guitars are intended to offer state-of-the-art engineering at reasonable prices, and there is a choice of bolt-on and fixed neck instruments, rare woods, pearl inlay work and oil or high-gloss finishes. The NS basses feature Schaller machine heads, EMG or DiMarzio pickups and active equalisation giving 15dB boost and cut of bass and treble.

Spector Guitars, 444 12th Street, Brooklyn, New York 11215, USA. Tel. (212) 788 0483.

Multivox have introduced two new rack mounting effects units. The MXD1R Mini Echo is a footswitchable unit with input volume control and peak LED, Balance, Repeat, and Delay from 30 to 200 mS. U.S. retail price is $225. The larger MXD7 Analogue Echo features a more complex version of the MXD1R's impedance matching, together with 20-500 mS delay, footswitchable chorus and built-in spring reverb. Suggested retail price in the U.S. is $499.

More information from Multivox/Sorkin Music Co., 370 Motor Parkway, Hauppauge, New York 11788, USA. Tel. (516) 231 7700.

Deltalab also have a new effect, the ADM-64, claimed to have twice the flange ratio of any other digital unit. It gives 3 octaves of flanging (8 to 1 ratio) and includes an envelope follower control voltage for special flanging effects.

It also produces ADT and 16-64 mS of short echo, with 16K bandwidth and a 90dB dynamic range maintained, it is claimed, at all delay settings. Other Deltalab Effectron units include the ADM 310, a relatively inexpensive delay line designed for rack mounting. Deltalab units are distributed in the UK by Scenic Sounds Ltd.

Scenic Sounds Marketing, 97-99 Dean Street, London W1. Tel. 01-734 2812/3/4/5.

Home recording enthusiasts comprise the intended market for two new microphones from **Beyerdynamic.**

The M1 is a moving coil mike with an omnidirectional pickup pattern and frequency response stated at 40-15,000Hz.

The M2 is a dynamic mike with cardioid characteristics (i.e. directionally sensitive forward and, to a lesser extent, backward). Both mikes come with a neat table top tripod stand: retail prices are £20.70 and £31.05 respectively including VAT.

Beyerdynamic GB, 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Tel. 0444 451003.

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Bateman, Intro. to Computer Music; **Penfold,** Electronic Music Projects; **Sinclair,** Practical Electronics H'book; **Jackson,** Newnes Book of Video. April

Flind, Electronic Projects in Music; **Mendelson,** Inter-Related Integrated Electronic Circuits; **Kybett,** Electronics — a Self-Teaching Guide; **Engel,** Stimulating Simulations. May

Capel, Mics in Action; **Jackson,** Newnes Book of Audio; **Michaels,** International Transistor Equivalents Guide; **Berry,** Electronic Synthesiser Projects June

Chamberlin, Musical Applications of Microprocessors; **Stein,** The Joy of Minis & Micros; **Parr,** Electronics Pocket Book; **Wilson,** Qractical Electronic Calculations & Formulae; **Polyphony Patching,** The Source; **Hickman,** Oscilloscopes; **Joselyn,** Auto Electrics; **Rayer,** Electronic Projects for Beginners. July

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Lawrenson, The Complete Guitar Guide; **King,** Servicing Radio, Hi-fi & TV Equipment; **Neal,** Organ Registrations & Techniques. Aug

Crombie, The Complete Synthesiser Oct

Moore, Atari Sound & Graphics; **Devarahi,** Complete Guide to Synthesisers; **Celestion,** Cabinet H'book. Nov

Video Reviews

1982

Fleetwood Mac Feb
Kate Bush Live Mar
Wings: Rockshow April
Queen: Greatest Flix May
Hot Gossip Dec
Genesis: 3 Sides Live Dec

Music Maker Equipment Scene/Music Shows

1981

Vox Pedals Mar
Frankfurt: Kaleidophon, Wasp Deluxe etc. April
Novatron, Firstman, OBXa etc. June
Jupiter 8, E-H Minisynth, Zeus Mini Amp etc. Aug
Technics organ, TC Effects Nov
Harrogate Hi-fi Festival Nov

1982

Japanese Music Fair: Roland, Casio, Yamaha Jan
Dolby 24-T, Korg Tuner, Prelude Tutor Feb
ARP, SCI, Technics Digital Audio Mar
Peavey Amps, AKG mics. April
Vox Combos, Alembic guitars, Peavey Guitars, Legend amps June
Tascam 244, Linn Drum, Bose Speakers, Sennheiser headphones July
Zeta violin synth, JVC KB500, Gibson Chet Atkins, Celestion Acoustic Lenses Aug
London Music Trade Show: Yamaha, Seck, Technics, Solton etc. Sep
Harrogate Hi-fi & Video Festival: DBX, Quad, PCM Audio etc. Oct
Buchla synth, ADA Time FX, Milab mic, JVC Personal Hi-fi Oct
Synthi 100, AKG Headphones, Accessit Effects, EMT Digital Reverb Nov
Korg EPS-1, Korg 3000 Delay, Korg Rhythm 55B, Korg KPR77, BEW Amps Dec

America

1981

Synclavier, Fairlight Mar
Pitchfinder, Multivox, E-H April
Mighty Mite guitar kits June
Linn LM-1 etc. July
Synare MP, Emulator etc. Aug
Zeta Systems FEANC, Dod Flanger/Doubler etc. Sep
NAMM Expo: Oberheim Sequencer, Gleeman Pentaphonic etc. Oct
Peavey Guitars, Shure mics etc. Nov
Prism synth, dbx etc. Dec

1982

Guild M80 guitar, organ-matic, EVI Jan
Fender & Steinberger guitars, Crate amps, Shure mics. Feb
Patch of Shades, dbx, Morley Pedal Mar
NAMM Expo; Melobar, DeMini, Dean, Ovation, Music Man, Kubicki, Peavey & Fender guitars April
Firstman Synth, Voyetra Modules, Syntar, Ibanez Multi-effects May
Studiomaster Studio 4, Crate amps, Shure mics, Gibson acoustic guitars June
Chroma, Emulator, Memorymoog, Crumar Composer, Roland Spirit Amps July
Steinberger, Synsonics drums, Memorymoog, Prism Sep
Duncan pickups, MXR FX, Sunn Amps, Shure mics Oct
Trident II, Synthia, Korg EPS-1, Morley ECV, Sierra guitars Nov
Haner, Ibanez & Gibson guitars, Alembic basses, Roland amps, Unicord & Boss effects Dec

New Products

1981

Mini Relays, Hifi mains boxes, McKenzie Speakers, Flat switch, Multicolour LED, West Hyde boxes, Gate turn-off Thyristor Mar
Hitachi VCR, Sharp dual cassette, Antenna trainer, West Hyde Card Frames, Scopex dual scope April
Sinclair Frequency meter, DIY Hi-fi Speaker, Aiwa Hifi, Sharp vertical Hifi, Mentor LED's, Function generator May
Tape heads, Multivox Amps, Wilmslow Cabinet kits, Board pinning tool, Crotech scope June
Turner V-F convertor, Coral cartridges, Standards book, Handtools, Wharfedale pro speakers July
Speak & Maths, Hitachi Video Camera, Voltage probe, Speech Module, Newsletters Aug
Sinclair Signal generator, PCB DC convertors, Printer, Fidelity CB, Cable glands Sep
Logic probe, Bimdrill, SM85 mic, Hitachi Bookcase Hifi Oct
Ultrasonic alarm, Kef Speakers, Digital thermometer, ZX Printer, Function generator Nov

1982

A/DA Delay, MF 100 Sync, ZX81 Learning Lab, Shure mics Jan
Cirolec Powertran Kit Service, Advantage Computer, Farnell timer & light Controllers Feb
Frankfurt: Roland, Burns guitars, Trace-Elliot PA etc. Mar
JVC PCM Cassette deck, UCX-S Cassettes, Bosch car cassette, Quad FM tuner, tuner, Ursa Major Digital Reverb May
Zaerix LED's, ZX81 keyboards, Fidelity CB, Minim Noise Level Control June
Revox Cassette Deck, Hitachi Cassette Deck, Thandar Scope, Linex templates, Teisco keyboards, Yamaha CE20, Carlsbro Cabinets, Korg & Roland Pianos July
Soundex PPM, Tardess NR, JHS Popstar Outfit Aug
Sifam Meters, Zaerix 3-colour LED's, Epson LCD Graphic, BK Amps Nov

Circuit Maker

1981

Disco Cue Light, Temperature cutout, Cheap 3rd Hand, Multispeed Osc. Mar
Remote Disco Deck Switching, Cassette de-thump, Headphone Sensitivity, 2 LED's one switch, Earth Fault Detector, True Amp Clip Indicator, DIY PCB's April
Dashboard Light Dimmer, Ex-Or Synthesis, 555 Power Latch, VU/Peak Indicator, Slow fade for 7-segment displays, Immersion heater one-shot, Ni-Cad charger, Speaker Jack sockets June
Logic Power Up Resets, Syntom Trigger Input, Audio Cassette Auto-Cue July
Car Aerial Controller, Syntom Stand, OpAmp Tester, Patch Bay, Inverse RIAA Source, Capacitor Bridge, LCD Clock Supply Aug
Capacitor Discharge Doorbell, Neutrix Style Cannon Connectors, PCB Stand, Car Indicator Sep
Stereo LED meter, Touch Switch, Square Wave Osc, I/O Port Monitor, Guitar Tuner Mod, Hexadrum Mod, Clean Gated OSC. Oct
Syntom Snare Mod Dec

1982

Fuse Failure, Valve Amp Transformers, Pseudo phaser Jan
Z80 PIO for Sharp MZ80K April
Harmony generator extension, Elapsed time indicator, Touch Sensitivity July
VCO Calibration Aid Aug

NEW FROM A+H

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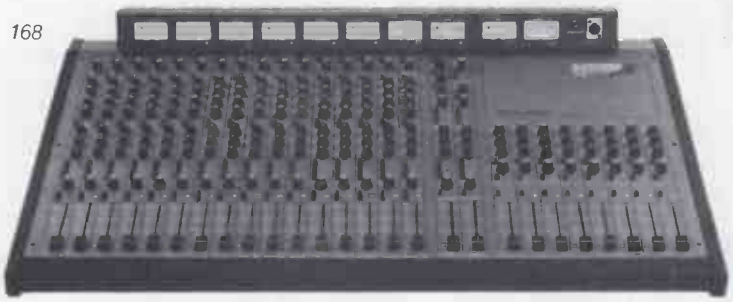
164

168



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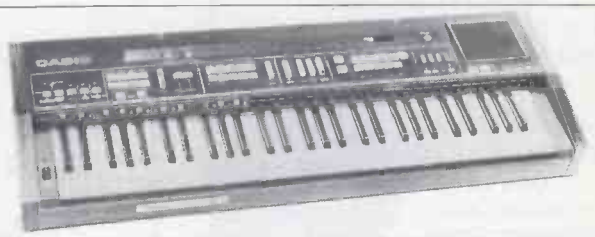

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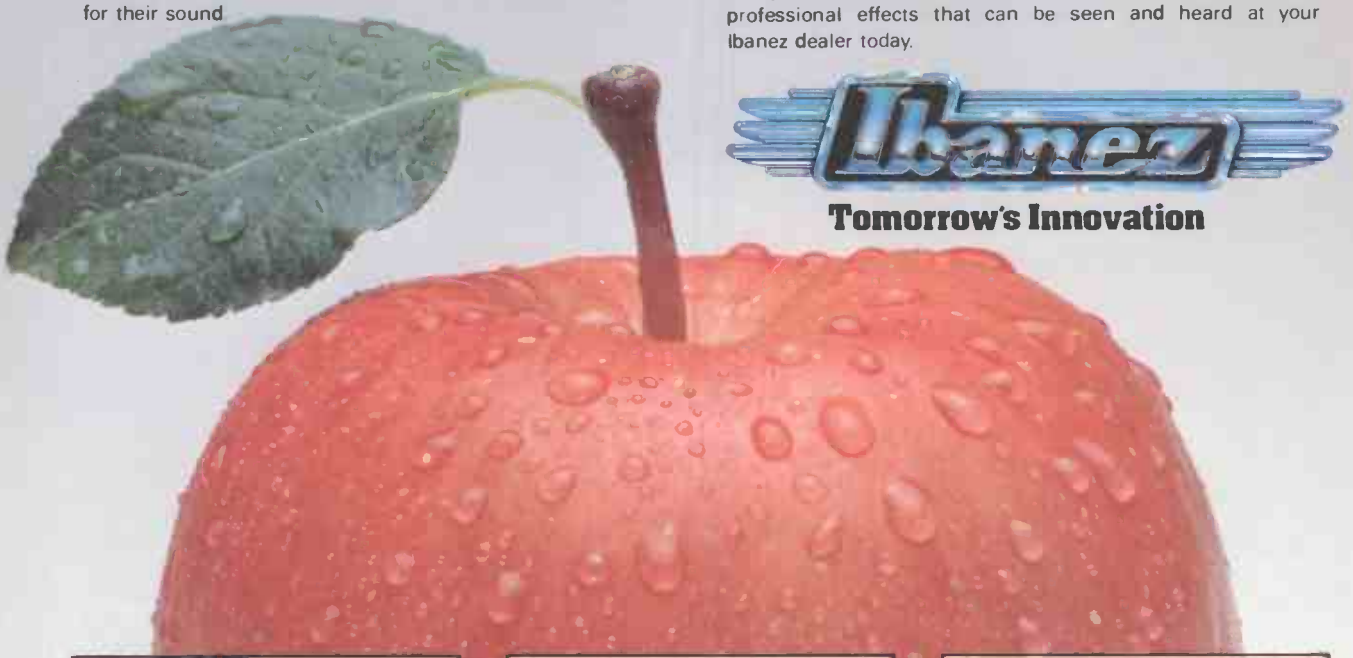

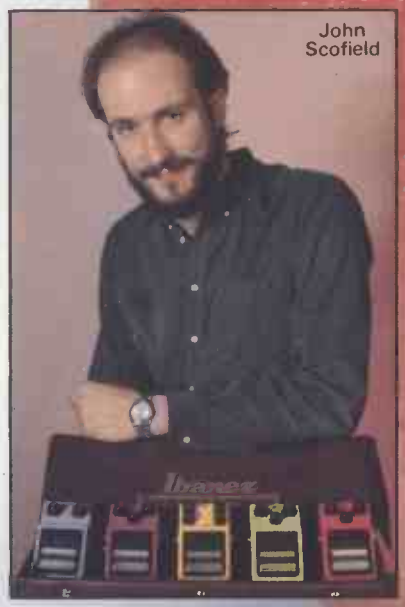

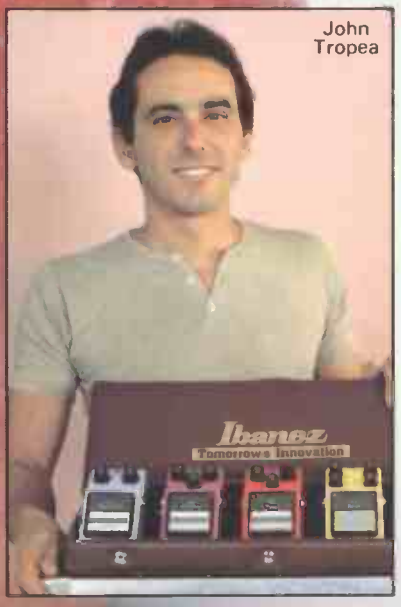

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