Electronics & Music Maker

September 1983 95p

INCORPORATING COMPUTER MUSICIAN

JETHRO TULL – Peter Vetesse on keyboards

★ Which Synth? Comprehensive Selection Chart

★ British Music Fair Report

★ Build E&MM Synclap and Amdek Tuning Amp

REVIEWS:

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Rickenbacker 360/12 Guitar
SCI Pro-Fx 500 Effects
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Electronics & Music Maker

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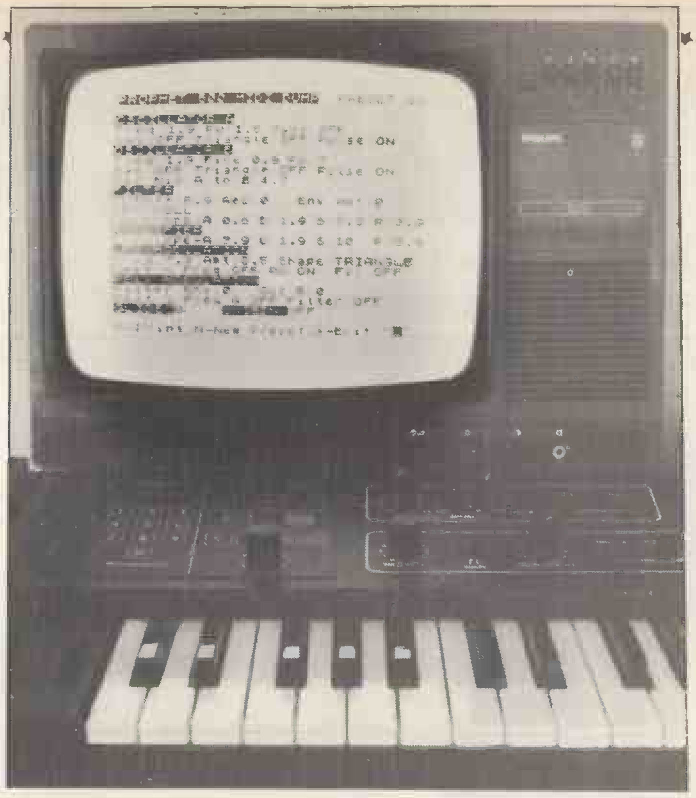

EDITORIAL

When E&MM was first launched in February 1981, it was structured on composing and performing concepts that are still only just being accepted as major growth areas in music making. I called the new musicians "Electro-Musicians" and their approach to music was based on three attributes: First, a strong desire to create and play music whether through traditional notation used in realtime, or through step-by-step coded input. Second, to have acquired enough skills to use electronics for music projects and interfacing. Third, to learn to use microcomputers as another invaluable link in future music making.

In retrospect, although these new ideas were avidly accepted by readers who were already Electro-Musicians, many music advertisers were not so keen to become part of a magazine that carried electronics ads. As for the computer people, they were too absorbed with Space Invaders to even consider the potential of a music computer for the home or studio (Fairlight's apart!). Mind you, plenty of dealers admitted that one of the biggest draws to their micros was the noises they emitted!

Two years later, the electronics mags continue to publish basic music projects for the electronics hobbyist, the computer mags have glossy pages about wondrous sound chips (not the 76489 again!) inside micros, and Clive Sinclair himself does not seem too bothered about his own computers becoming the total leisure centre for the home, during his pre-occupation with electric cars. Yet, with his new microdrive now available and still promise of a flat TV screen, he could be our great hope for home music education and enjoyment.

Meanwhile, new digital instruments from the major music manufacturers have brought their own seemingly attractive technologies, with algorithms, operators, MIDI, additive synthesis, and so on, and may leave a lot of us wondering whether we should abandon all those wonderful analogue machines that have taken so long to acquire.

Alongside the instrument development, nearly always on the keyboard front (unfortunately for us editors trying to maintain a fair balance between all electro-acoustic instruments — where's that new guitar synth they're whispering about?), there has been the emergence of new multitrack machines. Now you can have a portable multitracker' for a few hundred pounds, and even 16-track recorders are accessible (considering how much I paid for my Hammond years back on HP!). And that's where HSR will open up the opportunities for you to record creatively.

At this point in time it is particularly hard for me to divorce HSR from E&MM completely, for the Electro-Musician will always be his own recording engineer as well. But future issues of E&MM will now be able to expand their computer music editorial significantly within its 116 pages, as well as continue its in-depth coverage of the latest instruments, and above all, hopefully inspire its readers to be creative in making music.

News & Events

Inkeys 5 cassette is now available, featuring artists appearing at UK Electronica plus new releases by Zanov, Clara Mondshine and music from Australian band Peak amongst others. There's an interesting story behind the latter feature as IC Records sent the tape of Peak's music to Inkeys for inclusion on their cassette in order to obtain feedback from listeners, as to whether or not IC should sign Peak to their record label. All listeners are invited to send their comments to IC via Inkeys, and there'll be a prize draw for the best response. Inkeys 5 available priced £1.99 inc. P&P from 50 Durell Road, Dagenham, Essex RM9 5XU.

The Quest

Up and coming group, **Mainframe**, whose recent computer software-backed single was reported on in the last issue of E&MM, are soon to release their first album titled 'The Quest'. The album contains clues hidden within the lyrics and album cover artwork, to a competition. The first person to correctly answer all ten questions in the competition will win the prize — a gold pendant fashioned like the Mainframe logo which is valued at £2,500! The album release will coincide, hopefully, with an appearance on the 'Show Me Show' BBC TV, to be broadcast on September 14th at 7 p.m.

Television

Rockschool will be studio based and will feature three experienced and versatile performers who will give tuition to and trade ideas with a small audience of young musicians. The programmes will also feature filmed interviews with leading players who have become widely associated with the styles and techniques being demonstrated.

The musicians will include: Gary Moore, Neil Murray & Ian Paice (Gary Moore Band), Carl Palmer (ELP, Asia), Wilko Johnson (ex-Dr. Feelgood), John Entwistle (The Who), John Taylor (Duran Duran), Nile Rodgers & Bernard Edwards (Chic). The scheduling is for 8 25-minute programmes to be transmitted Tuesdays on BBC-2 at 6.10 pm from 1st November 1983.

Events

Plans are well advanced for the third Sandown Park Music Show which seems to be going from strength to strength. Sponsored by **ABC Music**, the Surrey-based music-store, this year's show promises to be bigger and better than ever, with more live performances, more exhibitors and hopefully, an even bigger attendance than in previous years. The show takes places at the Sandown Park Racecourse in Esher, Surrey, on Wednesday, 21st September, from 2 p.m. till 10 p.m. The Mayor of Elmbridge will officially open the show at 2.30 p.m.

The impressive list of exhibitors, with the accent on keyboards, includes the Roland Roadshow, Yamaha, Casio, Boosey and Hawkes, Aria Guitars, Vincent Bach, John Hornby Skewes, CBS and Premier plus many more.

As in previous years, facilities will be provided for visitors to try out various instruments on display, a feature which has always proved very popular. Once again, experts will be on hand to advise on any aspect of music making, and it is hoped to set up a special stand where music teachers and tutors can meet members of the public to discuss their musical problems.

Admission is £1 including programme, with a half-price concession for students and senior citizens. Tickets will be available at the door, or in advance from ABC Music at 85 High Street, Esher; 14-16 High Street, Addlestone, or 56 Surbiton Road, Kingston.

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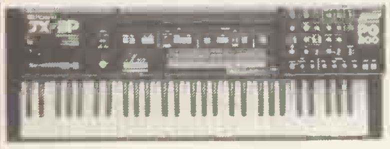

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Computer Music

Dear Sirs,

I would like to comment on the letter about computer music by R. L. Tams in the June edition of E&MM.

With respect to Mr. Tams, there are remarks and generalisations in his letter which are inaccurate and although the main point of this letter is not to correct them, I must point out, for example, that Guido of Arezzo was responsible for neither the diatonic system (which came into being c.600 years after his time) or plain chant. We tend to remember him for his work with regard to the tonic solfa and the notational system of the stave.

As I understand it, a computer works on the principle of being able to answer the question - is it yes or no? Using this principle, it may successfully be asked questions to which it has been previously given the answer. This can be extended to the filtering of information through a set of yes or no questions called a program to give answers to complicated questions and do it very quickly. At no time is there any input from the computer which has not originated from the programmer and therefore any critical judgement must be implicit in the program. Therefore in order to use a computer to write music in the style of Mozart the program would need to be as sensitive as Mozart's creativity and would need to be programmed by Mozart himself or by someone with Mozart's awareness of what he was doing. This awareness could only be achieved through analysis of a sufficiently detailed nature to give results considerably more sophisticated and accurate than 'analysis reduced W.A.M.'s stuff to strings of questionable passing notes between harmonies.' The music produced by any program would be a function of the method of analysis used to write the program and it is not surprising, therefore, that Mr Tam's apparently had little success.

It is interesting that Bartok should be mentioned at the end of Mr Tams' letter, because of all composers, his music would probably be the most fruitful for anyone undertaking a project of this kind. Bartok was very interested in nature and natural things, collecting as well as folk music (which greatly influenced his own writing) plants, insects and mineral specimens. Through this, Bartok apparently became interested in the Fibonacci series, a mathematical progression by which things grow, and the extensive use of which can be seen in many of his works such as Music for Strings, Percussion and Celesta, Sonata for Two Pianos and Percussion etc. Because the products of Bartok's use of the Fibonacci series are so musical, and because they are also the result of the manipulation of something as tangible and computable as the Fibonacci series, a study of this area by someone with adequate musical knowledge and programming ability might be able to write a program capable of producing computer music of a higher order of 'musicality' than any yet computed. There is a book by Erno Lendvai called Bela Bartok (SBN 900707 04 6) which deals with this aspect of Bartok's music.

Martin Glover
Hull

Computer Musician

Dear E&MM,

Recently I have become very interested in Electronic Music and computing. I play classical guitar and keyboards and know quite a lot about music theory and how sounds are made up of overtones etc. I hear a lot about computer music and would like to know how it is generated.

I bought a ZX81 last year and know a little BASIC. I was wondering if there was a book available that deals with computers, in respect of making music, on a step by step basis.

John Joyce
Chorley

We suggest you go back initially and re-read the E&MM articles on computing in the 'Basically BASIC' and 'Micromusic' series published in previous issues. A good book we can recommend is Wayne Bateman's 'Introduction to Computer Music' published by J. Wiley and Sons and priced around £15.50. It's a bit heavy going in parts but persevere and it will be worth it. Our last advice is to also keep reading the Computer Musician supplement featured within the current and future issues of E&MM.

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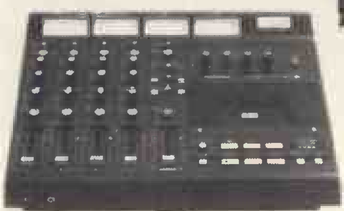
or a  and a 

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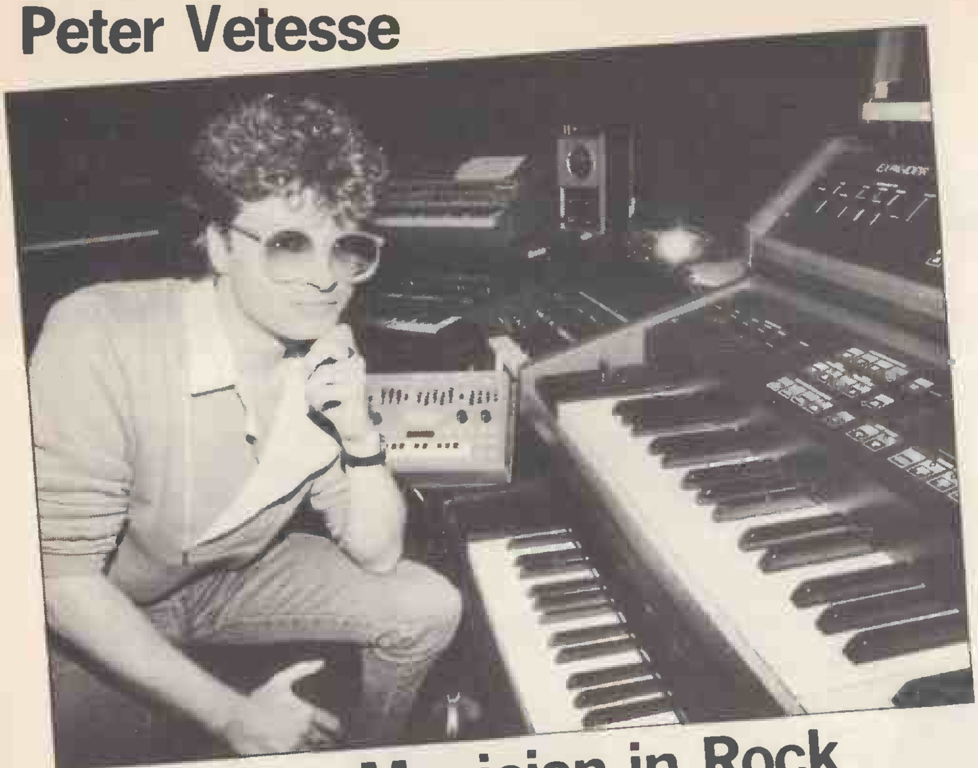

Computer Musician in Rock

P*eter, what has made you turn towards computer-orientated instruments?*

I haven't made a conscious effort to actually turn to computer instruments, I haven't done anything like that, I've found through a gradual learning process — that started with an ARP Odyssey and continued through many various analogue monophonics to analogue polyphonics and lately digital synthesisers — that there are many ways in which a computer can help my performance input techniques and means of storing the input, as well as storing prepared sequences. One obvious advantage with something like this instrument here — the Roland MC-202 Microcomposer is that it kind of frees my hands and we can have an abslutely accurate backing track done even within a few seconds.

The way I do this is by writing the music, discussing the part that I should be playing with Ian, and writing music and entering the pitch data, the gate data and the step data, and we'll have an accurate and groovy bass track in the first take!

With instruments like the Rhodes Chroma, the computer aspect of the thing, as you know, has changed our thinking away from the volt per octave control and more towards digitally scanned keyboards. Now it's a microprocessor that scans the state of readiness of the synthesiser, which obviously makes operation quicker and more versatile.

The Chroma was designed from the outset to interface to the Apple II and various other micros and it gives me a chance to initially store many programs and recall them in a couple of seconds. As far as live rock work is concerned, I can go through hundreds of programs per night and have them sequenced in order of events from the computer.

Jethro Tull has such a distinctive musical style that the possibilities for short sequencing and polyphonic riffs are very evident even from the last record, the 'Beasty'. Is that how you see a linking of micro control into the rock music of Jethro Tull?

I'd only been with the band for about three months when that album was being rehearsed and played and my input was limited to writing some of the musical passages. My input on the electronic side was not as much as on the album that we're doing now; the reason being that it's contextual, I really have to play in a sort of context not to offend any of the Jethro Tull public but at the same time I tend to introduce, without surrender, with my kind of feelings as to what Jethro Tull perhaps should sound like, and also the fact that I'm playing with guitar players, bass players and drummers, and you simply have to play in context so that the computer control enabled me to recall many patches, program and controller settings instantly. I also play short arpeggios often sync'ed to a control pulse, although there are times when we do 'wild' things. Plenty of the arpeggios you hear sounding micro-generated are actually played live.

Of course your musical interests run much deeper than rock music, is jazz your strongest base for your own music?

Well, I would have to say yes, but then again simultaneously as I say yes there will be thousands of (well at least seven) people I know that will chorus a resounding "no". One of the reasons is that the synthesiser has taken its own place in jazz now, but at the time when I was trying to play synthesised jazz there was just complete and utter confusion as to what I was doing on stage with the synthesiser. I remember silly comments like, "It doesn't sound like a piano" and "Oh dear, isn't that terrible, and you're not really a player because you play one," and all that crap!

But my interests do run to jazz and just prior to Jethro Tull the Scottish Music Society asked if I would lecture on jazz and I toured with the Scottish jazz lecture group discussing the history of jazz, bringing it up to date and showing the influence of electronic instruments. Unfortunately, that was limited to the arrival of the Fender Rhodes piano, which obviously played a large part for people like Herbie Hancock.

So my interests are primarily 'jazzoid' but at the same time I don't think it gives me the full satisfaction of making music — jazz tends to be slightly technical and harmonically 'wondrous', and I like the incredibly loud aspect of Rock — so my desires can really be fulfilled when playing with Jethro Tull because I'm LOUD!

Tell me how you put together Jethro Tull music?

On the last album for Jethro Tull it worked that Ian would come in and say that he had some kind of sketch, an outline of a melody and some thoughts on what kind of chords the melody was going to have. The band would have a reasonable free hand in its input as to what kind of rhythm should happen although I an would invariably specify that it should not be of this or that type. We'd rehearse the first verse, chorus, second verse and then land up at a place where we thought something else should happen musically — whether it be instrumental or something else should happen musically — whether it be instrumental or something else should happen — and then Ian sort of casts out "Well, who can think of anything to happen here?" and I was invariably the first one with my hand up! For every ten ideas that I had invariably only one or two of them would be possible to use.

So how did you reckon on using an Apple IIe or Commodore 64 or some other computer with your current system on stage?

I started using the Chroma with the Apple II and later updated to the Apple IIe. So the Apple sees 16 independent synthesisers, which means that, along with all the very complete expression devices that are on the Chroma: velocity, sensitivity, pressure sensitivity, plus spring loaded modulatin levers, I can assign extra control of most functions in a creative way. Any of the input that you have expression wise will be recorded by the Apple II as well as the note playing and sound programming information. So its use is virtually like an 8-track or, with an expander, a 16-track tape recorder with all the realtime expression that you care t put into a performance retained. You can clock the sequences from an external source and this is important for stage use.

If Ian and I toured this kind of music on tour from this album, then we could perhaps clock some of the backing tracks played on the Chroma, using a clock in from a Linn Drum say, playing all the various parts on the album that originally played. But I would still do some of the lines that were important to play live.

So that's how the micro could be used in a live context and also, as I mentioned earlier, the fact that program dumping and storage takes much longer on cassette, the computer's floppy disk system gives retrieval and storage within about a second-and-a-half.

You're a creative musician who likes touch sensitive keyboards and things like that and you're having to give away some of that to introduce the computer on stage, because the computer then takes it over at your press of a button and it plays a sequence. So you're giving up part of your playing for that machine, and I wonder how quickly the computer musician will become the all-embracing musician or whether he will always be part of the existing creative player?

Well, my thoughts about the musician and the computer run along these lines. Anybody that says no matter what music they play, if it's classical music, if it's jazz, if it's rock, if it's anything, if they stand on the side lines and say "oh dear, this computer music is taking all the feeling away, it's robbing us of jobs, it's doing this and it's doing that — these people I have no sympathy with. I'm also antagonised by the fact that they just stand back and say "Oh no, definitely not because I play piano," because I was doing a demo of the Chroma in a well-known music shop in London and somebody came up to me and said, "Of course, I play the piano and

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it's touch and all the rest of it," and that kind of attitude is just so ridiculously short-sighted. Whether or not you can play keyboards or whether you can't play keyboards, whether you're fantastic or not, the computer and computer related devices are shaping the new developments in music making and anybody that chooses to ignore that, be it at their own peril!

Even though Jethro Tull music has a free feeling in its performance, I get the impression that it's precisely organised.

Oh yes, Ian's astute enough to know that even the best of the band's own jam sessions only come together for a precious few seconds where everything is wonderful and you want to go down to the pub with all your friends and say we are the best band in the world, but of course there's nothing that replaces a concerted effort by either Ian or myself or with the rest of the band in getting together and saying, well, that works, but of course it took 15 minutes to blow through the entire soul before it started happening and so let's analyse how we can bring that much closer, much nearer to the beginning of the tune, let's say.

You then get a danger that you can over contribute as individuals to the piece and it becomes too busy or whatever. I did hear a lot going on with JT in the tracks. I personally like it because I think it's not muggy as a result, but that is a criterion that one has to watch, isn't it?

Well, of course, you're talking about my input into a band like Jethro Tull, with such a sizeable reputation as they have. I was in second year at school when somebody brought in 'Thick as a Brick' so I've come into Jethro Tull with a slightly different viewpoint concerning how things should sound. Not that it's any big deal, but I prefer myself a more transparent, more direct or apparently direct approach while Jethro Tull tends to, because there are many fine musicians in Jethro Tull who by right should be heard anyway, keep bits that they might find they can't live without.

Even the bass takes over some of the melodic lines.

Yes, and of course that's what makes Jethro Tull Jethro Tull. If it weren't for that Jethro Tull would be nameless countless others.

What do you currently use on stage with the Chroma then? What are the instruments you are using now?

On the American Tour I didn't have the Chroma at that point, that was ended in November of last year, so I didn't have the Chroma until I got back from America. On the American Tour I used the Yamaha Grand Piano and I had the JP8, OBX-A, the Promars, CSQ 600 Sequencer, a Roland Vocoder Plus, and all the various peripherals plus my custom-built hand-held monophonic synthesiser for going out front, posing and trying to see if there's any good-looking women in the audience!

How do you use the Korg Vocoder?

I played the notes and Ian triggered it from his microphone. Strangely enough a master vocal had gone down and I played the Vocoder from the tape track which was quite an interesting thing to do — good for phrasing, although very difficult. Ian's phrasing is the result of many years of thought and practice and his phrasing very much belong to him and him alone. One of my hardest tasks was to try and play in his type of phrasing.

Yes, it's quite hard to learn the techniques of another skilled musician in that detail, isn't it?

Yes, very difficult. I also sang some of the harmonies on the 'Broadsword' album which had to be phrased with Ian, and some of the tunes he was phrasing behind the beats and you had to hang back. It's not the way I would do it, but then again it's a great challenge to try to do it that way.

So on stage you've got a Chroma keyboard with the Chroma Expander module on top?

On the forthcoming efforts I will have a Chroma with an Expander or perhaps I will have a few Chromas with a few Expanders, because as you know the Expander simply duplicates any of the things — it doesn't increase the polyphony, simply paralleling two different set of sounds together.

Right, and the Emulator, how many discs will you carry and what sort of sounds are you using with that?

On this album as I mentioned previously, Emulators I'm a bit wary of because first of all I can (I'm sure lots of other people can), spot an Emulator at twenty paces — I hear it on the new Midge Ure single, I hear it on Dave Stewart's which is a very good single, but I can hear an Emulator, the French horn sound on that Paul Weller single trumpets solo playing incredible queen triplets the likes of which I've never even heard Woody Shore playing, and also during the Weather Report Concert I thought it was a bit of a giveaway to hear the standard Emulator four-piece playing timpani and French horn.

But Ian has got all of his own sounds now on the Emulator and they were generated by him playing that instrument, so there's flute, cello, bits of piano, guitars, mandolin — we have all these things on the Emulator and I'm sure that it will become a part of the stage set-up. The Emulator suffers from that horrendous silly plastic keyboard that current technology will only allow.

Are you criticising it because of its lack of pressure and touch sensitivity?

Yes, but there's nothing very much at the moment that you can do to bring out filtering or whatever because the digital filter is not with us and won't be with us for quite some time. All you can do is adjust volume and filter cut-out.

That's an important point that was raised with the designer of the 360 Systems, Bob Easton, who also said that with sound sampling the modulation is not just with the VCA but is also with the filter.

Yes, that's right, it's all very well having an analogue filter tweaking the cut-off or whatever, but it's just going to sound like somebody stuck their cello into a wah-wah pedal.

It just takes it away from the fact that you've got a real sound to begin with.

Yes, in fact I've found that most orchestral types of things can be best achieved at this point in time by using an analogue synthesiser.

How do you cope with the vocals as well when you're playing on stage?

I've never found that difficult. It's just been one of these things I've done naturally since the age of six. I've played various instruments, I wrote my own tunes and all the rest of it, and so I can play reasonably complex things on the keyboards and sing "La la la I love you" on top of it and it's no difficulty. The only difficulty is in a loud band situation, hearing your vocals well enough to be able to pitch properly, but of course, as far as I can tell, pitching problems are tending to become less and less important!

I imagine that you would consider that the use of the computer instrument in your set is going to be even more valuable when you're making your records.

Oh yes, for instance, in the new album we used the Roland MC-202 and I can dulicate all the things that I've done by playing it back again into an Apple or such like micro and reproduce it and perhaps not even turn up

for the gig — but of course I wouldn't do that!

Has the Chroma offered you any real Improvements in playing and composing now you've exploited the playing and composing side?

Yes. First, I feel that the Chroma allows a musician to put his stamp on not only his playing, his style of playing, but also his sound, in other words he not only goes down on record playing the way hopefully that he wants to, but he also comes out sounding the way that he personally wants to.

For instance, although you can spot piano players all over the world, you can spot styles and stuff, it's a piano and it may be wonderfully recorded but it's a piano; and there's such things as wonderful technique and great singing cantabile and all the rest of it, but I can be exactly the way I want sonically and technically by playing the Chroma. The Chroma has made me rethink my playing, where perhaps before when I had my Oberheim, my soloing tended to be of a Jan Hammer type — it would be guitar-type bends and that sort of thing. But the Chroma tends to change my attitude because of the keyboard. I can return to the way I really should be playing which is the way I want to be, sometimes I do pitch bends, other times I'm just playing in a more pianistic type of way.

I think it's a good thing to practice pitch bending, but it is somewhat overused and I notice nowadays that another style that's emerged is to play more saxophone-type phrasings — pitch bends bending from underneath the note instead of bending up to it. And also to do saxophone-type things like the Stevie Windwood thing from 'Arc of the Diver' or sometimes harmonica-type phrasing. I notice too there tends to be another style where synthesiser soul-type lines can develop.

What about the pitch bend wheels themselves. How do you come to terms with Chroma's rather simple sliders? Well, it's a bend lever that looks like a slider, isn't it. Do you find that adequate or do you go for the more horizontal Roland kind of approach?

I don't mind, I quite like the quantifiable pitch bend where you can definitely see that you will bend whole tones or some other interval accurately, because there's nothing worse than guitar players especially bending up and not landing on the notes. It's something very satisfying when they do but diabolically horrible when they don't and if

you know there's a passage you are going to play where you want to bend whole tones, it's nice to quantify it, as you can on Roland stuff. Then again, the Chroma allows me to specify most intervals and I need not necessarily have one lever for modulation and one for pitch bend, I can have two different depths of pitch bend and I could have the modulation on the pedal. I could also leave the last thing into the program reachable by the main panel Parameter Slider to be the amount of quantisation of the thing — so I could change it if I wanted to during the course of each specific passage.

Isn't it more likely that the MIDI will be of greater benefit than say a dedicated system like the Chroma which is restricted as far as we know to the Chroma and nothing else?

Well, possibly, I think the MIDI is obviously a wondrous step forward to be able to interface things together and you can layer sounds and stuff like that and you can also clock things properly and what not, but the Chroma has actually gone out on a limb and said that synthesisers and microcomputers will be as one anyway and ultimately I think that research and development will gel in future Chroma products to have a dedicated user instrument with in-built micro capabilities and you won't necessarily have to rely on patching lots of things together in order to do that sort of thing. The MIDI is a great idea but I believe that the way Chroma is going at the moment in terms of their research and development is the right way, as far as I can tell.

Provided it has the expansibility then you're not worried?

That's right. The Chroma can link up to five expanders. Future Chroma products will not only be able to parallel the expanders but also to put them in series to increase the polyphony and the amount of programs, and sequences, so I think it's going the right way.

How important then is it to you as a person who writes music down to have VDUs perhaps showing music on stage. Would you like that possibility?

I never like to see bits of music floating about on stage in a band situation, unless of course it's incredibly difficult to remember. I don't like to see that because it's just not nice, I don't like it, the kind of music that Jethro Tull plays it's not so complex as to have music floating about, and I wouldn't ever thing of a time where I would have to look to anything to be able to remember something that happened. If I did, then of course we haven't rehearsed properly or I haven't rehearsed properly! But I could see that it would be a good idea to perhaps have something equivalent to an auto cue with music being screened.

On the other hand, as far as the Chroma is concerned, it would be nice to have all parameters displayed, but of course that might be getting away from what the Chroma tried to do in the first place because, even displayed on a screen, it's a kind of analogue way of incrementing various different functions, that you could do with a lightpen or whatever. But the Chroma relies on a slider incrementer for making setting changes, and now Korg use two switches to put things up or down, and even the Synclavier has an Incrementer. I quite like the Incrementer idea, people might think it's slow, but I quite like its very orderly way of doing things. The new Chroma Polaris just unveiled uses analogue controls for all the things that you would tend to gratuitously twiddle with anyway during a performance, plus assignable controls. I suppose that's the one thing that the Chroma has taken away from the new synthesist is the opportunity to twiddle! But it's still built around the normal synthesiser functions, an oscillator, a filter, an amplifier with assignable envelopes to each of an ADSR variety if you wish.

Do you feel that the algorithms are adequate then within the Chroma as it stands?

Well, the algorithms in the Chroma relating to the various keyboard algorithms and the way that it assigns its oscillators to the notes that you play, I don't feel have been quite fully developed yet. There are some things that I would like to try and sort out for instance, with keyboard algorithms 3 and 4 — well 3 is a note sharing thing, if you play one note all 16 oscillators are in unison but it's not sharing where you can play chords as well — but 4 is completely monophonic with all 16 oscillators on the one note that you play and I would like to be able to change the priorities of that setting, I would like to be able to make it top note, bottom note priority, even with all 16, and also I would like to be able to change things so that it can, for instance, leave the amplifier open all the time when retriggering notes, just simply retrigger the filter instead of having to retrigger the filter and the amplifier every time. It means that you can't do trills, you know, holding a finger down you have to retrigger every time.

So, in a little more detail, how do you actually construct your keyboard music for Jethro Tull? You say you get an idea from Ian and then you would have to create your harmony, Do you have any sort of special way of going about things?

When I first joined Jethro Tull I listened to the music they played and generally felt it to be a kind of classical orchestral arrangement and so it was simply a matter of me playing in context with the music. Certainly for the last album, where I thought Ian wanted to hear in that situation, yet still try to make it something that satisfies me too. And it tended to be more classical kind of stuff but it's all a matter of musical sensibilities which you gather during your life, during exposure to other people's music.

So if Ian gives you an E major chord that you don't necessarily play E major, you might play E major seventh, you might add the 13th or 11th to it and give a jazzy input or a new edge to it by the way you're playing?

Yes. In this album that we're working on — I mean Ian's solo album on which I contribute keyboard playing — I feel that he has certainly allowed me more of an input on the harmonic structure.

Does he actually specify then the full chord or would he give you a root?

He would give me a fairly open kind of thing. He likes the sound of the tonic fifth, but the notes that give a chord it's mood are invariably the thirds, minor third, or the seventh, or things like that, even ninths. They give chords and therefore music its very meaning, so I would suggest, "What about this Ian, do you like that, let's try that, I really like this — can you not put up with it," or whatever.

How have you developed your exceptionally fast playing technique?

Well, I went to piano lessons way back when I was five or six years old and I didn't enjoy it very much, so I came away from my piano lessons and started playing, writing songs of a kind of Beatles nature and singing and generally being a bit of a 'child protege' I suppose! On looking back, my songwriting given current standards was probably at its best during those years, you know, when I was seven years old or something! Because they were quite uninfluenced, not derivative of anything, unashamed, raw, rough and reasonably nasty.

As a piano player not very much development took place until I was about 11 when my father, who's a saxophone player, moved us further north near to a good friend of my father who'd also tutored my father on the ways of saxophone and piano playing. He said I was a piano player of 'zero promise' and my parents gave me the encouragement to interpret that remark in various different ways and after I got it into my head, I decided to attack the technique side of things because I wasn't going to be left at the post not knowing how to play scales and stuff, which I didn't at that point.

So you were reading music as well?

I read bits of music and although my classical repertoire is not much because I never really did advance further than a few preludes and fugues and some Chopin, but by that time my harmonic expectations had probably exceeded the things that I might hear from. Dare I say it, some of the classical things are harmonically mundane as far as I see it.

What do you listen to in terms of music — do you listen to a lot of keyboard music, do you listen to other people, do you like that kind of input or do you tend to keep away from it.

I love music, I love playing the piano, I love playing the synthesiser, I love talking about piano, I love talking about synthesiser. I listen to Radio 1, I listen to all the pop stuff, love it all, have many criticisms to make concerning the various... they're just tetchy little technical observations about one or two things. But I just love it all. But the music I listen to and discovered after I'd come through my kind of Keith Emerson — not come through, I don't mean this glibly come through the Keith Emerson phase, because Keith Emerson I still find to be a very very great piano player, but I was halfway through that when a friend let me hear 'Black Market' by Weather Report which kind of changed things around and I realised that there were other people in the world, which is a thing that people should try and remember when hiking after the Keith Emerson, Rick Wakethings. There are other people in the world now who are prepared to do for synthesisers and pianos what maybe Keith Emerson did in his day.

How much do you write down these days?

I write down all the bass patterns for the MC-202 because the most accurate way to enter information into the 202 is either numerically or using the normal entering in quavers, crotchets, what have you, so we discuss — Ian and I — what these patterns should be, I enter in the pitch information... and then I go back and enter in the gate and step time simultaneously, because entering in the pitch and then going back and tapping in things, even though you might be the most accurate player in the world, it's still a slightly random thing and syncing back off a Linn, if you have an ear to be able to detect

things that take less than 19mS to elapse, then you will be able to tell that it isn't accurate unless you enter it numerically or the normal crotchet, quaver way.

Thinking positively, what does the MC-202 offer you?

It frees my hands bass wise because I can play the bass part with the drum part as we're rehearsing the tune, and then I can enter all that information into the MC-202 and we can play the two things back and then we can layer up and find out if we like this or that part, and instead of having to go from the Control Room, open the Control Room door, through into the studio and say to the bass player, "honestly, I don't like that, it's terrible, being honest about it, you're just playing a load of rubbish," you can simply switch the thing off and start again.

There are a lot of problems with tuning machines, although they've been consistendly improved upon — a touch of a button allows you to have an auto tune facility, and I see that you've got a Conn Tuner running here. Do you use that for setting up?

Yes, I refer to this Conn Strobe Tuner before every overdub and it's not just a kind of habit I've formed now — I suppose it is a habit — but I would find it absolutely necessary to refer to the thing, not because my own ears would fail to tell me when things are out of tune, but because I would prefer to be rest assured in the fact that it is in tune.

Yes, I think that if you're using a lot of detuning or polygliding and so on that you ear or your brain can actually take you away from the pitch you're working at without you realising.

Well, of course, there are some times during a track where I have something heavily detuned on the Chroma where you have to find the sort of point in between the two where the entire effect will be in tune with the tracks. Sometimes I might look or use my ear to tell when it's in tune and when it is not.

Do you think the rock musician or rock music needing a fairly free approach might have problems using computers? Or do you think that it could develop into a different kind of style?

Well, I view it this way. When the first punk revolution or the new wave revolution came around I went "Oh my godness, what's all this" and everybody said to me "Well, this is the shake up that the music industry has needed." I'll come more to your point, this is in fact what I think playing did need, it needed someone to say, "all this stuff, let's have something a bit more honest." It's like anything, there's a lot of trail blazers, pioneers, followed by a lot of people jumping on band wagons... but all these pioneers, of which I think Ian and Jethro Tull were such, are the people that I have respect for. Even when the punk thing came out and I went "Oh my goodness, the playing's not very good." But at the same time it doesn't matter because what's developed from the punk thing has been tremendous playing as well as creative ideas, with honest to goodness straight-down-the-line-popular tunes... memorable tunes. I'm not saying that harmonically they're satisfying, and I would say "What's happened to beautiful music, what's happened to stuff that's nice?"

The music's got to hit people, it's got to be hypnotic, it's got to hit them within three minutes, and do all this and more. Ian's obviously never needed that kind of approach and I admire him for that. And when we look back and we see skiffle and we think about how our parents reacted to skiffle and even further back when classical musicians reacted to jazz, they said, "Oh my goodness, it's terrible," when I look and I see guys that can't actually play a keyboard instrument but are using computer technology well, they well might be pioneers themselves and something equally tremendous will evolve, I am sure, from the people who pioneer computer music — they can be non-players or they can be players. I have chosen the path of playing, I enjoy playing, but will not ignore the fact that the computer and the synthesiser are now one.

How do you choose for example between the Jupiter 8 and the Chroma now, because they both have tremendous potential on the sound making side?

Nowadays I tend to think of 'no contest' because I'm very much enamoured with the way that the Chroma performs and responds to my input. I would say that the plasticy robotic type of clinical approach works well with the JP8 and is very good from that of point of view, and of course you can clock the arpeggiator so you can do runs the likes of which would take many years to get together.

I would also never deny that I like the monophonic synthesisers, you will still see a monophonic synthesiser in somebody's set up, I do believe these multiple set-ups... with keyboards rising, I do believe that kind of thing — I'm not so keen on seeing that anymore, I think that's the hankering for days of yore.

Yes, you've been through that cycle and you just come back to using your special few, don't you?

It's about ergonomics and your desires. The ergonomics of keyboard playing is if you stack things up and you're standing there facing the audience and you're playing two parts with two hands and you're looking wonderful, you really look like you're being crucified!

Do you find that you spend a lot of time practising technique or does that just come through playing because you're playing as much as you can now?

To play well, there is no other way other than to practise. Roundabout when I first got my first professional engagement as an organist at a French restaurant, my days were spent many many hours practising scales, arpeggios, Czarni studies and a book that I've just got by Oscar Beringer, with scales or passages all using C fingering, which is interesting for your technique. It's published by Bosworth, but I wouldn't suggest starting off on that, definitely not.

That's right, but that's not to say that the ultimate aim is incredible speed, because I've been reading a book on psychology of music and there's a certain speed you can reach when people will not be able to tell whether or not you've played a sort of linear portamento run or whether or not indeed it's in fact all fingers giving it broken chords. But recently I've played a lot of arpeggio things that sound like an arpeggiator which in fact are crossing over hands and that's something that you have to practice, there's no other way of playing something where you cross over hands back and forth other than practise the thing. There's good exercises in that Beringer book for using left and right hand cross overs.

I don't want for people to think that this is the ultimate thing to have... shocking horrendous technique — I enjoy it — but it's not necessary because you can divide it up to the songwriter type of piano thing, where if you want to take it on the basis of input versus money earning ability, well... if you weant to go and earn money in music, forget the practice and go and develop your creative skills and if it's pop music you want to do, then don't bother about harmony either. No, I shouldn't say that!

Do you use a lot of foot pedals?

I use volume pedals and of course any of the control functions from the Chroma are assignable to a foot pedal so I could increment the filter from a foot pedal. I also play bass pedals, I'm a bit of a whizz on bass pedals. I've learnt the heel toe and crossover and stuff like that. I've got a set of those Eko bass pedals.

I don't use bass pedals on stage because I quite enjoy not having too much stuff around me so that the audience can see that I'm playing and that I'm human and that I like them and hopefully they'll like me!

Do you have any particular notation that you use now?

At the moment I would think that the best way would probably be a fairly long-hand explanation. For instance, making notes on my sounds is not so difficult with the Chroma as I simply note which group it was, which bunch of programs it is, which numbers I used, whether there's any editing to be done during that, what I edit during that thing. It's a fairly long-hand way of going through things and also I note — I don't know if you saw the sound synthesists memo that's a schematic of the MC 202 panel — the various positions of the sliders in relation to a specific tune.

As far as effects are concerned, I don't take much note of what specific effect went down, because invariably if there's something that we're convinced about having, especially recording, we'd just put it down with the track since there's no point leaving it to the mix when you're just convinced that's the right thing to do.

Before you choose the Chroma, you must have looked at all the current micros, like the Commodore, the Sinclair Spectrum, and looked at maybe the music facilities of those. Did you go through that process?

Well, strangely enough, it kind of worked around the opposite way for me, the first thing that drew me to the Chroma was the fact that it had this keyboard and it had just something about it. It's a flawed instrument but it's gloriously flawed, the way that the Yamaha CS 80 was a gloriously flawed instrument, it just sounded fantastic, invariably it was never in tune anyway, but the Chroma struck me as yes, here's something that's taken up where the CS80 left off. And that's what drew me to it. Then when I found out that it was interfacable to a computer which I knew to be more and more important in the role of the synthesiser player or at least the computer musician, then I got more and more interested in the computer side. So it was the instrument that drew me to the computer, not the computer that drew me to the instrument.

Do you have any feelings about current micros, have you any ideas that maybe we shall be using a Commodore 64 for example?

I recently went to the Apple UK organisation to speak with some of the people

Peter Vetesse

continued from page 14

there, and they talked about the Apple Lisa which is a completely different format that uses a slightly more analogue kind of way using The Mouse and stuff, and I thought that might be quite a good way of getting various functions from a micro computer with music as the language. But even more exciting I think that, as music is a fairly finite language, voice recognition would also be a good way to call up various routines from a computer and also to sing or to instruct the computer to set a note in a certain bar on a certain line or whatever, voice recognition might be another way to go.

At present, I prefer the more dedicated function of say the Roland MC-202, where I know if I press a pitch followed by a gate time I know it's going to be a quaver, I know I'm entering it in, I know the gate time, I know the step time, and it makes a lot of sense whereas I'm slightly, not anxious but... you're playing a Rhodes Chroma and you turn around and you've got a QWERTY keyboard, and I feel a more dedicated form of interface to the computer would be better.

Didn't you find that the editing of the Chroma sequencer as it stands is really a hard job?

Well, yes, it's bloody difficult. The editing of the thing is a drawback. The other thing is it has kind of missed the point in a number of ways, although it's fantastic it's got all these things where it can record all the various dynamic expressive input, but it's kind of got it wrong in a couple of ways — as indeed the Roland MC-202 has got it wrong.

It would have been nice if on both of these instruments the Chroma interfaced to an Apple or whatever micro and the MC-202 had an error correct function the way that the Linn Drum has: it corrected to the nearest 16th, 32nd, 8th, whatever, it would do an error correct so it might encourage slovenly playing but who cares, but it would have been nice if we could have done that error correction. Also, as far as the Chroma is concerned, it would have been nice if firstly we could have had a way of entering information in step time rather than real time because most of the information that you enter into the Chroma viz a viz performance is of course done in real time, so you will be limited ultimately with this software revision with how good a player you are unless of course you do it a note at a time and do... 8 track or 16 track multitracking which kind of perhaps defeats the object slightly and also, yes you're quite right, the editing facilities are not fully developed and they would have to find out a way of portraying the appearance of the bar in a more visual way.

Have you been attracted to other smaller keyboards — there's a tremendous boom in the portable keyboard market now?

I would agree and then immediately after agreeing would disagree with you because the thing that really has me in amazement is people falling over themselves to buy Synclaviers and Fairlights. Let's say now, until Synclavier come up with something better — its plastic, it does nothing. OK, it's a digital synthesiser but if you play a low note you just listen to that huge amount of digital noise, you must have heard it, it's just beyond belief. The Fairlight itself, no performance controls, plastic — it's something they'd want to look at, the performance aspect of these things, the performance input. Smaller keyboards — I have a Casio MT40 which is quite good. I bought it initially with the idea that I might be able to practice and write tunes on it and write songs in my odd moment, but of course with the small keyboard it's a bad idea to practice on it because it's too small for your fingers you get into terrible problems crushing your fingers up and then you can't play. In fact, once when I first had it I practised on it for a day before going and doing a Jethro Tull concert and I made a complete boo-boo of myself — I just couldn't adjust to the small keys.

But the portable keyboards can make very good creative tools. When I was on holiday in America last year, I did write a few tunes on the Casio and the drum unit and stuff. It's good from that point of view, so yes, I'm not convinced that the type of synthesis they use is going to satisfy Chroma users, but I think it's good enough for creating musical ideas.

Do you see yourself having to learn computer languages to keep up with the technology?

I would and I am learning about computer language, but as I say, I've a notion that the synthesiser and the computer will become more dedicated to one another anyway and it might become more understandable to those who first walk up to a synthesiser when I suspect they will see buttons that say 'What do you want to do now' and 'Help' and such like, so I will learn that anyway because it's a simple fact of life that's how commuters work, it's binary, it's bla bla bla! I don't think you necessarily have to be able to write in machine code, I certainly can't.

An interesting past of the growth of music making is the apparent ability of non-musicians to walk up to a synthesiser and be able to produce music with the aid of the computer, and there isn't anything so wrong with that providing of course that all the guys who think they can play are not willing to sit back and say "tut tut tut, isn't that terrible'.

When something new comes along people always tend to criticise it instead of realising that what it's doing is opening up the amount of people that make music and the possibilities of making music.

I've asked my girlfriend many times to sing me something, say a pop tune that comes up, and I've asked her to sing what part of the tune she heard that struck her. Well, she's tone deaf and she can't actually sing it back but there was something about it that she liked, is that something's just waiting to be captured by a computer, that certain something that no musician can fathom why the general public likes that tune.

For instance, a great example would be Kajagoogoo's follow up to 'Too Shy', 'Be a Jet Setter'. Now I can dare anybody, virtually anybody, to try and sing me the pitch of the notes that constitute the chorus to that tune. Could you do it? 'Be a Jet Setter' — I mean it's pitchless. So what was it that attracted people, okay there's the image and okay there's the word and the nice jet setter, but what was it that made that so interesting to the general public other than those things.

Yes, and for instance as far as harmony is concerned, what I've asked many people is "What do you hear when I play this." 'Tell me why you dislike that chord intensely, what makes that chord dissonant and yet when I put it in a different circumstance, in a different place it makes you happy."

There's another thing that's crept into music — irony — well, it's always been there but there's a lot of ironic sounding stuff and as far as I'm concerned it is all about the confirmation or denial of expectations in music. Pop, I suppose, if you wanted to try and sum it up would perhaps be a stream of confirmations of what you hoped would happen in pop music followed by perhaps a twist here and there. I suppose my own music — I will be making a solo album myself, after I've finished this album — could be viewed at times as a constant stream of denials, but of course that's too simplistic.

Has the Chroma taken you a long time to master?

It's not the kind of instrument one can say "I've mastered this." But all the ballyhoo about the Chroma not being understandable, is ridiculous. There are two independent channels that you can edit, each has eight oscillators A and B. You can turn off the B oscillators whilst you attend to the sound shaping of the A channel eight oscillators, and you can then go on and switch off A, turn on B and do B, and continue the way that you would with any other synthesiser ie. you assign the envelope generators to the filter if you wish, an envelope shaper to the amplifier, you would find out how much filtering you want, you find out how much resonance you want, you check what kind of tuning you want, and also very importantly with the Chroma, it's virtually a digital version of a modular system where you can change the position of the filters and ring modulators and the amplifiers in relation to the oscillators. So from that point of view it's virtually modular. Of course, the temptation with synthesisers is "Oh wait a minute, I have 120 programs stored so let's have a different program for every millisecond that elapses!" But it's all to do with your musical sensibilities. And, I think the important thing to communicate to people that are not players and are coming to computer music 'don't be frightened'. You don't have to know everything about how a computer works, you don't have to know the technicalities about a synthesiser too much, I mean, but there are books that will give you a basic insight into synthesis.

So, what's the most exciting step for you now, because you're already working with Ian in a big way on his solo album, you've got a Jethro album to do in the autumn and you're thinking of doing your own solo album?

Yes, this album I'm working on with Ian has been quite an honour for me to contribute. Also, with Jethro Tull, I still would enjoy to be seen with Jethro Tull again and to go back out on tour. Last year, I don't know if you know, but I came second in the Overall Best New Talent in 'Keyboard' Magazine in America and I want to be seen over there again to try again! So I obviously want to get back over with Jethro Tull, and my own album offers exciting prospects as I will be using computer music techniques and of course, I'll be exploiting the devastating far reaches of my technique!

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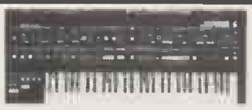

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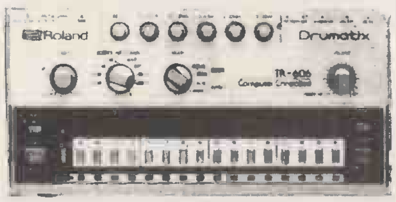

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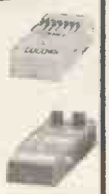

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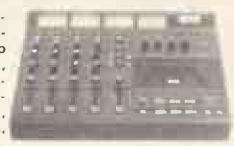

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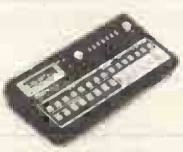

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Which Synth?

With so many models on the market, how do you know which one to buy? There is no easy answer, but here E&MM tells you what you can expect from individual features and on which synths these can be found.

The term 'synthesiser' covers a host of different instruments, occasionally used inappropriately or even incorrectly by manufacturers, retailers and consumers. Clearly it would be impossible to cover everything that is loosely termed a synth. For the purposes of this feature (particularly the comparison chart), synth is taken to refer to oscillator/filter/envelope-based subtractive synthesis machines, played from a conventional keyboard and programmed with a front panel laid out to give access to the individual elements of sound creation. The only other criteria is that the instruments are readily available, first-hand, in assembled ready-to-play form in British shops.

It is therefore essential to briefly mention some of the exclusions to our table and the reason for their omission. The new Yamaha DX range represent excellent value-for-money and a high standard of sound quality. They do not however function on the subtractive synthesis principle but on FM technology and therefore can only be compared with the synths featured in terms of sound (a subjective judgement for the reader's own ears). There are many multi-purpose keyboards on the market which feature a synthesiser section (Korg Trident II, Crumar Composer, Trilogy and Stratus) as well as many string and brass synths, all of which are useful machines, particularly in terms of a big sound or a single versatile keyboard. All however suffer in terms of scope or access to individual elements of the sound creation and are therefore not treated here.

Many excellent synthesisers of the past are for one reason or another no longer readily available in shops and are omitted to avoid creating any demand for non-existent machines, and for the same reason new models on their way (Prophet T-8, Rhodes Polaris, Siel Opera 6, Voyetra 8) have not been included. Synths built from kits (Powertran, Maplin, etc.) often represent a huge saving to the buyer without loss of quality, but again they require a certain time and skill to build hence their omission.

We should point out however that by obtaining the specification of any synthesiser, the features stated can be compared to those in our chart and an idea of the flexibility and suitability to the buyer's need of that particular model can be formed.

When considering purchasing a synthesiser, it is vital to decide firstly the role it will be required to play and from this to establish an order of priorities in terms of features. If you particularly need to play polyphonically, then you may decide to sacrifice flexibility for a larger number of voices, and if you are not as interested in learning to program as in having a good selection of sounds, you might opt for a preset only machine or even a personal keyboard or ensemble. If the ability to change sounds quickly (eg. in a 'live' situation) is more important than total flexibility (say in the studio), then a machine with programs at the expense of features is the answer.

To aid this decision, we have detailed the basic elements of subtractive synthesis and overleaf you will find a chart breaking down the features of such synths into these individual elements. To permit analysis of the chart and how it relates to your needs, here is an explanation of the function of each element, the uses it can be put to and the abbreviations used in the table:

Keyboard: The main interface (in real time performance) between the player and the instrument, must be tried to form a definite opinion, but here are some guidelines. Clearly a longer keyboard is necessary for full polyphonic playing, whereas a monophonic can cover a large range by use of the footage control. Most keyboards are based on a C scale (C to C, or F to C) and are plastic, but some of the latest products aim for a more piano-like keyboard, using wood and/or touch sensitivity for extra familiarity and control from the keyboard.

Voices: Monophonic or polyphonic, this is perhaps the biggest decision you have to make. To obtain the same features polyphonically can cost you 5 or 10 times as much as a similar monophonic set-up, and in opting for polyphony under £1,000 you are inevitably going to limit your flexibility. However, it can be seen from the chart that several synths offer a choice on this score. The Korg Mono/Poly can be mono-, duo- or quadrophonic, and as such makes a good choice for an all-purpose synth, particularly in the studio, but again loses true flexibility in poly modes. *The Oscar has a duophonic assignment ability which is particularly useful for playing along with the sequencer (normally only possible on polyphonics). [6]The Rhodes Chroma has numerous internal set-ups (called algorithms) which give total freedom in the assignment of oscillators to voices.

Oscillators per Voice: The number of oscillators played by any one note determines much of the sound. Two or three oscillators can be set at different octaves (a sub-oscillator is a good compromise here) or fixed intervals. Slight de-tunings between oscillators give a much richer sound introducing 'beating', although Chorus and PWM can both be used to fatten up the sound (see these headings). *VCO* stands for the original analogue Voltage Controlled Oscillators which have a rich sound, but need a periodic Auto-tune or manual re-adjustment. *DCOs* (Digitally Controlled Oscillators) are software-generated, crystal-derived and need no tuning but they can sound thin if PWM, chorusing or 'overdrive' is not available.

Waveforms on Oscillator: These are responsible for the basic timbre of the sound as they each have different harmonic content.

triangle wave gives the fundamental with little harmonic content as it resembled a sinewave (pure fundamental). Some synths actually give a pure sinewave, but this is quite easily obtained by close Low Pass filtering from any waveform. Gives a pure 'flute' sound unfiltered.

sawtooth wave contains all the harmonics in inverse volume to their number (ie. the higher they are, the quieter they become). Gives a fat 'brassy' sound unfiltered.

square wave contains only the odd harmonics, which gives a hollow 'oboe' sound.

pulse wave has a different harmonic content depending on the width of the pulse (which is almost always variable except on the Roland JX-3P). If the width is half the wavelength then of course we have a square wave. As the pulse gets wider or narrower (the effect is symmetrical), the high harmonic content increases as the fundamental weakens.

Pulse Width Modulation: automatic control of the pulse width of oscillator waveform. The effect created is a richer moving sound, particularly effective in lower registers. On some instruments this is available as a choice on the waveform select, whereas on others it must be routed through an LFO or ENV (envelope), or controlled by the other OSC (oscillator).

Osc. Sync. This feature causes the second oscillator to begin a new cycle every time the first oscillator does. This synchronisation means that oscillator 2 can only run at the same frequency as oscillator 1 or a harmonic. In combination with glide this can give interesting harmonic sweep effects.

LFOs. Low Frequency Oscillators are used to create regular modulation effects, such as vibrato, trills, tremolo, PWM etc. It is often possible to use *Osc 2* or *Osc 3* as an LFO but this negates audio use. As different modulations require different speeds it is useful to have 2 LFOs, especially if sequencing or arpeggiation speed is controlled by an LFO as well *(Seq/Arp)*.

As some effect (vibrato for example) sound a bit odd as the note is played, it is also handy to have a *delay* control, or if the modulation is brought in afterwards by the *joystick*.

Waveforms on LFO: Some LFOs are unmarked, which means that they are triangle wave or sine wave only.

triangle wave gives an even modulation up and down useful for vibrato, PWM etc.

rising ramp wave gives a slow attack modulation suitable for 'backwards' effects.

falling ramp wave gives a sharp attack modulation suitable for rhythmic effects.

square wave gives two distinct levels. Ideal for trills.

S/H: Sample and Hold or Random, changes the level of the LFO at regular intervals but by random amounts. This is particularly effective if used on the filter as a rhythmic device.

Keyboard Track determines how much the pitch of the note played moves the filter cut-off frequency.

Full, On or *100%* means that the frequency of the filter goes up in direct proportion to the oscillator frequency. This means that the timbre of the note stays exactly the same. More than 100% means higher notes are brighter, less means the lower notes are brighter. *O* or *Off* or nothing means there is no filter frequency movement with notes. Negative amounts attenuate the higher notes drastically. Continuously variable tracking (shown by the word *to*) means that you can actually 'tune' the keyboard follow to the required amount on upper notes, having set the sound on lower ones.

Filter Type(s): On synths with a choice, this enables you to choose various filter modes.

Low Pass attenuates the frequencies above the cut-off point, low frequencies are unaffected.

Band Pass attenuates the frequencies above and below the cut-off point.

High Pass attenuates the frequencies below the cut-off point, high frequencies are unaffected.

A *24dB/oct* effect gives a sharp cut-off, a *12dB/oct* cut-off gives a less pronounced effect and *6dB/oct* is very slight. On some synths you can alter the cut-off slopes but on most these are fixed and contribute to the overall sound of the synth.

Ring Mod. (or effect): A ring modulator is a circuit which produces the sum and the difference of all the frequencies of the inputs. This gives harmonically-unrelated frequencies which are very useful for making 'bell' or 'plucked' sounds. If the circuit itself is not available, it is often possible to create the effect by using *Polymod* or *Cross Mod* sections, or an additive synthesis section *(waveform creation)*.

Glide Types: Any of the following are possible.

Gliss: glissando causes the pitch to slide smoothly from the last note to the new one.

Port: portamento causes the pitch to jump in semitones from the last note to the new one.

Man: manual means the glide effect only happens when last note is still held (legato playing).

Auto: automatic means effect always happens.

Poly means glide effect works in polyphonic mode.

Mono means glide effect only works in unison mode (see this column).

Fixed T or R allows you to choose whether glide happens at a constant rate (the usual way) or in a fixed length of time.

Envelopes per Voice: if you only have one envelope per voice then it is not possible to get independent filter and envelope contours which is limiting to more complex sounds. The four possible envelope controls are attack, decay, sustain and release and they are refered to as *A,D,S* and *R*, so an AD has only attack and decay controls.

Performance Controls: these permit 'real time' pitch bends or modulations to be controlled in performance, essential for adding expressions and character to the playing. *Wheels* allow bends and modulations to be controlled independently, whereas a *joystick* means that the two can be executed together. The Yamaha CS-01 has an additional breath controller (BS-1) available which means that both the Filter and Amplifier can be controlled by blowing. If the wheel amounts are *programmable* it means that they can be adjusted to suit your individual preferences.

Noise Source: can be either *White* or *Pink*. On some synths noise actually replaces one of the oscillators *(r/Osc)* which can be a little limiting.

Hold keeps the envelopes open indefinitely after they have been triggered. This means that the synth will continue to play itself after the key has been released.

Uni: (unison) only applicable to polyphonic instruments. Turns the instrument into a monophonic with all the oscillators triggered by one key. Gives a very 'fat' sound and is ideal for lead lines and solos.

Arp.: (arpeggiator) an increasingly popular feature on both monos and polys. Causes the notes held to be played in an arpeggiated fashion. Possible ways of playing are Up (U), Down (D), alternating up and down (UD) or assign (Asg) ie. in the order the notes were played.

Crs. Set.: (chorus settings) chorus effects are also more common, particularly useful for ensemble sound such as strings and choirs.

Sequencers: The capacity of these is expressed as a number of notes for each sequence (X) or shared between the sequences (÷). A *Real Time* sequencer plays back the notes exactly as played, whereas *Step Time* has to programmed one note or rest at a time. If there is no division between the columns it means that the capacity is shared between step and real time.

Programs: these allow you to store patches made on the panel to be recalled for future use.

Pre. (presets) are patches made at the factory which are permanently stored and cannot be overwritten.

Mem. (memories) are storage locations for the user to keep his own patches stored. Some synths come with factory presets in memories which can be over-written. Where this is the case the number of programs is in the middle of the two columns.

Cass. Dmp.: (cassette dump) this allows program and sequence information to be stored in digital information on cassette tape. This allows valuable presets to be safeguarded and leaves storage space in the synth free for further creative use.

External Controls: These are inputs and outputs which allow the synth in question to be used in conjunction with others, with sequencers or with computers.

In allows the synth to be controlled externally.

Out means the synth can control others.

Through means the synth can be used in a chain.

Tr (trigger) is a signal which opens an envelope or clocks an LFO (seq/arp).

G (gate) is a signal which holds an envelope open for an appreciable time.

C.V. (control voltage) is a (1 volt/octave scaled) voltage which determines the pitch the oscillators should play.

Which Synth? — A Comprehensive

Make	Model	Keyboard (in Octaves)	Voices	Oscill. per Voice	Waveforms on Oscillator				Pulse Width Modulation	Osc. Sync.	LFOs	Waveforms on LFOs				S/H	Keyboard Track	Filter Type (s) Low Pass	Band Pass	High Pass
Yamaha	CS01	2½(F—C)	1	1 DCO	•	•	•	•	Adjustable speed		1	•						12dB/oct		
Moog	Rogue	2½(F—C)	1	2 VCOs		•	•	•		•	1	•			•	•		24dB/oct		
Jen	SX1000	3(C—C)	1	1DCO	•	•	•	•	Using LFO		1	•						12dB/oct		
Roland	SH101 / MC202	2½(F—C) / 2½(F—C) Rubber pads	1	1VCO		•		•	Using LFO or ENV		1	• / •			• /	• /		24dB/oct		
Korg	MS10 / MS20	2½(F—C) / 3(C—C)	1	1VCO / 2VCOs	•	•	•	•	Using LFO		1	•	•	•	•	/ •		12dB/oct		/ 12dB/oct
SCI	Pro-One	3(C—C)	1	2VCOs	•	•		•	Using LFO	•	1(+Osc2)	•		•	•		±100%	24dB/oct		
Synton	Syrinx	3½(F—C)	1	2VCOs	•	•	•	•	Using LFO	•	2	•	•		•		0 to 200%	24dB/oct	2x12dB/oct	
SIEL	Mono	3(C—C)	1	1DCO	•	•	•				1(delay)	•					Off/Full	12dB/oct	12dB/oct	12dB/oct
OSC	OSCar	3(C—C)	1(2*)	2DCOs (1*)	•	•	•	•	Independent LFO for each Osc.		1(delay) 1 seq/arp	•	•	•	•	•	—50% to + 150%	12 to 24dB/oct	12dB/oct variable width	12 to 24dB/oct
Moog	Source	3(C—C)	1	2VCOs	•	•		•		•	1		•		•		Off/½/Full	24dB/oct		
Korg	Mono/Poly	3½(F—C)	1,2 or 4	4,2 or 1 VCOs	•	•	•	•	Using 2nd LFO	•	1 normal 1 PWM/arp	•	•	•	•		0 to 100%	24dB/oct		
Roland	Juno 6 / Juno 60	5(C—C)	6	1DCO		•		•	Using LFO		1(delay)	•					0 to 100%	24dB/oct		12dB/oct
Korg	Poly 6 / Poly 61	5(C—C)	6	1VCO / 2DCOs		•	/ •	• / •	Using LFO /		1(delay)	•					0 to 150% / On/Off	24dB/oct		
SCI	Prophet 600	5(C—C)	6	2VCOs	•	•		•	Using LFO	•	1(+Osc2)	•			•		Off/½/Full	24dB/oct		
Roland	JX-3P / Jupiter 6	5(C—C)	6	2DCOs / 2VCOs	/ •	• /	• /	• /	/ Using LFO or ENV	•	1(delay) / 1(delay) 1 Normal	• /	/ •		• /	• / •	0 to 100%	24dB/oct	/ 12dB/oct	12dB/oct / 24dB/oct
Moog	Memorymoog	5(C—C)	6	3VCOs		•	•	•	Using LFO	•	1(+Osc3)	•	•	•	•	•	Off-⅓-⅔-full	24dB/oct		
Oberheim	OB-8	5(C—C)	8	2VCOs	•	•		•	Using LFO1	•	1 Normal 1 PWM/arp	•	•	•	•	•	On/Off	12 or 24dB/oct		
Elka	Synthex	5(C—C)	8	2DCOs	•	•	•	•	Using LFO1 or OSC	•	1(Delay) 1(joystick) 1 seq.	•	•	•	•		0 to 100%	24dB/oct	One 6dB/oct One 12dB/oct	12dB/oct
Roland	Jupiter 8	5(C—C)	8	2VCOs	•	•	•	•	Using LFO or ENV	•	1(Delay) (+Osc2)	•	•		•	•	0 to 120%	12 or 12dB/oct		24dB/oct
Rhodes	Chroma	6¼(E—G) Wooden Touch	1—16†	16—1 VCOs	•	•	•	•	Using LFO or ENV		3	•	•	•	•	•	Pro-grammable	24dB/oct		24dB/oct

DCB (digital communication bus) is a Roland connection which allows the MC4 (sequencer) to operate with their synths.

MIDI is a universal interface system developed by Sequential Circuits to facilitate interconnections between synths, sequencers and computers.

Now we have explained the relevance of all the columns and abbreviations used, the chart is below. You will see that some products by the same manufacturers occupy the same row. This is because many of their features are the same. In the sections where they do differ they are separated by a dotted line. Otherwise they share identical features and the same box in the chart.

Companies mentioned:

Elka-Orla (UK) Ltd., 3/5 Fourth Avenue, Bhiebridge Industrial Estate, Halstead, Essex C09 2SY. Tel. (0787) 475325.

(Jen) British Music Strings, Pontygwindy Ind. Estate, Caerphilly, Mid Glamorgan. Tel. (0222) 883904.

(Korg) Rose-Morris Co. Ltd., 32 Gordon House Road, London NW5. Tel. 01-267 5151.

(Moog) Ray Goudie, 11 Forth Wynd, Port Seton, East Lothian, Scotland. Tel. (0875) 812033.

(Oberheim) Chase Musicians, 22 Chalton St., London NW1 1JH. Tel. 01-387 7626.

OSC (Oxford Synthesiser Company), 5 Gladstone Court, Gladstone Road, Headington, Oxford. Tel. (0865) 67065.

(Rhodes) CBS, Fender House, Centenary Est., Jeffrey's Road, Brimsdown, Enfield, Middx. Tel. 01-805 8555.

Roland (UK) Unit 6, Great West Trading Estate, 983 Great West Road, Brentford, Middx. TW8 9DN. Tel. 01-568 4578.

SIEL (UK) Ltd., Suffolk House, Massetts Road, Horley, Surrey RH6 7DT. Tel. (02934) 76153/4.

Synton, Rod Argents Keyboards, 20 Denmark St., London WC2. Tel. 01-379 6690.

Yamaha/Kemble Ltd., Mount Avenue, Bletchley, Milton Keynes, Bucks MX1JE. Tel. (0908) 71771.

Guide to Features and Capabilities

Ring Mod. (or effect)	Glide Types	Envelopes per Voice	Performance Controls	Noise Source	Hold	Uni.	Arp.	Crs. Sel.	Sequencers Real Time	Sequencers Step	Programs Pre.	Programs Mem.	Cass. Dmp	External Control In	External Control Out	External Control Thr.	Additional Comments	R.R.P.
Using BS-1	Gliss.	1ADSR	2 Wheels (also BC-1)	White r/osc										BC-1			The additional Breath Controller (BC1) makes this a unique instrument, but keyboard is small scale	£199 (+ £19 for BC 1)
	Port	1AD/AR	2 Wheels	White	•									Tr C.V.	Tr C.V.		This Moog has an 'overdrive' option giving a beefy sound. Also doubles as Taurus II bass pedals module.	£318
	Port	2ADSRs		White/Pink													A good all-digital basic mono but lacking in performance controls and external controls.	£190
	Port	1ADSR	1 Wheel on MSG1	White	f/sw				2729 notes	100 notes / ÷2 voices			•	G. C.V.	G. C.V.		The MC202 is a composer sequencer version of the SH101. It only has a rubber keyboard, but can store duophonic sequences to play back with another 1v/oct synth.	£299 (£30 for MSG1) / £365
Using routing	Port.	1ADSR / 1ADSR 1ADR	1 Wheel (routable)	White / White/Pink	•									G. C.V.	G. C.V.		Both these synths are completely patchable, the MS-20 being a dual-oscillator version of the MS-10 but with a Pitch to Voltage converter for external input	£289 / £485
Using Osc 2	Port Man. Auto.	2ADSRs	2 Wheels	White	•					40 notes ÷2 seq.				G. C.V.	G. C.V.		A non-programmable monophonic version of the legendary Prophet 5 with extensive modulation.	£470
Dedicated Circuit	Port. Man. Auto.	2ADSRs	Bend Pad	White										G. C.V.	G. C.V.		A Dutch product with versatile routing. Ideal for studio, but rather complex 'live' use.	£350
	Port	1ADSR	Bend Lever	White				1			10							£249
Using Waveform Creation	Port Gliss Fixed T or R Man. Auto	2ADSRs	2 Wheels (programmable)	White	•		U.D UD			580 event ÷ 12 seq. +10 chains	24	12	•	Tr	Tr		A digital British synth with an extensive sequencer, programmable filter drive, additive waveform creation and duophonic assignment of the oscillators.	£499
	Port.	2ADSRs	2 Wheels	White			UD		2x88 notes			16	•	G. C.V.	G. C.V.		A basic mono from the people who started it all.	£895
	Poly Port	2ADSRs	2 Wheels	White	•	•	U.D UD										A versatile machine which doubles as a complex mono and a basic poly. A good choice for a single synth	£689
		1ADSR	1 Bend Lever	White	•	•	U.D UD	2				56	•	DCB	DCB		The Juno 60 is a programmable version of the Juno 6.	£799 / £1,199
		1ADSR	2 Wheels / 1 Joystick (programmable)		•	•	U.D UD	3				32 / 64	•	Tr	Tr		The 61 is a digital version of the 6 which loses on resolution in exchange for 2 oscillators but is a lot cheaper	£1200 / £995
Using Polymod	Poly. Port.	2ADSRs	2 Wheels			•	UD Asg		400 notes ÷ 2 seq			100	•	MIDI	MIDI	MIDI	The replacement for the Prophet 5 with an extra voice, sequencing arpeggiation and the MIDI.	£1,650
Using Cross Mod	Poly. Mono. Port. Gliss	1ADSR / 2ADSRs	1 Bend Lever	W / White r/Osc	•	•	U.D / UD	1		128 events x6 seq	32 / 48	32 / Split Double	•	MIDI	MIDI	MIDI	The JX-3P is more easily programmed using the PG200 / New 6 voice version of JP8.	£900 (+ £195 for PG 200) / £2250
Using Osc. 3	Poly Mono Port.	2ADSRs	2 Wheels (programmable)	Pink	•	•	U.D UD					100	•	Tr			The top of the range with the configuration of 6 MiniMoogs now with computer interface available	£3,100
	Poly. Port. Gliss. Glide	2ADSRs	2 Levers	White	•	•	U.D UD				120	Split Double	•	Tr			Features a second 'page' of programming controls. Fits into the Oberheim system	£2,999
Digital on Osc 1 & 2	Poly. Port Gliss. Glide	2ADSRs	1 Joystick (programmable)	White/Pink	•			3	128 notes x	4 seq	40	40 Split/Dble	•	Tr			All digital synth with an onboard sequencer and future computer interface.	£3,199
Using Cross Mod	Poly Port Gliss.	2ADSRs	Lever	White r/Osc	•	•	U.D UD					64 Split/Dble	•	Tr	C.V. G.		The first of the Split/Layer keyboards, still selling well after several years.	£3,999
Using Cross Mod	Programmable	2ADSRs	2 Bend Levers	White/Pink	•	•	U.D UD					50 Split/Dble	•	Computer Interface			Already available with computer interface and expander touch-sensitive keyboard and alterable internal configuration	£3,800

COMPETITION ★ COMPETITION ★ COMPETITION

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Complete the entry coupon with your full name and address, the size and colour of T-shirt you would require and send it (or a good photocopy) to E&MM/Roland Competition, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG, to arrive no later than the closing date of Friday, September 30th, 1983.

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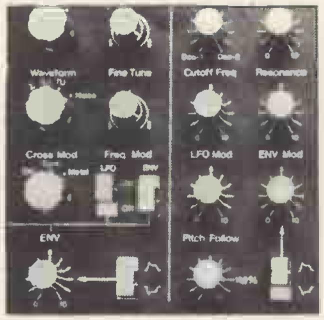

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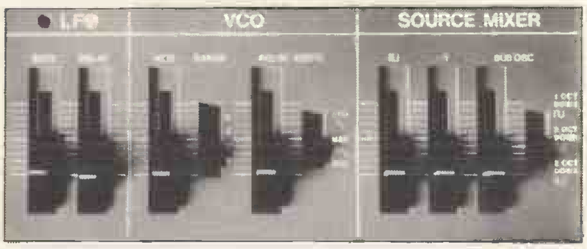

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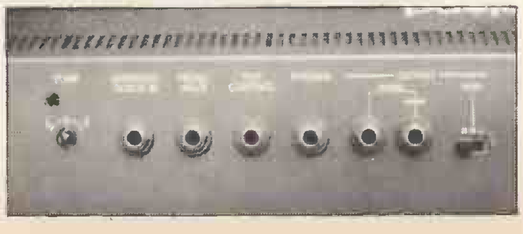

◂ 4

E&MM/Roland Competition

Answers

Pic 1) .... Pic 2) ....

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Pic 3) .... Pic 4) ....

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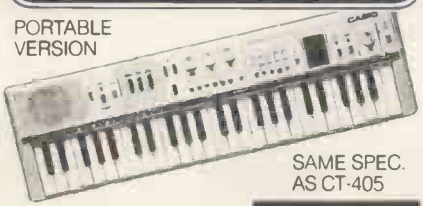

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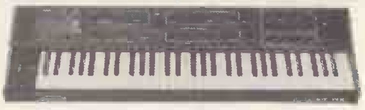

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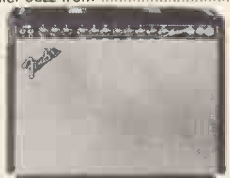

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BARCLAYCARD AMERICAN EXPRESS ACCESS

Advanced Music Synthesis

Voltage Controlled Filters

Part 2

by Steve Howell

In the last Advanced Music Synthesis column we looked at the basic theory behind voltage controlled filters, in particular, voltage controlled lowpass filters. We saw how a basic sound is made up of harmonics and how these harmonics can be affected by filters. This month we're going to try a few patches in an attempt to put that theory into practice.

In Figure 1 the filter is being used as an elaborate tone control and is not being controlled by any other device except the keyboard. This will allow us to get a wide range of sounds by simply altering the cutoff frequency and resonance controls. Using this particular technique many impressive organ sounds, from pipey church organs to cheap, electronic organs, can be obtained. For more fruity Hammond organ sounds it would benefit to overdrive a Leslie speaker or alternatively, use a chorus or mild flange to duplicate that effect. Vocal sounds, in particular soprano voices, can be imitated by selecting a pulse wave and varying the cutoff frequency control and resonance to suit. If you find the voice effect too 'shrieky' further up the keyboard try backing off the keyboard track control. Vocal sounds also benefit from a touch of portamento, vibrato and reverb.

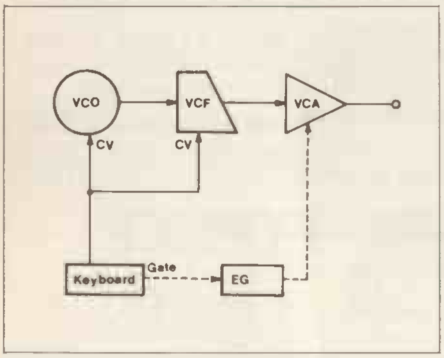


Figure 1. Basic synthesiser patch.

Both organ and vocal sounds utilise a fairly high resonance setting but things like strings usually have the resonance set at minimum and the cutoff frequency control sets the 'brightness' of the string sound. String sounds benefit from either multiple VCOs or from a touch of chorus and vibrato. If your synthesiser allows it, try mixing in a pulse wave whose width is being modulated by a low frequency sine or triangle wave as this will thicken the ensemble effect.

Filter sweeps are also easy to achieve using a patch such as in Figures 2a or 2b. The example shown in Figure 2a is, in fact, how most small prewired synths such as the Roland SH101, SH09, ARP Axxe etc., are internally patched whilst larger synths such as the Pro-One, MiniMoog and Moog Source are patched together as in Figure 2b where one envelope generator is devoted solely to filter sweeps and the other to the VCA for amplitude shaping. Whatever type of synthesiser one has, a few things should be borne in mind when setting up the filter controls.

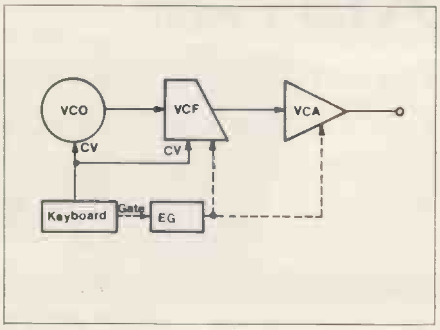


Figure 2a. Filter sweep with envelope generator patch.

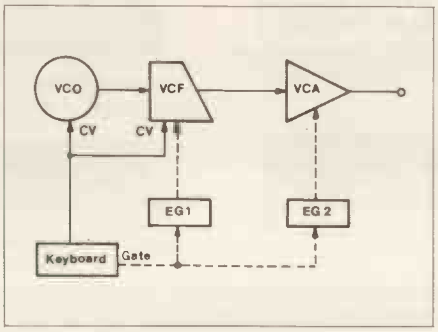


Figure 2b. Filter sweep and amplitude shaping using two EGs.

If you want the sound to have a wide filter sweep, set the cutoff control fairly low (practically at minimum) and set the envelope generator (EG) modulation amount control fairly high. This will allow the voltage output of the EG to sweep through the full range of the filter cutoff frequency.

For more subtle tonal variations set the cutoff frequency control to any given point (say about halfway or whatever) and adjust the EG amount control so that there is just a hint of harmonic movement. In this example, the position of the filter cutoff frequency control sets the lowermost limit of the filter, so that no harmonics will be filtered out or affected below that point, whereas the EG amount control sets the uppermost range of the filter modulation. In this way quite a wide range of subtle tonal changes can be obtained which are ideally suited to muted brass, vocal, flute and various synth effects. Just listen to the work of Wendy Carlos or Larry Fast to see how effective this more delicate approach to filter modulation can be when compared with the more 'bombastic' tactics of other synthesists who go for wider filter sweeps.

The setting of the keyboard amount and resonance controls depend on the exact nature of the sound you are trying to create, as does the setting of the EG controls. Remember, also, that if you have the filter cutoff control set at maximum there will be no change in sound regardless of how much you change the EG amount control. This is because the filter is at its maximum frequency capabilities and is allowing *all* the harmonics to pass through and so no amount of modulation from the EG will affect the sound. Unless, that is, you have your synth patched up as in Figure 3.

Here, the EG is routed via an inverter which turns the otherwise positive going voltage output from the EG into a negative going voltage. Now, whenever a note is played, the output voltage goes down instead of up and so you must set the filter cutoff control fairly high. This allows the cutoff frequency to be swept 'downwards' and then 'upwards' to the point set by the cutoff frequency control during the decay/release portion of the note. This particular technique can yield some exciting effects and is available as a standard feature on some synths such as the Roland Juno 6/60 and Korg Polysix but sadly doesn't appear on some of the smaller (or even larger) synths currently available. If I had my way, *all* synthesisers would have this feature on them as it can be extremely useful.

Filter sweeps with a low frequency oscillator (LFO) as shown in Figure 4a operate on the same principles except for one important difference. The output from LFOs, in particular sine and/or triangle waves oscillate *around* 0 Volts — that is, one half of their cycle is positive going and the other half is negative going (see Figure 4b). What this means in practical terms is that you will have to set the cutoff frequency control to a point around which the modulating waveform of the LFO can sweep.

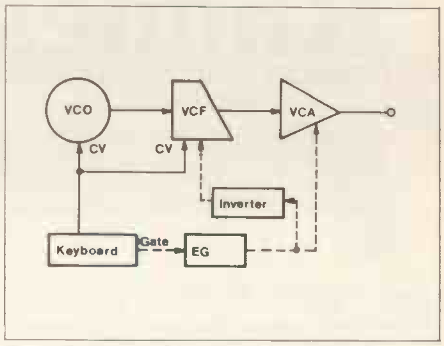


Figure 3. Inverted envelope sweep patch.

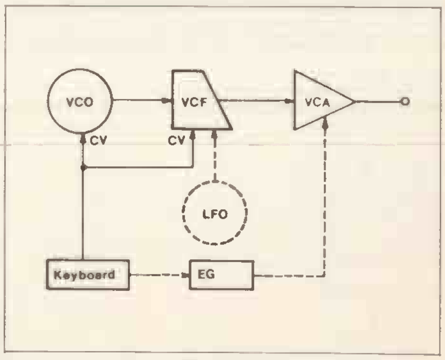


Figure 4a. LFO modulation of filter cutoff.

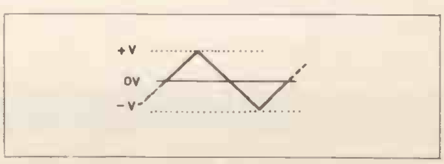


Figure 4b. Typical output from LFO.

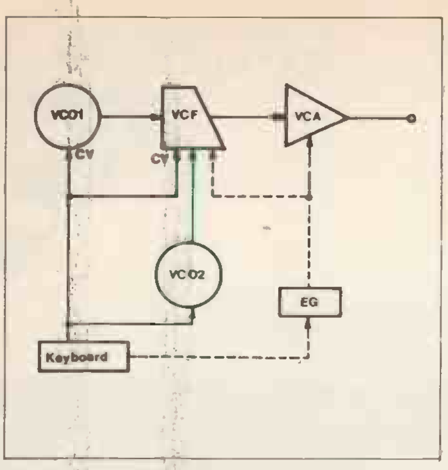


Figure 5. Filter modulation using a VCO in the audio range.

In other words, imagine that the cutoff point is to be the 0 Volts line; when the voltage increases the harmonics will be swept above that point but when the waveform goes into the negative half of the cycle the harmonics below that point will also be affected. Therefore, if you set the filter cutoff frequency control too low you may find that you lose the sound altogether, as the sweep moves below the fundamental of the note during the negative sweep. So the settings of the cutoff control and the LFO modulation amount control are crucial, but with patience and experimentation the filter and all its associated controls can allow you to create some very exciting sounds and effects. This may all sound somewhat complicated but it looks worse on paper than it is in practice. Filters can be difficult to understand fully as there are so many variable factors which can affect their operation, but hopefully by bearing these few tips in mind when you are setting up a sound things might become a little easier.

Finally, let's have a look at some of the other things one can do with voltage controlled filters.

On many synthesisers it is possible to mix the outputs of two or more controlling devices for an even greater range of sounds. The voltage controlled filter is no exception. One could, for example, mix the outputs from two LFOs to create interesting rhythmic effects or mix the output from an EG and several LFOs.

One technique of which I am particularly fond is that of using a VCO in the audio range as the modulation source. By patching up as in Figure 5 it is possible to obtain a wide range of textures that would be impossible to create by any other means. By experimenting with the frequency of VCO 2 one can create curious vocal sounds, very realistic percussion sounds such as kalimba, glockenspiel and so on, as well as many interesting concordant and discordant bell and clang sounds. Many of the textures produced in this way sound very digital and complex. In this example of filter modulation, as well as subtracting harmonics and sweeping through them, VCO 2 is also adding harmonics and, for want of a better word, distortion in a variety of ways which makes for some highly original sounds.

Most of the filter effects described above can be obtained on even the most simple of synthesisers but are difficult to achieve on elaborate digital instruments such as the Fairlight or Synclavier. As such, it is these filter effects that characterise many analogue synthesiser sounds and even though they have become somewhat overused and a trifle cliche, they can still be very exciting and very effective if tastefully employed.

E&MM

RECORD REVIEWS

Asia: Alpha

Geffen GEF25508

From the opening bars of 'Don't Cry' to the closing instrumental of 'Open Your Eyes' this band's roots are showing. The album title, the sleeve artwork (by Roger Dean), everything underlines that this band comes from the distinguished line of English Progressive Rock which brought us Yes, ELP, King Crimson and UK.

However, the music itself is moving in a different direction. The first clue to this is in the track listing: 10 songs with titles like 'Don't Cry' and 'My Own Time (I'll Do What I Want)'. Hardly 'The Gates of Delirium', 'Karn Evil 9' or 'Starters and Bible Black' at a side of an album each! The closest comparison in their communal past is probably John Wetton's solo album 'Caught in the Crossfire' of a couple of years ago. Indeed Wetton has a writing credit on every track, shared on all but one with Geoff Downes, and Steve Howe and Carl Palmer's contributions are solely as performers not writers (unlike the first album which was more equally balanced).

The 'Alpha' side opens with the current single 'Don't Cry'. The opening is pure seventies classical rock complete with rippling keyboards, powerhouse drumming and searing lead guitar, but the song itself is more in the American FM vein of REO Speedwagon or Styx, both lyrically and musically. Wetton's voice is as powerful and expressive as ever, and seems as comfortable with a love song as with more esoteric material. 'The Smile Has Left Your Eyes' is a ballad in a similar vein with some excellent orchestration from the keyboards of Geoff Downes. 'Never In A Million Years' contrasts heavy verses and guitar instrumentals with harmony choruses and sounds like another single.

'My Own Time (I'll Do What I Want)' features Steve Howe sounding like Paul Simon in the acoustic guitar passages but unmistakably himself on lead solos. The dynamics of the track are beautifully constructed, and the trumpet sound on the fade out seems to acknowledge Purcell's Voluntary. The 'Alpha' side closes with the 5 minute 'The Heat Goes On'. Opening with a splendid keyboard intro and an extended Hammond solo, this is a showcase for Geoff Downes all-compassing keyboard skills. Howe's guitar duets with Wetton's voice in what is the most impressive track on the first side.

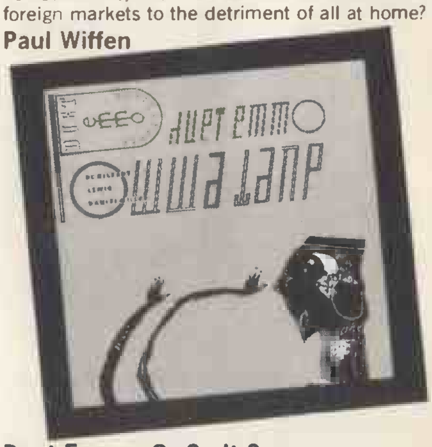
'Beta' (side two for the uninitiated) begins with a bang. 'Eye To Eye' has Palmer laying down that thunderous syncopated 4/4 beat that pushed ELP along. But this track really belongs to Steve Howe, driving the choruses with muted demi-semi-quavers covering the diminished bridge passages with cascading runs and in the closing solo giving once more that blend of melodic line and technical brilliance which earmarks his playing. 'The Last To Know' begins as a slow ballad, adding instrumental frills building to the grandiose harmony vocals and orchestral texture of the chorus. A quadruple-time instrumental section reaches a classical-type climax leading back into the choruses.

'True Colours' finds the band in similar vein to their first album, more complex musically and more subtle lyrically. The rich texture of the verses contrasts with driving syncopated choruses (reminiscent of 'Solo Survivor' of the first album). Soaring guitar lines and synthesised orchestration fill out the arrangement. The band function as a single unit (as opposed to singer-soloist/accompanist) more than anywhere previously on this record. The timing and changes are impeccable. 'Midnight Sun' continues this united feel on a slower song, reminiscent of 'Cold of the Night' off the Wetton solo LP. Howe unleashes a blinding solo and Downes deps for the LSO.

The final track 'Open Your Ears' opens with a beautiful ensemble flute sound and vocoded title line. Wetton's vocal is impeccable. The band crashes in behind him leading into the chorus. The second verse repeats the delicacy of the first with a pipe organ backing. The middle eight features harmony vocals and leads into a doubled guitar solo, which continues as answering phrases for Verse 3. After the chorus the flutes and vocoder return to build through question and answer phrasing to the final instrumental climax with Downs and Howe trading riffs, until the fade interrupts what will probably be a 'live' highpoint.

Another triple platinum album in America no doubt, although on their home territory it will do no better than gold from the faithful in England. After the reception the band received (even before the first album) from the English Press and also Pete Townsend (who should know better) for the size of the advance they received (I'm sure Mr. Townsend has obtained comparable advances for Who albums), it is not surprising they have angled their current album for an American FM audience and they choose to promote it on the road in the States first. Still, they will eventually arrive on our shores to play a few concerts, no doubt to attendant press sneerings (a prophet is never welcome in his own land). Why does Britain have to export its greatest achievements, musical as well as technical to foreign markets to the detriment of all at home?

Paul Wiffen



Duet Emmo: Or So It Seems

Mute Stumm II

To say that the Duet Emmo project was conceived and created inside London's Blackwing studio, without any prior preparation, by Graham Lewis and Bruce Gilbert (of Wire fame — "best described as making unorganised sympathetic noise") and Daniel Miller best known as the producer of Depeche Mode and Yazoo may prepare you for this bleak atmospheric debut album.

The title track 'Or So It Seems', available also as a 12" single (Mute 025) c/w 'Heart of Hearts' (not on the album), is by far the most commercial track with a mesmerising swirl of rhythmic synth patterns, interspersed with various stereo-echoed motifs.

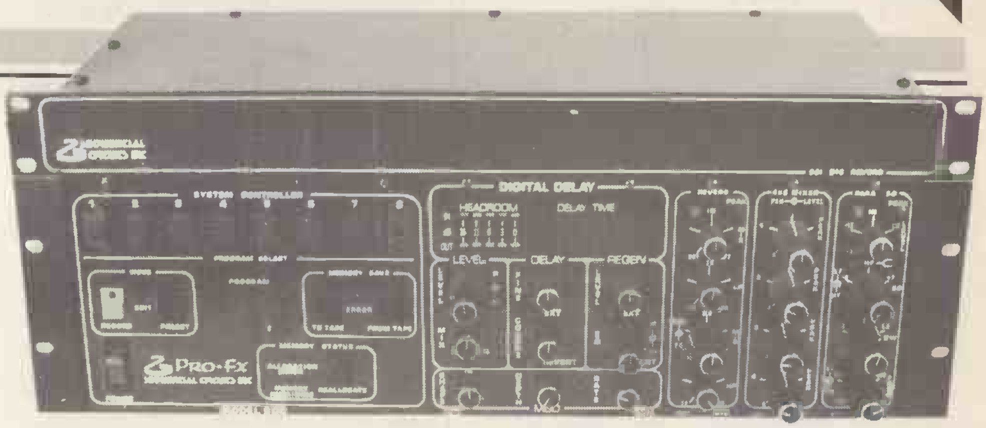
'Friano', also on Side 1, consists of random synth notes panned left, echoed right, above a mixture of industrial noises, whilst 'The First Person' which follows is based on what could best be described as a powerful 'rock 'n' roll' electronic bass synth with continuously varied vocals (listen out for the 'barber-shop' harmonies!).

Side 2 consists mainly of 'The Long Sledge' (the other three tracks totalling only a couple of minutes) — a curious mixture of experimental sounds, effects and strange 'human' noises. The overall effect is of a pop 'musique concrete'.

The single is well worth a listen (and could perhaps be redone as an electronic dance record?) — but only your taste can bring a verdict on the remainder of the album.

Patricia McGrath **E&MM**

SCI Pro-FX 500



The Pro-FX 500 from Sequential Circuits is a fully programmable, microprocessor-based, modular signal processing system. It consists of a mainframe 19" x 3U high, rack-mounting chassis containing the System Controller and space for up to six effects modules. It is capable of storing the control settings for every knob and switch as a 'program' in memory. Up to 64 such programs (eight banks of eight programs each) can be retained in non-volatile memory, as well as 64 user-created sequences.

Up to 30 effects modules can be controlled by one System Controller alone which only remembers and reprograms each module according to their slot location within the rack. All interconnections of modules are done using mono jack leads, and since modules only have one output you require 'Y' cords to patch one module to two destinations. Modules can be relong as their cage (chassis) slot remains vacant.

The System Controller front panel contains eight Program Select black pushbuttons below which is a two digit LED display. This shows the program number selected eg. 34, which describes bank 3, program 4 in memory.

The Pro-FX has three modes of operation: (1) Manual (2) Preset and (3) Edit; these shall now be described.

Manual

On power up the Controller defaults into Preset mode and the effects are programmed for the default (11) setting. Pressing the 'Preset' button to the left of the LED display once, disengages this mode returning all control settings to their current front panel status. In Preset mode the knobs do not indicate their value, so switching to Manual can be hazardous if you have a level control turned up full, for example.

Preset

The Pro-FX 500 stores settings of every front panel control as one 'program'. You can create Presets by setting your patch up in the Manual mode and recording them into the memory; or by editing an existing Preset, then recording your new version into the same location or a different one.

64 programs are available as eight banks of eight programs. To select one of them you press a combination of the Program Select buttons. The programs run from 11 to 18, 21 to 28 etc.

To record a program you first need to set the back panel slider to Enable, then press the red Record button — it should light. Select the location you wish to record in eg. 74, and it's recorded. You verify your program is safe by hitting 'Preset' and select 74. Switching back the slider to Disable prevents erasure of your data — it's ideal for live use where you don't want people fiddling with your control settings.

Edit

Any program can be selectively edited in Preset mode by adjusting any front panel controls, which remain 'active' all the time. If you get it wrong, pressing the Preset program number again restores the original values, as they weren't recorded.

If you move a control in Edit mode nothing happens. Edit is only activated by turning the control until it reaches the programmed knob setting, when the Preset button LED will blink and Edit LED lights up. That control only, is now in Edit mode. The idea is that slowly turning a control until the LED lights will then show you at what position the previous programmed control was left. Simply press 'Preset' to return to start if you turn the knob too far. To store that edited program, press Record plus the program number!

Sequences

Up to 64 sequences of program changes can be recorded then played back, advancing them one at a time via a footswitch or sync pulse from tape — superb for mixing, on stage or even in the studio. These sequences can be programmed in any order and then looped automatically to cycle through the changes. All sequences are saved and loaded along with the programs through the tape interface.

To record a sequence you need to connect the footswitch to the socket marked FTSW 2 on the back panel, then press and hold it down. Enter the required sequence number (the SEQ display will light), press the Record button and select the numbers of the programs, one after the other, and release the footswitch.

To playback that sequence you press and hold the footswitch, select the sequence number (display lights up) and release the switch. Now every time the footswitch is depressed the program will advance. A clever feature, enables you to manually select another program at any time from the front panel without destroying the program running order.

It is, however, impossible to erase sequences; you have to overwrite a long sequence with a single program sequence in order to free extra program areas. If the sequence memory is full to capacity then the display will read 'FF' and no more sequences can be constructed.

The Pro-FX System is an extremely easy unit to get on with. There's even a self-diagnostic memory test procedure available if the System Controller refuses to obey commands, which makes troubleshooting so much more simple a task.

Rear Panel

This features a CV In socket. Connecting an external control voltage to this lets you programme those module functions having 'External' front panel switches. The Data jack socket is used to send and receive data between several 'slaved' System Controllers, whilst the 24 pin connector 'daisy-chains' the expansion cages of modules, so that they can all be controlled by the one overall System Controller. Lastly, there are the Record Enable/Disable switch and the XLR (FTSW 1) socket. The former allows you to write to the Controller memory locations or not, whilst the latter socket is for future connection to an 'intelligent' footswitch that will incorporate an LCD display and give access to programs.

Tape Interface

On the rear of the back panel are the To Tape and From Tape jack sockets which are used to store program/sequence data onto cassette or tape, thus allowing a library of effects patches to be maintained. These sockets also read sync pulses in/out from tape.

It's advisable to get into the habit of dumping all important programs and sequences to tape as soon as is convenient, thus safeguarding against computer failure. Tape sync pulses are designed to be recorded onto one track of a multitrack machine using the To Tape socket fed to the Mic or Line input of the recorder, and recorder output fed into the From Tape socket. Then, everytime a program is advanced (either manually or automatically via the footswitch) a sync tone is output to the tape recorder. However, this is not the case when reading pulses off tape; if it were, you'd end up with another (unwanted) pulse being recorded back onto the multitrack.

Modules

Now we shall take a look at the range of effects modules available for the Pro-FX.

Digital Delay

This unit offers a delay range of 0 to 1 second at 15 kHz bandwidth, or 666 milliseconds to 2 seconds at 7 kHz. It occupies three times the width of the usual module and has a 4 digit LED display for Delay Time. To the left of this are In and Out, 5 segment horizontal LED bargraphs giving indications of the system headroom.

Both input and output Levels are provided with a dry/delay Mix control for setting the balance of effect to original signal.

The Delay section has controls for Fine and Coarse tuning of the delay time, the latter selecting the delay in a 15 step range, whilst Fine is used to set precise times. Fine is adjustable over a 3:1 range set by the Coarse value. These control knobs were fairly jerky to use and prevented really accurate setting of a delay. Pressing in the External switch below the Fine knob effectively halved the overall delay time.

Regeneration Level sets the amount of signal being fed back into memory, resulting in multiple echoes at long delay and hard reverberation on faster delays. A novel feature is the inclusion of 24 dB/octave high and low pass filters on the regeneration circuit which can be used to filter the echo/reverberation effects, creating the feel of various size rooms.

The modulation section is used to produce flanging, vibrato and chorus-type effects and has Rate, Depth and Shape controls. Depth is variable from 0 to 4:1 sweep of the delay time, Rate from 0.03 to 18Hz (a nice range), whilst Shape sets the type of modulation in use. Sine, square and envelope follower are all possible. Sine produces a very good chorus, and some weird vocal treatments, not too unlike a vocoder, can be produced on envelope follower with Depth and Rate near full.

The rear panel features a Repeat footswitch jack, which is extremely useful; an external modulation input, and Regeneration Input/Output sockets to allow external signal processors to be inserted in the Regeneration loop.

The sound quality from the unit is high; as expected from a 14-bit device. When you consider that every control is programmable and delay 'patches' can be stored and saved on cassette, you begin to realise how powerful this unit is and how useful it is. *RRP £895 inc. VAT.*

Parametric Equaliser

One of the best modules, having a comprehensive selection of dual controls that caters for almost all equalisation requirements. There are two overlapping frequency bands each with EQ cut and boost of 16dB, a bandwidth control adjustable from one-sixth to 2 octaves range and centre frequency can be adjusted from 20Hz-2kHz (Low Frequency) and 200Hz-20kHz (High Frequency). An overall Level cuts the input signal to prevent distortion, which is easy to produce when cutting or boosting levels by excessive amounts, and the peak LED indicator should prove helpful on this count.

LED switches change the high frequency bandshape to a shelving response which gives a frequency cut-off on one side of the band only, whilst the HF/Filt switch converts the HF band into a tunable low-pass filter for removing top end hiss. In this mode, the bandwidth control functions as a resonance adjustment.

Using the CV input facility on this module lets you control the LF band externally from a synth to produce swept bandpass 'wah-wah' effects which were particularly appealing on a direct-injected bass guitar signal, for example.

Setting the exact amount of equalisation is always quite difficult, but one way of simplifying matters is to continually switch the EQ from effect to bypass after each adjustment in order to hear the difference. All in all a very versatile module that would provide a powerful EQ system for live work or even the studio. *RRP £383 inc. VAT.*

Transpose/Sync

This module provides synthesiser effects and is designed for guitars/basses. It will only accept a monophonic input signal, but by using the controls it can produce outputs one octave above and either 1 or 2 octaves below the original. The switch labelled

Right hand panel modules.

'Lower Fuzz' is used to boost the extremely low frequencies through distortion, which introduces an upper harmonic content boost to add a bit more definition to the bottom end.

A dual dry/effect control lets you mix the relative balance between the various signals. The upper voice can be selected to track the original at any interval between a -1 octave/+2 octave range when voltage controlled via the rear panel CV input, or made to sweep up and down in frequency. This was excellent on lead guitar, and utilising the upper sync LED switch, the upper voice could be 'hard synced' to the input producing timbral modulation effects that totally transformed vocals and virtually turned a rather thin Casio MT-30 into a Prophet 5! If this was polyphonic it would be tremendous. *RRP £395 inc. VAT.*

Distortion

Four rotary controls provide adjustments to Tone, amount of Distortion, input Level and Sustain. The latter controls a built-in compressor which can be used to obtain long, sustained guitar lines without the need to resort to distortion if required.

The Distortion is variable in depth and produces a smooth overdrive sound when set below halfway, and a warm raspy effect on full. External voltage control is possible of both Level and Distortion, but the CV input signal is the same for both parameters, so you need to alter the panel functions to vary the relative depths of each. Considering the price of this module it is the most disappointing with a limited range of sounds on its own. *RRP £228 inc. VAT.*

Reverb

The unit utilises a 6-spring delay line, built into a 1U high, black 19" rackmounting case, with active limiting to help overcome the usual springline side-effects on transient material. The actual module houses controls for dry/effect Mix and there's a three band EQ which can be used to tune the reverb signal bandwidth to create different 'acoustical environments'. This has controls for Low Pass (200 Hz - 20 kHz) and High Pass filters (20 Hz - 2 kHz) and a Mid tone control whose frequency could be varied as well as the amount of signal cut and boost. Whatever you do don't mount the reverb on top of the System Controller as this tends to result in excessive 'hum'. A fairly versatile module. *RRP £315 inc. VAT.*

4 x 2 Mixer

Each of the four programmable inputs have both Pan and Level controls with a peak LED indicator to help set mixing levels. The input is panned between outputs A and B which are available at the rear panel ¼" jack sockets. Also on the rear are two A and B input sockets which permit several 4 x 2 Mixers to be cascaded to increase the channel inputs. This module has no in/out switch, since it is the one unit that you'll always have need to use and so it's left permanently in circuit once patched.

An interesting use of the unit is to provide a programmable level control for an external delay, for example, by patching the delay into a mixer channel and varying the mixer's Level control (and effectively altering that of the delay!). A basic module this one. *RRP £290 inc. VAT.*

Phase Shifter

Six 180° phase-shift networks are employed to produce three frequency notches which, when combined with the original input, produce phasing. A triangle wave LFO is used to sweep the notches up and down the frequency band set by the Range control. Regeneration is used to vary the intensity of the phasing, and controls are available for Speed and Depth of modulation which are indicated by a pulsing LED. Selecting Vibrato defeats the 'dry' signal completely to give a pleasant effect that resembles a Leslie speaker on faster Speed settings.

A built-in noise gate helps clean up the background modulation noise leaving a clean signal. Voltage control of both Speed and Range is possible on this unit which can lead to some interesting treatments. *RRP £290 inc. VAT.*

Flanger/Chorus

A stereo module offering delay times ranging from 0.5mS to 38mS, Regeneration and four sources of modulation: LFO triangle waveshape, LFO sine, Envelope Follower and an External control voltage. The modulation sweep ranges from 0.05 Hz to 10 Hz and LED indicators display the signal peaks, depth and rate of modulation.

Individual output levels for dry and effect help set up a wide range of flanging effects, and the Effect Invert pushbutton produces a 'hollow' colouration. The 12 kHz bandwidth ensures a bright, clear sound and a very rich chorus. *RRP £448 inc. VAT.*

Conclusion

The System Controller is a well designed, easy to operate device. Programmability is without doubt the plus factor of the whole Pro-FX system, and tied in with the modular format, makes this package highly desirable. The major hurdle is that of price. At £771 inc. VAT the System Controller isn't exactly budget-priced, and neither are the majority of the effects modules. As stand alone units (if that was possible) they lack in sound quality slightly in comparison to similarly priced devices. All said and done though, you are paying for the exclusivity of having the programmable function. Is it worth it? Well, that's for you to decide.

Ian Gilby **E&MM**

The Pro-FX 500 package is distributed in the UK by HHB Hire & Sales Ltd., Unit F, New Crescent Works, Nicholl Road, London NW10 9AX. Tel. 01-961 3295.

MUSIC MAKER EQUIPMENT SCENE

Moog gave us a preview of their new product, the SL-8, at the Chicago Show. As the name implies, it is an 8-voice polyphonic with split/layer capability. This means you can divide the keyboard with two different sounds (4 voices each) on either sides of the programmable split or double two different sounds on 4 notes over the whole keyboard. There are 100 programs plus 100 programmable locations of voicing combinations and stereo outputs. There is only one oscillator per voice, but sync sweep is possible. Normally this can only be done with two oscillators, but Moog have put in a circuit called the Variable Harmonic Multiplier which produces this effect from just one. There is also a sub-oscillator for each voice.

The filters are the patented Moog design (analogue) but everything else is done using digital technology from the DCOs to the envelope generators. Auto-tune is therefore no longer necessary and there is 8-bit resolution on all the knobs (giving 256 individual increments).

The digital nature of the instrument also facilitates the comprehensive arpeggiation/sequencer section. There are 3 polyphonic sequences with 500 notes each, and using the split voicing, it will be possible to play them in combination with each other or with the arpeggiator (at different tempos if required). The System Controller will have a blue flourescent display with an alpha-numeric keypad (like the Memorymoog). The instrument will also have MIDI in, out and through, and software will be available to run it with various popular home computers.

The other good news for Moog endorsees is that a sequencer for the Memorymoog will soon be available which will be standard on all models built from September, and for those who have already bought their instrument it is retro-fittable.

For information on prices and availability on all Moog products please contact: Ray Goudie, 11 Forth Wynd, Port Seton, East Lothian, Scotland. Tel. (0875) 812033.

Moog SL-8.

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Korg PME40X Modular Effects.

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Guyatone have developed the overdrive effect by including Bass and Treble controls on their new Overdrive Sonic pedal.

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Guyatone have designed a multi-function Stereo Chorus which provides a total of 4 patterns of chorus and vibrato effects.

All these new Guyatone models feature ON/OFF and battery indicator, AC adaptor jack and luminous labels for identification on a dark stage.

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ELECTRONIC GUIDE TO MUSIC TECHNIQUES

Polyphonic Portamento

by Dave Crombie

Dave Smith, the designer of the Prophet 5, was once asked why said instrument didn't feature any form of polyphonic portamento — it would have cost an almost negligible amount to provide such a facility, and as the instrument already had a 'glide' control (for monophonic use), no cosmetic alterations would have been necessary to the main control panel. He was of the opinion that because such a facility was beyond the control of the player, it was musically invalid.

Let's see what he meant by that. Portamento, as we discovered last time, is an analogue effect caused by the slewing of the control voltage routed to the VCOs. Thus the pitch slides from note to note as opposed to stepping cleanly when portamento is removed. In effect there will always be some degree of portamento between notes produced by the same oscillator, but the slew rate is so fast as to be aurally undetectable. Figure 1 shows a simplified analogue portamento circuit.

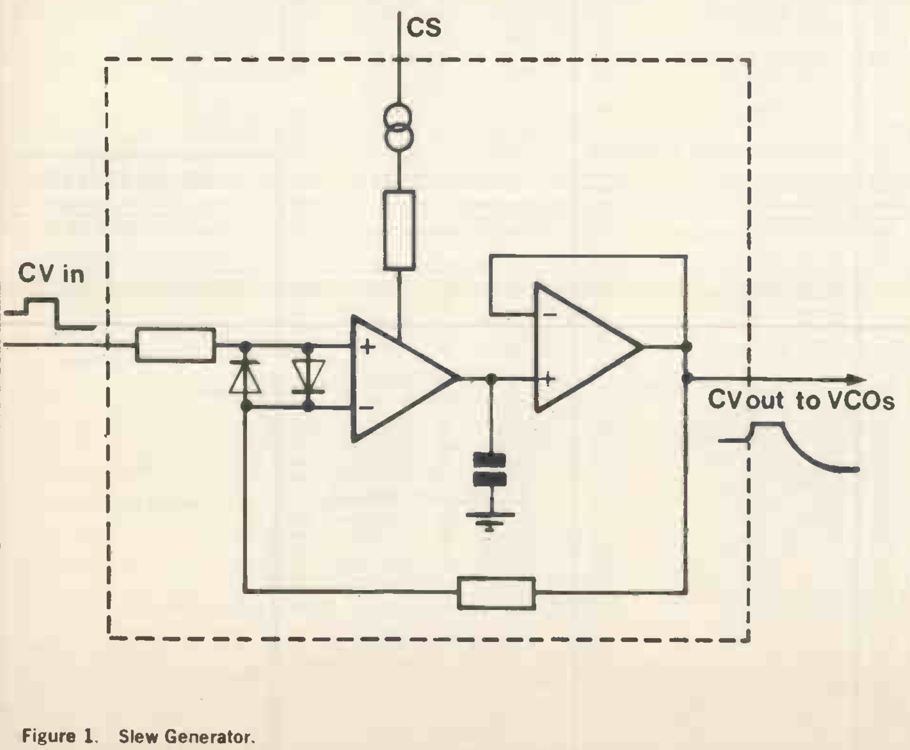


Figure 1. Slew Generator.

Consider a five voice analogue synth which offers poly-portamento; here we'd have five voices each with a similar circuit in the CV to VCO line. To determine the slew rate (octaves per second) a control voltage is applied (Cs) and this obviously will be the same for all voices. Say we played a five note chord, then another as shown in Figure 2a. Since all the notes have a different interval to travel they will all reach their destinations at a different instant in time; 2a shows a simple 1:1 relationship where the voice assignment leads the lowest note played to be routed to voice 1 etc. but more often than not this assignment won't be applicable and the situation will be even more confused as in Figure 2b.

This is the problem to which Dave Smith was referring — and there's no simple way out. If you think about it, polyphonic portamento/glissando is not too common a phenomenon in the world of acoustic music. Most acoustic instruments are monophonic anyway, and of those polyphonic ones the effect isn't that often used. Generally polyphonic glissando effects from keyboard instruments can be obtained by running one's hands up and down the keyboard — and you can perform exactly the same operation using the synthesiser's keyboard. Bottle neck, pedal steel and Hawaiian guitars are examples of polyphonic portamento that are 'under control' but again clever use of the pitchbender on your synth can get you pretty close to the desired effect. It is when you come to orchestral or ensemble synthesis, where you are simulating groups of instruments, that you may find yourself caught short without an accurate system of polyphonic portamento.

Figure 2a. Polyphonic portamento.

Figure 2b. Complex poly-portamento.

Dave Smith may have decried the musical validity of polyphonic portamento in the past, but I note that the Pro 600 has now got it. And let's face it, it is a pretty dramatic sound when five or six voices are swooping all over the place, moving from one chord to another, even though they might not 'get there' all at the same time. If you use just a hint of poly-portamento the gap between the notes is usually so small as to be virtually negligible. So even a crude polyphonic portamento effect is worth something.

The Prophet could have incorporated this if it had been felt desirable, but some polysynths, by their very design criterion, cannot accommodate this effect. These are the top octave tone generation models. All the pitches are derived either from a single high frequency VCO and divided down, or from 12 top octave generators which produce all the pitches for every note. Only voice assignable synthesisers can provide this facility.

Digitally Controlled Oscillators (DCOs) have thrown somewhat of a spanner in the works. These devices derive the pitch of the oscillators from the processor which puts out a pulse to a waveshaper that does the same job as a VCO, only it's cheaper and more efficient (no tuning problems etc.). However, portamento now becomes a bit of a problem as there is no voltage line in which to stick a slew generator. So if the synthesiser is going to offer this facility it will need to process the pitch data with much greater accuracy, and output a continually varying pulse train to the waveshapers. Some DCO based machines do provide poly-portamento facilities (eg. Kawai with their SX-210), others feel that the extra memory and processing room required doesn't warrant the effect, and thus don't feature it on their machines. Check this one out if you feel you want this effect on your machine.

Now perhaps we can start to solve our initial problem — the machine gun effect of all the notes reaching their destination at different times. If the machine has powerful processing facilities it is a (relatively) simple matter to build in a system whereby the user defines the slew time (T) rather than the slew rate. As the second chord is played the processor looks at these Destination notes (D1, D2, etc) in turn and then from the Origin chord (notes 01, 02 etc.) is calculated the distance each voice has to travel (D1-01, D2-02, etc.) and thus the slew rate (S) for each voice can be determined (S1 = (D1-01)/T, S2 = (D2-02)/T, etc.). This information can then be used internally by the processor to vary the pulse train accordingly, or, in an analogue system with separate slew limiters for each, to define the slew control voltage (Cs in Figure 1).

This is an extremely versatile system once initiated as it facilitates all manner of accurate sliding effects. For example, it would be possible to specify a start point either at the top or bottom end of the keyboard (say), so that any chord could be assigned a perfect positive or negative Glide effect, which is invaluable for certain imitative synthesis effects.

When using polyphonic portamento, even in its basic form, one must remember the importance of voice assignment. Systems vary from synth to synth, but knowing the order of note assignment, and when the next note played is going to be 'robbed', gives you so much more control over the output of your instrument — there's a lot more to synthesiser playing technique than is apparent to the piano convertee.

E&MM

KEYBOARD TALK

by Ken Lenton-Smith

Leslie Speaker

The ubiquitous Leslie Speaker — or perhaps we should call it a Doppler Speaker — is so inextricably connected with various types of electronic music that we tend to take it for granted.

Listen to some really old recordings of electronic organs and you will hear a difference; the Leslie had not yet arrived. Electronic vibrato was then the order of the day and, with the possible exception of Hammond's delay time and scanner system, the effect was often rather ungainly.

In the early Hammond days (circa 1939), the loudspeaker was sometimes placed at the bottom end of a tall, square enclosure resembling a large scale church organ Bourdon pipe. Mounted just above the speaker was a butterfly valve, similar to that in a carburettor, which was rotated to provide a tremulant effect.

I wonder whether this principle set Donald Leslie thinking? The butterfly valve simply chopped the emerging sound waves into slices but he was looking for a method of imposing frequency modulation on the speaker's output so that vibrato (rather than tremulant) could be obtained. In my view he did better than that as the route he chose combines both FM (vibrato) and AM (tremulant) and it is the mixture of both types of modulation that give the Leslie Speaker its characteristic sound.

Doppler Effect

The Doppler Effect is widely used in scientific circles; astronomers, for example, use it to measure the speed of a star. If it is moving away from the earth, we see the star as slightly redder than its true colour. Conversely, when moving towards us the star will appear bluer. At the other end of the frequency scale, sound waves are equally affected.

A moving sound source, such as a train's whistle, will drop to a slightly lower frequency as it passes. The pitch of the whistle may be constant as heard by the driver in his cab but as the train approaches us the pitch we hear is slightly higher because sound waves are reaching us at the frequency of the whistle *plus* the speed of the train. After passing, the apparent pitch will fall because the train's speed is now subtracted from the true frequency. See Figure 1.

Another thing we notice is the increase and decrease in volume as the train approaches and then recedes. This phenomena has been translated musically in various ways. Mounting the speakers on a rotating baffle has been employed, or a speaker spun on the end of a counterbalanced rod. The problems here are that connections have to be made by slip rings, which can wear and become noisy; circular mercury troughs have been used to circumvent that problem but if the baffle is large there still remains the question of getting it spinning fast enough.

Donald Leslie's solution was to mount a downward-facing speaker in an (almost) infinite baffle, below which was a rotor. When this is turned, the listener hears sound approach and recede from him as the mouth of the rotor passes — synonomous to the passing train.

Rotor

The shape of the rotor is shown in Figure 2 and the sound it emits is fairly directional. The rotor is circular for aerodynamic reasons but in effect it embodies a 45 degree 'sound mirror' under the speaker and the sound is thrown out through a wide port, almost in a centrifugal fashion (if such a thing applies to sound!). The width of this port and those in the tone cabinet or console are carefully designed for the smoothest effect. As the rotor's port passes, not only the Doppler Effect comes into play but also a momentary amplitude rise. Many electronic vibrato systems are excellent at imposing FM but the Leslie system's combination of FM and AM is quite unmistakable to hear.

Leslie's original idea has been copied by other manufacturers, perhaps with modifications of some sort, and this is the reason for the earlier suggestion that 'Doppler

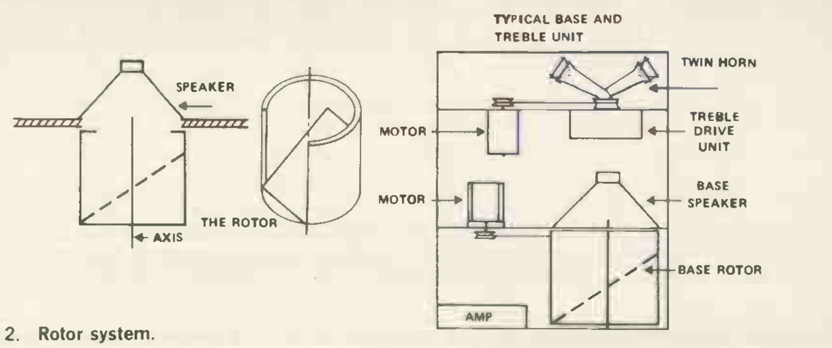


Figure 2. Rotor system.

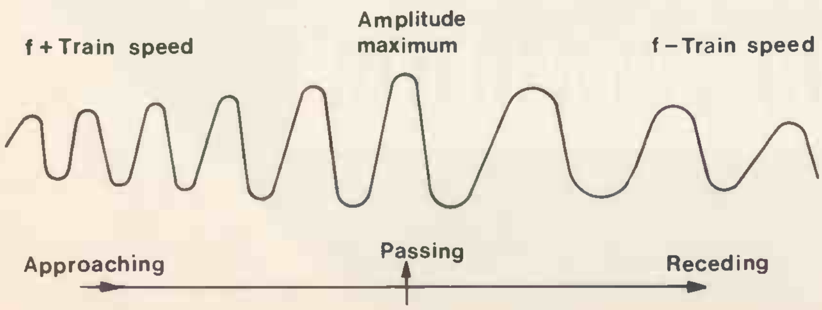


Figure 1. Principle of the Doppler Effect.

Speaker' should perhaps be a better generic term. If it is not obvious already, let me add that I wouldn't part with my Leslie 145 for anything!

The rotor should be made of dense material (heavy plywood is common) to ensure that all frequencies emanating from the speaker are projected through the ports. This requires a fairly powerful synchronous motor to belt-drive it. Motors with brushes are quite unsuitable as they will interfere with amplification.

When the system is used in an organ console, it is often turned on its side and the sound emerges from the side of the instrument. In this case the rotor is often made of polystyrene foam. Being light in weight, this can be driven fast by a modest-sized synchronous motor but will tend to absorb part of the speakers output. This arrangement is

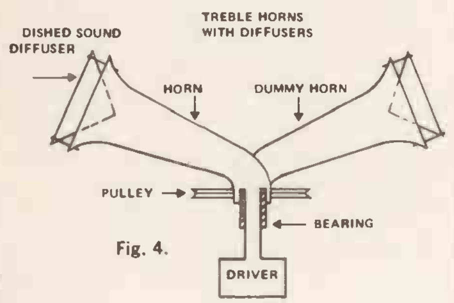


Figure 3. Horn unit.

reasonably adequate but better results are obtained from a separate Doppler cabinet with substantial speaker and rotor.

Although the tonal spectrum of keyboard instruments is not as wide as an orchestral recording, one speaker will be hard pressed to deal with 16 foot pedal and 1 foot manual pitches simultaneously. To emphasise modulation of the upper frequencies, Doppler cabinets are sometimes fitted with a horn pressure unit fed from a crossover network. Mounted above this are a pair of exponential horns (one of which is a dummy for dynamic balance), rotated by a second motor, (Figure 3).

Horn System

The bell of the operative horn is some 4" across and the modulation is rather too transient. This being so, small dish-shaped diffusers are mounted a short distance from the mouths of the horns to give a more bland effect.

Chorale is also obtainable by running both rotor and horns at a slow speed — approximately half a revolution per second. The effect is improved if the same signal is applied to a conventional speaker in parallel with the Doppler. This results in a slow heterodyning of frequencies, the meandering of sound being reminiscent of a large cathedral organ whose pipes are always minutely out of tune with each other. Chorale is equally useful for light and secular music, providing a round and spacious effect.

Of course, it is not possible to get a heavy rotor up to full speed immediately: the average vibrato speed is 7.5Hz so the rotor must turn at 450 r.p.m. Hence the typical run-up to correct vibrato frequency takes 2-3 seconds. Some organists appear to dislike this aspect but I find it useful to sustain a note or chord while the rotations build up!

Maintenance

Maintenance of the mechanical parts of Doppler systems tends to get overlooked. Motor bearings should be lightly oiled from time to time but not too liberally. The speed change from fast to Chorale is often by means of rubber-tyred pulleys, which may misbehave if they become oily. Methylated spirit applied lightly to the rubber surfaces will correct their grip in these circumstances.

Rotor and horn bearings also require occasional oiling and it should be noted that these are rubber mounted to eliminate noise. Belt drives should be inspected for wear and their tension adjusted if so required. Leslie belts are often made of cotton material but in an emergency could be replaced with light plastic belting; certain types of plastic belt can be cut and joined with a soldering iron.

E&MM readers will in most cases be highly practical, but think twice before considering construction of a Doppler system. The relatively high price of a commercial Doppler cabinet reflects the considerable know-how and skill that goes into manufacture. Be assured that a silent bearing is not that simple to make for this application. There is also the problem of finding a really powerful synchronous motor to drive that ideal but heavy rotor. Wind noise from the moving parts also has to be considered.

Weaknesses in this respect will come to the fore when you set up your stereo mics and Dolby tape. No matter how sweet the music, bearings that rattle and groan will be recorded faithfully. Finally, if you own such a speaker system remember the maintenance and if you don't own one forget about construction!

E&MM

E&MM EXCLUSIVE

DX Digital Drum Machine

Marcus Ryle of Oberheim Electronics introduces the review by talking about his design

"The DX is a digitally sampled drum machine that was designed after our DMX digital drum machine. We took out the modular voice card design which the DMX has, which has user changeable voices in order to bring the cost down to £1,000 retail in the UK, but we didn't compromise at all on any of the sounds that are in the DX so we still have the same high-quality recordings that we had in the DMX. The DX has three volume levels of bass drum, three volume levels of snare drum, two volumes of closed hi-hat and open hi-hat, three toms, three volume levels of crash cymbal which is a long crash cymbal by the way, two volumes of shaker and hand claps. It also has the same memory capacity as the DMX which is 100 sequences at 50 songs and will store approximately 2,200 events, ie drum beats, which is more than twice as much as the competition in that price range. We still have the direct outputs on all of the drums, and the clock in and out so it'll be compatible with 'the system' ie. the DSX and the OB-A.

There is no MIDI interface on it but we're currently looking into MIDI and our stance currently is that we will most likely put it on future products. We have a parallel interface we've been doing for about three years which is of course much faster than MIDI and that's how we do our sequencer to synthesiser interface. The transmission is very fast and we've been very happy with that interface but it's too expensive for a lot of the other manufacturers to get into. We have to have a 37-pin connector and the other manufacturers wanted to do something that was more affordable of course. We will probably be including MIDI in the future but we wouldn't be able to do everything that we are currently doing with our own interface system as it's not as versatile nor is it as fast. So as far as the DX is concerned, the interface is done with the clock in and clock out which we feel, at least for the moment, is sufficient information to do just about anything you'd want to do with a drum machine.

You can always use the clock out to drive the other machines in any case, which is exactly what we usually do in a normal set up of 'the system'. The sequencer's clock input is able to sense when the clock starts up and it automatically jumps into play (it doesn't need to be told 'start at the beginning of the sequence here'), and it also notices when the clock stops to go into stop, so with an ordinary jack-to-jack from the clock of the drum machine to the clock of the sequencer, you can start both machines from the drum machine.

The clock pulse is 96 pulses per quarter note whereas the TR808 is actually 24 per quarter note and I think the Linn Drum is 48. They are even multiples of each other so you can use them all together. The DX has more resolution than the others do but they can all function together.

The DX has all real sound samples. It's certainly the most realistic way to get drum sounds. We've been working on it now for quite a few years, we have a dedicated computer system for doing the sampling — it allows us to edit the sounds and alter them in computer memory and get them to sound just the way we like them. The tom-tom sounds are the same samples but tuned differently. Each voice card or each set of three buttons on the DX and the DMX are a single voice consisting of one DAC, a counter and some memories. Sometimes the memory is one sound with either different pitches or different volume levels, sometimes the memory is divided for two separate sounds. The toms are one sound recording at three different pitches whereas in the DMX we have two separate tom recordings, each with three different pitches giving six toms. There is one recording of bass drum but three volume levels of that same sound, the snare sound has three volume levels and so on.

Each drum has a tuning pot on the back panel. The cymbal tuned all the way down sounds quite a bit like a gong in fact. Your readers may also be interested that on the DX all of the tunings are in fact voltage controllable — there's actually no connector inside but the tuning pots on the back go to a connector on the board and are simply providing a voltage for each drum for the tunings so if a hobbyist wanted to have something else actually controlling the pitch, you could do that. The voltage range is 0-5V.

The DMX actually has a connector on the back with eight individual control voltage inputs that can control either pitch or volume of each of the voices which enables you to do quite a few other things. It also has eight trigger inputs to trigger the drums. If you wanted to, you could use an external computer to be changing all those things as well. There's a gentleman in the United States who's taken a set of practice pads and designed a little circuitry and has it set up so that hitting the snare drum harder adjusts the volume. The thing sounds amazingly like real drums which are continuously dynamic on all sounds.

I think the most important thing that we did in designing this was not to skimp on the amount of memory necesary in order to get a good sound. We're sampling at a significantly higher rate than the other machines which means it takes more memory but I think we result in a better sound. Certainly the crash cymbal is a difficult one and it takes up the most memory space. The chips in the DX are 2764 EPROMS, and there is one for each of the five standard voices and then there are 4 x 64s, that's 32K of memory, for the crash cymbal.

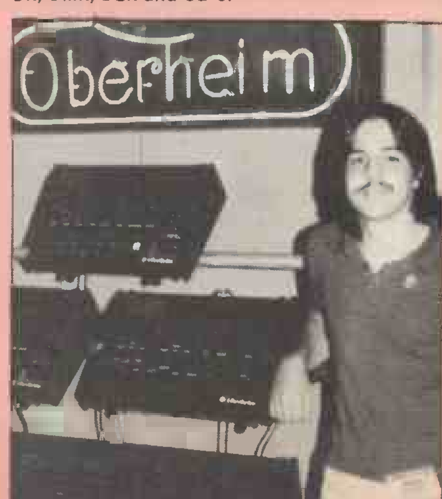
The bandwidth is dependent on the pitch of the sound, but I believe, with the pitch of the cymbal, it normally ends up we're actually sampling at a rate close to 40kHz. Some are between 35 and 40k, and it's quite a bit higher than the others, because you really need the high end. The crispness of the cymbals is what seems to show through. The hand clap is also sampled. In fact, out of all the sounds it is probably one of the most difficult because even when you get a hand clap recording good enough to make it convincing, you have to have a hand clap recording that will sound convincing when it's repeated and real hand claps are different every time. A lot of factors go into what someone might call 'good handclaps'. What we actually did was simply record quite a few sets of handclaps, digitise a number of different ones and then one of us took a survey of what people liked and came up with what we think is a really useable hand clap, even though it is the same every time.

We're very happy with the sound quality we've achieved. It's been an Oberheim philosophy to always put the sound first and sometimes that means our machines end up costing a little more but we don't want to compromise on the sound — that's really what our name has been based on, it's very important to us. There's no glitching at all in the DX. Not only did we digitise the sound and put a DAC in there, but we carefully selected all the components to fine tune each voice individually so that it sounds best for that particular purpose. For example, the cymbal you want to have nice high end. On other sounds that may not be as important as having a long sustain sound and so on.

We have about eight engineers in the Engineering Department and we all work on different facets of the product. The Oberheim Organisation is not really a very specialised, very small cottage industry anymore, with 'the system' and how it's grown over the last few years. We have all of our manufacturing in house as well, we have approximately 80-90 employees, and these machines are being turned out at quite a fast rate now. We're certainly producing quite a few DXs. It's already available on sale in the UK at Chase Musicians and Rod Argents is also a dealer for it.

I think sound sampling will be important in the future, not just with drums, but each individual type of sound has to be addressed separately because they all have specific problems when they are sampled. We find that drums are particularly well suited to sampling and the techniques we use. There are other instruments which when sampled are less realistic. I would be hard pressed to call what some machines call a sampled violin a 'real' violin. These are very difficult for all involved and since at Oberheim our main concern is with the sound, we do things that sound good and if we can't make something sound good, we won't put our name on it."

Marcus Ryle with the Oberheim 'system', DX, DMX, DSX and OB-8.



The instrument comes in the classic Oberheim livery, a wooden-ended metal case with a blue-striped sloping front panel, 18 inches wide, 12 inches deep and 5 inches high. Apart from the volume sliders, all the programming controls are the sturdy, ¾ inch square buttons which seem to be 'de rigeur' on all the professional quality drum machines. These are uniform black with the exception of the white Play/Stop and the red Record buttons. All Mode Function buttons (as opposed to Instrument buttons) have an LED set in them, which tells you at a glance if they are in operation. On the left hand side, there is a numeric key-pad with four 7-segment displays immediately above to give status readout in the various modes of operation, and above this is the standard illuminating mains switch.

The Instruments

For substantially less money than the DMX, the DX still features most of the instruments it's big brother has, with three Bass Drum buttons, three Snare buttons, Hi-Hat (Open, Closed & Accent buttons), High, Mid and Low Toms, Cymbal (Soft, Medium and Loud buttons), two Shaker sounds and last but by no means least, the increasingly popular Claps. These are tidily arranged in columns of three from lower right to lower middle of the panel. Immediately above each column is its individual volume slider and the instrument name, presenting a very neat and clear layout. The first column is the Bass Drum and has a button each for Soft, Medium and Loud. This allows considerable subtlety of accent to be programmed into a rhythm pattern, whatever the overall mix of the instrument set on the volume slider. The actual sound (a digital sample of real drums as are all the sounds) is as 'meaty' as one could wish with a nice distinguishable 'smack' from the pedal. There is no loss of power in the sound even when it is retriggered rapidly, often a problem if the rise time on a bass drum is more than 5mS.The next column along, Snare is organised on a similar basis, Soft, Medium and Loud in descending order. Again full marks here for a good solid full sound, entirely acoustic in feel and a welcome relief from the synthetic, over-resonant snare sounds featured on many records these days. Again two separate sounds, the stick against the head and the snare spring can be heard. The interplay of just Snare and Bass sounds at the Accent levels enable some very powerful rhythms to be created.

The Hi-Hat column assigns the three buttons slightly differently, uppermost to Closed, middle to Accent and lower to Open. A small point but I would have felt more comfortable with Closed at the bottom and Open directly above it as I found 'real time' programming a little awkward. No such complaint about the sound, however, with the Open to Close transition being particularly effective. Oberheim have taken great care to keep the bright clear characteristic of quality hi-hats and cymbals by not skimping on the resolution necessary to capture the high frequencies. The Tom sound (next column of buttons) is equally good, being a great improvement on the original DMX tones. The pitch is clear without the resonant 'ring' of some toms and there is plenty of depth. The only problem is really in terms of triggering. As all three Toms (High, Mid and Low buttons) are the same sound off one chip read out at different speeds for different pitches, it is not possible to get two toms sounding simultaneously and in a roll the triggering of a lower (or higher) tom causes the first tom to cut off sharply. This is clearly something dictated by economy (the DX does represent extremely good value-for-money) and need not be a problem with careful programming as long as one is aware of it. 'Real time' programming of the toms can be a little tricky as the 3 buttons do not fall naturally under the fingers in the column, but this is a natural result of the logical layout of the instruments. A slight sidewards approach can help this positioning.

The Cymbal column reverts to the Soft, Medium and Loud buttons, and it is this sample which is the triumph of the DX. By using 3 chips on this sound, they have achieved both high resolution and length giving one of the most authentic cymbals available. In Soft or Medium, it a very crisp 'ride' on retriggering, whereas Medium gives a nice 'splash' effect and Loud gives a good enough enough 'crash' to end a track with. The decay on its lasts a good 10 seconds and is free of all glitches, dying smoothly away without any rise in background noise.

The Perc column is perhaps the most disappointing. It features 2 Shaker sounds and Claps (an indispensable addition to any drum machine these days). The Claps are excellent and have a nice ambience as well as a sharp attack. They retain authenticity even on fast retrigger and mixed in with the Snare give an almost inhuman crisp backbeat (a la Bruford snare sound). However, both Shakers are disappointing. Never the most useful of percussion, they seem rather weak in comparison to all the other excellent sounds and even at full volume tend to both get lost in the mix and at the same time render the crisp rhythms of the other sounds somewhat 'woolly'. I would have preferred the retention of either the rim shot or tambourine sounds of the DMX, which have a greater clarity.

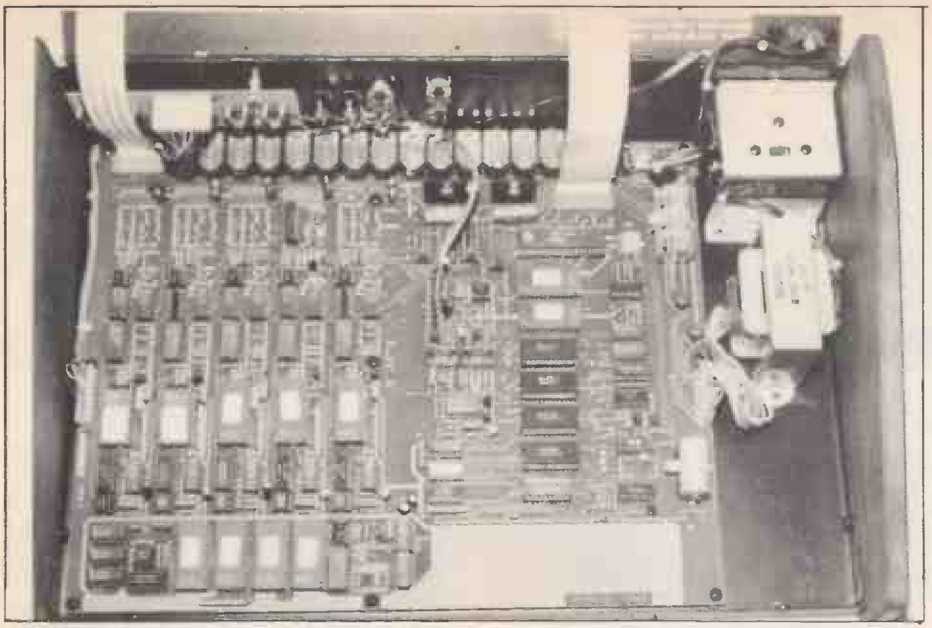
The Programmer

The DX programmer allows you to choose the way you record your rhythms. Real and Step Time are available, or the two can be used in combination. Using whichever method, patterns from 1 to 99 measures (bars) can be built up and then chained together into 'Songs'. There are 50 Song locations available and each can take 255 events. As memory is shared between all locations it can be used in a variety of ways to maximise the potential and if the potential is all used up, the display shows 'Full', the DX 'beeps' and it is impossible to erase patterns already recorded, unlike some sequencers and drum machines which start deleting from the beginning or ignoring further commands.

Real Time Recording

A metronome is provided to facilitate real time recording and its volume slider is immediately next to those of the instrument columns, with the master volume slider last in the row. The metronome is heard through the mix out when in 'record' mode, but is always available as the 'Click Out' from the Click Output jack socket on the back. The metronome can play minims (1/2 notes), crotchets (1/4), crotchet triplets (1/16), quavers (1/8), quaver triplets (1/12), semi-qua-

The DX rear panel.



The DX opened up.

vers (1/16), semi-quaver triplets (1/24) or demi-semi-quavers (1/32) (allowing 48 notes per 4/4 bar sequences to be triggered using the 'click'). The metronome ('click') can be changed at any time before or after recording which is very convenient. Nothing is more annoying to have written your drum pattern than to discover that you have to re-record it with a different click speed. With this facility you can change the click halfway through to help you record a tricky hi-hat line, for example, or change it afterwards to come in line with a sequence.

The DX defaults to two measures in record mode but by pressing Length, you are able to alter this to any length from 1 bar to 99. Similarly the bars default to 4/4 but by pressing Signature you can alter the number of beats in the bar and pressing Signature again allows you to change beat length from 1/2 to 1/32 notes. The Quantize feature is an auto-correct function which can be set to correct to the nearest 1/4, 1/4 triplets, 1/8, 1/8 triplets, 1/16, 1/16 triplets, 1/32 or 1/48. It can also be defeated (switched off) to allow resolution down to 1/192 of a bar. Tempo defaults to 80 beats per minute but can be adjusted by pressing Tempo and entering the number of beats per minute from 25 on the numeric up to 250 BPM on the numeric pad in a similar manner to the other 3 functions which control the recording process, but this function can also be accessed during playback. Tempos inserted in record are remembered and reproduced on playback, but they can be over-ridden in playback. Different bars can have different tempos, clicks, quantizations as well as different time-signatures, in other words each bar is independently programmable.

Step Time

This method of recording allows you to assign a note value from 1/2 to 1/64 to a step, any number of steps to a bar and any number of bars from 1-99. On each step, up to 6 instruments can be recorded until the desired pattern is created. Tempo can also be set while recording.

Swing Feature

This is an extra function in real-time record and acts in the same way as Quantize, that is to say it 'corrects' your playing to programmable limits. The DX defaults to 50% swing which means that the second 'half' of the beat takes up the same amount of time as the first 'half.' However, by increasing the percentage you can extend the amount of time the first 'half' takes at the expense of the second (keeping the beats themselves constant). At maximum (70%), this gives the equivalent of two triplets to the first 'half' and one to the second. This gives a pacy, more human feel to the beat. However, as Swing is a Record/Auto-Correct function, it is not possible to remove it if you do not like the effect produced. Any lines recorded in this manner must be erased and re-recorded after the Swing has been reset.

Copy/Append Feature

This is one of the strongest points of the DX. Before using the Song Feature it is possible to expand and combine the simple sequences themselves and store them in one sequence location (allowing longer and more complex songs to be stored).

Firstly, one can copy any sequence from one location to another. But by holding down Record as well as Copy, one can add a sequence to another, ie. Appending. This can be done until 99 bars have been stored in one sequence location. The practical upshot of this is that entire 'verses' 'middle eights' and 'choruses' can be stored in one location. It is possible to append sequences to themselves, to append sequences in different tempos or time signatures and to create complex pattern changes within one memory location by these means. This quite often means that you do not need to use the Song mode at all. However, for those who need long, constantly changing drum parts (Jazz- and Progressive-rockers) this is the section for you. Now let us look at the programming of chains.

Song Mode

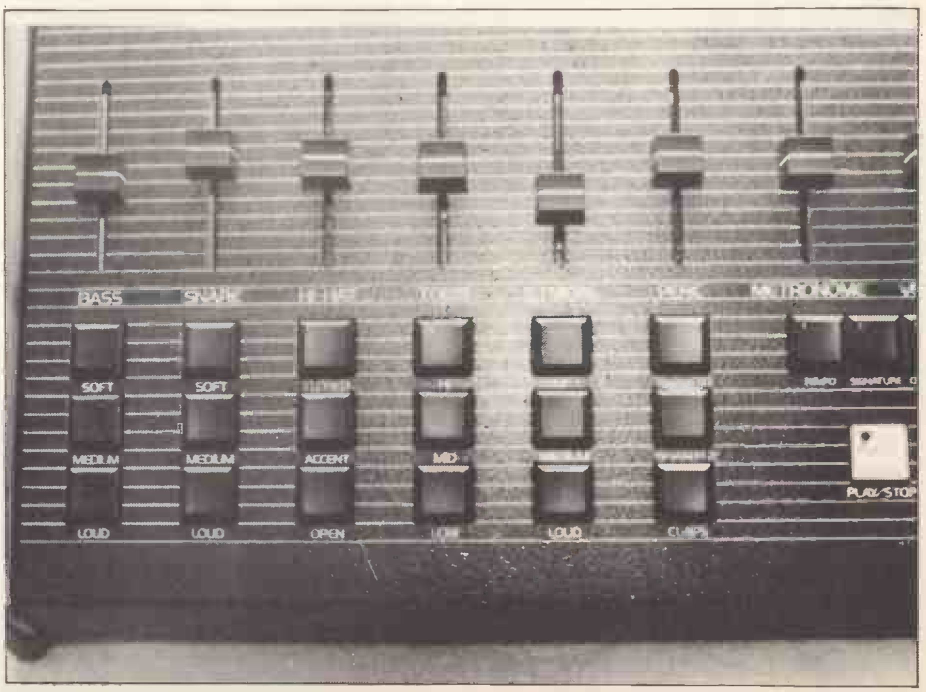
As with most drum machines this is called Song Edit. Whereas there are 100 sequence locations (fairly standard for this type of machine), there are also 50 song locations (considerably more than the competition at the same price). This means that a typical length 'set' can easily be stored without making use of the cassette dump facility. Few people will perform 50 songs in an evening, so the only limitation is the 220,000 event storage.

Programming songs is simplicity itself: one simply assigns a sequence number to each of the (up to) 255 events in a song. The only other function which needs to be assigned is End. Repeats are unnecessary as these can be inserted into the sequences themselves using Copy/Append. Songs can be re-edited at any time, and can be of any length. An overall tempo can be set which proportionally speeds up or slows down the individual tempos in each sequence (an extremely useful function which saves having to reprogram each individual sequence if a slight tempo change is necessary).

Back Panel

At the right end are the six presets controlling the tuning of the six columns of sounds (unlike some drum machines which have no tuning facility or others with only one overall tune). Basically this adjusts the speed at which the digital information is read out, and changing the frequency alters the pitch. Again, as the three toms are all one sound, the tuning adjusts the pitch of all three simultaneously, but the other instruments are all individually tunable, a very useful feature indeed. Perhaps the knob range is a little wide (the highest and lowest pitches are a bit extreme), but this is far better than having a limited range, as careful adjustment allows the necessary accuracy of tuning.

Below these are the six individual outputs, plus the click output (programmed using the Metronome). The volume of these outputs is unaffected by the sliders on the



Left-hand voice controls.

front panel (which are only active on the mono or stereo mix) allowing them to be put through a mixing desk and equalised and mixed individually as required.

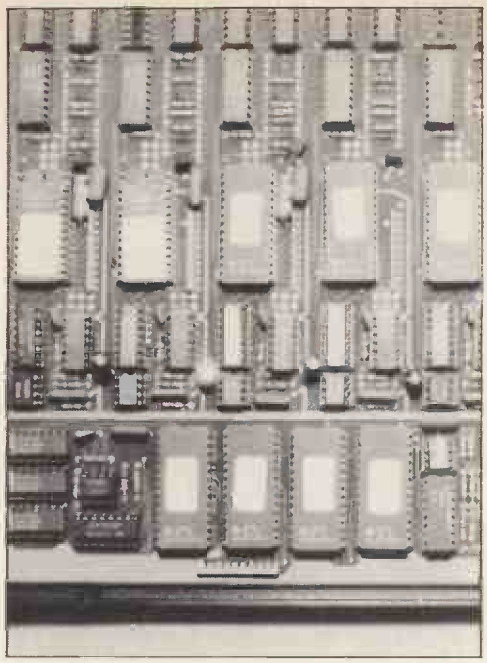
Next to these we have the three mix outputs, Left, Right and Mono, allowing the full mix to be heard if only one amp channel is available, or a stereo spread if two channels are used. Then come 2 footswitch inputs, Start/Stop and Next (for advancing the sequence/song number). Trigger Input allows the machine to be externally triggered and Clock In/Out allows Sync to Tape for which the software update will soon be available. Above all these jack sockets are two switches, the all-important Memory Protect and Cassette Interface Enable.

Cassette Interface

This is accessed by two standard jack-sockets (as opposed to mini-jack sockets, as is so often the case — I wish more manufacturers would follow Oberheim's example as mini-jacks are so much more delicate and difficult to make up into leads). The Song, Edit and Step Buttons double as Check, Play and Record Functions when the Cassette Interface Enable Switch is on. With the Interface it is possible not only to dump programs onto tape and reload them into the DX, but by playing them back in again, the DX can be made to check the information coming in against that already loaded and verify that the two are the same. The whole process takes only a few seconds and is extremely reliable.

Internal Circuitry

The processor which runs the DX is the Z80 (CPU). There is 16K of firmware (for instructions) provided by two 2764 chips and 8K of CMOS RAM (four 6116 chips) with battery back-up to handle the system and programs.



The DX voice circuitry.

The Bass and Snare Voices are each stored in a 2732 chip (4K of memory) and the Hi-hat and Toms have a 2764 (8K of memory) each, as does the Perc channel. The remarkable Cymbal sound uses no less than four 2764s (that's 32K of memory) to allow the necessary resolution and speed for the higher frequencies it contains.

Each voice has a counter, clocked by a 555 oscillator. The frequency of the clocking is adjusted by voltage control from the tuning presets on the rear panel. The stored data goes through a companding DAC (one for each voice, hence the extremely high quality of the DX's sounds) and is then filtered to remove quantization noise before being connected to the final mixer at the respective output. It is the way in which each voice is separately clocked, controlled, converted and filtered (unlike most of the other machines in this price bracket) which has led to the high quality and independent controllability of the sounds.

Summary

Oberheim have not let their standard slip whilst producing this competitively-priced digital drum machine. It looks good, it sounds very good and it has lost none of the memory space and programmability which usually accompany the modification of a more expensive product to a more economical price bracket. Indeed, to my ears it sounds better than the DMXs I have heard. I am told in fact, that the specially recorded new sounds for the DX are now available for the DMX as well, and this is the beauty of this system, that all the sound chips are user-replaceable. To get a new drum sound, a better drum sound or even just a different drum sound (and at this quality level, it is all really a matter of personal taste), you don't need to buy a new machine, just a new chip with a different sound stored on it. This, coupled with the extensive memory both of sequence length and song location together with the ease and flexibility of programming, makes this drum machine a good long-term investment.

The DX drum machine can be seen at Chase Musicians, (22 Chalton Street, London NW1. Tel. 01-387 7626) who are the Oberheim importers for the UK. Their current price on the DX is £999.

Paul Wiffen **E&MM**

RECORD REVIEWS

John Miles: Play on
EMC 1651471

John Miles has made a bold move by abandoning his backing band of the last decade and using the musicians his producer Gus Dudgeon has hired. The lyrics are still written by Bob Marshall, but his place on bass is now filled by Paul Westwood and Barry Black (the man who put all that pace into 'Slow Down') has been replaced by Graham Jarvis. Miles shares keyboard credits with Pete Wingfield and synthesiser specialist Duncan McKay and the guitar playing with Martin Jenner. Mel Collins throws in a couple of classy solos on sax.

Miles is clearly now being promoted a solo singer, which is a shame for the band were a powerful unit. It is for this reason that the bulk of the first side doesn't have the power of previous Miles recordings. There are also very few of those blistering guitar solos which were highlights of his records and concerts alike. It is only on 'I'll Never Do It Again' that any hint of former punch shows through. Miles was one of the great rock 'n' roll guitarists of the seventies and on this track he shows he hasn't lost it.

Side Two is much more satisfying beginning with 'Heart of Stone', a snappy disco track which could repeat Miles previous success in America with 'Slow Down' (the first disco single by a white artist to make it into the Billboard chart). Indeed the voice-box solo harks back to this former success. An all-star brass section punctuates the crisp rhythm section. 'Home' is another soul ballad in the vein of 'Lady of my Life' or 'Time' which, like these former tracks, has a definite something of Stevie Wonder in the vocal style. A steamy sax solo from Mel Collins completes the atmosphere of the track.

'Close Eyes Count To Ten' has more than a hint of 'What a Fool Believes' and features Martin Jenner on lead guitar whose languid style contrasts well witht he fury of Miles second solo. 'Carrie' (no relation to the Cliff Richard hit of the same name) is back to Miles' old style and boasts some fine orchestral touches from Duncan McKay, which with the counter-melodies from Miles' guitar in the chorus add an extra music depth to the song. But we have to wait to the final track for the classic. It begins innocently enough with Miles' flowing piano lines and breathy vocals, but Bruce Baxter's orchestral arrangement which had been in the background for the first two choruses suddenly hijacks the song. Miles screaming guitar comes in over the top of the major 7th and minor chords, climaxing in the final chorus, a statement of personal independence. The echoed guitar phrases at the end bring up the gooseflesh. It properly this track released as a single could, with enough airplay, repeat Miles success with 'Music'. It certainly deserves to put Miles back into the public attention.

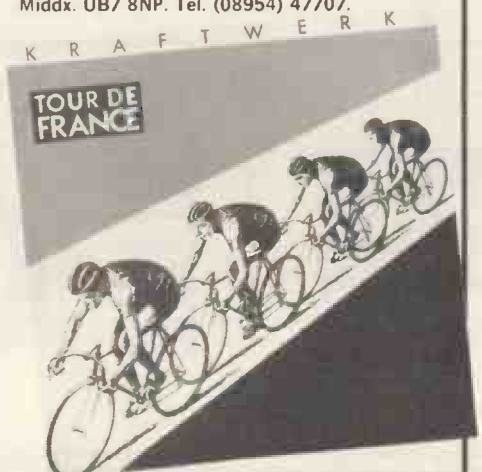
Singles

Kate Bush: Ne t'enfuis pas b/w Un baiser d'enfant
EMI (France) PM102

Inported by Conifer Records, this French release was the B-side of her last British single 'The Dreaming'. It begins with a earth-shattering Linn drum pattern with Del Palmer adding a rich fretless bass-line. Kate plays Fairlight and breathes sensously over the top. Definitely reminiscent of 'Je t'aime'. By the way, 'Ne t'enfuis pas' means 'Don't Go'. How could we when she asks so nicely?

The B-side is also an interesting collectors' item. What Peter Gabriel did for the Germans and Abba for the Spaniards, Ms. Bush has done for the French. She has re-recorded the vocals to 'The Infant Kiss' translated into French. If more artists did this, I'm sure their European sales would benefit.

If you have trouble obtaining this single, contact **Conifer direct at Horton Road, West Drayton, Middx. UB7 8NP. Tel. (08954) 47707.**



Kraftwerk: Tour de France EMI 5413

More continental capers: German electronic band sing of French international cycle event. The rhythm track, synthesised percussion and sample heavy breathing is very effective, but the music is the usual minimalist stuff. More French lyrics (giving course details) spoken between a tinkling arpeggio and a harp glissando. On the B-side, you get an instrumental (without the irritating vocals) and on the 12 inch you not only get a long version (6½ tedious minutes) but also a version without the music. I like this version best, but not for long.

Asia: Don't Cry TA3580

Someone English singing in English at last! Oh, it's this lot again. See the album review for comments on this track. I only mention it because there is an excellent track called Daylight on the B-side, which for some inexplicable reason has been left off the album. Beginning with church organ, it features the ensemble playing a tight syncopated number. By the way, the 12 inch version also includes the best track off the LP, 'True Colours', for those of you who can't afford the Alpha album.

Paul Wiffen **E&MM**

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HOME ELECTRO-MUSICIAN

This month's Home Electro-Musician is Brian Whiting, who by profession is a Doctor of Pharmacology.

My musical world finally turned over when I first heard 'Dark Side of the Moon' on a car stereo somewhere in the High Sierra, California, late one night in 1978. Up until that time, the only significant dent in my classical world had been made by YES and ELP. Otherwise, my musical experience stretched back to choirboy days, to a limited period of piano and organ training, and to many years of singing in, and finally directing, a small choral group. At the same time, one of the many aspects of music that had always fascinated me was rhythm, and this, together with a passion for modern classical music, drew me towards composers such as Stravinsky, Boulez and Messaien. But I was also intrigued by the deceptively simple, yet enigmatic rhythms set up by Steve Reich and Terry Riley and by the compelling rhythms generated by Tangerine Dream. These diverse forms were the background to my more recent (electronic) musical interests and represent the kind of experience which can form a useful bridge between what we understand as classical music and the relatively new means of musical expression and rhythm generation provided by modern electronic instruments.

When I returned to Scotland in 1979, I decided to learn as much as possible about electronic music, and, helped by a small group of enthusiastic friends, started in a relatively small way with a Powertran 'Transcendent 2000' monophonic synthesiser. This instrument was an excellent introduction to all aspects of electronic music, but I quickly realised that some form of multitrack recording system would be required if music was to be created! After some extremely frustrating months 'bouncing' noisy tracks inefficiently from one radio-cassette to another, the purchase of a TEAC 144 transformed this aspect of composing into a kind of joy! As the emphasis of my work would indeed be on composing, the relatively limited monophonic capability of the Transcendent soon became apparent and it was not long before I acquired an interesting polyphonic instrument with a number of preset orchestral sections, an Italian 'Siel-orchestra'.

At this time, I began to realise that an enormous amount of hard work (and concentration) is required to produce a 'finished tape'. My first significant effort, a collaborative venture with my friend Hamish Good, was a fairly comprehensive tape of original music and sound effects for a play about the Orkney Islands, 'A Spell for Green Corn', by George Mckay Brown. This experience taught me two important lessons: no amount of sophisticated electronic equipment can substitute for good musical ideas and the production of a detailed musical score may be an extremely important and time consuming process. On the other hand, 'automatic' devices such as sequencers and arpeggiators may lend themselves to free, improvisatory composition of the kind that cannot be written down beforehand. Indeed, I think that these devices represent a unique contribution to modern music and it is doubtful whether their full potential has yet been realised.

Composing with the Juno 60.

But returning to the theatre, initial success with the music for the Orkney play led to a number of other commissions, including music for two of Samuel Beckett's plays — 'Waiting for Godot' and 'Come and Go' — and the Greek Tragedy 'Antigone' by Sophocles. I find this sort of work interesting and challenging because it demands a real understanding of the drama itself. This understanding (hopefully) provides the right kind of musical inspiration although I must admit that Samuel Beckett does pose a unique kind of challenge! Much of this music is, of necessity, atmospheric in nature and it seems clear that the electronic music medium is an ideal vehicle for this. For the 'home musician', a strong connection with a dramatic society provides one very useful outlet for musical ideas, particularly if the more usual connection with a group is not sought, or solo performance is not contemplated.

Many aspiring electro-musicians have probably found it impossible to resist the example set by Tangerine Dream. I am no exception and when I am not composing for a specific purpose, then the Tangerine Dream influence is pretty obvious. In a way, this group has defined the direction in which a great deal of electronic music has gone, and will continue to go, both from the point of view of rhythmic complexity and the quality and intensity of synthesised sound. In my work, I realised that the best approach to the creation of *new* sounds would be to have complete control over all sound parameters and that this could easily be achieved by working with a modular system such as that produced by Digisound Ltd. Again with a group of friends (including Ken McAlpine and Jim Grant) I have spent the last two years assembling a Digisound modular system and hope to have it controlled by a microcomputer (Acorn Atom) with an OMDAC (E&MM June 1983) in the near future.

The other instrument which I acquired more recently, and which has made a tremendous difference to my musical activities, is a Roland Juno 6 polyphonic synthesiser.

All these sound sources are processed to a greater or lesser extent through a number of peripheral devices including a spring-line reverberation unit (Maplin), an analogue echo chamber (Melos DE-1), a flanger/filter matrix (Electro-Harmonix Deluxe Electric Mistress) and a ten band graphic equaliser (MXR). Percussion/rhythm is provided by a Clef Products Master Rhythm and mixing before recording with the TEAC 144 is carried out with a simple (noiseless!) passive resistance mixer (DOD 240). Finally, the output is played through a Sanyo G 2611-Super Hi-Fi System and tapes are made using a TEAC A-770 Stereo Cassette Deck.

As I have hinted, writing and recording music for plays is an excellent outlet for the amateur electro-musician, but I also enjoy creating and recording less formalised music, often inspired by visits to fascinating places such as the Zen Buddhist Temples of Kyoto, Japan, and the mountains of the Sierra Nevada, California. The limitless expression allowed by electronic instruments is extremely well suited to improvisational work of this sort. Titles include 'Ranryo-o-no-ha', 'After Nagasaki' and 'Sierra Dance'.

For sheer fun (and it all must be for fun!) I have finished a number of smaller pieces based on interesting rhythms generated with the Juno 6 Arpeggiator and the Clef Master Rhythm. The future looks good because the 'home electro-musician' can have at his disposal an impressive array of electronic equipment, including microcomputer control, which, used skillfully, will lend itself to endless musical invention.

Brian Whiting **E&MM**

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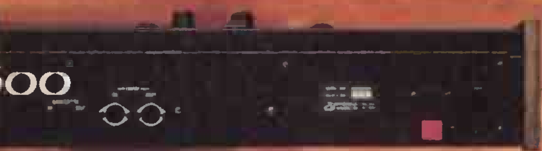

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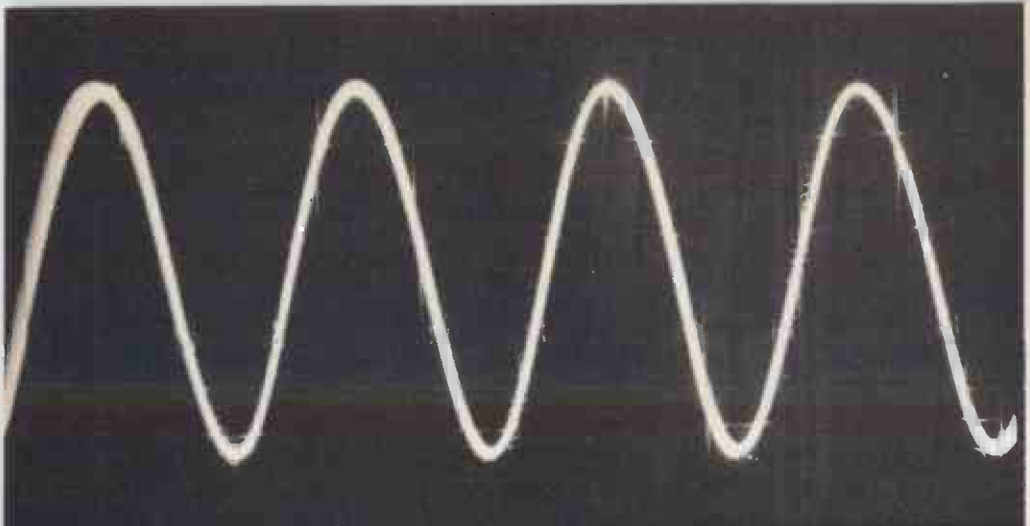


Figure 1. Sine Waveform.

Oscillators And Waveforms

by Robert Penfold

Looking back through past issues of 'Electronics And Music Maker' it is not difficult to find a number of projects which use at least one oscillator, and a brief examination of a few circuits reveals that the oscillator circuits used vary considerably from one project to another. The reason for this diversity of oscillator configurations is merely that the requirements differ greatly, with one project perhaps requiring a squarewave clock signal at a high frequency of a few hundred kilohertz, and another project needing a sub-audio oscillator having a triangular waveform to operate a VCA, VCF or VCO.

In this article, we will consider a few useful oscillator circuits which provide most waveforms that the electro-musician is likely to need. One or two Voltage Controlled Oscillator circuits will be included.

Sinewave Generator

The oscillograph of Figure 1 shows a sinewave, this being an important waveform since it is produced by an oscillator which provides a fundamental with no harmonics or other frequencies. This gives an audio sinewave signal a very distinctive sound which is easily distinguished from any other waveform.

Although a sinewave is in a way the most basic of waveforms, it is actually quite difficult to generate a very high quality signal of this type. Probably the most common type of sinewave generator is the Wien Bridge type, and a circuit of this type is shown in Figure 2. Frequency selective positive feedback is provided over IC1 by C2, C3, R3 and R4, the circuit oscillating at the frequency where there is maximum feedback, provided the voltage gain of IC1 at least compensates for the losses through the Wien feedback network.

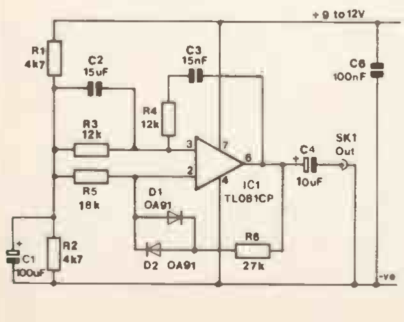


Figure 2. Sinewave generator circuit.

If the voltage gain of IC1 is accurately stabilised at a level which is just sufficient to produce oscillation, a good quality sinewave will be produced at the output. If the voltage gain is only marginally lower the circuit will simply fail to oscillate at all. Slightly excessive gain is sufficient to produce strong oscillation that results in the output being clipped and badly distorted. In order to obtain good results it is necessary to have some form of automatic gain control to maintain the gain of the circuit at precisely the correct level.

Special thermistors such as the RA53 type are often used to give this stabilisation, and circuits using these are capable of extremely good results. However, thermistor stabilisation has two major drawbacks which are the high cost of suitable thermistors (about £5.00 each) and a drop in performance at very low frequencies. The circuit of Figure 2 uses a simple and inexpensive alternative which gives a slightly less pure output than that obtained using thermistor stabilisation, but the distortion is still only around one or two per cent which is more than adequate for most purposes. The circuit also functions well at very low frequencies.

The closed loop voltage gain of IC1 is controlled by the negative feedback network formed by R5, R6, D1 and D2. With only a small output voltage D1 and D2 have a relatively high resistance so that the circuit has sufficient gain to oscillate reasonably strongly, but at higher output voltages their resistance is much lower and the voltage gain of IC1 is reduced. This prevents the circuit from oscillating so strongly that the output is clipped and seriously distorted, although the action of D1 and D2 rounds the waveform peaks and produces the small amount of distortion mentioned earlier.

The specified values for the components in the Wien network give oscillation at approximately 1kHZ, but changing the value of C2 and C3 gives an inversely proportional change in operating frequency, as do changes in the value of R3 and R4. This enables the circuit to operate at any frequency from about 0.1Hz to a few hundred kilohertz. By using a dual gang potentiometer plus fixed value series resistors for R3 and R4 the operating frequency can be made variable. The output level is about one volt peak-to-peak.

Square/Triangle Wave Oscillator

Figure 3 shows the circuit diagram of a very useful oscillator which gives both Triangular and Squarewave outputs, Figure 4 shows the output waveforms of this circuit.

A low or medium frequency squarewave signal sounds very harsh when compared to a sinewave signal, this being due to the strong harmonic content. A high frequency squarewave does not sound different to a sinewave of the same frequency simply because the harmonics will be above the upper limit of human hearing. A squarewave only has odd harmonics (three times the fundamental frequency, five times the fundamental frequency, seven times the fundamental frequency, and so on), with the relative strengths of of the harmonics reducing as they become further removed from the fundamental. In fact the third harmonic is only one third of the amplitude of the fundamental, the fifth harmonic is just a fifth as strong as the fundamental etc.

A triangular waveform has a weak harmonic content, although the harmonics are strong enough to be clearly heard on a low frequency triangular signal. It is the third and fifth harmonics that are present, but only at half the amplitude as the same harmonics in an equivalent squarewave signal. Due to the low harmonic content of

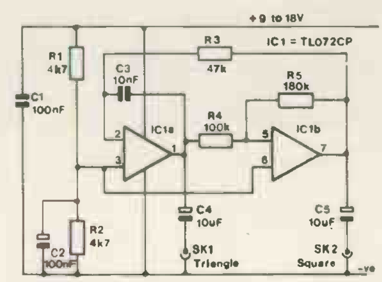


Figure 3. Square and Triangle waveform generator.

triangular signals they are often used as the low frequency control signals in effects units such as Tremolo, Phaser, Flanger and so on, but sinewave generators should be used in applications of this type. Incidentally, the analysis of the frequency components of a waveform is called 'Fourier Analysis'.

The way in which the circuit of Figure 3 operates is quite straight forward with IC1a being used as an integrator and IC1b acting as a Schmitt trigger. Initially the output of IC1b is high and C3 charges via R3, but IC1a maintains its two inputs at the same potential by a negative feedback action, and this results in the output of IC1a going negative at a fixed rate. When this output voltage goes below about one quarter of the supply voltage the potential divider action across R4 and R5 takes the non-inverting input of IC1b below the bias voltage fed to the inverting input so that IC1b's output triggers to the low state. A reverse circuit action then occurs with C3 discharging through R3 and the output of IC1a steadily rising in voltage until it reaches about three quarters of the supply potential. The circuit then triggers back to its original state, and this whole process repeats indefinitely.

Thus a triangular waveform with a peak-to-peak amplitude of about half the supply voltage is generated at the output of IC1a, and a squarewave output with a peak-to-peak amplitude of about three volts less than the supply voltage is produced at the output of IC1b. Looking at Figure 4 it will be apparent that the output waveforms do not

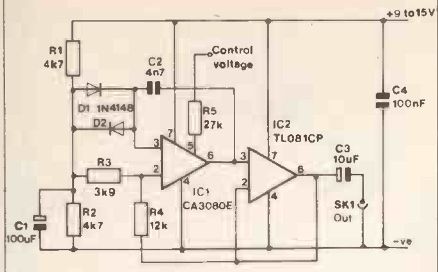


Figure 5. Voltage controlled Triangle wave generator.

have a perfect one-to-one mark-space ratio, and this is caused by IC1b having a peak negative output voltage which is about 2 volts above the negative supply rail, and a peak positive voltage which is about one volt less than the positive supply potential. It is possible to compensate for this lack of symmetry, if necessary, by using a 10k preset potentiometer in place of R1 and R2, and adjusting this for a one-to-one mark-space ratio.

The specified values for R3 and C3 produce a fundamental output frequency of approximately 1kHz, but as with the previous circuit these can be changed in value to give any operating frequency from about 0.1 Hertz to a few hundred kilohertz.

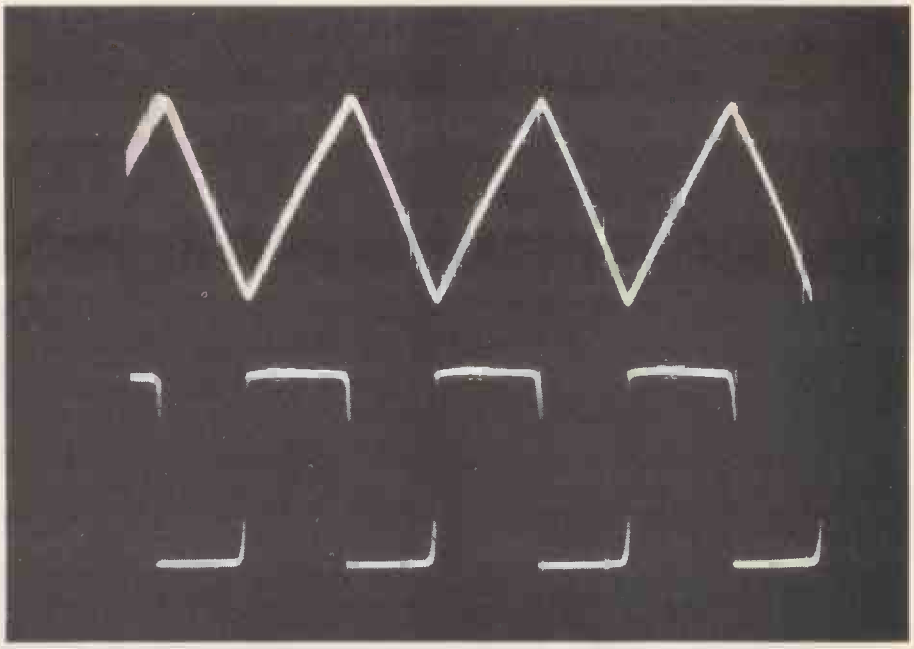
Triangular VCO

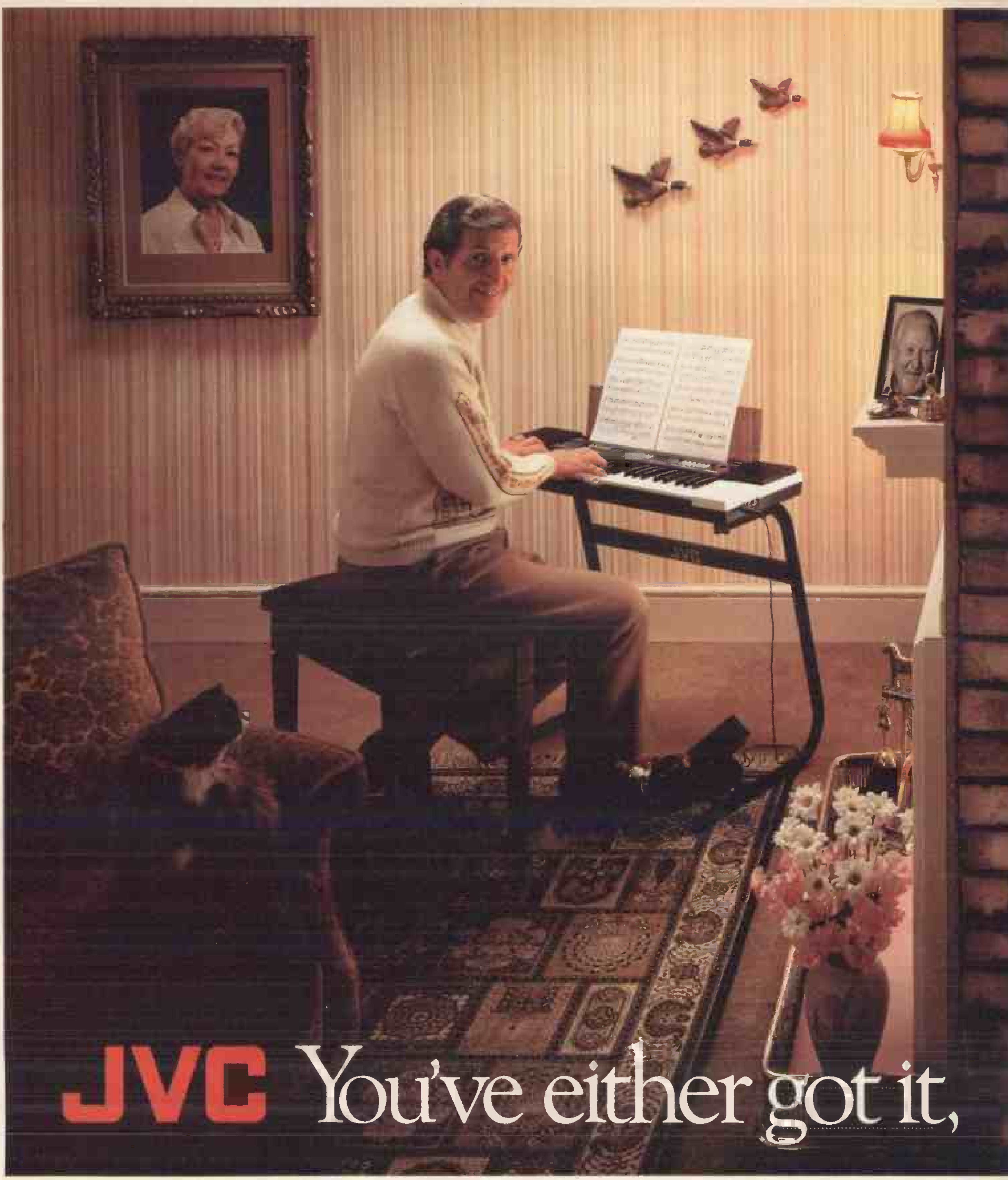
Figure 5 shows the circuit diagram of a simple but useful VCO which gives a reasonable triangular output waveform, and this circuit could be employed in applications such as the generation of falling pitch drum sounds. IC1 is a transconductance operational amplifier which is used to charge and discharge C2 at a linear rate and generate a triangular waveform. The control voltage determines the charge and discharge current and therefore the operating frequency of the circuit. R3 and R4 set the peak-to-peak output voltage of the circuit, and this is approximately 5 volts with the values given in Figure 5. IC2 is merely used as a buffer stage which gives the circuit a low output impedance.

The frequency range of the circuit is very wide with an output frequency of just a few Hertz with the control voltage at a low figure of about 0.5 volts, rising to an operating frequency of about 7kHz with a 9 volt control voltage. The frequency span of the circuit can be shifted up or down by altering the value of C2, with changes in value giving an inversely proportional shift in frequency range. Note that C2 (and the timing capacitors in the other two circuits described in this article) cannot be polarised types such as electrolytic or tantalum bead capacitors.

E&MM

Figure 4. Output waveforms from Square/Triangle generator.





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

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

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All have ultra chord for instance, a magic button that converts melody notes into rich chords for effortless full-bodied accompaniments.

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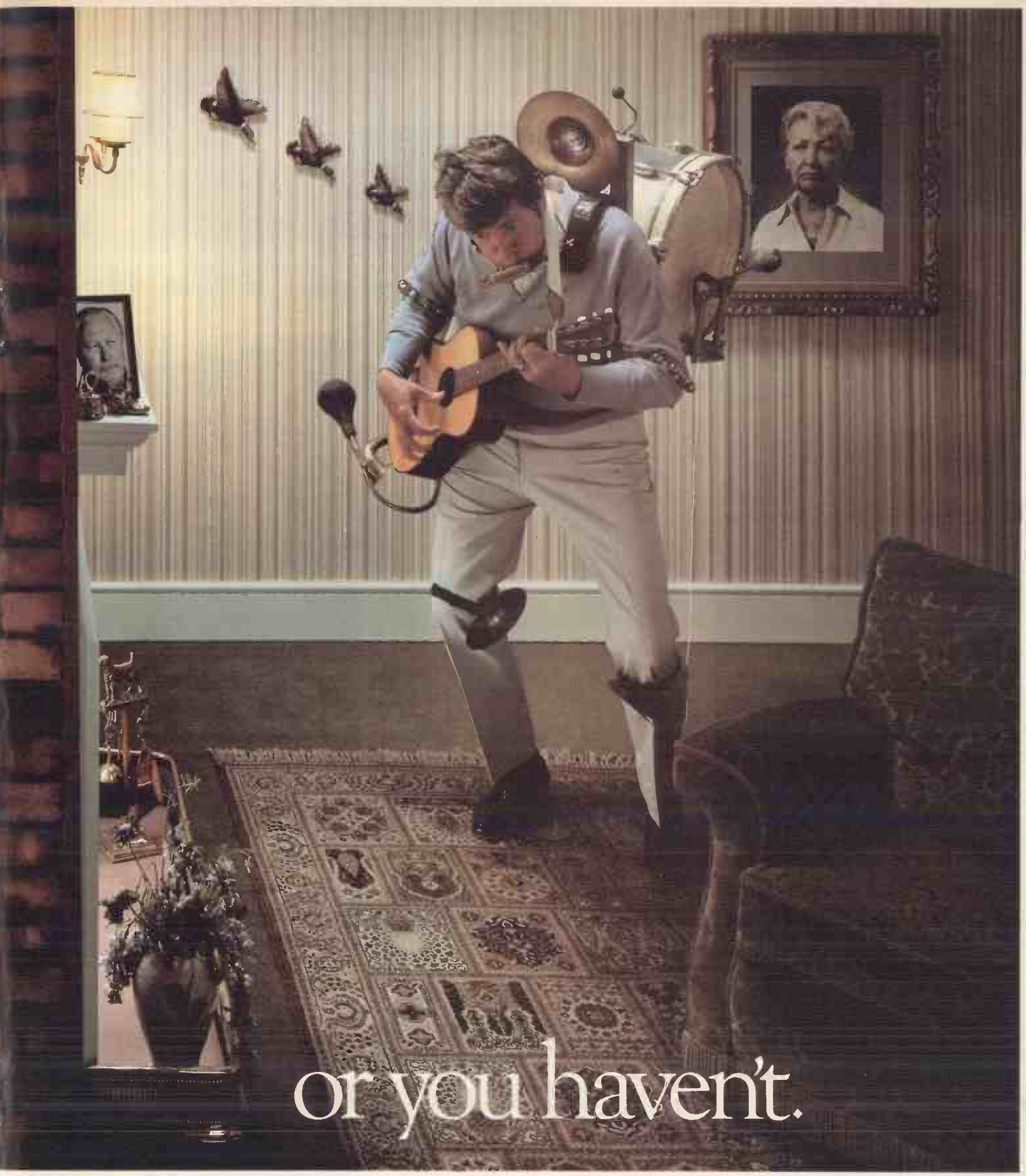


still using all the notes on the keyboard.

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

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

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

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

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

London College of Furniture

Summer Show 1983

Every year in June the small, but well respected, London College of Furniture holds a Summer Show. This involves numerous exhibitions by the various departments within the college.

One of these is held by the department of Musical Instrument Technology, which specialises in the design and construction of many types of instruments ranging from harpsichords to recorders.

Of particular interest is the section of MIT which concentrates on the application of electronics to the music industry.

As part of their final year studies the students design and build a wide variety of electronic projects, a selection of which are shown here.

PX-1 Rhythm Computer

This unit, built by Simon Bailey, is based on E&MM's Electric Drummer, designed by Peter Kershaw. Analogue circuitry is used for the sound generation, controlled by a Z80 processor. The sturdy aluminium case and silk-screened panel were made using the college's impressive facilities.

Portable Mixer

The mixer shown was built by Louis Backer. It is a comprehensive unit consisting of 6 input channels which mix down to a stereo output. Each channel has parametric equalisation and echo/effects send. A 'gadget bag' normally used to carry photographic equipment houses the circuitry making the mixer compact and portable.

Modular Synthesiser

Tim Orr, designer of E&MM's Digital Delay and countless other electro-music projects, is a part-time lecturer at the college. This synthesiser has been put together with his help over the past couple of years.

The keyboard is monophonic, but digitally scanned, producing a control voltage with no drift. Synthesiser voicing is based around a variety of circuits, some using SSM ICs.

E&MM's Synbal is also provided as a module along with a very interesting 'Vowel VCF' for creating vocal sounds, which Mr Orr was most secretive about.

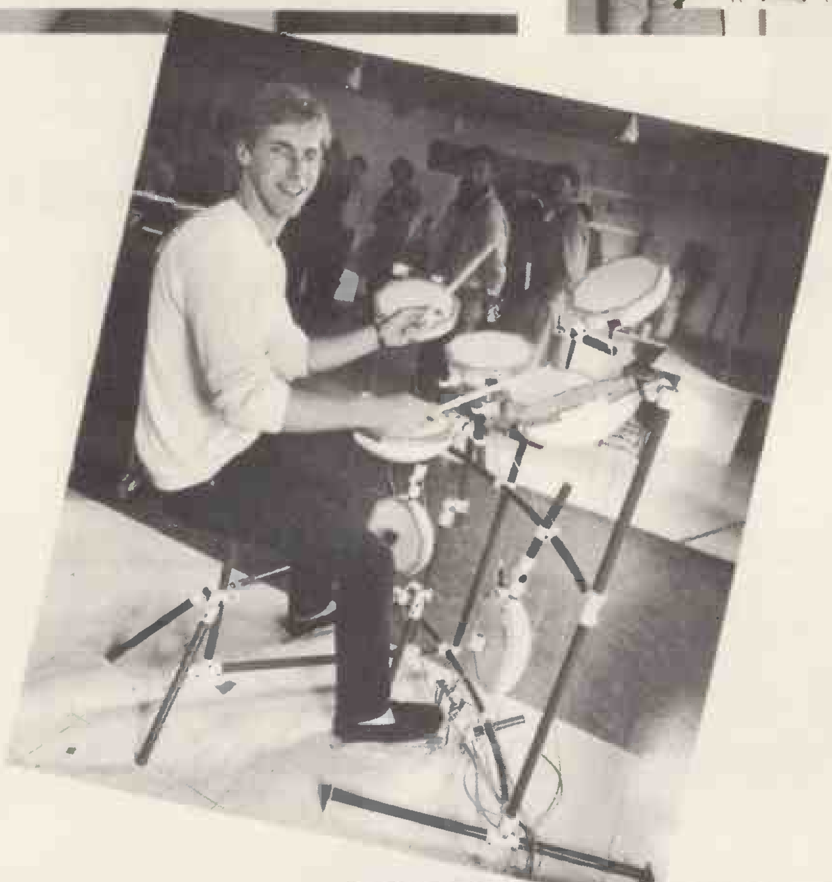
Electronic Drum Kit

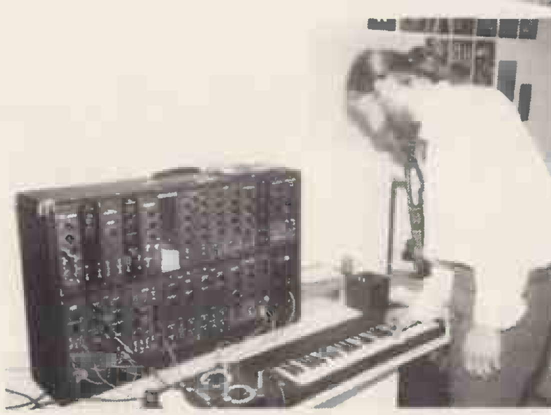
This project, the largest taken on this year, was completed by three students. Chris Bonk did the shell design; Jim Kimberley (playing the kit) designed the frame and Lars Theglar did the layout of the PCBs holding the drum electronics.

The electronic circuitry was designed by Jim Grant, who is a lecturer at the college and no stranger to the pages of E&MM.

Drum shells are vacuum moulded from ABS plastic and fitted with piezo pick-ups, connections being made via Cannon plugs and sockets.

The frame is made from tubular steel and was kindly donated to the project by Kee Klamps International Ltd. Plans are under way to put the kit into production, so hopefully we should see more of this exciting project.





Electric Guitars

In the 1981 Rose Morris Guitar competition, first and second places were taken by two LCF students.

First was Martin Hartwell with his Duraluminium guitar, the idea being to have a light but strong construction which could support different body shapes.

Second was Jeff Warner's 'Magpie', shown here, which has a mahogany body and is intended to sound like a Stratocaster or Les Paul. Pick-ups are DiMarzio X2N and Vintage, with phase and coil-tap switching. The fingerboard has 24 frets which should help produce more accurate intonation.

Disco System

Another student, Ed Williams, had on display a complete disco system called the 'Red Baron Roadshow', along with an Active Crossover and Graphic Equaliser. These are not shown here but were finished to a very high standard as they were built for a professional user.

E&MM

For more details about MIT and other courses offered by the college contact: London College of Furniture, 41 Commercial Road, London E11LA. Tel. 01-247 1953.

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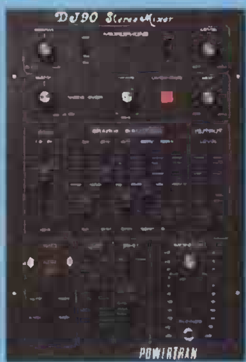

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computer MUSICIAN

Greetings, Computer Musicians!

One of the really heartening things that's happened recently is the sudden awakening of the media and public to all that computer music has to offer. In fact, from the one 'Making the Most of the Micro' programme on sound and music, the BBC had 4,000 letters — more than from any other programme in the series! At the same time, there's a minor chain reaction going on under our feet in the shape of burgeoning commercial interest in interfacing synthesisers with personal micros, and this can only mean that our creative tools get more efficient and more powerful.

However, there's one big problem. What musicians coming to computers expect from their micro-based instruments seems to be rather different to what the computer buff enjoys producing on his home micro. We need to see a meeting of minds in the middle, so that both the personal micro owner and the musician are able to realise fully their different creative aspirations with the assistance of the micro, and the best way of doing that is to have an all-encompassing forum that presents every aspect of the micro music scene. In very broad terms, that's the idea behind the ***Computer Musician*** supplement.

Where does one start? Well, obviously there's the theory to consider — whether it be how digital synthesis actually happens or what makes a music composition language a good music composition language. And ***Computer Musician*** won't stint itself on this, though practical implications will always be the keynote of any theoretical dissertation.

Then, there's the question of which micro. We'll try to cover all of the popular micros, though this will obviously be dependent on (a) their innate musical talents, and (b) the potential for expansion. In a future article, we'll try to analyse the way synthesiser hardware and software companies are heading in their choice of micros with musical potential. At the present time, our tips for the top are the BBC Micro and the Commodore 64, but it's also apparent that the Apple II, like Red Rum, will be a firm favourite for many years to come.

Because technology moves much faster than the development of programming skills, the ***Computer Musician*** needs to appreciate the whys and wherefores of the chip business as applied to his art. The Electro-Music Engineer does a fine job at keeping us up-to-date on the analogue side of the field, but *Chip Chat* will go behind the scenes of chips that have a direct relevance to micro music. Similarly, *Studio Scene* will take a close look at how people actually get on with micro-based systems outside the world of the glossy brochure or E&MM review.

At the beginning of the editorial, the term 'forum' was mentioned, and we mean that. There's no point on earth of writing in a vacuum, so there are four areas where we'd really welcome input from you: firstly, letters — please send them in, whether candid comments or ecstatic effusives; second, articles — if you have something you'd like to offer, feel free to write in with a brief outline and then we'll get back to you; third, feedback - particularly for the *User Feedback* section, from musicians who've been using some particular item of software or hardware and would like to tell of their delights and misfortunes; and fourth, programs - mainly for an intended *Program Corner* 1 in the supplement, but larger ones would be equally valuable. Ideally, we're looking for fairly short programs on any of the popular micros, but the caveat is that they must be musical, though juicy sound FX would do at a pinch! Please send these in as a listing (preferably from a printer, and dark enough for photographic reproduction as it is — to avoid yet another plague of those damnable typographical errors!), a brief explanation of how and why the program works, plus a cassette (or disk) of the program. Needless to say, all contributions will be amply rewarded! **CM**

David Ellis
Consultant Editor

MUSIC COMPOSITION LANGUAGES

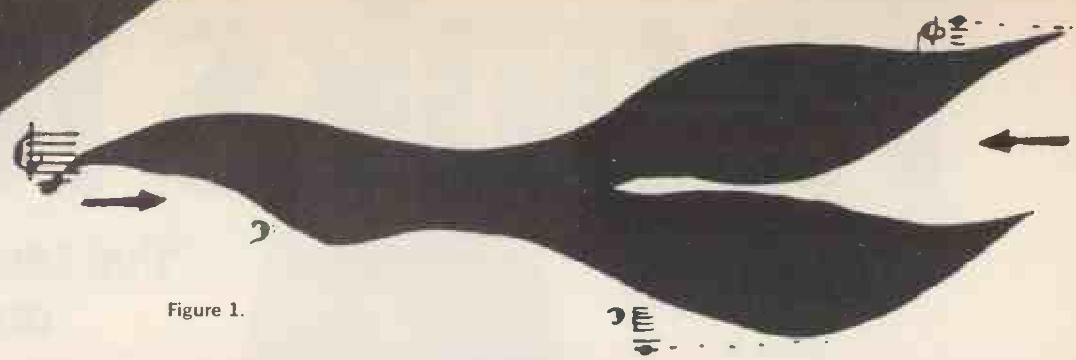

Figure 1.

Introduction

So, why the notion of an MCL in the first place? Well, as soon as you start using a computer for music synthesis, it rapidly becomes obvious that redundancy and inefficiency are out if you and the computer are to enjoy anything like a mutually beneficial relationship. Unfortunately, both of these attributes are only too commonplace in the two languages that a musician customarily uses — musical notation and his or her native tongue. A computer has to be told to put the right thing in the right place, and that's just as true for organising the complexities of a multi-dimensional musical structure as the multitude of columns in a Visi-Calc program. So, it's exceedingly unlikely that the plain English language will ever be usable as a music composition language, simply for the reason that you'd be forever correcting the sort of miscomprehensions that crop up between humans, let alone a human and a computer. Even if it were ever feasible to use English as a means of indicating musical instructions to a micro, how would you describe the picturesque clustering that's suggested by the graphics of Figure 1? Come to think of it, how would one describe it in MCL? That's one of the thorny problems we'll be attempting to get around later on in the series!

In looking at MCL, we'll aim to keep the semantics and communication theory to a bare minimum. Analysis of the language problem can help to clear the ground for further exploration, but, in this instance, we'll be spending the bulk of the time looking at practical implementations of MCLs. For instance, in a few issues time, we'll be taking a look at an interesting piece of software called AML, or Algorithmic Music Language, that can be run on any CP/M micro, and which offers extremely flexible facilities ideal for creating complex pieces entirely from one's own notes or by using auto-compositional procedures. Furthermore, it doesn't actually require you to know over much about computer programming to get the most out of it. By way of a trailer, Figure 2 shows a brief excerpt of an AML score.

This example of MCL is pretty much self-explanatory. Musical phrases are written as subroutines, which can then be repeated, with or without transpositions, simply by calling the name of that particular phrase. This approach is terrific for rock and other riff-based music, and enables complex pieces to be specified without using acres of memory space and a massive number of keystrokes.

At the other end of the micro scale, we have a review next month of AMICS, a software/hardware package for non-real-time sequencing on the ZX81 that offers professional standards for a cost that's affordable by the home musician. We'll also be reporting on how musicians actually get on with their MCLs, and computer systems in general, in the User Feedback section, and Francis Monkman will start things off with an inside look at the Synclavier's SCRIPT software. We'll also be taking a detailed look at that doyen of MCLs, the Fairlight Composer, and, later on, there'll be a Music Compiler program using an easy-to-learn MCL for the BBC Micro.

Universal MCL

Having examined the various MCL options already available, where do we go from there? Well, we could draw together all the good and bad points of the various existing MCLs and use this information to design a universal MCL afresh. However, the hotch-potch approach rarely delivers precisely the goods you're after, and one may be far better off looking for possible models in other computer languages. The crucial point is to make the language work for all musicians working in the field of micro music, regardless of the fine points of their musical predilections, and to provide the sort of flexibility and speed that a high-level language like Forth provides. Indeed, Forth may well turn out to be the best hope there is for a universal MCL, and the series will end by considering this possibility in some depth.

In closing this introduction to MCL, I'd like to suggest that, if we want really powerful musical languages, then it's up to us musicians to design them. Too many musicians have foregone the possibility of designing a language for themselves simply because they've seen musical language development as being indistinguishable from programming. However, if musicians are expected to know the rudiments of their instruments, why should composers be any different when it comes to computers? So far, it would seem as if we've allowed programmers to define MCLs according to their own concepts of musical composition and performance, when, in fact, these may bear little reality with what computer-based instruments are really capable of. The future lies with an MCL that truly communicates between the musician and the computer. If that means the composer has to add a modicum of programming skills to his musical vocabulary, then surely that's but a small price to pay for the rewards of putting the 'music' back into MCL.

CM

```
; THIS IS A SHORT EXAMPLE OF A 'MODE A' SCORE USING SUBROUTINES
; TO KEEP SCORE SIZE AND INPUT TIME TO A MINIMUM. PHRASES NEED
; ONLY BE WRITTEN ONCE AND THEN CALLED AGAIN AND REPEATED.
;
        MACLIB AML
        VOICES <V1>
        PLAYVOICES <1>
        TRIGDEF <0>
        ITEMPO S,2,2,110
;
V1:     REPEAT 2
        CALL BASS1
        ENDR
;                                   ; WHOLE NOTE REST
        @        W,R,,,
;
        REPEAT 2
        CALL BASS1                  ; TRANSPOSE UP A 4TH
        @T       +5
        ENDR
;
        ENDV
;
;                 SUBROUTINE LIBRARY (PHRASES)
BASS1   REPEAT 2                    ; EIGHTH NOTE, STACCATO, C, FOURTH
        @        O,S,C,4,F          ; OCTAVE, FORTE
                                    ; PLAY IT AGAIN
        @                           ; PLAY A BELOW C
        @        ,,A,3,             ; PLAY E WITH TIE
        @        ,T,E,,             ; END REPEAT
        ENDR                        ; END SUBROUTINE
        RETURN
;
        END
```

Figure 2.

Thanks for th

**"I've seen many of my idea
and I lean on them li**

...e memories.

...s perfected by Korg ...e old friends."

KEITH EMERSON

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McCormacks	Glasgow	041-332-6644
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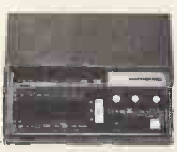

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Goldsmiths College Electronic Music Studio

Studio Scene is intended as a frank look at the pitfalls and delights of using computer-based synthesisers in a studio environment, whether it be commercial or educational, individual or establishment. We do this in the hope that it will offer a useful and realistic perspective on what it means to be a Computer Musician within an analogue world.

By any criteria, the electronic music studio at Goldsmiths' College in South London is pretty impressive, including as it does three racks of Roland 100 Modules, multiple Wasps and VCS-3s, a 16/8 Chilton mixing desk, a Soundcraft 1" 8-track, a Publison pitch shifter, various digital delays, a vocoder, two alphaSyntauri systems, and a Fairlight CMI. At the risk of roasting myself alive, courtesy of the Underground in the July heat-wave, I journeyed down to Lewisham Way to visit the studio and to talk to its main co-ordinator on the micro side of things, Benedict Sarnaker.

D: Could you give me a run-down of the micro-based equipment you've got in the studio?

B: We've acquired recently a couple of alphaSyntauris and a Fairlight CMI, funded by the Music Department, and a further alphaSyntauri and two BBC Micros that have been funded by the school of Adult and Community Studies. Though these additions actually happened over just six months we've been pressing for them for some years. Initially, we got our first two Apple systems as a kind of booby prize for not having the Fairlight, but then, because of some money being left over at the end of a financial year, we were able to get the Fairlight at the end of September 1982.

D: One of the perennial problems that university music studios seem to face is the hit-or-miss financing from year to year.

B: Yes, the central problem is that music departments conceptually belong to Arts Faculties, which means that people are inclined to think that all you need are a handful of books! Of course, music needs a lot more than a handful of books, and, when one gets to digital equipment, we really need to be funded as a science department, both in terms of capital costs for setting-up, and also recurrent costs for replacement, extension, and development. Although nobody will actually admit to it in quite those terms, this does seem to be the principle that's being slowly adopted by the college.

D: Could you give us some sort of idea of the people that are able to use the facilities?

B: Well, it's a little difficult because developments have been so recent that we're still finding our feet, but, for the Fairlight, we're thinking primarily of use by our post graduates and people from outside — either composers of some established reputation or younger composers who don't yet have that reputation. Of course, it's the younger one's that are in the worse situation, in that they can never get access to this sort of equipment, so we're very much hoping that we'll be able to open house to them.

D: I think that's really encouraging. You probably remember that Syco Systems had a competition last year where the prizewinner was awarded a year's use of a Fairlight. That sounds great until you actually start working with the thing and find the 150 hours allocated to you rapidly whittling away to nothing. If young composers and musicians are to grow up with digital systems as friends rather than foes, they do need the sort of access you're hoping to offer.

B: Yes, what we'd like to do is to make it possible for composers simply to work, charging them a nominal figure purely to cover incidental costs like floppy disks and so on. We're still negotiating this, and the implications are very complex for the college, so we obviously don't want a huge flood of people at the door the day after these comments have appeared in print! What we really do want to avoid is the idiotic situation where yet another Fairlight means yet another private Fairlight.

A general view of the main studio.

One of the alphaSyntauris.

The alphaSyntauri

D: Moving on to the rest of the equipment, it's very unusual to see two alphaSyntauris alongside a Fairlight. In fact, it's unusual to see two alphaSyntauris, period! What made you go for the alpha?

B: A difficult one! To give you an absolutely candid answer, I'd just been asked to direct an electronic music option course within the B.Mus. degree. I knew that we had no digital equipment, which meant that I faced the problem of being unable to demonstrate digital techniques to students who already had something of a passing knowledge from reading about them. Now, as you can well imagine, this was a pretty depressing situation. So, I spent a day playing with the alpha, thinking seriously about buying it, firstly, because I had an Apple already, and secondly, because I'd then have one piece of digital equipment to show to the students. Also, it was the only readily available system based around the Apple, and I felt that that would give me some confidence in working with it. The reason for buying two was simply because of the number of students on the course.

Why alphaSyntauri as well as Fairlight? Well, again, because of the educational situation. The undergraduate students get exposure to the studio anyway, so they have some idea of what's there. Those who opt for the electronic music option spend a whole year of doing that sort of work, and we simply wanted the digital equipment integrated into that. Analogue synthesisers are there of course, but the availability of digital ones enables students to investigate their comparative values. For that, we needed something fairly simple, relatively less expensive, and which we could spread amongst a lot of students.

D: One criticism that has been levelled at the alphaSyntauri and, I think, American micro-based systems in general, is that they're heavily reliant upon real-time entry. Do you think that is a just criticism?

B: I think it is a just criticism. In fact, it's a very severe limitation on the system and, worse, it's a limitation which I don't think is really necessary within the technology. If we had non-real-time entry, we could be using our alphas as something that's more than half-way to the Fairlight rather than as a conceptually different machine. That's the real pity. On the other hand, what we have at present in the alpha is useful to those students who are used to the real-time method of working.

D: I agree with your point about what should be available from current technology. For instance, if you look at the Casio CT-7000 keyboard, which has a multi-track tape recorder in software, allowing you to step through the sequence to edit mistakes and change voices within tracks, the alpha seems pretty unintelligent in comparison. After all, if you'd spent a lot of effort entering 20,000 notes in real time, and had to locate a mistake, you'd have every right to expect a bit of auto-location assistance from the micro to avoid a hunt-the-needle-in-the-haystack syndrome. Also, a fair number of people have put the point to me that you could quite easily put together a system based on a good polyphonic synthesiser and a Portastudio for the same price as the alpha system which would easily outstrip it in terms of performance. So, apart from the ability to build up waveforms, and play around with disk files, what's one really gaining from the alpha?

B: I agree entirely. Franky, if I had a student who's got his fingers around the alphaSyntauri well enough to be entering 20,000 notes seriously, I'd put him on the Fairlight! It's as simple as that and, for us, it's a simple

solution to the alpha's limitations as the Fairlight is just down the corridor. Of course, conceptually, it's a daft solution and it's a daft way of using our resources.
D: I suppose by using the alpha one is acquiring some sort of computer literacy in a musical situation. For instance, the student rapidly gets to learn that there's a key marked 'Return' that has to be pressed at every other opportunity! Moving on to the sound of the alphaSyntauri, and in direct comparison to the Roland modules, what would you say to somebody who questions what he'll get in place of a low-pass filter sweep? How would you assess the alpha's sound quality?
B: Well, not a great deal if you're comparing it to the most expensive analogue machines. The price differential certainly hasn't yet crossed over between analogue and digital systems. Rather than using the alpha for sound comparison, we're using it as a concept, for different ways of working, and for education. When the sound quality becomes the predominate issue, then it's the time, in my opinion, that the student becomes a post-graduate, and he'll then be given access to the Fairlight.
D: Do you therefore think of the alphaSyntauri as a sort of proving ground for somebody interested in micro music?
B: For us, it's a training ground. It's a training machine which looks different and has to be operated differently. That's extremely important for the students to grasp, and I think we'd be failing in our educational responsibility not to give them access to it. And for that purpose, the alpha works very well.

The Fairlight

D: Moving on, how easy would you say it is for somebody to come from the real-time input of the alphaSyntauri to the MCL of the Fairlight?
B: My impression of the Fairlight is that you're now given a great deal of help in the most recent software to actually guide you through its operations. If you work systematically, rather than trying to get a big, complex job done in a short period of time, you'll soon see the way through its tree-like structure and be able to move around fairly fluently. To actually grasp its range of capacity is obviously going to take a considerably longer period of time, and, so far, far too few people with access to Fairlights seem to have got beyond what I can only call the cliches of Fairlight sounds. By that, I mean the presets — the sounds that have sold the system because they display its power — but it's also true that the people who created those knew the system inside-out in a way which most of the users haven't yet given enough time and thought to.
D: I think that's very true and amply demonstrated by the rather middle-of-the-road quality of most of the examples on the Fairlight demo cassettes.
B: I think that's something that could have been predicted considering the pressures of commercial work, people will tend to take the ready-made and use it in a clever way rather than spending a lot of time on something else. I suppose people with private Fairlights are under such commercial pressures that they probably spend less time with their systems than they would like — the by-product of jet-setting around, doing various gigs, and so on. And that situation turns the Fairlight very rapidly into a glorified sound effects generator. In fact, it's become an in-house joke here for students to listen to new products by a number of artists and go and locate a particular sound on the disks supplied with the Fairlight!
D: Like 'Orchestra 2' on Kate Bush's recent album, the infamous 'Saxy', and that wretched pan-pipe which appears on every commercial and wild-life documentary under the sun!
B: Yes, those presets are becoming pure cliches, and that should never have happened to what were originally very exciting sounds — rather like wearing a beautifully-cut suit so much that it becomes worn-out and threadbare.
D: One of the most interesting features of the Fairlight — the ability to draw in individual harmonic envelopes — seems paradoxically to be causing the most headaches because of its perceptual complexity. Do you find this?
B: Indeed. That's where we really need much more development so that getting things out is not so slow. For instance, the most precious possesion for anyone working with Music 11 (a delayed playback software synthesis system derived from Max Mathews' Music V and running on a PDP-11/23 micro) is instrument files, because they take so long to create and are so complex. In fact, you find that Music 11 people form a club to exchange this sort of information because it's so hard won, and it'd be good to see a similar thing happening for the Fairlight.
D: Changing tack to the composition side of the Fairlight, do you find that students with a rock bias are more interested in the Sequencer Page (Page R) than those with a classical bent who might be more attracted by the MCL?
B: Yes, I think this is an absolutely fair summary of the situation so far, though I must add that this impression is based on a fairly small number of people using the system. It's also something that I hope we will very actively undermine, because it's my feeling that each has something to offer the other and anyone using the Fairlight ought to master both and use them selectively for their needs, rather than using them because they're reminiscent of processes they're already familiar with.
D: Do you think the Fairlight MCL is a music language that really works as hard as it should for the composer?
B: I'd say probably not, though I say that very hesitantly, bearing in mind my rather limited use of it. I think one of the problems is the influence of commercial pressure on its design. For instance, you can't have simultaneous different tempi on all 8 tracks, which is something that the more experimental sort of composer might actually want. Mind you, I think the MCL has got the versatility to do most things pretty well provided you dig into it deep enough.
D: Is it the MCL or sampling facilities that attracts students most?
B: Well, there has been a big demand on both fronts. There are those that see the MCL as an ideal way of working — they tend to be a smaller number, but they're also the more intensive users, as you might well expect. The sound sampling facility, of course, has excited everybody. When we finally got the go-ahead to buy the Fairlight, but didn't actually have it, our engineer, Richard Guy, grabbed a cassette recorder and recorded single tones from a Javanese Gamelan orchestra which we actually had here for one day. Then, when we'd finally received the Fairlight, he sampled the tones and put them on file. Using the samples with a Page R sequence, one's got a pretty good imitation of Gamelan orchestra music, although obvious problems arise at the extremes of the range.
D: Sooner or later, though, one's got to get off the sampling hobby-horse and move on to something that's more creative than regurgitative.
B: Well, the way you do it is by people like you, me, or whoever building libraries of really imaginative sounds which don't exist anywhere else, and sounds which are so compellingly used in compositions as to start making people re-think all their preconceptions. I think the limitation is one of experience, and, without that experience, the imagination tends to be stifled rather than stimulated.

The BBC Micro

D: Could you tell me what you're using the BBC micros for?
B: Well, I haven't been directly involved with their use because they actually belong to a different department, but a project that's well underway in the evening classes is an interface to the Roland modules. At the moment, it's just a monophonic sequencer, but the idea is to extend this to a fully polyphonic system.
D: Various people, or, rather, EMAS in particular, are trying to persuade university studios that the BBC micro with the addition of The Tube will be ideal for the sort of software synthesis approach typical of Music 11 and so on. I personally think that's slightly misguided when you can design special music synthesis hardware specifically for the job.
B: Yes, I agree. I don't see the value of that. I see real values in the Beeb for extending people's awareness of these things fairly cheaply. If we could get better service and back up from Acorn than has sadly been the case, then I think more external firms would be encouraged to produce cheaper add-ons for music synthesis. There's no question that there must be a vast potential market for that sort of thing. If we could get the alphaSyntauri translated into a Beeb Plus for half the cost, then, almost certainly, we'd have bought three more Beebs rather than three more Apples.

The Future

D: Is there any new equipment you're thinking of getting in the future?
B: Well, we're thinking about Music 11 as the complementary parallel to the Fairlight for the composer, or things of that ilk, but the problem, of course, is finance — even though there's a lot of sympathy within the college. The encouraging thing is that nobody is suggesting that these are ridiculous sums to spend on a music department, but, in the case of Music 11, we're really talking about a similar sum to the Fairlight.
D: What is the particular advantage gained from Music 11 over the Fairlight MCL?
B: I think it offers a wider range and more flexibility when you've really mastered it. Also, it's very important from an educational point of view to show what's happening.
D: Benedict, many thanks for a fascinating discussion, and I wish the studio lots of success in the future.

David Ellis **CM**

The Fairlight plus David Bernand, one of the lecturers.

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chip chat

Chip Chat is an occasional series that will make an appearance whenever there's a new chip with relevance to micro music that looks interesting. This month we're looking at one of the most intriguing slices of silicon to appear for some time, the 6581 Sound Interface Device (SID) from MOS Technology.

It's a sorry fact of life that most people coming to grips with computers and programming will have been relentlessly conditioned into the view that square waves are part and parcel of all micro music. The reason for that lies with the insistence of computer manufacturers to plonk a wretched programmable sound generator (PSG) of the Texas or General Instruments ilk somewhere on the Motherboard, in the hope that that alone will be sufficient to satisfy most enthusiasts' appetites for zaps, bleeps and the odd (out of tune) note or two. Thankfully, a few more enlightened companies are now breaking out of the traditional PSG straitjacket, and the Commodore 64 currently offers one of the brightest hopes when it comes to flexible musical (meaning what people rather than micro manufacturers would describe as musical) capabilities on a cheap(ish) machine. This time, musical motivation comes from an entirely new PSG, the 6581 Sound Interface Device, or SID for short. We'll leave aside considering how the 64 actually organises its platonic relationship with SID for a later article, when we'll also have a look at Simon's BASIC — a structured programming language that also provides high level commands for control of sound and graphics — together with the much-vaunted music keyboard add-on. This month, it's the turn of the SID chip itself for examination under the *E&MM Chip Chat* spotlight.

Let's start this investigation by looking at the genesis of the chip. The designer of the SID, Bob Yannes, is a well-respected American synthesist whose contributions to the PAiA in-house magazine Polyphony always guaranteed a wry smile, whether for his inimitable laid-back style or the wayward PCB designs that occasionally graced the magazine's pages. He also worked as an engineer for MOS Technology (now no longer extant after being bought up by Commodore), and it was they that commissioned the design of the SID from him. I use the past tense to describe his activities because he's now moved on to concentrate on his own company, Peripheral Visions, which seems set to continue the work he started at MOS Technology.

It would appear that Commodore's original idea was to produce a sound chip that would serve the games side of micro applications, but Yannes twisted their limited specifications to something more like a complete three-oscillator synthesiser-on-a-chip. In terms of raw specs, the SID chip looks mightily impressive: a hybrid digital/analogue device with a programmable ADSR envelope generator for each of its three voices, a choice of four different waveforms (pulse, triangle, sawtooth and noise) with 16-bit resolution over a nine-octave range, hard sync, reset, and ring modulation options, an external signal processing facility, a 'universal' volume control, and programmable low, high, band pass, and notch filters — and all in a 28-pin DIL package! The big question is whether or not it'll succeed in delivering the goods that its quart-in-a-pint-pot configuration suggests.

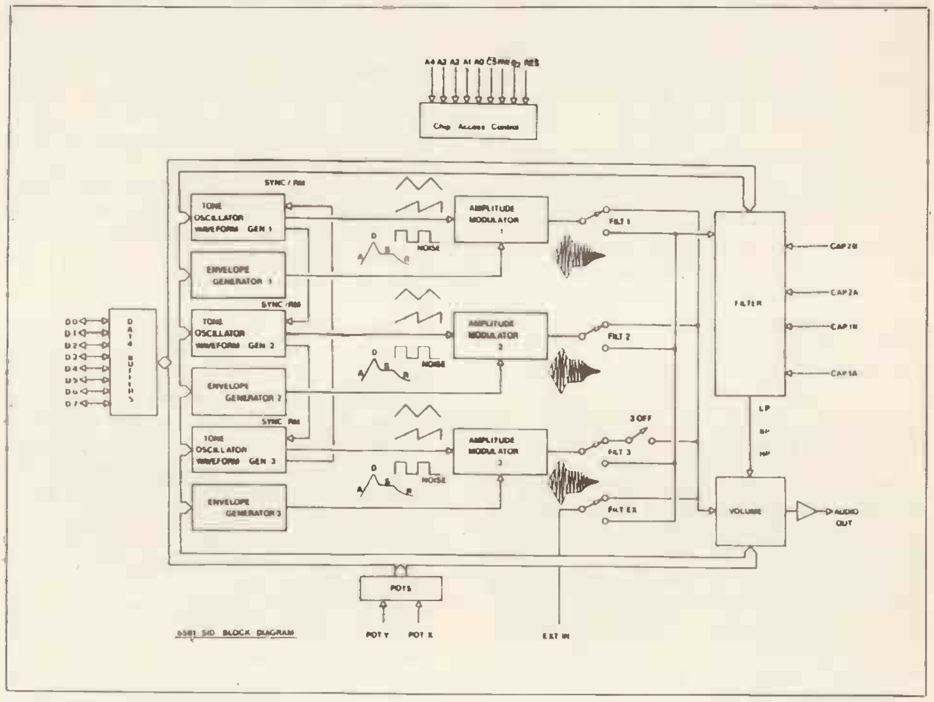


Figure 1. 6581 SID block diagram.

POKEing SID

A quick glance at the SID's block diagram (Figure 1) shows that it's far from being a straightforward device — especially when compared to the very much more restricted synthesis options of the bog-standard square wave PSG. In fact, whereas a PSG like the Texas 76489 (used in the BBC Micro) makes do with just 8 internal registers for controlling the three tone generators, noise source, and respective attenuators, the SID has 29 (see Table 1) — that's 7 per voice before even getting to the filter section! This clearly shows that implementing all the control functions needed to patch a three-oscillator synthesiser-on-a-chip into action is a pretty formidable business. However, because all the envelope generation is done on-chip, rather than by scaling from amplitude data in memory, the micro driving the SID is freed for other operations between bouts of feeding the hungry mouths of all those registers. Furthermore, because the chip is 100% digitally-controlled, there's a complete (and welcome) absence of those customary multiplexed DACs used for directing CVs to all and sundry in the average micro-controlled synthesiser.

Where the SID scores an immediate and resounding success is in the oscillator side of things. After the poor frequency resolution of square wave PSGs, the 16-bit resolution of the SID comes like a breath of fresh air. Each of the Freq. High and Freq. Low registers can be loaded with a value in the range of zero to 255. However, because the High and Low registers act as coarse and fine frequency controls, respectively, with 256 steps of the Low register being equal to one step of the High register, a resolution of 1/50 Hz is achieved over the entire 9-octave range — so no more stair-step approximations to glissandi and portamenti! The ways and means of waveform selection are also pretty ingenious; apart from simply setting the relevant bit in the control register for one of the four waveform options, the user can also add these waveforms together to create 15 different mixed waveform combinations. On top of that, the High and Low Pulse Width registers allow very accurate definition of the duty cycle of the pulse wave, which means that PWM can be produced without discernible steps.

Unfortunately, the amplitude control side of the chip looks less impressive, with only 4-bit resolution (ie. 16 possible values) for the Attack and Decay times (2 milliseconds to 8 seconds). Though this should be adequate for most purposes, it's not going to be like twiddling the four ADSR pots until you hit exactly the right settings. Curiously, there's no way of simply adjusting the level of one oscillator relative to another apart from fiddling with the envelope generator parameters. In fact, there is a further 4-bit volume register, but this works universally on the combined audio output of the chips, and the 16 amplitude steps make this no more musical than what goes on in the Texas or General Instruments PSGs.

Where SID comes back into favour is with the control register options. For instance, setting the Sync bit synchronises the fundamental frequencies for any two oscillators, thereby producing the hard sync effect that's so characteristic of the Prophet and others. A further control bit called Test, when reset, causes the selected waveform to go back to the starting line, and allows for complex phase or frequency modulation. In addition, another control bit effects the ring modulation of one oscillator by another.

The read-only registers that the SID provides (shown at the bottom of Table 1) are also rather interesting, because, by reading the values in these registers, the controlling micro is able to follow the rise and fall of the third oscillator waveform or envelope. So, if the chosen 3rd oscillator waveform was a low frequency triangle wave, the Osc/Random register would present a series of numbers representing the instantaneous amplitude of the cycling waveform. The micro could then take these values and plug them into the frequency registers of some other oscillator, with the result that you'd then have the equivalent of LFO modulation.

After being subjected to amplitude modulation, any or all of these oscillators, together with an external audio input, can then be routed to the filter section. Here, the High and Low Centre Frequency registers combine to give a 11-bit number that determines the linear range of cut-off frequencies, with the overall range determined by a couple of external capacitors (shown as Cap1a/b and Cap2a/b in the block diagram). A further 4-bit value selects the amount of resonance (again, too low in resolution for comfort). The bits in the Mode/Volume register determine the type of filter: either 12 dB/octave low pass, 6 dB/octave band pass, 12 dB/octave high pass, or any combination of these, ie, low pass plus high pass for a notch response. Curiously, no provision is made for controlling the filters from the envelope generators themselves, meaning that filter sweeps are only achieved by corresponding sweeps of values to the Centre Frequency registers. For something as standard as a low-pass filter sweep, that seems an awful waste of the processor's time. Mind you, the fact that the filter is digitally programmable opens up a lot of scope for timbral modulation.

There's one further sensible control point, namely the provision of inputs for reading a couple of potentiometers, ie. Pot.X and Pot. Y, and this facility can obviously be used for joystick control of this or that. Finally, there's the external signal input, over which lots of commentators seem to be waxing lyrical. I'm not sure about this. It'd be great if a pitch-to-voltage converter was incorporated, but routing through the filter seems a little too obvious, really.

So, in the final analysis (as they say), does SID just hiss, or does it do the tradition of the three-oscillator Minimoog proud? Well, the main spanner in the works that makes assessment a problem is that those 29 registers are a pain to program. So far, the Commodore 64 user has had the unenviable task of running the chip from BASIC with POKEs, which isn't fun when one's also obliged to set up screen displays with similarly tedious operations. To give you a taste of what's involved, here's a program for getting a Middle C from the 64:

```
10 POKE 54296,15: REM Loudest volume setting
20 POKE 54277,190: REM Sets Voice 1 attack and decay rates
30 POKE 54278,248: REM Sets Voice 1 sustain vol. and release rate
40 POKE 54273,17: REM Freq. High for Voice 1 Middle C
50 POKE 54272,37: REM Freq. Low for Voice 1 Middle C
60 POKE 54276,17: REM Choose triangle wave and initiate envelope
70 FOR  DUR=1TO250: NEXT: REM Timing loop for duration
80 POKE 54276,0: REM Terminate envelope
```

Sample program for Commodore

And that's not even using the filter!

The appearance of Simon's BASIC and the music keyboard should make assessment of the chip's potential a darn sight easier, but there are various lucky people who've managed to get hold of some of these chips for experimentation with other machines, and realistic reports on the SID's pros and cons are starting to filter (note that word!) through. Some hint that all wasn't well was indicated by the lack of any mention of the programmable filter in Commodore's advertising for the 64. Seeing that timbral modulation is what most synthesists are after, that omission seemed curious.

An innovative Cambridge firm called Hybrid Technology has been assessing the SID chip for possible use as an add-on for the BBC Micro, and their conclusions show up a few problems which may conceivably explain the embargo placed on advertising the programmable filter facility. According to Peter Wolfers, one of the directors of Hybrid Technology, the main areas of concern are as follows:

1 The filter section distorts when more than one oscillator is fed into it (DC offsets from the attenuator sections) or when CVs are applied at either the top or bottom end of the cut-off range (clipping resulting from feed-through of the CVs to the output stage).

2 The envelope generators chop off abruptly and produce DC thumps if envelopes are retriggered.

Once again, it would appear that the ship's in danger of sinking for the sake of a ha'p'orth of tar! However, Hybrid Technology do say that the digital side of the chip works more-or-less perfectly, so things are still reasonably hopeful — especially since the oscillators can be very effectively synced together or used for FM synthesis. Another problem still to be overcome is the recalcitrance of Commodore in the States to release the SID chip for consumption by other 6502-based micros, and that's despite the fact that the chip was specifically designed to be interfaced with MOS Technology's 6500 series of micro chips. Not surprisingly, Hybrid Technology have decided for the time being to concentrate on producing their own music synthesis hardware for the BBC Micro. We'll let you know more about that in due course!

So, all in all, a preliminary assessment of the SID's performance reveals an exciting bag of tricks that's of rather less than uniform quality. But, to be fair to everyone, I'm reserving final judgement until I've had a chance to audition the complete Commodore synthesiser package, ie. Commodore 64, keyboard add-on, and Simon's BASIC. In fact, a piece of cartridge-based software has been announced in the States that allows SID to talk with the inflections of man, woman, child, or whatever else takes your fancy. If that's not just idle hogwash for the silly season, one can assume that somebody somewhere really knows the SID inside-out and has had more assistance from Commodore than all the potential but starved SID fans in this country! **CM**

SID source: Falk Baker Associates, 382 Franklin, Nutley, NJ 07110 U.S.A.
Tel: 201-661-2430.
One-off price = $17.50 + $1.50 post.

Table 1. The SID's control registers

Register number	Register name	Register type
	Voice 1/2/3:	
0/7/14	Freq. Low (8 bits)	Write-only
1/8/15	Freq. High (8 bits)	Write-only
2/9/16	Pulse width Low (8 bits)	Write-only
3/10/17	Pulse width High (4 bits)	Write-only
4/11/18	Control register (5 bits)	Write-only
5/12/19	Attack/Decay (4 bits each)	Write-only
6/13/20	Sustain/Release (ditto)	Write-only
	Filter:	
21	Centre freq. Low (3 bits)	Write-only
22	Centre freq. High (8 bits)	Write-only
23	Resonance/Input (4 bits each)	Write-only
24	Mode/Volume (ditto)	Write-only
	Misc:	
25	Pot. X (8 bits)	Read-only
26	Pot. Y (8 bits)	Read-only
27	Osc/Random (8 bits)	Read-only
28	Env. 3 (8 bits)	Read-only

Notes: 'Control register' includes bits for setting waveform type (Pulse, Sawtooth, Triangle or Noise), initiating envelope generation (Gate), synchronising oscillators (Sync), resetting oscillators (Test), or for ring modulation (Ring Mod); 'Input' determines which (if any) oscillators are to be patched to the filter; and 'Mode' selects filter type.

Sounding Out The Micro

Part 1

Over the past few months, the Macro-music series has taken us from the humble beginnings of main-frame computers, squawking at each other in the confines of the Bell Telephone Labs to the high-tech wonder of the Lucasfilm Audio Signal Processor blasting Death Stars and the entire 'little people' population of the United States. Now, it's time to start off on a new tack with more immediate practical relevance, namely the synthesis of sound on microcomputers.

For the moment, though, how one actually gets sounds out of the computer is less important than some decision-making as to the nature of the fundamental parameters that constitute sound, which of these need to be varied in something approaching a musical context, and how all this can be best (or easily) achieved.

The starting point of sound synthesis is a series of operations that define two parameters — the frequency and the duration. Both of these involve the essential ingredient of the passage of time; with frequency, the time factor applies to the gap between one event and the next at the level of something like a waveform, ie. between the amplitude high states of square waves; with duration, we're concerned about a timing level one stage up, ie. between one sound (with a certain timing gap) and the next (with a different timing gap). So, the one crucial aspect of sound that needs working on from the word go is *time*.

One way to ensure that different frequencies and different durations have their say is by making use of the fact that micros can be very accurate time-keepers if they're given the right kind of instructions. In fact, the fundamental concept to ground level micro music is the 'timed loop', a series of instructions that will be entirely consistent in their speed of execution from one minute, hour, or day to the next. By choosing instructions that will both slow execution times down sufficiently to produce oscillations in the audio frequency range, and also effect, by fair means or foul, an analogue output to the waiting world, one should have succeeded in creating a simple digital oscillator capable of sound synthesis at a basic level.

So, what options are available for projecting a micro's timed loop oscillations to the outside world? Well, early micro music enthusiasts quickly discovered various short-cuts to digital-to-analogue conversion, including some that were ingenious, some that were a dead-end, and some that were just plain quirky. In fact, one particular method didn't even involve a direct connection to the micro! This was based on the chance observation that an AM radio tuned to a spare frequency, placed close to the computer, generated sounds as a result of fast-switching computer logic spewing out harmonics that extended into the radio frequency end of the spectrum. By altering instructions in the timed loop, it was actually possible to vary the timbre of sound, but, because of all the other logic switching going on in the average computer, the technique was incredibly noisy and erratic. In the States, RF interference from micros is considered detrimental to public health (like most things that are fun), and most new micros are now obliged to have some form of shielding against such electro-magnetic interference. However, if you're interested in following up this particular historical avenue, the Apple II and Video Genie micros are both pretty effective at making themselves out to be pirate radio stations in sheep's clothing.

Another early method of making the computer annunciate its timing loops centred around the use of a line printer. Hook-ups between some early computers and their printers gave the computer software control over the action of the printer hammer. By using a timing loop program again, it was fairly easy to make the hammer buzz away over a limited range of pitches. In fact, you could probably replicate the effect on a modern dot-matrix printer, but it's unlikely that anyone (let alone the printer itself) would really benefit from the exercise.

However, there is a modern alternative that's easily tried out which doesn't involve damage to either ear drums or printing heads, ie. the cassette relay on the BBC Micro. The Operating System command *MOTOR switches the relay on (*MOTOR 1) or off (*MOTOR 0), which, in turn, is designed to similarly switch the cassette motor on and off (though I've yet to hear of anyone bothering to do it). Writing a program that repeatedly toggles between these states will instruct the machine to manically flap the cassette relay, and, like the prior inflictions on the printer hammer, that action manifests itself as sound.

```
 10 REM Hammer-klavier program
 20 REM for the BBC Micro
 30 REPEAT
 40 REPEAT
 40 RESTORE
 50 DATA12,11,10,9,8,7,6,5,4,3
 60 FORnote%=0TO9
 70 READpitch%
 80 FORX%=0TO15
 90 *MOTOR0
100 FORY%=1TO3:NEXT
110 *MOTOR1
120 FORZ%=0TOpitch%*5:NEXT
130 NEXT
140 NEXT
150 UNTIL0
```

This program, simple as it is, actually demonstrates pretty well a couple of salient features about the use of timed loops in a sound synthesis context. Basically, Life, the Universe and Everything centres around three nested FOR...NEXT loops. One of these, namely the delay loop on line 100, inbetween the *MOTOR commands, is peculiar to this program and simply makes sure that the relay isn't toggled off and on at a rate that's beyond its innate capabilities. On some machines, a fast-responding relay may allow one to get away without it, but, on my machine, the loop has to be there to prevent the thing jamming up.

The loop starting on line 80 determines the number of passages around the relay-toggling circuit before going on to the next value of pitch%. So, this delay loop effectively determines the duration of a 'note'. The third loop starting on line 120 is the other important practical realisation of our earlier discussion about basic sound parameters. Using values of pitch% read out of the DATA statement, this sets the gap between one off/ on toggle of the relay and another, thereby determining the period between the individual relay clicks and, therefore, the frequency of the resultant buzz.

As it stands, the program merely churns out a repeating (sort of) scalic sequence and flashes the cassette motor LED in time — son et lumière a la BBC, one might say. Changing the values in the DATA statement should allow something like a tune to be played provided you can reach some sort of conclusions as to the scaling relationship between d% values and pitch. A potentially useful application of the relay-toggling effect is as an apoplexy-inducing sound effect in games and the like. For instance if you change line 120 to

```
120 FORZ%=0TOpitch%:NEXT
```

and replace the REM statements with

```
 10 ENVELOPE1,1,127,-21,-1,255,121,
 231, 127,-1,0,-127,126,126
 20 SOUND1,1,0,-1
```

you'll then have invader swoops plus an extremely dirty 'grunging' sound coming from within the innards of your BBC Micro. Not for the faint of heart, though.

```
NEXT:   OUT    (OFFH),A   ;Output contents of accumulator (A) to port
        LD     B,150      ;Load register B with delay of 150
LOOP:   DJNZ   LOOP       ;Decrement B by 1, if not zero remain in LOOP
        INC    A          ;Increment A by 1
        JR     NEXT       :Return to 1st instruction and output bit value
```

Well, red herrings and fun aside, what are the other options for sending some sort of manifestation of timing loop machinations to the outside world? Firstly, there's the option of using the cassette port, which, on some machines, can actually allow a two-way exchange of sound info. in addition to the usual loading and saving of data. Thus, the cassette port on the Apple II has been used for such diverse applications as speech synthesis, speech sampling, two- and three-part music synthesis, sending and receiving tape syncs, producing metronomes and click tracks, and as an input for a software-based spectrum analyzer! Remember that all that's achieved with output and input circuitry which is only capable of sending or reading an on or off state (just like the cassette relay, in fact), ie. giving just a single bit of resolution. Note, however, that not all micros provide anything like a free passage to and from the cassette port (the BBC Micro being a case in point) and there are certain reasons why the Apple is uncannily effective as regards these sorts of tricks.

A second possibility is just to use one of the output port bits, with a speaker connected via some suitable hardware. By then toggling this port with POKEs, the speaker cone can be made to flap itself into square wave ecstasy. For instance, if we were playing around with the ZX81 that's now confined to use as an elegant door stop since we got a BBC Micro, and assuming that the LSB of the output port is our focus of attention (address =11000), then the following few lines will give you a buzz!

```
10 REM ZZZZZZ
20 FAST
30 FORA=1TO200
40 POKE11000,1
50 POKE11000,0
60 NEXTA
```

Again, there's a FOR... NEXT loop (from line 30) that's responsible for establishing the duration of the emerging buzz. We could also insert a further loop, using a sequence of values read out of a DATA statement or two to do something about altering the frequency from time to time. The only drawback to this honourable intention is that, like the sounding-out program using the BBC Micro's cassette relay, the range of frequencies will be limited to something of the order of a few hundred Hertz. In this case, the main problem doesn't lie with a relatively immovable bit of mechanics like a relay but with the limited speed of the ZX81's BASIC interpreter. However, there is a solution to the limited frequency range, and that's to use a machine code subroutine that does all the necessary bit toggling.

One of the other problems with the ZX81 is the lack of input/output port facilities, so it's really a lot more straightforward to toggle the mic output of the infamous cassette port — unless, of course, you've got the necessary port circuitry conveniently to hand (the circuit shown on p.68 of the January 1982 issue of E&MM, for instance) — and most basic music programs for the ZX81 seem to follow this tact.

So, let's amalgamate the suggestion of toggling the cassette port (for convenience) with the idea of a machine code subroutine (for speed) on a further micro, the Tandy TRS-80:

The above assembly language listing operates along the following lines:

1. The contents of the Z-80's accummulator (A) are sent to the cassette port (OFFH). The TRS-80 decodes this port address and sends the LSB of the accumulator to the cassette output circuit.

2. Register B is loaded with a delay value of 150 and then decremented until the result of the operation is zero (the DJNZ instruction). If the result of the operation isn't zero, there's a jump to the location LOOP, which happens to be the same place. With the value set in this instance, the program does this 150 times before moving on, thereby adding the magical ingredient of delay to the proceedings.

3. The accumulator is incremented by 1, with the result that the LSB is obliged to present a pattern of bit values that alternate between 0 and 1 each time round the program loop. So, if the contents of the accumulator were originally 0, the following bit values would be observed:

	MSB	LSB
	0000	0000
1st INC	0000	0001
2nd INC	0000	0010
3rd INC	0000	0101
4th INC	0000	1000
5th INC	0000	1001
6th INC	0000	1010

etc., etc.

4. Finally, there's a return to the start of the routine, and the bit value arising from the current run-through of the program is sent to the cassette port.

With this routine, it's the constant switching of the state of the LSB that causes the cassette port to follow suit by producing a square wave. This time, the delay counter (register B) establishes the time between successive outputs to the cassette port and, therefore, the frequency of the resultant square wave (which is variable between 200 Hz and 20 kHz). Duration control can also be easily added, but this obviously requires a further bit of looping on top of the port toggling routine.

One of the few micros around that makes use of these toggling techniques for its standard repertoire of sound effects is the Apple II. Here, a speaker is connected via a simple amplifier to a flip-flop that can be persuaded to alter its state by performing a read or write operation to a particular address. As with the ZX81, toggling from BASIC is a slow business, and an extremely basic program like the following (from the Apple II User's Guide) doesn't exactly inspire great confidence!

```
10 REM Click
20 A=PEEK (-16336)
30 GOTO20
```

In fact, the highest frequency possible with integer BASIC toggling is about 256 Hz, and, in Applesoft, only gets as far as 72 Hz. So, yet again, it's necessary to turn to a machine code subroutine for anything more than a low-pitched buzz. Bearing in mind that Apples are very fond of beeping at their owners, it's not surprising to find that this sonic shortcoming is met by a short routine in the monitor ROM (at location $FBDD) that produces a beep for .1 sec at 1 kHz.

So far, all we've been concerned with is the setting up of various loops that, a) switch something on and off rapidly and repeatedly, and b) do this for a certain amount of time before doing it again at a different rate. All we're doing here, then, is pulsing something — the cassette relay or speaker, for instance — on and off. What we haven't considered is the proportion that the toggle is in the on state to the off state — and therein lies the means of injecting some timbral variation into the basic scheme for sound synthesis.

The point is that a square wave is just one member of the pulse wave family, ie. where the mark/space ratio (the time spent high in each cycle of the pulse wave) is 50%. Now, by varying the mark/space ratio, the harmonic content of the waveform is also varied, which means that the timbre of sound is altered. So, one method for varying the timbre of toggling is to alter the proportion of time that a bit spends high to low.

This is easily investigated on the Apple II by plugging in a pair of game paddles and entering the following assembly listing from the monitor (CALL -167):

Assembly listing for Apple II.

```
0300-  A2 00     LDX  #$00   ;Load register X
0302-  20 1E FB  JSR  $FB1E  ;Jump to paddle-reading routine (value to X plus
                                accumulator scrambled)
0305-  8D 30 C0  STA  $C030  ;Accumulator contents to location $CO30
                                (speaker toggle)

0308-  E8        INX         ;Increment X
0309-  20 1E FB  JSR  $FB1E  ;Jump to paddle-reading routine
030C-  8D 30 C0  STA  $C030  ;Accumulator contents to $C030
030F-  4C 00 03  JMP  $0300  ;Jump back to beginning of routine
```

Running the routine (300G (CR) from the monitor, or CALL 770 from BASIC), whilst twiddling the paddles, is a pretty effective demonstration of the range of timbres possible just by varying the pulse width. What's happening here is that the routine is using the paddles to vary the delay between the speaker toggles, with one paddle setting the proportion of time spent high, and the other the proportion spent low. Obviously, there's a good deal of scope for extending this routine to more fruitful use than variations on Apple bleeps, and one example that's worth investigating is the variable timbre music utility in the Programmer's Aid supplement to Integer BASIC.

Next month, we'll look at ways of escaping from the limitations of pulse wave toggling with that mainstay of quality digital synthesis, the digital to analogue converter.

CM

Macromusic

by Dr. David Ellis

Part 4

Beyond the Groove

Having commenced his attack on computer music that simply played back like some glorified tape recorder, Max Mathews was under strong pressure to justify his standpoint with workable alternatives. GROOVE went a certain way in this direction, but such hybrid techniques of synthesis — computers controlling analogue synthesisers — negated the tremendous versatility inherent in the 'pure' digital synthesis of Music V and its descendants. However, the GROOVE system, for all its analogue synthesis limitations, was a very productive system — particularly because of the apparent efficiency of the 'successive-approximation improvisation' (gulp...) achieved with it by a continual process of editing/feedback/editing/feedback/etc.

One of the originators of GROOVE, F. R. Moore, has also claimed that "the presence of a listening, thinking, feeling human being in the production feedback loop, rather than as a mere observer of the production, is readily audible in the results." That realisation doesn't come as any great surprise, but, of course, life is made more complicated in the design stage if real-time or almost real-time feedback is desired. The goal to develop a computer music system that meets every eventuality as regards demands from composers and performers must be a powerful driving force, and this is well typified by the Computer Audio Research Laboratory (CARL) that's under construction at the University of California, San Diego. Figure 1 gives the schematic for such a 'functionally complete' computer music system. However, there was one essential difficulty in going from the GROOVE system to interactive digital synthesis, and that was the problem of making the latter operate fast enough to function in real time.

Fortunately, the '70s saw the emergence of suitably fast digital hardware that permitted real-time synthesis. Two digital engineers working at Bell Labs, Pepino di Giugno and Hal Alles, produced a sound generator building block consisting of a digital oscillator time-multiplexed 64 ways (giving 64 individual digital sound generators) on a single 8" x 10½" board (a total of about 160 cheap ICs). Development of this hardware was given a considerable incentive by the fact that Boulez's great white hope, IRCAM, was currently on the look out for a suitable real-time synthesis system to operate alongside the trusty Music V on a PDP-10 minicomputer. In fact, the original idea of Luciano Berio, the head of the computer music side of IRCAM, was to construct an analogue synthesiser with 1,000 oscillators! It was tactfully explained to him that this wasn't the best way of going about synthesis in the digitally-enlightened '70s, no matter how generous the French government's grant might be, and the di Giugno/Alles board became IRCAM's so-called '4B machine' for implementing real-time synthesis. However, there were a fair number of problems associated with this hardware, and it's worthwhile noting them just to appreciate the difficulties that 'classical' electro-musicians had in pursuing their various goals at this time (1977) and the remarkable advances that have been made since then.

The 4B machine ran at a 32 kHz sampling rate, giving a practical upper limit to the audio bandwidth of 13 kHz, but generated envelopes by a piecewise approximation method using a series of ramp waves. The big problem was that these envelopes were generated at 4 kHz, which produced an annoying 'chirp' on some very fast envelopes, and required the controlling computer to initiate a new ramp each time an old one ended. This was a lot of work for the computer (which tended to slow down under the strain) and a lot of work for the composer (who tended to do something fairly similar). Furthermore, the design of the board was based around unit generator-type 'module definitions', and these were hard-wired into PROMs in such a way that repatching wasn't very practical. The unit generator concept also extended to using (or 'burning') some of the 64 oscillators for other purposes, such as envelope generation. Thus, the initial promise of 64 tone generators tended to evaporate as soon as more complex synthesis was mentioned.

The next development in the 4n series of IRCAM 'sound processors' was the 4C machine, another single-board digital synthesiser designed by di Giugno. This included 64 oscillators with up to 16 different waveforms at any given time, 32 envelope generators, and various other timing and control functions. The standard 4C system used a PDP-11 minicomputer, a single 4C synthesiser board, and up to four DACs. With everything running full ahead, the 16 kHz sampling rate brought the effective bandwidth down to about 6.4 kHz, but, by judicious mixing of sampling rates internally, and by sacrificing some of the oscillators, high quality, flexible synthesis was perfectly feasible. The basic 4C system has also been modified considerably to include digital recording/processing of live sound via the connection of an ADC and a direct memory access (DMA) controller (Figure 2). As we'll see in a later article, DMA is really a great boon for real-time digital synthesis because it enables DACs and ADCs to gain access to memory without the time-consuming intervention of a microprocessor, and, with current processor technology, you really need that extra speed!

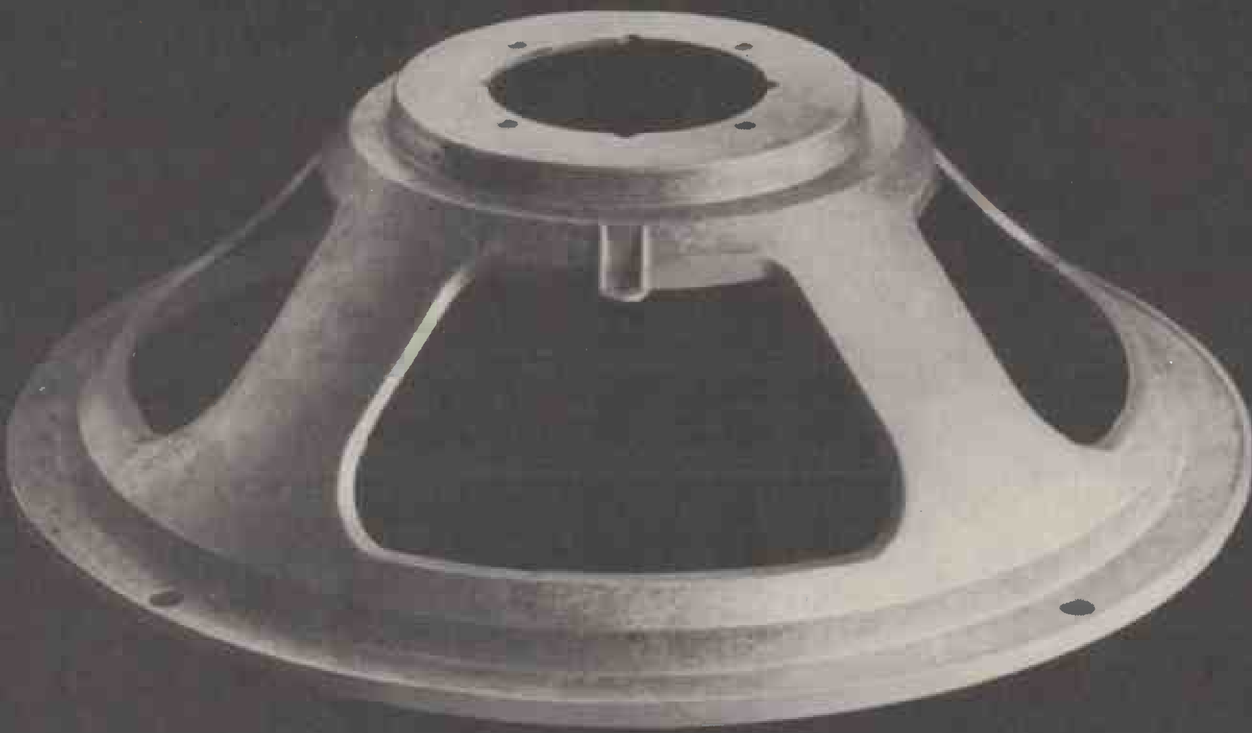
The most recent piece of di Giugno hardware at IRCAM is the 4X machine. This impressive system is designed primarily for the synthesis and processing of natural sounds, including as it does 16 ADCs and 16 DACs, and can perform real-time Fast Fourier Transforms (a complex mathematical operation that breaks sounds down into their harmonic constituents); carry out linear predictive coding (the technique used by the Texas 'Speak 'n' Spell' type of chips) of speech and music; and record, edit, and mix sounds inputted from microphones.

One of the more recent uses of the 4X machine was in the performance of Boulez's 'Répons' at this year's Proms, where it was used to transform in real time the sounds of six solo instrumentalists. This is definitely an intelligent way of using intelligent synthesisers, offering as it does the spontaneity of a live performance with the extraordinary possibilities opened up by real-time digital sound processing. However, the 4X machine would appear to have nothing on the utterly awesome machine that's being developed at Lucasfilm Ltd. in San Rafael, California.

A.S.P.

The digital audio project at Lucasfilm Ltd. (established by George Lucas of 'Star Wars' fame), under the direction of James A. Moorer, a stalwart of the computer music field, was set up to produce a successor to the Moviola, a machine invented in 1900 for the purpose of transferring sound tracks onto film and still going strong 80 years on. The Lucasfilm machine is called the Audio Signal Processor (ASP) and is constructed from one to eight Digital Sound Processor (DSP) units. Such unglamorous titles hide the mind-boggling technology of 3,600 emit-

POWER STRUCTURE



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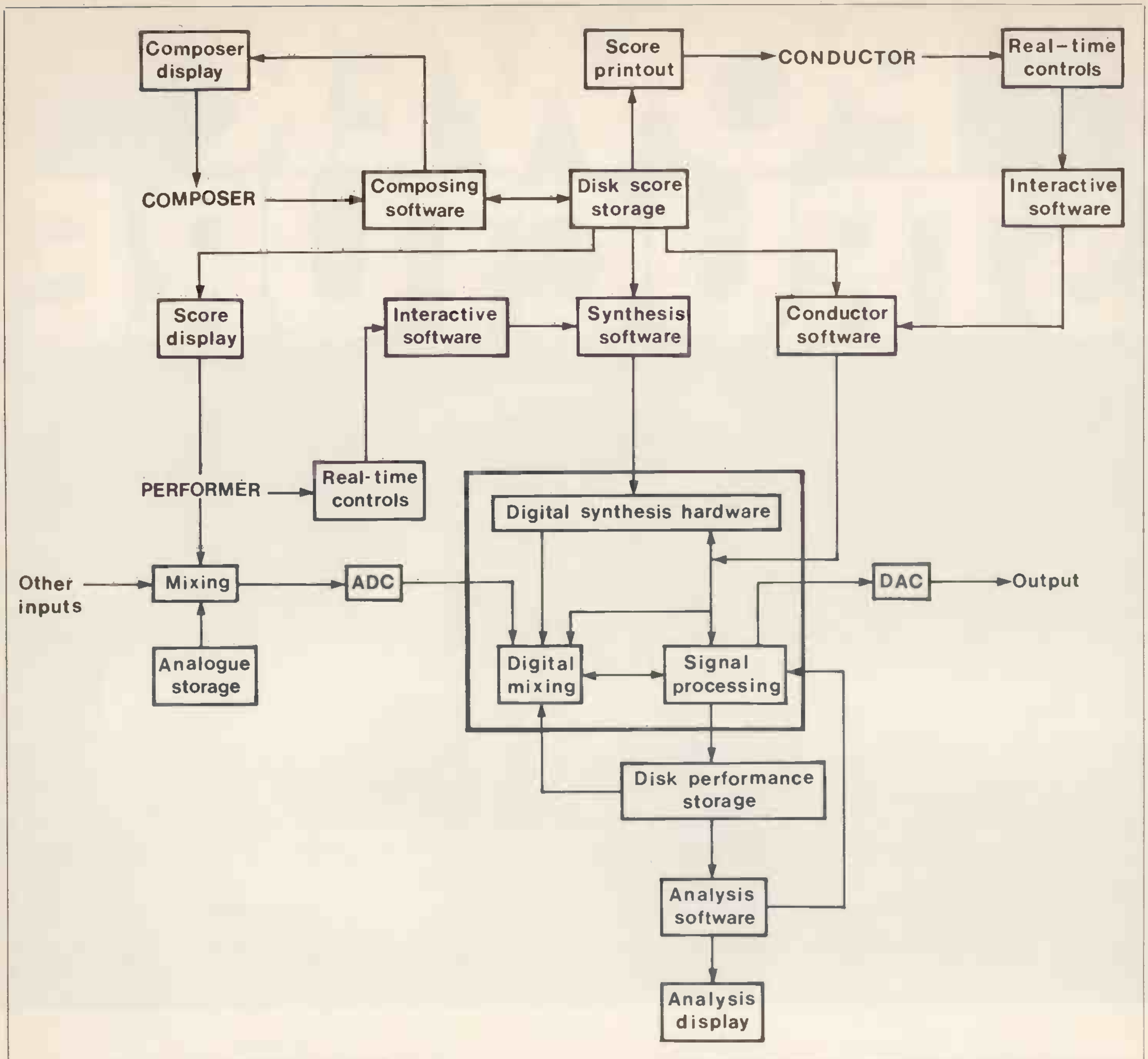


Figure 1. A complete computer music system.

ter-coupled logic chips in each DSP. The point about emitter-coupled logic is that it's very fast (more than twice the speed of Shottky TTL logic) and, when put together in the form of the ASP, will perform some 140 million operations per second! Remember that a Cray-1 gets up to about 33 million operations per second on a good day and a 1 MHz 6502 microprocessor can just about drag its feet along with 330,000 simple arithmetic operations in the same time period.

Each DSP unit handles 16 ADCs and 16 DACs (16-bit, of course) configured as sound transformation channels, with overall control coming from a 68000 processor embedded in each DSP. Wavetables, interpolation functions, reverb algorithms, or whatever are stored in 3 Mbytes of memory in each DSP unit. These DSPs also make waveform sequencing, and most other software tricks aimed at producing timbral variety, totally redundant, because with all that processing power, they're able to perform the real McCoy of digital filtering — in fact, each DSP is capable of generating sixty 2nd order filter sections without blinking (ie. slowing down the sampling rate). As if all that wasn't enough to make even a Venusian green with envy, a real-time console — also based around a 68000 processor — provides just about every interactive control one could possibly wish for. The design of the console is such that every control input (knobs, joysticks, digital faders, touch-sensitive strips, keyboard, or 'Lucasmouse') can be assigned to any more-or-less musical parameter, such as modulation index, spatial mixing, reverberation contours, and so on.

Quite honestly, a machine like the ASP makes the average computerised mixing desk look old hat! Mind you, given the tired state of the film industry, it's hard to see how such a revolutionary machine could make any sort of inroad into Moviola territory. There's also the old adage of "garbage in equals garbage out", and the same is likely to be true of the humble film music composer struggling to come to terms with such a system. Still, it should ensure some amazing sound tracks for sequels to 'Star Wars' and 'The Empire Strikes Back' (assuming that there are still cinemas around to show them).

Whilst one half of the 4B design team was beavering away at IRCAM, the other half, Hal Alles, returned to Bell Labs to work on his own digital synthesiser hardware. What actually emerged was a single board design, comprising a mere 110 ICs, offering 32 independent digital oscillators, envelope generators to control amplitude and frequency, as well as time functions and FM inputs for each oscillator. In fact, only one high speed oscillator circuit is used, but it is time-multiplexed 32 ways to generate the multiple oscillators (each with a 32 kHz sampling rate). Each oscillator is controlled with eight 16-bit registers in RAM (addressed as sixteen 8-bit words) which is interfaced to the buss of the controlling microprocessor so that it appears in the processor address space. All this makes for an easily-controlled, high quality system (especially if 16-bit DACs are used) for real-time digital synthesis, and the long and the short of this happy hardware story is that the Alles design ended up in the memory map of a Z80 as the driving force of a commercial digital synthesiser, the Synergy (from Digital Keyboards Inc.).

In fact, the original testbed system built around the Alles board was a fairly lavish affair, including dual disk drives, 64K of RAM, and many performance and software features (notably those for constructing sounds and very extensive multitracking facilities) left out of the Synergy. This system was (is?) actually marketed under Crumar's name (one of Digital Keyboards' backers) as the General Development System (GDS) and includes amongst its users Wendy Carlos, Klaus Schulze, and Billy Cobham, to name but a few.

Max Mathews was also involved in some

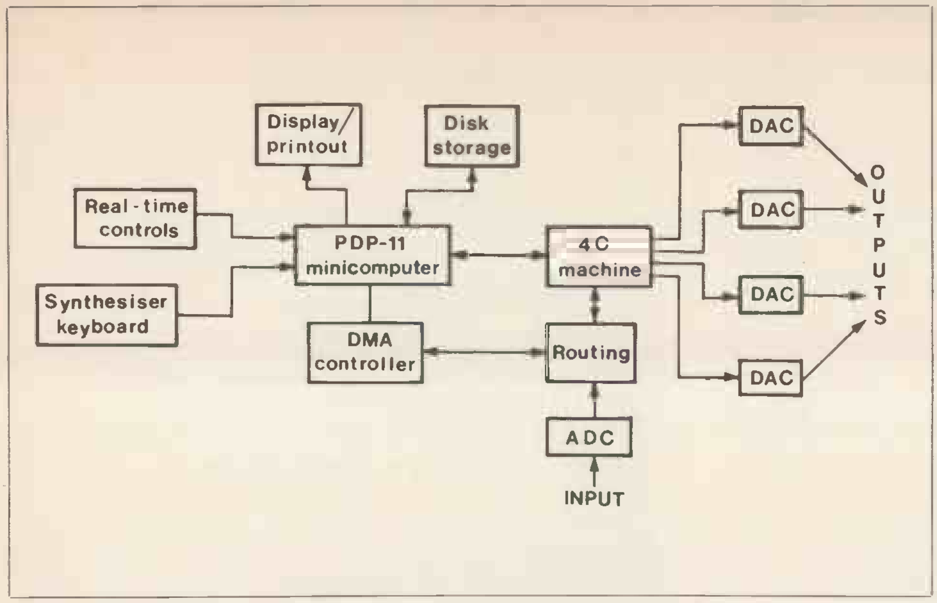


Figure 2. The 4C system modified for real-time processing of sound.

of the design considerations of the GDS and the Synergy, but his main preoccupation from Music V days onwards has been to improve the composer's relationship with the computer. After all, the whole idea was to do better than some pianist playing a piece of graceless contemporary music, and that meant devising ways and means of getting away from the 'sewing machine music' label of a computer that played like a switched-on Bach.

The first device that Mathews developed, with a view to real-time control of the playback process, was the 'electric baton'. The idea behind this was that it should allow the composer to rehearse and conduct the computer's performance by setting tempos and balancing voices in real time. The rehearsed performance could then be stored, and subsequently played back as a closer approximation to the real intentions of the composer, or further conducted as a 'live' performance. The GROOVE system provided the interactive speed needed for such real-time control, with Pierre Boulez being one of its main users (in conjunction with the Conductor program).

Sequential drum

However, a more potentially useful development for promoting musician-machine interaction is Mathews 'sequential drum'. Instead of producing a sound, the 'drum' produces three electrical signals. The first is proportional to how hard one hits the drum and triggers the sounding of a note and determines its loudness. The other signals from the drum indicate to a computer where the drum was hit in terms of X and Y co-ordinates. The X signal might be used typically to control the decay time of a note across the stereo field. Thus, hitting the left side of the drum would slow down the decay of a note on the same side, leaving the right to decay at a faster rate. The Y co-ordinate can be used very effectively to vary the timbre of notes: hit at the top, one gets a rich harmonic sound; hit at the bottom, there's just the fundamental. The 'sequential' side of the drum comes into view when it's interfaced with the playback of a score already programmed and stored in memory. Each time the drum is hit, the player automatically gets the next note or chord in sequence (actually, this is rather similar to the 'one key' operation of the VL-Tone and other Casio sequencing keyboards!), thereby giving him plenty of time to concentrate on the more juicy details of timing, timbre, dynamics, and whatever else he cares to allocate to the tapping of fingers. Figure 3 illustrates some ideas about performance and where the sequential drum fits in.

Macro conclusions

The interesting (and, for us musicians, important) thing that's happened over the past five or so years is the development of digital synthesis hardware, like that from the wire-wrapping pens of di Giugno and Alles, that shoulders a good deal of the responsibility for waveform generation, scaling, and so on. This means that the move from macros to micros as controllers of such hardware is possible without making whacking great sacrifices as regards quality, efficiency, or flexibility — factors that are amply demonstrated by Crumar's GDS and, more recently, the Buchla 400 system. Moreover, even the Lucasfilm Audio Signal Processor, a machine that must truly deserve the tag of 'state-of-the-art', exists and works by virtue of microprocessors (albeit 16-bit ones). But a measure of caution is also worthy at this stage, as it's all too easy for the musician or composer to lose track of his aim — creating music — in pursuit of whatever pot of gold lies at the end of the computer music spectrum. Devices like Mathews' sequential drum and Boulez's use of the 4X machine redress the balance by returning to the down-to-earth business of man-machine interaction with intelligent ways of playing intelligent music-making machines.

All the work in macrocomputer music that Mathews sparked off in the '50s has provided a vast amount of food for thought, and if this mini-series about music on macrocomputers has provided even a mere aperitif, I'll be delighted: the problem now is to guide the development of music on microcomputers in a similarly fruitful way. Max Mathews has one vision of the future: "Computers will add a new dimension to music, especially the home computer. It will be sufficiently easier to play so that many people who otherwise could only listen to music will become active musicians. This may be the biggest accomplishment of the home computer market." There are other points of view, of course, but, in the next article, we'll put controversy aside and go back to the basics of digital synthesis on microcomputers.

CM

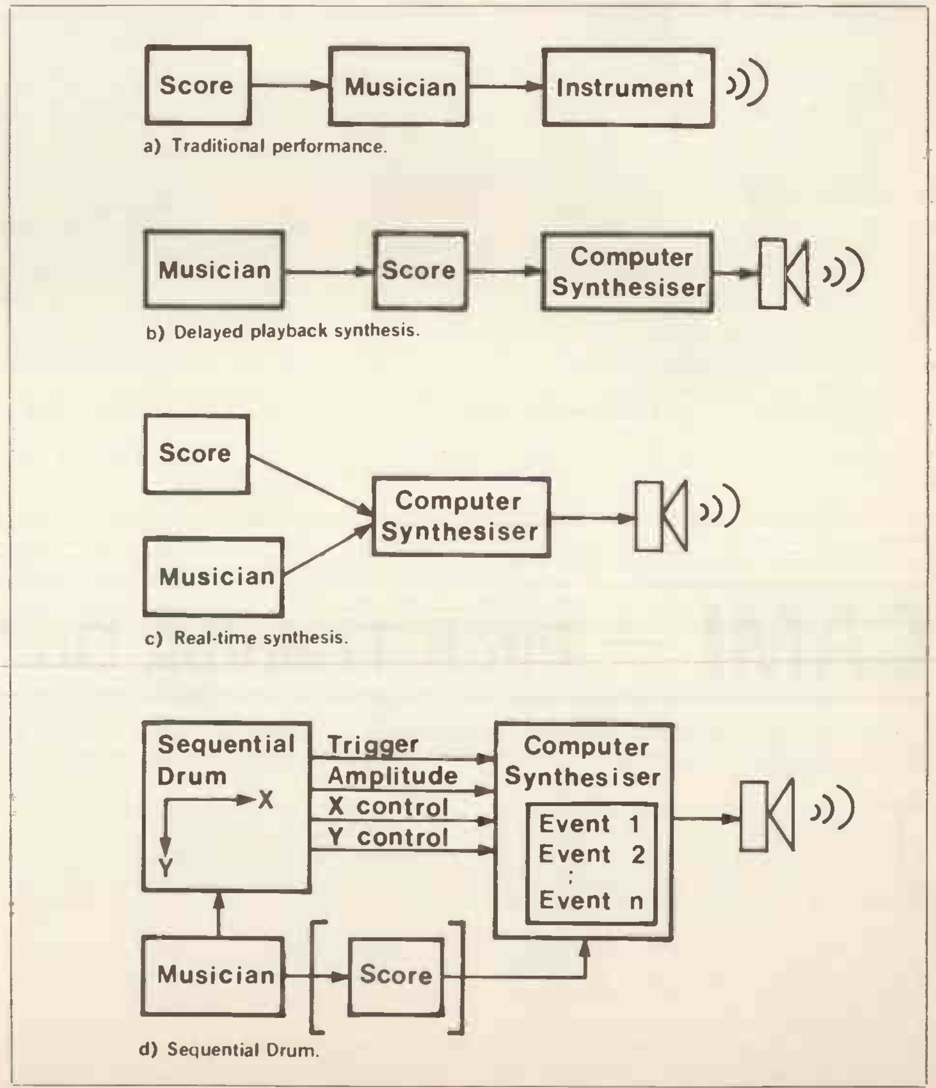


Figure 3. Performance options.

```
>LIST

   10REM Pitch Tuner
   20REM Creative Sound on the BBC Microcomputer
   30REM Acornsoft (C) 1983
   40
   50DIM points% 7,right%(5),mess$(5)
   60DATA 1st,2nd,3rd,4th
   70FORI%=1TO4:READmess$(I%):NEXT
   80ENVELOPE1,1,0,0,0,1,1,1,126,-1,0,-10,126,126
   90
  100signs$="- +":sp$=STRING$(10," ")
  110dx%=11:mx%=22:my%=0
  120sx%=30:sy%=4:tx%=30:ty%=21
  130!points%=&0102050A:points%!4=0
  140MODE7
  150ONERRORGOTO1150
  160@%=3
  170VDU23;10,32;0;0;0;
  180*FX4,1
  190*FX12,4
  200*FX11,14
  210
  220REM Print Display
  230pre$=CHR$&97+CHR$&B5:post$=CHR$&EA
  240PRINTTAB(30,1)"* Pitch *"
  250PRINTTAB(30,2)"* Tuner *"
  260FORI%=+12TO-12STEP-1
  270n$=STRING$(10," ")
  280IF(I%AND3)<>0GOTO330
  290nnum%=I%DIV4
  300IF(nnum%AND1)=1:n$="Minor "ELSEn$="Major "
  310IFABSnnum%=3:n$=n$+" 3rd"ELSEn$=n$+" 2nd"
  320IFnnum%=0:n$="Unison     "
  330PRINTTAB(dx%-11,12-I%)n$+"  ";
  340PRINTMID$(signs$,2+SGNI%,1)ABSI%;
  350NEXT
  360
  370cy%=0:PROCpcur("[")
  380ONERRORGOTO990
  390PROCpmess(sp$)
  400VDU28,sx%,24,39,sy%,12,26
  410score%=0:tests%=0
  420FORI%=1TO4:right%(I%)=0:NEXT
  430
  440REM Main Loop
  450REPEAT
  460REM Present pitches
  470diff%=RND(25)-13:first%=RND(48)+12
  480PROCplay:go%=0
  490
  500REPEAT:REM Until correct or 4 goes
  510REPEATUNTILNOTINKEY(-74)
  520*FX15,1
  530REPEAT
  540key%=GET
  550IFkey%=135:PROCplay
  560IFkey%=13:GOTO610
  570PROCpcur(" "):PROCpmess(sp$)
  580IFkey%=139:cy%=cy%-(cy%<>12)
  590IFkey%=138:cy%=cy%+(cy%<>-12)
  600PROCpcur("[")
  610UNTILkey%=13
  620
  630go%=go%+1
  640err%=cy%-diff%
  650IFerr%=0:GOTO690
  660IFerr%>0:a$="(v)"ELSEa$="(↑)"
  670IFgo%=4:a$="   "
  680PROCpmess("Wrong!  "+a$):GOTO740
  690PROCpmess("Right!")
  700right%(go%)=right%(go%)+1
  710score%=score%+points%?(go%-1)
  720PRINTTAB(tx%,ty%)"Score:";
  730PRINTTAB(tx%+1,ty%+1)score%;
  740UNTILgo%=4ORerr%=0
  750tests%=tests%+1
  760TIME=0:REPEAT
  770FORZ%=0TO100:NEXT:UNTILTIME>70
  780PROCpmess(sp$)
  790UNTIL0
  800
  810DEFPROCpcur(c$)
  820PRINTTAB(dx%+6,12-cy%)c$;
  830ENDPROC
  840
  850DEFPROCpmess(m$)
  860PRINTTAB(dx%+8,12-cy%)m$;
  870ENDPROC
  880
  890DEFPROCplay
  900SOUND1,1,first%,10
  910SOUND&1001,0,0,5
  920SOUND1,1,first%+diff%,10
  930REPEATUNTILADVAL(-6)=15
  940REPEATUNTILNOTINKEY(-106)
  950*FX15,1
  960ENDPROC
  970
  980REM Error Handler
  990ONERRORGOTO1150
 1000IFERR<>17ORINKEY(-1):GOTO1150
 1010IFtests%=0:GOTO380
 1020REM Display scores
 1030@%=&A03
 1040PRINTTAB(sx%,sy%+1)"Results:";
 1050FORI%=1TO4
 1060PRINTTAB(sx%,sy%+I%*3)mess$(I%)" time:";
 1070PRINTTAB(sx%,sy%+1+I%*3)INT(right%(I%)
      /tests%*100 )" %";
 1080NEXT
 1090PRINTTAB(tx%,ty%)"Overall:"
 1100PRINTTAB(tx%,ty%+1)INT(score%/tests%*10)" %";
 1110ONERRORGOTO380
 1120A%=GET:GOTO380
 1130
 1140REM not escape
 1150ONERROROFF
 1160*FX4,0
 1170*FX12,0
 1180VDU23;10,&72;0;0;0;
 1190REPORT:PRINT" at line ";ERL;" OK?"
```

CAMI — Pitch Training On The BBC Micro

"I even think that sentimentally I am disposed to harmony. But organically I am incapable of a tune. I have been practising 'God Save The King' all my life, whistling and humming of it over to myself in solitary corners, and am not yet arrived, they tell me, within many quavers of it."

Charles Lamb

The aim of this series of articles is to show how the micro is emerging as a powerful medium for solving many a problem in music education. We start with the bane of many a student's musical education, namely ear-training.

The basic objective of this invariably disliked subject is obviously to provide the developing musician with a built-in framework for pitch perception, key recognition, and rhythmic fluency. However, teachers of ear-training are frequently faced with the problem that students come to their courses with very differently developed skills. This makes class teaching unworkable, but the alternative of individual attention is uneconomic. Where this leaves systematic ear-training is in the doldrums, and it's here that CAMI can step in.

'CAMI' stands for Computer-Assisted Musical Instruction and is really all about making life easier for teachers trying to teach music or for those attempting to teach themselves. The programs that will be presented in this series hopefully go one step forwards by providing an ever-patient teacher that doesn't rap you over the knuckles when you play the wrong note or make an incorrect response. Also, a computer is in many senses an ideal vehicle for the training of musical rudiments because of the comparative ease with which the necessary systematic presentation of both visual and aural stimuli can be accomplished. Moreover, when such drill and practice is done in a self-paced, computer-based environment, learning seems to be a good deal more efficient and a lot faster.

From 'Creative Sound on the BBC Microcomputer' by David Ellis & Chris Jordan — to be published by Acornsoft in the autumn.

Pitch Training

Most of us can make a pretty good stab at tapping a finger in time with music, so the teaching of practical rhythmic skills isn't too much of a problem. The development of pitching abilities, on the other hand, is nowhere near so straightforward. There are basically two forms of pitch perception: 'abolute pitch' and 'referential pitch'. Absolute pitch refers to the ability of the lucky few to be able to pluck any pitch from thin air, whether it's sung, played, or whatever, as well as being able to accurately recreate it on demand. Stories abound of prodigies like Mozart with exceptional pitch-sensing abilities, but the description of the absolute pitch demonstrated by the young Frederick Ouseley (later becoming the professor of music at Oxford University) is probably more like the average trained musician's abilities. At five, the young Fred was apt to remark, "only think, papa blows his nose on G". He also apparently saw music in the wind (whistling in D) and weather (thundering in G).

The good news is that absolute pitch can be taught, and one of the best ways of acquiring pitch sense is to have a micro randomly present pitches and then analyse your responses for statistical significance, ie. the degree to which your pitch sense is random rather than absolute! In 'Creative Sound', there is a program which does just that, but, as it's a very basic tool, this article will jump on to a program one stage up the ladder that trains both your absolute pitch sense and your ability to work out intervals.

Now, one advantage of using a computer to generate pitches is that one's not limited to the notes of the diatonic scales. In fact, courtesy of the BBC Micro's operating system, playing around with eighth-tone scales is quite permissible (though rather on the out-of-tune side of things). So, the Pitch Tuner program coming up is designed to stretch the student's accuracy of pitch perception by asking him or her to assess the degree by which two pitches differ. These may fall on the standard notes of the chromatic scale or they may fall in between.

Instructions

The hapless individual encountering the program is presented with two pitches, between which he's expected to make some sort of value judgement, ie. how far apart they are. The vertical scale on the left of the display indicates the potential range of differences — from plus a major 3rd to minus a major 3rd, depending on whether the second pitch is higher or lower than the first. To make a choice, the UP and DOWN cursor keys are used to move the arrow to what is thought to be the correct pitch difference between the first and second tones, and then RETURN is pressed to lodge that decision with the micro.

Remember that we're talking about multiples of eighth-tones, so don't despair if it's tough going at first! Should the first attempt prove vaguely disastrous, the program will then offer a helping hand in the shape of an arrow head hint in the right direction. After the fourth attempt at the same two pitches, you'll be directed onto a new set of tones. Pressing COPY allows you to replay the pitches as many times as you want before making a valiant attempt at answering. ESCAPE gives you your score, both individually for those trials successfully answered on the 1st, 2nd, 3rd, and 4th tries, as well as overall. Bon chance!

Workings

When it comes to writing CAMI programs like this one, the job is often made much easier by drawing out a simple plan of the loop structure beforehand. With anything up to half-a-dozen loops, including some that are nested, handling sound, user input, and scoring, the plan-it-as-you-go approach can soon end up with a perfect example of spaghetti programming — a tangle of unfathomable GOTOs and IF statements. However, if you take the trouble to set the program out with commented REPEAT... UNTIL loops, using logical variables where it makes the conditional functions clearer, you'll probably save the extra time it would have taken to fix the bugs incurred by adopting the first approach!

The Pitch Tuner program is actually pretty simple in this respect, having just three major nested loops. The outer one (lines 450 to 790) repeats indefinitely, presenting a different test each time. Inside this, the pitch is chosen randomly (line 470) and played (line 480), before entering the answer loop (lines 500 to 740). This terminates after the right answer is given, or, failing that, after four wrong answers. The input loop (lines 530 to 610) deals with cursor key presses, moving the selection pointer up and down, until RETURN is pressed to register an answer.

CM

Rickenbacker 360/12 Guitar

Rickenbacker guitars have been absent from these shores for quite some time, having lacked a UK distributor. However, a new company called Golico have set things to right and are now handling distribution of these 'classic' instruments — and judging by their crowded stand at the recent British Music Fair, are managing very well indeed.

The Rickenbacker guitar 'sound' has been an integral part of many bands' music — most notably The Beatles; and more recently Genesis, The Jam, Pretenders and even Rush.

The model reviewed here, part of their extensive 360 semi-acoustic range, is a twelve string guitar. This in itself is fairly unique as, apart from Shergold, very few manufacturers seem to build electric twelve strings these days.

Four standard finishes are available for the 360/12 — Fire-glo (red), Burgundy, Jet-glo (black) and our model, Azure-glo (blue). A choice of custom colours or natural finish can also be obtained at extra cost if requested.

Construction

The guitar body is 1¾" deep, neatly bound around the edges and carved from maple wood with a hand buffed finish. The semi-acoustic body design is the distinctive Rickenbacker shape having one large, dart-shaped, 'f-hole' on the top of the body.

The long scale neck has a four piece, laminated maple construction with a 24 fret, rosewood fingerboard that has pearl-style inlays. It is bound at both edges and coated in a fairly thick varnish. The supplied action on this guitar was set fairly low and it was quite easy to hold down a full bar chord with little thumb pressure being required. The neck itself is extremely narrow in comparison to many six string let alone twelve string guitars! The heel of the body begins around the 15th fret position which makes it a simple task to play chords in high inversions, but the narrow neck width and string spacing mean that it's difficult to hold down a chord past the 12th fret if your fingers are at all on the large size.

The nut on this model was well cut to accept the twelve strings (the octave string being the inner one of each pair, from the low E upwards). Nobody seemed to know from what the nut was made, but it appeared to be fashioned from either ebony or a carbon graphite substance. If this is the case, then it should help prevent excessive wear on the nut — something that can quite easily lead to unwanted fret buzz and bad intonation.

Machine Heads

The headstock, once again, is the usual Rickenbacker shape and comes fitted with twelve, individual Kluson Deluxe, chrome-plated machine heads. These are laid out in two groups of six in order to keep the head mechanism as compact as possible. Six of the heads project at a 90° angle to the headstock (these control the normal string tuning), whilst the remainder are fitted to the side of the head (as is usual) and control the tuning of the octave (and unison) strings.

A clever arrangement, this, that overcomes the problems encountered with additional heads, namely, balance and space. The heads themselves were unusually stiff to turn but this will probably ease with continued use.

One problem that could be foreseen with the 360 would be on 'restringing'. Because the machine head barrels pass horizontally through the headstock, there are two grooves cut into the face to allow access to them. However it is practically impossible to thread a string through these barrels with other strings already fitted, as these simply get in the way. You really need to fit each octave string first before attaching the others, and this could well prove a nightmare job if you ever had to do it 'live'!

Finally, removing the white plastic decoration on the headstock reveals the two, separately adjustable, steel trussrods that enable neck tension to be adjusted, very accurately.

Controls

The whole guitar is some 39¼" long and 15¼" wide. A large area of the body is covered by a white plastic section, that acts as a pickguard. This houses five ridged control knobs for bass and treble, tone and volume. Between these is the smaller, fifth knob which appeared to act as an overall highpass filter tone control. Advancing this gradually reduced the bass content, creating a hollow, jangly sound. A three position toggle switch completes the pickup controls and is used to select between bass and treble pickups or a combination of the two.

Removing the previously mentioned plastic cover exposes the passive tonal circuitry. The pickups are earthed to the pots and bridge assembly, but there is no overall screening for this compartment — a minor point, but one that should never be overlooked on an instrument of this price.

The positioning of the pickups very close to the neck and bridge respectively, helps to create a slightly wider than normal tonal variation between pickups. The treble pickup produced an extremely bright, 'toppy' sound that is able to cut through any sound mix. The bass pickup, in contrast, produced a warm sound that proved ideal for sleazy, jazz chord meanderings, yet packed quite a punch when the amplifier level was wound up.

Cosmetically speaking, the pickups are chrome-plated with black plastic coatings that cover the polepieces, preventing compensatory adjustments to string output levels from being made (if ever required). A novel feature of the pickup housing is the foam rubber wedge on which they are each mounted. One suspects that this is designed to cut down the transmission of vibrations, through the body, to the pickups in the hope of reducing natural feedback. Something that can plague any semi-acoustic when played at high sound levels.

Bridge

The 360/12 is fitted with a chrome, 'R' shaped tailpiece that anchors the strings which then pass over the bridge saddles. There are six of these, one per pair of strings, which are curved to retain the action height of the strings over the cambered fingerboard. All saddles are adjustable forwards/backwards using the appropriate screw/spring mechanism. The bridge is chrome-plated, suspended on two threaded pillars which adjust the overall height, raising and lowering the string action (the height of the string from the fingerboard surface) by means of Allen — like screws. The bridge cover provides a convenient resting place for the palm of your right hand when dampening strings.

Since each string pair shares the same saddle, the intonation can never be set exactly for individual strings. This, however, is not too much of a problem on a twelve string guitar as slight mistuning between strings actually improves the overall 'chorus' effect that's produced when the guitar is strummed.

Finally, on the bottom edge of the body is a chrome plate containing two quarter inch jack sockets. One provides a normal mono signal output, the other a stereo signal when the optional Rick-O-Sound kit is wired in, producing extra tonal variations and noise reduction. Without this kit, which costs around £45, a heavily bass cut signal can be obtained from this socket when a mono jackplug is connected.

Conclusions

The problem with Rickenbacker guitars is that they produce such a characteristic 'sound' (especially true of this 12 string); so much so that you either love them or hate them.

The instrument in question does have its little idiosyncrasies and can be rather awkward for large fisted players, but when it comes to the crunch, the guitar does produce a 'beautiful' sound. That really, to my mind, is the dominant factor in the choice of any instrument — the sound — and you really need to experience it personally to draw your own conclusion.

Ian Gilby **E&MM**

As far as prices go, Golico don't have an actual RRP on their products, preferring to let each dealer set his own price. However, the guide price is £600 for the 360/12 guitar, so shop around for the best deal. For further details contact Trevor Smith of Golica Ltd., Studio House, High Lane Village, Stockport, SK6 8AA. Tel. (06632) 3968.

Rickenbacker TR75GT Amplifier

If you were to ask most musicians to list all of the amplifier manufacturers known to them, it would be a safe bet to say that the name 'Rickenbacker' would not be amongst them. This is ironic, for in the USA, from where the amps originate, they are highly thought of. Now that Golico are distributing the full range of these amplifiers over here the situation will undoubtedly soon alter. The model chosen for review, the TR75GT, forms part of an eleven model range, seven of which are combos ie. self-contained speaker/amplifier systems.

Specifications

The TR75GT is a transistorised, twin channel combo amplifier measuring 20"(H) x 26"(W) x 12"(D) and providing a maximum 75 watts (RMS) power, delivered into two heavy duty 12" speakers. (JBL speakers are optional).

The amp is primarily designed for use by guitarists, having a 10 kHz bandwidth upper limit. Having said that, it did perform well with a synthesiser input, whose upper harmonic content was strong. The bass end, as well, proved something of a revelation, being tight but not harsh. The open-back cabinet design does mean that the speakers have a slightly improved sound dispersion characteristic over similar twin speaker combos. This may or may not be a good thing, depending on your particular requirements.

The unit is soundly constructed and elegantly finished in a durable black vinyl fabric. Plastic moulding strips afford the edges some added protection but metal excursions would have been preferable. Detachable castors are provided for the amplifier, and are best fitted, since the unit is too heavy to carry for any length of time without them. A flimsy speaker cloth is the only protection provided for the speakers and this really should be reinforced to prevent accidental damage from occurring.

Front Panel

This is silver and black and houses the controls for the two separate channels. From left to right, there are high and low gain input sockets for channel one. Input 1 (high) is generally used for most guitars unless they have a higher than normal output level from the pickups, when the second input should be employed.

A separate volume control is provided with bass and treble tone controls which only afford a basic means of equalising your guitar signal. The reverb control is next, which adjusts the mix between dry and reverberated signals. The reverb is produced from a springline device housed in the main amplifier compartment and creates a warm, but not too deep, effect which adds a useful colouration to most types of guitar sound.

Next, is a stereo jack socket which accepts a stereo plug and feeds the input to left and right channels for independent level control and equalisation. Used in this way, the effect is not too effective, since the close proximity of the speakers prevents a decent stereo image from being perceived. It is much better when one channel is fed to an auxiliary speaker from the rear panel speaker connection.

Channel two has the same controls as channel one with several additions. A built-in overdrive circuit can be used to give fuzz and distortion effects. The associated distortion level control has a click 'off' setting, and advancing this clockwise increases the degree of 'clipping'. Some pleasant effects were achieved with the knob set at 5 and the midrange boosted to give a raunchy sound that's ideal for heavy rhythm work.

Further tone controls are provided for bass, mid and treble ranges whilst the presence helps project your guitar sound by boosting the all-important 1.5 kHz frequency band.

A three position power switch with neon indicator lamp completes the front panel array and provides a line reverse switching capability that helps reduce mains hum, if a ground loop happens to occur on your PA or recording system. A useful feature that worked effectively.

Rear Panel

A comprehensive group of connections are provided on the rear. Left of the heatsink are sockets to allow external speakers to be connected, if required, for additional backline monitoring, say, or stereo operation This 'External' socket does not disconnect the internal speakers however. If this is required, you can do so using the other socket labelled 'Speaker'.

A footswitch socket permits remote switching on/off of both reverb and distortion effects when a stereo jack and dual footswitch (optional) are connected. Using a stereo lead plugged into the effects in/out socket also allows an external signal processor such as a digital delay or chorus to be patched in-line and controlled via the amplifier levels. Alternatively, the reverb can be sent to an external mixer or amplifier for even greater variation.

The final two sockets are each combined input/outputs for the channel preamplifiers. These can be used to send the respective channel signals to other amplifiers (for stereo) to effects units, mixers or even to the second channel of the same amp for 'master volume' type overdrive effects.

Impressions

The TR75GT represents value for money, considering the power rating, twin channels and comprehensive effects/speaker routing facilities. The modular circuitry should make this an easy amp to maintain and the solid state design should prove reliable on the road.

The sound produced is characteristically 'transistorised', being clean, and punchy with a sharp response. At times it appeared a little 'hollow' but boosting the midrange frequencies rectified this easily. All in all a handy, efficient amplifier that's ideal for small clubs or studio sessions.

Ian Gilby **E&MM**

Golico's guide price for the TR75GT is £300 (£400 with the JBL speakers fitted). Further details from Golico Ltd., Studio House, High Lane Village, Stockport, SK6 8AA. Tel. (06632) 3968.

TR75GT amplifier.

British Music Fair

The AMI Trade Show

The buzzword at this year's BMF was touch sensitivity. Not only were **Sequential Circuits** just round the corner with the Prophet T-8 and **Rhodes** previewing the Chroma Polaris with the Triad Interface, but **SIEL(U.K.)** — a new name for many of us — showed the Opera 6, a smart new dual-oscillator poly with a velocity-sensing keyboard. Previous SIEL synthesisers (for those of us who have seen them) could be accused of a home organ/string ensemble look, but no danger of that here. In a smart blue-trimmed professional looking case, the Opera 6 has a clear layout. We were told Sequential Circuits had a hand in the design and this certainly shows in the In, Out and Through MIDI Interface with which the instrument is fitted. For your £1,300 (RRP) you also get 2 oscillators and 2 envelopes per voice, 2 wheel controllers and 100 programs.

SIEL also showed the PX piano which is actually being marketed in the States as the Sequential Circuits Pianoforte. Both these products show the fruit from the co-operation of the two companies.

Yamaha, whose range of FM keyboards includes the touch-sensitive DX7 (seen here for the first time by many British dealers) were also actively demonstrating the MIDI potential of their machines by interfacing them with an Apple IIe computer. The complicated timings and polyphony demonstrated thus was very impressive and gave us another perspective to the flexibility of these innovative machines.

Casio have also entered the amp market (as reported in August's E&MM) and two of their range were on show, the AS10(8w) and the AS120(20w). Casio's prices are nothing if not competitive at £39 and £145 respectively.

New home keyboards were shown by **Korg** (the SAS-20) and newcomers to the musical instrument field **Seiko**. However, the latter keyboard is particularly interesting. All the presets are digitally created and with the add-on of the DS202, new sounds can be created using 24 harmonics which have individual envelopes and levels. Further moves into the area of electronic music can be made by adding the DS303 sequencer.

The range of **Ibanez** signal processors were on display at the Summerfields stand including the new HB1000 digital delay. This tidy package covers a multitude of functions and for ease of use comes with a schematic diagram and sample settings on the top of its rack-mounting case.

Aria also added a digital delay to their processor range, the DEX 1000 a digital version of the AD-05 analogue delay (reviewed in May E&MM), with increased flexibility.

Pearl added two new effects pedals to their range, the Analog Delay and the Octaver. The latter is particularly interesting as it allows you to mix 1 octave above, normal, 1 octave below and 2 octaves below independently.

There was also a computer music system from **Jen**. Totally software run, it can be played from the system keyboard or programmed from the computer keypad. This, plus their new polyphonic synthesiser, the Synx 508, suggests that yet another Italian company is up and coming in the field of electronic/computer music. **Elka-Orla** were also showing the Synthex amongst the home organs, soon to have a computer interface as well.

Drum machines however were the rule in the **Atlantex** room. Not only were they showing the MXR Drum Computer and the Music Percussion Computer but they were also previewing a new British product called the Desert Drums designed by Peter Kershaw (ex-E&MM). This system comes in three parts: the actual pads in the form of a real kit, the voicing controller (with 5 digital sounds and 5 analogue sounds) and the sequencer (which will apparently also control the Simmons system). The voicing can be used with either the pads or the sequencer or with both at the same time.

Keyboard combos seem to be gaining an increasingly large share of the amplification market. **Ohm** showed two new models, the 4-channel PK125 and the budget-priced Hobo Reverb.

SIEL Opera 6 and PX piano.

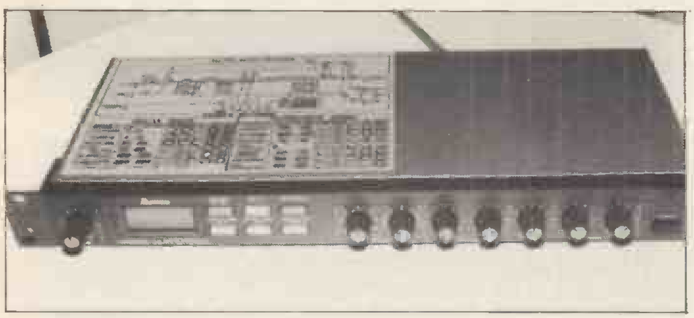

Yamaha DX keyboards with Apple IIe interface.


Rhodes Chroma Polaris.


Jen Computer Music System.

Korg SAS-20 Personal Keyboard.

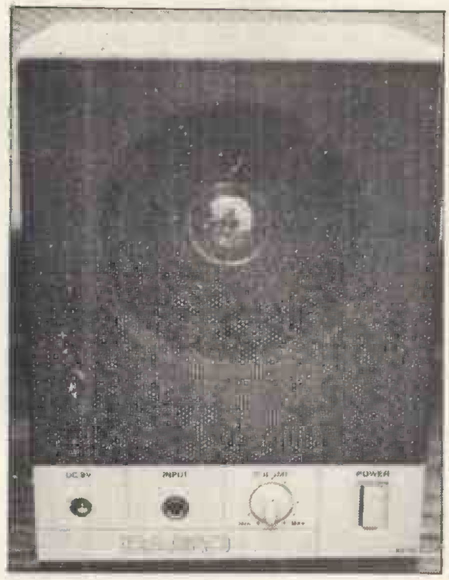
Ohm Hobo Reverb.



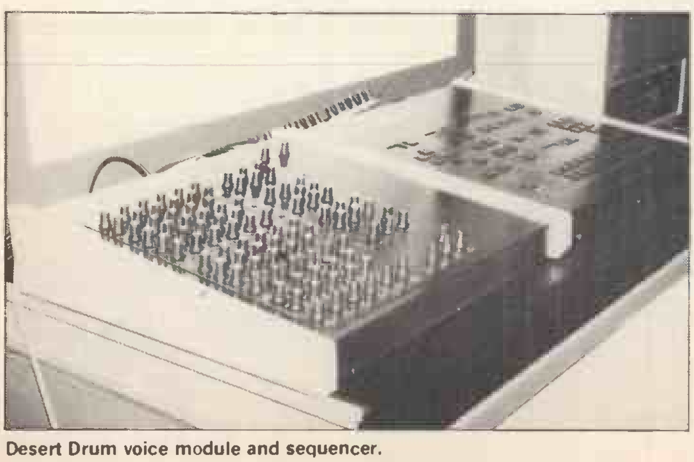
Ibanez HD1000 Harmonics/Delay.

Pearl Octaver Pedal.

Desert Drums.



Casio AS10 amp.



Desert Drum voice module and sequencer.

The new range of Rickenbackers.

SEQUENTIAL CIRCUITS, INC

Special Report

John Bowen (right).

At the Ivanhoe Hotel, we spoke to John Bowen, product specialist for Sequential Circuits, who was over here to demonstrate the new Prophet T-8, about his career with Moog and SCI.

"I was invited to work for Moog by David Luce shortly after he joined to develop the polyphonic instrument (which ended up as the Polymoog). David was very good to me when I was getting started in this business, and he works so quickly. I told him the sort of thing I would like to see on a polyphonic synthesiser and in three months he had come up with a complete system.

The working name for the system was the Constellation. There was a keyboard called the Apollo (the Space Race was everyday headlines) which had a pressure and velocity keyboard (remember this was back in '73!). This eventually appeared as the Polymoog, but it took 3 years to get out and by the time it was available to the public, it had lost not only its fancy name but also the touch sensitivity on the keyboard. The system's bass pedals fared better however and emerged virtually unchanged even in name as the original Taurus pedals.

I was a clinician for Moog for 4 or 5 years, as well as a musical consultant on the new products. When Norlin took over, our department was phased out, but they took me back on later. It was through my Moog clinics that I met Dave Smith (head of Sequential Circuits). I was using quite a few MiniMoogs in my clinics and I really needed some sort of programmer/controller to take the hard work out of sound changes. While I was in California someone suggested that Dave could help with this. I rang his wife asking to see the 'factory', but at the time it was only their apartment. He showed me a rather neat sequencer while I was there. I managed to convince him that as I worked for Moog I could get them to buy the design if he gave me one. So I left with one under my arm.

As it happened, Moog weren't interested in the sequencer, but I kept in contact with him and our friendship grew. A couple of years later he wanted to do 5 programmable MiniMoogs configuration in one box and he asked me to come and join him in California. I told him what to put on it (the layout of the panel and so on) and he built it. That's how the Prophet 5 was born. When it came out the SCI workforce was only 6 people.

It seems incredible, but the 5 has lasted over 5 years which is a long time for a synthesiser. But now the market is ready for the features the Apollo originally had, the touch sensitivity. Yamaha are doing it with the DX range, Rhodes with the Chroma and SCI are up there with them with the T-8.

We spent a lot of time getting both the velocity and the second touch right. We abandoned our original contact system in favour of light beams. As you hit the key, it breaks one light beam and then another when it reaches the end of its travel. We time how long it is between these two events and this to control the parameters in the velocity section (all the envelope parameters). Even the release time can be controlled by the speed of key release. We took particular care with the 'second touch' (that's the pressure sensitivity). We didn't want it to be triggered on the first touch, but we also wanted to make it easy to bring in at will. We're very pleased with the result and of course both effects are individually triggered by the keys. The 'second touch' can be used to control the frequency or pulse width of Oscillator A or B, the filter, the amplifier the LFO amount or frequency or all of these."

It is this comprehensive modulation potential which has always set SCI products apart and the T-8 is no exception. Besides these two new features which give some very impressive sounds (including the most realistic electronically-created piano sound I have ever heard), there are still the excellent Poly-Mod and LFO-Mod Sections. Another new aspect is in the new envelope flexibility. Both envelopes allow a second release characteristic to be set up, which can be

Velocity and Sequencer Controls.

The Prophet T-8.

brought in either using the switch or footpedal (similar to a piano sustain pedal).

There is also an ADSR/ADR option. In ADR the sustain time is reduced to zero, which forces the decay straight into release at a point which can be set by the sustain level, good for percussive envelopes.

Another addition to the T-8 is a realtime sequencer, with eight separate sequences and over 600 note storage, and it actually remembers velocity information and loop length can be programmed.

The keyboard is 6 octaves (E to E) with weighted wooden keys and is a delight to play. The look is vintage Prophet, the panel layout will be familiar to all Sequential Circuits users (only the 'touch' controls to become aquainted with) and the sound is better than ever. Place your orders now!

For prices and information please contact Sequential Circuits, P.O. Box 16, 3640 AA Mijdrecht, The Netherlands, Tel. 02979-6211. **E&MM**

MUSIC WORKSHOP

How to write a Rock Song

Six articles showing you how to write a song (or instrumental) from scratch, explaining the idea of rhythm and the use of syncopation, melody writing, how to fit words to a melody, how to build appropriate harmonic structures, the use of form, how to devise such common devices as riffs and how to use the instruments you have available to play the music you have written. Month by month the lessons you have learned and the exercises you have written will enable you to write a complete piece of your own.

Part 5

Arranging Sheet Music

In this month's article we will look at the problems involved in arranging a song in sheet music form for a small group — vocals, guitar, bass, drums and keyboards.

In the last article we arrived at a complete sheet music version of 'Mary Had A Little Lamb' ie. an introduction, verses and choruses, middle eight and coda written for voice and piano accompaniment plus chord symbols. Most sheet music appears after a song has been recorded and is a condensed version of the arrangement used on the record, often in a different key. Anyone who has worked in a situation of having to back singers who present you with a sheet music version of their repertoire will know that a successful accompaniment will be achieved in most cases by using the chord symbols, previous knowledge of the songs and experience rather than by playing the actual music given.

Sheet music generally contains only the essential parts of the song — melody, words and chords — plus a particular type of accompaniment for piano, which stands quite happily on its own as an instrumental version. Much of the detail that gives the record its effect is lost, some styles suffering more than others in this respect.

In this series of articles, we have arrived at the sheet music version before the song has been arranged for performance. Instead of reducing the recorded arrangement to a piano and vocal version, we will be doing the opposite. At first it is worth breaking the process down into steps that are easily managed and enable a clear view of what is happening. In order to gain an overall view of the way the instruments and voices will fit together, it is a good idea to write out all the parts in open score — this is a layout where the parts for each instrument are written on separate staves below each other on the same page. Figure 1 shows the arrangement of the introduction of 'Mary Had A Little Lamb' written out in open score. This can be a laborious process which uses quite a lot of paper but can avoid a lot of the problems that can arise from writing out parts directly from sketchy first draughts of ideas. Once the open score version is complete, the individual parts can easily and accurately be copied out using separate pages for each instrument. Figure 2 shows the bass part for the whole of the song.

The basic principle involved in making any kind of arrangement is that while reflecting the harmonic implications of the chords indicated, rhythmically the parts dovetail together, at the same time retaining an identity of their own. This can be seen in Figure 1 where the guitar and bass parts each fill in the gaps left by the other across the quaver texture provided by the Rhodes electric piano. At the same time the bass fits very tightly with the drum pattern and in combination, all of these instruments provide solid support for the top parts of the introduction which are written for the synthesisers. The guitar is used in a lead role, creating interest by filling the gaps in the phrases in the synthesiser parts. Individually each part makes sense while contributing to the overall effect.

In general it is a good idea to write parts that leave spaces for the other instruments, enabling the dovetailing described, rather than writing parts which would work as complete accompaniments independently and which duplicate each other. The accompaniment should be a team effort rather than several self-sufficient individual performances. Any duplication should be in the interest of tone colour and strength of the part. An example of this can be seen in the synthesiser part which is shared between two synthesisers for this reason. (The notes with stems pointing upwards are played on one synthesiser, another taking the rest of the notes).

Writing parts

It is now worth making one or two points about the way the individual parts should be written out. Make sure that each part has the title written clearly in fairly large letters at the top of the page with the name of the instrument to be used. Write the actual notes as accurately as possible using a ruler for the bar lines. Work out the total number of bars and divide them out as evenly as possible between the number of lines to be used. It is best not to use more than two sides of manuscript paper as this will avoid having to turn a page over during performance; so that if you are using twelve stave paper you will share out the bars between twelve or twenty four lines, which should be sufficient for most songs. Where possible make the ends of the sections (verses, choruses etc.) come at the end of a line. Make sure that any signs and instruction are clearly visible. Make a 'pad' for each instrument by filing each of its parts for different songs in a ring binder. It is a

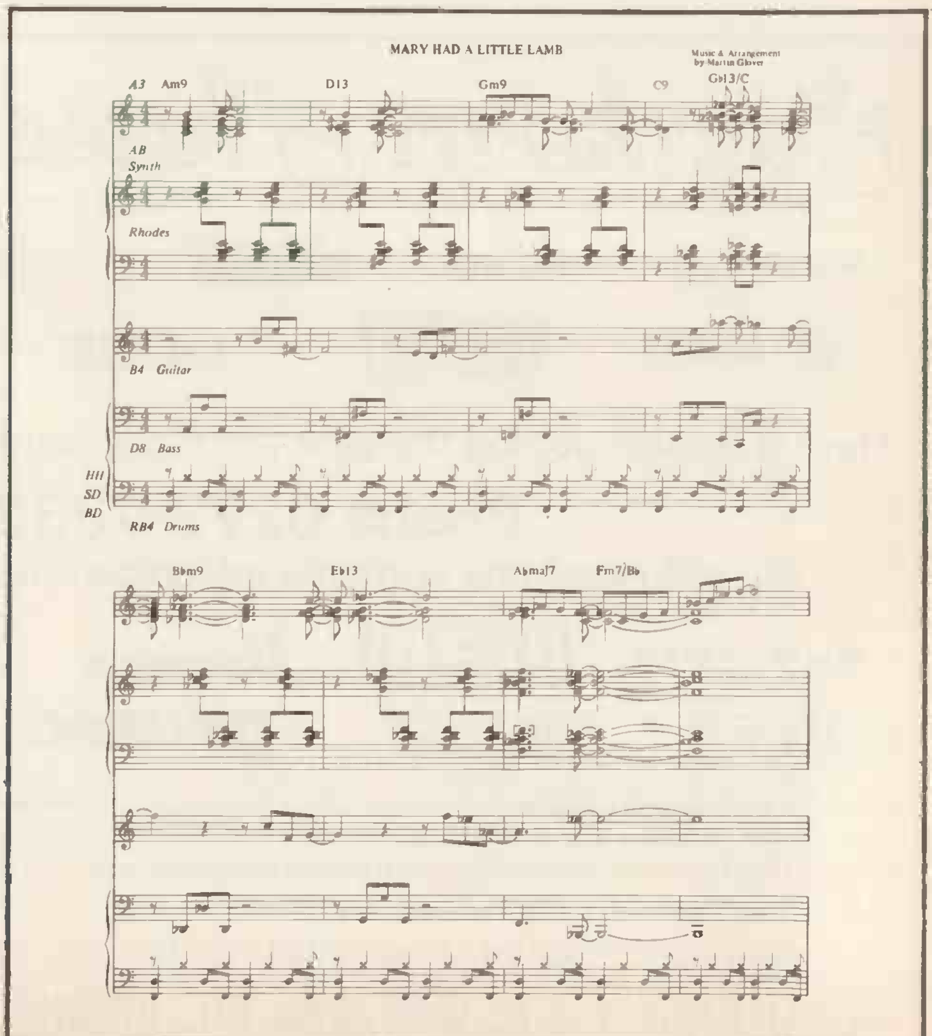


Figure 1. Introduction arrangement.

good idea to protect the paper by placing the sheets inside plastic covers.

When making an arrangement of sheet music it is a good idea to start with the lead vocal part. There are two reasons for this; first, if the key has to be altered to suit the vocalist, this can be settled before the other parts are written and secondly, apart from the consideration of key, this part should need little alteration and is an easy one to start with.

The most important part in rock song arrangements is the bass part because of its central position, both rhythmically and harmonically. This means that as well as providing the harmonic foundation for the upper parts, in conjunction with the drums it dictates the rhythmic feel of the song. This part is often quite accurately presented in the sheet music. In my arrangement, I decided to alter the bass line in the introduction and choruses so that, with the drums, there was more of a feeling of drive and also to give a little variety.

The next part to be considered would be the drum part. The best drum parts tend to be fairly simple and consistent with sparing use of fills to mark the ends of sections. Unfortunately, this is not often the view of drummers who tend to use every number as an opportunity to string together their favourite licks, quite happily changing the feel of the piece in the most inappropriate places, and usually varying the tempo in the process. Once you've written your drum part, make sure that this is what is played because between them, the bass and drums control the effect of the whole piece, easily outweighing the upper parts, and are ultimately responsible for the success or otherwise of the whole song.

It is a good idea to aim for a drum part that has a very supportive basic rhythm which leaves as much space as possible. These spaces can then be used by the other instruments, producing an interwoven texture of sound, more interesting than if all the upper parts simply overlay a full rhythm already provided. It is also a good idea to make the bass and drum part fit tightly together. This can often be achieved by using the rhythm of the bass part for the bass drum pattern and fitting the rhythms for the other drums around it. If the bass line is fairly florid use the bass drum to accentuate the main notes in the bass line.

In the third part of this series I used the medium rock rhythm shown in Figure 3 as a basis for the piano accompaniment of the sheet music verse of the song. To give a more driving effect I have used the rhythm shown in Figure 4 as the basic rhythm throughout the song, fills being used sparingly to mark the phrases.

The next part I considered was the Rhodes electric piano part. This was achieved by taking the chord voicings, an octave apart and imposing on them the rhythm shown in Figure 5 in accordance with the dovetailing theory discussed above to provide with the bass and drums, a solid support for the main ideas given to the synthesisers. It is a good idea, though not essential, to have one instrument playing a part involving some thicker lines such as this, providing harmonic security. It is also good to make the voicings change smoothly, without big leaps, in fairly much the same register. This role could have been given to the guitar or synthesiser but the mellow sound of the Rhodes suited the effect better and the variety of sounds available from the other instruments made them more suitable for the fill-playing and melody roles given them in the introduction.

The right hand part of the sheet music version is handed intact to the synthesisers, the notes being shared between two of them to give added prominence to the melody contained in the top line of notes. The spaces left in the synthesiser part are filled by the guitar line. The line contains leaps implying the prevailing chords and contrasting with the smoother voice leading of the other parts.

Figure 3.

Figure 4.

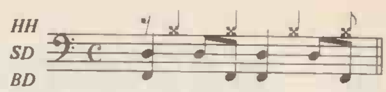


Figure 5.

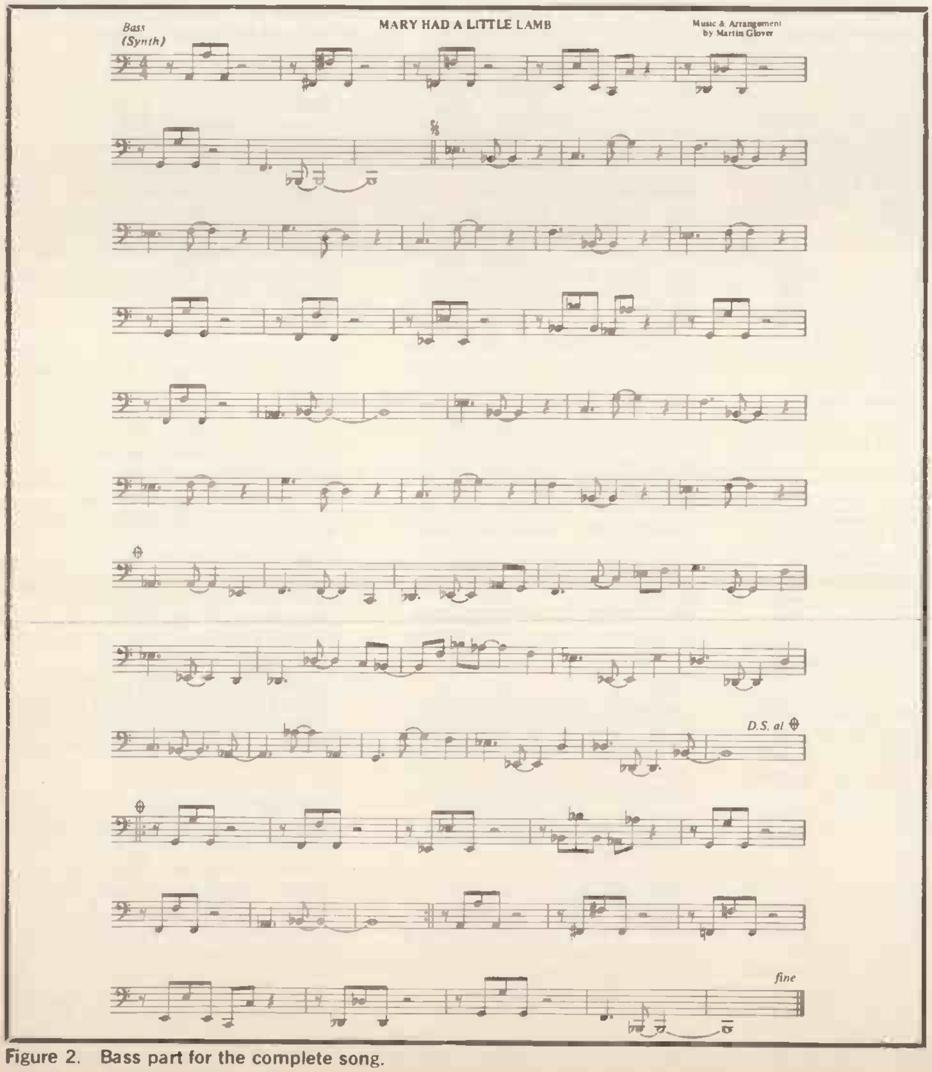


Figure 2. Bass part for the complete song.

Transcriptions

It is worth repeating that my objective in this arrangement was to produce idiomatic parts that were independent of each other and which fitted together to give a suitable effect. These are sound principles which are used in many arrangements. You can check this for yourself by making open score transcriptions of records that you like, taking down the parts for each instrument one by one. Often record sleeves give details of the instruments used so you will know how many parts are to be written. A band well worth studying from this point of view are Steely Dan, an American band consisting basically of Donald Fagan and Walter Becker, who write the songs and the majority of the arrangements, plus a variety of top players. Greatly under-exposed in this country, Steely Dan and Donald Fagan are the Berlin Philharmonic and Mozart of rock, well worthy of study by anyone interested in approaching songwriting in a conscientious way. Whilst in a classical vein, the Two and Three Part Inventions of J.S. Bach are good pieces to study to learn how to fit parts together.

The point I have tried to make in this series of articles is that the art of songwriting is a process — something that can be broken down into a set of stages, each of which can be studied and practised, rather than some mysterious ability that you either have or haven't. As in all things, some people will be better at it than others, but most problems can be overcome by having a well-organised system. Compare my arrangement of the introduction of 'Mary Had A Little Lamb' with the sheet music version given in Part 4 and think about the remarks made in this article. Often even if you don't agree with an idea it serves as a trigger for an idea of your own.

Martin Glover **E&MM**

Electronics & Music Maker

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1981

MARCH Matinée Organ * Spectrum Synthesiser * Hi-Fi Sub-Bass Woofer * Balanced line system * Yamaha SK20 review * BBC Radiophonic Workshop

APRIL Syntom Drum Synthesiser * Workshop Power Supply * Direct Inject Box * Ultravox * Paia 8700 review * Matinée * Spectrum

MAY Noise Reduction Unit * Lowrey MX-1 review * Apple Music System * Matinée * Spectrum

JUNE Wordmaker * Guitar Tuner * Hi-Fi/Group Mosfet amp * Fairlight CMI review * David Vorhaus * Matinée

JULY Alphadac 16 Synthesiser Keyboard Controller * Synwave effects unit * Matinée * Atari Music * Duncan Mackay * PPG Wave 2/Wersi Pianostar reviews

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

SEPTEMBER Partylite * Tape-Slide Synchroniser * Synpac 9V effects supply * Noise Gate * PA Signal Processor * Digital Keyboard * One-handed Guitar * Chromascope & Linn Drum reviews * Kraftwerk revealed

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

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

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

1982

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

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

MARCH Klaus Schulze * Robert Schröder * Kraftwerk Music to play * Killing CB Interference * Reviews: Firstman SQ-01, SCI Pro-One, JHS Pro Rhythm Mini Synth, Tascam 124AV, Wersi Comet, Hamer Prototype, Shure 517SA & B * Synth Buyers Guide * Projects: Power 200 Speakers, 1.6 sec Digital Delay Effects Unit

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

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

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

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

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

SEPTEMBER Richard Pinhas * Non-Concordant Tone Generation * Yamaha CS-01 Breath Controller * Reviews: Jen SX1000, Casio 1000P Synthesisers, Fender Squier Guitar, Carlsbro Stingray Electro-Acoustic Amplifier, Pearl Effectors, Delta Lab DL-5 Harmonicomputer * Projects: Comp-Lim, Twinpak ±15V PSU.

OCTOBER Kate Bush interview and 'The Dreaming' music to play * Digital Recording, A New Landmark * Ken Freeman * Spectrum Micromusic * Reviews: Rhodes Chroma, Fender Squier guitars, Kay drum machine, Carlsbro Power Amp * Projects: ElectroMix 842 Mixer, Amdek Distortion Kit.

NOVEMBER Patrick Moraz interview and 'Adagio For A Hostage' music to play * Robert Moog * Bill Nelson * K. Schulze and K. Crimson in Concert * Reviews: Yamaha PC-100, Technics SX-K200, Casio MT-70, Hohner P100 and JVC KB-500 MiniSynth Supplement, Gibson Firebird 2 Guitar, Alligator AT150 Amplifier, Allen & Heath 1221 Mixer, Eko Ritmo 20 * Projects: ElectroMix 842 Mixer, Amdek Chorus.

DECEMBER Cliff Richard interview and Little Town music * Patrick Moraz * ARS Electronica * Digital Recording Pt II * Reviews: Elka Synthex, Crumar Stratus Synths, Tokai Basses, Shure PE Series Microphone, The Kit Percussion Unit * Projects: The Transpozer, Amdek Percussion Synth, Canjak.

1983

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

FEBRUARY Isao Tomita * The Human League * The Novatron Revisited * E&MM Index 1981/82 * Reviews: Linn Drum; Godwin Drummaker 32P; Wersimatic CX-1; Mattel Synsonics; Simmons SDS Drum Sequencer; Klone Kit; Movement Drum Computer 2; Korg KPR-77 Programmable; Memory-moog; Synclavier II; Powertran Polysynth; Vigier Guitars, Tokai TA35 Amp; Pearl Mics * Projects; Synbal; Caltune; Amdek 6-2 Mixer.

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

APRIL Naked Eyes * Gabor Presser * Scarlet Party * Frankfurt Show Report * Ambisonics * Magnetic Cartridges * Reviews: SCI Prophet 600, Casio 7000, Chroma/Apple Interface, Eko Bass Pedals, Loco Box Pedals, Aiwa Cassette Copier, Vox Guitars * Projects: Syntom II Percussion Module, Amdek Metronome.

MAY Keith Emerson * Guitar Buyers Guide * Roland MC-202 * Introducing the MIDI * Reviews: Fostex X15 Multitracker, Echo Unit Supplement; 13 echo reviews, M&A K-1/B, Yamaha Portasound MP1, Carlsbro Cobra 90 Amplifier, Technical Projects DI Boxes, Boss TU-12 Tuner * Projects: MicroMIDI, Home Active Speaker, Amdek Flanger Kit.

JUNE Steve Hillage * Arthur Brown * Larry Fast * History of Guitar Synthesisers * Casio Modifications * Reviews: Synton Syrinx, Synclavier II, Clarion 4 track, Cutec MR402, Ovation Balladeer Guitar, Drumulator, Vesta Fire Flanger/Chorus, Aria AD-05 Delay, Suzuki, Mic * Projects: OMDAC, Amdek Power Distributor, Active Bass Guitar.

JULY Marillion * Hans Zimmer * Programming Yamaha's DX Keyboards * Reviews: Kawai SX-210 Synthesiser, Aria U60 Deluxe Guitar, Trident VFM Mixer, MXR Omni Effects, Milab Mics * Projects: Digital Signal Processing For Sinclair Spectrum, Tap Tempo, Amdek Delay Kit.

AUGUST Bill Nelson plus 'Chimera' music to play * Hubert Bognermayr * MIDI Dump * Barclay James Harvest * Reviews: Roland JX-3P/PG200, OSCar Synthesiser, 360 Systems Digital Keyboard, Music Percussion Computer, Fender Stage Lead Amplifier, Yamaha SG200 Guitar, Tubby Drum System, Frontline Effects * Projects: Digital Signal Processing (Part 2) — Echo programs for your Sinclair Spectrum, Amdek Phaser Kit.

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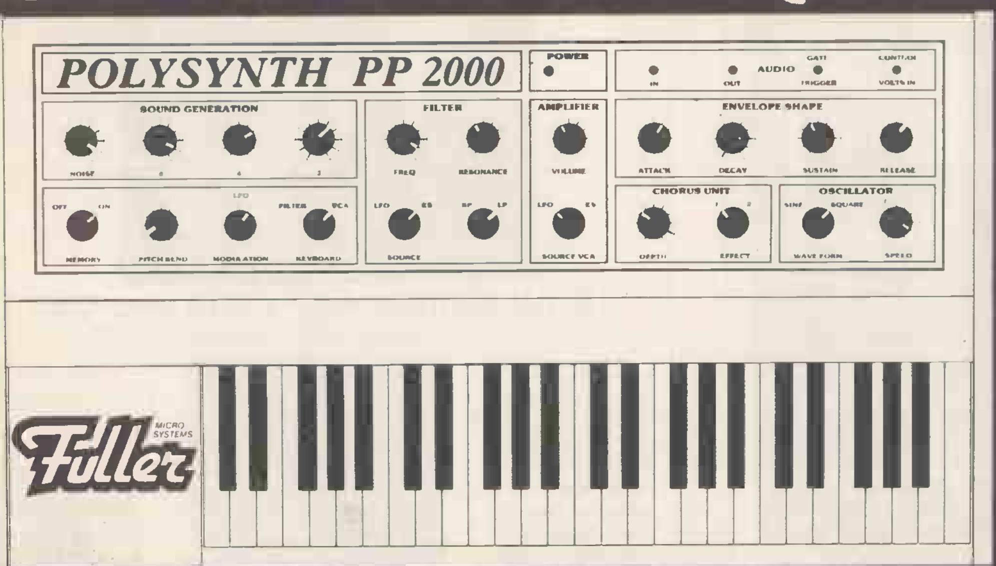
ABOVE COMPARISON



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The amplifier is also voltage controlled. Using the L.F.O. and A.D.S.R. with it, it will create tremalo effect, key sustain and crescendo.

Chorus Unit
This adds depth and body to the sound. It has variable speed depth and there are two effects.

L.F.O.
The L.F.O. can be used to give tremalo, wah wah, vibrato and variable chorus speed.

A.D.S.R.
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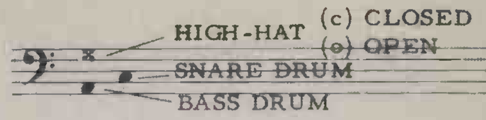
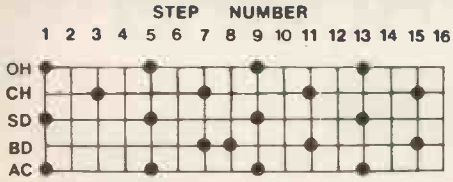
WARREN CANN'S

Electro-Drum Column Part 9

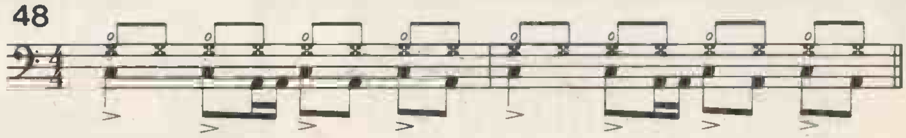


This month our electro-drum column continues with more rhythms provided by consultant drummer Warren Cann of Ultravox. In addition this month we feature rhythm matrices to help you to programme your drum machine more easily.

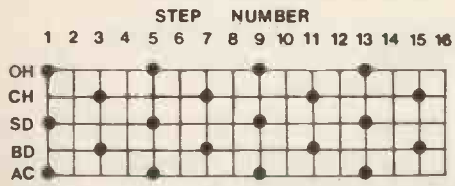


48 Bars 1 and 2

48

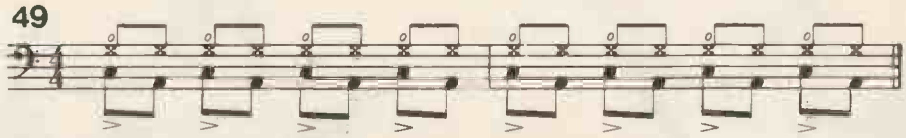


This has snare playing every beat within the bar but it has a slightly busier bass drum pattern.

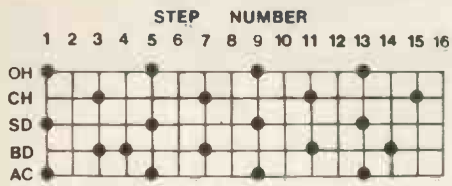


49 Bars 1 and 2

49

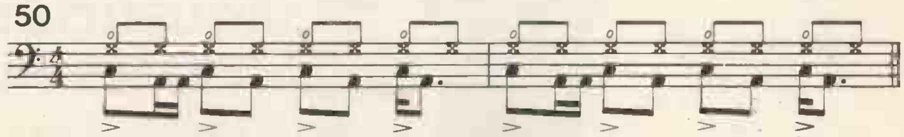


Here snare plays on every beat and bass drum plays the off-beats. It's so effective when played with any kind of accompaniment.

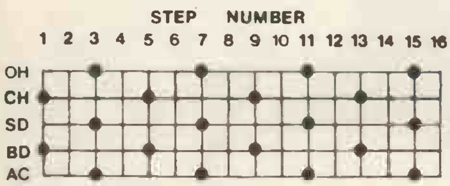


50 Bars 1 and 2

50

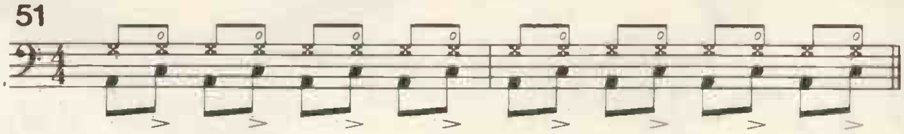


Using some of the fast flicks that we learned in earlier examples helps push this pattern along.

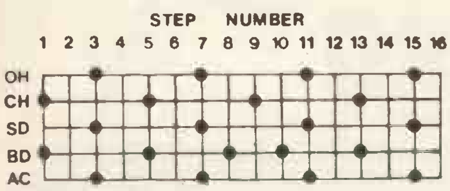


51 Bars 1 and 2.

51

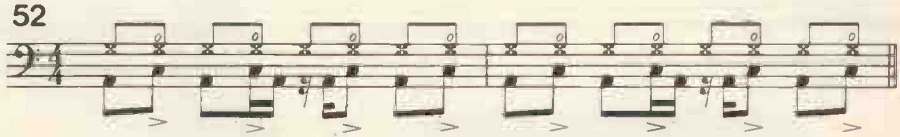


Bass drum plays the down beat whilst snare plays the off-beat. It is the same pattern as 49 only reversed. Again, a well-known rhythm, but a very effective one nevertheless.

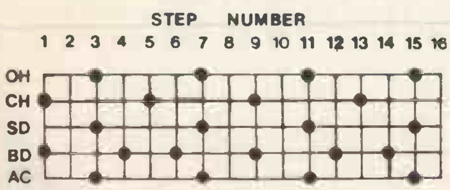


52 Bars 1 and 2

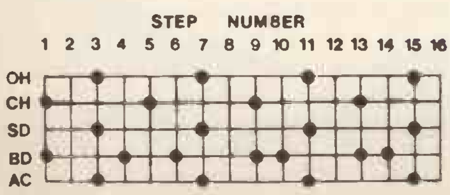
52



Snare continues playing the off-beats within the measure but we've added some syncopation to the bass drum.

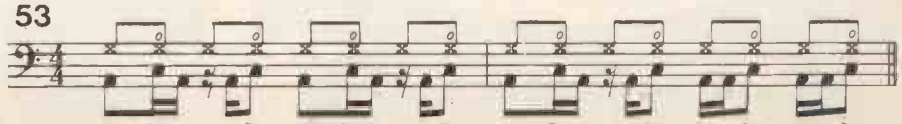


53 Bar 1



53 Bar 2

53



A two measure pattern with the bass drum adding the variation as usual on the second bar of the pattern.

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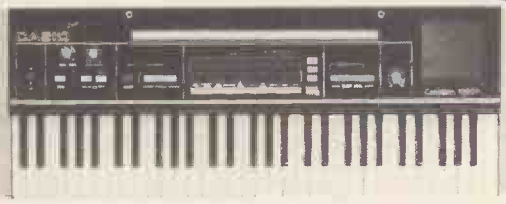

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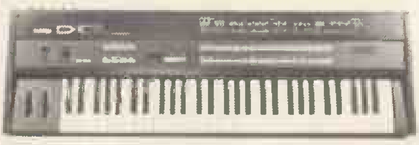

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AMERICA

Jerry De Muth

Makers of sound equipment and accessories — from guitar pickups and tuners to effects devices and amplifiers — have been as actively taking advantage of technical advances as have the makers of electric guitars and keyboards.

Starting at the guitar itself, Seymour Duncan Pickups has introduced The Stack for some models of electric guitars and also a new acoustic pickup. The Stack, which features a noise cancelling design for Stratocaster, Telecaster and Jazz Bass pickups, is available in two versions for each model — The Classic, which faithfully reproduces the vintage tonal and output qualities, and the Hot version, which has increased output and a more effective sustain and tonal response without being muddy. Prices are $65 for all versions of the Strat Stack and $68 for all versions of the Telecaster and Jazz Bass models.

Duncan's new acoustic pickup adjusts the magnetic field for an even response between the bare steel and the wrapped steel strings and for a natural acoustic tone. The two coil humbucking design cancels 60 cycle hum while the tube design allows minimum interference with the guitar's acoustic properties. List price is $78.

Any acoustic or electric guitar can be automatically tuned with the Korg AT-12 which also will automatically give a visual indication of what note is being played, what octave the note is being played in and how much the note may be either flat or sharp. The Korg AT-12 has seven octave automatic chromatic tuning and four octave sound output, all of which can be changed instantly with the use of up and down buttons.

The AT-12 also includes soft and loud sound output settings and fast and slow meter calibration settings, with the performer using the fast meter calibration for instantaneous calibration of notes while playing. Other features of the Korg AT-12 include a lighted meter, battery check, power LED, in out and output jacks, earphone jack and DC6V in. With a measurement of about 7.5 inches in width, 3.9 inches in depth and 1.4 inches in height, and 15 ounces in weight, the AT-12 is very portable. Its suggested list price is $179.95.

Microphones

To handle other types of amplification Shure Brothers has expanded its moderately priced Professional Entertainer microphone series, and modified its SM57 microphone for use inside drums in a system developed by Randy May, and available on all Slingerland drums.

The new PE86 and PE66 mics, patterned after the SM58 and SM57, are unidirectional (cardioid), dual low impedance models with fixed bass roll-off, upper midrange presence peak and shock-mounted cartridges. The PE66's frequency response is 40 to 15,000 Hz; the PE86, which also features a built-in spherical windscreen to minimise wind and breath noise has a frequency response of 50 to 15,000 Hz. Suggested retail prices are $109 for the PE66 and $125 for the PE86.

The "magic" of the May EA drum amplification system is "not so much in the mic as in the remote radial rotation," Randy May explained at the National Association of Music Merchants show in Chicago in June. The mic connects, through a shielded cable, to a cannon plug mounted in the side of the drum. A shock mount eliminates mechanical vibration while tone and volume can be balanced for each drum, and equalised between different drums. A wide range of internal frequencies isolated by means of an external turning knob allows the mic to be rotated a full 180 degrees.

"Amplifying drums always has been a problem," pointed out May, whose background includes much studio work. "I've mounted the mic inside for two reasons — acoustic phase cancellation and minimisation of the sound leakage. The right angle connections also eliminates interference between mics," he added.

May said that when he approached Shure about modifying and using one of their microphones for his system, the company was overly co-operative. "They'd been searching for the ultimate drum mic,'May pointed out. The SM57 was modified by taking out some of the hardware, including the transformer.

The May EA system is sold separately for mounting within any drums already owned and can also be ordered included on any new Slingerland catalogue drums. Pros already using the system, according to May, include Carmine Appice with Ted Nugent, Danny Seraphine with Chicago and Chad Wackerman, who's with Frank Zappa's band.

Mixers

New mixers, stage speakers and loudspeakers have been introduced by Electro-Voice. The new mixers are two additions to their Series 52 mixer line — the 8-channel EVT 5208 and the 16-channel EVT 5216, with suggested prices of $825 and $1,275 respectively.

These two, and their predecessor, the EVT 5212, employ individual plug-in printed circuit boards for each channel that incorporate additional gain, the proper gain structure and a built-in connector for a plug-in high intensity mini-light. Controls and panel graphics are colour-coded and complete hook-up diagrams are silk-screened on rear panels. Each input channel accepts a balanced low-impedance mic level or unbalanced high-impedance line level source and also has a channel effects insert. The output sections, which include mono, stereo and monitor outputs, also feature effects return master, aux input master and reverb return master; each pannable to the stereo subgroups, and also effects send master and meter assign switch controls. Three band EQ sections consisting of +/-15 dB bass (100 Hz), +/-12 dB range (3 kHz) and +/-15 dB treble (10 kHz) controls, provide for a wide range of musical equalisation.

Electro-Voice's Stage System 200, can be used with or without an external equaliser, is designed as a stage monitor, a permanent sound reinforcement speaker and as part of a small club system. The S-200 employs a high-output version of Electro-Voice's Super Dome tweeter coupled to a high-frequency Direktor that is moulded as an integral part of the cabinet. The low-frequency section employs the new EVM Pro-Line Model 12S which can handle 300 watts continuous power. The speaker lists for $589 and an optional active equaliser lists for $149.

The EVM Pro-Line Model 12S, whose low-frequency section is employed in the Stage System 200, is one of three speakers in Electro-Voice's new EVM Pro-Line Series which is designed for professional, extra high-level, high-performance sound reinforcement systems. In addition to the 12-inch Model 12S and Model 12L with a 300 watt rating, there are 15-inch and 18-inch models, the 15B, 15L and 18B, which can handle 400 watts continuous power and short duration program peaks of up to 1600 watts. The B designation indicates speakers designed for low-frequency performance, including heavy fundamentals in the 30 to 40 Hz range, and are best for organ, synthesisers and other keyboard systems where both clarity and high power capacity are critical requirements. The speakers with S and L designations are designed for more emphasis on the higher range and provide more brilliance and punch in full-range uses. List prices are $240 for the 12-inch models, $264 for the 15-inch models and $395 for the 18-inch model.

In addition to these new speakers Electro-Voice has also lowered the prices on its EVM Series II speakers, to which it also has added a 10-inch speaker, the EVM-10M Series II, which is specially tailored for mid-bass performance and has a long term power handling capacity rated at 200 watts. At $155, it's the least expensive speaker in the series. Prices on the series 12-inch, 15-inch and 18-inch speakers now range from $188 to $330.

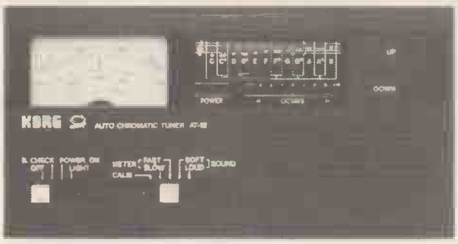
Amps

A less costly, more compact version of the Nova amplifier, the Super Nova, has been introduced by Canada-based Vibration Technology Ltd. The Super Nova, which delivers 60 watts rms power into a 12-inch heavy duty speaker features normal, overdrive, main amplifier, reverb footswitch and overdrive footswitch inputs and also speaker, headphones, preamp and recording outputs. Controls include gain, bass, mid-range, treble, reverb, master volume, bass expander and mid-range frequency selector.

Vibration Technology's Dirty Thirty is a stripped down low power head with reverb that can be carried under the arm. The adjustment of gain and master volume controls will make the sound as dirty as any performer wishes. The Dirty Thirty also can be used as an instrument preamp and the headphone jack enables it to be used as a silent practice amplifier.

The Dirty Thirty, which weighs only five pounds, features normal, overdrive, main amplifier, reverb footswitch and overdrive footswitch inputs and also speaker, headphones, preamp and recording outputs. Controls include gain, bass, middle, treble, reverb and master volume.

TOC 23 time offset correction unit.



Korg AT-12 auto chromatic tuner.


Shure PE Series microphones.


Seymour Duncan acoustic guitar pickup.

Electro-Voice Stage System 200.


Shure PE66 and PE86 mics.


Electro-Voice EVT 5208 and 5212 mixers.

An audio processor that will correct time offset, the TOC 23 time offset correction system, has been introduced by Professional Audio Systems. The TOC 23 provides an active delay that creates an identical acoustic source for the low, mid and high frequency components and combines component loudspeakers into a phase coherent, high definition sound reinforcement system. The processor's delay section can provide 900 microseconds of low frequency delay, switchable in three 300 microsecond increments; up to 1,000 microseconds of mid-frequency delay (low frequency delay in the two-way mode), switchable in one 500 microsecond increment and ten 50 microsecond increments; and an in/out switch for both low-frequency and mid-frequency delays.

The TOC 23 also features special filters for flat group delay through the crossover points, equal group delay in all outputs in both two-way and three-way modes, adjustable time offset correction in low and midrange outputs, subsonic and supersonic filters, limiter on input, additional limiter on high-frequency output for sensing amplifier output power and high-frequency EQ for constant coverage horns.

Effects

A variety of effects pedals have been introduced by Morley, MXR and EXR. Morley's Analog Echo Reverb or AER-6 has a range of 20 to 600 milliseconds. It features separate controls for desired length of delay, mix or adjustment of echo loudness and number of repeats from one to infinity. Two LEDs indicate when power is on and when effect is on. The suggested retail price is a relatively low $279.95.

The new EXR Projector provides three functions in one foot pedal. The Exciter Psychoacoustic Processor will project the instrument into the foreground without cranking the volume or equalisation. A full frequency direct box provides a continuously variable input/output of up to 40 dB gain and XLR connector output. The volume pedal function features a fully adjustable EXR Process Preset. A 12-segment, three-colour bar graph and four function LEDs allow easy visual monitoring at a glance.

MXR Innovations has unveiled a complete new line of six effects pedals, its Series 2000 — Distortion +, Dyna Comp, Phaser, Stereo Flanger, Stereo Chorus and Time Delay. Common features include in/out indicating LEDs, dual outputs, FET switching for silent operation and a multiple function interface connector that provides capabilities such as remote switching, remote status indication and selection of the highest voltage power source available when used with an AC adaptor.

The Distortion +, which has an output level variable from -9 dBV to + dBV, allows the user to insert a variable amount of distortion into the effects chain, from a warm tube amp sound to 'fuzz' with long sustain. Dyna Comp is a limiter that automatically varies the internal gain so the output level remains constant regardless of the input level. Its Sustain control permits long sustain effects without distortion. The Phaser provides a wide range of phasing effects, with both sweep and regeneration variable with the front panel controls. The Stereo Flanger provides a wide range of effects from flanging to vibrato to shorter time delay effects. The Stereo Chorus provides vibrato, chorus and true simulated stereo outputs. Both the amount of sweep and the rate at which the delay is swept can be varied while a depth control varies the output mix from full dry to approximately half dry and half effect.

Finally the new MXR Series 2000 Time Delay provides a continuously variable delay from 30 milliseconds to 300 milliseconds. Delay, mix and regeneration controls on the front panel allow creation of a variety of delay effects, including hard reverb and multiple echoes.

Manufacturers and companies mentioned:

Electro-Voice, Inc., 600 Cecil Street, Buchanan, MI 49107.
EXR Corporation, 5520 South State Road, Ann Arbor, MI 48104.
Korg/Rose Morris, 32 Gordon House Road, Kentish Town, London NW5.
Unicord, 89 Frost Street, Westbury, NY 11590.
May EA, 8312 Seaport Drive, Huntington Beach, CA 92646.
Morley, 6855 Vineland Avenue, North Hollywood, CA 91605.
Rosetti & Co., 138 Old Street, London EC1. Tel. 01-253 7294.
MXR Innovations Inc., 740 Driving Park Avenue, Rochester, NY 14613.
Atlantex Ltd., 1 Wallace Way, Hitchin, Herts, SG4 0SE. Tel. (0462) 31511.
Professional Audio Systems, 1224 West 252d Street, Harbor City, CA 90710.
Seymour Duncan Pickups, P.O. Box 4746, Santa Barbara, CA 93103.
Shure Brothers, 222 Hartrey Avenue, Evanston, IL 60204.
Vibration Technology Ltd., 1950, Ellesmere Road, Unit 12, Scarborough, Ontario M1H 2V8, Canada.

Concert Review

Peter Gabriel

Thompson Twins
Selhurst Park
July 9th 1983

The crowd at the Crystal Palace Football Ground was capacity, and by their reception of earlier acts, Gaspar Lawal and the Undertones, it was clear who the vast majority were there to see. Banners with such legends as "Gabriel is God" abounded. Most of the crowd lay in the sun, blissfully unaware of the support acts, patiently awaiting the main event.

The Thompson Twins punchy electro-pop sound gradually caught the listeners attention as the sound quality improved following the initial numbers. Grey umbrellas adorned a stage well stocked with Prophet 600s, an OBXa and Simmons Drums.

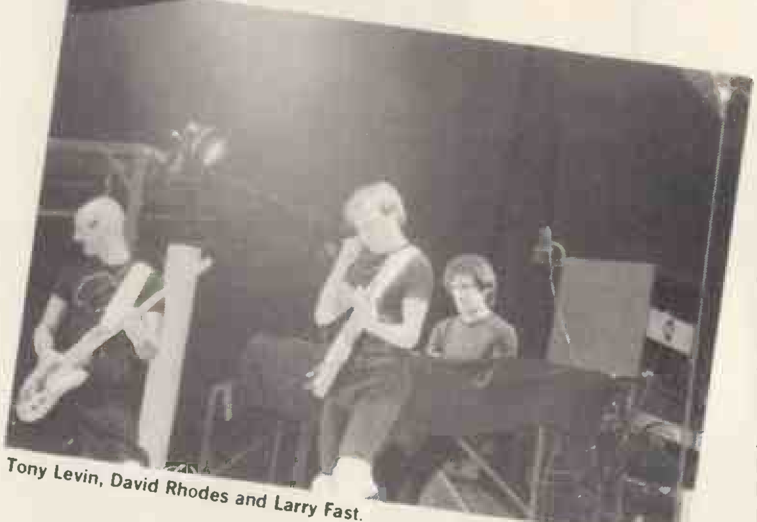
The antics of Alannah Currie and Joe Leeway complimented the pseudo seriousness of such songs as 'Love On Your Side', 'Lies' and 'In The Name Of Love', while Tom Bailey's vocals emerged powerfully above the synthesised backdrop. The rhythm section were tight and the bassist particularly impressive on fretless.

The majority of the set was courtesy of their excellent 'Quick Step and Side Kick' album. The only evident newcomer was 'Your Lucky Day', yet another commercial dance tune, and although the Twins were impressive, they never won the audience's heart. Calls for an encore were ignored.

After a lengthy performance by his piano tuner, Peter Gabriel and the ensemble appeared on stage at 8.40 p.m., just as the sun was going down and launched into 'Across the River'. Co-written by Gabriel and Stewart Copeland (of the Police) this little-known track has only appeared as the B-side of 'I Have The Touch'. It began by Gabriel building up a vocal chord using a delay/harmoniser with Fairlight strings and guitar feedback adding depth. Then with a crashing bass chord from Tony Levin, the rhythm section entered, hammering out the riff, with Gabriel adding piano chords and vocals on top.

The quiet resolution of this piece was interrupted by the band punching out the introduction to 'I Have The Touch', as Peter Gabriel mimed his way through the 'rush hour'. In the "Only... Only... Wanting Contact" line, he exploited the out-stretched hands from the audience by attempting to reach them, and during "shake those hands" he rushed round the stage, shaking hands with the band members (who managed to continue playing faultlessly despite this distraction). 'Not One Of Us' continued the aggressive feel as the audience shouted the title line in chorus with Gabriel.

'Family Snapshot'.



Tony Levin, David Rhodes and Larry Fast.

'The Family And The Fishing Net' ("a song about rituals") marked a distinct change of mood, with Gabriel creeping about the half-lit stage, intoning the menacing verses over the unearthly backing (chiefly reversed Fairlight samples). The choruses were sung by the band emphasising the liturgical response phrasing of the chorus. Tony Levin used a remote keyboard to play the bass line on this track, abandoning his usual Chapman Stick. A quiet middle eight delivered by Gabriel sitting on the edge of the stage was electrifying.

With the beginning of 'Shock The Monkey' ("a hairy love song"), Gabriel left the stage and reappeared swinging from a scaffolding bar. He continued to "ape the ape" throughout the entire song, using a radio headset (as were the rest of the band) allowing complete freedom of movement and mime.

In contrast, for the narrative 'Family Snapshot', he sat at the piano and sang into a standard mic, as if the nature of the song made elaborate illustration unnecessary. This song was one of the most moving performances of the concert, the bass counterpointing the melody beautifully in the quiet personal passages, whilst in the up-tempo sections the full power of the band underlined the tension of the impending assassination.

'Intruder' found Gabriel once more on the prowl as the rivetting drum pattern and diminished fifth feel set an atmosphere of tension and menace. Sampled scrapes and clicks on the Fairlight and jagged guitar chords from David Rhodes completed the unpleasant backdrop to the threatening vocals, leaving one feeling distinctly unnerved. The whistling at the end sent shivers down the spine.

'Humdrum' (off the first album) started innocently enough but built to an epic grandeur as Larry Fast piled orchestral textures on top of Gabriel's CP80 and Prophet strings. This is perhaps the track which most shows his roots in 'pomp-rock' but this grandiose sound held up well in contrast to his recent sparser style.

Next followed a reworked version of 'Games Without Frontiers', based around Tony Levin's bass synth and sustained guitar lines from David Rhodes.

Then came the evening's big surprise! An unused drum kit had lain dormant next to Jerry Marotta's from the beginning, but now it was in use, as two drummers struck up the opening pattern of 'Lay Your Hands On Me'. Gabriel explained that Jerry Marotta had been doubtful for the gig because of a back injury. Phil Collins ("we looked in Yellow Pages under Drummers") had agreed to dep. if necessary. Jerry had been pronounced fit to play but "we got him (Collins) along to play anyway". This song turned into the highlight of the evening as it grew from the marimba in the spoken verses through the building vocal, synth and guitar lines of the bridge passages to the ecstatic "I am ready... I am waiting... I believe" lyrics of the chorus with band and audience together chorusing "Lay Your

Collins and Marotta pounding out 'Biko'.

Hands On Me". The atmosphere was of a religious revival meeting, with Gabriel as the Messiah.

'Solsbury Hill' built on this feeling as the audience echoed Gabriel's every word, but the optimism and solidarity created was deliberately dispelled by the stark isolation of 'I Don't Remember' which followed, as he staggered bemused and uncomprehending around the stage, to the octave leaps of Tony Levin on Stick bass.

This sense of the individual alone in a hostile environment was developed by the Indian initiation ceremony of 'San Jacinto'. The Fairlight sequence was slowly augmented by hammered Stick bass, soaring descant lines on guitar and counter melodies on orchestral strings. The concluding section found Gabriel totally alone on stage, accompanied only by an unearthly backwards Fairlight sequence, lit by one white light at the foot of the platform on which he stood, intoning "Hold the line" in an ever-weakening voice. The light, the sequence and the voice disappeared. The set was over, and this final image persisted until the opening arpeggios of 'On The Air' announced the return of the band. A joyous performance with exuberant audience participation followed but all too soon they were gone again.

Gabriel returned in more sombre mood and as Collins and Marotta struck up the familiar African rhythm of 'Biko' on tom toms, he proceeded to explain the reasons for the concert, namely in aid of the Lincoln Trust, created to fight Apartheid. He introduced the founder, Donald Woods, and with the simple phrase, "this song is for his friend, Steve Biko", began the very moving damnation of South African political methods in song. "You can blow out a candle, but you can't blow out a fire", sang the entire audience as one man and the united atmosphere of a religious gathering returned, but this time in specific rejection of political oppression. As Gabriel left the stage he said, "it's up to you now", and the audience continued singing, even after the rest of the band had stopped playing.

Loud cries for more were not disappointed as the band returned with yet another percussionist, Allan Schartzberg (Gabriel's drummer on the first solo album and tour) to add to the fiery drumming of Collins and Marotta on 'Kiss of Life', which was even more powerful than the studio version. Band and audience alike lept up and down to the acapella rhythms. The quiet middle eight was in sharp contrast with its minor chords and lyrical vocals but it was soon back to the staccato beat of the chorus and the dancing started up again with renewed fervour.

A question and answer three-man percussion solo followed as the pace kept building to impossible fury and then suddenly, too soon, it was all over. The applause lasted so long that Gabriel brought the band back to make a final bow, but what could they have followed that frenzied 'Kiss of Life' with? Everybody left physically and emotionally drained.

Paul Wiffen **E&MM**

'The Family and the Fishing Net'.

CASSETTE REVIEW

CASSETTE REVIEW is always interested in music from E&MM readers whether recorded live, on a couple of cassette decks, in a professional studio or by any intermediate method. We try to give at least a mention to every tape received, although with limited space and scores of tapes coming in it's best to have a little patience!

Send one cassette, mono or stereo, clearly marked with your name and address on the cassette itself and preferably in its plastic case. Include a covering letter giving full information on instruments and recording method used, and a relevant colour or black and white print, and send to E&MM Review, 282 London Rd., Westcliff-on-Sea, Essex SS0 7JG.

Unfortunately it's no longer possible to return tapes or photos, but readers should note that our Electro-Music compilation cassettes will contain full details of each selected track and will ensure international promotion of our readers' music. Tapes are accepted on the understanding that permission has been given for the use of a track or part of a track if space permits, with copyright remaining with the contributor.

Scores below refer to musical content, recording technique, packaging and promotional material and hi-fi quality respectively, and are out of a maximum of ten in each case.

Java

Java

'Strangers' 'Reasons Escape Me' 'Adieu Mon Gars' 'Too Much Noise'

Java are two people, Vicky Licorish and Martyn Phillips. Vicky sings, Martyn plays all instruments and produces. The songs are co-written. Apart from the first song, everything was recorded on a Fostex 250 and despite 'bounce-downs', this is one of the best quality cassettes we have ever received at E&MM.

'(We are) Strangers' begins with DMX drum machine and MiniMoog bass, with jagged piano chords over the top. The tempo picks up as the vocals come in, and in the chorus the accompaniment emphasises the back-beat under the languid harmony vocals. Vicky's voice of a character traditionally associated with blues or soul, lends emotion to a musical form which is often criticised as being emotionless. A rising MiniMoog leads into a guitar solo which builds over piano arpeggios to the final impassioned chorus fade out which is reinforced with piano and synth sequences.

'Reasons Escape Me' starts with a virtuoso slap bass-line of the Level 42 style. The 12-string guitar chords are interesting suspensions and inversions which add complexity to the basic pentatonic tune.

The fast feel is kept going in the chorus by an echoed sequencer whilst the bass plays a jerky counter-melody and rhythm. Again the vocals contrast beautifully, adding emotion to the unrelenting backing. The only time the pace is slackened is for the synth solo, which glides over a stop/start bass-line. But it is only a brief respite and the bass groove is back. Harmony choruses repeat the title, underlining the confusion expressed in the lyrics.

The third song, 'Adieu Mon Gars' is sung in French to a pulsating electronic disco beat. A powerful lead line is played on a Gnat synth over triggered Wasp chords (made possible by a modification Martyn did himself). The track fair steams along, but the vocals still breathe desperation and despair. Any A&R man worth his salt would have this playing on a 100 continental radio stations and it would be a massive Euro-hit.

The final track 'Too Much Noise' is at the same time the simplest and yet most moving piece of all. Whilst the other tracks deal with various fated emotional entanglements, the lyrics of this song deal with the plight of the solitary whale, separated from his mother and fellows as the oceans are gradually taken over by shipping, the noise of which prevents whales communicating with one another. The whole piece is based on a 2-bar bass riff, around which Martyn improvises economically on his Wal fretless. Waves of heavily modulated synth chords rise and fall under the vocal line full of loneliness and incomprehension. — "I speak to them (the ship's engines), they talk amongst themselves" — "My mother told me 'Keep in Line', the factory cut her away from me love." 'Too Much Noise' in the most powerful comment on the plight of the whale, I have yet heard.

The musical styles on the tape are quite diverse, but Vicky's emotional vocal style and Martyn's musicianship hold the whole thing together well. The synth sounds are a testament to how much can be done with old EDP equipment (Wasp and Gnat synths, Spider sequencer and Caterpillar keyboard controller) even if Martyn has added PWM, Oscillator 2 Filter Mod and poly pitch mod to the Wasps himself (he tells me that he is happy to modify other peoples Wasps for a small charge). The combination of new electronic music with a timeless vocal style works well and sounds fresh and underivative. Wake up A&R men, this is the sort of thing you should be looking out for!

Contact Martyn at 101 West End Lane, London NW6 for more information on Java (as well as further details on Wasp Modifications).

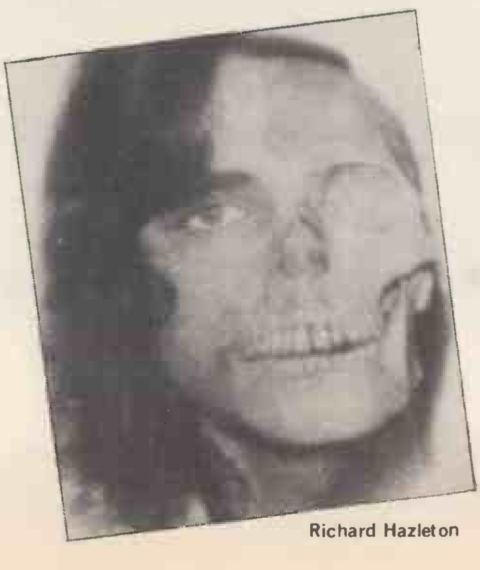
The Best of the Rest

Encounters

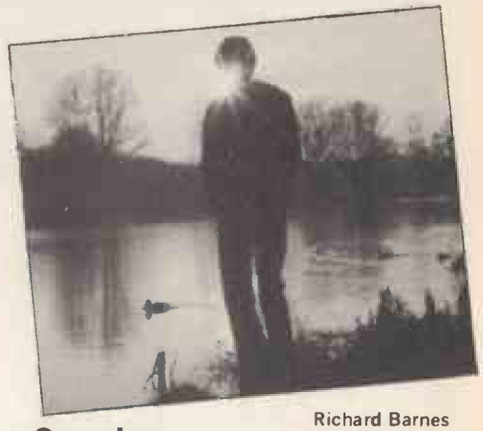
R. M. Hazleton

A collection of 7 pieces in a beautifully produced cassette box (from the cover photo I suspect that Mr Hazleton is something of a photography expert). All composition, recording and performance is by Richard Hazleton playing SG, Transcendant 2000 and on acoustic piano recorded on a Teac Portastudio using a Powertran Digital Delay for processing. The faster tracks are reminiscent of Ashra, with the layered guitar lines Manuel Gottsching and Mike Oldfield favour, whereas the more reflective pieces could be out-takes from the second side of Bowie's 'Heroes'. Of particular note are 'Third Hour' which features some very interestingly treated sounds and 'Encounters' which would make a good score for a romantic film.

Contact R. M. Hazleton, 9, Ramsgate Road, Margate, Kent.



Richard Hazleton



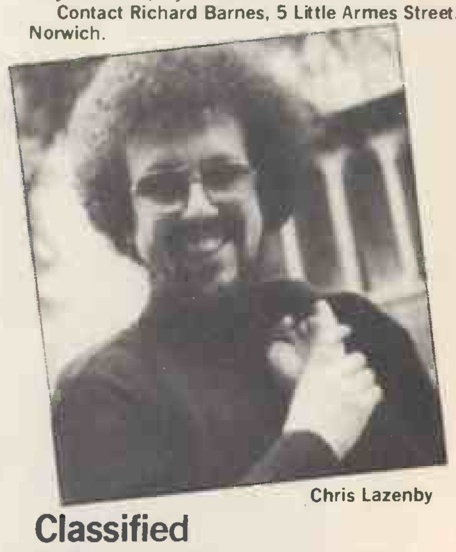
Richard Barnes

Sunrise

Richard Barnes

An album's worth of material here, again is a nicely packaged cassette format. 10 songs in the singer/songwriter vein. Flowing piano lines and dreamy sax embellish the quieter tunes such as 'Dreaming My Life Away' and 'Song of Love'. On the more up-tempo numbers, guitars and electronic keyboards add pace and depth. 'I Need To Know' features an excellent piano solo introduction and and some lovely syncopated accompaniments. The title track has a lovely atmosphere created by electric guitars and electronic keyboards. If Mr. Barnes plays all these instruments himself, he is a very talented player indeed.

Contact Richard Barnes, 5 Little Armes Street, Norwich.



Chris Lazenby

Classified

9 Original Pieces from the Keyboards of Chris Lazenby

A wide diversity of musical styles on this tape from tongue-in-cheek pieces like 'Country & Eastern to tricky time-signatures like 'Elevenate'. The song 'My Kids' sounds not unlike a John Miles ballad, whereas Ursa Major has more in common with German electronic bands. Chris certainly acquits himself well on the variety of keyboards he uses, and the tape is excellently recorded (using Teac A3440 and X10).

Contact Chris Lazenby, Arranging & Sound Services, 24, Westerby Crescent, Silden, Keighley Bd20 0BW.

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Accurate tuning to some form of known reference is essential in music, be it for musicians playing together or one person multi-tracking.

Amdek's Tuning Amp is a handy little unit which can provide precise, crystal controlled, frequencies of 220, 440 and 880Hz. The tones go through an amplifier and are then output to the internal speaker, or headphones, if required.

An input, via a standard jack, allows instruments, such as guitar or keyboards, to be connected and tuned audibly. Switching off the tuning note allows the device to become a small practice amplifier.

The Kit

The Tuning Amp is supplied in a bubble pack, complete with all the parts necessary for construction. Tools required are: a 15-30W soldering iron, wirestrippers/cutter; cross-head screwdriver and a small pair of pointed nose pliers. All the connecting wire and solder required is supplied in the kit.

Parts should be laid out on a clear surface and checked off against the list in the assembly manual. Once this has been done assembly of the unit can be started.

The first steps involve connecting wires to the controls and socket. Three leads are cut to length, stripped, tinned and then attached to the Volume control. Another four leads are prepared and attached to the headphone jack. A further six leads are prepared and attached to the Mode select switch. A white lead is also cut, stripped and soldered to the -Ve terminal of the speaker (Steps 1-5). The PP3 battery snap connector and LED leads are then stripped and tinned.

PCB preparation is next. During the flow-soldering process used in manufacturer of the PCB, the eyelet holes have been partially filled with solder. However, more solder should be applied, where necessary, to make a raised dome on each eyelet. This helps make a clean joint where wires are attached.

All the wires, when prepared, can now be connected to the board, as shown in the assembly manual. Also connect the purple wire from the headphone jack to the +ve terminal of the speaker. This completes all the soldering iron work (Steps 6-9).

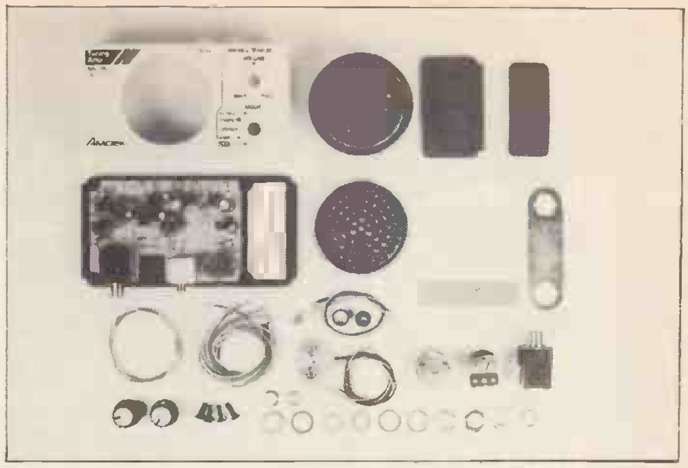
The LED holder should be inserted and the speaker grille clipped in place. After slipping the locking ring over the LED, the LED can be clipped in place and locked with the ring. Mount the headphone jack next with a toothed washer, plain washer and nut.

After the detention key stud has been broken off the Volume pot it can be mounted, along with the Mode select switch into the case. Secure using washers and nuts (Steps 10-15).

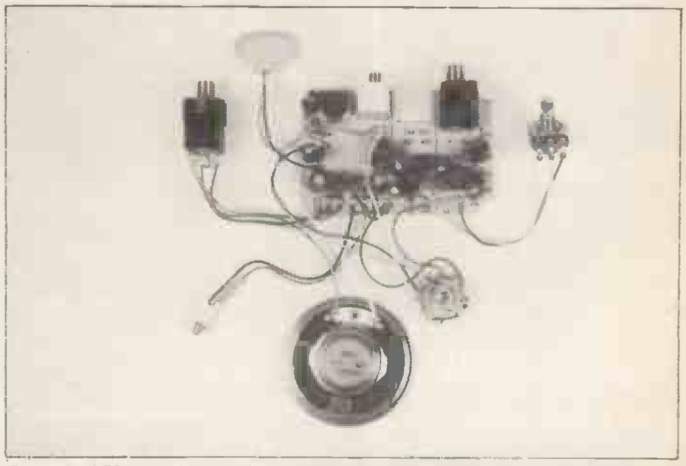
The speaker should be placed inside the case on the grille and the small piece of sponge pushed into the PCB opposite. Inserting the PCB into the case, and locking with the nuts and washers on the DC and input sockets, retains the speaker. When this has been done the clear insulation sheet can be added to the bottom plate to protect the circuitry from shorts on the solder side.

To prevent the case from slipping, when used on a smooth surface, stick the rubber pad onto the other side of the bottom plate and using four M3 x 10mm screws attach the plate to the case.

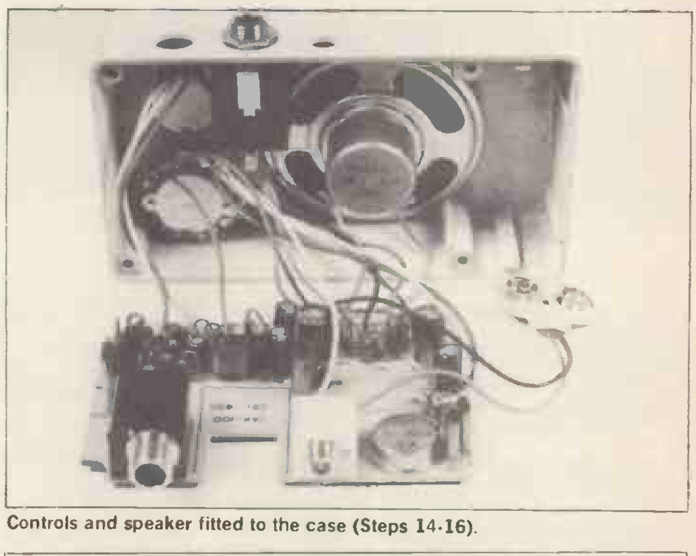
Once a PP3 battery has been inserted and the rubber battery cover



All the parts ready to be checked off.



Controls, LED, speaker, socket and battery snap connected to the PCB (Steps 2-9).



Controls and speaker fitted to the case (Steps 14-16).

PCB fitted and insulation added to the bottom plate (Steps 17-18).

fitted the two control knobs can be pushed on to the pots to finish the unit (Steps 16-22).

The Circuit

The circuit diagram of the Tuner Amp is shown in Figure 1.

Input signals are pre-amplified by the circuitry around Q1 and Q2. This amplifier has a frequency response characteristic most suited to the electric guitar. Signals from this pre-amp are mixed with tones from the crystal oscillator IC1, via the Volume control, and then sent to the audio amplifier, NJM386N. Output from the amplifier goes to the internal speaker unless headphones are connected via the jack socket.

The four way Mode select switch makes the unit operational and selects: Amplifier, 220, 440 or 880Hz.

Operation

The unit worked first time and produced a pure tone on each frequency setting. With an instrument connected the amplifier produced a clear sound, adequate for quiet practice and headphone use.

Should you have any problems contact the Roland 'Hot-line' at the UK factory. Tel. 01-847 1671.

Modifications

One modification which Amdek suggest is to disconnect the pre-amplifier, by removing R25 and C16 and linking R23 to C15, to provide a flatter frequency response ranging from 100Hz to 250kHz.

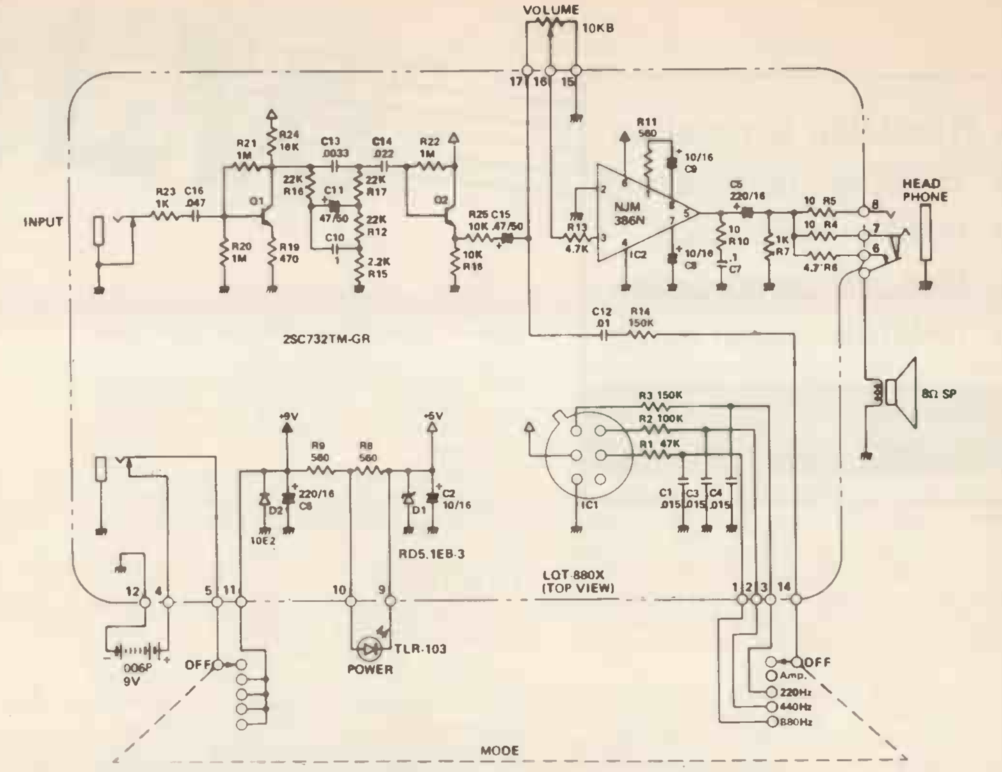


Figure 1. Circuit diagram of the Tuning Amp.

E&MM's special offer price for the Amdek Tuning Amp Kit is £35.75 inc. VAT and P&P. Please order as: Amdek TAK-100.

SYNCLAP

by Kenneth McAlpine

★ Handclap simulation
★ Variable clap spacing
★ Built-in ambience
★ Modular construction
★ Optional stereo output

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Two projects, featured in the last few months, which have proved to be very popular are the Synbal (February '83) and Syntom II (April 83). These units were designed to be built up into a modular system which could provide a complete range of electronic percussion.

This month we add another module, the Synclap, which, as the name suggests, allows convincing imitations of a handclap to be produced. The circuitry is designed to integrate with the rest of the percussion system and be triggered via pads, mic or switch.

Handclapping

This instinctive sound must be one of the oldest in history and is used to punctuate many forms of music. The action is obvious! but the sound is fairly difficult to synthesise accurately.

When several people clap together the result is an ensemble of claps. This is because they do not bring their hands together exactly at the same instant. To generate this effect the circuit must create a few bursts of filtered noise in rapid succession. The block diagram of the Synclap is shown in Figure 1.

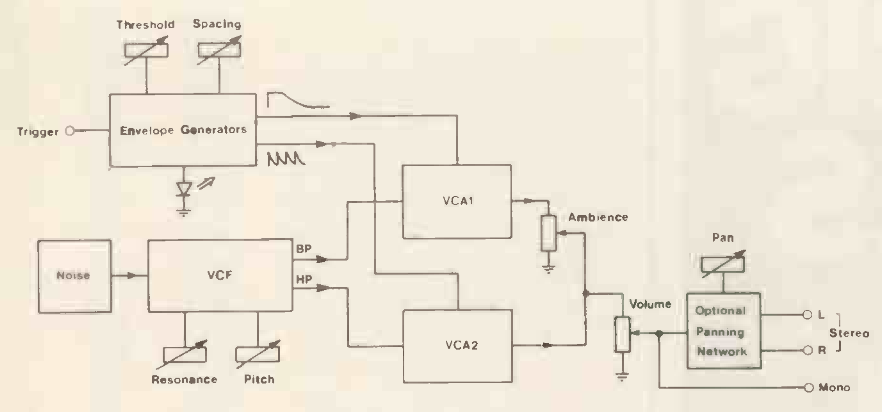


Figure 1. Block diagram of the Synclap.

Noise is processed by the Voltage Controlled Filter (VCF), which has two outputs, high pass (HP) and band pass (BP). Both the Pitch (cut-off frequency) and Resonance (feedback) of the filter can be controlled. The high pass output is fed to a Voltage Controlled Amplifier (VCA2) which is controlled by a burst of four short envelopes each time the circuit is triggered. The spacing between the envelopes can be adjusted from 10-30mS. This produces an output from VCA2 of four short claps, which are close enough together to sound as one. The band pass output is connected to VCA1 which is also controlled by an envelope, this time with only one long decay. By mixing this output with that of VCA2 a 'pseudo reverb' or ambience is created.

The optional panning network allows the circuit to be connected to a stereo percussion system and claps placed in the stereo field.

Circuitry

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

Trigger signals, which can be from a piezo pickup, crystal mic, rhythm machine or computer are connected to R1. The input is differentiated by C1/R2 to produce a short spike, which sends the output of IC1a low when it reaches the threshold voltage on pin 5, set by RV1. This low level sets pin 4 of the SR flip-flop, IC2a & b, high. IC2c is configured as an oscillator which starts running when pin 2 is high. The oscillator clocks IC3, a binary counter, which resets the flip-flop on the fifth negative-going edge. This in turn stops the oscillator and resets the counter.

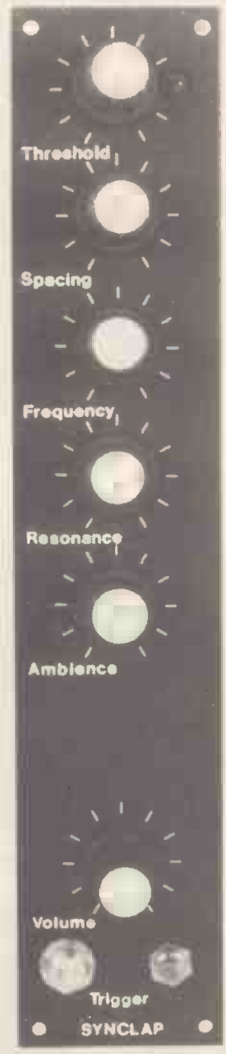
The four clock pulses are differentiated by C3/R7 which then charges C4, discharging via R8, R9 and opening the VCA, IC5c.

Counter output, Q2, goes high during two clock pulses thereby lighting the LED, D2, and charging C5 to produce the other envelope. C5 discharges via R11 and opens the VCA, IC5a.

White noise is produced by the reverse breakdown of Tr1. This signal is amplified by IC1b and connected to the state variable filter, based around IC1d and IC4.

The cut-off frequency of the filter is controlled by the current flowing into the two transconductance amplifiers IC4a & c. This is set by the voltage on RV3. The 'Q' or Resonance of the filter can be varied by RV4 which sums more of the band pass output into the filter producing a sharp peak, rolling off at -12dB/Octave.

Signals from the high pass output are fed via C11 to the 'clap' VCA and those from the band pass output via C9 to the 'ambience' VCA. RV5 is used to adjust the amount of 'ambience'. The VCAs are similar being based around IC5, a dual transconductance amplifier.



Outputs are mixed via the Volume control and sent either as a mono output: by omitting RV7 and the '100-up' components, and including R45; or as stereo by omitting R45 and including RV7 and the '100-up' components. The final stereo mixer, IC101, provides the right and left signals.

Power is supplied from a single rail, +12V, which is split, by IC1c, into a dual +/-6V supply.

Options

The Synclap PCB has been designed to match the Synbal and Syntom II with the same dimensions, control spacing and input output connections. It also offers the same flexible options which have to be selected before construction can begin.

Controls: 1) *rotary* - The PCB can be

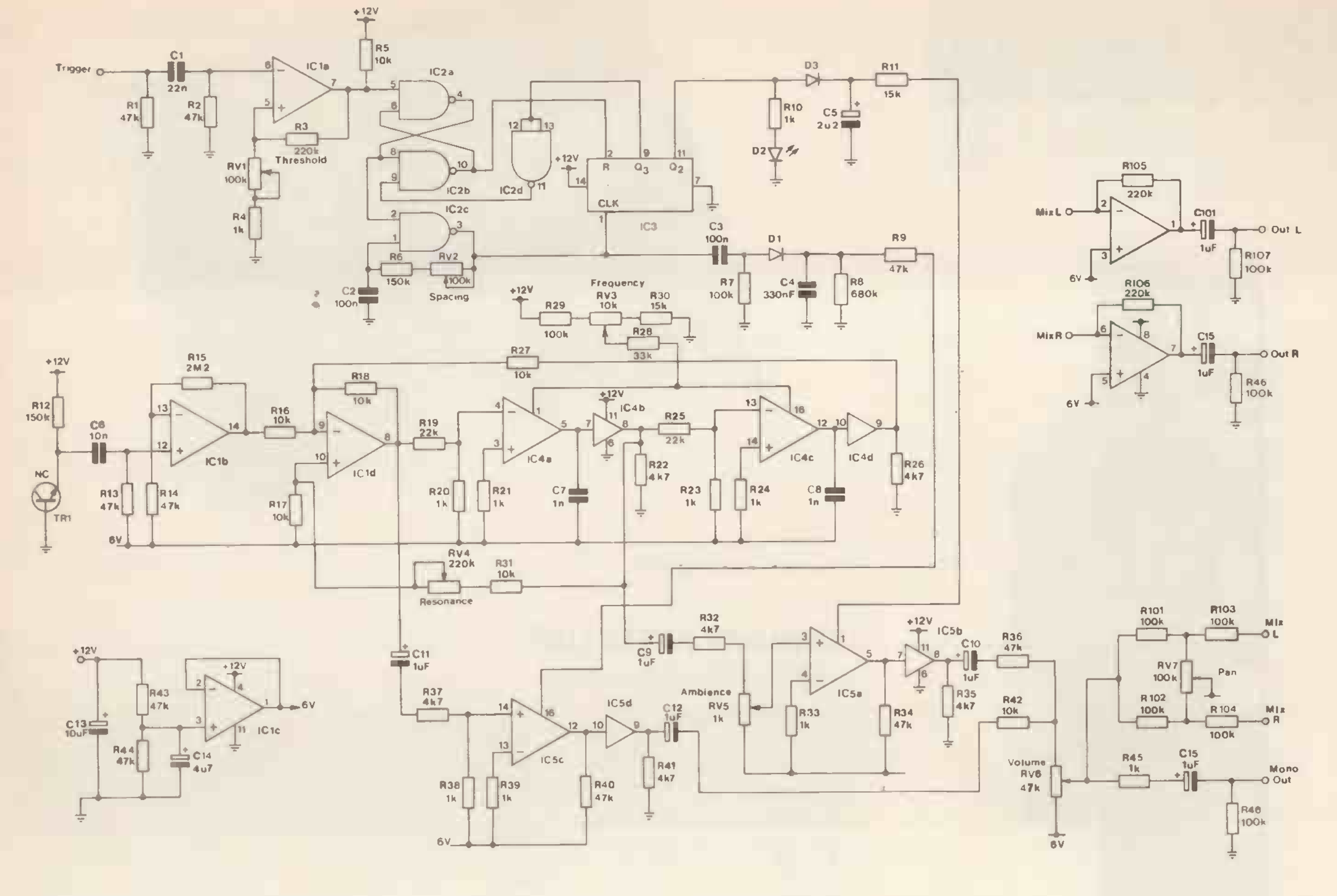


Figure 2. Circuit diagram of the Synclap.

mounted on a panel such as the one shown in the photo. All the pots, switch, LED and socket 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. 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 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 Spacing and Pitch, could be rotary and the rest pre-set.

Outputs. 1) *Mono* — If mono outputs are required then RV7 and components numbered 100 upwards are omitted. Resistor R45 should be inserted and Out R/Mono used as signal output.

2) *Stereo* — For stereo use R45 should be omitted with RV7 and the 100-up components inserted. Outputs are taken from Out L and Out R.

3) *Modular Stereo* — To allow a modular 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 the Pan pot inserted. All of the Mix R and Mix L outputs are connected together and the final output taken from the board with IC101 inserted.

Construction is fairly straightforward and components should be assembled in the following order: Veropins, links, resistors, capacitors, diodes, transistor and IC sockets (if required). Controls and LED can then be mounted with ICs inserted last.

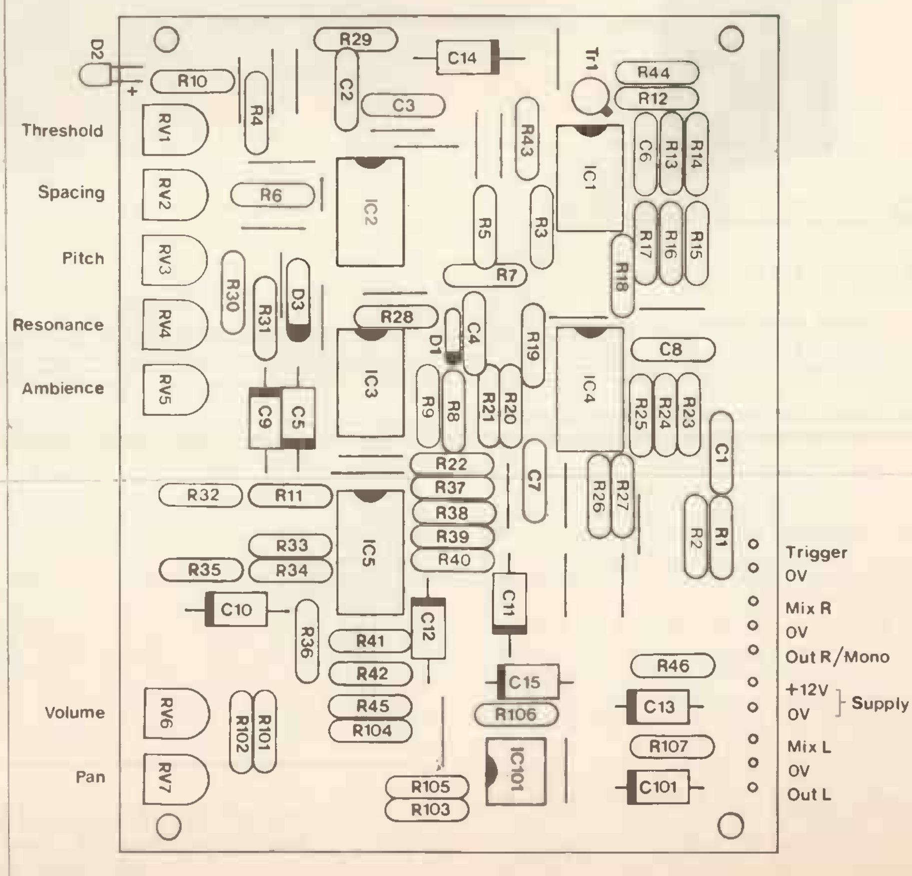
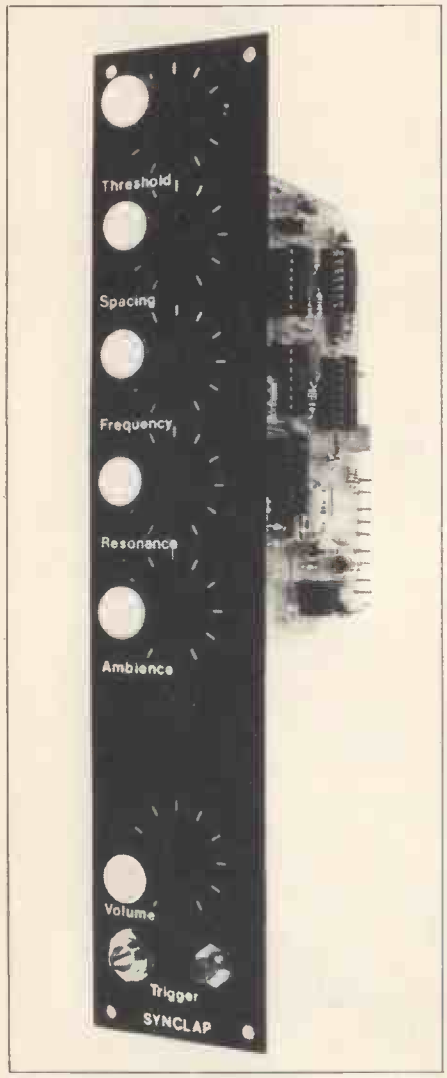


Figure 3. Component overlay.

SYNCLAP



PCB mounted to a modular panel.

Using the Synclap

Trigger signals can be from a variety of sources: crystal mic, piezo pickup, rhythm unit such as the Amdek described in March 83, or even a computer port. A switch could be connected across the trigger input and 12V for manual operation if required.

Since only one type of sound is produced no sound settings are given, however, the controls and their use are listed below:

1) *Threshold*: adjusts the trigger level to allow a wide range of input signals.
2) *Spacing*: varies the space between the four claps.
3) *Pitch*: alters the frequency of the filter and thus imitates changing hand size.
4) *Resonance*: makes the filter more 'peaky' and gives a more 'cupped' sound to the clap.
5) *Ambience*: adds a faint background signal imitating the effect of reverb.

Additional reverb or chorus could be used to thicken the sound but the built-in Ambience is quite convincing.

Power can be supplied by the circuit shown in the April 83 issue or by an equivalent 12V source. Get Clapping!

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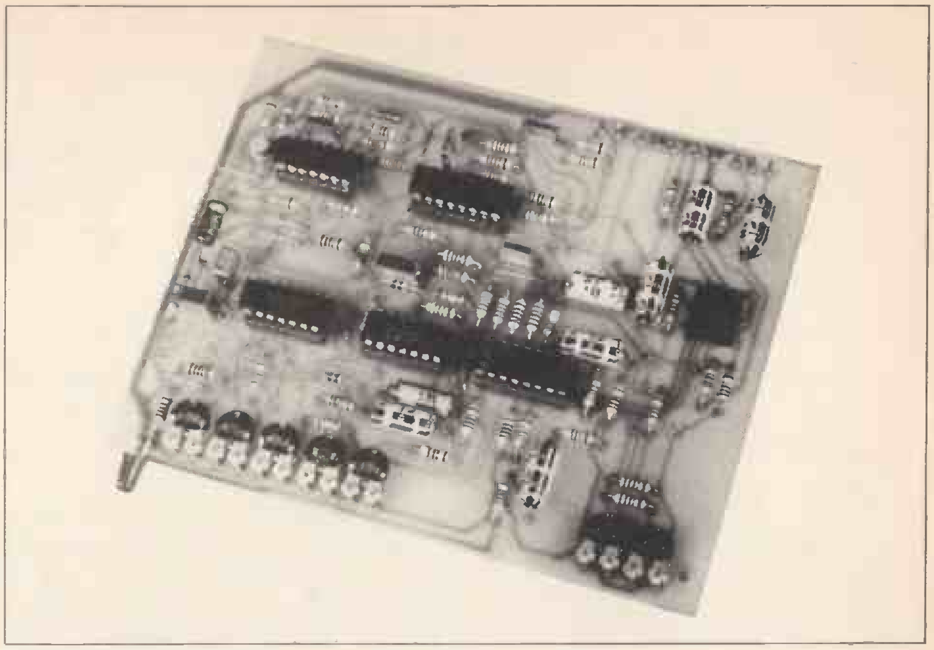

The completed Synclap PCB.

SYNCLAP PARTS LIST

Resistors — all ¼W, 5% carbon film

R1,2,9,13,14,34,36,40,43,44	47k	10 off
R3,105,106	220k	3 off
R4,10,20,21,23,24,33,38,39,45	1k	10 off
R5,16,17,18,27,31,42	10k	7 off
R6,12	150k	2 off
R7,29,46,101,102,103,104,107	100k	8 off
R8	680k	
R11,30	15k	2 off
R15	2M2	
R19,25	22k	2 off
R22,26,32,35,37,41	4k7	6 off
R28	33k	

Potentiometers (Rotary or Pre-set)

RV1,2,7	100k lin	3 off
RV3	10k lin	
RV4	220k lin	
RV5	1k lin	
RV6	47k log (Rotary) or lin (Pre-set)	

Capacitors

C1	22nF polycarbonate	
C2,3	100nF polycarbonate	2 off
C4	330nF polycarbonate	
C5	2u2 63V axial electrolytic	
C6	10nF polycarbonate	
C7,8	1nF polycarbonate	
C9,10,11,12,15,101	1uF 63V axial electrolytic	6 off
C13	10uF 25V	
C14	4u7 63V	

Semiconductors

D1,3	1N4148	2 off
D2	LED	
Tr1	BC108B	
IC1	UA3403 or LM324	
IC2	4093	
IC3	4024	
IC4,5	LM13600	2 off
IC6	1458 or 4558	

Miscellaneous

	Veropins	
	16 pin DIL socket	2 off
	14 pin DIL socket	3 off
	8 pin DIL socket	
	PCB	

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

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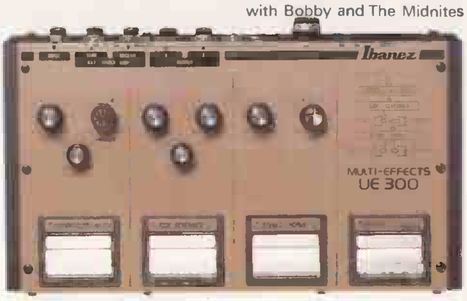

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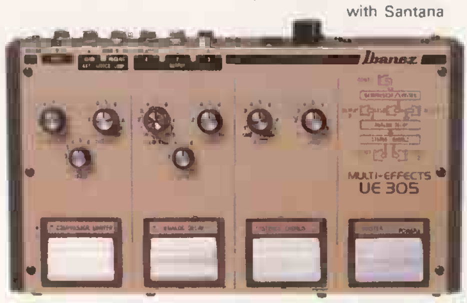

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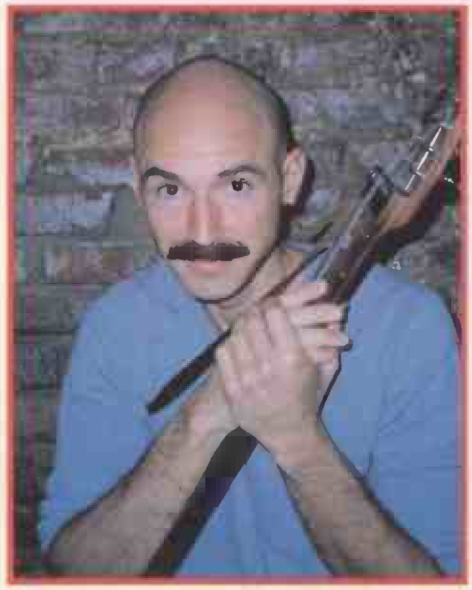

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