

Electronics &

# MUSIC MAKER



**KATE  
BUSH**

- ★ *Spectrum Micromusic*
- ★ *Sound Shaping for Percussion*
- ★ *Digital Recording – A New Landmark!*
- ★ *Synthesiser Performance Controls*
- ★ *Harrogate Festival of Sound & Video*
- ★ *Guitar, Drum, Amplifier & Keyboard Reviews*
- ★ *Projects: ElectroMix 842 – Studio Mixer for under £150*
- ★ *AMDEK Distortion Effects Kit*

# Roland

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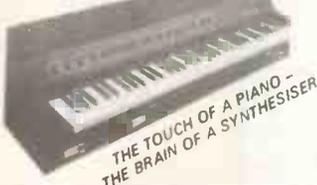
## OCTAVE KITTEN & CAT

**CRUMAR DP/50**  
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12 incredible Piano Voices, the ability to create your own and a keyboard response you can tailor to your touch

**THE VOICES:** Sit down at the Crumar DP-50 and you'll discover the world's most popular pianos are at your fingertips. Six presets function in two modes, the first six being more traditional acoustic and electric piano sounds, the second six offering more brilliantly defined sounds not normally associated with acoustically oriented instruments. **FREE SECTION:** The seventh preset enables you to control our very special Free Filter Section. This section lets you create your own piano sounds, plus many expressive synthesiser voices individually coloured by the energy you direct into the keyboard. **THE FEEL:** There are several electronic pianos claiming to be dynamic, but they still dictate what your playing style and touch should be. Not so with the DP-50. In the back of the piano is a Keyboard

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## OBERHEIM THE SYSTEM

CHASE ARE THE SOLE U.K. AGENTS AUTHORISED BY OBERHEIM TO SELL AND SERVICE THE PRODUCTS IN THE U.K.

**THE OBERHEIM SYNTHESISER PERFORMANCE SYSTEM** consists of either the Oberheim OB-XA or the OB-SX Polyphonic Synthesiser, plus the DSX Digital Polyphonic Sequencer and the DMX Programmable Digital Drum Machine. You can record notes, patches and drum beats, then play them on stage or in the studio in a dazzling performance that would take a dozen musicians or a dozen tracks to pull off conventionally. **THE OBERHEIM SYNTHESISER PERFORMANCE SYSTEM** makes getting your ideas down faster and easier than ever before. Program the multi-track DSX directly from the Synthesiser keyboard — record different sections and then merge them together to make the song as long as you want. The DSX can store up to 6000 notes plus patch changes, splits, tempos and transpositions in any of 10 different sequences, each with 10 tracks. In addition to driving all of the voices in the Synthesiser, the DSX also has eight external CV and Gate outputs, which can be used with other synthesisers for up to sixteen voice polyphony. The DSX also syncs up with

the DMX for sound you wouldn't believe could come out of a box. Program your drum beats, combine the individual parts into a complete song, then let the whole SYSTEM loose with the touch of a single button! **THE SYSTEM** has cassette interface and battery back-up too, so you don't lose your recordings when you lose power. The Oberheim Performance System: products that work together to expand your creativity as never before. **THE OB-XA POLYPHONIC SYNTHESISER:** 4, 6 or 8 Voice Synthesiser 120 Patch Programs 5 Octave Programmable Split/Double Keyboard Stereo/Mono Outputs. **THE OB-SX POLYPHONIC SYNTHESISER:** 4, 5 or 6 Voice Synthesiser 56 Patch Programs 4 Octave Keyboard. **THE DSX DIGITAL POLYPHONIC SEQUENCER:** 6000 Note Capacity 16 Voice Polyphony 10 Sequences, each with 10 tracks 10 Merges Loop and Transpose. **THE DMX PROGRAMMABLE DIGITAL DRUM MACHINE:** Real Sounds Recorded Digitally. 2000 Event Capacity 24 Drums 100 Sequences 50 Songs.

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Chase Price £299.00  
Weekly Repayment £6.33



4-octave fully polyphonic keyboard with violas, violins, trumpets and brass, all mailable, to produce unlimited range of sounds including organ, electric piano, etc. Separate bass section. Attack and crescendo facility. Interfaceable with other synthesisers to produce polyphonic synthesiser sounds. Reduced from over £800 to £299! Carrying case also available for only £20 extra. This is the best bargain we have ever had on offer!

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**CRUMAR STRATUS POLY SYNTH**  
RRP £900 CHASE PRICE £549  
Weekly Repayment £10.56

**SYNFLUL SOUND:** The Crumar Stratus is the first polyphonic synthesiser that satisfies the needs of both the creative synthesist and the multi-keyboard player. It offers a powerful array of sound, from the explosive to the expressive, and yet the majority of control comes from the keys you play, not the dials you turn. The heart of this outstanding versatility is found in the six actively engaged Filters and Envelopes that span the keyboard. These generate true polyphonic capability, letting you depress as many keys simultaneously as you want. Most polyphonic synthesisers are limited by their 4 or 5 voice capability. Go beyond that and notes drop out. The Stratus also features unique trigger modes (both Multiple and Mono) which allow you to turn on the Oscillator Glide, reset the LFO delay the alternate between the sawtooth and square



waves all directly from the keyboard. You can retrigger a particular effect whenever a new note is played, even though other keys are depressed. There are other noteworthy qualities to the Stratus, like two independent oscillators, continuously variable and invertible envelopes and polyphonic resonances. But, we suggest you experience this "synful" sound for yourself at Chase. At a price under £550, it's a devilishly exciting way to burn up a stage.

**CRUMAR PERFORMER Strings & Brass**  
RRP £500 CHASE PRICE £399  
Weekly Repayment £7.68

**MORE STRINGS — MORE BRASS — MORE GIGS!**

Violins, violas and cellos, Trumpets, trombones and French Horns. Synthesiser effects. You can have them all at your fingertips with the Crumar Performer. This incredible range of sounds that you can mix and overlap in any proportion you choose, make the Performer the most gig-producing keyboard on the market. Whether you do cover tunes or originals, the ability to add a true-to-life string and brass section tremendously expands your musical versatility. The Performer is priced just right for the working musician. Get your hands on one today. Crumar's completely new



Performer is a professional quality strings and bass synthesiser at a not so professional price. You could pay much more and still not get all the features the Performer offers: Two distinct 8- and 16-foot string voices, an on-board graphic equaliser, variable crescendo, full brass filter and envelope controls, delay modulation, a 4-octave range keyboard and trouble-free LED switching.

**CRUMAR ROADRUNNER PIANO**  
RRP £300 CHASE PRICE £229  
Weekly Repayment £3.88

The ROADRUNNER/2 has been designed for a colourful new look and positive electronic and mechanical reliability. The features include a new variable "chorus" effect, and accessible pitch control and rainbow tab controls for bass and 3 different piano sounds. Still included is the two octave bass extension that can be fed through a separate amplifier to give a "stereo" effect. For the ultimate in portable pianos, play CRUMAR'S new ROAD-



RUNNER/2 — the first and foremost of its kind.

**CRUMAR TRILOGY POLYPHONIC SYNTH**  
RRP £1300 CHASE PRICE £749  
Weekly Repayment £14.41

**TRILOGY:** Crumar's Trilogy combines polyphonic synthesiser, orchestra, strings, and cathedral organ in one instrument, then lets you combine them in any proportion for limitless creative potential. Usually we do not think one single instrument should do everything or be everything to the professional musician, but with the TRILOGY natural events "led" us to betraying this ideal. Accordingly we have created the most complete polyphonic synthesiser the musician would wish to have. Big, fat, aggressive, today's sounds combined with some unique features such as alternating waveform keyboard trigger and invertible envelopes in a



polyphonic format. Added to these a comprehensive, easy to use, bank of presets which may also be internally altered to your own taste, a super String Section and you have all the ingredients to make the TRILOGY live up to our highest expectations.

# CHASE

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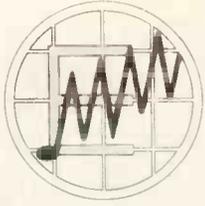
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# Electronics & Music Maker

Volume 2 Number 8

October 1982

Publisher

Terry Day

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Advertisement Offices Electronics & Music Maker, Hillcroft House, 16, The Avenue, Highams Park, London E4 9LD. Tel: 01-527 3376.  
 Publishers Glidecastle Publishing Ltd., 282, London Road, Westcliff-on-Sea, Essex SS0 7JG.  
 Distributors Spotlight International, Spotlight House, near 1 Benwell Road, London N7 7AX. Tel: 01-607 6411.  
 Printers Thomas Reed, (Sunderland).  
 Typesetters Quillset (Southend)  
 Subscriptions Rates for 12 issues: UK £12.00; Europe & Overseas (Surface) £12.90; Airmail (including Europe) £27.20.  
 Binders £3.95 inc. p&p Overseas add 11p extra covered by bankers draft in pounds sterling.

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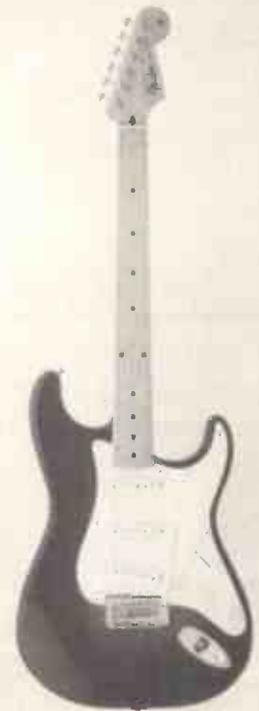
*This month's Industry Profile visits an audio/video recording and retail outlet in the heart of Essex.*

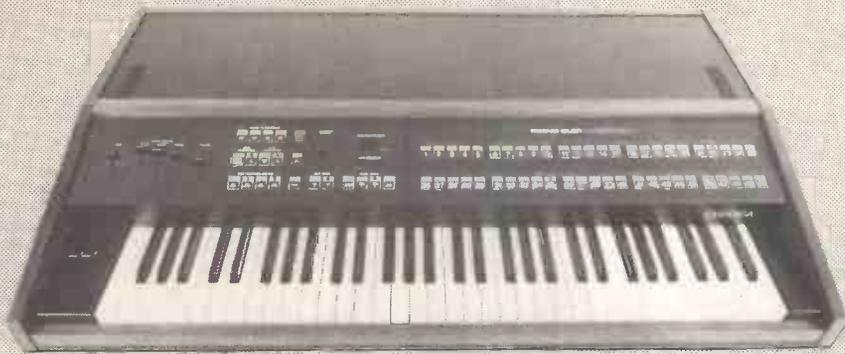
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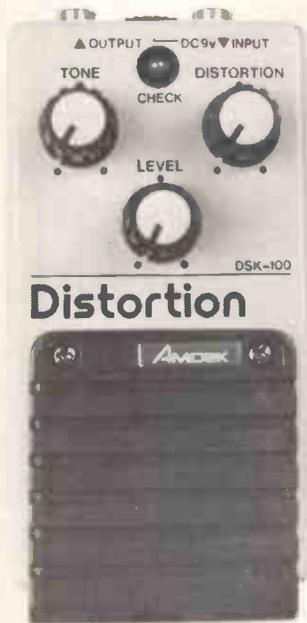


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**kits**

**Music-Making for all**

Two long awaited items appear at last. First, the ElectroMix 842 which is in constant use in our electro-music studio. (If you haven't noticed, our aim is to furnish it almost completely with E&MM projects!) Secondly, the superb Amdek kits have now reached our shores, and we'll have a strong involvement with these in future issues (in addition to our usual projects). Each kit is built, tested and recorded on E&MM cassettes to ensure it meets our own standards — and yours too. The Amdek range should ensure that every one of our readers does build at least one project from our pages.

With Sinclair's new ZX Spectrum, the talk of the micro enthusiasts, we've started our own series of music making this month using its BEEP function. There are also rather more sophisticated things in the pipeline!

The very good response to our cassette column is now revealing contributions with individual artistic qualities in their presentation aurally, verbally and pictorially. Keep them coming — wherever you are — and this month, just to rally some interest on the education side, I'll give away a new electronic music LP to the first 40 or so school music teachers that would find it useful for their students. So, pupils and teachers alike, if you're short on electronic music LPs in your music classroom, here's your chance to put things right!



Finally, we welcome Tony Halliday to the E&MM staff as Advertising Manager. His long experience in the music industry, with companies that include HH Electronics, Carlsbro, RSD and CBS, has already given him strong links with sales and marketing people in the U.K. and abroad. He'll be pleased to hear from potential advertisers. Enjoy exciting electro-music!

*Mike Becher*



## Laservision

Philips LaserVision Video Disc is to be made nationally available through over 1,000 outlets from this month onwards. Divisional Director Jimmy Dunkley said the decision to go national follows a successful introduction of LaserVision into London and the South-East in May, through 150 outlets, which has generated positive consumer response. Expansion of the disc catalogue above the current 120 titles is also imminent and will include additional feature films and special interest programmes as part of an ongoing plan to widen consumer choice.

This dramatic increase in distribution means that LaserVision will be available in all main shopping areas in England, Scotland and Wales and Philips is maintaining its policy of having both players and discs in all outlets. Philips is supporting its national distribution with a major autumn advertising campaign which will boost its 1982 LaserVision promotional expenditure to nearly £3 million.

## Computermusik

The Schweizer Gesellschaft für Computermusik (Swiss Society for Computer Music) has been founded on July 3rd, 1982, in Oetwil am See, Switzerland to encourage the development of computer technology in all domains of music, music research and music pedagogy. Of special concern is the artistic exploitation of the vast technical possibility offered by the computer.

The Society has informed E&MM that it is looking for contact with all persons and institutions at home and abroad who deal with similar problems.

## New Composer of the Year Competition

Barclaycard, in association with Nene College, Northampton, is organising and sponsoring a national competition — Barclaycard Composer of the Year Competition — to stimulate musical creativity.

The major aim of the competition is to discover new British talent, particularly among the young — though entry will be open to everybody aged 16 and over. Entries may come from popular to classical, from folk to jazz and from varying levels of experience.

On hearing of the competition, E&MM were particularly concerned that electronic music would be well represented and at a recent press reception our editor raised the question of whether electronic and avant-garde composition would be deemed acceptable by the organisers. It was decided that such compositions would be welcome and would be judged on musical merit alongside more traditional entries.

For more information contact: Bruno Spoerri, Studio für elektronische Musik, Sommerau, CH-8618 Oetwil am See, Switzerland.

## New Tape Magazine

After a year spent producing a 15 minute electronic music item for local radio husband and wife team Dennis and Jeannette Emsley are now producing a quarterly cassette magazine featuring synthesised music.

The magazine aims to "not only allow you to hear interviews with the artists and keep you informed about who's doing what and where, but will also allow you to actually hear some of the music."

Called Inkey\$ the first copy is now available on C90 for £1.99 (although discounts are available for orders of 10 or more) and is distributed by Lotus Records, 23, High Street, Newcastle-under-Lyme, Staffs. Copies are also available direct from Inkey\$, 50 Durell Road, Dagenham, Essex, RM9 5X0. Anyone who wants more information or would like their own music on the cassette, should contact Dennis or Jeanette Emsley at this address.

## ARS Electronica

Arguably the most important international electronic music festival, ARS Electronica will be taking place between 25th September and 1st October this year as part of the International Bruckner Festival in Linz, Austria.

Some of the events this year include Paul Earl's 'Icarus', a "Laser-Opera for Multimedia and Electronics"; a performance of 'Galaxy Cygnus A' by Michael Weisser and Robert

Shroder, during which the world's largest radio telescope will be pointed towards that galaxy with the messages received (which sound like a white rustle) forming part of the concert; and an electronic jazz section featuring Joe Zawinul of Weather Report.

Many other events and conferences will be taking place over the six days and a 'Grand Prize' will be awarded to "the most original and future-orientated new development in the field of electronic sound production." E&MM will be reporting on the event in a coming issue.

## New Production Service

Geraint Hughes, independent record producer, is the brains behind a new kind of advisory service for new, young bands who have lots of ideas — but not too much money. Hughes intends to offer a complete, all-round service, from advising on which studio to use, how to get the very best results on demos, and how to achieve the kinds of sounds they want to make but just don't know how to.

Hughes is well qualified to give advice on production techniques; he's been in the music business for ten years and was responsible for writing and producing, among others, 'Barbados' — he was one half of Typically Tropical who had a No. 1 hit with it in 1975; 'I Lost My Heart To A Starship Trooper' — a top ten hit in 1978 for Hot Gossip, and has also produced the 'Sad Wings Of Destiny' album for Judas Priest. Label credits for Hughes include: EMI, RCA, RAK, PRT, Ariola-Hansa and Gull.

How does he imagine the service operating? "Well, suppose a band wants to make a demo, but only has a

limited amount of money. They've got to make the very best of that money, but maybe they have little or no studio experience. That's when I would come in. I could advise on which would be the best studio for their money, how many numbers they could get away with and yet still sound professional. And, most important of all, I can interpret their ideas and help them get them down on tape. For example, they might have an idea for a certain effect or sound, but not know how to reproduce it — that's where I help. There's all sorts of areas where people might need help but not know how to get it, or think they can't afford it. I can tackle most things — programming Linndrum machines, arranging, and I'm very much at home with all modern synths".

And what would all this expert advice cost? Hughes says it depends on what people can afford. Obviously there is a fee for his services, but he says he's definitely affordable! And maybe with all that production expertise, people can't afford not to use him.

Geraint Hughes can be contacted at 41 Culverden Road, London SW12. Tel: 01-673 0377.

## Top Marks for Alphasyntauri

Topmark Computers, who were the first Apple dealers in East Anglia, have introduced a new fully programmable, 8-voice polyphonic digital synthesiser called the Alphasyntauri. This synthesiser has an infinite number of presets stored on floppy discs and facilities to create, draw or analyse any wave and use it through an A.D.S.R. or percussion (A.R.) envelope.

Other features include pitch-bend, pitch-sweep, timbre, modulation and a 3,200 stage sequencer with 'overplay' facility. The system is based on the Apple II and Topmark have musical and technical facilities to provide, install and configure the instrument anywhere in the world. They also give complete support from fixing or replacing hardware to editing, rewriting or customising any software needed.

Details from Geof Twiss, Topmark Computers, Peppercorns Business Centre, Peppercorns Lane, Eaton Socon, St. Neots, Cambs. Tel: 0480 216234.

## Beatles Video

Pre-empting the plans already made by Thorn EMI and Apple the first Beatles video will be released by MGM/UA in mid-October.

Joseph Cooper of 'Face the Music' and a distinguished pianist; Carl Davis, successful composer with many television and film themes among his achievements; Joseph Horowitz whose major recent work was the score for the television series 'Lillie'; Andrew Lloyd Webber, composer of many hit musicals including Jesus Christ Superstar, Evita and Cats.

Mr Joseph Cooper, Chairman of the panel of judges, said: "This is an exciting new competition, especially the thought that this deeply musical country may well be hiding a few budding Beethovens, Lloyd Webbers or Ellingtons. Maybe on May 5th, 1983, one — or more — will surface; what a wonderful prospect and what a task for the judges".

Entry forms may be obtained from David Gravelle, Dept SA, Barclaycard, Northampton NN1 1SG.

# Readers Letters

Send to: Reader's Letters, Electronics & Music Maker  
282 London Road, Westcliff-on-Sea, Essex SS0 7JG.

## Hand-Claps

Dear Sir,  
I have constructed a hand-clap synthesiser but I am disappointed with the effect that it produces. The circuit I used was given in the August '81 issue of ETI. Can you suggest where I might obtain another circuit to give a more authentic hand-clap sound?

D. Vanderwolf  
Cornwall

*E&MM's Synwave project in the July issue 1981 was originally designed to be a 'clap' generator, and if you use its controls properly you will get a basic clap that's as good as anything on the market (except a sampled sound!). Add reverb and echo for best effect.*

*We have sold over 1000 of the Synwave kits to date — that shows how good it is — and we changed its use to make it more versatile.*

Dear Sir,  
Your magazine is truly great — so much better than anything here in the States for sure. I am most thankful to you for such a beautiful publication and I hope that you will prosper immensely for the benefit of all electro-musicians.

Bernard Xoloti  
Syntasy  
San Rafael  
California

Dear Sir,  
I am writing to let you know that your magazine is nothing less than superb. There isn't a magazine, here in the entire North American continent that can come close to yours in articles or projects. Keep up the excellent work.

Brian Hlopina  
Winnipeg, Canada

## Kraftwerk

Dear Sir,  
Please could you tell me the names and makes of the synthesisers used by Kraftwerk on the 'Pocket Calculator' track, shown on pages 62/63 of the September 1981 issue. Also, what make are the headphones/microphones they use?

Richard Belle  
Hants

*In addition to their custom-built-drum machines and sequencers, Kraftwerk decided to use only musical toys — the Dubreq stylophone, the BeeGees Music Machine and the Texas Speak and Spell, to show how an awareness of computers in our everyday life and a little imagination on the part of the electro-musician can often make up for a lack of finances! As part of their Sennheiser Vocoder, however, their headphone/mikes represent a considerable investment; Shure, Eccle-*

*ston Road, Maidstone ME15 6AU, manufacture a less expensive model.*

## Vocoders

Dear Sir,  
I have had a Jen SX1000 synth for some months and would now like to be able to speak through the synth: would the addition of a mike input provide me with a vocoder-type effect?

Graham Marsh  
W. Yorks

Dear Sir,  
I'd like to add choir-like chords to my music: can a vocoder do this as well as the 'Mr Blue Sky' type of vocal effect? Is a vocoder a separate entity from a keyboard, and what can trigger it?

John Dyson  
S. Yorks

*Any synthesiser with a suitable input can alter the tone qualities of a voice input via a microphone, but a vocoder is needed to provide control over its pitch. The vocoder assigns the tone quality of the voice to the pitches produced by a keyboard or guitar, a monophonic keyboard providing single vocal lines and a polyphonic keyboard providing chords. Some vocoders (such as the Korg VC10) include their own polyphonic key-*

*board, others (such as the Electro-Harmonix or EMS) need an input from an external keyboard. Either way, the end result is a cross between a human voice and a musical instrument — a 'singing guitar' for instance. For more accurate choir sounds a Novatron (playing pre-recorded tape loops) or Roland VP550 (with imitations of male and female voices) would normally be used.*

## Projects

Dear Sir,  
I am only sixteen years of age and, I'm sure, like many readers of E&MM I am very short of money. For this reason I find E&MM very useful because it enables me to afford many items such as effects which would otherwise be out of my reach.

I do not know if it would be possible or even if you would find it desirable, but here are some ideas of some projects that I would like to see: A vocoder, a decent quality combo practice amp, a powered mixer (e.g. the RSD Studio master 8-2 powered mixer) to complement your 'Power 200 speakers'. This is ideal for a multi keyboard set-up. Also I would like to see more cheap effects pedal projects.

Thanks for an excellent publication.  
David Thornton  
Herts

*This month's 8-4-2 mixer project, is an excellent low-cost unit but your suggestions for a powered mixer are certainly interesting and we will bear them in mind. A practice amp, The Guitar Buddy, was featured in the August issue and we are starting a series on effects pedals (based on the Amdek range) this month. Any vocoder plans we have are strictly secret for the moment.*

# BOOK REVIEWS

## The Complete Synthesizer

by Dave Crombie  
Published by Omnibus Press  
Price £4.95

This book is written by Dave Crombie, who is well known as a reviewer of electronic musical instruments for several publications, including E&MM. He has aimed to explain the fundamentals of electronic music, particularly the operation of the synthesiser and his extensive experience in this field makes his comments worth noting.

The presentation physically of the book is rather unusual, if not irritating, with very wide blue borders on each page and large type that has little spacing between the words. For some reason the figure numbers are highlighted, while important terms are not. But the text is accurate with few spelling errors — essential for what must be considered a reference manual from its title — apart from 'synthesiser'! There are copious line drawings to illustrate the text which are sufficiently accurate for the most part. There are plenty of terms and their usage to learn about — such as parametric, periodic and synchronisation. Chapter one deals with E&MM OCTOBER 1982

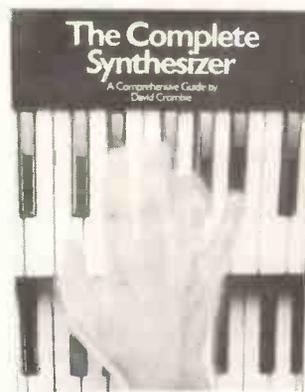
understanding sound; Chapter two looks at synth sections. Useful information is given on filters and the EG is explained well (but no mention of negative EG). Some less used terms are also covered, such as 'filter bias'.

Categorising synthesisers does help in comparing instruments — for example, the Polymoog is detailed as a hybrid polyphonic instrument, but it would have been useful to have details of products classed as string synths, ensemble keyboards and pseudo polyphonics. Guitar, wind and percussion synthesisers are only briefly discussed with no specific examples. Surely Roland deserve some recognition for their guitar and percussion synths, the Variophon and the Yamaha CS-01 for wind, and the Linn for real sampled drums?

Only four commercial instruments are examined and surprisingly Korg and Yamaha products are omitted.

Chapter four gives some valuable pointers for imitative synthesis of traditional instrument sounds. Not much is written about experimenting with abstract synthesis — but that would require a whole book!

Chapter five looks at accessories,



particularly the sequencer, with brief mention only of reverberation, echo (only tape echo, not analogue or digital) and omitting flanging, panolo and harmoniser effects.

The last chapter gives a potted history in 3½ pages, introducing developments from the Telharmonium at the turn of this century, and there's a useful glossary of terms to finish.

The book makes enjoyable and instructive reading despite its omissions. Its title is good for publicity but hard, if not impossible, to realise in a 96 page book. But if you're as keen on electronic music as we are at E&MM, you'll definitely find a place for it in your music library.

Available from Book Sales Ltd, 78, Newman Street, London W1P 3LA.

# KEN FREEMAN



Probably best known for his contribution to 'War of the Worlds' LP, we find out how electronics, synths and a PET have influenced his music.

by James Betteridge

Ken Freeman's success as a keyboard player and writer is largely due to his combined talents as a musician and a technician. At the age of sixteen his band, 'Second City Sound', had already made a single and were managing to make a living playing pubs and clubs in and around Birmingham. Six years later they were to earn the dubious distinction of winning Opportunity Knocks six times in succession. "From our success on Opportunity Knocks we were offered a summer season in Brighton with Ronnie Corbett," recalled Ken, "it wasn't exactly inspiring, and soon after that I left the band."

During this period Ken had been teaching himself electronics through the pages of hobby mags, and having left the band he was able to concentrate on completing a string synth project that he had been toying with for some years. "In those days there weren't any synths around with a really natural string sound. It occurred to me that when a string section was playing together, each player's vibrato was slightly out of phase with that of his fellows. I therefore designed what was actually an organ rather than a synthesiser, with three oscillators and three LFOs per note. The front panel provided controls for adjusting the pitch of each of the three groups of oscillators and each of the three groups of LFOs, and by slightly detuning the oscillators relative to each other and putting

the LFOs out of phase, I was able to get a very rich and authentic string sound."

In partnership with a Leslie speaker manufacturer in Harrow, Ken built a second, more refined prototype, and during 1971, exhibited it at the 'Musical Instruments Fair' at the Russell Hotel, London and received overwhelming interest. A company called Ling Dynamic Systems wanted to manufacture it and financed the construction of a pre-production model to be exhibited in Frankfurt the following February. Although Ken and his partners once again experienced a great deal of interest, they were also subject to what Ken loosely describes as 'industrial espionage'. In the same period they were forced to pull out of their contract with Ling Dynamic Systems due to a financial disagreement, and so they were left with a pile of orders and no manufacturing facility. Whilst they were fighting Ling for release from the contract, other manufacturers were bringing on to the market various adaptations of Ken's idea, and so the marketing impact of the Freeman String Synth had been somewhat pre-empted. Ken is keen to pass on the advice to any would-be inventors, that if you get a good idea, don't put it on general display until you have the final product ready to sell, and then flood the market.

The cost of negating the contract with Ling had left Ken completely broke, and he was therefore forced to take a job servicing electronic instruments. However, he still had the second prototype of the synth, and with it he managed to get some sessions. At that

time the natural quality of its sound was without equal, and even though he had no other keyboards, Ken soon found himself doing around ten sessions a week. Even today he still prefers it to modern synths for full chordal string sounds.

## In the Studio

Since that time Ken has become more and more in demand in the studio, working with many acts including Elkie Brooks, Jon Anderson, Mike Oldfield, Justin Hayward and in 1975 with David Essex on the single 'I'm Gonna Make You A Star', which was produced by Jeff Wayne. In the same year Ken was part of the band that accompanied Essex on his American tour, with Jeff Wayne as MD. The synth sound on the record had been produced in the studio by quadruple tracking, and so to recreate it on tour Ken had to play a duophonic ARP Odyssey and the monophonic ARP 2600, while Jeff played a second 2600. As the tour promoters were going to have to hire the synths anyway, Ken decided to buy an Odyssey and offset the cost of its purchase by hiring it to them for the duration of the tour. "The Odyssey was very well designed, and although the sound quality isn't that good, the facilities for internal routing without the need for patching and so on are great. If it had a more powerful VCF it would still be very useful — as it is I don't really use it anymore."

The Odyssey provided Ken with his first experience of interfacing synths with computers. He built a bi-directional A to D, D to A

interface between it and his PET to allow lines to be played on the synth, stored in the PET's memory and then subsequently played back through the synth. He could build a whole piece up line by line, storing each one on disc, and by using his Korg Rhythm 55 drum machine as a trigger pulse, he was able to play the lines in slowly and then have them played back at a faster speed, all perfectly in time. Of course, only one line could be replayed at any one time and so it was necessary to have a multi-track facility to get a complete piece recorded. When the first line was recorded, the trigger pulse was also recorded on a separate track, and thereafter was used as the trigger for subsequent lines. In this way sync between the individual lines was ensured. This method had several advantages: Ken could save time by writing the piece at home using his own four and, later on, eight-track facility, and then go in to the studio with the sure knowledge that a piece, which might under normal circumstances be technically very difficult to play, could be played back from the PET perfectly in time and perfectly in sync at any tempo required. With studio time costing what it does, that kind of reliability is very valuable. Ken wrote and recorded the current LBC station ident using this method.

After the David Essex tour, Jeff Wayne started to use Ken on a lot of his jingle sessions, and when he started work on the recording of 'War of the Worlds' in the summer of 1976, he hired Ken to play all the synth parts. The project took three years to complete and during the first two of those years Ken had little time to do anything else. "The equipment was relatively primitive in those days and things that would be easy to do now took a long time. We were using a 48-track recording facility, and including all the bouncing down, we must have actually used over one hundred tracks to get the sounds right. It was very good experience."

In 1977 Ken bought what was one of the first CS80's in the country, and armed with his experience with the design of the string synth, set about modifying it. In its normal state the CS80 is capable of 8-note polyphony, with each note using two VCAs, VCFs and VCOs. If, however, a single note is played, all eight pairs of VCOs are tuned to that note (that is, until another key is depressed) but only two of them are actually triggered. Ken's mod simply allowed a single key to trigger all eight pairs at once. He then put the LFOs through a phase shift network with eight, 45° stages, each of which were then used to modulate each of the eight pairs of VCOs, thereby giving the rich chorus-like effect that had been the basis of the string machine design. With the mod switched in, it is of course reduced to monophony, and Ken tends to use it to get a big sound for single line parts, preferring the old string synth for the full chordal sounds.

In January 1980 he signed a contract with Jeff Wayne Music to write and produce jingles, and to allow himself greater freedom to build up complete pieces on his own at home, he updated his TEAC 4-track to a TEAC Tascam 8-track. His complete equipment list now reads as follows: a TEAC Tascam 8-track, a Revox A77 and B77, a Studiomaster 12:2 mixer, a Korg Rhythm 55, a Roland Space Echo, a JVC portable VHS video, a PET 32K plus dual floppy disc drive, 3040 series, two Commodore 5¼in. floppy disc drives, a JCL high speed assembler, a TCM heat sensitive printer, the old and faithful string machine, a Yamaha CS80 and his latest acquisition, a Synclavier 32 voice.

When Ken bought his Synclavier in May 1980 it was, once again, one of the first in the country. He saw an advert for it in the American magazine, 'Computer Music Journal', and flew out to Norwich in Vermont to

take a look. "I was very impressed with the bowing effect on the string sounds, especially on the cello; for rhythmical work it's unbeatable. Each sound has a digitally transparent clarity, and again because it's digital there is an absolute precision about everything it does. I bought a 32-voice model because of the extra flexibility it allows; for example, a long glissando can be more effective because you can have thirty-two notes sounding before the first one cuts off, whereas with the CS80 you are limited to eight notes at any one time. It has a vast wealth of unusual sounds, with the software continually being updated. The facility to store data on disc is also invaluable, both in the studio and live. In the past it has often been the case that you'll get a sound that a producer likes during one session, and then at a subsequent session, having been asked to set the same sound up again, the producer will claim that it isn't quite the same as the original one, even though the settings are identical. With the Synclavier the exact sound can be stored on disc in seconds, and recalled in seconds any time it's required in the future, and there's no argument. Each disc can store up to eight banks of eight different sounds, giving sixty-four different sounds per disc. It takes less than a couple of seconds to recall a bank, and then recalling each of the eight individual sounds is practically instantaneous. Working live, this gives a very wide variety of sounds which can be accessed at the touch of a button, or at the most, the changing of a disc."

Ken continues to do a lot of work for Jeff Wayne and has therefore had a good opportunity to use Jeff's Fairlight: "The real sound facility is great, it makes it possible to make a tune out of almost any noise you want. It's limited though by its short sample length, which is only one-and-a-half seconds; after that it has to loop back and read the same data over again. This inevitably causes a glitch as it loops back, and although you have complete control over how much it reads and where it loops back to, you can spend ages trying to get a smooth, reasonably glitch-free loop, and still end up with something unusable; it's really too time consuming for normal studio work. Each overall sample period is split up into 128 samples, and if you can get each cycle of the sound to fit one sample, it gives much smoother loops, and so it is important to try and get the sample rate and the pitch of the sound right.

"The sample frequency also determines the cut-off frequency of the digital recording,



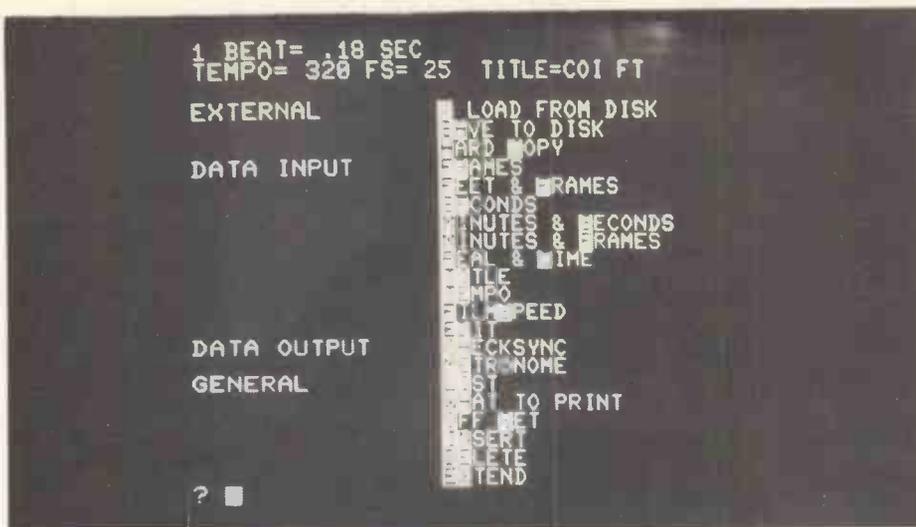
and to get an overall sample period of one-and-a-half seconds, the high frequency response is brought down to about 6kHz which tends to make all the sounds a bit woolly. It's also a bit noisy for normal use: There's an odd hissing noise which accompanies each note as it's played. I don't know what it is and I haven't been able to get rid of it. Being able to process real sounds though, really does provide new scope: for one jingle we used the sound of a paper bag being screwed up, played back at a different pitch, backwards. Only the Fairlight could do that."

## Writing for film

Since signing the contract with Jeff Wayne Music, a major part of Ken's work has been writing music to go with television commercials. When working with a visual medium, it is often necessary to have certain sounds or effects take place in synchronisation with specific points in the film or video. When working with film, there are so many different units to relate to a position in it, that complications and confusion often arise. The speed at which each individual frame of picture is moved past the projector's gate can be either twenty-four or twenty-five frames per second, and the units in common use for film length include frames, feet and frames, seconds, minutes and frames, and minutes and seconds. Ken has written a program for his PET to simplify the writing process. Film cue data can be entered into the PET in any of the above forms, and it will then list it in any of the other forms as

ADD NO.	COMMENTS	SECS	IDENT
0		0	SOH STREET
1		1.48	BOY WALKING
2		2.4	CAR OVER HILL
3		4.32	BOY WALKING
4		6.16	CAR
5		7.68	BOY TURNS CORNER
6		9.7	CAR IN DISTANCE
7		12.08	BOY
8		13	CAR BONNET
9		14.39	BOY AT KERB
10		15.36	C/U FEET AT KERB
11		16.36	BOY LOOKS L&R
12		18.36	BOY CROSSES ROAD
13		21.39	BOY REACHES OTHER SI
DE 14		23.71	CAR TO CAMERA
15		25.11	BLACK
16		28	FRED
17		100	FRED
WHICH NUMBER (, TO CONTINUE)? 7			GIRL?
7		12.08	

Listing of cue points and timing for film music.



Pet film writing menu.

selected. The most common method that Ken employs is to take the computer along to the viewing of the film, and referring to the countdown at the beginning, start its clock at the first frame of picture. As cue points arise in the film, he enters them by depressing another key on the keyboard, and they are then listed in order on the PET's screen. This timing sequence can then be 'played back' again, starting it at the beginning of the film. The PET will give out a blip at each cue point so that the producer can check that they are all in the right place. Any that are found to be a little out of sync can be individually adjusted in either direction. Having got all the cues in the correct positions, comments relating to each cue can be added to the list of timings on the PET screen, e.g. man turns corner, woman opens bonnet etc., and of course the data originally entered can be displayed in any of the previously mentioned units. When the tempo is entered for the piece of music, all the cue points are also printed on the screen as numbers of beats, and if the tempo is subsequently changed, the beat count is also changed accordingly. The cue points can then be used to trigger a synth or any other electronic instrument via a synchronous pulse from the user port, to give an effect at exactly the right point in the film. More often though Ken simply takes a VHS cassette of the picture home with him, and uses the PET to verify that he is writing the jingle as it was discussed at the run through, and that he isn't making any mistakes concerning the various cue points. A 4k7 ohm resistor connected in series to the line input of his mixer allows the PET to give an audible beep at each one.

## PET music

Ken's style of writing often lends itself to the use of a rhythm machine, and so he has written another program for his PET which allows him to program a complete piece at home, and then if necessary, let the PET run it through in the studio, for the master recording. His rhythm machine is a Korg Rhythm 55, and although there is a difference in logic levels, the PET's 5V is enough to trigger it. The program is written half in BASIC and half in machine code using a JCL high speed assembler. The BASIC makes it operationally simple enough for an inexperienced user, and the machine code allows it to be fast enough for the demands of the program. Being an 8-bit micro, the PET is limited to the control of eight functions, which Ken finds to be sufficient for normal use. The eight available are: bass drum, snare, tom one, tom two, claves, cowbell, hi-hat and finally a tom-tom accent control which gives the toms a long or short decay time. A dot matrix is printed on the PET's screen eight dots high and up to thirty-six

wide, with each line denoting a different function and each dot being a beat or rest. The eight lines are programmed individually, with an asterix replacing a dot wherever a sound is to be played and a dot remaining to denote a rest.

In this way a graphic description of the rhythm is built up on the screen as you write



Rhythm machine program showing VDU display during operation.

it, which is very useful, especially for non-drummers, for getting a rhythm that's in your head into the PET accurately. At the beginning of each thirty-six by eight dot frame, information in the PET regarding the length of the next frame, its tempo and certain other functions that we'll look at later, is updated. If the rhythm pattern is to stay the same for perhaps eight or sixteen bars or so, you can use the full width of the frame as there will be nothing to update. However, if you want changes in tempo to take place within one or two bars, it will be necessary to have the frame updated within that period, so that the new data can be acted upon. These accelerando and rallentando functions allow the tempo to be speeded up or slowed down to a new tempo over any given number of beats. If at any point you want the rate of change or the direction of change to alter, the frame will have to be updated to allow the new information to be read in. The PET's 32K memory has a capacity for a maximum of 255 full frames, and the program has the following facilities:

**FILL.** Having entered a bar, it can be duplicated as many times as you like, saving you the trouble of entering the same pattern more than once.

**COPY.** You can copy any single bar into any other existing bar — if you come across a pattern that is better than an existing one, you can substitute it in as many bars as you like quickly.

**MOD.** To modify the pattern in an existing bar.

**DELETE.** To delete an existing bar.

**INSERT.** To insert an extra bar between two existing bars.

**TEMPO.** To adjust the rate at which each time division is clocked through.

**ACCEL.** To effect an accelerando.

**RALL.** To effect a rallentando.

**PLAY.** Will play from the bar entered through to the end of the piece or until it is stopped by depressing the 'space' key.

**SAVE.** Will dump sequential data from RAM on to disc.

**LOAD.** Will dump sequential data from disc into RAM.

There is a second version of the program which omits the tempo, rallentando and accelerando functions and allows an external sync pulse to be used instead.

The fact that the data update part of the program is written in machine code makes it fast enough to access the new data in between beats, and therefore without interrupting the rhythm.

**E&MM**

# FACT FILE

## Clare Hirst *Belle Stars*



Really I'm a classically trained pianist turned sax player and I joined the Belle Stars after seeing an ad for a sax player who could double on keyboards. My keyboard playing takes second place to my sax playing - I tend to use keyboards just to add a bit of depth.

### Instruments

I play a Selmer Mark 6 tenor sax which is a great instrument. I used to play a Mark 7 but I find this model suits me better. I'm also learning alto and soprano and as soon as the money situation improves I'll be splashing out on those. For keyboards I just use a Casio 202 which is fine for this band. We tend to use the funky clavinet and electric bass settings mostly and so far we've only used it for live work. In the studio I tend to use whatever is available.

Obviously I'd like a Yamaha grand and a Prophet but again it's all a question of money. For the Belle Stars the Casio is adequate at the moment. I put both the sax and the Casio through a Roland Space Echo and the effects I get from that are amazing.

### FX

Just the Roland Space Echo - with that I don't feel I need anything else.

### Drum Machine

On the last two singles we used a Linn drum. I worry a lot about the use of rhythm machines, though, so many bands are using them and I think it often gives an over precise sound to the music. I know this is an electro-music magazine and perhaps I shouldn't be saying this, but I really don't think drum machines will ever replace live drummers.

### Recording

We tend to use the London studios like Mayfair and Air. We recorded 'Iko-Iko' at Mayfair. We recently used Regents Park Studio for 'The Clapping Song' and that was good - we'll probably go there again. For that session we had Pete Collins producing and Phil Chapman engineering. It's very important to get the right balance of studio, producer and engineer and I think we've been managing very well in that department recently.

### Home Recording

Nothing special. Sometimes we use a Portastudio but usually we use anything we can get our hands on.

## Stephen Luscombe *Blancmange*



We fit into the category of being electronic because we use synths but we try to use them in a human way and we're not terribly interested in the manufactured sounds of bands like Depeche Mode. I agree with what Martyn Ware said in an earlier 'Fact File' - that it's time we realised the limitations of purely electronic sounds. The electronic side has got a bit out of hand and become too robotic. We believe it has a better future than that.

### Keyboards

We use the Roland JP8, which is quite a versatile instrument and a Korg MS-20 mainly. We also like to use a Mellotron occasionally - it's about time they were revised. Other keyboards that we've tried are the Korg Trident (I must say that I didn't find it particularly impressive) and the Korg Delta which is a lot of fun. I also use a Bunny 1 organ which is a very cheap Italian job. It's got a great, individual sound and through my tape echo unit it's got a lot of applications.

One thing that annoys me is this whole MU versus electronic music thing. It's as though some people think that electronic players are out to replace 'conventional' musicians and I find this whole synth v trumpets idea so silly. I suppose its pretty much the same problem Adolf Sax had last century with his saxophone.

### Sequencers

ARP - I can't remember the model. To be honest we don't use it that much because over used sequencers become much too inhuman. We generally play sequences manually.

### Drum Machines

Combination of Linn drum and Roland 808.

### FX

MXR 12 channel EQ. Phase pedal. 2 Melos tape echo units. I prefer tape echo to digital - it gives a much denser sound.

### Amplification

We DI everything whether on stage or in the studio.

### Home Recording

At home I use the Roland 808 and the MS-20 for composing and trying out ideas. I record onto a Tascam Portastudio and I've also got a Teac 4-track reel-to-reel.

## Adrian Lee



I'm a synthesiser player and I just couldn't work without synths. I know there's a lot of controversy lately and I believe that in the wrong hands a synth can be a deadly weapon but it can also be a superb creative tool. The thing to remember is not to sacrifice performance for sound - you must have the technical performance there for the sound to be worthwhile.

### Keyboards

Jupiter 8 interfaced with micro-composer MC4 and linked via OC8 interface unit. Yamaha CS-01 Breath Control Synth - I've two of those because they're absolutely brilliant. Roland SH7 and SH09 synths. Wurliitzer electric piano. I also use a Novatron that has been converted to 1/4" tape. I don't use it for strings and such like because I believe that taking real sounds and reproducing them in this way destroys the art of synthesis. I use it mainly for live work and store effects on it because it's much more controllable than a tape recorder. This is the same set up I used during my 18 months with Toyah. That was a fantastic time and I'll probably be doing some more work with her soon.

### Sequencers

CSQ600 and CSQ100 which can be interfaced with the Jupiter 8 through a newly acquired OC8 interface.

### FX

All Roland: Vocoder, SDE 2000 digital delay, 555 echo unit pitched to Dimension D voltage converter, PH830 stereo phaser and various other bits and pieces too numerous to mention.

### Drum Machine

Drumatix. On the first half of the new album 'The Magician' there's hardly a drum machine in sight but sometimes they are necessary, as when I'm trying to run something with a sync code.

### Amplification

At home I use my Rotel hi-fi but on stage I always insist on a Cerwin/Vega rig.

### Studio

The new album was recorded at the Marquee Studio and mixed at DJM on their MCI computer.

### Home Recording

Fostex Multitracker.

# HOME ELECTRO-MUSICIAN

I remember taking the backs off cheap radios and "tweaking" the baffling array of circuitry long before understanding anything about electronics. Construction of a Mullard Unilex hi-fi followed in time, but building a square wave generator at school was the first real step towards a hobby with audible results! By this time I had also learnt to play rudimentary guitar and heard Terry Riley, John Fahey and Captain Beefheart to name but a few.

The end of schooling and the start of work enabled me to acquire a Sony TC377. An early discovery was that cross-connection of the line inputs/outputs produced a marvellous echo effect when replayed through a Hafler enhanced hi-fi. This was in 1971 long before Frippertronics became popular; I've been delaying sounds for years too (well, seconds anyway).

During the past eleven years assorted Sony, Ferrograph, Akai, Pioneer, JVC and Revox open reel machines have come and gone. A Teac A-3440 was acquired last year and this is definitely staying for the time being. Varispeed tuning, silent punch ins and the ability to mix tracks cleanly are true luxuries after bouncing signals between ancient two track machinery. Ancillary equipment has been updated as my knowledge of electronics and ability to construct useful devices has improved (practice may not make perfect but it does produce better signal to noise ratios in time). Passive mixers and one transistor fuzz boxes have been replaced by a low budget, but effective, rack of units.

The system currently centres around a 12 input to 3 stereo pairs output mixer of my own design (though I admit to borrowing heavily from published circuits for various stages); it features parametric equalisation per channel, effects send/return, monitoring facilities etc. Power supply is external (for hum free operation) and this also feeds Bi-Pak amplifiers which drive Videotone Minimax IIs. Although I record almost exclusively in Sennheiser phones, for comfort, the Videotones are useful for checking how things will sound on hi-fi systems. Other home built units include 4 compressors (a passable substitute for noise reduction if used with care and plenty of EQ during each stage of recording to maintain presence and cut out hiss), a fiendish fuzz-sustain, tremolo unit, assorted mic pre-amps and an ETI touch organ with CMOS 4024 octave divider. Bi-Pak graphic EQs and Maplin long spring lines have been assembled in pairs with peak LED circuits per channel and are very useful items.

The recording system is completed by an Ibanez AD150 analogue delay, Small Stone Phaser, Pignose practice combo, Sony Stow-away and TC-K5511, Teac A-3300SX and Shure and Grampian mics (some of these being borrowed from friends when necessary).

As well as piling up technology I have spent some while learning to make music, classical guitar and music theory being the main areas of formal study. In addition I mess around with electric guitar, bass

guitar, marimbas, a VL-Tone and musique concrete techniques. The A-3440 allows multi-tracking on a lavish scale and this has affected the way I assemble my ideas. Typically pieces of music are cudgelled onto tape in the following manner: an Electro-Harmonix rhythm machine is used to provide a guide on channel 1. Then pre-arranged guitar, bass and keyboards are added to channels 2, 3, 4. These are mixed onto channel 1 (the drums being erased in the process) and extra tracks of music and/or real world noises added as appropriate on channels 2, 3, 4. This melee may be bounced onto another machine, mixed to stereo and returned to the A-3440 for more multi-tracking before a final mixdown.

The 8 tracks can be built up for a complete piece; the temptation to go further has to be curtailed at present. Without companders it is almost impossible to maintain any real presence or sense of dynamics on the first tracks after 8 have been mixed to stereo by the above process. I prefer to rearrange the music and use echo to fatten up the sound rather than add extra muddy tracks. I have tried a great variety of tape and am currently using Racal Zonal back-coated. This is not quite as good as TDK or Maxell but quite acceptable and much cheaper.

Any attempt to explain musical creation ought to be prefaced by this statement: "Music critics will tell you how music is made (and how good or bad it is) but musicians will tell you the process defies explanation." Certainly I can't explain how my tunes appear (though they often grow from simple note patterns) or why I currently like the keys of E minor and D major more than any others. Sometimes I suspect the music I produce is my choice of tunes and tempi, the machinery's choice of timbre and a mutual understanding that each can only push the other so far in arranging overdubs, use of effects etc. Knowing I can split a difficult guitar part into several overdubs allows each to be developed separately (often to the point where the composite track could not have been played in one take).



Similarly with other instruments. This has led to me composing many pieces as a series of interacting and overlaid note patterns. Obviously I could use sequencers, trigger pulses, clocks, et al but I feel this would be to the detriment of my music. Most electro-music sounds to me to be machine controlled and lacking in humanity. Improved touch-sensitivity, filters and dynamic range are making synthesisers more useful but sequencers, like drum machines, are not subtle enough for my liking (or at least those within my price range aren't).

R. Stevie More (an American home recordist who may have invented the phrase "up against the wall recording" and whose records are well worth finding) claims that no effects units are necessary: the process of recording instruments and voices on to domestic tape decks introduces more than enough distortion and peculiar tonal qualities. I don't entirely agree, but the home studio operative should have an innate understanding of how, say, an untreated cymbal will sound after a couple of track bounces and a few remixes before deciding what effects to apply to it. Recording a complete piece of music to produce as natural a sound as possible has been a good way, for me at least, of learning about the quirks of a particular system. I like my set-up and this is as important as its signal to noise ratio or overdub qualities. Everyone knows headphones have to be comfortable; this applies equally to all your machinery. Unless you're at peace with your Teac creativity goes out of the window.

In an attempt to become fabulously well to do and adored by millions The Same (a band of which I am allegedly the major part) recorded an LP on my system during September and October last year. I thought we had produced a subtle fusion of Terry Riley, Captain Beefheart and John Fahey with references to the Grateful Dead and Frank Zappa. One critic recently described Sync or Swim, by The Same as "calm noise blending electronics and acoustic guitar and reflecting the peaceful Wiltshire countryside where it was made", which just goes to show you should never judge your own music!

Future plans include some improvement of instrumental abilities (obviously), acquisition of noise reduction and an E&MM digital delay line and construction of a polyphonic synthesiser for string and brass effects.

'Sync or Swim' by The Same is available direct from Robert Cox, 42 Haven Close, Felixstowe, Suffolk IP11 8LF for £3.50 including p&p.

Robert Cox

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OCTOBER 1982 E&MM

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# UNDERSTANDING ELECTRONICS

## Envelope Shaping for Percussion

When synthesising a sound of any type there are three main factors which must be correct if this final result is to be reasonably convincing and acceptable. The first is simply that the appropriate fundamental frequency must be present. As a few simple examples, this would entail generating low frequency tone of reasonable purity for drum sounds or a high frequency sine wave to give a sound similar to that produced by a triangle. The second factor is the harmonic content of the signal, that is the number of individual harmonics, or sine waves, which with the fundamental make the waveform. Complex metallic sounds such as those produced by a bell or gong can be simulated using a ring modulator as explained in last month's *Electro-Music Engineer* article.

The third, and equally important factor, is the envelope shaping of the signal. This simply means controlling the amplitude of the signal, or volume, throughout its duration.

### Envelope shapers

An envelope shaper is used to give the required changes in signal amplitude, and the most useful type for synthesised sounds is the ADSR (attack, decay, sustain, release) type. This gives an envelope shape of the type shown in Figure 1a. After the initial attack, or rise in amplitude, the signal decays to a sustain level, and then releases to an insignificant level.

Most ADSR envelope shapers have

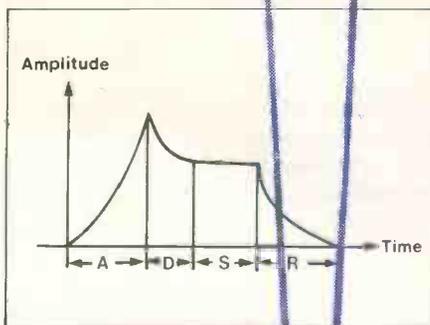


Figure 1a. Normal ADSR waveform.

the durations of all four stages of the envelope independently adjustable from around 2ms to 10 seconds for A, D&R and 0 to 100% for sustain. This gives immense versatility, but at the cost of complexity, and even the most simple ADSR circuits are still quite complicated and consequently expensive to build. Fortunately it is possible to obtain good results using relatively simple envelope shaping circuits that is hoped that this article (and part 2

next month) will show. Using more simple envelope shaping circuits and AD envelope shape obtained is usually something along the lines of Figure 1b,

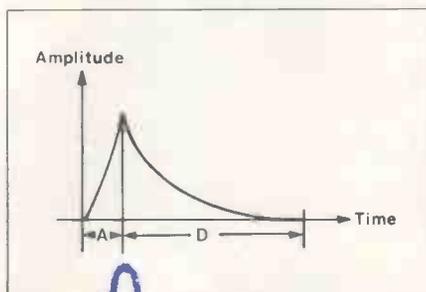


Figure 1b. Normal AD waveform.

and this is quite satisfactory for the production of simple drum, cymbal, and similar percussive sounds. This envelope has a preset fast attack of about 10ms and a variable decay. Very simple envelope shaping circuits using bipolar transistors and various types of field effect transistor (FET) tend not to give acceptable results, with the decay tending to be too abrupt. With careful adjustment of circuit values it is usually possible to obtain improved results, but adjustments are normally very critical with subsequent poor long term stability. Circuits based on integrated circuit VCAs tend to be more reliable and give better results, and only circuits of this type will be considered here.

### Control voltage

Basically an envelope shaper just consists of a circuit which generates a control voltage, plus a Voltage Controlled Amplifier (VCA) which is fed with this control voltage. Assuming that the VCA is a type which provides high attenuation with a control voltage of zero, and decreasing attenuation as the control voltage is increased, the control voltage must initially rise rapidly to a fairly high value, then decay quite slowly and steadily. In other words the control voltage must follow much the same path as the envelope shape of Figure 1b.

A simple control generator circuit which gives an output of this type is shown in Figure 2. This circuit can be triggered either by operating S1 or by applying a positive pulse of a few volts in amplitude to the input terminal. The duration of the trigger pulse is not critical, and anything over about one millisecond should be satisfactory. The circuit can also be triggered by tapping microphone Mic 1. The circuit operates in much the same manner whichever method of triggering is employed. IC1 is biased so that its output is normally at

the negative supply potential, but operating S1 or providing an input trigger pulse results in a short positive pulse being fed to the non-inverting input of IC1. This pulse is greatly amplified so that the output of IC1 goes fully positive, but for no more than a few milliseconds. Tapping the microphone results in a series of positive and negative pulses being fed to the non-inverting input of IC1, but the negative pulses have no effect and the positive ones cause the output of IC1 to go fully positive provided the microphone is tapped hard enough. Again the duration of this output signal will only be a few milliseconds at most since the microphone will provide only a very brief signal.

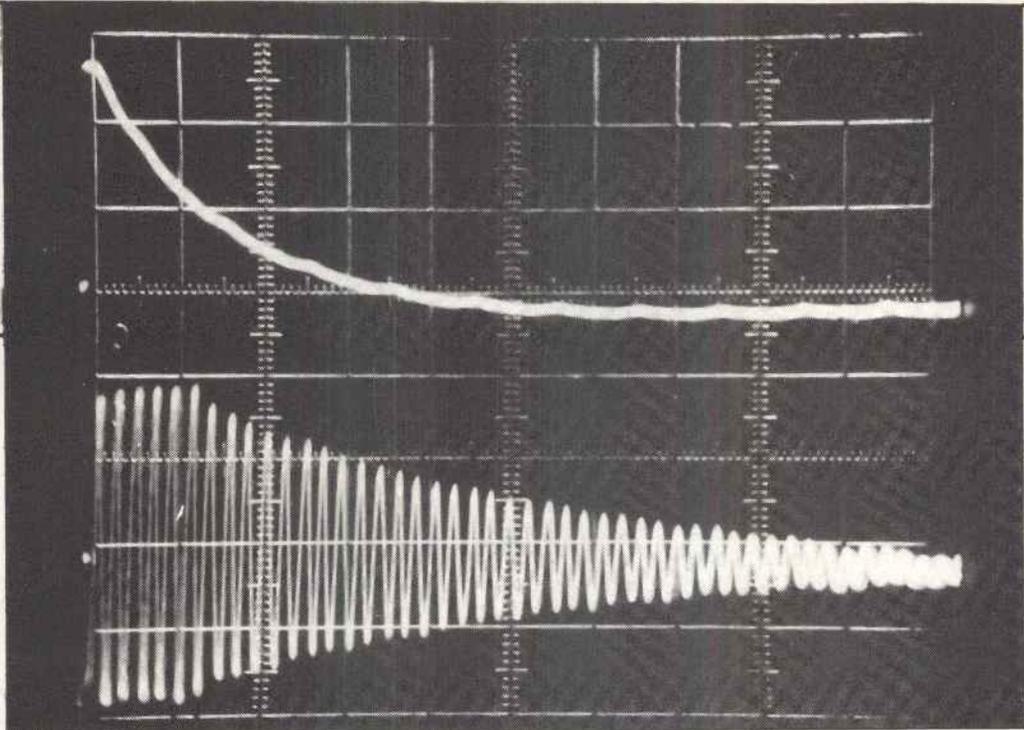
With the output of IC1 fully positive C4 rapidly charges by way of D1 to a potential almost equal to the positive supply rail voltage. When the output pulse ends C4 cannot discharge into the output of IC1 as D1 blocks any significant current flow in this direction. C4 therefore only discharges through R6 and VR1, and the rate of discharge depends on the effective value of VR1. At maximum value the decay time is about 4 seconds, but this reduces to less than a hundredth of this figure at minimum value and this control permits large changes in the nature of the sound obtained. The voltage across C4 falls quite rapidly at first since the high charge voltage produces a comparatively high discharge current, and as the charge voltage decreases so does discharge current and rate of discharge. Most natural percussive sounds decay in a manner which is analogous to this, and good results are obtained using this method.

An important point to bear in mind is that the output of the circuit must feed into a load impedance of at least several meg ohms, and a buffer amplifier will normally be needed at the output. If necessary the control voltage can also be fed to a voltage controlled oscillator or filter to give falling pitch drum sounds etc.

The microphone can be a crystal type, a ceramic resonator, or a crystal earphone used in reverse as a crude microphone. If necessary the sensitivity of the circuit can be increased or decreased by raising or lowering the value of R5, and to an extent the circuit is touch sensitive.

### VCA

Many Electro-Musicians probably have one or more MC3340P VCA integrated circuits in their possession, and



AD control voltage and VCA output waveforms.

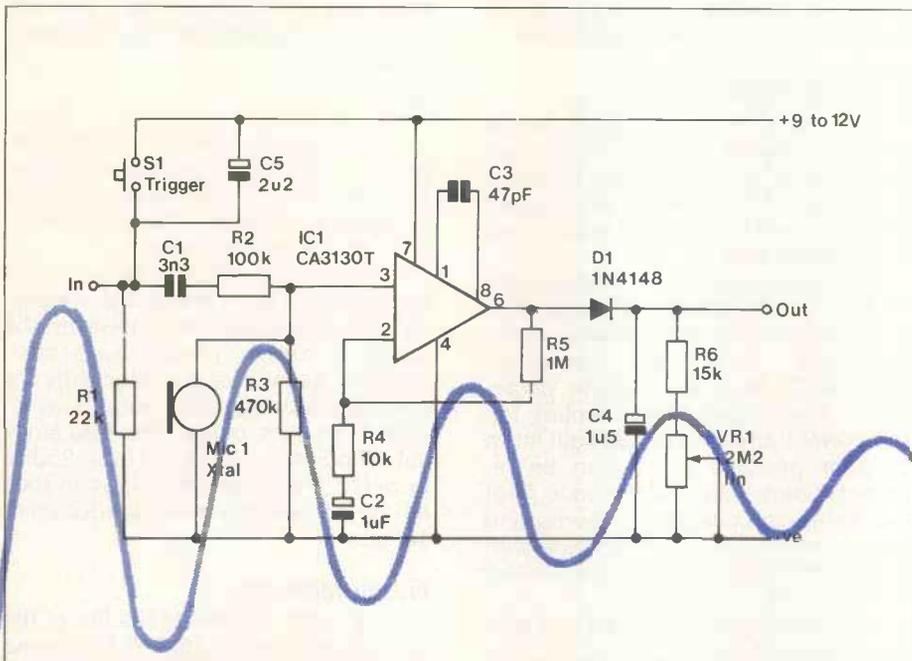


Figure 2. Simple AD control voltage generator circuit.

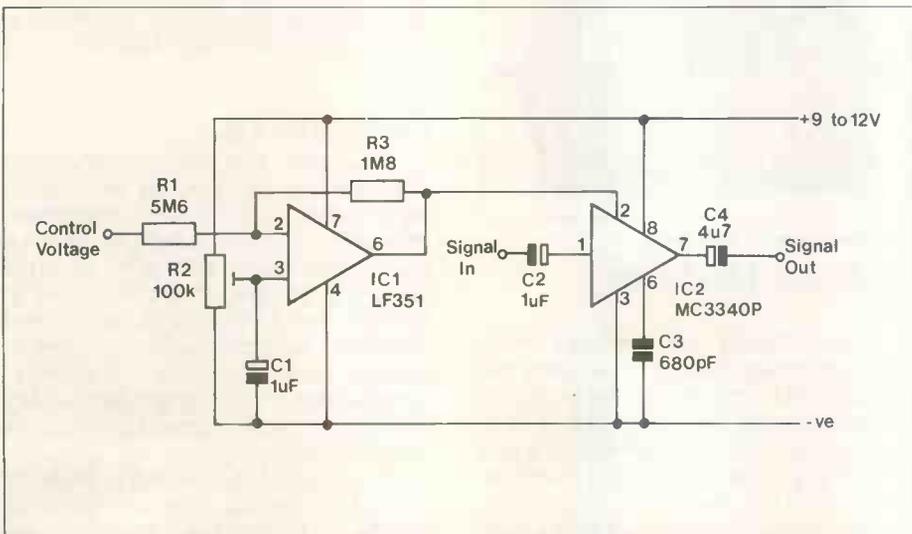


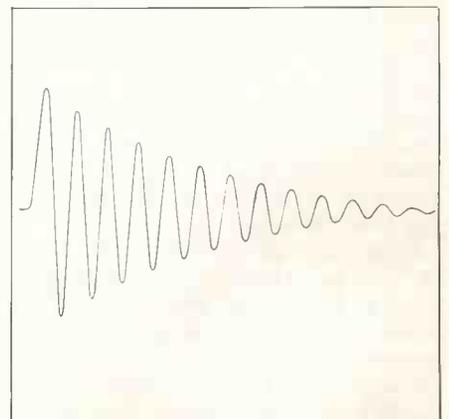
Figure 3. Simple VCA circuit.

the popularity of this device makes it an obvious choice as the basis of a matching VCA for the circuit of Figure 2. However, this device has a fairly low input impedance at the control input, and requires a control voltage which varies from about 3.5 volts (maximum gain) to 6 volts (minimum gain). This is obviously incompatible with the circuit of Figure 2, and to successfully interface the two it is necessary to have a buffer stage that inverts the control signal, provide level shifting, and also gives a certain amount of attenuation. This can actually be achieved using a simple circuit based on an operational amplifier, as shown in the circuit diagram of Figure 3.

In order to give R2 the correct setting first set the wiper of this component well towards (but not at) the negative supply end of its track, and then adjust the slider just far enough towards the opposite end of the track to give maximum attenuation.

The MC3340P gives around 13dB of voltage gain at maximum, and it can handle input levels of up to 500mV RMS without clipping.

Next month's article will describe alternative VCA's based on operational transconductance amplifiers, plus a simple VCF circuit. **E&MM**



# Carlsbro S600M Power Amplifier

The Carlsbro S600M is a stereo power amplifier designed to produce 300 watts per channel. Despite this large output the amplifier is extremely compact, measuring 476 x 120 x 270mm (WxHxD), and weighing about 13 Kgms. It can be used free-standing or rackmounted (when fitted with the two optional brackets, supplied by Carlsbro). The unit can be carried quite easily using the handle on the right hand side of the case.

The mains input is connected via a standard Eurosocket, on the rear panel, protected with a 20mm 6.3A anti-surge fuse. An earth link is provided to allow the case earth and amplifier ground to be separated to prevent hum-loops. All of the other connections in and out of the amp are made with XLR sockets and plugs.

The connections and controls for each channel are identical, as shown in the photograph at the beginning of the article. Working from left to right we have the input XLR socket, which will accept a balanced signal, a 'link' XLR plug which provides a buffered, unbalanced, drive output (not affected by the gain control), the master gain control, a 'Clip' indicator LED, 2 output XLR plugs wired in parallel and lastly, an illuminated mains switch.

The panel to the left of the controls, which shows the system block diagram, can be removed to allow one of the optional modules to be fitted (described later).

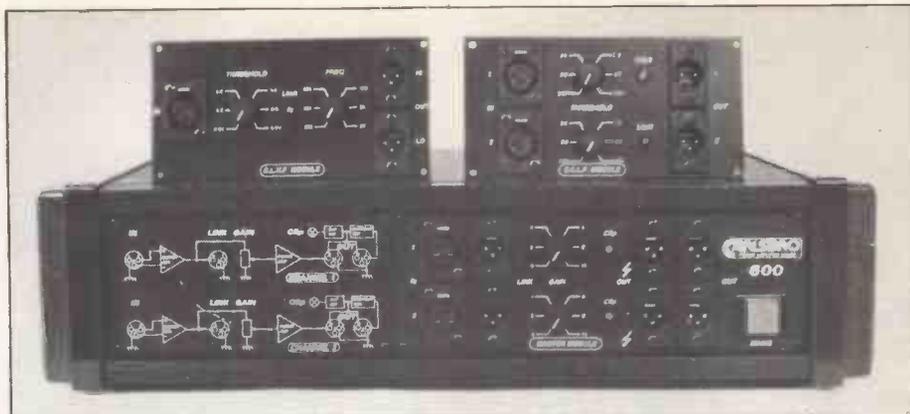
## Circuitry

Since both channels are identical it is only necessary to describe the operation of one of them.

The balanced input is fed to the inputs of a low noise op-amp which provides the buffered line signal for the Link output, and to the power amp section.

The power amplifier circuitry is of the Quasi-Complimentary type with high SOAR output devices manufactured to Carlsbro's specification. Early stage drive limiting coupled with constant bias sources ensure that the amplifier will tolerate overdrive and overload conditions without stress. These are mounted on a Force Cooled Heatsink assembly which forms a modular package.

Two thermal switches are mounted on each output transistor module. One trips at 60 degrees and activates the internal fan, while the other trips in overload conditions at 100 degrees, disconnecting the main supply to the transformer but leaving the fan in



The S600M with SCLF and CLXF modules.

circuit to cool down the unit.

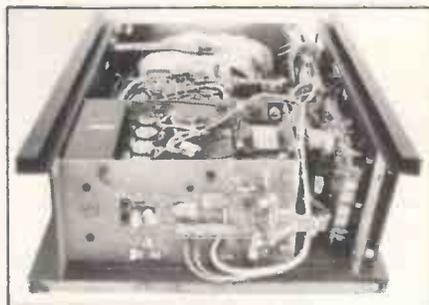
To prevent a large switch on surge the amplifier is powered up in two stages, using a Triac mains delay circuit, taking about half a second. Supplies to each channel are protected separately with 6.3A anti-surge fuses. The final output has an overload stage which lights an LED when the maximum output power is reached, before distortion. In the event of a catastrophic power amp failure a Triac 'crowbar' circuit will short the output to prevent damage to any speakers connected.

## Construction

The case is made from rexine covered plywood with aluminium panels front and back, and plastic panels at each end. This makes a very rugged package, built to take the knocks it will no doubt receive.

The input circuitry is mounted on a PCB behind the front panel, in front of the massive toroidal transformer, rectifier and smoothing capacitors (15,000uF!) as shown in the photograph. The power stages, cooling fan and power transistors are all built into a modular package which can be removed complete for maintenance. All of the wiring is collected in looms and bound, connections being made with plug-in terminals for easy dismantling and servicing.

Altogether a well designed unit built to a high standard.



An internal view of the S600M

## Optional Modules

### SCLF

Two modules are available from Carlsbro which can be used with the S600M. The first is the Stereo, Compressor, Limiter and Filter module. This is intended to be used when there is a risk of large overdrive signals, such as occur in PA situations.

The compressor circuit has a fast signal clamping action, using a trans-

conductance amplifier, which reduces smoothly over a two second period when the overload is removed. An LED on the front panel indicates when the compressor/limiter action is active. The circuit has a 'threshold' control which allows control over balanced inputs, ranging from 0.5-2.5V.

The compressor/limiter signal is then processed by a high-pass filter with a cut-off point at 35Hz. Removing these ultra-low frequency signals can minimise the risk of damage to bass speakers from rumble and LF acoustic pick-up.

### CLXF

The second module is the Compressor, Limiter, Crossover and Filter. This has only one channel but allows the amplifier to drive a loudspeaker system in bi-amp or tri-amp mode.

The compressor/limiter section is similar to that used in the SCLF module as is the high pass filter. However, the signal is further treated by a state variable, second order, filter with the low pass and high pass outputs available from XLR plugs. The frequency cut-off point can be varied from 250Hz to 5kHz. The crossover point can thus be set to match various loudspeaker set-ups.

## Fitting Modules

The dummy panel to the left of the control panel on the S600M is removed with its 4 screws. Behind this is a floating terminal which supplies the power to the modules. When it is connected the module is screwed in place and the two outputs connected to the inputs on the main amplifier.

## Conclusions

This unit has all the elements necessary to be a power workhorse; high quality clean sound, low noise, good internal construction, housed in a sturdy enclosure and with versatile operating options. Obviously a lot of thought has gone into its design and intended applications. The thermal cutouts, crowbar circuits and modular construction should all ensure that any servicing or repair necessary would not cost the earth.

The price of the S600M is £499.10 inc. VAT, with the modules priced at £74.84 for the SCLF and £60.61 for the CLXF.

# Carlsbro S600M Power Amplifier

## Specifications S600M

Maximum Output Per Channel	Load	Clipping Set for 5% THD
	16 ohms	100w
	8 ohms	200w
	4 ohms	300w
Power Response Harmonic Distortion Output Protection Stability	+0, -0.5dB 20Hz -20kHz at 150w, 8 ohms	
	Less than 0.02% at 150w into 8 ohms 1kHz	
	Short Circuit, mismatch and open circuit protected	
	Unconditionally stable into loads of all impedance characteristics.	
Input Connection Input Sensitivity Input Impedance	XLR type connector Input electronically balanced.	
	775mV for 300 watts into 4 ohms	
	100K ohms unbalanced	
	100K ohms balanced	
Link Output	CMRR better than 60dB	
	XLR type connector. Link output is 775mV unbalanced.	
	6V RMS (+18dBm)	
	Less than -100dB below 200 watts into 8 ohms	
Input Stage Overload Power Amplifier Noise		

## SCLF

Input Connection Input Sensitivity	XLR type connector electronically balanced.
	Variable 0.5V to 2.5V set by compressor threshold control.
Input Impedance	22K ohms unbalanced (constant)
	22K ohms balanced (constant)
Compressor Characteristic	CMRR better than 60dB
	Attack time 1mS
	Recovery time 2S
	Max input 10V RMS
Output Level	0.8V constant level
	18dB/octave. Cut off frequency 35Hz
High Pass Filter Characteristic Outputs	XLR type socket unbalanced. 0.8V

## CLXF

Input Connection Input Sensitivity	XLR type connector electronically balanced
	Variable 0.5V to 2.5V set by compression threshold control
Input Impedance	22K ohms unbalanced (constant)
	22K ohms balanced (constant)
Compressor Characteristic	CMRR better than 60dB
	Attack time 1mS
	Recovery time 2S
	Max input 10V RMS
Output Level	0.8V constant level. (Compressor can be disabled by removal of internal link).
	18dB/octave. Cut off frequency 35Hz
High Pass Filter Characteristic Crossover Characteristic	High Pass/Low Pass
	12dB/octave. Cut-off frequency 250Hz-5kHz
Hi Output LO Output	XLR type socket unbalanced 0.8V
	XLR type socket unbalanced 0.8V

Kenneth McAlpine

E&MM

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<b>SUPER-CLEAN</b> Is hiss a problem? This could clean it up nicely. SET-145 P.O.A.	<b>SUPER-NOME</b> Variable metronome with audio-visual accented beat marker. SET-143 £13.52
<b>SUPER-FREEKI</b> Gen-purpose freq-generator with Sine, Tri, Ramp, Pulse & variations. Switchable 0.4Hz-470KHz plus fine tune. SET-128 £18.44	<b>SUPER-PASS</b> Variable band-pass filter with gain & centre freq control. SET-142 £9.69
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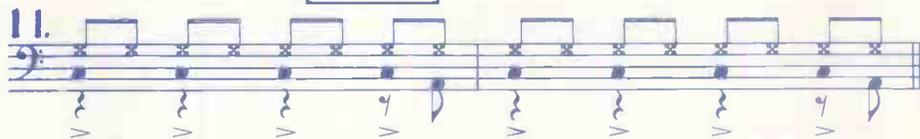
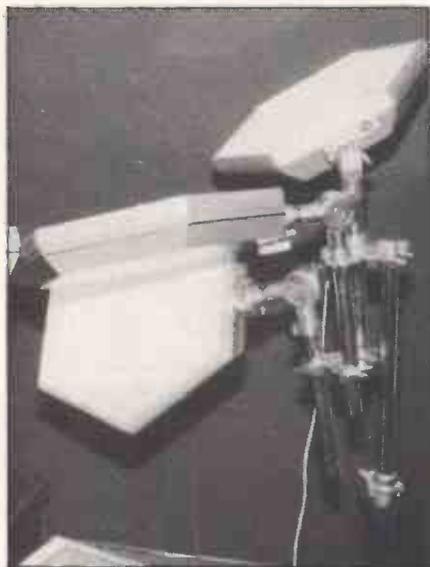
# WARREN CANN'S

## Electro-Drum Column Part 3

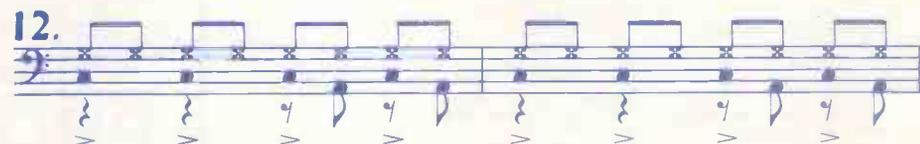
Part Three of our electro-drum column, written by our consultant drummer Warren Cann of Ultravox, continues with some more examples of beats useful to the modern percussionist. As always in this series, the patterns shown are suitable for both the acoustic kit player as well as the programmer.

"This month I am moving on from the simplicity of previous patterns and introduc-

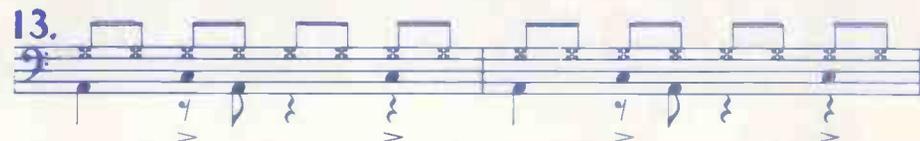
ing far more syncopation, especially in the bass drum part, and, in the last example, in the high-hat part. Apart from my first two examples all the snare drum lines retain the standard '2' and '4' beat format - for the time being anyway. I hope you enjoy playing, or programming, these patterns as they are ones that I am particularly fond of using."



11. Now we get away from 2 & 4 on the snare, this beat has straight 4's on the snare to double time the same tempo. Eighth notes on the high-hat but a more minimal bass drum part adds a Motown touch - there's only one in each bar! You can, of course, double the snare part on the bass drum and either keep the whole thing straight or include that bass drum off-beat.



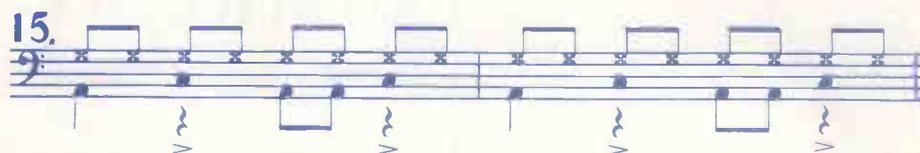
12. Straight 4's on the snare, eight notes on the high-hat, and bass drum on the '3 and' and the '4 and', experiment with placing only off-beats on the bass drum in different places. If you play a bass drum off-beat all four times in each measure you have one of the commonest beats in rock and R&B, it just chugs along and holds everything together.



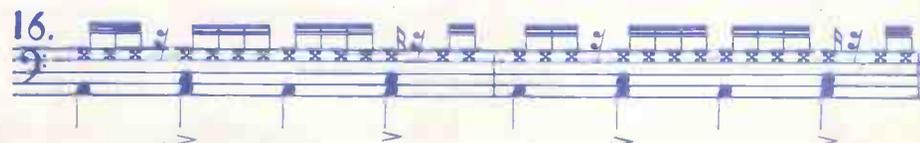
13. Straight eighths on the high-hat, 2 & 4 on the snare drum, and bass drum on the 1 (the downbeat of any measure) and the '2 and'.



14. Sixteens on the high-hat, snare drum on the 2 & 4, bass drum on the '3 and' and '4 and'.



15. Snare on the 2 & 4, high-hat can be on either  $\frac{1}{4}$  notes,  $\frac{1}{8}$  notes, or  $\frac{1}{16}$ th notes, bass drum is on the '1', the '3', and the '3 and'.



16. The disco beat with a syncopated high-hat part, practising this is excellent for developing independence co-ordination if you're an acoustic kit player, if you're a programmer then you can come up with even more complicated variations of 16 beat syncopations.

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## For the accomplished

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'57 Stratocaster.



'62 Stratocaster.



# The Fender

With original '50s and '60s Fender guitars changing hands for four-figure sums and purists swearing that their 1957 Strats are the best ever made it is no wonder that Fender have recently gone into the copying business — in this case copying their own earlier models.

Earlier this year an excellent series of vintage replicas arrived in Britain — the Fender Squier Series (see review in last month's E&MM) — which offered low-priced and cosmetically faithful examples of Fender's early range. America, however, already had its own series of replicas at that time and these were far more authentic than the budget-priced, Japanese-made Squier models. These guitars have just found their way onto our shores and they have been duly labelled the Fender American Vintage Series to avoid confusion with the Fender Squier Series.

With this American series Fender have really gone to town and every aspect of the original guitars has been copied as faithfully as possible. A team of veterans, many of whom had worked on the original models, was put together and manufacturing was based on the facilities of 20-odd years ago. Special tooling was re-constructed for machine heads and other pieces of hardware, pickups were accurately wound the right number of times, even Leo Fender's original pigment supplier was traced, and the result is a series of guitars that are virtually identical to those that any budding Buddy Holly or Dick Dale would have tried in some old, mid-western music store all those years ago.

Needless to say, this type of authenticity and attention to detail costs money. The three models reviewed here all have price tags of over £700 (the Squier series retails at around £200) and this leads into the whole question of why anyone would want to pay this type of money for a copy. After all, the main attraction of an original vintage guitar is that it is *old*. With passing time guitars attain a 'worn-in' feel, the wood mellows, damage done to coil windings and the changes which take place over the years in the magnetic field of a pickup give a distinctive 'personal' tone. It is these reasons, plus intangible, emotional and sentimental attractions that have placed 'originals' on their present high pedestal. No copy, however good, can provide these characteristics of ageing.

This isn't an argument that I'm prepared to go into here (really I'm just itching to write about the guitars themselves) except to say that if you buy one of these guitars you can rest assured that you'll be buying virtually the same thing that was on sale a quarter of a century ago. And, as the man from CBS-

Fender said, "Paying £700 for a '57 Strat is a hell of a lot better than paying £2,000."

The entire American Vintage range is as follows: '52 Telecaster, '57 Stratocaster, '62 Stratocaster, '57 Precision Bass, '62 Precision Bass and '62 Jazz Bass. In this article I'll be reviewing the first examples of the '57 and '62 Stratocasters and the '62 Jazz Bass that have come into the country. They are priced at £738, £738 and £758 (inc. VAT) respectively.

## '62 Jazz Bass

Visually, the guitar that I've been supplied with is rather outstanding, with a 3-tone sunburst finish and a laminated scratchplate that uses the same intricately patterned shell material that was used on the originals. The use of this shell was discontinued some years ago because in manufacture the shavings from it were highly combustible, but for the sake of authenticity Fender have used it again on this model (it's only available from a certain part of Italy) and its presence here will no doubt be appreciated. Chrome pickup and bridge covers and a finger rest are faithfully reproduced and the chunky, knurled metal pickup controls deserve a paragraph to themselves.

This new '62 Jazz Bass is patterned after an extremely rare version of that guitar which was only built for a short time in the early sixties and its outstanding feature is its separate dual-concentric volume and tone controls for each pickup (later models switched to a 3 knob arrangement with a single tone control). These are accurately reproduced — the outer rings are in black, and control tone with a 10 stage 'clicking' action, and the large inner volume controls are in contrasting silver. These controls are great, bulky things with a pleasing 'dated' feel to them and, needless to say, the wiring and the pickups they control are just as true to the originals.

The body is the original offset contoured shape which is great for those bassists who like to lean over their instrument, rest their forearm on the top, and pull on the strings with their fingers in classic jazz fashion. It also makes for very comfortable playing when sitting down.

The neck is one piece hard maple with a rosewood fretboard measuring 38mm at the nut. Very thin for a bass, but then these basses are renowned for narrow necks and ease of playing. There are 20 frets, as on the standard Jazz Bass, and action at the 12th fret measured a uniform and slightly uncomfortable 4mm. Strings were flat wound.

One major complaint is that the

guitar I was supplied with came with a marked camber on the neck so it was difficult to assess its playability. This was probably just a question of simple truss rod adjustment and there is no reason to suppose that any other guitar in this range would have the same problem. All the same it would be nice to see Fender checking this sort of thing before sending guitars out!

Fretting on the guitar is good, as one has come to expect from Fender, and machine heads are of the large clover leaf design. As Fender have re-made some of the original tooling for machine heads in this series they might not be Kluson's, although they certainly look similar. The white dot markers seem to be of the original mother-of-pearl, there is an extra third strap button behind the headstock and the fretboard is finished off at the nut by a gentle slope into the headstock - just as on the originals.

Soundwise this instrument is as good as, if not better than, any current Jazz model. Whether or not it sounds like, as well as looks like, the original '62 model is impossible to say but obviously the sound quality of these replicas will be much discussed as more and more professional players add them to their collections - and collectors items these guitars will most certainly be.

### '57 Stratocaster

This guitar really is a beauty. It is in classic two-tone sunburst graduating from black to a light brown that has the same yellowish tinges associated with the genuine article. The look and feel of the body, with its original contoured shape and high gloss finish is superb, and it's hard to think of this guitar as anything other than a definitive Strat.

A closer look at this instrument reveals how faithful Fender have been to the original design. Starting at the headstock the first thing to notice is that it has shrunk to the early, smaller dimensions. The distributors say that this return to former design will now extend to current Strats so all new standard models will also be featuring this headstock from now on.

The machine heads are also of the early design and the nut appears to be made of the correct material - bone not plastic.

The neck is of one piece hard maple with the frets set directly into the wood with no applied fretboard. As on real vintage Strats the frets have that slightly obtrusive, business-like feel to them and this, the lack of fretboard, and the black marker dots all add up to a real air of authenticity.

Authenticity doesn't extend to the shaping of the rear of the neck however. The original '57 Strats were aimed at a mainly Country and Western market

and this was reflected in a sharply angled V-neck. The neck on the model I was supplied with is certainly not the '57 version but is rather based on the '58-'59 shape which is softer and more rounded. This hardly matters - many players would plane away at the old style necks to smooth them out anyway and the V-neck wouldn't be acceptable to many guitarists today.

This does bring out the fact that Fender are well aware of the magic associated with certain years and of the mythology that surrounds their guitars. '57 is a poignant year in American consciousness (have you noticed that it's always a '57 Chevrolet etc. that's sung about?) and it's no doubt with this in mind that they called this guitar a '57 rather than a '58 or '59.

The neck measures 43mm at the nut with 21 frets and the action on my sample was set at a comfortable 2mm at the 12th fret on both E's.

Pickups are original staggered-magnet type with pole pieces sticking out in authentic fashion and the sound they produce using the old 3-way selector switch is archtypal Strat. Two volume controls and one tone control are fitted using original design knobs and the scratch plate is one-piece, non-laminated and, again, made of the original material.

Authenticity is extended to the bridge unit and tremolo arm. The bridge is in the old style - pressed metal rather than the more recent cast metal type - and the tremolo arm features the original extra twist out and away from the body of the guitar.

This guitar is also available in the much raved-about 'Salmon Pink' finish. There is, in fact, no such finish even though this is probably Fender's most famous 'original' colour - it's just another example of the mythology that surrounds vintage guitars. The official title is Fiesta Red and Fender will supply models in this finish at no extra charge.

### '62 Stratocaster

Five years on from the '57 model Fender made some changes in the Stratocaster and this 1962 model is another firm favourite amongst those who maintain that vintage is best. The '62 Strat, then, is basically the '57 with a few modifications and additions.

The most obvious of these is the fretboard. Whereas the earlier models were fretted directly into the maple neck the '62 models had an added rosewood fretboard and the '62 replica has a superb example of this. Neck dimensions and action are the same on this model as on the '57 but I found this neck far easier to play. In comparison the '57 neck seemed somehow bulky and lifeless. This is obviously a ques-

tion of personal taste and I must also say that I prefer to feel a different wood under my fingers to the one in the palm of my hand, but to my mind the '62 neck is an advance on the '57 - it also has softer curves which make it easier on the thumb. White mother of pearl dots, authentic bone (I think) nut, and original small headstock into which the rosewood curves in authentic fashion complete the vintage look.

The '62 finish is another modification on the '57. At this time Fender introduced a three-tone sunburst which is splendidly reproduced on this review model - the finishes on all these guitars really are a treat.

The last modification is the addition of a 3-ply scratchplate in white/black/white laminate and on this sit the original controls and 3-way switch.

Again the pickups are authentic staggered-magnet design and the bridge unit and tremolo arm are faithfully reproduced. The tremolo arms on standard Strats bend only in one plane. On these Strats the tremolo arms bend upwards *and* outwards so that the white plastic end piece is further out from the



# FENDER REVIEW

Continued from page 19

body. Both Strats come with bridge covers although these weren't fitted.

To my mind this '62 Stratocaster is an improvement on the highly-praised '57 model. The faster neck and the attractive 3-tone finish are the logical reasons for this but as always there is something indefinable that draws certain people to certain guitars and the end choice is always based on a 'feeling' one has for the instrument. Of the three guitars reviewed this is the one I would most like to take home with me.

## Conclusions

All the guitars in this series are supplied with the original leather-trimmed hard-shell tweed cases and are available in a variety of original finishes to custom order. These finished are completely accurate and the pigments have been mixed by Leo Fender's original supplier - more evidence of Fender's genuine striving for authenticity. The above are just two more examples of the effort that has been put into this series.

In comparison to the Fender Squier series the American Vintage guitars are expensive - £500 more expensive - and the question as to whether they represent £500 of extra quality has to be asked. What the punter is paying for here is the research that went into the series, the amassing of a veteran manufacturing team, retooling and the use, whenever possible, of original materials. Any choice between the two series has to be an extremely personal one.

The actual quality and playability of these instruments, although high, did not impress this reviewer as being appreciably better than that of the standard Fender instruments and for the less pecunious buyer who prefers the older Fender styling, the cheaper Squier series are an obviously more sensible choice.

There are those, however, who will throw credit cards to the wind and insist on authenticity - they will most certainly go for the American series. After all, these guitars do represent the nearest equivalent to the genuine article available and, apart from the money, the serious collector will see no competition between the two series.

**Alan Hardman**

**E&MM**

The American Vintage Series are distributed in the UK by CBS-Fender Ltd, Fender House, Centenary Estate, Jeffrey's Road, Brimsdown, Enfield, Middlesex. Tel. 01-805 8555.

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# INDUSTRY PROFILE

Future Music has been resident in Chelmsford, Essex, for nearly two years now and for most of that time it has been operating as a normal music retail outlet. In recent months, however, owner Trevor Taylor has realised a personal vision and transformed this backwater store into a veritable musical emporium housing a vast range of instruments, a 24 track studio and comprehensive video facilities. And, says Trevor, it's still growing.

The shop itself has been extended backwards into what was once the garden. This extension now houses percussion instruments and rhythm machines and a walk from there to the front door takes the punter past an impressive display of home recording equipment, keyboards, amplification and guitars in that order.

To the rear of the shop the extension continues and provides the additional floor space needed for the studio. It's 20' x 30', with a 15' drum booth housing a seven piece Sonor kit, and the studio area is bright and comfortable. Pieces of video equipment lying here and there testify that this is not a mere recording studio and a Yamaha CP80 piano sidetracked this intrepid reporter away from the job in hand for more than a few minutes of boogie-woogieing. Users of the studio



Trevor Taylor.

testify that it has a very distinctive sound quality and that, unlike some studios, what you hear through the monitors is pretty much what you hear through the home hi-fi.

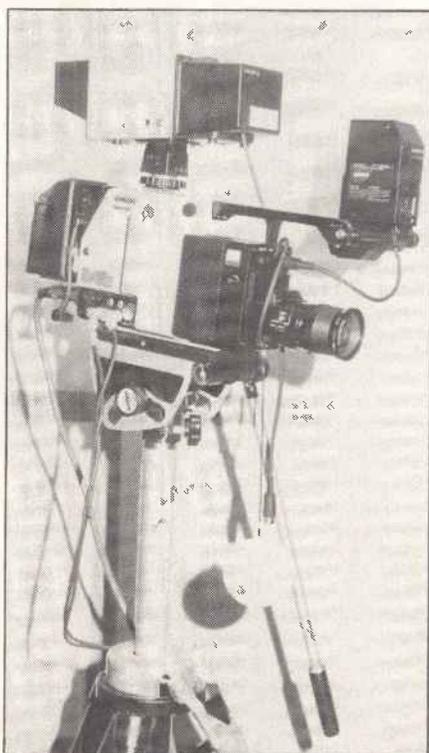
The control room is situated upstairs which means that there is no direct visual contact with the man behind the desk through the usual glass partition. No matter - three JVC TV monitors built into the control room wall facing the desk mean that he can see you even if you can't see him. The monitors also act as a useful security system when the studio is unattended.

The control room was custom designed for Future Music by BBC engineer Gary Frost, resident engineer Mo Witham, freelance studio outfitter Spud Sperling and Trevor Taylor, and it oozes a mixture of professionalism and comfort. The desk is a Soundcraft 24 track with the addition of a Roland 16 channel computer mixdown. Master machines are by Studer, cassette copying is done on Nakamichi decks, a comprehensive effects range is housed in 19" rack units and audio monitoring is on JBL 4343s. Plush carpeting and two leather Chesterfields complete an environment that compares favourably with any of its more well-known West End counterparts.

A great plus is that the studio is attached to a retail outlet and this opens up the possibilities of using a large variety of equipment. If, for example, a band decides halfway through a session that a Prophet 5 would be nice it is only a matter of walking a few feet and bringing one in! There is no extra charge for this facility and anyone who has wasted expensive studio time waiting for hired equipment to arrive - and then paid through the nose in hire charges - will appreciate this attractive bonus.

Audio studio costs start at £20 an

OCTOBER 1982 E&MM



One of the professional standard Sony cameras.

hour for block bookings of more than four hours. The regular rate is £30 an hour plus 10% after midnight and at the moment a special opening deal is being offered - £150 for 10 hours recording.

## Video

Trevor Taylor became involved in video production because he sees it as an integral part of the modern music scene. As he says: "I see an incredible future in video and I can see a situation pretty soon where record companies, agents and club owners won't even consider a band without some kind of visual presentation. The music is only half the story after all.

"In the good old days if you had a really good demo that was enough, but I can't understand present day bands that haven't thought about their visual effect. Loads of them have never worked on this in any way and they have no idea what they look like or what people think of them visually - I think competition is going to get so strong that people are going to be forced to think about it."

It was this faith in the video revolution that led Trevor to incorporate extensive video facilities into the studio set-up. Apart from the three JVC monitors already mentioned other video gear includes 5 Barco monitors, Sony, Hitachi and Ikegami cameras, the latest Sony VO 5850P U-Matic editing equipment, a colour vision mixer cap-



The Future Music shopfront.

able of all the standard effects (including chroma-key) and a Chromascope special effects generator. This last piece of hardware provides all those 'Top of the Pops' video special effects such as colour enhancement and flying picture boxes. Further extensions to the control room over the coming month will effectively double its size and house these video production and post-production facilities.

Videos at Future Music are made in two ways. The first is the "rock bottom budget version" where the band mime to the finished audio master in a one-off shoot which goes straight through the vision desk and onto video tape. With this system the band have to accept what they get - camera changes and all

- but at £150 for a whole day's recording and three cameramen this is remarkably cheap.

The second system utilizes extensive post-production work with the accuracy of U-Matic, frame by frame editing and provides the opportunity for endless creative possibilities.

Storyboards (the promo video equivalent of a script), location work, special effects, props, backdrops and superimposing can all be utilised in this second option and the costs will depend on the amount of production and post-production work involved. This second option is obviously more expensive but the result is a truly professional promotional video.

For both of these video recording methods Trevor Taylor has his own regular camera crew and he supervises all stages of production himself. And if a video is intended for television broadcasting he will ensure that all the relevant union conditions are met (this is something many bands don't pay enough attention to when having a video made - if conditions regarding crew union membership and format aren't met to the letter no TV station will broadcast the tape).

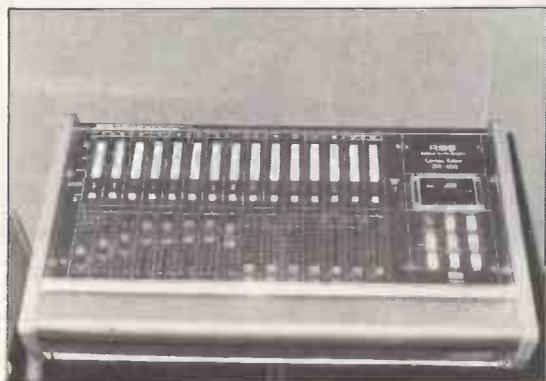
It can be seen from the above that as a video studio, a 24 track recording studio or as a music store Future Music takes a lot of beating. Put them together and this combination of all these facilities in one music complex provides a unique service for the musician that is well worth checking out.

Alan Hardman

E&MM

Future Music is at 10 Baddow Road, Chelmsford, Essex. Tel: Chelmsford 356218.

Roland computer mixdown unit.



The control room's Studer master machine.



Mixing down on the Soundcraft desk.

E&MM OCTOBER 1982



# RHODES Chroma

The Rhodes Chroma is the first of a new family of advanced musical instruments and has an interesting background to its eventual arrival in the UK. It was originally designed by the ARP company who were recently bought up by CBS and represents the only instrument product to be continued. ARP never actually marketed the Chroma and it is possible that it contributed largely to their insolvency. Working prototypes have been developed over the last two years, although further changes will be seen in the next three months, particularly the supply of a pressure sensitive 'after-touch' option.

The delayed launch of the Chroma has first been to ensure that all the debugging necessary for its micro software was complete — space has even been made on the boards for linking and testing with an external computer system at the end of the production line. And second, more importantly, to decide on the location for its manufacture. ARP products were made at Woburn, Massachusetts and, although it was suggested it was put together at Fullerton, California along with all the Fender products, it is now being made at Hooperstone, Illinois. This is one of the main CBS plants where the Gulbransen organs are made. Meanwhile, the ARP facility at Woburn has been turned over solely to R&D, with some 200 people currently employed at this Rogers/Rhodes division.

John Shygun, who will be well known to synthesists for his fine demonstrating of keyboards, contributed to the Chroma's specification and the instrument is now reaching main dealer shops. Vic Emmerson of Sad Cafe/10cc and a 4-piece band will be doing a promotional tour in the UK (and Benelux).

The Chroma is a polyphonic fully programmable synthesiser, a hybrid of analogue/digital technology and that's what makes it very flexible. With every Chroma is a cassette with 3 program sets containing 150 voices in all. One set contains the presets that come stored in part of the memory (3K of the 7K RAM available) on delivery, powered by means of a battery back-up system. It is therefore possible to commence playing the instrument immediately by simply selecting one of the 50 Program Select 'pressure sensitive' pads. All the voice presets have 50 parameters already programmed into them, including synth routing, keyboard dynamics and oscillator assignment. It was demonstrated at the NAMM show in conjunction with the Apple II and an independent program exists to develop the software (not currently available).

The Chroma can therefore be regarded as a 'dual' instrument: 1) a versatile performance instrument with the ability to make changes to the selected voice (or paired voices) as you play, or 2) as a comprehensive programmable instrument that allows you to synthesise your own library of sounds in batches of 50 that can then be stored on a separate low cost mono cassette recorder.

One of its major features is undoubtedly its velocity pressure sensitive dynamic keyboard that employs 14" weighted wood keys that utilise an internal microprocessor to measure key speeds to within a 1000th of a second. In fact, two processors are employed, with a second generating all the control signals for the Chroma.

Two very good manuals are supplied, one for performance and a comprehensive one for programming — obviously a sensible approach that helps you get started quickly.

## Playing the Chroma

Setting up is straightforward, once the instrument is lifted out of its sturdy flight case. This also holds a large piano style dual foot switch unit and other accessories, including a single foot-switch, foot volume pedal, cassette (with 150 programs) and interface card for a cassette recorder (the only item not supplied — the Radio Shack TR-80 is recommended, although a mono recorder with remote auto stop, pause and tape counter should do, e.g. Lloydtron from Comet discount shops).

On the rear panel of the instrument, various connecting options to your mixer or amplifier give

the two LED displays on the main panel are activated, with 'Program No.' indicating the last program selected (prior to switch-off). If the smaller 'Data Readout' shows 'Err' followed by numbers, then this indicates a fault which can then be diagnosed from the number indicated. Normally, everything will be in order and the five left hand sliders can be adjusted for Bass, Middle, Treble EQ and Volume, plus Tune which sets the overall pitch to match other instruments.

In the right section of the main panel are 50 numbered switches that each have several uses during operation, determined by 4 'Panel Mode' switches with indicator LEDs. In normal use these are 'Program Select' — each numbered switch selects one of 50 different programmed instrument sounds, 'Parameter Select' — above each number is a synthesiser parameter that can be selected and modified. The individual functions are logically divided into numbered groups: Control, Glide, Sweep, Envelope 1, Envelope 2, Pitch, Waveshape, Cutoff and Volume; 'Copy from A' and 'Copy from B' — parameter copying from one program to another. In addition, temporary Panel Modes are set by pressing two of these switches together (shown by flashing LEDs).

Each program contains all the information necessary to process a sound, plus performance control extras. Besides the 50 programs stored in memory, there's a further 'current program' that acts as a workspace for inserting a particular program number (shown on the large 2 digit display). This can then be edited during performance and also stored at any time during programming as a new program in the memory.



Rear connection panel.

studio mono balanced/unbalanced cannon line out, high/low level mono standard jack outputs or choice of 4 separate outputs. These are linked as you wish, along with dual footswitch and a lock/unlock switch is maintained in the 'lock' position to avoid loss of programs.

When the power cord is plugged in and the Chroma switched on, all 16 LEDs in the left section of the main panel blink 16 times over 6 seconds. This indicates the Chroma is going through an initialisation and tuning program. When complete,

There are 16 complete synthesiser channels, each with an oscillator, waveshaper, filter and amplifier, that are split into 8 pairs, enabling detuning parameters to be set up as you play up to 8 notes at once (but this can be reassigned to other mono/poly formats).

Another important option is the ability to link two programs together, with the additional program called LINK as opposed to the initial MAIN program. The LINK channel selected may be stored as a parameter and is shown in the Data



Readout display (prefixed by 'L'). Four switch buttons with indicator LEDs set link modes: LINK LOWER, LINK UPPER, LINK UNISON and NOLINK. The first two place the MAIN and LINK sounds above and below the specified 'Keyboard Split' point, whilst unison puts them together over the whole keyboard.

## Other Performance Controls

**Set Split** The 64-note keyboard (E to G) in 'default' mode (i.e. without any parameter set) will give the split at D#/E (approx. 3/2 octaves at lower/upper). Using the 'Set Split' switch followed by the note you require the split at, the Data Readout will indicate the new split point (over -32 to 31 range), e.g. SPL 0 = Middle C.

Since balance between the two programs chosen is critical in performance, this is easily modified by a 'Parameter Control' slider over -14 to +14dB in 2dB steps, indicated on the Data Readout.

It is worth noting that the link mode, program number and keyboard split are stored parameters in each program.

**Transpose** — a section of 4 switches along with LED indicators for putting Main and Link up or down 1 octave.

**Auto tune** One problem that did occur during editing was some drifting of oscillator pitches. Like most advanced polyphonic, some facility must be provided to easily compensate for drift during use over a period. This is catered for by the Auto Tune switch which goes through a tuning routine similar to switch-on. Not only do the LEDs flash, but soft, high pitch random notes also accompany the process!

Rather than have a joystick controller, the Chroma has two levers at the left of the keyboard. These are spring-loaded, moving backwards or forwards to return to centre positions. The levers, designated 1 and 2, can be programmed parameters, although surprisingly only one program ('Harmonica' in Set 3) uses them for bends and muting.

Two pedal inputs enable connection of volume type footpedals (100k to gnd). Assigned Pedal 1 and 2, these can be programmed for volume and effects. Also placed underneath the instrument is the dual footswitch plate (two piano type brass pedals) and a simple footswitch. Normally the dual pedal is for latching and holding a chord (left) and for sustain (with the right). The simple footswitch is actually for sequencing through programs, done via a stored 'pointer' number in each program, so that jumps from one to another can be specified for moving several around without losing any.

Finally, an optional pressure sensor modification kit will soon be available that gives extra 'after-touch' control from any key. So the player can assign initial touch sensitivity (dependant on the velocity at which a key is struck) and then by pressing further onto the depressed key, the after-touch is brought in. Both these keyboard controllers can be assigned to change dynamics, tone or pitch in each program.

## Programming the Chroma

The Chroma's 16 synthesiser channels are grouped into eight pairs so that they may be reconfigured to provide a wide variety of sounds. The main processor controls the oscillators, filters and amplifiers directly. It also digitally generates 32 envelopes (2 per channel) and 16 low frequency Sweep signals. Signals for the levers, pedals, control panel and keyboard are all encoded digitally prior to the main processor. Because of this all 50 parameters for a sound are able to be stored digitally in the Chroma's memory. The information may also be saved and loaded from cassette, sent to an external computer via the rear panel 25-way socket, or even to control another Chroma.

Chroma's logical structure has four audio synthesis groups: Oscillator, Waveshaper, Filter and Amplifier (controlled by parameters in the bottom row of the 25 numbered pads); four main control signal generators: Glide, Sweep and 2 Envelopes (controlled by the top row of 25 pads); and six performance controls: 2 levers, 2 pedals, keyboard velocity and pressure.

When a sound is chosen by means of one of the



Left hand part of control panel.

50 Program Select buttons, it is then possible to edit it. Once a change is made to one of the sound's parameters, a small dot appears below the program number in the display. This 'Modified Flag' reminds you to store the current program if you want to retain the new control settings. To do this, you first set the Lock/Unlock switch to Unlock, and then press the Store switch followed by the chosen program number pad. The system also provides retrieval of a previous program in case you decide to start again, as well as 'unselect' and 'unstore' operations — wise precautions with 50 parameters at stake!

## Creating a Sound

First, the workspace must be cleared so that you can start from scratch. Unfortunately, no single 'magic button' does this and the user has to go through a routine of first selecting both Edit A and B buttons, then holding the Parameter Select switch down whilst pressing each of the 50 numbered switches in turn. Once completed, the existing program is conveniently set to a raw sawtooth sound, rather than a silent 'all functions shut-down' situation, for one channel per note playing. Continuing in the Parameter Select programming mode, any of the 50 switches on the right hand panel can be activated so that a particular parameter can be set up. All the changes are noted on the 8-digit Data Readout which provides constant monitoring of parameters as they are selected and then changed by the Parameter Control slider. The effect can of course be immediately monitored aurally by playing notes on the keyboard.

Parameters like Decay, Tune and Modulation are variable and have their range scaled appropriately, e.g. for Decay this is 0 to 31, and for Tune it is 0 to 63 whilst Modulation Depth gives bipolar control: -64 to +63 (0 = no modulation). Others are switched continuously by the slider up to a maximum of 16 positions.

The Parameter Control slider works remarkably well with adequate resolution up to 128 settings on critical sound adjustments. It soon becomes the focal point of the left hand when doing program changes. Meanwhile, the right hand selects parameters and monitors sounds from the keyboard as they are changed. In some respects, the location of the slider might have been better placed away from the other switch functions to its left as they are easily switched on by accident as the hand leans on the panel.

## Shaping the System

The first parameter that needs attention in creating a sound is PATCH. Incidentally, even though confirmation of the Parameter Select number appears in the 2-digit LED display, the Chroma has an unusual feature — a solenoid-operated plunger attached internally to the main circuit board to cause a mechanical thump to be clearly heard (and possibly felt!). Every switch change including those made with the Parameter Control slider is registered and is presumably an

aid to blind players. (I wonder how the 50 program switches are taken in without keeping an eye on the display?) I prefer to program out the effect which becomes slightly irritating after a while.

Back to the Patch! Here's an exclusive feature that enables 16 modes of osc./filter/amp. routing covering one 16 channel/16-note playing, and fifteen 8-note configurations of 4 independent 8-note modes, 4 parallel filter modes, 4 series filter modes and 3 variable mix filter modes — each employing no cross modulation/sync/ring mod/ and (except for the final group of modes) filter FM. Here's the reason for including 2 edit buttons A and B, as 15 modes require separate modification for each A and B pair of 8 channel banks.

This kind of control technology will leave most of us behind — especially if as you read this you're trying to conceive the end results! (Needless to say, if this parameter function has you thinking, 'Is it all necessary?' then a listen to E&MM Demo Cassette No. 8 and be convinced!)

The creative possibilities with 2 glides, 2 LFOs, 4 envelopes, 2 oscillators, 2 waveshapers, filters and amplifiers on an 8-note polyphonic that can program and store the lot is exciting, to say the least. Other special sounds possible are dual 2/4 pole low pass, high pass, band and notch filter effects, bells, phase shifter and vocal effects, percussion, flanging, complex harmonics, ring modulation and dual timbre effects.

Another important group of parameters during initial editing is the General Modulation Selections (GMS). These enable you to choose 3 modulation sources for the oscillator, one for the waveshaper, and 3 for the filter. 16 sources are available for each (coded 0-15): Keyboard Glide A, Sweep A, Env 1A, Env 2A, Keyboard Glide B, Sweep B, Env 1B, Env 2B, Lever 1, Lever 2, Pedal 1, Pedal 2, Velocity, Threshold Velocity, Pressure and Threshold Pressure.

In addition, 3 Modulation Select parameters can be chosen from Env 1A or B, or Env 2A or B. Modulation depth for all these is then set by appropriate individual Parameter Select pads.

Before coming to the main synthesis sections, there are four other control functions besides 'Patch': FOOTSWITCH mode, which sets 8 combinations of sustain and latch for the dual pedal assembly, either enabling, disabling, using gate or inverted note gate. The latter two are useful for making Main and Link programs come on during playing by correct use of the pedal.

**KEYBOARD ALGORITHM.** Besides the unique channel assignment modes already discussed, this parameter offers monophonic and polyphonic note playing variations. The mono modes are best selected for lead or bass line (using only one pair of channels so that the remaining 14 channels can be utilized in a polyphonic section of the keyboard (set by Key Split).

Some very useful algorithms are given, including Polyphonic: least recently used note/same note — same channel/pitch ordered, for moving from one chord to another in the same note order/storage of chords for recall on left foot-pedal/sharing of notes by all synth channels.

Monophonic: full synth channel playing on one note/last note, multiple or single triggered/first note of a group (for inner playing with a polyphonic cluster)/bottom note (ideal for bass line)/top note (for lead). There are also 6 mono arpeggio modes played at a speed set by Sweep A 'Rate' control: up, down, up/down, down/up; sequence (played in order from the keyboard while remembering key velocity); random notes playing from your notes played.

DETUNE makes fine pitch adjustment of the B channel against the A channel in 1/32 of a semitone steps (from 0 to 31).

OUTPUT SELECT not only routes a channel to one of 4 audio outputs, but also acts as a send/receive function by using a correctly wired stereo jack in the rear sockets. If a Link program is added, stereo output is then obtained.

## Synthesiser Process Controls

Here we have Glide (for portamento or glissando at different rates); Sweep which is really an LFO oscillator *par excellence* with 16 different

wave shapes available, as well as amplitude modulation selection and delayed sweep. It can run independently, or be synchronised by key depressions. Each note then may have its own sweep generator. The Sweep Rate can be itself modulated in 16 ways, from the keyboard, envelope, pedals and levers. The waveshapes offer advanced synthesis possibilities with sine, cosine, offset sine, half sine, and stepped patterns, as well as the more usual triangle, sawtooth, square and random shapes. Amplitude modulation sets 15 different control effects of the Sweep Depth, available from the same sources as the Rate, plus 4 delay times up to 5.1 secs.

ENVELOPE. There are 2 envelope generators per channel with AR and ADR shapes, although more complex EGs can be used by combining envelopes and by using modulation inputs to Cutoff, Pitch or Amplitude functions. Variable parameters are Amplified Touch (based on Key Velocity), Attack time with modulation control, Decay time with modulation control, Release time and Delay (Env 2 only). Maximum times prior to full sustain each measured 10 secs, but modulation controls no doubt extend these further.

As the modulation controls of the instrument become more familiar, the potential of Chroma's keyboard system is more fully realised — not just with pressure and velocity control, but also by means of specific threshold settings (for soft and hard strikes) with individual fingers for exclusive note/control execution. This should inspire experienced players to extend their performance techniques!

### Pitch Parameters

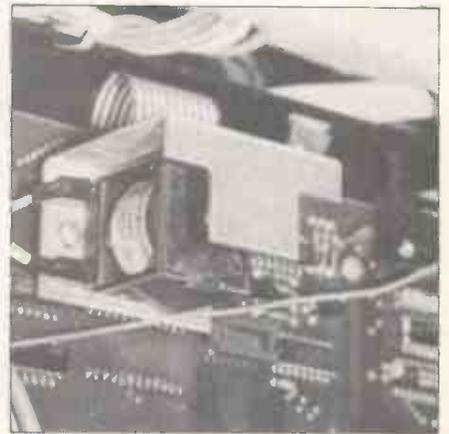
Oscillator tuning is set with the TUNE parameter in semitones from one octave below to 4/4 octaves above, whilst modulation can come from 3 sources at once. There are 16 sources to choose from, (the 'general modulation selections' GMS mentioned earlier). What is unusual is the allocation of different depth gain increments, from 1/16 semitone, 1/4 semitone to semitones (maximum depth for the latter over -64 to +63 range).

### Waveshape Parameters

Further control of the oscillator waveshape is provided here, with 'saws' — a combination of pulse and sawtooth simulating the sound of two sawteeth, and pulsewidth and sawshape adjustable from 0 to 100%. Modulation with the GMS is also possible. Two noise generator sources can be



Main panel opened up.



The 'tapper'.

Right hand part of control panel.



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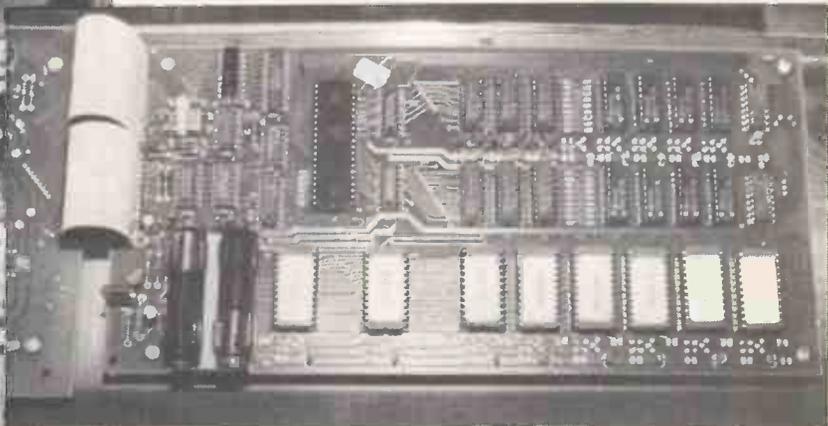
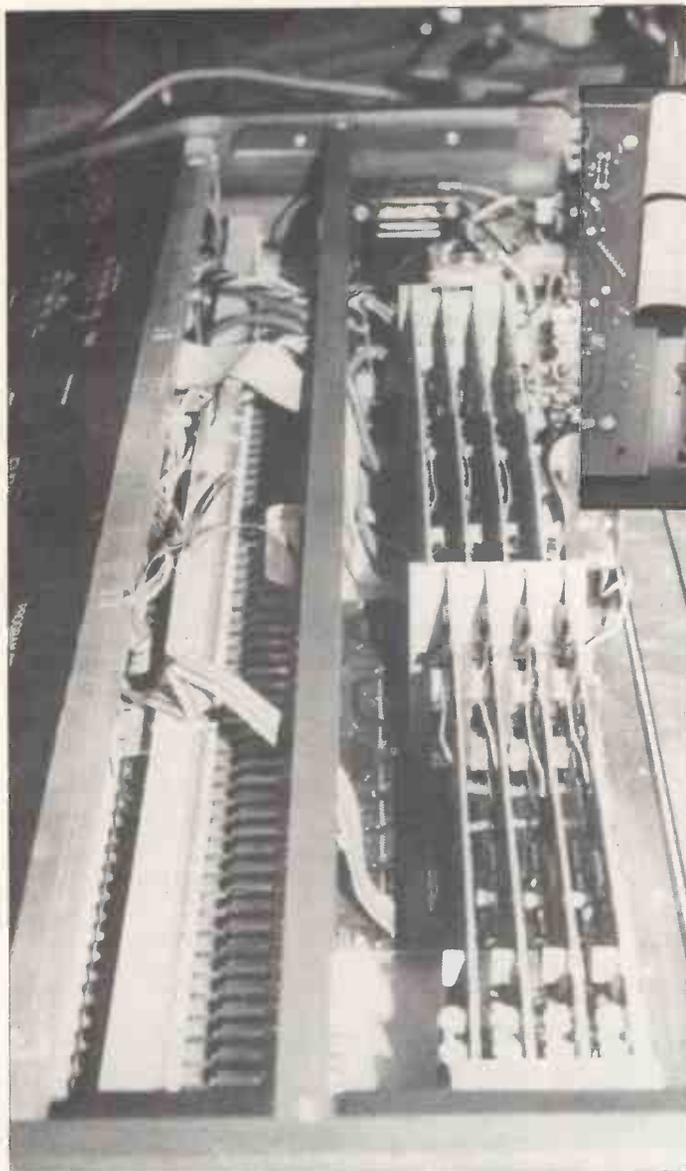


## Rhodes Chroma

This is a 16-channel programmable polyphonic with a wooden dynamic keyboard. The architecture can be re-orientated as with a studio system, but digitally rather than with leads. The Chroma is digitally self-maintaining, has its own sequencer and interfaces with an Apple II for full 16-channel orchestration. We have a demonstration model in now.

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Main processor board with 7K RAM and 16K ROM.



Internal view of paired synth channels.

selected here instead of the oscillators — white or pink.

### Cutoff and Amplitude Parameters

The filter can be high or low pass with variable resonance, tune, modulation from GMS (up to 3 at once), and depth. It does however not track the keyboard. Two Amplitude Modulation select sources are given, with at least one needed to be set to operate the amplifier. One of four envelopes can be chosen for each. There is also post modulation control of the VCA from performance controls, as well as tremolo and volume compensation over the keyboard.

### Hidden Functions

These are useful extras that put another control to the numbered switches and they are accessed by pressing the Set Split switch followed by the correct number. Included are temporary stereo setups, cassette functions and subroutine in/out, diagnostic checks, channel muting, linking to another Chroma, and envelope threshold and fast/slow release parameters.

### Cassette Storage

Four switches operate an external cassette recorder for the purpose of storing programs and a special interface via a Din socket will turn on and off the recorder automatically. You can SAVE ONE or SAVE ALL programs with or without spaces on the tape and the LED will show any program SAVE errors clearly. Once saved on cassette, your programs can be reloaded with LOAD ALL or LOAD ONE. The latter is useful as it puts it in the workspace for you to allocate to any program number.

Obviously, once a new set of 50 programs is loaded you lose the previous set unless you've already got it on tape. No problems were encoun-

tered with the tape interface. During execution, LEDs flash between programs as they load, with a buzz in the output amp you're using as well.

### Chroma Sounds

On E&MM Demo Tape No. 8 we've put a selection of sounds from the three sets of 50 program sounds supplied with the instrument on cassette. Since the output voltage ranges over  $\pm 10V$ , the Chroma really punches out a large signal and quality is good enough for most studios. The range of sounds is vast and often defies description. Most orchestral and band instruments are provided, with plenty of percussive sounds and modern synth effects. You even get the sea, seagulls and ship's bell on one program!

The modulation facilities really do make a huge difference and the overall clarity combined with the full pitch range and the complex synthesis that takes place — often just by the host of performance controls — makes it a challenging and exacting instrument to play.

Considering it can be interfaced to the Apple II, Tandy TRS-80 and possibly other micros (surely not the Spectrum!) it's future looks very bright indeed.

You'll have to pay around £3,850 including VAT for the Chroma and its extras mentioned, but the

design seems to have taken in all the requirements that a keyboard player could ask for especially as it offers instant change of any parameter. The touch pads take a bit of getting use to and the instrument runs hot at the rear. I enjoyed the weighted keyboard immensely and could only begin to explore the Chroma's possibilities in the time I had with it.

These higher priced instruments usually offer special sequencing facilities but here we only have arpeggiation. I would expect the external computer interfacing to overcome this, and we'll be looking at the possibilities as soon as the information becomes available.

Large scale computer operated instruments such as the Chroma require plenty of back-up for users, and CBS assure me this will be provided in the U.K. So if you want to have full creativity and dynamic performance control, my advice must be to check out the Chroma as soon as you can.

Mike Beecher

E&MM

The Rhodes Chroma is distributed in the U.K. by CBS, Fender House, Centenary Estate, Jeffrey's Road, Brimsdown, Enfield, Middx, EN3 7HE. Ring 01-805 8555 for more details — they'll be pleased to hear from you.

# RHODES Chroma

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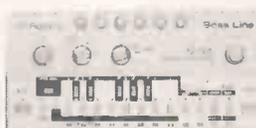


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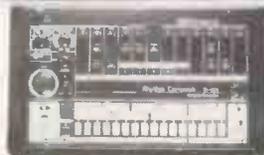
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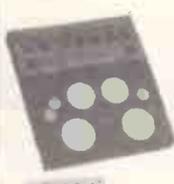
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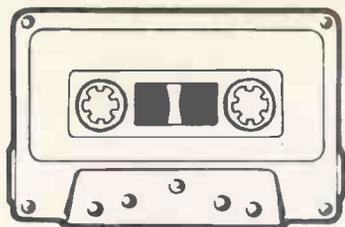
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# CASSETTE REVIEW

Electronics and Music Maker's CASSETTE REVIEW has proved so popular, and we are receiving so many cassettes from readers that we have extended it this month to two pages. Also, to ensure that the maximum amount of cassettes are included each month some of the reviews will be shorter than previously - we hope readers agree that a brief mention is better than no mention at all. The aim of CASSETTE REVIEW remains the same: to spotlight the recording activities of our readers and give a short appraisal of their work. Recordings can be one-off, live recordings with no overdubs, sound-on-sound, stereo bounces, or multitracked.

Send one cassette, mono or stereo, clearly marked with your name and address on the cassette itself along with a covering letter giving full information of instruments used and recording method adopted, and a relevant black-and-white photograph to: E&MM Review, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG. Subjective 'scores' are out of a maximum of 10 for each category. 'Tape' refers to the general hi-fi quality of the recording while 'Production' refers specifically to the musical aspects of production. We regret that tapes are not returnable and please note details of our Electro-Music Cassette offer.

## This month, our *Tape of the Month* Winners are:

**PETE AND SOPHIE JOHNSTON** (Fenham, Newcastle-on-Tyne) 2 tracks: 'Travel In Time', 'Paradise'. Sound Master memory rhythm SR-88, Roland SH-09, Roland RS-09, acoustic drum kit on 'Paradise'. Recorded on 8 track at Lynx Studio, Newcastle-on-Tyne.

Extremely commercial and accomplished tape from a brother and sister team that should be sent on the A&R rounds immediately. Sophie sings and writes the lyrics while Pete composes, plays keyboards and produces. Of the two tracks 'Travel In Time' was marred by an accidental erasure near the beginning and one synth line on this track was rather too familiar - I can't quite work out where it's from but it will come to me eventually. 'Paradise' is a sugar-coated pop offering that, like the previous track, makes excellent use of contrasting synth settings and both songs display an unmistakably individual sound. Pete writes that "we couldn't afford more studio time which would have ensured a more polished result, nonetheless, we hope you enjoy listening to it as much as we did making it." We certainly enjoyed listening to it and, although more studio time would have been desirable, there is enough talent on this tape to make it a good demo as it stands. Sophie sings with an attractive breathlessness, the production has a very confident feel to it, but what impressed this reviewer most were the extremely polished arrangements. A worthy Tape Of The Month Winner.

### Best of the Rest

Music: 7 Production: 6 Presentation: 6 Tape: 4



Sophie and Pete Johnston.

**EDDIE DOREY** (Nottingham) 4 tracks. Korg MS-10, Casio MT30, Epiphone EA250 guitar, bass (make unknown), Soundmaster SM8 rhythm machine, Casio VL Tone, Carlsbro parametric eq, Carlsbro echo pedal, Jen Cry Baby, Electro Harmonix Clone Theory, Shure Unidyne B. Recorded on Teac 108 simul-sync cassette deck, Ferguson 3280 cassette deck.

A mono recording that has been layered using bounces from one deck to the other - not the easiest way to 'multitrack' but a medium that Eddie Dorey is quite adept at, although sound quality has obviously suffered. A pleasant selection and Eddie sings well although, like so many home recordings, there is little contrast in the way of dynamics, instrumental sounds or arrangement within numbers. Other than that a perfectly adequate tape.

Music: 5 Production: 4 Presentation: 5 Tape: 5

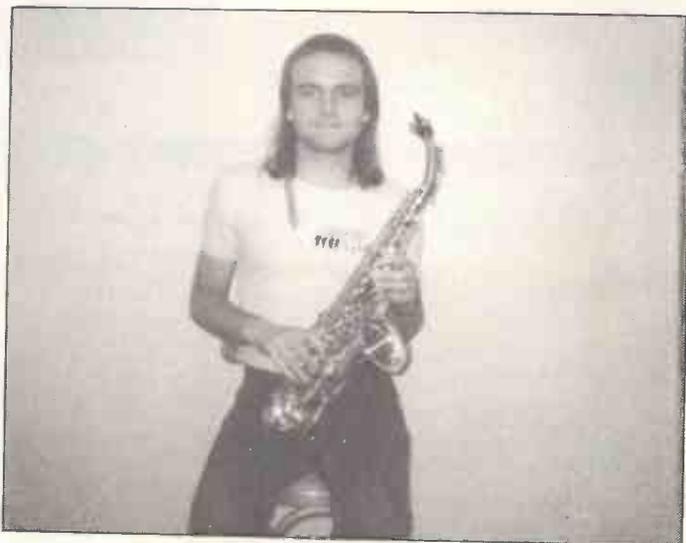


Jordan Heal.

**JORDAN HEAL** (Filton, Bristol) 11 tracks. Fender Stratocaster, Vox bass, Yamaha 12-string acoustic, Tatay Spanish acoustic, Korg MS-10, Casio MT30, Clef Master Rhythm, Boss flanger, Echopet EP50. Altai condenser mics, Teac 144 mastered onto Teac A107 cassette deck with Dolby 'B' NR.

Jordan Heal has been "mucking around with tape recorders for an awful long time now" and here presents a variety of numbers recorded on his new "magic box" i.e. 144 Portastudio. The Clef Master Rhythm becomes slightly monotonous after 11 tracks but percussion is enlivened by Jordan's ingenuity in using bits of aluminium grill and a convector heater (!) as percussive effects. Most tracks are primarily guitar based with keyboards used for occasional embellishments rather than as focal points or compositional aids, production is unsure in parts and vocal performance, as Jordan admits, is not a strong point. One nice touch, though, is the use of a speeded up vocal (for the female vocal part) in a cover version of the Human League's 'Don't You Want Me'.

Music: 4 Production: 5 Presentation: 5 Tape: 4



Eddie Dorey.

**PASSING STRANGERS** (Chesterfield, Derbyshire). 3 Tracks. Ian Davies: lead vocal, Roland SH09 synth, tambourine. Steve Deakin: Yamaha CS15 synth. Flash: Casio 202, Jen 2000 synth. Steve Long: Roland SH09 synth. Stuart Marsh: Simmons drums, backing vocals.

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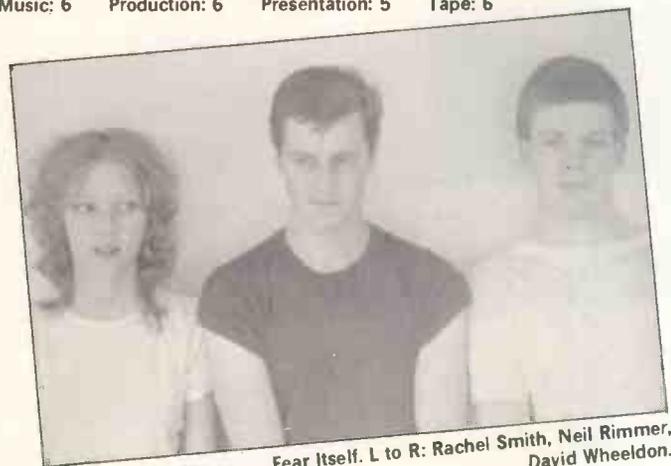
Each month our Tape of the Month Winner will have the chance to discuss their music with Martin Rushent, top producer for Human League, Altered Images etc. at his Genetic Sound Studio!



Passing Strangers. Stuart Marsh, Flash, Steve Long, Ian Davies, Steve Deakin.

Not much recording information given here, just that the tape was recorded on a 'Teac reel-to-reel' and mixed on a Paice 8-2 mixer. Of the three tracks the first 'Shattered Glass' is perhaps the most immediately arresting and features a nicely employed "car crash" overdub. The second track 'The Synthesis of Life' is an instrumental that uses sparse synth lines over a frantic percussion part - this track doesn't quite make it and really needs beefing up with some chording or extra bass. The third track 'Dream World', has the same commercial electro-pop sound as 'Shattered Glass' and it is obvious that Passing Strangers are aiming at the chart market. It's nice to hear manual electronic percussion as opposed to the ubiquitous programmed machines and, as a live act especially, this outfit should have a healthy future ahead.

Music: 6 Production: 6 Presentation: 5 Tape: 6



Fear Itself. L to R: Rachel Smith, Neil Rimmer, David Wheeldon.

**FEAR ITSELF** (Stockport, Cheshire) 5 tracks. Korg MS-20 and SQ-10, EDP Gnat, Soundmaster SR88 drum machine, bass, 12 string acoustic, Melos Echo, Ibanez phaser, Electric Mistress flanger, Shure mic. Recorded on 144 Portastudio and mixed onto Sharp RT 3151 cassette deck. Three piece comprising Rachel Smith (vocals, guitar, synth), Neil Rimmer (synthesisers), David Wheeldon (bass guitar) who have submitted a varied and atmospheric selection of tracks - electronic with tinges of traditional English folk music.

Music: 5 Production: 4 Presentation: 5 Tape: 4



Nigel Summers.

**NIGEL SUMMERS** (North Mymms, Herts) 11 tracks. Roland SH09, ARP Quartet, Roland Guitar Synth, Roland drum machine, Roland Cube 60 and Boss monitor, Bergs Lagen sax pickup, Boss chorus. Recorded on Teac 4 track reel-to-reel (model unspecified). An accomplished electronic jazz recording with the emphasis on guitar lines over synthesised backing.

Music: 6 Production: 6 Presentation: 7 Tape: 4

E&MM OCTOBER 1982

**PAUL DONALDSON** (Bexhill, Sussex). Roland 101/102 synth, 104 sequencer, Boss DR55, WEM ER15 amp, Copicat echo, homemade phaser, Reagun flanger, Pioneer SA-7500 amp. Recorded on 144 Portastudio and Sharp GF-9191 radio-cassette recorder.

A completely instrumental, mainly sequence-based recording using the 104 which has been stepped (initially) by the DR55 via the WEM amp. The sequences, however, are often over long and lacking interesting counterpointing or other musical ideas to break the monotony and as a result the overriding impression in the listener is occasionally one of irritability. As a recording exercise this was no doubt a fascinating project and facilities have been used to the full with around eight tracks built up by bouncing on the 144 (with a click track retained for sequencing) followed by additional overdubs between the 144 and cassette deck.

Music: 4 Production: 6 Presentation: 4 Tape: 5

**GLEN FORD** (Windlesham, Surrey) 6 tracks. Roland SA09, Roland SH09, Vox guitar, Eko 12 string, Boss Dr. Rhythm, Boss flanger. Recorded on Akai 4000DS, Aiwa AD 1600 cassette deck, Shure mic and homemade mixer.

The first track on this tape, an instrumental entitled 'Funk With The Punk', was enough to almost make this submission Tape Of The Month and it is rapidly becoming one of this reviewer's favourite instrumentals. Unfortunately the rest of the tape, though extremely pleasant and melodious, just doesn't have any 'poke'. Glen has been submitting his compositions to record companies without success and I'd suggest that it is this lack of vitality, specifically the absence of any really memorable hooks, that is the reason for this lack of success. This is a worthy, sensitive and thoughtfully put together selection of songs and I wish Glen more success in the future.

Music: 5 Production: 4 Presentation: 5 Tape: 4

**ROB YOUNGS** (Fairfield, Glos) 7 tracks. Sequential Circuits Pro One, Casio 202, Transcendent 2000, Rose Ploughman guitar, Rose bass, Rudalle Carte flute, Clef Master Rhythm, Electro Harmonix Poly Chorus, WEM Copicat. Recorded on a 144 Portastudio.

Rob Youngs writes that these songs are aimed at a commercial quarter and he intends forming a band to perform them live. A good idea as this is essentially band music that needs the interplay of other musicians to give it the force that is lacking in a solo recording situation. As a composer Rob Youngs has a lot to offer and on this tape he avoids the usual cliches and comes up with some imaginative ideas. Production, unfortunately, has to be rated low for the simple reason that Rob has been unable to isolate some very annoying noise that he identifies as coming from the mains supply he shares with heavy farm machinery and which is particularly noticeable when echo is employed.

Music: 6 Production: 3 Presentation: 5 Tape: 5

**STEVE GODSALL** (Lower Broadheath, Worcs.) 14 tracks. Yamaha CS15, Casio 301 and VL1, plus unspecified guitars, fiddles, piano, bass, drums, banjo-ukelele and percussion. Resounder flanger, Clone Theory chorus, Copicat tape echo. Recorded on Sony TC377, Revox A77, Ferguson cassette, Shure, AKG and Sony mics. Astounding selection of styles from the slightly Steely Dan-ish 'She's Asleep' through pure electronics to an up-tempo-country 'Don't Fence Me In' featuring Steve on fiddle. Top marks for variety.

Music: 6 Production: 5 Presentation: 4 Tape: 4

**BICYCLE THIEVES** (Bedford) 6 tracks. Roland RS09, Sequential Circuits Pro One, Korg MS-20, Wasp Spider, CR78 rhythm onto Portastudio. An independent release from Gary Braybrook, Bill and Lee Gould and Bruce Korpics who together comprise Bedford band Bicycle Thieves. From the six on offer we preferred the two instrumental tracks.

Music: 4 Production: 5 Presentation: 4 Tape: 4

**E-E** (Berkenham, Kent) 4 tracks. Two Wasps, two Casio VL-Tones, Resounder 11 flanger, Roland Jet phaser, Harmonix Analogue delay, Soundmaster SR 88 drum machine. Recorded live onto Akai 4000DS through homemade mixer. A selection of songs that E-E (Nick Dutton and Bob Suffolk) played live during two weeks of busking in Paris. For a two person live recording, with no overdubs, this is a remarkable selection of electronic pleasantries. We've heard far worse from many times the personnel with many times the hardware.

Music: 5 Production: 5 Presentation: 4 Tape: 4

**THE SAME** (Bristol) 13 tracks. Casio VL-Tone, Epiphone electric guitar, Electro-Harmonix Rhythm 12 drum machine, Framus bass guitar, Framus acoustic guitar, Premier 16" cymbal. Homemade 12 channel mixer, compressors, fuzz, sustain, vibrato, Ibanez AD150 analogue delay, Bi-Pak and ETI Graphic eq. Small Stone phaser, Maplin Spring Lines. Recorded on Sony Stowaway and TC-K 55 99, Teac A-108, A-3300SX, A-3440. The Same, and the independent label they record on, are both branchchilds of Robert Cox (this month's Home Electro Musician). Here he has supplied an interesting selection of tracks including a version of Tony Hatch's 'Down Town' which is being released as a single.

Music: 5 Production: 5 Presentation: 7 Tape: 5

### Electro-Music Cassettes

Starting soon we will be launching a new series of E&MM Electro-Music cassettes which will feature tracks from the tapes reviewed in these pages. Contact addresses for all tapes reviewed will be included with the cassette and this should ensure a lively 'musical grapevine' amongst E&MM readers. When submitting tapes, please indicate that you would like to have one track, or part of one track, used on an E&MM sampler cassette. This way you will receive free promotion of your music internationally amongst our readers. Include a price for your cassette (with postage) and you could soon be sending your cassette all over the world! In future, tapes for Cassette Review will be accepted on the understanding that permission has been given for the inclusion of one track, or part of a track, on our sampler cassettes. **E&MM**

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# The Bradford Musical Instrument Simulator

## Micros and Music

A research team in the Computer Science department at Bradford University have developed a digital musical sound simulator, controlled by microprocessors, which combines flexibility and quality with moderate cost. It is able to reproduce a wide range of conventional instruments and can also be used to synthesise new sounds, as well as offering some unique features.

The work started over seven years ago when Dr Peter Comerford — a Senior Lecturer in Computing and a church organist — started experimenting with sound generation using a purpose-built computer. A microprocessor-based design soon followed; the NRDC spotted its commercial potential and provided financial support. A small research team came together under the direction of Dr Comerford, and a number of prototypes have been built.

The system is based on microprocessors; they are used for keyboard scanning (to monitor the player's actions) but also to control the sound production itself. The design uses mass-produced components: specialised hardware (to meet realtime demands) is kept to a minimum so the majority of functions can be manipulated directly by software, which makes the instrument both powerful and versatile. The programs are written in a modified version of Z80 assembly language.

The simulator is of general purpose application: the sounds it will produce depend upon the numbers which are loaded into memory. Therefore, you can either analyse recordings of conventional instruments and use this information to recreate the original sound; or you can create new and experimental sounds by manipulating the data in the simulator, using an interactive program; or with a suitable interface, the simulator could become a high-quality, low-cost digital synthesiser.

For simulations of conventional instruments, the team make tape recordings which are played into a PDP11-20 at the University. Using analysis programs written specially for the project, the sounds are broken down into their constituent partial tones. This data is stored inside the simulator and is used by the microprocessors for generating the correct waveforms. Each waveform can be very precisely defined, which is important in the accurate reproduction of sound. But there is more to realistic sound than tonal quality. Pitch, attack, decay, enveloping and so on must all be taken into account. For instance, the first application of the simulator was as an organ, and the team have found that many complex and interacting features must be incorporated if such a simulation is to be musically satisfying. For instance, the harmonic spectrum of each stop is not a fixed feature — low notes are generally richer in harmonics than high notes — so the simulator must produce waveforms which change in composition across the keyboard. A pipe organ can contain hundreds of pipes, many having complicated transient tones at the beginning of each note; the instability of 'pipe against pipe' is another factor which



Project Director Dr Peter Comerford, Dennis Redshaw, Dr Miles Marks and Lucy Kitching.

must be part of a satisfactory simulation. It is also essential to use an adequate number of independent sound generators, to create a 'large' sound instead of just a 'loud' one.

By loading the simulator memory with different data from mini-floppy discs, the sounds produced can be changed completely within seconds. Therefore, the range of available conventional instrument simulations is limited only by the effort required to analyse them. On the Bradford prototype, the Roman Romantic Church Organ can become a Continental Organ, with a completely different specification of more aggressive sound. The Bradford team have also produced a unit cinema organ, which not only has the distinctive voicings and tremulants, but also a range of instruments (each with its own complicated characteristics). Percussion includes tubular bells, glockenspiel, xylophone, chrysoglott, bass drum, cymbal and triangle; the partial tones of these instruments are not harmonically related, so each frequency has to be individually defined. Other instruments are a harpsichord with 'plucked tone', an orchestral trumpet, and a 'touch-sensitive piano', which is also able to simulate the effects of both multiple stringing and sharpened tuning.

One of the Bradford prototypes has been on trial 'in the field' at a local church, where the specification swapping facility has made it useful for a wide range of music.

Using a video display terminal and a specially written interactive 'voicing' pro-

gram, it is possible to make direct changes to the data in memory — and to store the changes on mini-floppy disc — so that the parameters defining each sound can be modified in seconds while you listen. Thus an organ tone can be quickly and easily altered to suit the acoustics of a particular building or the taste of a particular player. (This facility can also offer pipe organ builders the opportunity to experiment with adventurous voicings, in a way which would be prohibitively expensive using pipework.)

Besides a new concept of sound generation, the Bradford system offers a number of special 'features'. For the player who is too nervous to play well in public, there is the chance to pre-record a piece and then play it back indistinguishable from the original performance. The floppy disc is used to record the music as a sequence of events — notes pressed, stops selected — a principle reminiscent of the pianola. The microprocessors then 're-enact' each recorded event, so that the piece is reproduced exactly as it was played. The playback speed can be altered without changing the pitch of the sound. Transposition is a matter of pressing a button and the instrument can also be 'fine tuned' in seconds to match the pitch of, say, a pipe organ or a piano, so that duets can be played.

Research continues at Bradford, to refine voicing and produce more simulations, as well as in other areas.

L. K. Kitching

E&M

OCTOBER 1982 E&M

# Allen & Heath's new stereo 21 SERIES

Allen & Heath proudly unveil their exciting new range of compact stereo mixers — the 21 SERIES. Stylish in looks and superb in performance, these three babies offer outstanding value for money.

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# arrogate International Festival

In August E&MM visited Harrogate for this year's International Festival of Sound and Video.

The main emphasis this year was on Digital Audio with prototypes on display from most of the large manufacturers of audio equipment.

You might think that when the Compact Disc arrives your current record and/or tape collection will be obsolete. However, most of the exhibitors view the digital disc as merely another option to add to your turntable, tape or tuner inputs. Eventually, it may be accepted as the standard medium for home, car or personal Hi-Fi, but with the current advances in Audio and Visual electronics, who knows?

For the time being, however, here is a selection of the new equipment and developments which were on show.

## DBX

The dbx 21, when used with one of dbx's large range of encoded discs, provides reproduction with increased dynamic range and virtually no record surface noise. The dbx disc contains signals compressed before recording which when decoded by the dbx 21 (or one of the standard dbx type II tape noise reduction systems) increases the dynamic range of a standard record pressing from 50dB to around 90dB! A large, and ever increasing, range of record titles is available.

## MORDAUNT SHORT

The MS20 is derived from the company's Carnival 3 with the same drive units and comparable specifications but designed to be driven by smaller systems. With a rating of 10-80 watts, frequency response of 80-20kHz  $\pm$ 3dB and a very pleasant sound, at around £90 a pair, they represent very good value for money.

## ALPINE

Claimed to be 'One of the best cassette decks money can buy', the AL90 certainly has a lot to offer.

The most interesting feature is a microprocessor controlled 'BLES' system. This stands for *Bias current Dolby Level and Equalization Search*. When activated the deck automatically records three brief sections of 1kHz, 7kHz and 15kHz tones from an internal oscillator. The deck then adjusts the bias current followed by the Dolby level and Equalisation in 0.25dB steps. The process is repeated up to six times to find the setting which provides the flattest possible frequency response. This takes between 20 and 40 seconds during which time the 'OK' lamp indicates. This signifies that the response at the three frequency points are identical to a tolerance of  $\pm$ 1dB. If the points are identical to  $\pm$ 3dB the light will flash, otherwise an 'ERROR' lamp lights,

The Dbx 21 disc/tape decoder with Dbx encoded discs.

The new Mach 7 from Wharfedale.



Sansui's Compact Disc Player Prototype.

indicating substandard tape or the wrong tape selector position.

Four sets of calibration data can be entered into the memory and recalled every time the same tape type is used. There are also four factory pre-sets for reference tapes.

The recording and playback circuits have separate power supplies for each channel to avoid channel-to-channel interference. The deck also contains Double Dolby systems, types B and C, three heads, three motors, recording meters switchable between Peak or VU, 4 digit tape/time counter and pitch control; even an optional rack mounting kit can be supplied. All in all a very impressive machine.

## INKEL

This system has the capability of being totally under infra-red remote control. The hand-held unit, shown in front of the cassette deck, has 23 buttons allowing control of the following parameters; Record Deck: Reject and tonearm Up or Down; Tuner: Wavelength selection and 14 Station Memories; Amplifier: Input selection, and Volume; Cassette: Play, Record, Stop, FF, REW or Pause. The unit can be operated at distances of up to 20m. The complete system is retailed at £499 from Logica (Audio Video) Ltd.

## WHARFEDALE

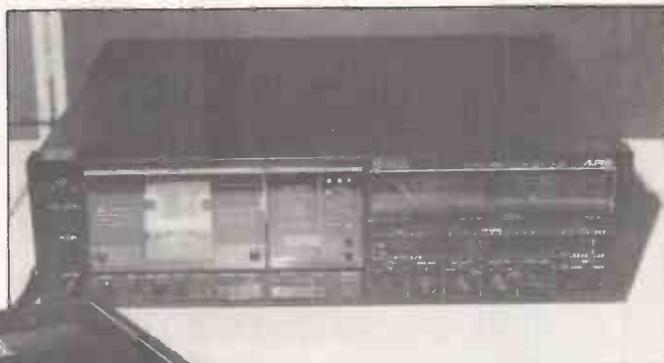
Wharfedale have introduced yet another new range of speakers, the 'Mach' series. The mid-range and bass drive units have been redesigned with ultra lightweight fibre cones, ceramic magnets and ventilated aluminium voice coils. The tweeters are compression driven loaded by horns which are designed to ensure a wide dispersion of sound. The speakers also have tone controls, LED metering and overload protection which can be reset from the front panel.

## QUAD

Quad have introduced a new control unit, the Quad 34, dubbed 'the thinking man's pre-amp.' It is shown here with the Quad FM4 introduced earlier this year. It features CMOS solid-state switching selected by push-buttons with isolated inputs. Four types of top-cut filter characteristics can also be selected to remove distortion without removing musical information. Bass and 'Tilt' controls are provided to control the frequency characteristics of the unit. The Bass can be set to 'lift' (boost) bass or 'step' which acts as a step filter to prevent distortion of the bass caused by a speaker situated in the corner of a room. The 'Tilt' control adjusts the balance across the frequency spectrum. A disc input can be accurately



The Quad 34 control unit and FM4 tuner.



Top of their range, the Alpine AL90.



Sansui's PCM processor prototype.



Fisher's Compact Disc prototype.



Remote control system from Inkel.

matched with a series of plug-in disc input modules. The unit is priced at approx. £219, including VAT.

### SENNHEISER

The SI406 has been developed to assist hard of hearing people who have difficulty listening to television or other audio devices.

Although this product is not of great use to the average reader it is an interesting application of current technology. The transmitter takes the input from a microphone and converts it into an infra-red signal. The user can pick up and decode the signal with a battery powered stethoscope headphone receiver, therefore adjusting the volume to his own level without bothering other listeners. A charger is also supplied for the rechargeable battery.

### DIGITAL AUDIO

The most exciting products at the show this year had to be the Compact Disc players and PCM processors. Although these machines were all prototypes and will not be available until early next year, they will be worth waiting for — the sound quality is astounding. Each disc is 12cms in diameter, can play uninterrupted for 1 hour, and will cost at first around £8. The disc cannot wear out and complex

error detection and correction circuitry in the players will allow for errors caused by dust and scratches on the playing surface.

The PCM processor is also an inspiring prospect. This allows you to record normal stereo analogue signals in digital on to a standard VCR, regardless of the format. In theory, you can have studio quality sound recording in your living room. Typical specifications for

the digital processors are: Frequency response 5 Hz - 20 kHz, Signal to Noise ratio of more than 85dB, Dynamic Range of more than 85dB, Channel separation of more than 80dB, Total Harmonic distortion less than 0.01% and wow and flutter unmeasurable!

Next month in E&MM we will be taking a close look at the Digital Disc and PCM techniques.

**Kenneth McAlpine**

**E&MM**

**Contact Addresses:** Here are the addresses to contact if you would like to know more about any of these products. Please mention E&MM when doing so.

**DBX** DBX Inc., Powke Lane, Cradley Heath, Warley, West Midlands, B64 5QH.

**Mordaunt Short** Mordaunt Short Ltd., Durford Mill, Petersfield, Hampshire GU31 5AZ.

**Alpine** Shure Electronics Ltd., Eccleston Road, Maidstone, Kent ME15 6AU.

**Inkel** Logica (Audio Video) Ltd., 90 Camden High Street, London NW1.

**Wharfedale** Wharfedale, Highfield Road, Bradford, West Yorkshire BD10 8SF.

**Quad** The Acoustical Manufacturing Co. Ltd., Huntingdon, Cambs. PE18 7DB.

**Revox** F.W.O. Bauch Ltd., 49, Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ.

**Sennheiser** Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St. Peter, Bucks SL7 9UG.

**Philips** Philips Electronics, City House, 420, London Road, Croydon, CR9 3QR.

**Sansui** Sansui Electronics (UK) Ltd, Unit 10a, Lyon Industrial Estate, Rockwave Avenue, Greenford, Middlesex UB6 0AA.

**Fisher** Fisher Sales (UK), Units 1-4, Walter Lawrence Estate, Otterspool Way, Watford, Hertfordshire.

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# Digital Recording

## A New Landmark!

In E&MM this month we have the first of two articles dealing with the current developments in Digital Audio recording.

We take a look at the reasons for going digital, Sony's 24 track digital recorder for studios, and equally exciting, Sony's PCM F1 processor which mates with domestic video recorders (VHS or Betamax) to produce what is predictably a landmark in quality home or small studio recording.

To enable readers to appreciate the information in the subsequent pages here are some digital Facts.

### Terminology

- Analogue Audio** — Conventional electrical signals which are continuous and take shape in direct analogy to the sound waves they represent.
- PCM** — Pulse Code Modulation, the technique used to encode digital information from an analogue signal.
- Bit** — A computer term meaning Binary Digit or single element which makes up a binary code.



The Sony PCM-3324.

### History

The concept of PCM, now simply termed Digital, was proposed in the 1930s by a British Engineer, Alec Reeves. PCM has been used extensively in the telephone business (as much by British Telecom as anyone) and by the BBC for feeding FM radio and TV sound from studios to transmitters. However, the system had not been commercially viable until the development of large scale integrated circuits brought the cost down to a practical level. Once in Digital form there are enormous advantages in the way quality can be maintained in the transmission or recording of such signals.

### How does it work?

No matter how complex a waveform is in terms of its frequency content, all

we need to know at any one moment, is its Amplitude. See Fig. 2. If we repeatedly measure the Amplitude at very, very short time intervals we have all the information needed to describe the waveform and thus transmit or store it.

Using computer techniques, the easiest way of describing the amplitude is to use a Binary Code. So a series of pulse/no pulse is created to describe the amplitude at each sample taken. The number of pulse (or Bits), used for each sample will determine how many different amplitudes can be accurately described. Eight bits are used in telephony ( $2^8 = 256$  levels). Thirteen bits are used currently by the BBC for VHF transmitter feeds ( $2^{13} = 8129$  levels) whereas sixteen bits is the accepted norm now for the highest quality audio recording ( $2^{16} = 65,536$  levels). So in the latter case, each waveform sample can take over 65 thousand different values which obviously allows very accurate coding, and therefore high reproduction quality.

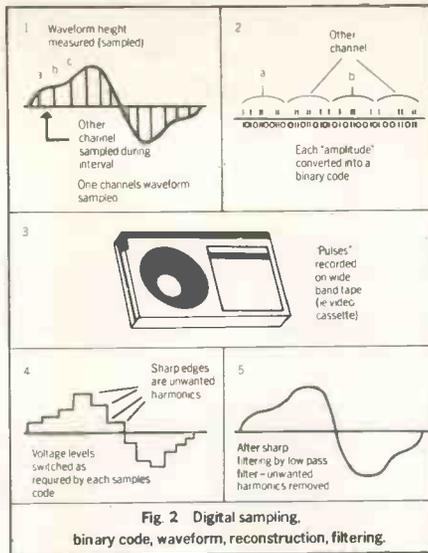
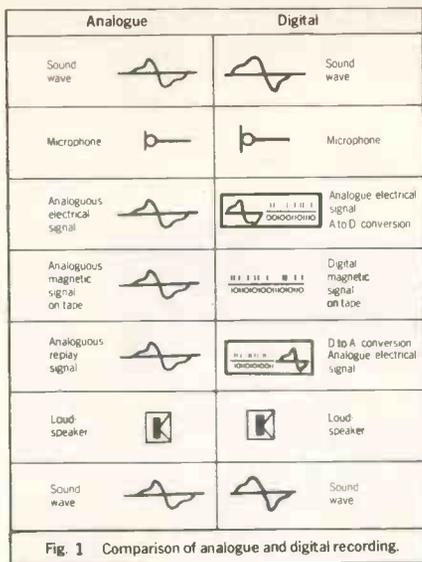
On playback, the codes are converted to the instantaneous amplitudes they represent and a 'ragged' reconstruction takes place. This produces irregularities which contain high frequency harmonics that have to be removed by sharp cut-off low pass filters to result in a faithful reconstruction of the signal.

### Why Digital?

The breaking down of a waveform into a stream of pulses in a binary code has one particular attribute — amazing resilience to any alteration that a transmission or storage medium could produce. It's the logic level that matters and not the shape of the signal or how much noise has been added. As long as the pulses and their 'order' can be recognised then near perfect reconstruction is possible. This is the thing to be grasped about Digital — a present day digital recording as near to perfection as possible. In fact improvements in microphones, amplifiers and

The Sony PCM-F1.





loudspeakers will be the way forward.

### Some Final Considerations

1. The fewer bits used in the code for each sample, the greater the noise generated — called quantization noise. With 16 bits, signal to noise ratios of over 90dB can be achieved!
2. Sampling of each channel must be carried out at least, at twice the highest audio frequency needed. Telephone systems are sampled at 8 thousand times a second. The current

BBC links are at 38 thousand times a second. In tape recording there are a number of systems using 44 thousand times a second. There seems to be a move to standardise on 50 thousand times a second though.

3. Being in 'computer language' form there are emerging some amazing error correction processes which are dramatically accounting for the latest digital equipments overcoming the alleged failings of earlier types.

## Sony PCM 3324 Multitrack Digital Recorder

Just before the annual APRS Exhibition in London, earlier this year, E&MM attended the Press launch of Sony's Studio Digital Multitrack Recorder — the PCM 3324. This was at the Advision Studios in London — a conventional Studer multitrack studio, where for instance, Kate Bush records.

Sony have joined MCI and Studer in adopting what is hoped will become world studio digital format standards. To this end the PCM 3324 has 28 tracks on the tape, with 24 for the 'music', two for conventional analogue recording of editing memos or talkback etc, and two for time code and digital control. Using time code synchronization for example would allow additional 3324's to be synchronized giving 48 channels or more — like conventional analogue machines linked, but without losing two tracks in the process.

However, as was explained by Keith Smith, Sony's Professional Audio products manager, the advantages of digital in multitracking perhaps makes doubling up unnecessary. This, with the absence of tape hiss, very low cross talk between tracks and the perfect multi-generation copying will allow re-thinking of studio practices.

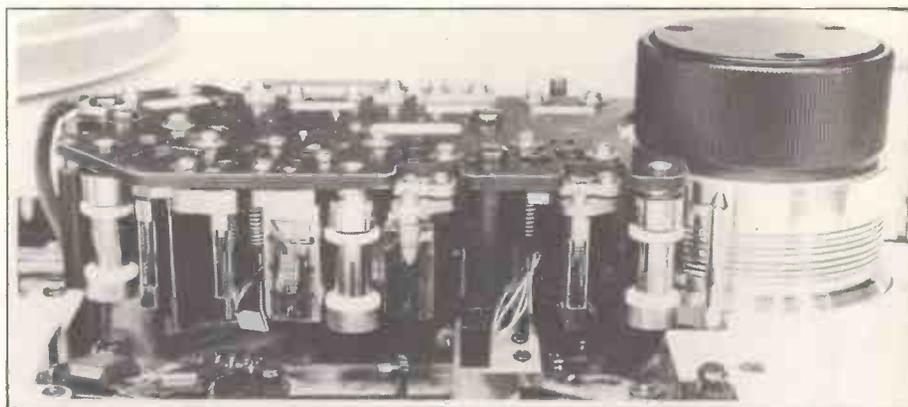
With conventional analogue recorders, the engineer has to be careful where he lays down certain instruments as crosstalk breakthrough is worst between adjacent tracks. If a 'pre-mix' bouncedown is done to clear some tracks there is the little 'nagging' loss of quality to consider. With digital multitrack there is no inhibition on the

choice of track as any cross talk present is not due to the tape but will be in the analogue part of the machine. Multi-bouncedowns produce no change in quality or in added noise.

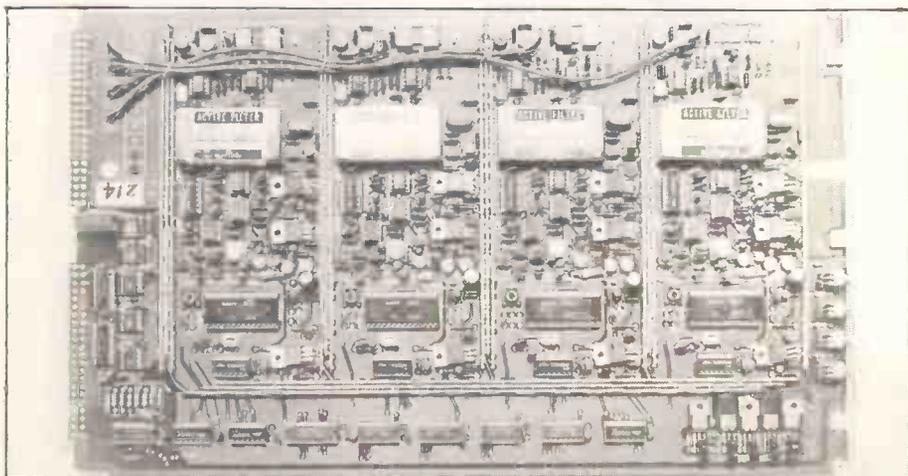
Top quality analogue 24 track recorders use 2" tape — the new Sony uses 1/2" tape. Capital and storage space costs are therefore much reduced. Drop-ins (or punch-ins) with conventional multitrack machines need care, as a 'clipped' signal already on tape will show up on playback. The new system does a digital cross-fade at the punch in point avoiding any sound discontinuity. The punch-in can also be rehearsed. This cross-fade feature also allows conventional spliced editing, however, it is envisaged that editing will be done using equipment such as the DAE 1100 Electronic Digital Audio Editor.

With the advent of the Compact Disc there will undoubtedly be a need to originate multitrack material in digital form so that all the recording stages to the listener are digital.

Good as multitrack analogue is with Dolby A and careful use, we were treated at the press reception to a fascinating comparison of bouncing a signal 24 times down on a conventional analogue system at 30 ips, and on the PCM 3324 (also incidentally at the same tape speed to get the frequency response necessary for the 16 bit/50.4 kHz sampling used). The analogue showed problems with hiss by the eighth generation and later on down the sequence the bass 'woodle' problem of 30 ips operation. By the 24th generation the analogue was decidedly sick! In contrast, comparison of 1st generation with the 24th on the digital, showed no audible difference, in the listening conditions that prevailed at the press release!



Head configuration of the PCM 3324.



PCM 3324 4-channel processor board.

### Brief Specification Of Sony PCM 3324

24 PCM tracks  
Tape speeds 76cms/sec at 50.4 kHz sampling  
Quantization 16 Bit linear per channel  
Dynamic range More than 90dB  
Frequency Response 20 Hz to 20 kHz +0.5 to -1.0 dB  
THD less than 0.05%  
Wow and Flutter Undetectable  
Channel Coding HDM-1  
Error Correcting CRCC and Cross Interleave Code



The Sony SL-F1UB Portable Videocassette Recorder.

## Landmark Prediction

Is it possible to predict what is likely to be a landmark in the recording world? In mid-1982 it is looking as though one particular piece of recording equipment is very likely to be at the centre of just such a prediction. And this writer is fully prepared to stick his neck out!

It's digital, it records on Video cassettes, it's around high quality reel to reel prices, although much cheaper to run than high quality reel to reel at 15 ips, and has created behind the scenes, reactions among hardbitten reviewers and digital sceptics that it is the first digital system without any curiosities!

The system is Sony's PCM F1, with separate mains power unit which feeds any domestic video recorder — VHS or Sony's own Betamax.

There is a matching, similarly sized Betamax recorder (see photo), without TV tuner, which also has a separate mains supply unit. If both the mains units are discarded and Nicad battery packs installed in the F1 and the Recorder, a system is created which must be the highest quality 'portable' yet. For video use there is a third matching programmable tuner/timer unit.

This article will confine itself to the Digital Audio use of the system, but overall the scheme produces very much the complete home video/audio installation.

### Video Involvement

We had the Sony PCM F1 and the supplied AC700 mains unit, shoulder strap, special connection cord for the matching video unit and phono to BNC cords for other recorders or digital dubbing on trial. The matching recorder SL-F1E/UB (PAL/SECAM) and its supplied mains units AC-F1E/UB completed the set up.

The audio inputs, levels and impedances for line and mic, and the line outputs are all similar to present day cassette decks. The video output, input and 'copy out' on the PCM F1 processor are also phono sockets (gold plated!) and are at the standard 1V P to P at 75 ohms.

There is absolutely no problem connecting the arrangement into the standard HiFi system. When recording, the input is fed to the output (after A to D and D to A) which can be handy in a monitoring situation. The mic inputs suit low impedance mics (200 to 600 ohms) and of course with the quality potential available one must have at

least a decent pair of capacitor microphones.

Stereo inputs, line or mic are connected to the PCM F1 A to D unit. Conversion of both channels at 16 bits (optional 14 bit use provided), sampled at 44.1 kHz is used. A Time Division Multiplex arrangement is used to handle the two channels i.e. the left is sampled and quantised and its 16 bits fed to the video recorder, followed by the right channel in a similar way and so on.

On playing back, via the PCM F1, the appropriate D to A conversion provides one of the most superb stereo line signals.

Three small problems were encountered during the use of the system. The first concerns the noise of the video deck — not obtrusive when the music is present and certainly nowhere near that from the U-matic once used to master a disc release, but it can be heard in a quiet domestic environment and at on-site monitoring rooms.

The second relates to the tape position counter on the SL-F1E/UB which is far too coarse in its operation — it counts hours, minutes and tens of seconds. This is probably fine for video programme search (who cares if ten seconds of Coronation Street is missed) but not enough resolution for audio work. Out live with mics the technique has evolved of letting the recorder run on for 5 secs after a take and another 5 secs before a new take. Then the very useful 'return to zero' rewind function is used to get a safe accurate start for playback or a new take. After a take is considered 'in the bag' the counter is set to zero to facilitate this. Also one has the bonus of having the timing displayed for each take.

Lastly, the system cries out for a ganged Master record level control and smaller separate presets. Thus recordings, particularly from mics, can be faded down or controlled without inter-channel level changes. The presets would allow the master to be operated over a decent range of rotation. A final thought — if the presets were controlling the feedback in the mic pre-amp, then the circuits head-room would be automatically tailored to suit higher level inputs. If a separate mixer were used via the line inputs then no doubt all this would be taken care of.

### Ideal Mics to Use

A pair of Calrec CM652D cardioid capacitors were tried. These via their

power unit are unbalanced, which is ideal for the PCM F1 mic input. The mics do, however, easily allow 50 metre plus lead length due to the low source impedance and the high signal levels available. One has to be in the capacitor mic class to take advantage of the PCM system — alternatives, at higher prices would be the AKG C451s or Neumann KM84s.

### Level Control

Peak levels must be properly controlled in digital systems! Analogue tape systems squash slowly — nevertheless the writer feels that too many people drive analogue tape too hard, so there is a relative rise in distortion and an HF compression. Digital has no HF compression problem, right up to the top signal limit. But take the level above that for which conversion is available and the system cannot cope. Actually the PCM F1 appears unique in this respect. Its error correction arrangements seem to deal with short term excursions if one makes them!

The PCM F1 has an excellent LED metering system. This has a 70 dB dynamic range (revealing to see traffic noise showing on classical sessions in London) covering -50 to +20 dB. The words 'over' are lit up if this is exceeded. A feature of the scaling is an expanded warning area. It pays to consider minus 15 dB as one's working zero, especially with mic inputs, and then one should never need to trespass into 'over'.

### Conclusions

It seemed a waste of time to do extensive technical tests — tone sound like the oscillator itself. Especially 10 kHz and above — the absence of modulation noise behind the tone is a revelation. No unsteadiness on a 3 kHz tone could be heard — a notorious frequency to show up wow and flutter. The response was 10 Hz to 20 kHz at all levels.

Subjective impressions — exceptional cleanness and precision stereo imaging of recordings. Especially from a decent pair of mics. Other sources are simply replayed complete with whatever quality or faults they already have.

Tape running costs — Reel to reel at 15 ips probably works out at about £15 per hour whereas with the Betamax tape we used the running costs of the Sony PCM F1 seem to work out at about £8 for 3 hours!

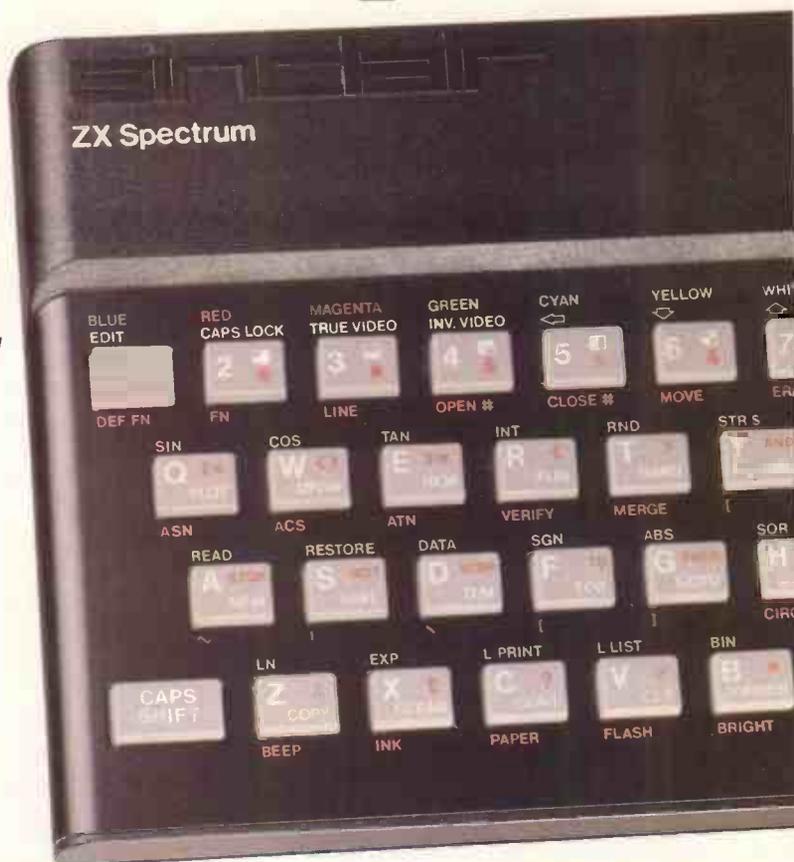
Mike Skeet

E&MM

# Sinclair ZX Spectrum

**16K or 48K RAM...  
full-size moving-  
key keyboard...  
colour and sound...  
high-resolution  
graphics...**

**From only  
£125!**



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

## **Professional power— personal computer price!**

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can upgrade later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

## **Ready to use today, easy to expand tomorrow**

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer—available now—is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232/network interface board.



## **Key features of the Sinclair ZX Spectrum**

- Full colour—8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound—BEEP command with variable pitch and duration.
- Massive RAM—16K or 48K.
- Full-size moving-key keyboard—all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution—256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set—with upper- and lower-case characters.
- Teletext-compatible—user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE—16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC—incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

# um

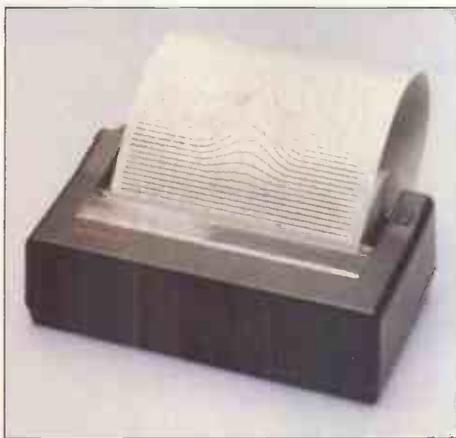


## The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



## The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microflop.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



## RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

## How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard,

Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. Order

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt

\*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ \_\_\_\_\_

\*Please charge to my Access/Barclaycard/Trustcard account no. \_\_\_\_\_

\*Please delete/complete as applicable \_\_\_\_\_

Signature \_\_\_\_\_

PLEASE PRINT

Name: Mr/Mrs/Miss \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_ EMM 810

**FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.**

# ZX Spectrum

Available only  
by mail order  
and only from

# sinclair

Sinclair Research Ltd,  
Stanhope Road, Camberley,  
Surrey, GU15 3PS.  
Tel: Camberley (0276) 685311.

# Spectrum Beepquencer

Those of you who own a Spectrum will no doubt be quite familiar with the BEEP command by now. The BEEP being a square wave tone of specified pitch and duration produced from the Spectrum's internal speaker.

The duration is set in seconds, and the pitch in positive whole numbers for each semitone above middle C or negative numbers below e.g. **BEEP 1, 0** produces a one second tone at middle C whereas **BEEP 1, 12** produces a one second tone at C one octave above.

The Spectrum can therefore be used to create simple tunes by stringing together BEEPS of appropriate frequency and length. However, this is a tedious way to enter in a melody.

To store values for note and duration, and be able to recall these to be 'played' with the BEEP we need a more complex programme, see Figure 1.

## The Beepquencer

This is a sequencer programme which allows you to compose up to 16 repeating melodies, 32 notes in length over a span of 4 octaves. Each note can have a length of 1 to 8 intervals. A length of 1 being the smallest interval. Consider this to be a demi-semi quaver, 2 would represent a semi-quaver, 4 would represent a quaver and therefore 8 a crotchet.

The programme allows each sequence to be written, played or listed and allows complete sets of 16 sequences to be loaded from or dumped to cassette.

## Programme Breakdown

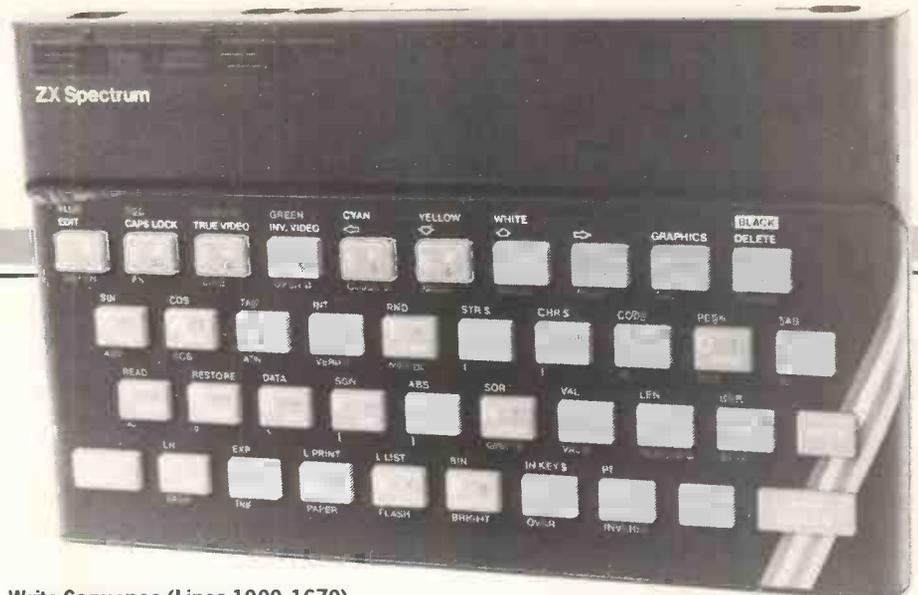
The easiest way to understand how the programme works is to split it into separate sections or routines.

To allow the sequences to be stored and loaded on cassette at any time the note values and lengths are placed in memory above the User Defined Graphics. To do this the CLEAR command is used to provide 1040 bytes after 'Ramtop'. Each sequence requires 1 byte for the number of notes in the sequence, 32 bytes for the note values and 32 bytes for the lengths i.e.  $(1+32+32)*16=1040$ .

The tempo variable 't' is set to 5 at the beginning of the programme but can be varied during the Play Mode.

### Input Menu (Lines 30-170)

The title and options are printed on the screen after which input variable 'x' is checked to make sure that it is within the set range. If Save or Load has been selected a jump is made to the relevant line number. However, if Write, Play or List has been selected, the sequence number, variable 'y', is input. This number is used to provide the base address, variable 's', of the appropriate sequence. The variable 'length' is then set to 4 (quaver) and the appropriate jump made.



### Write Sequence (Lines 1000-1670)

The titles are printed and the number of notes required, variable 'b', input and checked. If 'b' is 0 then the programme returns to the menu, if not, the loop counter variable 'step', is set to zero and the value of 'b' is stored at the base address, 's', of the sequence. A For-Next loop is then used to store the notes and lengths. Firstly, the two flags 'sharp' and 'rest' are set to 0 then the sub-routine for Note Entry is called (Line 1550).

This reads in a character string, n8, used to represent the Octave, Note and Length required. The characters are stripped, checked for errors and the appropriate values for 'rest', 'sharp', c2 (ASCII for note), c1 (offset for octave) and 'length' returned.

If a rest is entered (R), the value of 'note' is set to 100 and the following conversion omitted. Lines 1120-1180 are used to convert the ASCII to a 'note' value. The offsets for 'sharp' and octave (c1) are then added with an extra 24 (since the minimum value for note is -24, 24 has to be added to allow it to be stored in memory). The values for note and length are then stored.

Another subroutine is called (line 3170) which converts the stored values back into a form which can be displayed. The programme then returns for the next note, continuing in this fashion until the required number of notes have been stored. After this the option to Play or return to the Menu is offered.

### Play Sequence (Lines 2000-2170)

The titles are displayed and the options listed. The base address, variable 's', is calculated using the sequence number 'y'. The number of notes in this sequence, 'b', is read from the base address, and the 'tempo', initially set to 5, is displayed. The Play For-Next loop is entered and the appropriate note and length read from memory. If the note read is a rest, i.e. has the value 100, the programme waits for  $(length * t / 2 - 0.037)$  seconds (line 2100). If not a rest, the BEEP (at long last!) is set up for the equivalent time. The -0.037 seconds is to allow for a 37mS delay produced while the Spectrum Basic is read and disassembled before the next note is played. This value was chosen to give the most accurate results on our machine but you may have to make slight adjustments to obtain correct timing on your own. The keyboard is then scanned for interrupt options before returning for the next run through the loop. When the required number of steps has been made the For-Next loop is initialised again. (Which will repeat until the ram's come home!)

### List Sequence (Lines 3000-3350)

The titles are printed on the screen, the base address calculated from the sequence number, and the required number of steps read from this address. The List For-Next loop is set up with this limit, the note and length values read and the List routine used earlier is called (Line 3170).

The first stage in this routine is to increment the loop counter 'step'. If the note read is a rest, i.e. value 100, the note character string, r\$, is 'Rest' and the octave, 'o' set to 0. Otherwise, the octave is calculated from the offset and the note converted to a character string. Once the step, octave, note value and length have been printed the values for the next note and length are read and processed. When the whole sequence has been listed it can be played, a new sequence entered or the menu displayed.

### Save and Load Sequences

Line 4010 allows 1040 bytes from address 31559 to be stored on tape. When this is complete the menu is displayed. Line 5010 allows the 16 sequences to be loaded before returning to the menu.

## Using the Beepquencer

To write a sequence, enter option 1 on the menu and specify the sequence number. The Write Mode will now request the number of notes required. If you no longer wish to continue enter 0, which returns you to the menu, otherwise enter the required number from 1 to 32.

The notes are entered in the form Octave (1-4), Note (C-B) and Length (1-8) i.e. for middle C, a quaver in length enter 3C, for C# two octaves below, a crotchet in length enter 1C#8. When a new length has been entered this is held and used until respecified. To enter a rest, input 'R' with the length required i.e. R4. If at any time you wish to start again enter 'X'. When all the notes have been entered you have the option to Play or return to Menu.

To play a sequence enter option 2 on the menu and sequence number. The sequence can be stopped at any time, a new Tempo entered (1 to 10), a new sequence selected or return to the menu.

To list a sequence enter option 3 on the menu and sequence number. After listing you have the option of playing this sequence, listing another or back to the old menu (board of chips please!)

Kenneth McAlpine

E&MM

OCTOBER 1982 E&MM

# Micromusic

```

10 CLEAR 31555
20 LET t=8
30 REM Input Menu
40 CLS : PRINT "E&MM BEEPQUENC
ER"
50 PRINT AT 5,6:"Write Sequenc
e 1";AT 8,6:"Play Sequence
2";AT 11,6:"List Sequence
3";AT 14,6:"Store Sequences
4";AT 17,6:"Load Sequences
5"
60 INPUT "Selection ";x
70 IF x<0 OR x>5 THEN GO TO 60
80 IF x=0 THEN STOP
90 IF x=1 THEN GO TO 4000
100 IF x=2 THEN GO TO 5000
110 INPUT "Sequence Number ";y
120 IF y<1 OR y>16 THEN GO TO 1
10
130 LET s=31494+(y*65)
140 LET length=4
150 IF x=2 THEN GO TO 2000
160 IF x=3 THEN GO TO 3000
170 IF x=4 THEN GO TO 4000
1000 REM Write Sequence
2010 CLS : PRINT "WRITE MODE"
SEQUENCE ";y
2020 PRINT AT 4,0;"STEP";AT 4,8;
"OCTAVE";AT 4,16;"NOTE";AT 4,26;
"LENGTH"
1030 INPUT "Enter No. of Notes "
;b: IF b<0 OR b>32 THEN GO TO 10
30
1040 IF b=0 THEN GO TO 30
1050 LET step=0
1060 POKE s,t
1070 FOR a=1 TO (2*b)-1 STEP 2
1080 LET sharp=0
1090 LET rest=0
1100 GO SUB 1500
1110 IF rest=1 THEN LET note=100
: GO TO 1200
1120 IF c2=67 THEN LET note=0
1130 IF c2=68 THEN LET note=2
1140 IF c2=69 THEN LET note=4
1150 IF c2=70 THEN LET note=5
1160 IF c2=71 THEN LET note=7
1170 IF c2=65 THEN LET note=9
1180 IF c2=66 THEN LET note=11
1190 LET note=note+sharp+c1+24
1200 POKE s+a,note
1210 POKE s+a+1,length
1220 GO SUB 3170
1230 NEXT a
1240 INPUT "Play-P or Menu-M ";w
$
1250 IF w#="P" THEN GO TO 2000
1260 IF w#="M" THEN GO TO 30
1270 GO TO 1000
1500 REM Note Entry Routine
1510 INPUT "Octave,Note,Length "
;w$
1520 LET l=LEN w$
1530 IF w$="X" THEN GO TO 1000
1540 IF l<2 OR l>4 THEN GO TO 15
00
1550 LET c#=w$(1): IF c#="R" THE
N LET rest=1: LET c4=VAL w$(2):
GO TO 1650
1560 LET c1=(VAL w$(1))*12-36
1570 IF c1<-24 OR c1>12 THEN GO
TO 1500
1580 LET c2=CODE w$(2)
1590 IF c2<64 OR c2>71 THEN GO T
O 1500
1600 IF l=2 THEN RETURN
1610 IF l>3 THEN LET sharp=1: L
ET c4=VAL w$(4): GO TO 1650
1620 LET c#=w$(3)
1630 IF c#="#" THEN LET sharp=1:
RETURN
1640 LET c4=VAL w$(13)
1650 IF c4<1 OR c4>8 THEN GO TO
1500
1660 IF c4<>length THEN LET leng
th=c4
1670 RETURN
2000 REM Play Sequence
2010 CLS : PRINT "PLAY MODE"
SEQUENCE ";y
2020 PRINT "Enter T to change Te
mpo";AT 1,16;"A to Stop";
N for New Sequence";AT 1,24;
M to
return to Menu"
2030 LET s=31494+(y*65)
2040 LET b=PEEK s
2050 PRINT AT 21,0;"TEMPO ";t
2060 FOR a=1 TO (2*b)-1 STEP 2
2070 LET note=PEEK (s+a)
2080 LET length=PEEK (s+a+1)
2100 IF note=100 THEN PAUSE leng
th*1/2-0.037: GO TO 2100
2110 BEEP (t*length)/100-0.037,n
ote-24
2130 IF INKEY$="M" THEN GO TO 30
2140 IF INKEY$="A" THEN INPUT "P
ress Enter to start ";z$
2150 IF INKEY$="T" THEN INPUT "T
empo ";t: GO TO 2000
2160 IF INKEY$="N" THEN INPUT "S
equence Number ";y: GO TO 2000
2165 NEXT a
2170 GO TO 2000
3000 REM List Sequence
3010 CLS : PRINT "SEQUENCE NUMBE
R ";y
3040 PRINT AT 3,0;"STEP";AT 3,8;
"OCTAVE";AT 3,16;"NOTE";AT 3,26;
"LENGTH"
3050 LET s=31494+(y*65)
3060 LET b=PEEK s
3070 LET step=0
3080 FOR a=1 TO (2*b)-1 STEP 2
3090 LET note=PEEK (s+a)
3100 LET length=PEEK (s+a+1)
3110 GO SUB 3170
3120 NEXT a
3130 INPUT "Enter Play-P, New Seq
uence-N";AT 1,16;"or Menu-M ";l$
3140 IF l#="P" THEN GO TO 2000
3150 IF l#="M" THEN GO TO 30
3160 IF l#="N" THEN INPUT "Seque
nce Number ";y: GO TO 3000
3170 REM List Routine
3180 LET step=step+1
3185 IF note=100 THEN LET r#="Re
st": LET c#=0: GO TO 3340
3190 LET c=INT (note/12)+1
3200 LET note=note-((c-1)*12)
3210 IF note=0 THEN LET r#="C"
3220 IF note=1 THEN LET r#="C#"
3230 IF note=2 THEN LET r#="D"
3240 IF note=3 THEN LET r#="D#"
3250 IF note=4 THEN LET r#="E"
3260 IF note=5 THEN LET r#="F"
3270 IF note=6 THEN LET r#="F#"
3280 IF note=7 THEN LET r#="G"
3290 IF note=8 THEN LET r#="G#"
3300 IF note=9 THEN LET r#="A"
3310 IF note=10 THEN LET r#="A#"
3320 IF note=11 THEN LET r#="B"
3340 PRINT TAB 1;step;TAB 10;0;T
AB 16;r$;TAB 29;length
3350 RETURN
4000 REM Save Sequences
4010 SAVE "SEQUENCES"CODE 31555,
1040
5000 REM Load Sequences
5010 LOAD "SEQUENCES"CODE 31555,
1040
5020 GO TO 30

```

Figure 1. The Beepquencer Programme.



# KATE BUSH

A unique vocal style, piano and Fairlight instrumental playing, and new role as producer as well as manager, designer, choreographer, composer and arranger, inspired this interview about Kate's music and her new album 'The Dreaming'.

There appear to be two major steps that influenced you as a singer: that your family's interest in music inspired you to teach yourself the piano, and that after securing your first recording contract you started mime and dance lessons.

**Kate:** Yes, that's right. My father played the piano and we also had an old harmonium in a barn next to our house, where I'd spend a lot of time just pedalling away hymns. I really loved their melodies and harmonies and worked out myself that a chord was made from a minimum of three notes and by changing one of these notes you could get completely different chords to work with the new note. In a way, that started my interest in the way things could sound and feel very different just by putting different chords to a tune. As the harmonium got eaten up by mice, less and less of the stops that selected the sounds worked, so naturally I turned my attention to playing the piano.

I couldn't read music at all, it was really a question of having a logical approach once I knew where middle C was. Even though I wasn't much good at maths at school, I could see the logic of how the piano was working and got on with it myself very well. I've now been playing the piano for many years and I really did start off in the most basic way. After a couple of years I'd got a slight style and since then I've simply developed it

more, just by writing and then practising playing the songs. Often, I'd be writing songs beyond my technique which would stretch my playing even further.

*In the early days, did you write the lyrics first?*

I usually started off with the tunes and used library books for a source of lyrics, but I couldn't get on too well with the restriction of always fitting the music to the words. So I started making my own lyrics up alongside the music.

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"I realised there's so much potential using movement with songs."

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*And then you became involved with dance?*

Yes, but that didn't happen until I was 17 because I didn't really get on with the dance teacher at school. Once I'd left school I tried to get into a dance school full-time but no-one would accept me as I had no qualifications in ballet. I had almost given up the idea of using dance as an extension of my music, until I met Lyndsay Kemp and that really did change so many of my ideas. He was the first person to actually give me some lessons in movement. I realised there was so much potential with using movement in songs, and I wanted to get

a basic technique in order to be able to express myself fully.

Lyndsay has his own style — it's more like mime — and although he studied in many ballet schools and is technically qualified as a dancer, his classes and style are much more to do with letting go what's inside and expressing that. It doesn't matter if you haven't perfect technique.

*Was the dance / movement approach just a novel visual image for you or did it actually help in the composing of songs?*

The thing is, when I'm actually writing something, I can't conceive the dance at the same time. But when I'm listening and watching dance performances I can conceive musical ideas.

*There are several avenues of composing procedures open to you: through the lyrics, the dance, the melodies, rhythms or harmonies, or even the computer. Do you follow any particular one?*

Since I've first started writing, the styles and attitudes have changed. Initially, it was just 'me and the piano' and I would write the song until it was completely finished — the lyrics, the tune of one song would take me a couple of weeks. For the last two albums it's been much looser and I've been working with rhythm machines as well as the keyboard and using subject matter already in my head. I'd then make up the music almost on the spot for the subject matter.

*How did you get on with rhythm machines?*

It took me quite a while to get used to working with them because they seemed very limiting. I like rhythms to 'move', especially in the ballad songs where the tempo would ebb and flow with the words, stopping and slowing down as necessary. Suddenly, having to work with a very strict rhythm, I found it almost impossible at first to tie myself down to the rigid beat. Once I had got used to this, I found that I could work 'in between' the beats.

## KATE BUSH

Born 1958. Has two musical brothers. Studied violin then piano (self taught). Left school at 16 and gained a recording contract with EMI after sending demo financed by Floy Dave Gilmour. Between EMI contract a first single studied mime and dance. Debut album 'The Kick Inside' produced by Andrew Powell at the end of '77. C track was 'The Man With Child In Her Eyes' written when only 14. This was followed by 'Wuthering Heights' since reluctantly released in '78, only to establish Kate's originality overnight.

Kate has always taken an active interest in every aspect of her career. She is in charge of her own management company and composes all the songs she performs, as well as arranging much of the harmony parts. Plays piano on Yamaha CS80, and now the Fairlight on her albums and does her own choreography for live shows and video. Second album 'Lionheart' included memorabilia

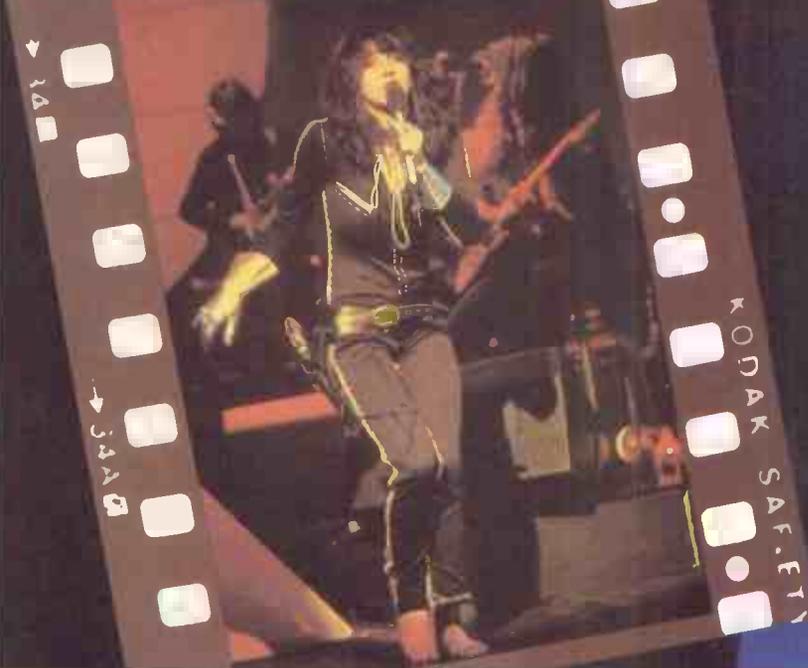
One other aspect of your dance intrigues me, since you have created a style that visually compliments modern music, and that is your own preferences and influences for dance styles in this country and abroad.

I don't really avidly follow contemporary dance styles — Lyndsay Kemp definitely was the starting point for me although I like to think that I don't visually copy.

What I try to do is work in front of mirrors and then without whilst the music is playing and seeing what happens. This helps me to create my own choreography best. Obviously, a lot of my movements come from my training — during that time Robin Kovak certainly had a big influence on me at the Dance Centre. She certainly gave me the strength to develop my own style.

I now do my dance rehearsing in a small studio room near my home and have a set group of dancers that I can call upon to work with. My musicians haven't changed much either that work with me.

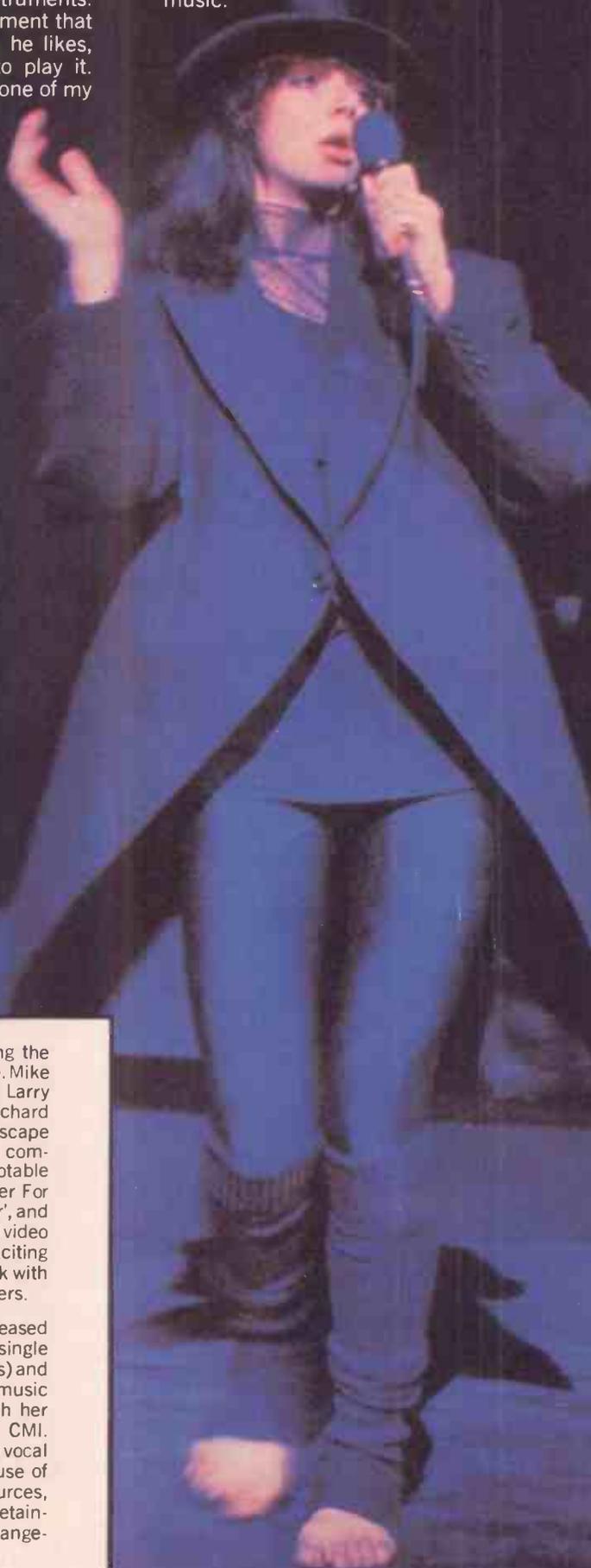
Even from your 'Lionheart' album



days there's been a noticeable interest in unusual instruments: panpipes, mandocello, strumento da porco, sitar, koto, balalaika, harmonica, recorders and musical saw.

Yes, that's because Paddy Bush, who has played on my albums, has made a lot of instruments since he studied at the London College of Furniture, specialising in medieval instruments. Whenever he finds an instrument that doesn't appear to exist that he likes, he'll make one and learn to play it. Consequently, it ends up on one of my tracks!

Sounds are very important to me and I think there are a lot of standard instruments that don't actually sound that emotional or that interesting, which is why it's really nice to have the flavours of these other instruments. In so many cases they are not used any more and that means people don't recognise them, giving an air of mystery to the music.



tracks like 'Wow', 'Oh England', 'Hammer Horror' and 'Don't Push Your Foot on the Heartbrake', with use of unusual instruments, mandocello, strumento da porco, mandolins, harmonium, etc), as well as synthesisers, Fender Rhodes, Hammond organ, acoustic drums and guitars, and electric guitars.

Began to co-produce her own records with first EP 'Kate Bush On Stage' (assisted by Jon Kelly) and did live shows early in '79 that showed not only her wide ranging vocal style but also her individual piano style. As a solo performer, her contribution was a lengthy 2½ hours of singing, dancing and mime during successful UK concerts and a 6 week European tour, BBC TV 'Kate' and 'Dr Hook Special', and American TV 'Saturday Nite Live' shows, plus an appearance with the London Symphony Orchestra.

Kate's third album 'Never For Ever' showed a refinement and strengthening of her vocal style, a continuing use of a variety of instruments old (generated by

Paddy Bush) and new (introducing the Fairlight played by Duncan Mackay). Mike Moran played the Minimoog and Larry Fast added Prophet lines, whilst Richard Burgess and John Walters of Landscape inspired Kate even more towards computer music sampled sounds. Notable tracks included 'Babooshka', 'Never For Ever', 'Delius', 'All We Ever Look For', and 'Breathing'. Also 'Violin' which on video particularly emphasised Kate's exciting and original style. Did session work with Peter Gabriel, Roy Harper and others.

Latest album 'The Dreaming' released in September '82 followed the title single (with Rolf Harris and Percy Edwards) and put Kate well into the electro-music limelight as a producer along with her own contribution on the Fairlight CMI. The album reflects her interest in vocal counterpoint, strong vocal solos, use of human and mechanical sound sources, CMI sampled sounds, whilst still retaining well constructed musical arrangements.

## "The Fairlight in a way is what I've been waiting for."

Duncan MacKay introduced the synthesiser, Fender Rhodes, Prophet and the harpsichord in my songs. I've used the synthesiser in particular because it was part of the new music at that time. I must admit I'm now much less interested in synthesisers, especially since the Fairlight CMI. I just find a lot of the sounds that perhaps before were interesting a little too machine-like. What attracts me to the Fairlight is its ability to create very human, animal emotional sounds that don't actually sound like a machine. I think in a way that's what I've been waiting for.

Richard Burgess of Landscape introduced me to the CMI at Syco Systems in London and Steve Payne who works there has helped me a great deal with it. I've now got my own Fairlight which I use — the problem was, having met the Fairlight on my last album 'Never For Ever' (played by Duncan MacKay) I'd realised that it was invaluable for my music.

*Do you regard the CMI now as your most important instrument?*

In many ways it is, although I think piano still holds above it because for me it's more versatile than any kind of synthesiser. It's like an old friend in a way. Often a certain sound that you want on a synthesiser for a particular piece can be distracting when I'm composing and it's nice to use the piano instead because it doesn't conjure up anything particular — then later translate those ideas to a synthesised sound.

*Occasionally you've used the Yamaha CS80 polyphonic synthesiser instead of the piano for your keyboard playing. Do you get yourself involved in the technical intricacies of the instrument?*

I would never say that I'm really that knowledgeable about the CS80, I've mainly used it with the preset sounds. What I like about it is its velocity/pressure keyboard sensitivity — it makes it much more 'human'. A lot of its sounds have more emotion too, perhaps from its dual sound layering although mainly the touch sensitivity.

*Can you read music now?*

No I can't — I read chords but not the actual music.

*So how do you arrange all the instrumental and vocal parts in your songs?*

For most of them I literally just run the tape and learn them in my head and then translate them. I multitrack my own voice parts, having worked them out first at home. Sometimes I can tell that they're going to work in harmony without having to put one down and then work to that, but it depends really.

## "I just go for what sounds right."

*Do you work up from the root and then add the third and the fifth?*

No, I never work that way — I just go for what sounds right, and never think technically about thirds and fifths, because very often I think fourths and sixths could be better. I like to use parallel movement for a more medieval feel and I also sing unrelated notes against the harmony, say dropping semitones, which help to create a lot of tension. But I do try to avoid thinking about the technical things when I'm working — it's afterwards that I like to think about those aspects.

## THE DREAMING



For the male voice parts, I just sing to them what I want them to do and I tell them the particular phraseology and timing, then they go out and do it, while I oversee it in the mixing room. I'm lucky in that they're not really session singers but more friends with good voices.

*There's a lot of counterpoint in your compositions. Do you find this comes naturally?*

Yes, it's something that I find works in layers as well. For example, normally the song with its basic tune and chords would be down and then, as things start to go on more to the track, I can just hear holes that need to be filled in a certain way.

Sometimes I would be doing this with tapes at home or during a meal break at the studio. I'd go round and round parts of the tape and sing with it.

*So your procedure is to compose the piece on the piano with the lyrics and have some definite ideas for performing it at home.*

For the actual tune, whilst any additional harmonies would be added afterwards using a tape with the basic piece on it. I use a Revox ½-track machine to sing along with — I never put it down though at this stage — I just sing with it to see if it works. Really, it's for playback to help me, and I would use an 8-track studio for demos. I've also been using the Teac Portastudio 144 which I find useful.

*Do you have any set of composing your harmonies?*

None at all, it depends completely on the song. Whatever the song's saying then that little hole in there that's waiting for a harmony needs something special. For example, in the 'Hammer Horror' song I thought out the clashing harmonies carefully and the 'Violin' piece came about because that was the only instrument I was ever taught.

## "In the past my voice has never sounded the way I wanted it to."

*Your vocal melodies are very original and there's a recognisable style of swooping pitch glissandos, acciaccatura vocal decoration plus a preference for 3rd/root jumps. Then of course you have an extremely wide pitch range.*

In fact, I've stretched the pitch range over the years. What I used to do in my earlier performing was to go for notes higher than I could reach easily in the song, so by the time I'd written the song and played it for a good few days I could actually reach those notes. By making my writing more acrobatic than I was, I was stretching myself to it — it's something that's grown over the years. Definitely my voice has got stronger in the last two years, because on 'The Dreaming' I was so aware of the difference in my voice. Not only is it much stronger, but it is also more controlled.

It has been frustrating for me in the past because my voice has never sounded the way I wanted it to and so whenever I was listening to the albums it was unbearable for me. It was not just the weakness but the style of it. I've always tried to get my voice the way it's starting to be now. Because the songs always controlled me, they were always tending to be in a higher range — it sounds strange but I think that when you write songs, very often you don't have control of them. You can guide them, but they have their own life force really.

My use of decorative notes probably comes from Irish music — my mother's Irish — and in my childhood my brothers were very into traditional music and we could hear it in the house all the time. The airs and inflections are beautiful and I love Irish singing. On the 'Night of the Swallows' Liam O'Flynn plays the Uilleann pipes and the penny whistle, to give this track an Irish flavour.

I think my use of thirds is because in a lot of songs there are times when I want it to sound like someone actually talking rather than singing. There are things that you say that often people don't put into songs and I quite like to use those lines. Quite often when people speak they naturally use the 'third to root' pitch change in their voices — little tension marks that take it up a couple of tones.

*Another interesting aspect of your singing style is the way you change your voice tone.*

I purposely try to do that because I do feel that every song comes from a different person really, so this is one way of making something different about it. I like to 'create' voices — I've been trying this over the years. I often find that I do 'word painting' without realising and my singing/speech



style probably comes from the Irish influence again.

Sometimes I don't think the words are important and I'll just use sound shapes, which establish the mood. The lyrics of the lead vocal are awfully important to me while the backing vocals are very often just trying to create a picture (as in 'The Dreaming', with "na na - cha chan cha cha -")

I hardly ever use the Vocoder — only once for a tiny effect on 'Babooshka' (Never For Ever LP) to make the drum sound like the title.

We've been experimenting a lot with effects units — particularly the flanger, to get different textures with the voices. In several of the songs there are at least four or five layers of voices. In order to have them not sounding like one clump, we've had to try and separate them by treating them and playing them carefully in the stereo field. Some have more reverb or more echo than others too.

*Listening to your past albums you seem to like running verses into choruses, without the more usual 'here comes the chorus' feeling.*

Yes, I suppose so, but you see, for me, I know where all the choruses are because they're so obvious to me, although it's interesting you say that. It's quite likely, too, that people say they can't dance to my music at parties or discos, but of course, I can dance to it, so it doesn't bother me.

The only person I've met who is really into the same kind of approach to playing as I do is Peter Gabriel. He seems to be working 'behind the scenes' in a similar way — he's going for the emotional content of the music and lyrics and he changes his voice. As for my use of local vibrato, if there's a song that needs it, I'll put it in. I have used a choirboy's voice (it was Richard Thornton) to get a different feeling on 'All The Love'.

## "The space in between is as important as the words."

*During mixing do you consider spatial placement of sounds in relation to your obviously spatial dance movements?*

No, I don't think that far really, but that's a nice idea. I really do just listen to the music just as an audio thing when I'm working out the dance. I do place the sounds — certainly more so on this new album, since it's the first one I have produced myself and anyway it's the first time I've known enough to do that.

*Do you 'chorus' your voice a lot?*

We have used delay machines for this on a couple of tracks, and added a very slight harmoniser effect as well as sometimes very tight double tracking. It really does depend on the song and how strong the lead vocal needs to be. For a more delicate song it would be wrong to put a heavy harmoniser on it — it would sound so affected. We've also been using an awful lot of compression on the new album, with nearly everything in fact. It's interesting the kind of dynamics you can actually create, which is what I really never understood before. Especially with

voices, as you start compressing them more and more, so many different levels start coming through on it — the breath particularly, and for me that's as important as the words: it's the space in between.

*In 'All The Love' the 'sighs' seem to be important in this way.*

Yes, it's the idea of using the breath as a voice. There was another backing vocal sung by our engineer and it's fantastic because in the gaps there are these huge passages of him going "haah-uuh" where you can feel the breath moving past.

*Which studios have you recorded in?*

Normally I've recorded between Air and Abbey Road Studios, but this time I seemed to make the album at studios where I had to grab time between other major artists because I wanted particular facilities. We worked at the Townhouse, Abbey Road, Odyssey Studios, and did the digital mix at Advision Studios with Paul Hardiman using the Sony machine. The final recording wasn't digital even though I would prefer to do it that way. Editing with the digital recorder did seem to be difficult — some things were quicker but others were easily three times as long.

*Does your music require a lot of editing?*

It really did this time, especially when you've got mixes that are very complicated and demanding. We'd get the whole mix and there'd be one little bit that wasn't quite right of an echo plate would distort on us, then we'd just have to edit that in.

## "I like to create voices and sound shapes."

Having got the whole field right it seems crazy to do a whole track again, so we prefer to do spot edits.

*What's your procedure for recording?*

First we do all the backing tracks in one go and then we'd work on it in layers until we'd got all the other musicians out of the way, so then I can really concentrate on my own stuff. It took weeks to do the vocals, especially because we were having to find the right effects and ambience for each voice. Then on top of that came the Fairlight.

*Did you work on the Fairlight at home?*

Yes. I did as much work at home as I could, but it got very difficult because I was usually in the studio all day and when I got back at night there were tapes of that day's stuff that I would listen to in order to decide what to go on to the next day. So in fact I wasn't really getting much time and when I could I'd tend to do the Fairlight in studio mealbreaks in the control room.

I suppose I could have done tracks like 'The Dreaming' with a large amount of Fairlight, but it does lack a little top for some sounds and there are some things, like loops, that can be tricky to do. I ended up using three or four of the presets available on the Fairlight's menu, while most of the others were sampled. What we tended to do was try samples at home although they would often be too noisy to use, so we'd then do them again in the studio. I have to be honest about the instrument — I really only have a working knowledge and everything I want to do I can. I love the sampling facility, it's one of the best things — being able to put your own sounds in and then play around with them. Features like the reverse play are useful too. There's loads I can't do yet I'm sure, but I'm taking it step by step.

*I would have thought the Fairlight was almost a 'trade mark' for you because it can conjure up aural images while you're making the visual dance movements.*

Absolutely, it does work so well for me. As an educational instrument, too, it's fantastic. Initially, I thought a lot about buying one because it was so much money. When I started this album I did try hiring one in but it was costing me so much and I knew that to do everything I wanted I'd need it more or less all the time. So I decided to buy it and haven't regretted it once. I'm also interested in the new rhythm facilities now available.

Coming back to 'The Dreaming' album, we certainly enjoyed using real sounds as well. The title track in particular has Rolf Harris on the Digeridu, Percy Edwards mimicking animal noises, bullroaring from Paddy Bush and crowd noises by Gosfield Goers!

*Which drum machine do you use?*

I've got a Linn drum machine which is very good for demos, but I don't like it to be used in the finished thing. I think you can tell it's the Linn — it's got a very specific sound — and I can often recognise it on the radio.



Some particular sounds that might stand out are the 'car crash', which was a 'screech' on the Fairlight plus several recorded 'bangs' mixed together. It was in fact the engineer's car door miked up! There's also fluttering birds and an orchestra chord sampled on 'The Dreaming' track and plenty of others elsewhere.

I like to be involved with everything that's going on the album and I do have a lot of interest in the technical problems that crop up as well — that's really happened over the last couple of years. In a way, the technical side of what is happening is as inspirational as what you get out of it.

*The new album has a stronger voice feel to it and plenty of variety in the percussion.*

There has always been plenty of vocal activity at heart before, it's just that it's never actually manifested as such. As for drums, it's basically a drum kit and for a couple of songs other things like Chinese drums, military bass drum and African drums are used. The other interesting instrument used on 'The Dreaming' is the digeridu played by Rolf Harris. He is such a good player and real honour to work with.

*I like the use of silence and space in your music.* I've begun to value silence much more because I think even from the start I realised silence is as important as the notes. But actually getting your songs to realise that is so much harder, and also knowing where to put the silence. Again, this album is probably the first one that has actually let silence into it. The bass lines are kept fairly 'dry' which helps too, and my piano playing is never over-busy — it probably couldn't be though, my technique holds me back quite a lot there! I use the synthesiser for things that I definitely want to hear, so I will specifically ask for that, but again in a lot of cases, maybe I've asked them to do something and while they're mucking around I'll pick on another sound that's so good we'll go with that.

## "The Dreaming — emotionally demanding."

The LP for me has been quite fulfilling. I feel I have made a step forward which is always great for one artistically obviously. And I suppose one of the things that I do feel pleased about is perhaps that I feel we've got a sense of the emotional value from each song to have come across in some way. It was very emotionally demanding, especially some of the tracks, because of the subject matter. It's taken a year to put together, with a lot of studio time taken up. It was actually finished in May, but we felt it was better to release it in the autumn — but it's really such a long time to wait.

While working on the album I can't possibly work on the dance as well and I've got very unfit over the last year. A few weeks ago I started again in complete agony! But I'm not so stiff now and we're getting the dances done. We've not planned any concerts yet — I wanted another two albums before I could tour

them again. Now I've got that with 'Never For Ever' and 'The Dreaming', so it'll be nice to do another tour. The big problem is the dance as well as the singing when performing, as this does put a lot of extra pressure on me personally — but the determination alone to do the show always keeps me going.

I would like to mention that it's interesting to do this interview, because the music for me is, of course, the most important thing. I feel it's what I know most about and although I'm into dancing it's much more a matter of using my ideas for that. With the music, it's been part of me for a long time and I'm really looking forward to the music that instruments like the Fairlight will bring in the next few years.

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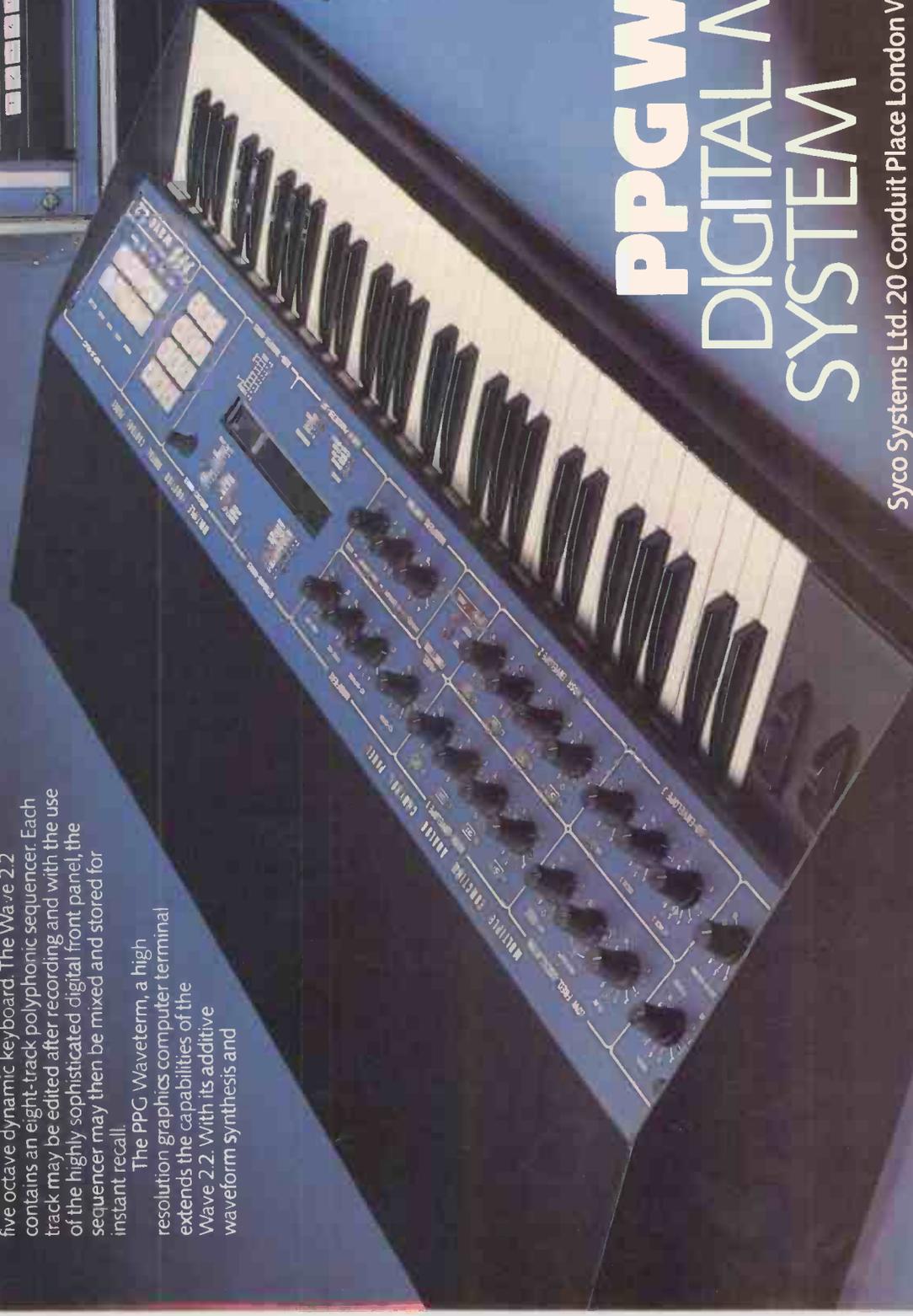
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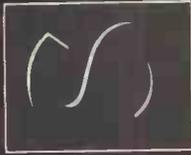
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# PPG WAVETERM DIGITAL MUSIC SYSTEM



# THE DREAMING

by Kate Bush

Title track from the LP: EMI EMC 3419

You've probably noticed by now, if you're a regular reader, that E&MM transcriptions provide a special opportunity to study works by musicians who are making an important contribution to electro-music. This month's setting of 'The Dreaming' is no exception, as Kate Bush has developed a style of composition that relies heavily on vocal lines. Many of these are multitracked by Kate and use different timbres created by her voice or through flanging and other processors.

The Fairlight CMI also adds a new dimension to Kate's music — a soundscape of sampled sources. Even though some of the samples are

actual music, e.g. full orchestra chord played ff, there is no suggestion that these make the piece an 'electronic copy'. In fact, combined with the sounds recorded direct, the final mix creates an extra depth and atmosphere all of its own.

Listening to the album track alone, the music appears complex and is hard to analyse. With the score in front of you, the picture instantly changes and the skill of the composer is revealed.

## An original Electro-Music Transcription by Mike Beecher

### Notes:

Percussion parts shown on bass staff when important (pitch related). Drums played by Stuart Elliott.

### Instrument Codes:

D = Digeridu by Rolf Harris, W/M Wood Metal tap, HD = high pitch drum, LD = Low pitch drum, T = Tambourine, (F) = Fairlight CMI, P = Piano, Baa = Sheep noises by Percy Edwards, PI = Pipe sample, ORCH = orchestra chord sample, W = Whistle sample.

### Voices:

KB = Kate Bush solo (with ADT left/right), KBD = Kate extra track (dry), (FL) = Flanged effect, Haw- = Haw-uh-Haw (exhale-inhale-exhale!), MV = Male voices, Crowd by Gosfield Goers, Bullroaring by Paddy Bush.

### Stereo:

(L) = Left, (C) = Centre, (R) = Right, (+RE) = With Reverb, (+E) = with Echo.

Steady 4

Vocal Parts

Instrument Codes

on the bon-net of a van- a. Ma- ny an Ab- o-rig-in-es mis-

See the light ram thro' the gaps in the land.

ta- ken for a tree 'til you near him on the mo- tor-way the tree be- gin to breathe. See the light ram thro' the gaps in the

The musical score is presented in a multi-staff format. The top staff is for 'Vocal Parts' and includes lyrics such as 'MV humm', 'KB Um Ban- ga goes a- noth- er Kan- ga', 'on the bon-net of a van- a.', 'Ma- ny an Ab- o-rig-in-es mis-', 'See the light ram thro' the gaps in the land.', 'ta- ken for a tree 'til you near him on the mo- tor-way the tree be- gin to breathe.', and 'See the light ram thro' the gaps in the'. Below the vocal parts are two staves for 'Instrument Codes', showing a variety of rhythmic patterns and effects. The bottom staff is a bass line with drum notation. The score includes various annotations such as '(L)', '(R)', '(F)', '(C)', '(+RE)', and '(+E)' to indicate stereo placement and effects. A small illustration of a car is placed above the 'Car Squeel' notation in the second system.

# The Dreaming

Kate Bush

MV hmmm In the mo-r-ning.

land. MV Haw - - Ha - - Ha. KB(F/L) Come in with the Come in with the

PI

Is the New Man Is my den- ted van- a

gol- den light. Come in with the gol- den light.

PI

ma roomoo moo, aah (Baa) (Baa)

MV na Cha - - Cha - ah ah ah na na na na

P (F)W

(Baa) a-woo-me-ra (Baa) (Baa) (Baa)

gee bee na na na na na na cha - - cha - ah ah na na na na na gee- ee ah ah

P (F)W

(Baa) KB The ci- vi- li- sed keep a- live the ter- ri- to- ri- al war.

na na na na na cha - - cha - KBD See the light ram thro' the

ORCH (F)(+RE)(+E)

E-rase the race that claim the place and say we dig for Ore or Dan-gle Dev-ils in a bot-tle and a

gaps in the land.

ORCH (F)

*sfz*

push them from the Pullof the Bush.

You'll find them in the ro- ad.

+MV

See the light ram thro' the gaps in the land.

In the ro- ad

See the light bounce off the rocks to the sand.

KB(FL) Come in with the gol- den light.

In the mor-ning

With no war-ning

Come in with the gol- den light.

Come in with the gol- den light.

PI

PI

We bring in the rig-ging.

(FL)

jun jun jun jun jun jun

(Baa)

(Baa)

*ff*

MV gee

na na na na na

PI

W+P(R)

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(Baa) (Baa) KB a- woo-me-ra (Baa) (Baa)

cha - - cha - ah na na na na na gee - - cha - - cha - ah ah

T T T T

(Baa) (Baa) KB a- woo-me-ra (Baa) (Baa)

na na na na na gee ee ah - - ah - na - - na - cha - - cha - ah ah na na na na na gee - - ee -

T T T T W(F)+P

(Baa) (Baa) (Baa) (Baa) huh- mo-mo-ma- ny an Ab-or- ig- in-e's mis-ta-ken for a

ah - - ah - na - - na - cha - - cha - ah - - ah -

T T T T ORCH sfz

tree You near him on the mo-tor-way the tree be-gin to

(Dow Dow) See the lights ram thro' the gaps in the land.

T T T T ORCH sfz

breathe E-rase the race that claim the place And say we dig for

ha - - he - - ha - - ha - - ha - - ha - -

T T T T ORCH sfz

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Ore Dan- bot- tie and a push them from the

See the lights ram thro' the gaps in the land

ORCH (F)

Pull of the Bush A Ban- ga goes a- noth- er Kan- ga on the bon- net

ff See the sun set in the hand of the man.

CAR SQUEEL (L) (R)

ORCH (F)

+ DOOR CLANG

of the van- a You find them in the

See the light bounce of the rocks to the sand.

ORCH (F)

CROWD:

road In the

See the light ram thro' the gaps in the land. MV he - - ha - - MV ha - - ho - - he - -

ORCH (F)

Road. the Pull of the Bush

+ echo feedback

ha - - See the ligh- eee- ee See the light

CROWD: ~~Handwritten scribble~~

CROWD: ~~Handwritten scribble~~

ORCH (F)

ff

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The Pull of the Bush

bounce off the rocks to the sand. See the sun

CROWD

set in the hand of the man.

(Stereo) Fluttering birds wings

fade up Digeridu (chorused (L/R)) HD HD

birds chirping fade birds

*sfz* ORCH (F) HD ORCH (F) Added reverb

Digeridu pitch wavering around

SPOKEN M/VOICE (C)  
Woo-rem-ee- kay- e-na.

FADE OUT TO END

HD HD

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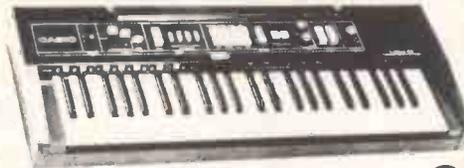
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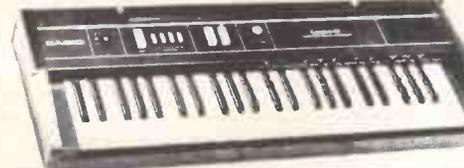


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# ELECTRO-MUSIC ENGINEER

Tony Newnham

## Powering Capacitor Microphones

Although it is generally recognised that capacitor microphones provide the best available quality for recording, and PA work, many musicians and sound engineers, particularly those of us working on tight budgets, have been dissuaded from purchasing them because of the need to buy separate power supply units, which add considerably to the initial costs. However, as this article shows, substantial savings can be made by building your own power unit.

### Phantom powering

In the early days, capacitor microphones used valves in the head amplifier. These were powered through special multi-core cables carrying HT and heater supplies, and the return signal. Early transistorised mics also used this system, with appropriate voltages. Although perfectly workable, this system has the major disadvantage of using special multicore cables and connectors, which limits the flexibility of the system, and made interchange with other types of microphone difficult. Most modern capacitor microphones use a system of 'phantom powering', using the two signal leads of a balanced microphone cable for the positive supply, with the screen forming the return. Figure 1 is a block diagram of a typical capacitor microphone, showing how supply and signal share the same cable. The use of phantom powering means that standard balanced mic cable and connectors can be used throughout the system, and any balanced microphone, whether dynamic or ribbon, can be plugged in and used on a channel carrying phantom power without damage. This is very useful in the musicians environment, as it means that, if all channels have phantom powering, any type of *balanced* microphone can be used on any channel. However, *unbalanced* mics cannot be used.

An explanation of the balanced line system appeared in the March 1981 edition of E&MM. The term 'phantom' refers to the latency of the DC voltage: It isn't seen by dynamic microphones.

Figure 2 shows the basic phantom powering system. The power source could be dry batteries — particularly if your mics will function on 9V. However, dry batteries are an expensive way of buying electricity, and are not really justified if you need mains power for other equipment. A well stabilised mains power supply is preferable for this system; obviously, this is what is done in most mixers having built-in

phantom power facilities (or you could modify an existing mixer). A main criterion here is that residual ripple cannot be tolerated in the mic supply, and so a very high degree of smoothing will be required. A disadvantage of building an external unit using transformers, as opposed to modifying existing equipment, is the high cost of a good quality component; and unless high-quality transformers, preferably bifilar-wound types, are used, the *quality* advantage of capacitor microphones will be lost.

The series resistor Rx serves three functions: Firstly, it provides isolation between channels if a common supply is used for more than one microphone.

Secondly, they allow the unit to power most common types of microphone. Most capacitor mics fall into two categories, those working on a nominal 48v supply, and those working on anything between 7.5v and 52v. Most mics draw about 0.5mA from the supply. However, one of the most popular types, the AKG C451 series, although functioning on any voltage between 7.5 and 52v, need a series resistor, depending on supply voltage (the values are quoted in AKG's literature), and draw 2-6mA at 48v and 10mA at lower voltages. As the specified resistors only drop 0.17v at 0.5mA they can be included without affecting the operation of other microphone types.

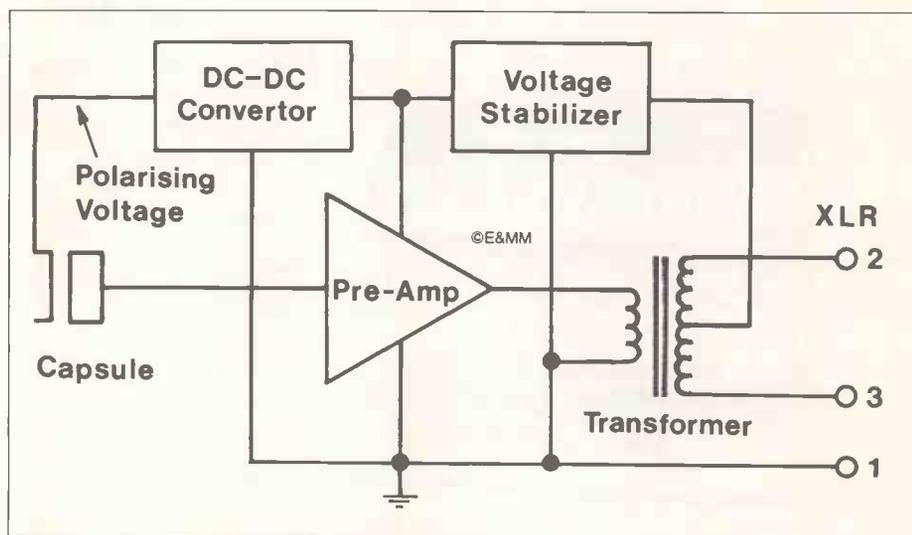


Figure 1. Block diagram of a typical capacitor microphone.

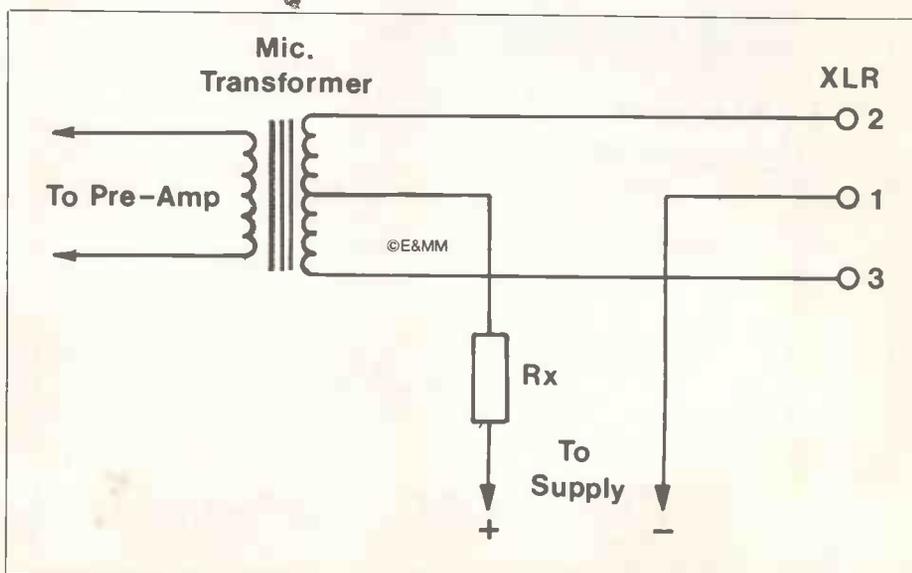


Figure 2. Basic Phantom Powering system.

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ON PAGE  
36



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# ELECTRO-MUSIC ENGINEER

## Powering Capacitor Microphones

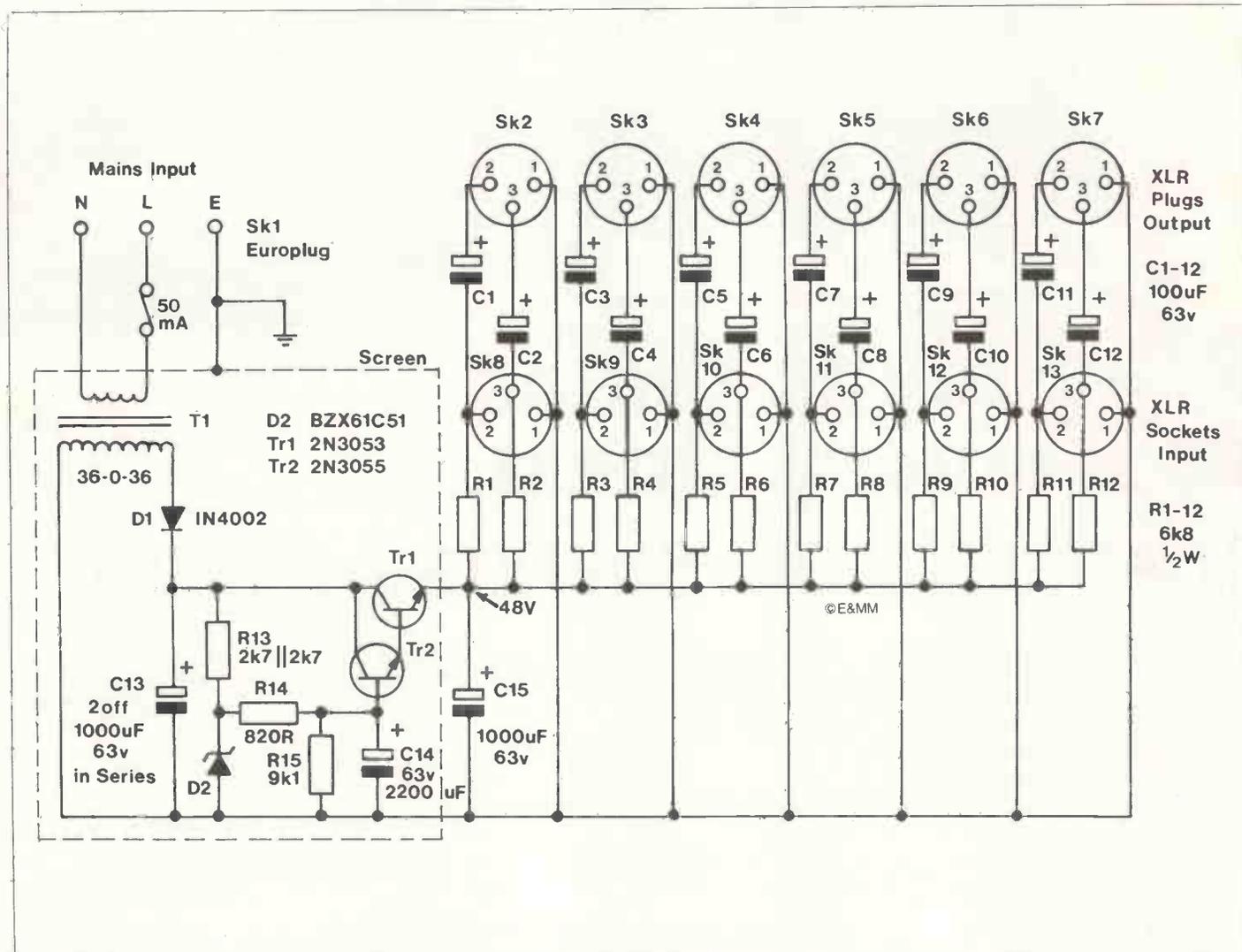


Figure 3. Power unit suitable for home construction.

Finally, the resistors provide protection for the power unit in the event of a short circuit on the microphone lines. Cut-outs and fuses are not recommended because their operation would shut down all the microphones running from the supply — not a nice thing in the middle of a concert or live recording!

The circuit diagram (Figure 3) shows an inexpensive unit suitable for home construction. Microphone transformers are avoided by the use of capacitors in the signal lines. A metal cabinet is essential for screening purposes; and the power supply section is built into a separate screened compartment, including a piece of steel plate behind the mains transformer to reduce magnetic field radiation. The power supply incorporates a simple series stabiliser, using transistors in 'Darlington' configuration. Additional

smoothing is provided by the use of high value capacitors, especially C14, the effect of which is magnified by the gain of the transistors. C15 ensures that the output impedance of the power unit is low at high frequencies, therefore preventing any possibility of crosstalk between channels. The same power supply circuit could be used with centre-tapped transformers, as in Figure 3.

The use of a toroidally wound mains transformer would be advantageous in reducing the risk of hum pick-up, if the additional cost can be justified. It is often advisable to run capacitor microphones for about half hour prior to use, to ensure that any moisture in the capsule is dried out, as damp causes noisy operation. A small pack of silica gel in the microphone case is also a worthwhile precaution, as is arranging storage in a warm place.

With an ohmmeter, check that the

chassis is connected to mains earth. Also check that there is no connection between any XLR pin and chassis. Switch on and check that there is  $48V \pm 4V$  at the emitter of Tr2. ( $\pm 4V$  is the usual tolerance on mics.) Check that +48V appears on pins 2 and 3 of each female XLR connector with pin 1 at 0V. Switch off and connect a resistor of 1k2, 1W across C15. (This simulates 'worst case' maximum load conditions). The voltage should remain within the range  $48V \pm 4V$ . Next, connect a link between pins 1, 2 and 3 of one XLR connector, and check that there is no significant change in output voltage (having first disconnected the test resistor). Finally, leave the unit running 'off load' for 24hrs, to ensure reliability. If a long term full load test is desired, the resistor should be 3W rating. A 1W unit will overheat if left connected for more than a couple of minutes. **E&MM**



Memory Rhythm Machine.

# Kay Memory Rhythm Machine

The Kay Memory Rhythm Machine, distributed by British Music Strings Limited, was one of the new products featured at the London Music Trade Show in August.

It is programmable with 240 beats worth of storage capacity, the memory being split into two sections; A and B. Each section is further split into six rhythms of 16 steps and two rhythms of 12 steps for 4/4 and 3/4 timings respectively. Up to four instruments can be triggered on each step, representing Bass Drum, Snare, Hi-Hat and Cymbal.

The case is formed from pressed steel covered in textured plastic. A small panel at the back can be removed to allow the four HP7 batteries to be replaced when required. Power can be supplied via an optional 6V adaptor although the batteries are required to retain the memory contents when the unit is switched off.

## Playing

The machine comes to life when a jack is connected to the output socket and the volume control switch is on. A stored rhythm can be played by selecting the desired number on the *Rhythm Select* switch, setting *Variation* and pressing the *Start* button. The rhythm will always start on the first beat in the bar no matter where it is stopped. An optional footswitch can be connected to control the start and stop functions remotely provided that it is a locking push on/push off type.

The *Variation* switch can be set to play A or B (16 or 12 steps each), AB (32 or 24 steps) and *Fill-in*. In this mode you can select 4 (3A's then a B), 8 (7A's then a B), or 16 (15A's then a B). This

means that you can give the rhythm a slightly more 'human' feel with interesting breaks or fills.

## Programming

Now to the more interesting bit! Programming is accomplished in a way analogous to multi-track recording. Each instrument being recorded one at a time in play/rest fashion.

Setting the *Mode* switch to 'Write' puts the unit into its programming mode. The down-beat LED (situated beside the Tempo control) comes on to indicate the first step in the rhythm. Select the rhythm number and variation; A or B for 16 or 12 steps or AB for 32 or 24 steps, and the *Sound*; Bass Drum, Snare, Hi-Hat or Cymbal.

The rhythm can now be entered step by step using the start and stop buttons as play and rest for each sound until the required number of steps have been recorded. After the 16th or 12th beat the LED will come on again to indicate the first step.

Having entered the rhythm it can be played by selecting 'play' and *Start*. The only way to edit an individual track, however, is to re-enter it from the first beat.

## Interfacing

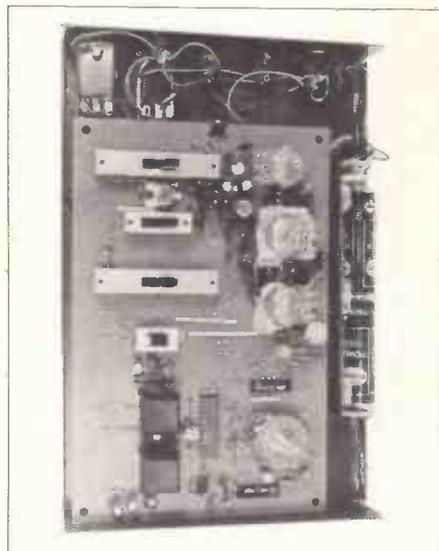
The machine has two trigger outputs; *Clock* and *SQ*. These are provided for interfacing with a sequencer, computer or another drum machine.

The *Clock* output, as the name suggests, is derived from the internal clock and provides a gate, with a positive-going edge, of approximately 6V (supply voltage). The *SQ* output is in fact the Hi-Hat trigger and connecting a jack to this socket disconnects the

trigger to the Hi-Hat generator. This trigger does not have the same drive capability as the *Clock* output and probably would need to be buffered for use with external units. However, this is a useful facility to have for triggering external sounds (e.g. E&MM's Syntom or Synwave) during a rhythm.

## Circuitry

As this was an engineering prototype it is not fair to comment on the internal construction. However, the circuit is based around a Toshiba IC which contains all the memory and decoding circuits. The clock and counter are provided by two other CMOS devices. Instrument voices are generated in the usual analogue fashion with Twin-T networks for Bass and Snare drum and Zener generated noise, filtered using a small inductor, for Snare, Hi-Hat and Cymbal noise.



Internal view of the machine.

## Conclusions

The unit is very neat with clear and functional labelling, however, the steel case provided for the prototype had some very sharp metalwork protruding, but BMS assure us that this will be amended in production models.

The inclusion of the interface outputs is a welcome addition to this type of machine but a clock input would have been useful for synchronizing with a click track trigger.

Probably the most important consideration when buying a drum machine, though, is the quality of the sounds. Although these are not 'real-drum' sounds, they do provide an adequate simulation. The *Tone* control is useful here for adjusting the high frequency content of the Cymbal and Hi-Hat.

From the control point of view the unit is simple to programme and allows a versatile range of playing options with the *Fill-in* selection.

The most exciting thing about a programmable rhythm machine is the challenge of creating new and interesting drum patterns. For £75 (less if you shop around) you have the sounds and the means to control them, so the rest is up to you.

Kenneth McAlpine

E&MM

# America

Jerry De Muth

Music making today involves more than musicians and their instruments and effects devices. The sounds have to be gotten out to audiences and to help do this companies keep coming up with everything from new mikes and pick-ups to an assortment of power amplifiers, mixers, monitors and speakers. And since all this necessary equipment can cost far more than the instruments themselves, more companies are promising affordability with some lines during these economically tight times.

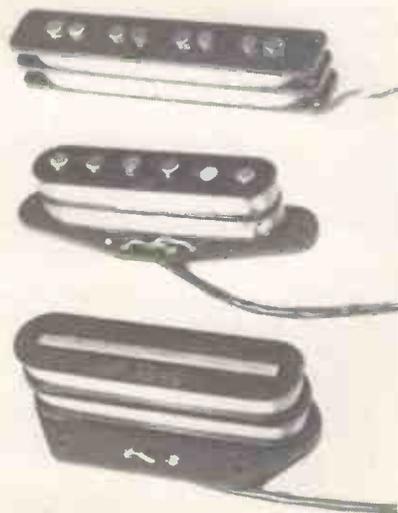
Shure Brothers has introduced an entire new line of nine inexpensively priced dynamic microphones, the Professional Entertainer series. The four new vocal mikes and five new instrumental mikes priced from \$62.75 to \$175.00 are available with or without cable and include a locking or non-locking on-off switch, a built-in windscreen and a built-in shock mount. In addition, one model, the PE85L-SP, also features an impedance matching transformer to adapt the microphone to low or high impedance equipment.

For those whose movements are cramped by microphone cords, the range of wireless systems has been expanded with the introduction of a series of transwave wireless audio systems by Schell Electronics. They include the self-contained hand-held microphone, the wireless hand-held system, the wireless lavalier microphone and the wireless guitar system. Each system includes a transmitter and a receiver with telescopic antenna which plugs into any Hi Z amplifier input.

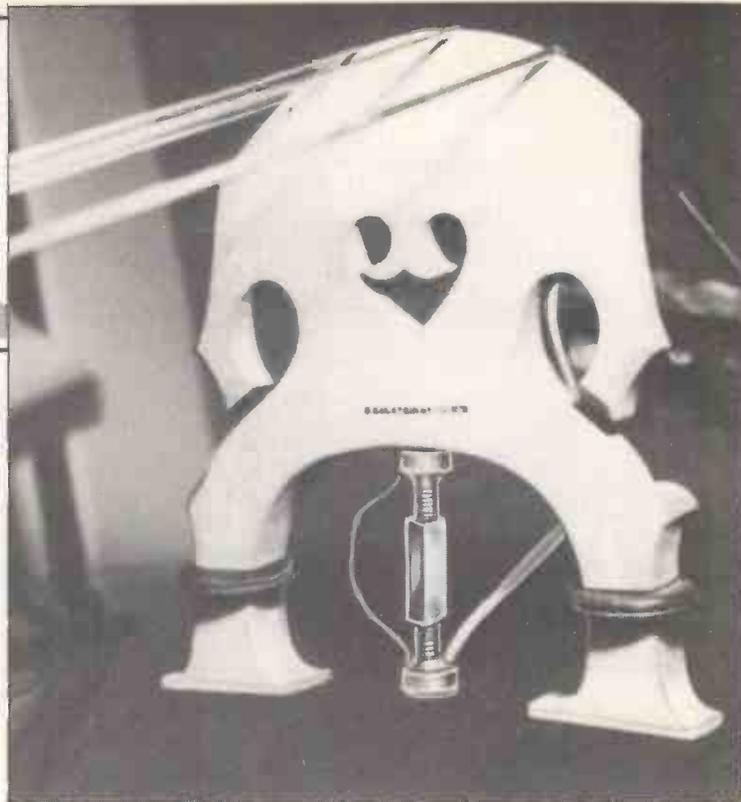
The top system, the self-contained hand-held mike, incorporates a Shure SM58 cartridge and FM type transmitter circuitry and is designed for use by any vocal entertainer. The lavalier mike is intended for speakers, and, powered by batteries, can even be used outside, while the wireless hand-held system is ideally suited for singers. The wireless guitar system operates with guitars and other electric instruments and includes a custom guitar strap with transmitter mount and antenna guides. Prices for the various Schell systems range from \$694.95 down to \$449.95.

## Pick-ups

Various new versions of the standard stringed instrument pickups have been introduced by Seymour Duncan and George L. Lewis for guitars, by Kolstein Music for basses, and by Alvarez for violins.



Duncan Pickups.



K101 Kolstein Dual Transducer Pickup.

George L's Pop-In Magnetic Pick-up for flat-top acoustic guitars has an adjustable head that, when moved up, down, or slanted, can provide a wide spectrum of sounds when playing acoustic, bottle neck, jazz or rock. The pick-up, which features humbucking qualities, snaps easily into the sound-hole of any flat-top. It carries a suggested list price of \$52.50.

The Stack is Seymour Duncan's noise-cancelling pickup for Stratocaster, Telecaster and Jazz Bass. Each model comes in a Classic version which faithfully reproduces the vintage tonal and output qualities and a Hot version which has increased output and more effective sustain and tonal response without being muddy. They all come with a special cover, a four conductor lead wire for optimum wiring combinations and a wiring diagram.

The Kolstein Model K101 dual transducer pickup for bass violin already has been used by Ron Carter, Eddie Gomez, Rufus Reid, Bertram Turetsky and others and is now being made commercially available. The unit draws its bass frequency responses from its lower housing pickup positioned on top of the instrument while drawing tenor frequency responses from the upper housing transducer. But it can be used with a one channel as well as a two channel amplifier, and can even be plugged directly into a mixing board for a more natural acoustic sound. In addition, the compression feature of its filtration system stabilizes the quality of reproduction of tone and volume level to a basic constant during either pizzicato or arco use.

Knilling String Instruments is now marketing the Alvarez "Hot Bar" violin pickup as a separate accessory item. Internally mounted in the centre of a top quality, solid German maple bridge, it creates a well balanced acoustic sound that is neither "hot" or "cold."

## Effects

A lot of effects heard on records today are studio effects, not easily duplicated during live performances. However, MXR Innovations' Professional Products Group is introducing a pitch shift doubler, a digital time delay and three equalizers which can be used in live performance as well as in the recording studio.

The new Model 174 pitch shift doubler provides "barber pole" flanging, stereo chorus effect, double tracking and unison effects in stereo, feedback suppression, 1.1-0.99-type effects, 12 string sounds and other studio-quality effects. The new Model 175 digital time delay provides studio-quality flanging, doubling, chorusing, simple reverb, echo and slap-back echo.

The new MXR equalizers - Model 170 dual octave, Model 171 Dual two-thirds octave and Model 172 one-third octave - can help eliminate system feedback or be used as a very elaborate

tone control device to alter or enhance the sound of instruments and voices. They can also be used to differentiate between relative frequencies throughout the audio spectrum. All three equalizers, plus the other two products, will be priced lower than competitive units, according to MXR.

## Amplification

Sunn Musical Equipment Co. has introduced a power amplifier with graphic equalizer specially designed for heavy road use as well as a bass amp and four new speakers. The Sunn SGA 107 combines a 100 watt amplifier with a seven band graphic equalizer into a single \$349 unit that can be used with stage and studio monitors, extension speaker systems, home hi-fi systems, or any bi-amplified system. The equalizer features 15 dB of cut and boost on octave centers from 125 Hz to 8k Hz, excellent for feedback suppression and system/environment equalization.

The Sunn SB 160 60 watt portable bass amp has a headphone jack, accessory patch loop, external speaker jack, two C-MOS limiter stages, high and low gain input jacks, preamp input gain and master level controls plus, in the equalizer section, active cut and boost bass, mid and treble controls, variable mid-frequency sweep control and a bright switch. The suggested price is \$429.

Sunn's new speakers include the Model SPL 8112E front loaded reflex horn which was designed primarily as a mid-bass/mid-range enclosures but also can be used as the bottom end of a two-way system. Priced at \$499, its single driver reproduces the mid-range frequencies of 200 to 2000 Hz.

The \$750 Model SPL 8028 is a two-way bass/mid-bass speaker enclosure that uses a Sunn SPL 918R 18-inch low frequency loud speaker and a Sunn SPL 912E 12-inch extended range loud speaker. It can be used as either an extended range bass guitar enclosure or as the bottom end of a two-way or three-way PA system. The low frequency speaker provides reproduction down to 50 Hz while the extended range speaker delivers mid-range response up to 4000 Hz.

Sunn Model 14, which carries a \$599 suggested price, is a bi-amplified three-way, full-range speaker enclosure that consists of three Sunn speakers - a 15-inch Model 145 woofer, a Model 014 10-inch mid-bass/mid-range speaker and a Model 8600 tweeter horn. With protective steel corners, Tolex covering, rubber feet, spring loaded handles and removable casters, it is built for years of reliable road use.

Finally, Sunn's new Model 6M is a compact, two-way speaker system that uses a Model 558 extended range 15-inch hard cone woofer with a dampened aluminium dust cap and a foam roll suspension and a Model 5030 tweeter horn with a



**Electro-Voice Model SH15-2.**

one-inch phenolic diaphragm coupled to a fast flare rate die cast aluminium horn. Like the Model 14, the Model 6M can be used for either live or recorded performances.

Other new amplifier systems come from Grossman Music Corp., Electro-Voice, Tusc and Rickenbacker.

The two new amplifiers and one new PA system from GMC are designed for use by small bands on club dates. The guitar and bass amps carry 100 watts RMS with normal, bright inputs and integrated circuit pre-amps, and have volume, bass, treble, middle and master volume controls. The guitar amp, which also has reverb control, has a 12-inch speaker, while the bass amp has a 15-inch speaker.

GMC's new PA system consists of a 100 watt channel power pack and two ported column speakers, each with two 10-inch GMC speakers. Each of four individual high impedance inputs has its own volume, reverb, treble and bass controls. There also are master volume and reverb controls.

Rickenbacker's TR-50GT amp is a compact, lightweight 50 watt guitar amplifier with an external speaker jack, effects channel, distortion, reverb, a front panel footswitch jack and a choice from three 10-inch and 12-inch speaker options.

A "Prestige Series" of tube amplifiers comes from Tusc. Available in 50 or 100 watt RMS units in various speaker configurations, they feature pre-programmable overdrive and a parametric equalization circuit that allows for a wider range of frequency response. Other features include pre and post reverb, master volume, pre-amp line out, stereo input for guitar and keyboard with split keyboard capacity and premium Fane speakers.

## PA

More ambitious, and also, with a \$2,818 price tag, more distinctive, is Electro-Voice's The Entertainer Model 100 portable club PA system. It features a pair of Model 100S high efficiency speakers which, with a Constant Directivity horn and an optimally vented low frequency driver, cover the 500 to 10,000 Hz frequency range.

But at the heart of The Entertainer system is the Model 100M 36 pound stereo powered mixer which features 10 inputs, a dual eight-band graphic equalizer, a power amp section rated at 150 watts per channel into 4 ohms, reverb colour control, mono/stereo function switch, a fluorescent bar graph display for easy visibility on a dark stage and a powerlock circuit that guards against amplifier clipping.

Electro-Voice also has introduced, at \$598, a two-way all horn stage speaker system designed for applications requiring both wide bandwidth and very high sound output. Low frequencies in the Model SH15-2 are handled by a 15-inch woofer in a vented-horn enclosure while high frequencies are handled by a Constant Directivity horn. Although rated at 100 watts, E-V says the Model SH15-2 can easily handle instantaneous peak inputs of 400 watts.

For the ears of the musicians themselves, Rickenbacker's Road Electronics Division has introduced a compact, two-way high efficiency vented speaker system, the Model RS-7920. This unit utilizes a specially designed 12-inch Road speaker plus a high performance radial horn and driver system in an 18 by 21 by 18 inch enclosure. Nominal impedance is 8 ohms with a power handling capability of 75 watts. A passive crossover with high frequency level control is included and parallel inputs are provided for ease in interfacing additional speakers. The RS-7920 is designed to allow 30, 60 or 90 degree angle placement for use with any stage set up.

Even more compact is Fostex Corporation's Model 6301 self-powered personal monitor which weighs only six pounds and measures 7-inches by

is made of heavy duty, quarter-inch, black anodized stainless steel for superior strength and sensitivity.

Stick Enterprises, which brought out The Stick, now has a new effect device, Patch of Shades, for electric guitar, electric bass, synthesizer and electric keyboard. In place of a pedal, it features a pressure pad that operates a volume output for shading echo, flange, etc., into a second amplifier or channel while simultaneously shading a normal, direct sound into the bass end of a smooth wah or moving through all the wah frequencies. A send/return loop allows shading of old effects like fuzz and phase as well.

**E&MM**

*Seymour Duncan Pickups, 203 Chapala St., Box 4746, Santa Barbara, CA 93103.*

*Electro-Voice Ltd, Maple Cross Industrial Estate, Denham Way, Rickmansworth, Herts. Tel. 09237 75387.*

*Fostex, Bandive Ltd., 8 East Barnet Road, New Barnet, Herts.*

*Grossman Music Corps, 1278 W. 9th St., Cleveland, OH 44113.*

*Knilling String Instruments, St. Louis Music Supply Co., 1400 Ferguson Ave., St. Louis, MO 63133.*

*Kolstein Music Inc, 1801 Shore Drive, Murrick, NY 11516.*

*Kramer Music Products Inc., 1111 Green Grove Road, Neptune NJ 07753.*

*George L. Lewis, L&L Sales Co., PO Box 238, Madison, TN 37115.*

*MXR, Atlantex Music Ltd, 1 Wallace Way, Hitchin, Herts. Tel: 0462 31511.*

*Schell Electronics Inc, 120 N. Lincoln, Chanute, KS 66720.*

*Shure Electronics Ltd, Eccleston Road, Maidstone, Kent. Tel. 0622 59881.*

*Stick Enterprises Inc, 8320 Yucca Trail, Los Angeles, CA 90046.*

*Sunn Musical Equipment Co, 19350 Southwest 89th Ave, Tualatin, OR 97062.*

*Tusc Amplification, 3 Oval Drive, Central Islip, NY 11722.*

five-inches. Designed specifically for location mix-down, it can be used to monitor almost any signal from mixers to tape recorders to electric guitars to synthesizers to amplifiers. The unit also provides for independent use of the 10 watt amplifier in situations where another power source is needed. Frequency response is from 80 Hz to 13 kHz; distortion is 0.95% at 1W output. Model 6301 carries a suggested price of \$149.

Getting back to the where the sounds begin, new effects devices have been introduced by Stick Enterprises and Kramer.

Kramer's Les Trem Tremolo fits any electric guitar with a standard stop tailpiece such as the ones used on all Les Paul style guitars. It requires no special mounting or routing. Rather it simply slides onto the existing posts of any standard stop tailpiece and is held in position with string tension. A floating hinge design enables the player to use the tremolo in both directions and assures that the tuning will remain constant no matter how far the strings are stretched in either direction.

The bridge of the Les Trem Tremolo is made of solid, highly polished brass while the tremolo arm



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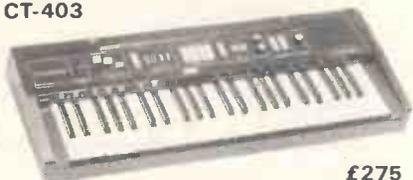
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8-note polyphonic. Integral speaker. AC/battery  
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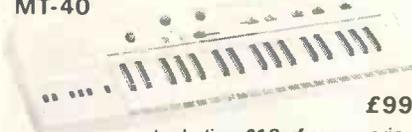


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BAR-CODE PROGRAMMABLE  
THE HIGHLY ACCLAIMED  
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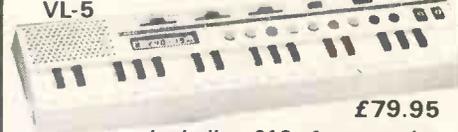
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PC-2 Hard case for MT-40/31 £ 9.95 □  
PC-3 Hard case for MT-70/60 £T.B.A. □  
HC-A Hard case for CT-101/403 £26.00 □  
HC-B Hard case for CT-701/601/1000P £35.00 □  
HC-3 Hard case for CT-202 £44.00 □

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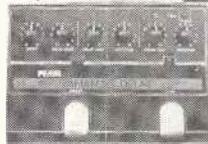
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E&MM

# MUSIC MAKER EQUIPMENT

## SCENE

### Bi-lingual Computer Music

Buchla and Associates have announced the addition of the model 404A to the 400 family of electronic musical instruments. With an expanded memory of 126 Kbytes, the 404A can run sophisticated music languages that can interact with moderately extensive data bases in real-time environments.

Two such languages are now available: Midas integrates a comprehensive score editor with multiple instrument definitions, tunings, and waveshapes; Patch V offers a generalised facility for establishing arbitrarily complex relationships between input gesture and instrumental response. Both languages are appropriate to composition as well as performance — Midas assumes a somewhat traditional approach to musical structure, while Patch V imposes no such bias. The model 404A can be supplied with either or both languages implemented and fully supported.

Introduced in the spring of this year, the Buchla 400 combines architecturally advanced hardware with specialised high-level software to achieve performance characteristics unprecedented in the world of musical instrumentation. Three computers are employed, each optimised to its task. A host computer, which may reside in or out of the instrument, takes charge of user communication, data handling, and executive control. A second processor is responsible for processing temporal parametric data, and a third processor applies digital pipelined techniques to the generation of sound.

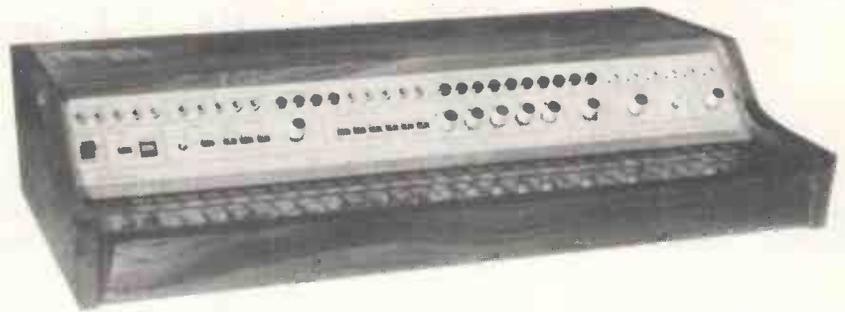
Dynamic waveshaping techniques, multiple complex envelope generation, and advanced concepts of instrument definition provide an extensive elec-

tronic vocabulary. A specialised touch sensitive keyboard can be organised in traditional or non-traditional fashions, can be tuned to any imaginable scale, and responds to the most subtle of musical gestures. Pressure-

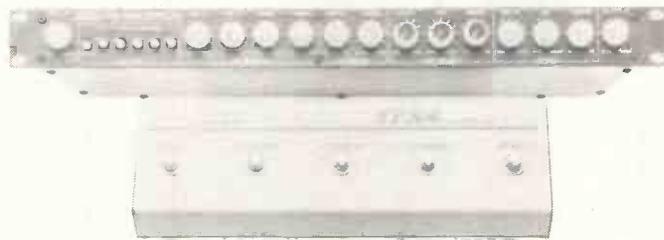
sensitive joysticks, control voltage inter-connections, and analog modifiers further extend the performance possibilities.

The instrument's circuitry is contained on plug-in cards, facilitating system expansion and

servicing. Power consumption is a modest 30 watts, which along with conservative engineering and sound construction, assures reliability and longevity. A hand-



finished oakwood case houses the 35-pound instrument. The model 404A's price is \$9500. Further information can be obtained from Buchla and Associates, P.O. Box 5051, Berkeley, CA 94705.



### Time Effects

American company ADA have introduced the TFX4 Time Effects, a new concept in signal processing for live performance applications that provides the on-stage versatility of floorbox effects and the reliability and low-noise of professional rack-mount equipment. The TFX4 has a separate group of controls for each effect: Flanger, Chorus, Doubler, and Echo. Each effect group can be individually preset and switched in with the front panel select pushbuttons or remotely with the footswitch TFX4 Controller.

Logic controlled FET switching silently allows selection of any one effect in any sequence. Other features include a Clip LED indicator, Input/Output Level controls, and multi-coloured LED's which indicate the effect mode and phase inversion. The system comes complete with a 20-foot cable and has a suggested list price of \$499.95. Though not yet available in this country (as far as we know) details can be obtained from ADA Signal Processors, 2316 Fourth Street, Berkeley, California 94710.

### Milab MP-30 Microphone

Much has been made recently of the application of the uniform diaphragm pressure technique to omni directional microphones. Some of the claims are valid, some dubious, but there is no doubt that this type of microphone does have many applications.

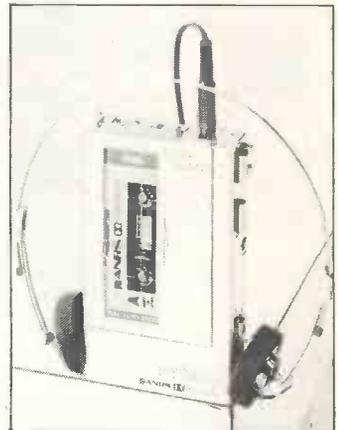
The Milab MP30 Pressure Zone Hemispherical Microphone is designed around a high quality electret capsule. The microphone housing is machined from a solid aluminium block resulting in a very rigid construction, and is finished in satin black.

For further details contact: Audio Video Marketing, Unit 21, Royal Industrial Estate, Jarrow, Tyne & Wear, NE32 9XX. Tel. 0632 893092.

### JVC Personal Stereo

JVC have introduced a new personal stereo cassette player, the CQ1, which is equipped with Dolby B-ANRS noise reduction. The CQ1 also features a meta-perm tape head, a tone control switch which boosts high or low frequencies, metal/normal tape switching, full auto-stop soft touch tape controls and an anti-rolling device for stable sound reproduction while on the move.

The unit comes complete

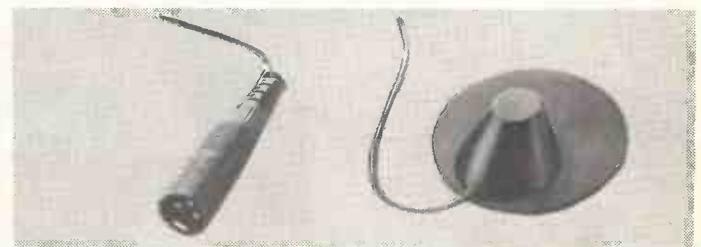


with a pair of lightweight headphones, wrist strap and carrying case with belt. Power output is 30mW per channel minimum RMS through headphones and retail price is around £70 including VAT.

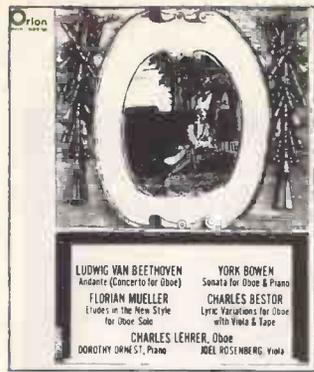
### Hi-Fi Speaker Stands

Riverside Wood Products have just announced a new range of up-market hi-fi speaker stands. Known as dB Speaker Supports, three sizes are available to suit most popular types of loudspeakers. Alternative finishes are African Walnut (solid wood, not veneer) black or plain (for home staining/varnishing). Suggested retail prices for models S, M and L are £33, £34 and £36.80 per pair respectively, including VAT, with lower prices for the plain types yet to be announced.

Manufactured by Riverside Wood Products Ltd, of Navigation Road, Northwich, Cheshire, dB Speaker Supports are available from usual Hi-Fi outlets and by mail order from Wilmslow Audio, 35-39 Church Street, Wilmslow, Cheshire.



# RECORD REVIEWS



## Lyric Variations for Oboe with Viola and Tape Charles Bestor Orion ORS 82432

This work is one of a series of four written for live instruments and tape that was begun at the University of Utah where Charles Bestor was co-director with Vladimir Ussachevsky of the Electronic and Computer Music Studio, and finished at the University of Massachusetts/Amherst where he is currently head of the Music Department and director of the Electronic Studio.

The Lyric Suite for oboe and tape was written for and dedicated to Charles Lehrer, and received its premiere in New York, Spring 1980. On this recording the oboe is played by Charles Lehrer and the viola by Joel Rosenberg.

Although there are no other electronic pieces on the LP - instead you'll find the music of Beethoven, York Bowen and Florian Mueller - this piece alone merits study for the serious student of electronic music, especially as it shows the composer's skill in blending electronic sounds with acoustic instruments.

The Suite has six sections each separated by a short pause. It begins with punctuated portamento software electronic sounds that highlight the stereo field throughout the suite and create a gentle atmospheric mood for the solo oboe melody at centre. Bell-like sonorities surround the oboe until the gently percussive electronic tones announce the viola. The first section continues the dream-like mood whilst oboe (centre) and viola (right) atonal notes and trills enhance the portamento electronic shapes that echo from left and right to distant centre.

The second section continues the development with stronger wide-ranging electronic melodic lines first left then right, whilst oboe and viola play detached but sustained motives. Oboe and viola come together as electronic chords blend a more harmonic structure to the piece.

The third section uses the original electronic descending portamentos as its main background more or less continuously. Oboe and viola play detached notes in their fixed spatial locations, until the viola pizzicato flows splendidly into deeper electronic 'pizz.' envelopes. Acoustic melodies become extended and the viola is more prominent. The soundscape rises and falls with subtle charm.

A change of emphasis is characterised by upward electronic arpeggios that continue in harmonic tone row fashion in the fourth section. Echo is used to stretch the arpeggios whilst oboe and viola melodies contain noticeably stronger sfz notes until the end, where a frozen echo delayed synthesised tone emulates the final acoustic phrases.

The suite reaches its most dramatic point in the fifth section even though it maintains the lyrical feeling. Computer synthesised sounds (right) are more resonant, filtered tones, followed by lively oboe. Synth (left) in the same manner is joined by legato viola, although the piece concludes with both viola and oboe taking up the rather jerky synth counterpoint.

The final section returns to first statements of portamentos, oboe trills, with sustained viola and more sonorous electronic sounds. A dialogue is held by oboe and viola over the pulsating electronics, highlighted by long echo delays on sharper envelopes and a final dual left/right portamento that gracefully ends the suite.

It's an interesting work that should hopefully encourage the more avant-garde readers of E&MM to contribute to our pages.

*The recording is obtainable from P & C Orion Master Recordings Inc., P.O. Box 4087, Malibu, CA 90265-1387, U.S.A.*

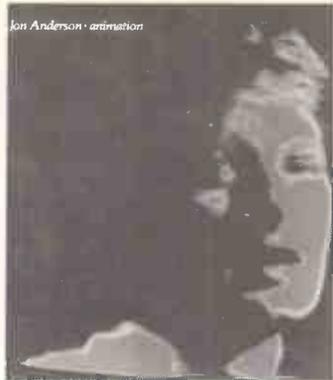
## Animation Jon Anderson Polydor Pold 5044

It's difficult to think of Jon Anderson without thinking of that great seventies band Yes. Anderson carries on the tradition set by that band in all his work, particularly in the vocal lines and harmonies, and this album is no exception.

The first track 'Olympia' could almost have been taken from an early Yes album. It has the same driving rhythm section, soaring synth lines, chord changes and vocals that characterised that period in Anderson's career. The lyrics deal with the 'computer age' and electronic music, and this track has one of the most memorable hook lines on the album.

'Animation' follows - a moving song about birth presumably drawn from Anderson's own experiences of fatherhood - and this is in turn followed by 'Surrender', a reggae based track that introduces Hammond sounds and a nicely placed, light Caribbean mood after the intensity of the preceding track. 'All In A Matter Of Time' rounds off the first side of the album and takes us back to vocal lines reminiscent of Anderson's 'Close To The Edge' era.

Side Two opens with a bass guitar and synthesised percussion intro to 'Unlearning' which explores some of the mystical concepts that have always pervaded Anderson's work. 'Boundaries' is based on a traditional folk format with much use of six-



string acoustic and synthesised strings and woodwind while the next track, 'Pressure Point', reverts to a more modern approach with vocoder and a syncopated percussion and bass section that owes a strong debt to Weather Report.

'Much Better Reason' and 'All God's Children' close the album and display a new found versatility in Anderson's compositional approach - although the latter, which sounds as though it was written for a congregation of ardent evangelists is definitely 'over the top'.

Nowadays, Anderson's lyrics rely less on abstract imagery and emphasis on the sounds of words rather than their meaning than hitherto, although that approach is sometimes still evident here. At other times on this album, however, he is able to put poignant, meaningful lyrics together with expressive musical passages and creates some very beautiful, touching and dramatic episodes. In this respect this is perhaps Anderson's most mature and accomplished album to date.

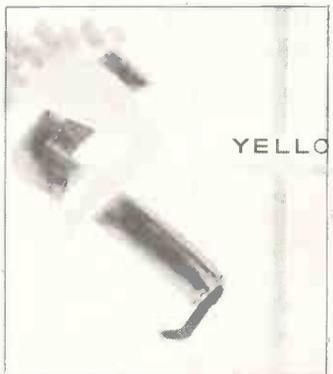
## Pinball Cha Cha

Yello  
Do It Records DUNIT 23

Yello are from Zurich, Switzerland, and they first appeared in 1979 with a single 'I.T. Splash' which one German rock paper described as "the strongest statement to leave a German studio for a long time". Last year they released their debut album 'Solid Pleasure' to much critical acclaim and improved their studio by going 24 track and installing a Fairlight.

Boris Blank, the electronics wizard of Yello, designs and builds all his own equipment and is the main musical force within the group. One of Boris' pastimes is recording 'found sounds' - particularly those of machinery. Whilst recording the noise of a very loud car shredder (110dB) Boris met Carlos Peron who was also recording it. This meeting led to the formation of Yello who are now joined by Dieter Meier, a refugee from the world of modern art, on vocals and also as lyricist.

Their recording technique, as displayed on this new 12" single, is unusual in that the basic tape effects are provided by Carlos



and incorporated into a musical structure by Boris. Dieter then adds his vocals, turning up weird and unusual subjects at the drop of a tape can.

'Pinball Cha Cha' is taken from the band's last album 'Clara Que Si' and is an example of the genre that would definitely not be heard on 'Come Dancing'. Along with the B-side 'Smile On You' this 12" release makes a fascinating introduction to the explorative electronic music of Yello as well as providing an example of the Fairlight's astounding versatility.

## Hot Space Queen EMI EMA 797

Hot Space is a slick, polished and professional recording and it proves once again that Queen have got their distinctly commercial music down to a fine art form. Production can't be faulted on this album and, love them or hate them, you have to admit that Mercury, May et al certainly know how to exploit their considerable technical abilities.

The eleven tracks on the album include the two hit singles 'Body Language' and 'Las Palabras De Amor' as well as the Bowie/Queen

collaboration 'Under Pressure'. A slightly incongruous offering is 'Life Is Real (Song for Lennon)'. Obviously written during the winter before last this track has a touch of Lennon's compositional style and voices sentiments that no one could doubt.

Other tracks are in typical Queen style and one can't help feeling that the impetus behind this album is summed up in these lines from one of the tracks "Success Is My Breathing Space/I Brought It On Myself/I Will Price It/I Will Cash it."

Alan Hardman

**PARTS  
COST GUIDE  
£29.75**



The complete set of parts laid out for checking prior to construction.



# AMDEK

## Distortion Effects

This month we introduce the first of an exciting series of kit projects that enable electro-musicians to build and customise effects units with the minimum of technical difficulty.

- \* **Soft or Hard Distortion**
- \* **Tone, level and effect controls**
- \* **LED effect on and battery check indicator**
- \* **Pre-assembled circuit board**
- \* **Complete kit with detailed instructions**

There are many of our readers who would like to construct our projects but do not feel they have the skill or experience to deal with the electronics on their own. Certainly, there is not often the space available for E&MM's technical writers to elucidate on the basic details of construction — soldering, recognition of components, choosing wire, and so on. That is why this new series of Amdek kits greatly interested us as a means for many musicians to get started in the easiest possible way. Needless to say we regard this type of kit as a 'middle' project between the commercial ready-made instrument and E&MM's full constructional projects.

Amdek Kits are manufactured by the Roland/Boss Corporation in Japan and, as far as quality is concerned, match their commercial types already offered in the Boss range of effects units. Development of the kits has been over the last two years and includes a range of 12 sound processors. These will appear individually in addition to our normal projects, having been built, tested and reviewed in the studio. Sample sounds will also be recorded on E&MM Demonstration Cassettes.

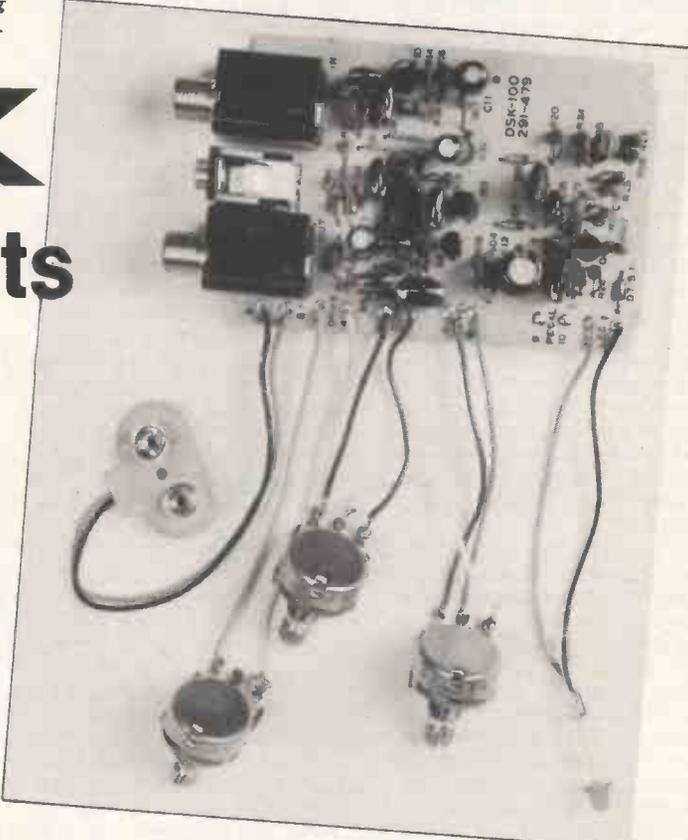
### The Kit

The Distortion unit is available in bubble-pack form, complete with all parts, a spanner for tightening nuts and detailed instruction sheet. The extra tools required are a 15 to 30 watt soldering iron with a reasonably fine tip, wire cutters and strippers, small pliers (not essential), and a cross-head screwdriver. You'll also need a 9 volt PP3 battery to power the unit.

There is no problem in identifying any of the parts and, once you've laid them out on your work area, they can be checked off one by one against the illustrated parts list.

Step-by-step assembly commences with the preparation of 7 lengths of connecting wire for attaching to the pots in the first four steps — made easy by the provision of a scale and specified lengths for each wire. Incidentally, step 3 should mention that the white wire connects to the left terminal (not the centre) of the 100k pot. You'll find helpful hints on soldering the components are given in the instruction leaflet.

In steps 5-12 the battery connector, LED and footswitch leads are cut to the specified length. Then all the necessary soldering to the factory-built PCB (which includes ready-



Step 9. Battery clip, pots and LED wired to the factory-built board.

mounted IN/OUT sockets) is done (step 9), and the footswitch and LED holder are mounted in the diecast case (step 10-11). This completes the soldering work.

Now the main components are inserted in the case, following steps 13-21. The small hexagonal spanner provides easy fastening of the pots and sockets. Care must be taken when inserting the PCB and it may be necessary to carefully bend the LED wire prior to this for a neat fit. Also, the plastic insulation sheet provided must be inserted in the base plate to avoid shorting out the circuit board against the case.

The base plate snaps neatly into place and the rubber battery cover gives simple and effective access without the use of screws — a good idea. Finally, step 22 requires the three control knobs to be push-fitted

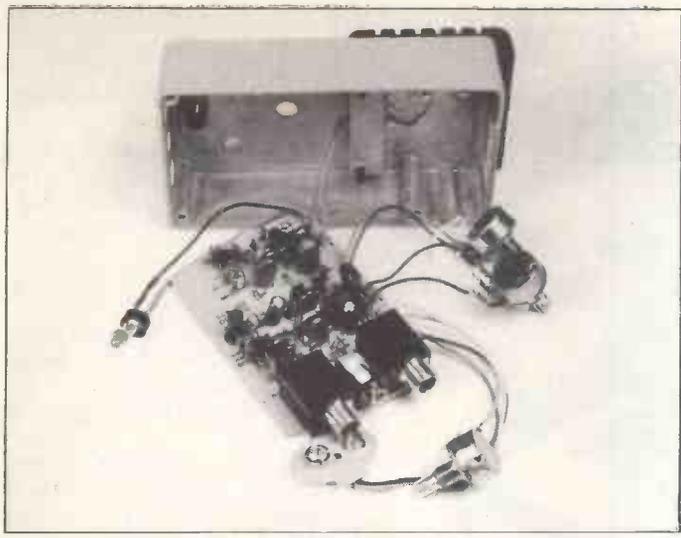
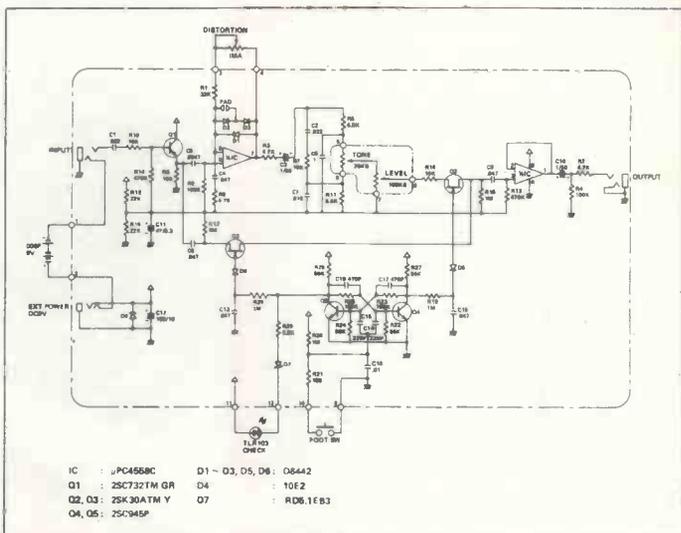
to the pots to complete the construction.

### The Circuit

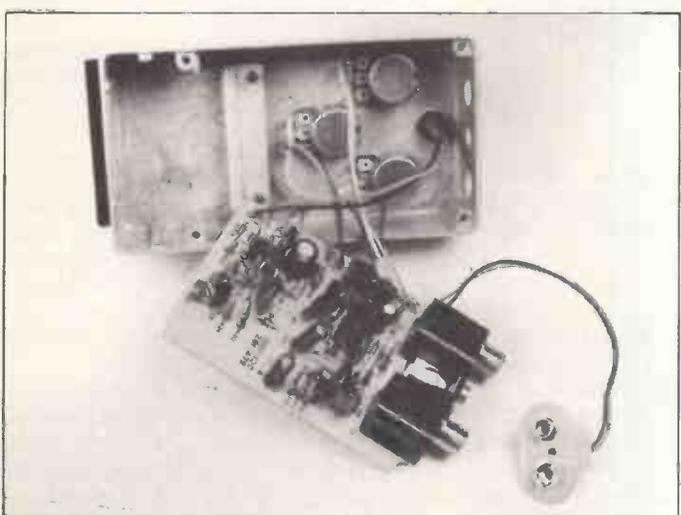
The unit produces a distortion effect with electrical instruments and, although effective on keyboards with careful playing, is best suited to use with guitar. The resulting high harmonic content is derived from the insertion of diodes D1, D2 and D3 in the feedback path of the op-amp. Whilst the input signal is low, the op-amp output remains undistorted at about 600mV. As the input signal increases, the diodes forward conducting barrier voltages are exceeded and the op-amp feedback current in the loop increases in proportion, holding peak output at around 900mV. So even a sine input will make a



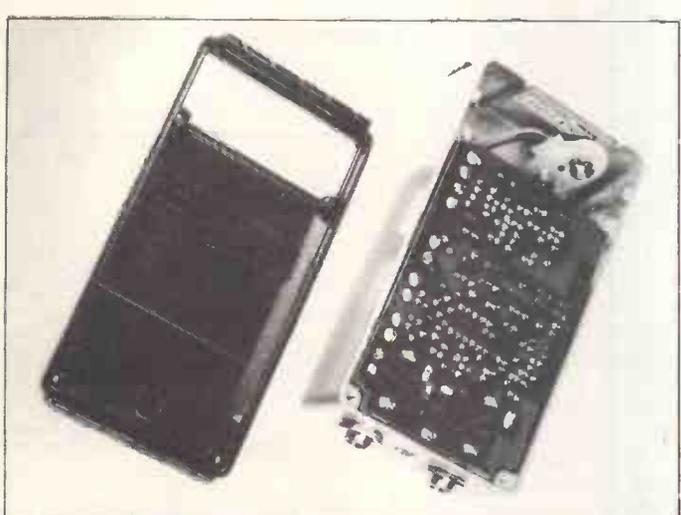
Figure 1. Distortion Effects Kit circuit diagram.



Step 10. Footswitch plate and mechanism attached.



Step 15. Last wiring work completed.



Step 17. PCB installed in case and insulation added to base plate.

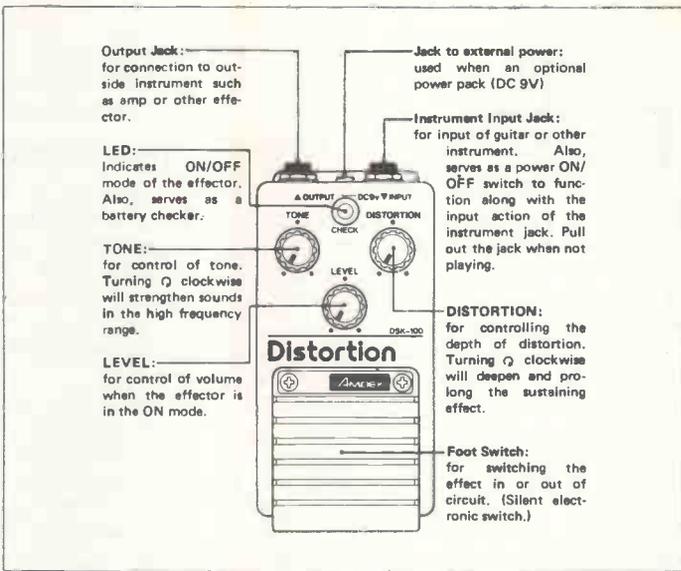


Figure 2. Panel description.



Step 21. Base plate rubber strips added.



Step 22. Final step fits on 3 knobs to complete.

square wave output, giving a 'hard sound. A further circuit then 'softens' the distortion. The tone control adjusts to hard effect and the electronic switch operated via the foot pad gives silent changeover from straight to effect (with LED on in the latter mode).

A modification of the circuitry is also explained in the notes to give a more pronounced 'hard' distortion.

**Operation**

Two of the Distortion kits were assembled and both worked first time, with no difficulties encountered. However, should you have any trouble, a 'Hot Line' at the Roland UK E&MM OCTOBER 1982

factory will lend assistance on 01-847 1671. Both keyboard and guitar examples using the Distortion unit are given on E&MM Cassette No. 8.

The unit works well and has a very effective tone control and may be classed as a 'medium' distortion effect, without producing the extremely dirty, raucous sounds of the heavy metal guitarist. Nevertheless, judicious boosting on amp and instrument tone controls 'dirty up' the sound considerably. On lower tone settings the unit adds a pleasant, slight overdriven effect that livens up most guitar solos.

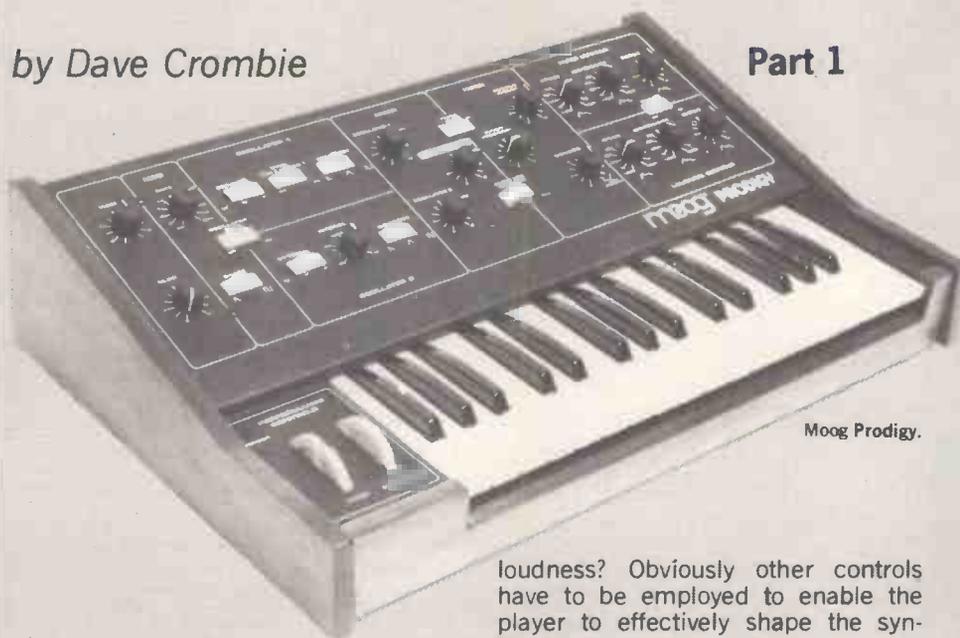
Next month, we'll examine the Amdek Chorus kit. **E&MM**

**E&MM's special offer price for the Amdek Distortion kit is £29.75 inc. VAT and p&p. Please order as: Amdek DSK-100 kit.**

# GUIDE TO ELECTRONIC MUSIC TECHNIQUES

by Dave Crombie

Part 1



Moog Prodigy.

For the benefit of the uninitiated, synthesiser performance controls aren't anything to do with Musicians' Union regulations regarding the use of the synthesiser for live work; but specific control devices that are used to modify certain parameters of the sound whilst the instrument is actually being played.

The necessity for performance controls is due to the very nature of the synthesiser. No acoustic instrument produces a sound with constant pitch, timbre and amplitude - at least two of these will vary during the course of a note. The synthesiser, with its voltage controlled modulation facilities, can automatically change the pitch, timbre and amplitude of the sound (envelope modulation of the VCF, VCA etc.) but to really get the best out of the instrument the human element has to be injected and this is where the performance controls come in.

Obviously it is possible to twiddle the VCF cutoff frequency knob (say) whilst playing the keyboard, but preferably special controls should be used that are easy to operate, conveniently located, and able to accurately modify specific parameters.

Let's get back to our analogy between the synthesiser and acoustic instruments; the latter have, over the years evolved into complex pieces of equipment that are designed to produce specific sounds and to accept the various control signals (e.g. breath control) that the player feeds it. However, the synthesiser's controls have come from existing technology, and have been adapted to fit the role demanded by the synthesiser's modus operandi. For example, the keyboard is virtually the same device as used on the electric and electronic organs, yet it is only capable of determining a 'steady state' pitch - what about the timbre and

loudness? Obviously other controls have to be employed to enable the player to effectively shape the synthesiser's overall output.

## Pitch control

The best known performance control is the *pitchbender*, and to my mind a synthesiser isn't a synthesiser without one. But before discussing the various types of controllers available, we should look more closely at the problems related to user determination of pitch.

There are three different areas of pitch determination. Firstly (as previously mentioned) we have the 'steady state' pitch as defined by which note is played on the keyboard. Secondly, we have manual pitch modulation - pitchbend - which takes the form of a variable bias to the steady state pitch. And finally there is pitch modulation, which can take the form of periodic variation of pitch with time about the steady state frequency (LFO modulation), or aperiodic variation with time (envelope or noise modulation). A standard monophonic synthesiser should offer the musician facilities to control all three types simultaneously. See Figure 1.

There is a close analogy between pitch and timbre when considering voltage controlled synthesisers - with the frequency of the oscillators related to the frequency of the filter cut-off point - so again there are three degrees of timbral assessment: the steady state cutoff point, the periodic variation of pitch with time (LFO or oscillator modulation) and aperiodic variation of pitch with time (EG/Noise modulation). However, the ability to be able to quickly control these filter parameters is less important than for the pitch.

## Mechanisms

We'll start by looking at just the pitchbender, though in many cases, the

modulation wheel is designed along much the same lines.

What exactly do you want a pitchbender to do? Now this is important because there are several options available, and each one has its own unique qualities:

1. Do you want to be able to bend the pitch both up and down?
2. Should the control return the pitch to its initial 'in-tune' position when released or remain as set?
3. What kind of physical device do you prefer?
4. Do you need to be able to control more than one parameter with this single device?
5. Have you thought about the options available from touch or force sensitive keyboards?

A further consideration must relate to standardisation. As we shall see, mastery of the performance controls isn't easily achieved - it can take a lot of practice to be able to control a synthesiser with anything like as much confidence as a guitarist playing his 'axe'. So should you consider spending months getting to grips with one particular type of controller, only to find that when you come to update your synth, no other manufacturer has used this kind of mechanism?

The Minimoog and the ARP 2600 were the first two important synthesisers to become available in a commercial sense. The Minimoog used the now famous 'wheels' as its performance controls, and the musicians loved

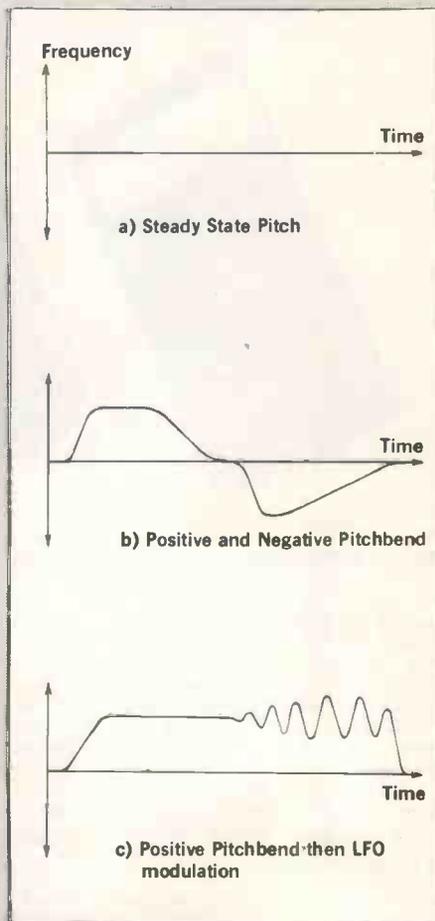
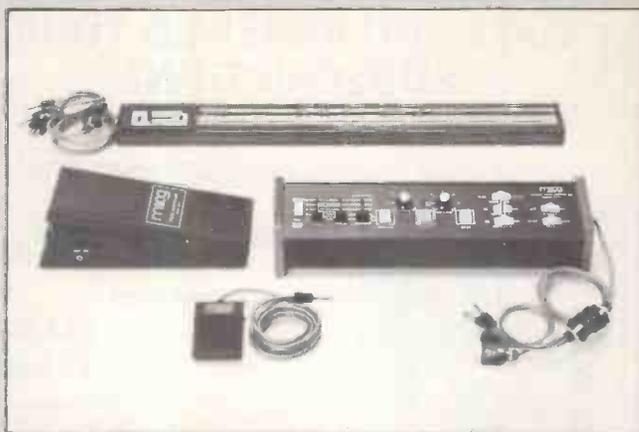
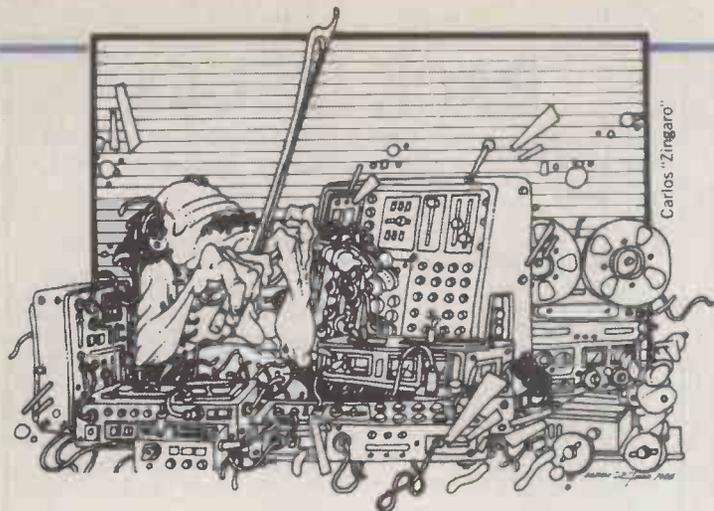


Figure 1. Pitch control.



Moog controllers (ribbon controller at top).

it; the ARP, although very popular, didn't have a convincing set of performance controls, and failed to match the Minimoog in terms of musicality. Performance controls turn what is essentially an electronic box of tricks into a musical instrument.

### Moog's Wheels

The wheels, one for pitchbend, the other for modulation, have changed little since their inception on the Minimoog some twelve years ago. Figure 2 shows how simple the centre-detent pitchbend mechanism is. The wheel is made from a plastic disc and can be considered to operate rather like a giant

edge-wheel knob. A small notch is formed into the plastic and a spring-loaded conical section mounted so that it presses onto the side of the wheel. At one point the conical piece of plastic will 'fall into' the notch and anchor the wheel. By applying pressure to turn the wheel, the cone can be freed from the notch and the wheel becomes free to turn the potentiometer again. This is a simple but clever system that reliably anchors the performance control in its mid position whilst still allowing the pitch to be shifted either up or down.

Many other manufacturers have adopted Moog's wheels for their instruments, and one, namely Sequential Circuits Inc, have even managed to simplify the mechanism - Figure 3 shows how SCI have used half of a P-clip to anchor the wheel in its central position.

It must be remembered that it is vitally important that the centre-detent mechanism clamps the control to its exact original position - a mere fractional amount of play will put the synthesiser out of tune with its accompanying instruments. In fact, the Moog system as detailed above is prone to wear - the conical piece of plastic tends to get rounded off, and it is necessary to replace it every year or so (depending on use). The SCI approach will last virtually for ever. The accompanying modulation wheel simply acts as an amount control with no centre-detent mechanism.

### Sprung Wheels

Moog toyed with the idea of using sprung wheels that automatically returned the pitchbend knob to its initial position when released. The Sonic VI was equipped with one such device. The nice thing about these devices were that they felt good to use, it was as if you were bending against an increasing force - a sensation similar to that experienced by a guitarist who finds the restoring force becoming more strong the further he bends the string. The disadvantage with this system is that you cannot leave the control set at a particular level as it returns to its initial position as soon as it is released.

### The Ribbon Controller

Moog originally developed the ribbon controller in the Sixties for use with his modular instruments, at this time

the device was about 30 inches long and consisted of two separate ribbons from which a control voltage and a trigger pulse could be derived. Many of you will remember Emerson prattling around on stage making the most of this controllers phallic imagery. This control device was modified so that it could be used effectively in such Moog instruments as the Polymoog, Multimoog, Micromoog and in some Minimoogs. It consists of a short metallic strip (about 5 inches long) and it generates, with the aid of its back-up circuitry, a voltage directly proportional to the point at which it is touched - thus the further away from the centre position it is touched, the greater or lesser the control voltage, and consequently the pitch, becomes. The ribbon controller has a lot going for it as it is an electronic device and therefore there has been no problem returning it to its initial position; second, by rocking your finger on the strip you can induce a manual vibrato in much the same way that a violinist does; and third, you don't have to bend the note up before you can come back down - just touch the strip at an extremity and the pitch is instantly changed. You can even use it to do manual trills. The main reason that the ribbon controller isn't more widely used is that a lot of musicians feel that the ribbon is rather impersonal, and lacks feel as you aren't actually moving or turning anything (except your finger).

Yamaha also utilise an interesting variation on the ribbon theme. The CS80 (voice assignable polyphonic) has a strip around 18 inches long positioned just above the keyboard. You can touch this strip anywhere along its length and nothing will happen, but then by moving your finger in either direction the pitch can be raised or lowered, until releasing the strip returns the tuning to its original state. This is quite a nice idea, and it also gives a very wide pitchbending range.

Next we'll be looking at three more forms of modulation control: the proportional pressure pads used by ARP, the sprung lever used by Roland and the joystick often adopted by Korg, Polyfusion and others. Also we'll investigate how force and velocity sensitive keyboards can improve your playing technique. **E&MM**

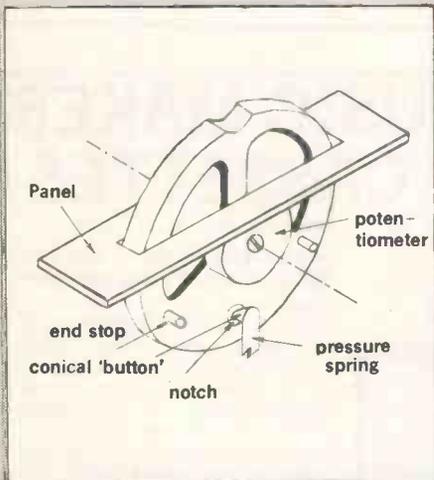


Figure 2. Moog's Centre-Dente Wheel mechanism

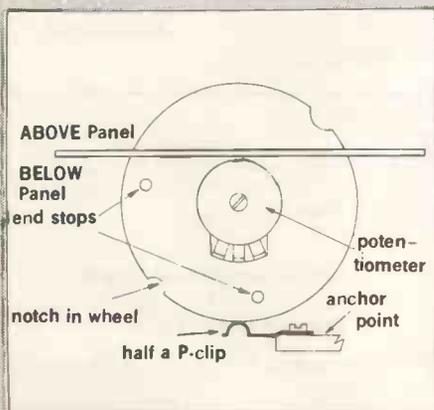


Figure 3. The SCI Wheel mechanism.

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ject. 6. Paia 8700 Computer music. 7.  
Frankfurt Music Fair.

**Demo Cassette No. 2 (May/June  
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Organ. 4. Apple Music System. 5.  
E&MM Word Synthesiser. 6. Fairlight  
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Sharp Composer program. 8. Yamaha  
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Roland instruments: Jupiter 8,  
TR808, MC-4, & GR300. 6. Steve  
Howell piece. 7. 'Ecstasy' LP by Georg  
Deuter excerpt.

**Demo Cassette No. 5 (Dec./Jan.  
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1. Teisco SX-400 Synth. 2. Poly ZX81  
music. 3. Study Music 1: Synth back-  
ing for you to play solo of Dec. '1984'  
Rick Wakeman music. 4. Casiotone  
701. 5. Yamaha CS70M. 6. Roland  
CR8000. 7. E&MM Synclock project.  
8. Study Music 2: 'Exit' music from  
Jan. issue minus theme for you to solo  
with. 9. Alpha Xtauri Computer  
pieces. 10. Elka X-50 Organ. 11.  
Soundchaser. 12. Ian Boddy music.  
13. Richard Mitchell's electronic  
music for film.

**Demo Cassette No. 6 (February/  
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1. Yamaha GS1 played by Dave  
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Roland Drumatix sounds. 4. Study  
Music 3: Ike Isaacs performs his  
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Firstman Sequencer. 6. Wersi Comet  
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Study Music 4: Kraftwerk's Ralph  
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Home Electro-Musicians: Johnny  
Dermestors, Gerry Taylor. 10. Digital  
Delay Line Effects Project. 11. Per-  
cussion Sound Generator Project. 12.

E&MM Spectrum Synth sounds.

**Demo Cassette No. 7 (April to  
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tains:**

1. Roland Juno 6. 2. Cardiff University  
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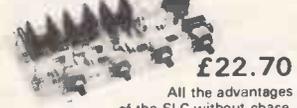
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## ELECTRONIC MUSIC — A PHILOSOPHICAL DEFENCE

I constantly find myself in the position of an apologist for electronic music in discussions with people who seem either to have heard very little E.M., or a very specific type of E.M. which they dislike.

By 'electronic' I mean any music which uses electronics in either its production or treatment or both. 'Classical E.M.' seems to be identified with *Musique Concrète*; indeed one musician I know remarked that the phrase *live electronic music* was a 'contradiction in terms'. It is important not to limit ourselves to this rather academic use of the term.

But *Musique Concrete* — so-called Classical E.M. — is as good a point as any to begin a defence of electronics in music, because it challenges our most basic assumptions about the nature of 'true' music. Can any sound be classed as music? Can the sounds one hears standing in the middle of Oxford Street be classed as music? The idea that they can is certainly older than John Cage. In 1855 the American poet Walt Whitman wrote:

'Now I will do nothing but listen,  
To accrue what I hear into this song, to  
let sounds contribute toward it.

... Sounds of the city and sounds out of  
the city, sounds of the day and night,  
... The ring of alarm-bells, the cry of  
fire, the whirr of swift-streaking engines  
and hose-carts with premonitory tinkles  
and color'd lights,

... The steam-whistle, the solid roll of  
the train of approaching cars'<sup>1</sup>

We need to develop a new *mode* of listening and appreciating: the old parameters of traditional musical expression are replaced or (better) supplemented by new ones which are new in an often radical way.

As far as using electronics to produce sounds is concerned, people will often claim that the idea of using 'machines' to make music is 'unnatural'. Unfortunately for this argument, the fact is that *all* musical instruments are machines. The piano is a machine, and so is the flute. If by 'machine' we mean 'human-created' then the only exception is the human voice. Connected with this is the notion that a drum machine rhythm is less 'human' than a real

drummer's equivalent. Desmond Morris<sup>2</sup> has pointed out how closely our appreciation of rhythmic pulse — especially of the 'disco' variety — is linked to our pre-natal perception of the maternal heartbeat. And the heart is itself a biological rhythm machine.

Perhaps the greatest misconception of all is that electronic instrumental sounds are cold, unfeeling, inexpressive. They can be, but they can also be the warmest, most expressive sounds available to a composer. It's a new, different kind of warmth, though, and the means of expression are new: phasing, filter-sweep, and complex dynamic envelope to name just three. For sheer expressive power try listening to the Ondes Martenot — an instrument unfamiliar to far too many people — in Olivier Messiaen's 'Turangalila' Symphony. In the realm of Time, electronic sequencers are opening up a whole new world of rhythmic expression. In the words of Peter Baumann: "The sequencer can play any rhythm, many rhythms in fact that we can't play. But these rhythms exist."<sup>3</sup> Unfortunately there are some people who take the attitude that anyone who dares to produce sounds that have never been heard before is simply not worthy of the title 'musician'. (In 1899 a Viennese music society rejected the opportunity of giving the first performance of Schoenberg's 'Transfigured Night' because they discovered a chord — the fourth inversion of the dominant ninth — which could not be found in any current book on harmony.)

Naturally, with all this wealth of novel sound suddenly available, there is a danger of over-indulgence in the purely physical aspects; an orgy in colour at the expense of line and form. To my mind this is the case with Larry Fast, and often in the past with Tangerine Dream: intimacy and expression are restricted. Compared with these, a track like Kraftwerk's "The Model" seems positively austere, which makes it all the more effective. This is only my personal view, but I think the trend towards austerity and economy of means, even repetition, in much recent E.M. can be seen as a return to the spirit

of early music, where we find exactly these qualities, but in the company of acoustic instruments. (Consider a medieval French chanson.)

E.M. is only as good as the people who compose and play it. It's the same with anything, but people regrettably blame the medium, not its exponents, when they don't like what they hear. In this respect I strongly believe that E.M. must be *original*, and not an attempt to 'do the classics'. More harm has probably been done to E.M.'s claim to be a serious art-form by Tomita's arrangements than by anything else. I personally know several classical music lovers whose hatred of E.M. seems to stem mainly from hearing Tomita records.

Most encouraging at present, however, is the rapidly growing commercial acceptance of electronic sound. Bands like Human League, O.M.D. and Soft Cell are showing that synthesisers can play tunes, and the sounds can be very pleasant to listen to. It doesn't seem very long ago that the idea of an all-electronic group topping the charts was regarded with amusement.

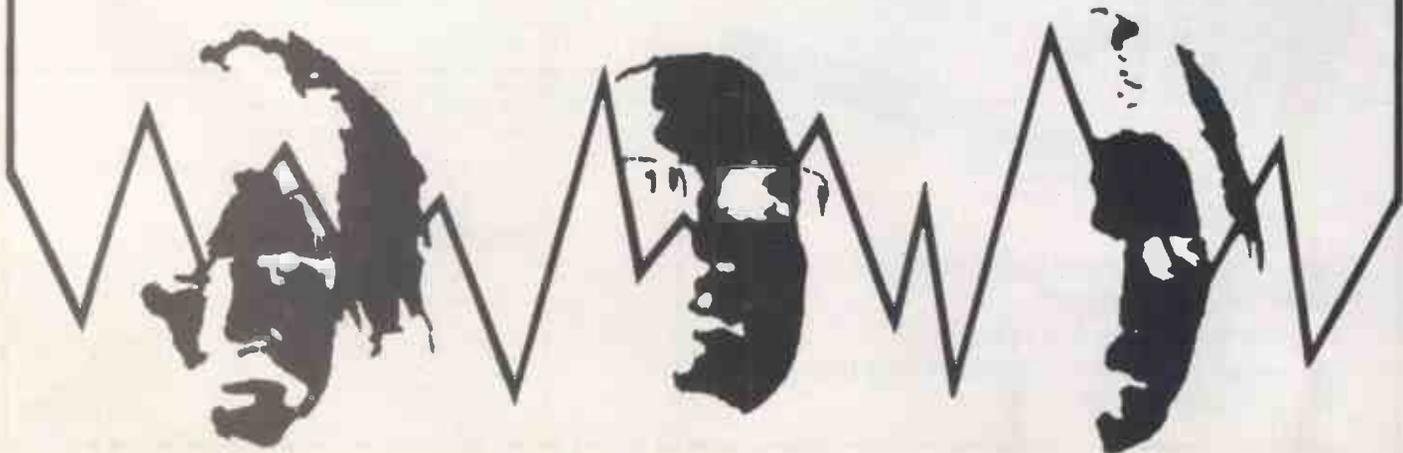
So what of the future? Will the present explosive development of never-dreamt-of sophistication (in musical rather than technical terms) lead composers and musicians to search for a new simplicity and purity, as I've suggested? (This is the light that music like Erik Satie's 'Gymnopédies' must be viewed in, coming as it did at the climax of 19th century Romantic indulgence.) Whatever happens, it is pointless to either oppose or lament it. Change is healthy in itself, and can only lead to greater freedom for art. As always we are at a developmental crossroads, but for my money it is the most exciting one in the history of music.

**Steve Moore**

### References:

1. Walt Whitman — 'Song of Myself', in *Complete Poems of Walt Whitman*. Penguin, 1975.
2. Desmond Morris — *Intimate Behaviour*. Jonathan Cape, 1971.
3. Interview in *New Musical Express*, 22nd September 1979.

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At last, after months of careful thought and development E&MM have come up with a unit we consider to be ideal, both in quality and price, for the modern musician: The ElectroMix 842.

This studio quality mixer was designed to provide a versatile range of facilities, good specification and considerable cost saving over commercial units. It features an 8 input, 4 group format with a stereo monitoring system, making it ideal for 4 track recording. It is equally at home in live performance situations where instruments and vocals can be sub-grouped.

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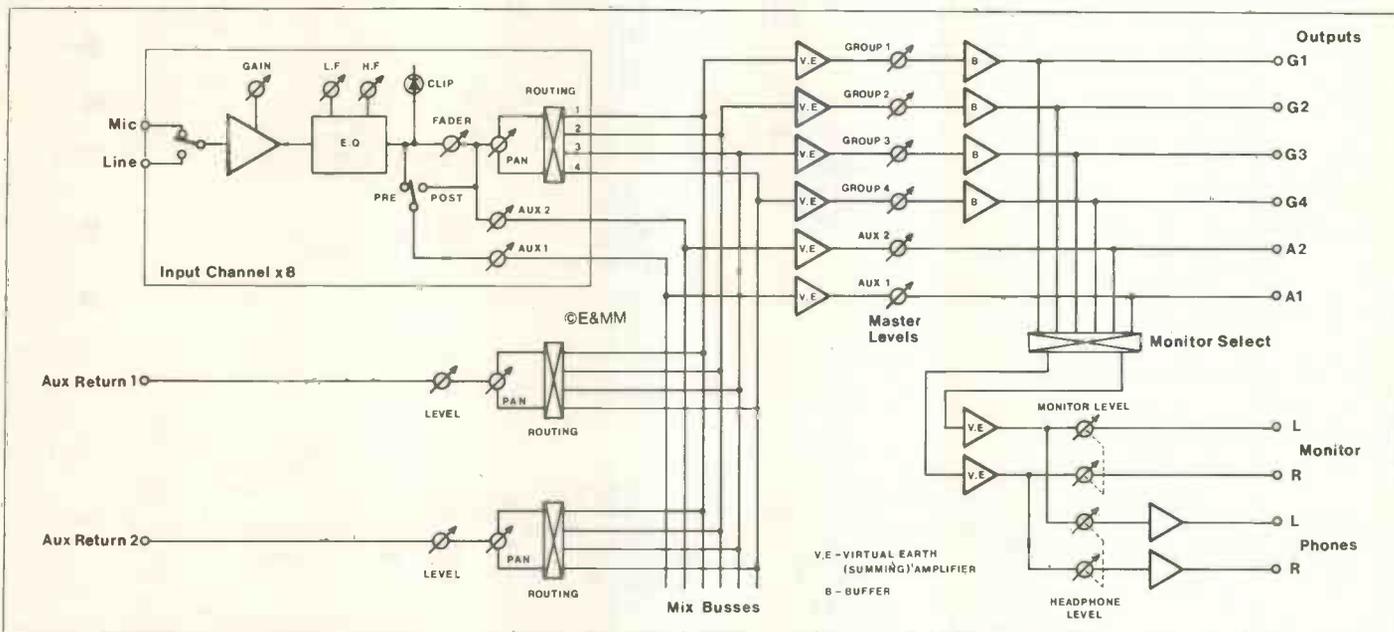


Figure 1. Block Diagram of the ElectroMix 842.

reduces the inter-wiring needed, thereby reducing the possibility of noise pick-up.

The inputs and outputs are connected via 1/4" jack sockets and operate at -10dB (330mV) which is standard for the popular tape machines such as Teac, Fostek, Sony etc. Higher output levels could be used but would result in lower input sensitivity.

A block diagram of the system is shown in Figure 1.

Mic and Line inputs are high impedance (47k) although details are given to modify the mic input to 5k. A 'Retro-Fit' channel module with an electronically-balanced mic input will be available. Bass and Treble controls with a wide range of Boost and Cut are provided — further EQ can be added from external Parametrics or Graphics. The channel faders feed the four group mix busses via the Panpot and routing switches. Recording on one track (mono) is simply achieved by selecting a pair of groups and panning to one of them.

Aux 1 is switched pre or post fader, so it can be used as a Foldback send (pre fade) or an Effect send (post fade). Aux 2 is post-fade giving the option of a Foldback and Effect send or two Effect sends. There are two Aux returns with level controls that can be panned across Groups 1 and 2 or 3 and 4.

The monitor section consists of a series of switches and a level control to drive an external stereo amplifier and speaker set up. The stereo headphone amplifier follows the monitor selection with a separate level control.

Although there are no meters on the

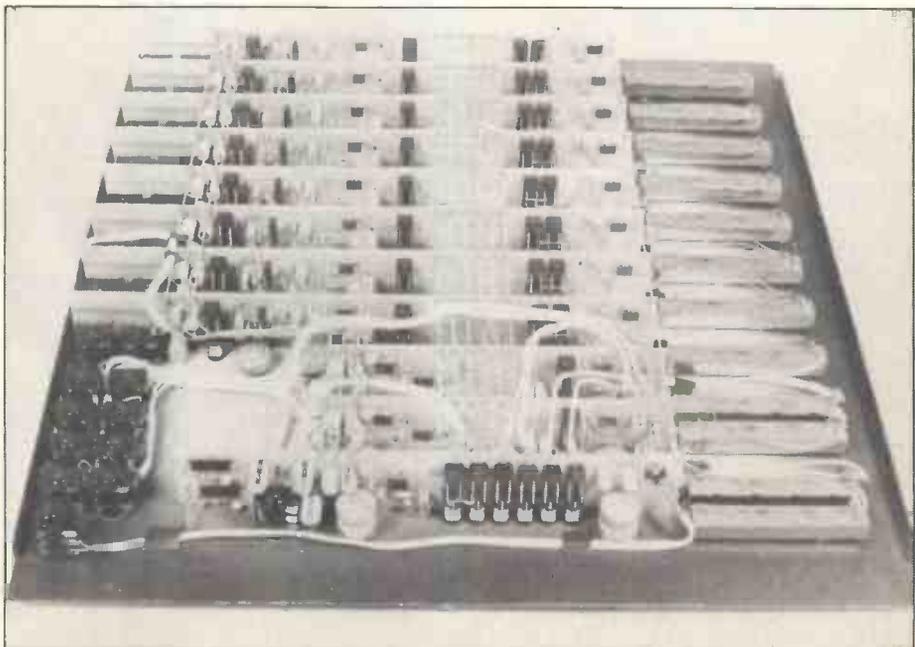
mixer there are fast acting clip indicator LED's for each channel. The threshold is common to all the LED's and can be preset over a wide range. Therefore they can be used as overload (clipping) indicators or set to operate when input signals reach a determined level i.e. simple metering. An add-on 19" unit to house 4 meters to monitor the group outputs (with one switchable to the Aux's) will be published in a future issue along with details of the 'retro-fit' channel module.

The power supply is housed in an external case to minimize hum pickup.

## Circuit Description Channel Module

The Input amplifier is based on a Hitachi Integrated Circuit, IC1 HA-12017, designed for use in low noise high performance Magnetic Cartridge pre-amplifiers. In this case, by modifying the feedback components, a high gain flat frequency response amplifier with low noise characteristics can be produced.

Mic and Line inputs are available selected by S1. With the component values shown in Figure 2, both inputs have a high (47K) impedance, which



A rear view of the panel showing neat modular construction.

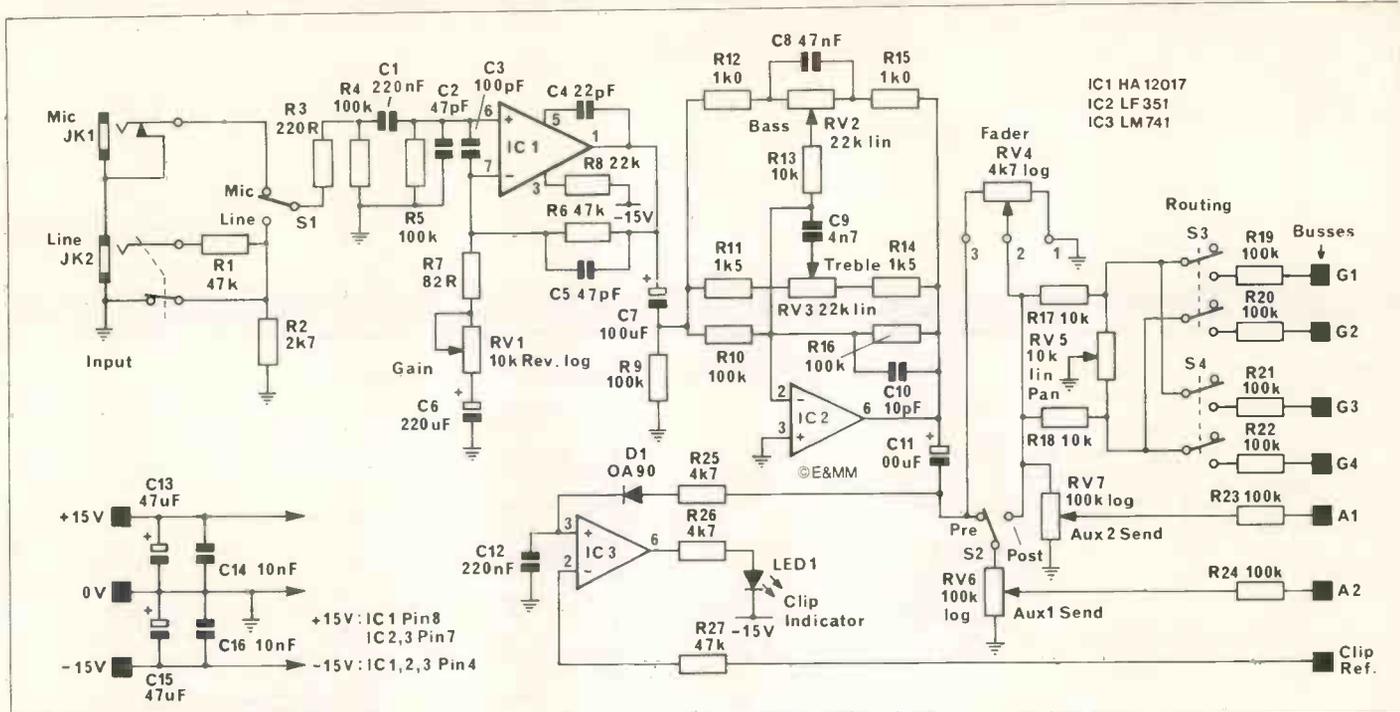


Figure 2. Channel Module circuit diagram.

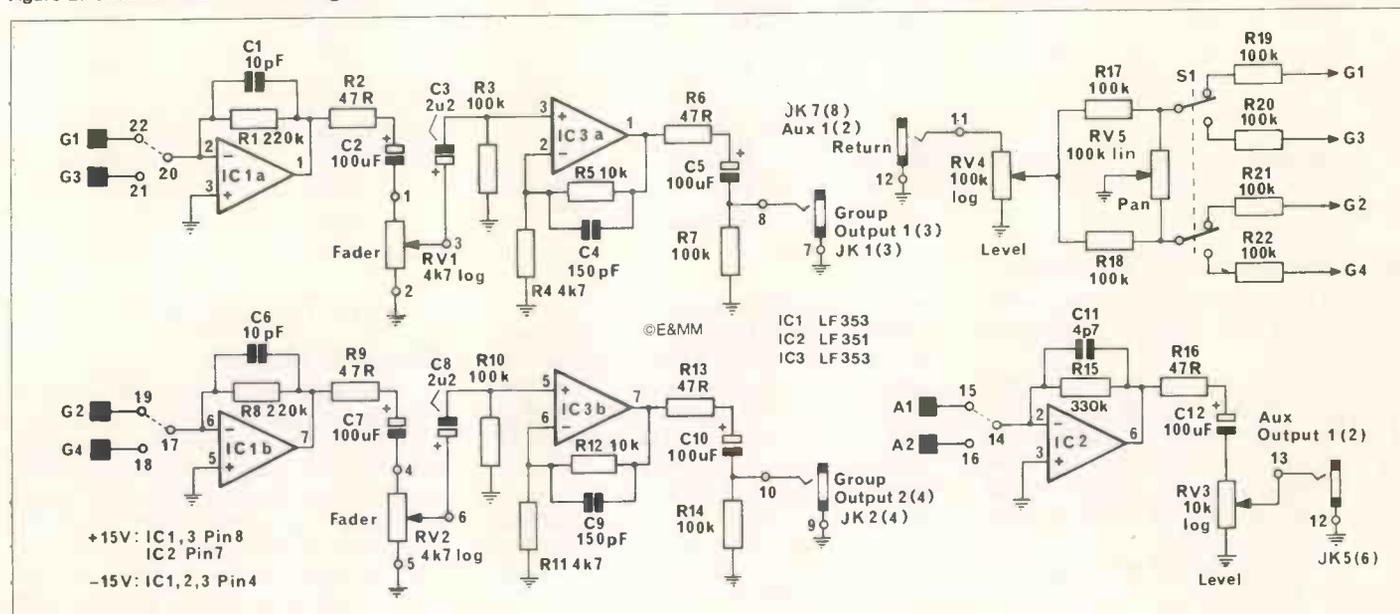


Figure 3. Group Module circuit diagram.

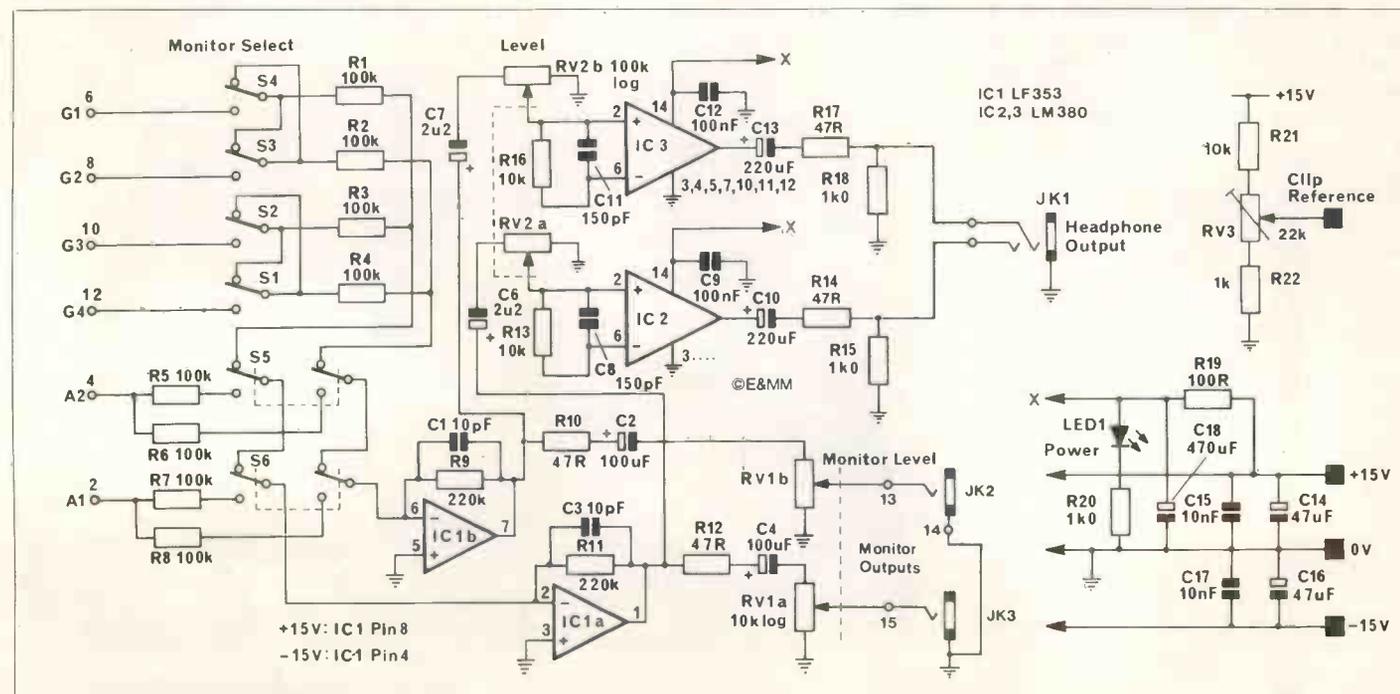


Figure 4. Monitor Module circuit diagram.

will suit low cost microphones, guitar pick-ups and most electronic equipment. Changing R2 to 5K6 and R4 to 4k7 gives input impedances for Mic and Line of 5k0 (suitable for low impedance microphones) and 50k respectively without affecting the gain. The Line input is attenuated by R1, R2 and then amplified by IC1. This arrangement may seem strange but the noise performance of a mixer is governed by the input stage and is worst case when using maximum gain on the most sensitive input, i.e. the Mic input. (The mixer specification is quoted for this condition.) It follows that attenuating Line level signals to a similar level to those seen at the Mic input will not increase the noise figure. Therefore, this method is both cost effective and easy to implement.

The amplifier IC1 is configured as Non-inverting with its gain set by RV1, R6 and R7;

$$\text{Gain} = \frac{R6 + R7 + RV1}{R6 + RV1}$$

As R6 is seen as a load on the output of IC1, keeping its value high will ensure maximum output swing. In this design R6 is a fixed value and the gain is adjusted by RV1, which has to be a Reverse log type to give an even rotation vs gain feel. Resistor R7 limits the maximum gain when RV1 is zero and C6 prevents any DC across RV1, R7 produced by the input current of IC1, causing an offset at IC1 output. R3, C2 and C3 provide a degree of RF rejection and C4, C5 are frequency compensating components. Capacitor C7 blocks any DC at IC1 output from the tone control stage which could cause the controls to be noisy in operation. The Tone controls follow the widely used Baxandal circuit and provides Boost and Cut at high and low frequency extremes. Resistors R10 and R16 were added to shape the response of the Boost/Cut curve and to limit the amount of Boost/Cut available. At this point IC3 monitors the signal level, where large amounts of EQ could cause the signal to clip. Using IC3 as a comparator, one input is fed by the rectified voltage on C12 with the other input fed by a reference voltage from R21, R22 and RV3 on the Monitor module. When the voltage on C12 exceeds the reference, IC3 output goes positive, lighting the LED. If the LED was connected to 0V, switching spikes produced as the LED lights would be picked up by the amplifiers and produce audible clicks. Returning the LED to the negative rail prevents this happening due to the good supply rejection of the Op-amps.

During recording, to cater for variations in signal level, the Channel Fader is operated at a nominal level below maximum. This position is marked 0VU on the fader scale and gives an output of -10dB relative to fader maximum. As -10dB is the final output level required this is ideal and gives +10dB signal adjustment without disturbing gain settings. From the fader the signal is split by R17 and R18 across the Pan-pot, RV5. Values are calculated to give a -3dB output from either channel with

## ElectroMix 842 Specifications

<b>Input Impedance:</b>	Mic 47k (see text) Line 47k.
<b>Input Levels:</b>	Mic -55dB (1.77mV) to -15dB (177mV). Line -30dB (30mV) to +10dB (3V) EIN -125dBV mic gain max. Group noise better than -70dB. -50dBV @ 20kHz.
<b>Noise: Unweighted.</b>	
<b>Crosstalk:</b>	
<b>Frequency Response:</b>	20Hz to 20kHz ±1dB.
<b>Equaliser:</b>	+16dB @ 100Hz Bass. +16dB @ 10kHz Treble.
<b>Nominal operating level:</b>	-10dB (300mV).
<b>Overload Margin:</b>	+20dBm (22V).

the Pan-pot central and 0dB at each end of travel. Audibly this gives a signal equal loudness as it is panned across a pair of speakers. In achieving this law there is some signal attenuation which has to be made up in Group amplifiers. S3 and S4 route the Pan-pot to the four Group mix busses, with the pan-pot operating across each pair of selected busses i.e. 1-2, 3-4.

Aux 1 (VR6, S2, R24) and Aux 2 (VR7, R23) feed onto their own mix busses to provide the foldback and effects send.

### Group Module

Each Group board contains the summing amplifier for a pair of Groups and one Aux, the appropriate buss is selected with links on the circuit board. The summing amplifiers use the Virtual earth principle produced by grounding the non-inverting +ve input of an inverting amplifier stage and applying signals via input resistors to the inverting -ve input. The -ve input is held at near ground potential (virtual earth) by feedback around the amplifier, which in effect forms a current summing point. Due to the low impedance at the summing point, there is very little interaction between inputs and as the mix busses are fairly long, less chance of interference pick-up. After the Groups are summed by IC1 and associated components, see figure 3, they are fed via the Group Faders to IC3, a +10dB amplifier. This restores the 10dB of signal held in the faders which operate in a similar manner to those in the Channels. This ensures a constant signal level through the mixer when the faders are at 0VU. These amplifiers buffer the Group faders so fairly low impedance loads can be driven.

The Aux returns are simply a level control, pan-network and a switch to route the return to Groups 1 and 2, or 3 and 4. By keeping the resistor values high, a reasonable input impedance (30k) is achieved, which should not load most effect units.

### Monitor Module

The Monitor section has been kept

simple to keep cost down and in many cases make it easier to use. The outputs of the Groups and Aux's are routed through S1-6 to summing amplifier IC1 and out via Monitor level RV1. The Output level should be suitable to drive most power amplifiers. Pressing any of the Group switches will select the appropriate Group to both outputs and is heard in mono. If Groups 1 and 2 are selected together, Group 1 will be heard on the Left and Group 2 on the Right. Similarly with Groups 3 and 4. The Aux switches have priority over the Groups and select the Aux to both outputs. This means the Aux's can be checked with the minimum of button pushing.

The Monitor output is tapped off via RV2, Headphone level, to a stereo headphone amplifier, IC2 and 3. LM380 power amplifiers are used because they require so few external components to operate. They do however tend to be noisy which appears to be due to the high internal gain of the device. R13 on IC2 (R16 on IC3) are added to reduce this gain and C8 (C11) helps prevent RF pick-up and further reduces high frequency noise. To prevent ear and headphone damage, (the LM380 can put out 2 Watts,) R14 (R17) limit the power available. If you are using low impedance headphones (8 ohm) the level is reduced more than if using high impedance (120 or 600 ohm) types, which gives suitable listening levels for both types. The headphone amplifiers require relatively large amounts of current which could lead to instability and cross-talk problems. The supply to the amplifiers is therefore heavily decoupled by R19 and C18. Careful track layout on the circuit board also helps to overcome any problems.

The chain RV3, R21 and R22 forms a potential divider to supply a reference voltage for the Clip comparators on the Channel modules. LED 1 and R20 provide a 'Power On' indication.

Next month we will move on to the construction and setting-up of the ElectroMix. However, to allow you time to order, the front panel and PCB's are available from us now. **E&MM**

The fully finished panel and a set of PCB's are available from Electronics and Music Maker, 282 London Road, Westcliff-on-Sea, Essex. The prices are £24.95 for the drilled, sprayed and screen printed panel and £24.95 for a full set of PCB's inc. p&p and VAT. Order as ElectroMix 842 Panel and ElectroMix 842 PCB set. Please allow 28 days for delivery.

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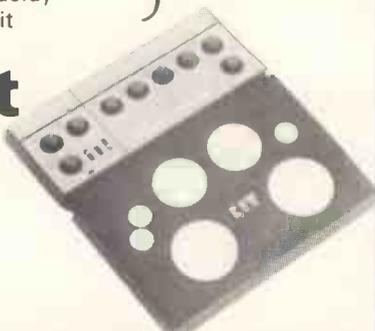
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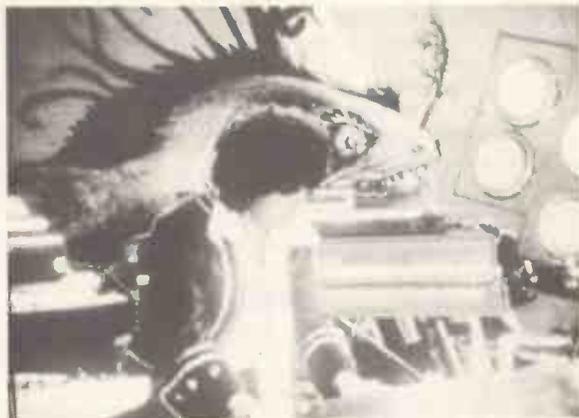
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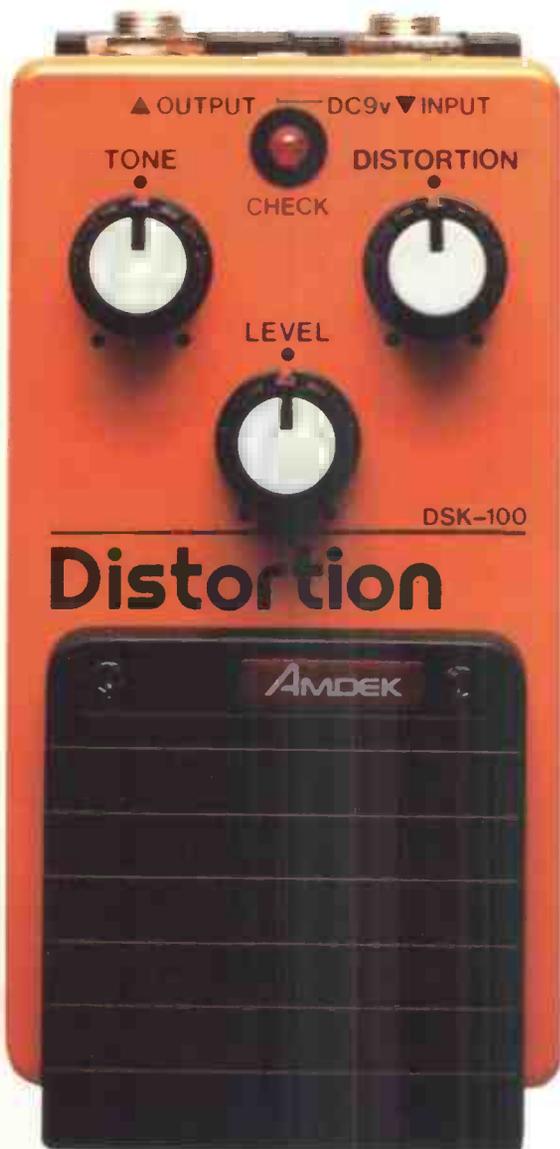
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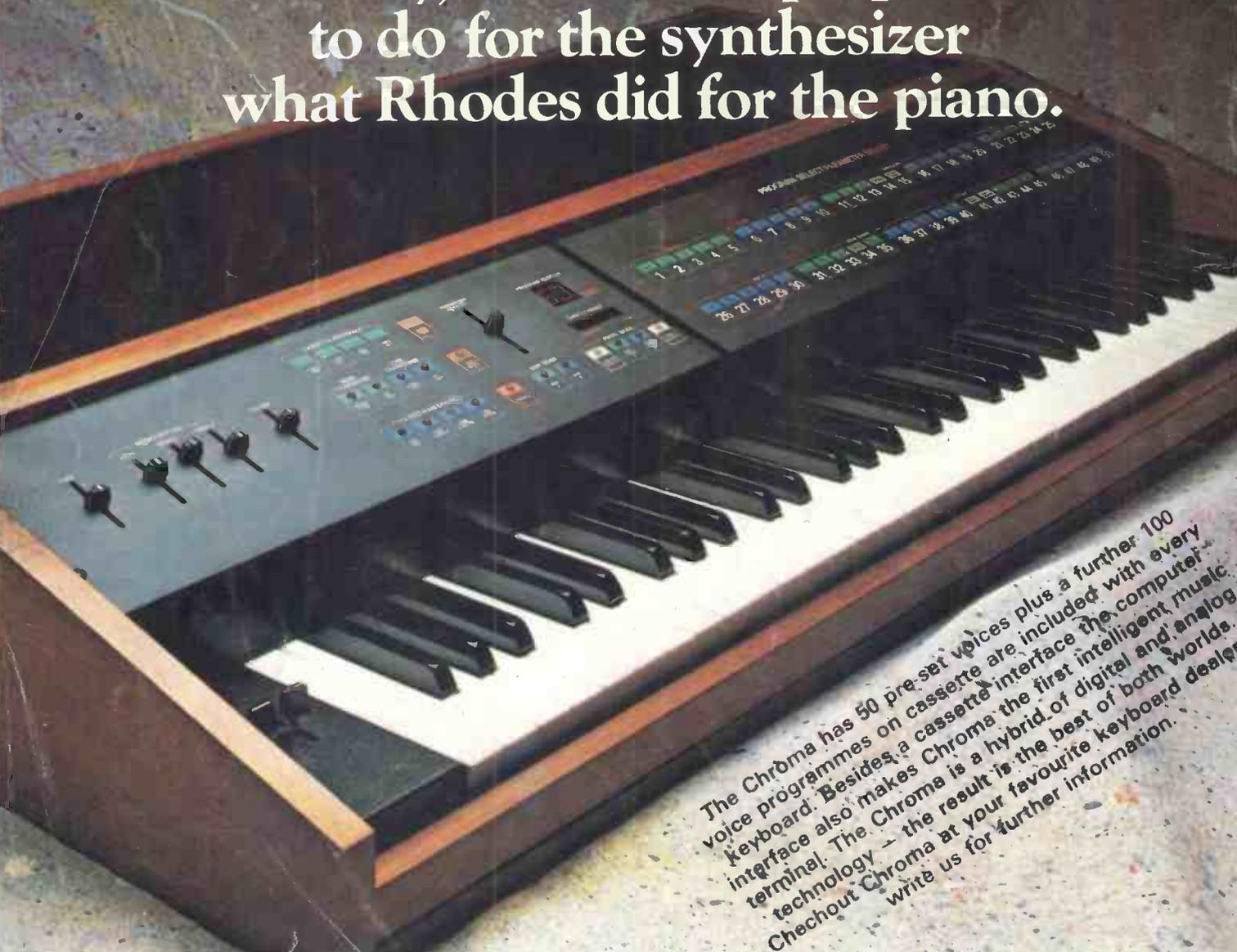


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