A.C.C AMATEUR COMPUTER CLUB NEWSLETTER
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On the left ; some of the forty or so ACC members who attended the meeting at DEC.

C.T.D.S.

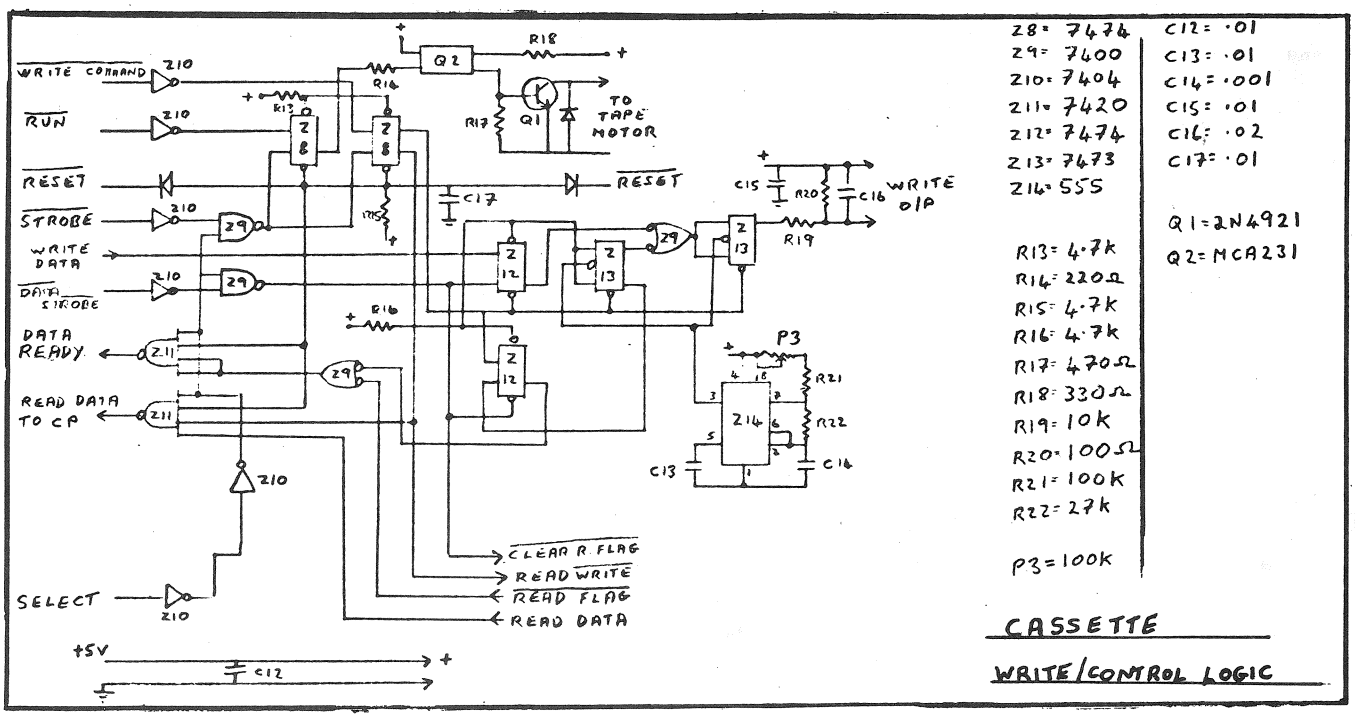
CASSETTE TAPE DATA SYSTEM

For over a year now I have been the owner of a 12 bit computer with 8k of memory and it soon became apparent that some form of back-up storage was necessary. I had seen many proposed standards for using audio cassettes but they all seemed to suffer from the same problem; they were rather slow, taking around 5 minutes to load 8k. Then I saw an idea used by a computer company for loading diagnostics which offered a much faster transfer rate and that resulted in the development of my present system.

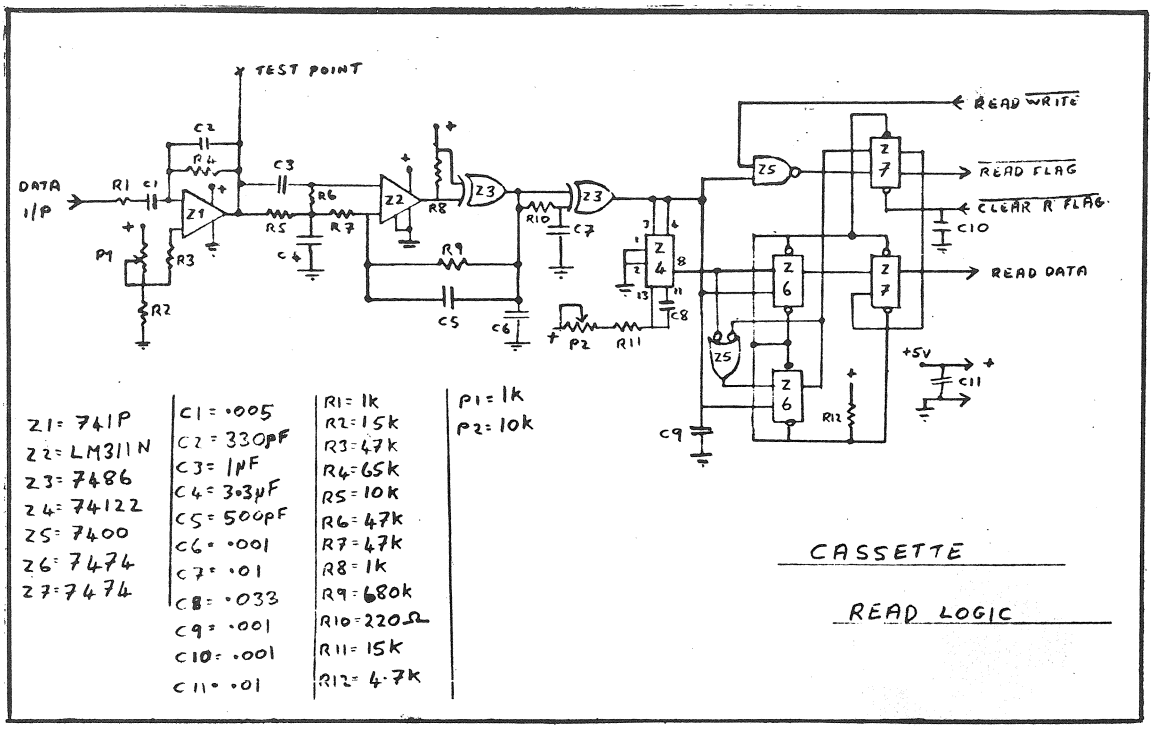
Basically the system is as follows;-
3300 bits/second using a normal audio tape deck and normal quality audio cassettes. This gives a transfer rate of approximately 360 char/s for 8 bit characters or, for my 12 bit machine, 250 words/sec, meaning I can load 8k of memory in just over 30 seconds.

The system works with the minimum amount of modification to the tape deck itself and uses saturation recording rather than the slower FSK (yes, and it does work with normal audio cassette tape heads).

The recording system is a fairly standard one for the computer industry. I record one flux change as a synch signal and then half a bit cell later I record another flux change to write a '1' or no flux change to write a '0'. The read logic fires a monostable on the first flux change, this monostable is set to time out after a time period longer than half a bit cell but less than a complete bit cell. If a flux change is seen whilst the monostable is set, it is read as a data '1', if no flux change is seen it is read as a data '0'.



CASSETTE WRITE/CONTROL LOGIC



I use a bit cell time of 300 micro-seconds with the monostable timing out after 225 uSec. This system requires a fairly accurate tape speed but this was not found to be a problem with cassette recorders of reasonable quality (£25 - £40), though I should avoid the very cheap ones. When I look at my read signal there is a lot of tape jitter on the timing but it isn't serious enough to cause problems. My system has been in operation now for about 6 months without any problems and tape read errors are very rare indeed.

You can record data in any way you choose,but I use the following method with my machine. First I record a block of zero's (about 4000). This gives time for the tape to come up to speed and for the monostable to be firing correctly before data is reached (we can call it the preamble), then I record a single '1' to mark the beginning of a data word. This is followed by 12 bits of data for program files or 6 bits of data for source files.Then comes another '1' bit and the sequence is repeated. The '1' bit inbetween data characters or words helps to detect loss of synch if the read logic ever misses a bit. Actually the first word I record is octal 1234. This is checked by software to make sure end of preamble was correctly detected. The words which follow indicate the type of file program name length of file etc. though the information included is a matter of personal choice.

The cassette logic is divided into two sections; one for read and the other for write and control. To interface it to a CPU you can use a simple hardware interface and send the bits serially by software or use a more complex interface and allow parallel character transfer between CPU and cassette. I use the simple interface system and more software; this allows me to change the word length and format very easily. With my system a simple cassette executive to load and dump files by name takes 512 locations in memory.

First the write control logic. Signals on the left hand side come from the interface. SELECT must be produced with every input/output instruction to the cassette. Control instructions to start tape in read or write mode must be accompanied by STROBE as must control instructions to stop tape in either mode. A control instruction to start or stop write mode must be accompanied by a WRITE COMMAND.

Write Operation

A write start instruction will set the two flip-flops Z8. The left hand one controls transistor drivers for the cassette tape motor, and the right hand one sets the logic for a write operation. (don't forget to put the cassette forward and record buttons down). The tape begins moving and monostable Z14 will complement Z13 to produce flux changes for the tape. The write output is taken to the cassette write amp with a short screened cable. Flip-flop Z12 and gate Z11 will generate a DATA READY signal to the interface which may now send a data bit. The data bit enters the logic as WRITE DATA and must be accompanied by SELECT and DATA STROBE. The data ready flip-flop Z12 is reset and the data bit itself is stored in the other half of Z12 from where it controls the complementing of Z13. Writing continues in this way until the run flip-flop is reset.

Read Operation

A read command sets the left hand flip-flop Z8 whilst leaving the other flip-flop in Z8 reset for a read operation. The read analogue signal is taken from the earliest point in the cassette which will give 2 volts peak to peak at the O/P of Z1. This signal is then limited by Z2 and converted into very short pulses for each flux change by the exclusive or gating Z3, each flux change produces a logic pulse to trigger mono Z4 which gives a data window in which we must see our data flux change to read a '1', or no flux change to read a '0'. The data bits are passed through Z6 and Z7 and then through Z11 to the interface and that's it ...

Setting Up

It isnt difficult to set up but note the following points;

Do not let the output of Z1 drop below 2Vp-p (gain of Z1 can be changed with R4). P1 allows the output of Z1 to be balanced.

Z14 should be set for 150 micro-seconds between bit pulses (half a bit cell) and whilst reading an all zero's block Z4 should be adjusted to time out 50 micro-seconds before being retriggered by the next flux change.

Its best to set up the system with a scope but I have tried doing it without and it can be done, however its not a practice I'd recommend.

I haven't included pin numbers on most of the chips as I'm sure anyone attempting a system of this type can work them out (though I have included them for the two monostables).

I don't claim any originality for the design which is basically the same as that used commercially, and my contribution to the design amounts

to the interface for my machine and the software to drive it. However with a little care its not too difficult to build and set up though of course not as tolerant as the FSK systems as regards signal level and tape speed. In writing this article I don't wish to challenge the CUTS FSK system but this design may be of interest to those who would like something a little faster even if it is not conforming to a standard.

Ian Spencer.

LETTERS

I thought you might like to give a mention in the next newsletter to a book : "An Introduction to Microcomputers", which some readers may have seen advertised in New Scientist some months ago. By Adam Osborne, it is extremely good for its price (£7.80 all-in). As well as giving a good general description of microprocessors, and the differences in architecture between them and minis, it gives details of timing and electrical connections, plus appendices giving complete descriptions of the following MPU, including their ancilliary chips ;

Fairchild F8
National SC/MP and PACE
Intel 8080
Motorola 6800
Rockwell PPS8
Signetics 2650

As someone who has sets of manuals for some of the above, the descriptions in the book are as much as you need until you actually buy one. To order send to;

Osborne & Associates Inc.,
2950 7th Street,
Berkeley, California, 94710, USA

You can quote Barclaycard (=BankAmericard) or Access (=Mastercharge) giving your account number and the card expiry date. Delivery was 4-5 weeks in my case.

P R Welham

****Got a copy myself, and it is really excellent value, beginners and old hands alike will find in it something of interest. If you don't want to order from the States, the European distributors are;

SYBEX, Publications Dept.,
313 Rue Lecourbe
75015 Paris, FRANCE

m lord *****

SHOP

FOR SALE

Creed model 54 teleprinter, with 5 track tape punch and reader. £25- ono.
G A Burkill
Rake Holt, Rake, Nr Liss, Hants

CLEARANCE SALE !!!!

1 off ¼" mag tape unit in working order with circuit diagram, power supply and spares (inc. head). Same as those from the Galdor Centre. £15-

1 off Friden Flexowriter with reader/punch. Works, with cct diagram. £15-

Stack of core planes, will give 8k by 12 bit, but can be rearranged. 250mA ½ select current. 50mV output for a stored '1'. £10- or offer.

Plus - - several other bits & pieces.

WANTED

A copy of Fortran 4 for the PDP8, with documentation. Papertape would be the best media but DECTAPE would be OK.I would be willing to pay for it or swap one or more of the above units or an optical paper tape reader for it.

RING;- 01-977-3222 x 3809
WRITE;- R.Selby, 145 Bedfont Lane, Feltham, Middx. TW14 9NH

CHEAP CORE STORES

I recently purchased some core stores from G.F. Milward of Birmingham. These are the ones mentioned under 'WOTSIT' on page 4 of the June issue. They are not just cores but come complete on a PC board about 9" square with 35 IC. All drivers are there, and they're all TTL compatible, as are the sense amps and inhibit drivers. I would estimate they were made in about 1972, and at £4.10 per board are excellent value. They are organised as 512 words by 8 bits, and although it appears the circuit has no set frequency of operation, and there are no output buffers, these are quite easy to dream up. It does not have a circuit diagram, but G.F.Milward very kindly supplied me with circuits of the main bits i.e. transistor source, sink and inhibit drive. I should point out that there are no discrete driving transistors, they're all in the 7545X series of IC core drivers on the board.

G.F.Milward charge £4.10 per board plus VAT (8%) plus 50p post. That works out at 10p per IC plus £1 for the core mat. They also have IC boards available, scrap, at 10p per IC.

Adrian Shead

HELP

I recently purchased an ICT (Welmec) 8 track paper tape punch unit together with a control panel equipped with; Verify, Reader Feed, Error Amend, Single Insert, Multi Insert, Punch Feed, Parity Check, Back Space, Error Cancel and Mains ON switches, and indicator neons to show the state of the trip coils and read sensors, and lamps to show; Tape Jam or Run Out, Parity Error and Mains. Also I purchased a unit performing the control consisting of over 30 high speed relays,capacitors and miles of so far unfathomable wiring. Also I bought the power unit which gives 135V to run the relays and solenoids.

I should be most obliged if anyone could send me more information together with, if possible, a circuit diagram (I will returm postage and any copying charges incurred). The model No. on the relay unit is 1021/1924 and on the punch S1108.

Incedantally if anyone is interested in purchasing these units they are available from Casey Bros. 135 Boundary Rd., St Helens. The approximate cost is £10 for just the punch (135V trip coils require seperate supply),£20 for punch, power unit,relay unit and control panel and £32 for all the previously listed units plus a keyboard and a reader. They all seem to be in good condition. N.B. Casey Bros appreciate a 'phone call to tell them what you want to ensure it is in the shop when you call.
K.M.Roberts 56 Victoria Ave, Grappenhall, Near Warrington WA4 2PD

I have recently acquired an ADDO 8 track punch (series 40.50) with encoding electronics & tape reels, the whole built into a wooden cabinet. Can anyone help me find circuit diagrams ?
Dhur Armand
97 Bd. Salentiny, Luxembourg

Anyone interested in robotics ?
Anyone know any cybernetic projects already accomplished or of any literature on this subject.
R H Stopford
14 Uplands Rd, Flixton, Manchester

In the April 1976 issue of the Newsletter you published my letter suggesting that radio hams who are also members of the ACC should let us know their call signs so that we would know when we met on the air. The following are the call signs of those members who responded;-

G3OIZ G3VZH G3YYD G8ILO G8KGV

Bill Ingle

SUACC

I and a few friends have, over the last few weeks, formed an amateur computer club at sunny Southampton University - with patent originality it is called the Southampton University Amateur Computer Club.
R Kirkby 44 Whitby Rd., Ruislip Manor, Middx.

THE WEENY-BITTER

WB1 ; I was thinking of building it, and got as far as comparing prices from various adverts. No great difficulty as far as active components and resistors etc are concerned, but I have not been able to discover where to get plain veroboard as large as 8" x 8", and other inert parts for the project. Whether I would make it if I could locate sources for all the parts I am still not sure. At present I am in the middle of the Open University course 'Computing and Computers' which takes a good deal of my time.

I certainly intend to go ahead with something, whether WB or microprocessor. I have bought a teletype 35RO from Chiltmead, and I intend to connect a keyboard following the design in Iss 1, but lack of knowledge to design the interface (at least I expect to make mistakes if I have to design it myself).

I look forward eagerly to each issue of the newsletter; I learn a lot from it. When I first joined the club I hardly understood any of the articles, but by reading past letters over and over again I gradually found it made more sense. I expect newcomers are joining the club all the time, many like me with no professional connection with any branch of electronics.

Is the ACC a member of other clubs e.g. in other countries ? If that is possible I think it might be a good idea, with the possibility of exchanging ideas and articles for the newsletter.

Anyway, keep up the good work ! Bill Hughes

*** the original WB was in fact built on 'second hand' pieces of 8"x8" veroboard from which the copper tracks had been removed ! Also, the ACC, which has about 35 members living outside the UK, has an agreement with the French club AFACO to swop information - we've tried to get a similar arrangement with some clubs in the USA, but with out any success. ed. **********

WB IS USEFUL !!

A change of direction - I've now shelved the teletext project for the time being & started to build the WB.

My main reason for the sudden enthusiasm came from work on the assembler. 256 bytes (less a bit) sounds small but you can get real programs in it ! My assembler is now working fine - I've taken some liberties with your suggested statement form (using a comma as a delimiter) & I've also defined two assembler directives; START & DEF (define). The START card is optional, & if omitted the assembly is right for loading at location 0. The name field in the START statement (which must, if present, be the first statement) is used to title the listing and cannot be referenced in the program. It can, of course, be duplicated and referenced that way. The whole assembler is a bit restrictive - the OP code must be punched in col 10, and the operands must start in col 16. All numbers must be left padded as necessary, as the effort to allow single or double figure numbers seemed not worth while. # numbers are octal, and displacements on symbols are decimal. A blank must occur after the last operand, and the rest of the card may be used for comments. Errors are flagged by replacing the op code or operand as appropriate with ### (invalid op code mnemonic) *** (duplicate symbolic name) £££ (invalid syntax) or @@@ (invalid delimiter / symbol > 8 chars). The listing looks a bit like the IBM assembler listing. The program, incedentally, runs in 44kb on a 370/158 (OS/VS1).

G Hayes

LIST OF WB CONSTRUCTORS

HAVE ALREADY BUILT :

M Lord 7 Dordells, Basildon, Essex.
R Mount 13 Senlac Rd, Romsey, Hants SO5 8RE
A H Stopford 39 Stoneway Rd, Cheltenham, Glos.

ARE BUILDING :

A Deas 6 Lime Close, Turnpike Est, Newbury,Berks.
A Monro 14 Adams Rd, Cambridge, CB3 9AD
M H Baker 18 Hawthorne Ave,Garstang,Nr Preston.
D A Craddock Redhill Farm,Twyford,Shaftesbury, Dorset SP7 0JD
G D Hayes 42 North View Cresc,Epsom Downs,Surrey.
G Walker 7 Pool Lane,Brocton,Nr Stafford,Staffs.
A Cassera 140 Tilehurst Rd,Reading,Berks.
D Monro 7 Andersons Way, Woodbridge,Suffolk.
R H Stopford 14 Uplands Rd,Flixton,Manchester.

WB THOUGHTS

In addition to earlier comments in the April '76 issue, I would like to add the following after experience gained in actually constructing WB;

1) If using coloured wire for connections, use the resistor colour code to choose the wire colour determined by lower no pin of lower no IC to higher no pin / IC e.g. if connecting pin 3 of X1 to pin 5 of X19 use an orange connecting wire (3 in res code is orange). Also, if pin no.higher than 10, subtrack 10 and use that colour e.g. orange for pin 13. This method uses a lot more red and black wire if using same for power supply connections.

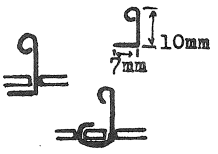
2) Connect +5V and ground connections (& decoupling C's) of IC's first, before starting signal wiring, and if 2 IC's make, say, a register, then work on these two at the same time or wires may be forgotten.

3) Tick off connections to IC's and individual wires as they are put in.

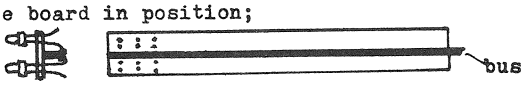
4) Use small diameter iron bit e.g. 3 or 4 mm.

5) If you want a lot of cheap terminals, use the idea below or veropins;

a) bend wire (about 0.7mm Ø) into shape
b) push through hole in board
c) bend bottom piece of wire back through board



6) Mounting LED's is difficult if you want them to look good ! Use long thin piece of board as below with busbar running along it and mount the whole board in position;



7) I found an ideal distance apart for the switches is about 30mm. (hold hand in front of you, palm down. Natural distance apart of major three fingers is distance apart for switches)

W G Beer

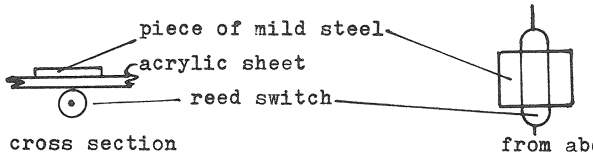
A new type of memory being developed by the USA company General Electric Co. combines an electron beam for fast access and a special semiconductor target for high density storage.

Called BEAMOS (BEam Addressed Metal Oxide Semicondoctor), the memory comprises an electron beam with suitable deflection circuits, and the semiconductor target mounted in a vacuum module 17 in long by 4 in diameter. The first model has a storage capacity of 32 million bits with an access time of 30uS.

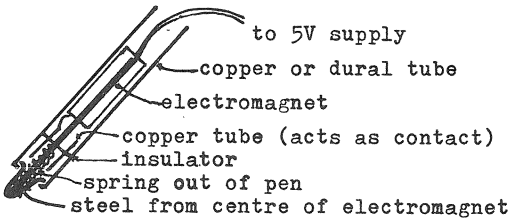
KB

I have produced a keyboard in a way which may be of interest to other ACC members;

I purchased 100 reed switches (glass encapsulated type) and a piece of dark green acrylic sheet and arranged the reed switches under the acrylic sheet in a matrix formation. Above each switch on top of the acrylic sheet I stuck square pieces of steel running in the same direction as the reed;



and to operate the switch I made a magnetic pen ;



This will only acuate when the bottom is pressed as if it was on constantly it would acuate other reeds. To close reed switch, the pen is pressed onto the centre of the steel pad over the reed. As reeds cost £4 - £6 per hundred this is a very economical method of producing a keyboard.

As you know, I'm making WB1 and at present I am on X36 of the control unit and so should have the unit completed by the time you receive this letter. Any member can come round and see it - just ring Newbury 47071 first. I am building it on three pieces of perforated PC $4\frac{1}{2}$" x 6". In the control unit there are 46 IC's & so it is getting a little crowded. I have found that Vero sell self-fluxing wire and I have made my own wiring pen which has saved me a lot of time, but care has to be taken as it acts as a very good fuse which blows when very small current surges go through it and so I have not used it for power supply rails or Data Bus lines.

A Deas

VDU

I would like to see the VDU project.

Having little knowledge of these beasties, I see two possibilities;

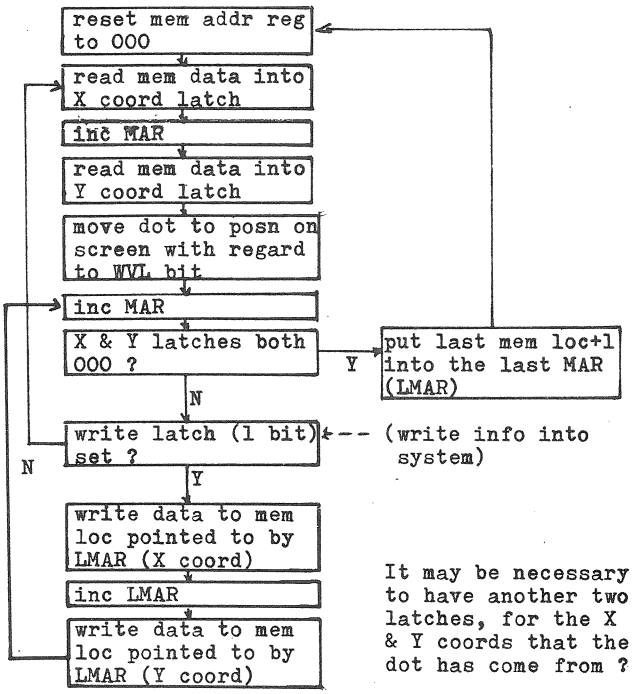
1) Use a system with a fixed memory, each location of which corresponds to one location (or character space) on the screen. e.g. PW or ETI systems.

2) Use an X-Y coordinate system (like a graphics terminal) with each memory location accessed in sequence, each containing alternately X and Y coordinates for positioning a dot on the screen. By using bytes, can use 7 bits for position (which will give definition of about 1mm on say a 20 x 30 cm screen (as per chiltmead ad in ETI Sep '76) and 1 bit for WHITE VIDEO LEVEL. This bit would go into a latch (1 bit) If the latch contains a '1', then the screen would have a line drawn on it while the dot moves from one position to another. Thus graphics are available.

I suppose that some delay mechanism would have to be incorporated to give the dot time to excite the phosphor on its journey. This time delay would govern maximum size of memory of course. The memory of course is not very restricted (apart from the above and the pound in your pocket !) but would probably have to be semiconductor RAM. Nonetheless, a 256 word 8 bit mem would give quite a detailed picture if it is composed of lines.

Is this idea feasible ? How would characters be generated ? What frequency would be ideal ? How about 25Hz (for 'FRAME')? Could use top left address position as a trigger. e.g. if the mem addr reg contained less than 128. when data in that mem location was 000 then the rest of mem would not be scanned (that loc and all successive locations would all contain 000) and the MAR would be reset. 'FRAME' would occupy time needed to access successively all locs from 000 to first mem location containing data 000, so if MAR is less than 128, FRAME frequency could be say 25Hz, else say 15Hz if needs be. (although 25Hz is better if it can possibly be obtained as there is little flicker at this frequency).

Maybe the pseudo flow diagram will help someone to come up with a better solution. This sets its own FRAME frequency. LMAR holds the maximum (highest) address +1 of the MAR that contains 2 successive 000's. Assume centre screen coordinate to be (100,100) so the most sig bit is '1' for right of screen and '0' for left i.e. governs a +ve or -ve signal to be applied to deflection plates (or coils).



It may be necessary to have another two latches, for the X & Y coords that the dot has come from ?

This second system is of course a dedicated system whereas the first only needs a modulator to interface to a standard TV.

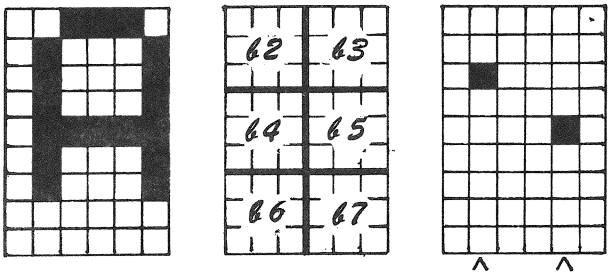
W G Beer

The basic idea is for a unit which will accept data from a computer and output a video signal to connect to a domestic black & white 625 line TV. this could be done either by building a VHF or UHF modulator, or by making suitable connections inside the set. The first idea is probably a lot more practical.

The computer sees the VDU as an extra 1k of 8 bit memory, and when no data needs to be displayed the VDU memory is a useful addition to the main computer memory. Fairly considerable editing facilities should exist in the VDU, so it can be used as a terminal with the minimum of software; I think this is justified because the extra hardware complication is fairly small, but anyway the editing facilities could easily be dropped to make a simpler unit.

The display is made up of 32 lines each of 32 character spaces, thus a total of 1024 character spaces are displayed. Each character space is controlled by one word of the 1024 byte memory. In each character space, three forms of display are possible; ASCII characters on a 5x7 dot matrix, graphics, or two points. These three forms are illustrated below. Each character space occupies 9 lines in every scan, and 6 dot positions in every line, so the total display uses 288 lines in each scan. This means that the bottom line or two may

not be visible on most TV sets, and so the number of useful lines may be limited to about 30.



ASCII character graphics point plot

For graphics, the character space is divided into 6 segments which are controlled by 6 bits of the control word.

In the point plot mode a point can be anywhere in each of the two columns marked by arrows, or either column may be blank; the left hand column being controled by bits 4 to 7, the right by bits 0 to 3, each treated as a hexadecimal digit which defines the line in which the dot appears,codes above 8 are treated as blanks. This method of display is particularly suited to graphs, which can be drawn with up to 62 plotting positions in the X axis, and up to 280 positions in the Y axis.

The 8 bit words held in memory are decoded in the following way;

In the normal mode b1 determines ASCII character (b1 = 0) or graphics (b1 = 1), b2-b7 then provide either a 6 bit ASCII code or the state (black or white) of each of the 6 graphics segments. b0 is a control bit which has no effect on the present character but causes the VDU to enter the point plot mode for the next character if it is 1.

In the plot mode the VDU will remain in this mode until it is reset into the normal mode. This is done automatically at the end of each line, and can also be done by a control word having b0 and b1 both 1. This resets the VDU immediately to the normal mode, so that b2 - b7 is interpreted as a graphics character.

T J W Clarke

In my view it is wise to incorporate the memory (at least for one 'page') in the VDU rather than accessing the computer. It is perhaps also as well to include a simple processor (e.g. using a small CPU chip) then data manipulation can be controlled by software. Since the machine is 'intelligent', the input can be converted by software from any input code to the appropriate characters, thus we aren't reliant on ASCII but can use 'any' computer's code. Editing etc. can be performed with minimal computer intervention, and the peripheral becomes very fast which means it can be used for, say, computer animation. Access can be via DMA or interrupt, depending on requirements. Since the terminal is intelligent it can be taught to recognise input, which means it can receive data, say from Ceefax, regognise the special codes (run-in, data, time etc.) and convert the information to compatible output. I think the VDU should be compatible with TV (obviously since TV can then be used as output) and we should aim for the full 6MHz bandwidth(approx 52 max displayed characters). A practical number of characters is then 48 (which is only 3 columns of BASIC standard format printout !).

P D Maddison

CT 1024 VIDEO TERMINAL

Similar to the PW videowriter, except that it has an ASCII serial interface, a kit including the keyboard but without case, UHF modulator, or TV is approximately £215 from;

Computer Appreciation, Castle St.,Bletchingley, Surrey RH1 4NX. tel; Godstone 3106

Computer Workshop, 174 Ifield Rd.,London SW10 9AG tel 01-373 8571

ALTAIR COMPUTER KITS

The Altair range of microprocessor kits and peripherals, which have been sold by the thousand in the USA, are now available in the UK from;

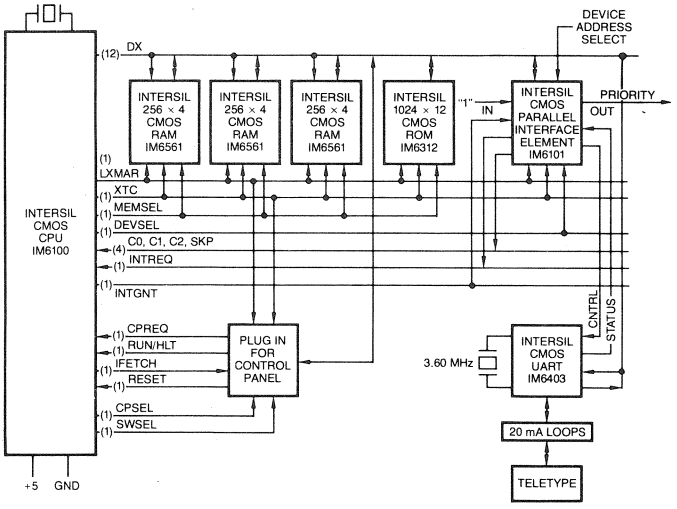
Compelec Electronics Ltd., 310 Kilburn High Rd, London NW6 01-3281124

The 8800a kit, based on the 8080, costs £396 with case, control panel, power supply etc. A similar kit based on the 6800 costs £342. Software is also available, e.g. 4 & 8k BASIC for the 8800, at £45/£55 to those who have already purchased the 8800 plus 4/8k of memory & I/O.

6100

The Intersil IM6100 is a single chip CMOS MPU designed to recognise the instruction set of the DEC PDP8/E minicomputer - useful because of the vast amount of software already available for the PDP8 although by modern standards its instruction set leaves a lot to be desired.It is basically a single address 12 bit machine. The 6100 is available in three versions, cheapest of which is the IM6100C which gives a 6uSec memory to accumulator ADD time when using a 3.3MHz clock and a 5V supply.

Main features of the 6100 are on chip clock, using an external crystal,single power supply, and a single 12 bit bus used for both data and address. When run from a 5V supply it is TTL compatible. Intersil make CMOS RAM's & ROM's to go with the 6100. These have internal address latches, external latches are needed to create separate data & address buses if other types of memory are used. A Parallel Interface Element - IM6101 - provides all the signals needed to communicate with an external device in accordance with PDP8 protocol. Because the devices are made using CMOS technology power consumption is extremely low; typically 12.5 mW for the MPU.



CPU'S

Some single board computers released this year, like the LSI-11, they are all 16 bit word machines, and are effectively scaled down minicomputers, rather than blown up micro's, and are consequently more powerful and a better buy (if you've the money to spend)than many of the 'single board computers' based on, for example, the 8080.

The Data General MicroNova comes with 4k words RAM on a 7½ x 9½ PCB at £570, one off. The basic CPU chip used costs £135 !

The Interdata 5/16 is £520, again with 4k words.

Computer Automation's 'Naked Milli' is 7" x 15", and costs £361 with 1k words of RAM and sockets for 4k words of EPROM, one off.

BUSSES

BUS STRUCTURED MACHINES

One of the important features in the hardware design of a digital computer is the way in which information is transferred from one part of the machine to another e.g. from register to register, to & from peripheral drivers, the store(s), arithmetic and control unit.

In early machines, and in most of today's large computers, many specialised data paths are provided as required to implement the machine's instruction set. A very simplified example is given in Fig. 1.

However, during the mid 1960's, minicomputer designers hit upon the idea of using one, unified, path for all main data transfers within the machine, with data flow control signals running alongside. This 'bus' concept came about when IC technology reached the point where a major function (e.g. Arithmetic Unit, Store, Control Unit etc.) could be accomodated on a single printed circuit board. By designing the computer so that all information transfer between these functional units was over a standard bus (Fig. 2), the card socket wiring was simplified and, more significantly, the resulting design was extremely flexible in that machines could easily be tailored to suit a particular application by plugging in suitable cards, and new versions of functional units could be introduced during the lifetime of the machine without too much difficulty. This versitility was featured in the marketing of the PDP8E; as well as the basic CPU, the computer case contained a number of 'slots' (card sockets) which you could fill with peripheral drivers, extra memory, or an extended arithmetic unit according to your particular requirement, each of these units being designed to interface to the standard bus. Perhaps the ultimate in bus oriented computer designs is the PDP-11 series, in which the bus dominates the whole hardware design. In fact the PDP-11 can be considered just as a bus connecting together a number of peripheral devices, plus a controller which determines which peripheral(s) can use the bus at any instant of time ! The peripherals hung onto the bus are memory, I/O controllers and the CPU itself (in fact you can connect more than one CPU to the bus or, theoretically, no CPU at all)- see Fig 3.

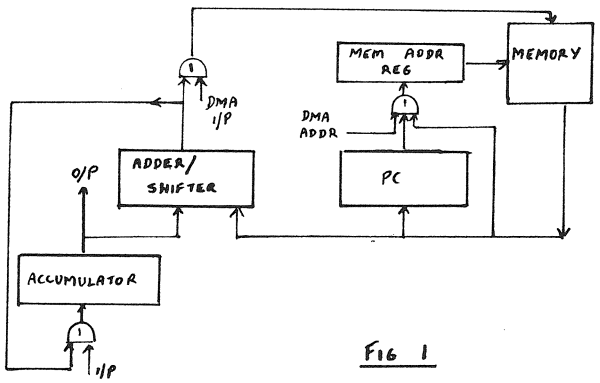


FIG 1

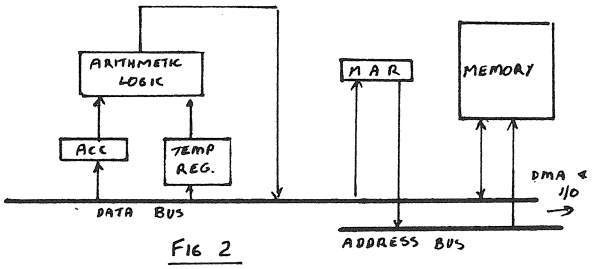


FIG 2

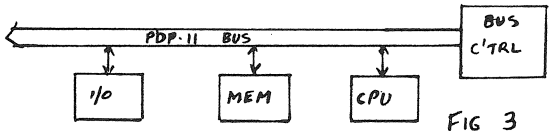


FIG 3

Nowadays, of course, we can get a functional unit into a single package rather than a single board, but the same reasons, namely flexibility by standardisation, have caused the designers of MPU and their supporting IC to rely heavily on the bus concept.

The only real disadvantage of a bus structured machine is that it reduces the system's data handling capacity slightly, since only one data transfer can be taking place between the major functional units at any one time. However this loss of potential performance is not very significant at the micro/mini end of the market.

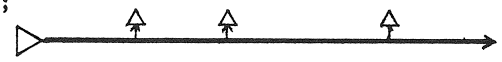
Note that a full bus system, as on the PDP-11, is usually a parallel assembly of a number of buses -usually Data, Address and Control - having slightly different characteristics

UNIDIRECTIONAL & BI-DIRECTIONAL BUSES

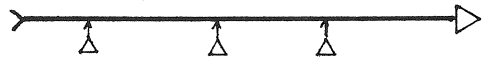
Generally a bus transfers a complete word at a time in bit parallel form (i.e. one wire for each bit in the word), however to simplify the diagrams we need consider only one of these bus lines.

Buses can be roughly classed as;

a) Unidirectional, from one sender to many receivers;



b) Unidirectional, from many senders to one receiver;



c) Bidirectional, from many senders to many receivers;

Note that in each case control circuits (driven from a control bus) may be required to decide which transmitter and which receiver(s) are to be used in the information transfer.

The next part of this article will discuss the circuits used in making a bus system.

BOOKS

MICROPROCESSORS
McGraw-Hill Electronics Books Series 1975 £8.95

COMPUTERS, COMMUNICATIONS and SOCIETY
M. Laver Oxford University Press

COMPUTERS and the SOCIAL ENVIROMENT
F.Gruenberger Melville Publishing Company

PEOPLE-ORIENTED COMPUTER SYSTEMS
E.Tomeski & H.Lazarus Van Nostrand Reinhold Co.

HANDBOOK OF DATA COMMUNICATIONS
£8.50 from Post Office Data Communications Division (TMk4.3.1) Freepost, London EC2B 2TX

LOGICAL DESIGN FOR COMPUTERS AND CONTROL
K.Dodd 1972 £2.40 Newnes-Butterworths

INTERACTIVE COMPUTING IN 'BASIC'
P.Sanderson 1974 £4.00 Newnes-Butterworths

MINICOMPUTERS & MICROPROCESSORS
M Healey
0 340 20588 1 Hodder & Stoughton £9.50

A GUIDE TO BASIC PROGRAMMING (second edition)
£6.0 Addison Wesley Publishing (London)

MICROPROCESSORS
Daniel McGlynn £6.95 John Wiley (Chichester)

PROCESSOR ARCHITECTURE
S H Lavington £2.50 NCC Publications

INTRODUCTION TO COMPUTER ARCHITECTURE
H Stone (ed) £10.0 Published by Science Research Associates & handled by Global Book Resources (Helny on Thames)

MPU NEWS

National Semiconductor are to introduce their own version of the 8080A, as a plug-in replacement for the INTEL part.

Harris Semiconductor are to second-source the Intersil IM6100 MPU and supporting IC.

Plastic pack version of the Motorola M6800 now advertised @£20.16. The faster version mentioned last month as the 6800D, now appears to be called the 6800A, or 6800A1 AP, hopefully things will have been sorted out by the time it is released - expected to be next month.

The ZILOG Z-80 is to be second-sourced by MOSTEK and released in this country soon. This MPU is described as a vastly improved 8080. It has the 8080 instruction set plus many new instructions, including an extended range of addressing modes. The CPU has an additional set of registers, and provides all control signals - including refresh- for static or dynamic RAM. Only a single phase clock and a single 5V supply are required.Because of the extra registers and extended instruxtion set, Zilog claim that program memory requirements are 25 - 50% less than for the 8080. Don't expect it to be cheap though, Zilog say they won't go in for the kind of price war that has brought the price of other MPU down.

64k Charge Coupled Devices should be released by Texas and Fairchild early next year.

New Intel MPU to be released at the end of the year; 8085, said to be twice as fast as the 8080 while including the clock generator and some other peripheral circuitry onto the chip, and the 8748 will have 1k bytes of PROM on the chip. Intel have also published their 1976 data catalogue, 600 pp £1.50.

Special Offer ! Valid only until October 31 !

Intersil IM6100 CMOS Family Sampler. A fully documented complete pre-packaged kit of components for an all CMOS IM6100 Microprocessor System. Only £38.50 (plus VAT, P&P etc.)

The seven devices are;

IM6100	12 bit microprocessor
IM6101	Peripheral Interface Element
IM6312	1024 x 12 bit ROM, programmed with an ODT (Octal Debugging Technique) program which allows the user to run his own program, and use a TTY to control its execution, examine registers, change their contents and make alterations to his program.
IM6402	UART (compatible with Texas' TMS6011 or GI's AY-5-1012)
3 off	IM6561 256 x 4 CMOS RAM (with a power down option such that data is retained at 2.2V

Intersil sales office is at 8 Tessa Rd, Richfield Estate, Reading, Berks. tel Reading 59 5011
Rapid Recall & Tranchant Electronics are Intersil distributors.

ED'S BIT

The VDU project; I've included in this issue a selection of the correspondence received over the last few months. It is only a selection, to give readers a flavour of the ideas that have been floating around, and in fact many more people have contributed, particularly John Owen, who has been doing much useful experimental work.

The question now is, should we continue ? I ask this because Practical Wireless and Electronics Today International are both publishing VDU designs.

The PW 'VideoWriter', in the August & September issues and to be continued, gives 16 lines of 32 characters (upper case ASCII) and incorporates a full upper case alphanumeric keyboard (Clare , £35.0 +£1.0 +VAT from Computer Sales & Services (Equipment) Ltd.,see September Wireless World, page 112). It really is a display device, suggested applications include displaying information in shops and public areas, communication for the deaf and dumb. It would need a fair amount of modification to be useable as a computer terminal. By the way, PW say that Marshalls of Cricklewood Broadway are offering several component kits for the Video Writer, one of which comprises six Texas TMS 4034 1024 x 1 RAM and a General Instruments RO-3-2513 character generator for only £20.30, including VAT & P&P. Their phone number is 01-5520161/2.

The ETI design, again in the August / September issues and to be continued, is a basic video generator for use with an MPU. The basic unit displays 8 lines of 32 characters on a TV, & they say it can be expanded to 40 char/row, 24 rows,although the PCB layouts do not allow for this. Data is stored in a 256 byte RAM (for the basic 8 x 32 display) and address & data buses are provided for input via switches or from a processor.

So, as there are two designs in circulation, and as printed circuit boards & component kits will be available, is it worth our continuing with an ACC design ? Opinions please.

Still thinking about VDU's, although both the PW and the ETI designs mention the use of a UHF modulator, neither includes this in the published design - the prototypes fed straight in at video to a modified Heathkit portable TV. There is, however, a design including PCB layout in the September issue of Practical Electronics, as part of a cross-hatch generator.

For several months now, ETI have been publishing a feature called 'Microfile' which, among other things, has been explaining the operation of a MPU (the Motorola 6800). They are now developing a computer, based on the 6800, and intend to publish full constructional details & PCB layouts in the forthcoming months. The CUTS cassette tape system will probably be used.

We have a limited number of copies of Vol 3 of the newsletter available at £1 for the complete set of 6 issues including P&P. First come first served.

It is estimated that there are about 50000 'Bit Bashers', or amateur computer builders/users in the USA, and this figure is expected to reach the half million within a year or so.To cater to this market, magazines are now being commercially produced devoted soley to the amateur computer enthusiast. Possibly the best is 'Byte', and I understand that a European distribution network is being set up - details later. Together with the interest being shown by the European electronics magazines, such as ETI, makes one wonder about the future of the ACC. The problem being that the news and the better articles will be carried by the commercial publications, as after all they can pay their contributors, removing much of the novelty of the ACC newsletter. It is noticeable that the American Amateur Computer Society newsletter (upon which the ACC was based) is now almost entirely composed of bits & pieces of gossip about members' activities, and I would expect the ACCN to go the same way over the next year or two. Perhaps this is the way it should be.

Because the newsletter plus envelope weighs less than the 60g limit for second class postage @6.5p in the UK, and to add to readers' interest, we will be allowing suppliers of computers/components to include advertising literature (one or two A4 size sheets) in the mailing. This service will be free for the next couple of months on a trial basis - anyone interested contact me for further details.

M Lord

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