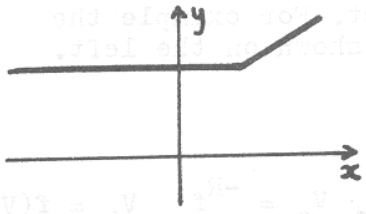
ACCN AMATEUR COMPUTER CLUB NEWSLETTER VOL 1 ISS 5 FEB 1974

ANALOGUE COMPUTERS for the AMATEUR CONSTRUCTOR Part 2 J. Allen

Part 2 ; Basic non-linear computing circuits

Non-linear elements;

So far, all the circuits considered have given an output which varied linearly with the input voltage or with time. Often, in analogue computing, we require that one voltage be a non-linear function of another (perhaps more than one) voltage. Circuits providing the function are described as non-linear.



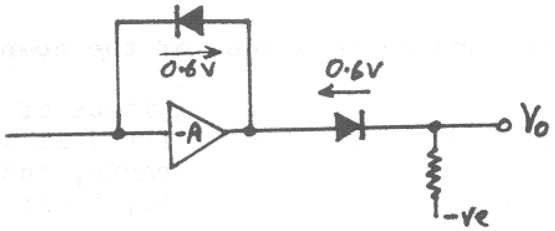
Diode-based circuits

Often the type of non-linearity is quite simple, consisting of a sudden change in the value of a variable or its rate of change with respect to another - as shown on the left.

This type of function is particularly common in elementary mechanics, for which the analogue computer is so well suited.

In designing circuits involving diodes it is well to bear in mind the fact that ,when conducting, a diode may drop up to 0.6V.

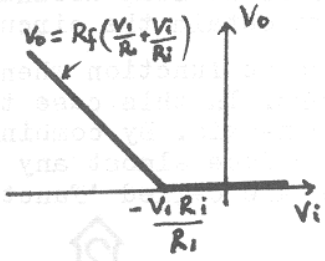
The forward current does not vary linearly with the forward voltage. These effects can be cancelled out, at least in part, by arranging similar diodes thus;

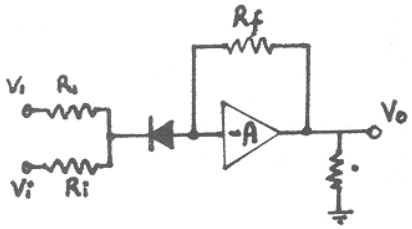


Such circuits are often (optimistically) referred to as 'precise'.

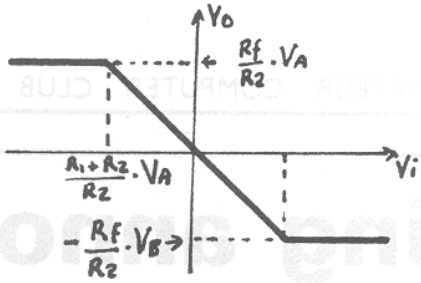
There follows a brief summary of simple non-linear circuits-

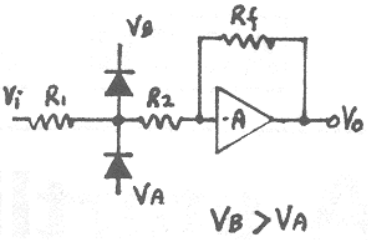
This can be used in simulating elastic collisions, mapping the position of a particle to the force acting on it, or where a quantity such as population can only be of one sign (+ or -). It will also be of use later.





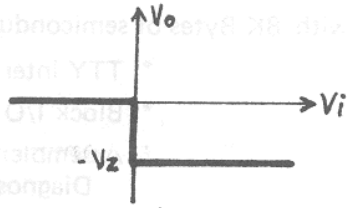
This has similar applications.

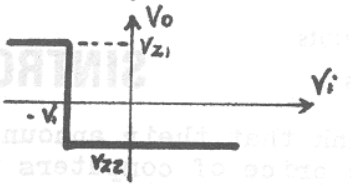


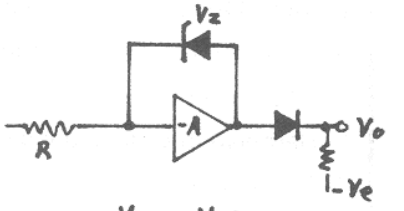


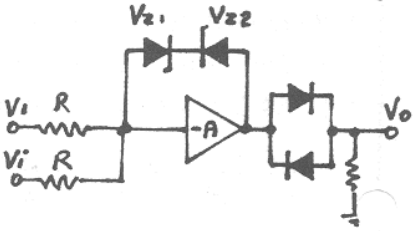
VB > VA

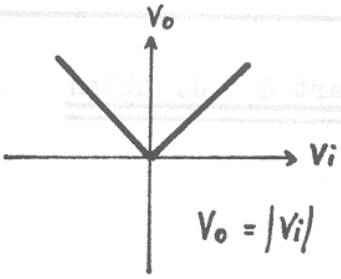
These two circuits find applications where conditions change suddenly at one value of a variable. If the output is used to operate a relay, or some other device, new terms may be inserted into the problem. The switching action should be made permanent.

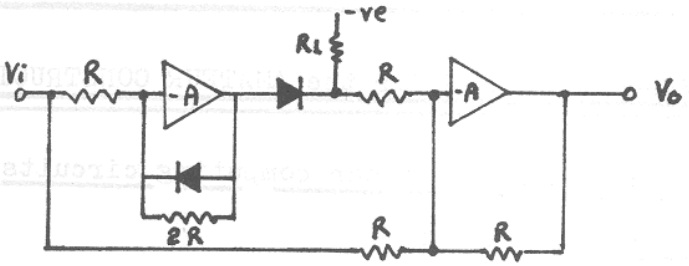




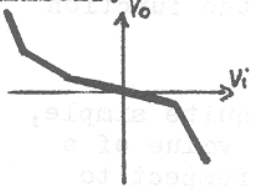


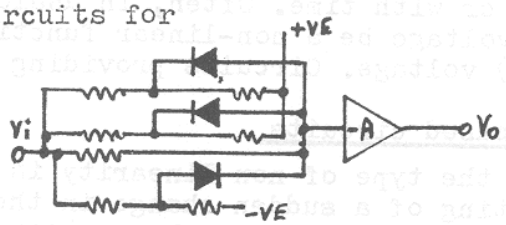






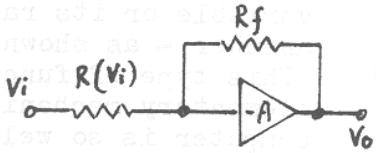
The reader can probably devise other similar circuits for himself.





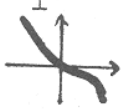
It is possible to generate other, more complex, functions by combining many elements like the first. For example the circuit shown on the left.

The network of resistors and diodes forms a resistor, the value of which is a function of the voltage across it. Let this be R(V). then we may represent circuits such as the above:

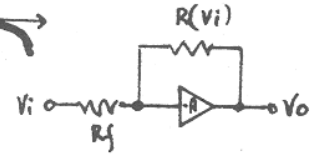


$$V_o = \frac{-R_f}{R(V_i)} \quad V_i = f(V_i)$$

We choose the values of the components so that the function f approximates to the one required. Unfortunately, it is clear that $R(V_i)$ is always increasing with the magnitude of V_i, and is always positive. The graph of $f(V_i)$ is therefore confined to the 2nd. & 4th. quadrants, and continually curves towards the y-axis, thus;



Also, for every value of f there is only one of V_i, and vica versa. If we swap around the resistors R_f and R(V) we obtain the circuit;



Thus we obtain the inverse function when we swap around the resistors. In this case the curve turns towards the x-axis. By combining these circuits we can produce almost any function. Such circuits are called 'Function Generators'.

$$V_i = \frac{-R_f}{R(V_o)} \quad V_o = f(V_o)$$

i.e. $V_o = f^{-1}(V_i)$

LETTERS

LIFE

Mr. Wainwright's address is now 56 Old Highway, Wilton, Connecticut 06897 - he has changed addresses from that quoted on page 7 of issue 3, for the newsletter 'LIFELINE'.

'BEWARE THE EDGES' on page 7 of issue 4 explains the problem of the edges of the matrix. 'LIFE' patterns can grow to enormous sizes and a 10 x 10 matrix is not nearly sufficient for many of them - even a 100 x 100 matrix fails for a lot of them. At first glance, I am not sure that the method for dealing with the edges will work - what happens if a pattern expands to the dummy positions? I don't think that just deleting them will give you a true history of the pattern, as these cells will probably affect the whole arrangement. I think a better idea is to set up the matrix as a torus, but have not tried this myself.

I enclose some comments on the programming of 'LIFE'. I cannot claim originality for these, but they will probably be of some use! more than my own!!

The nature of the rules for 'LIFE' makes the following techniques possible;

1. It is not necessary to examine every cell of the matrix for activity; only live cells can survive or die and, more importantly births can only occur at empty cells neighbouring live cells. This means that it is often better to process a list of live cells, birth cells, death cells and have only one matrix.

2. Each entry in the 'live' list is examined for possible death or survival. During this process, those cells that are empty and border the 'live' cells are tested for possible birth. Entries to the 'birth' and 'death' lists are made accordingly, and these lists, with the corresponding points on the matrix are processed (tidied up) at the end of each generation.
   Although it sounds long winded, the above method is more efficient for large matrices; a list of say 300 live cells is processed easier than every cell of (say) a 100 x 100 matrix (10 000 cells !).

3. Further efficiency is achieved by tagging cells examined for possible birth - this prevents them being re-examined. These tags must, of course, be cleared at the end of each generation.

D.J.ANDREWS

CORE FOR SALE

What is for sale is essentially my 'PDP-8' less the IC's from the CPU. The memory is 16K 13bits 3.5uSec cycle time, access time about 1 uSec. core array by Plessey. Electronics by ICL. Made about 1968 all TTL timing decoding, 711 sense amps and transistors for current switching.

Snags - one of the final output boards transformers diodes is missing hence only 12K can be addresses. Also this is a faulty memory from the ICL training place. I have corrected all the electronics but there are some broken wires in the stack. These can usually be fixed - it is more the bother than anything else that stopped me fixing them and the difficulty of addressing more than 4K with a PDP-8. I was using 4K 13 bits with one PDP-8 page missing (128 words lost). If it was used for storing 8 bit words more words would be useable.

Advantages - power supply made to measure, extender board made, link between Store - CPU is cable with PCB store end, plug - in Veroboard CPU end with parity test / generate circuits on it. Though it wasn't made to fit 19 inch rack I have made it do so. It takes up about 20 inches.

All the CPU was in a 7½" rack made on 6x8" plug-in Veroboard. All of these boards were cut for 16 or 14 pin DIP IC's. These boards and connectors are also for sale.

Make an offer.

John Florentin 203 Old Marylebone Rd, London NW1

I would like to start a local ACC group in Oxford. If anyone is interested please write to me at;
The Rook's Nest, Charlbury, Oxon or phone Charlbury 409 (STD 060 881) after 6 pm.

Texas Instruments - Manton Lane, Bedford - publish a handbook on their TMS 0100 NC MOS/LSI calculator chips; publication No. BCB 13, which is full of useful and relevant info. It is this series which is used in most cheap calculators, and I think they cost about £10-£12 according to the options included. One can also get a very good general (non-LC)semiconductor catalogue from them. Both are free.

A pretty basic book about the organisation & structure of computers is; 'A Survey of Digital Computing' by F.H.George, published by Pergammon. Unfortunately it is a 'programmed text' but even so is very readable.

Jeremy Wyatt

I don't know whether it comes under the heading of computers, but a friend and I are designing and building a deaf/blind communication device that converts keyboard impulses to the manual alphabet via a diode matrix and solenoids. We hope eventually to extend the device to read either magnetic or punched paper tape to provide a similar service to the 'talking book' system already existing for the blind. If anybody has any suggestions or would like to know more about the device I would welcome enquiries.

N.Titley
1 The Gables, Waterloo Rd,
Wellington, Somerset.

I have for many years been extremely interested in Metaphysical Philosophy, meditation and psychic research. My spontaneous enthusiasm for electronics and computers is biased towards the possible use of such equipment in terms of analysis, explanation and possible synthesis of such phenomena.
I would very much like to hear from anyone working on these lines. My own contribution to any such research will probably never materialise, but I would very much like to hear from anyone in the position of actually being able to do something about such resaerch.

A.V.Burrows

In answer to the WANTACOMPUTA in the ACCN; to obtain a computer is in fact very easy, so for the south of England if anybody contacts a Mr. T. Huggett at Pawsons Rd., Thornton Heath, Croydon Surrey. It is an electronic surplus shop, he has stacks of computers, he gets them by auction. I have had a computer in parts from him.
As for the rest of the country,I visit most computer manufacturers and some companys who supply new computers to firms, as a rule remove old models. Some of these old computers get stockpiled or dumped or even given to the Prison Home Office to be broken up for scrap. So all is needed is a nice letter to the manufacturers Public Relations Officer and they will be glad to help if you can get big transport.

P.Turner

THE MEETING OF DECEMBER 13th.

Unfortunately only 10 people managed to overcome the transport problems (no trains, hardly any petrol).

Outcome:

a) Election of Officers etc. postponed until next meeting when, hopefully, more members will be able to attend.
b) Encouragement should be given to local groups.
c) Membership fee to be raised to £1 (except for younger members), which will allow us, among other things, to produce a larger Newsletter more frequently (every other month - 6 issues / year).
d) Newsletter should contain more on software - contributions please.

THE FIRST ANNUAL GENERAL MEETING

Will be held on Thursday March 21 from 7.30pm at the South Bank Polytechnic (Borough Rd., Elephant & Castle), again thanks to Mr. J. Creutzberg.

Agenda:

a) Election of Officers & Committee members.
b) Discussion / approval of ACC Constitution.
c) A.O.B.

Even if you can't attend the AGM, we would welcome comments on the proposed constitution, also on the purpose, structure & organisation of the ACC.

PROPOSED CONSTITUTION OF THE AMATEUR COMPUTER CLUB

1) The club shall be known as the Amateur Computer Club.
2) Membership of the club shall be open to anyone interested in the design, construction or programming of computers as a hobby, subject to;
   a) the approval of the ACC Committee, who have the right to reject any applicant for membership.
   b) payment of the annual membership fee.
3) The membership fee shall be £1 per annum except for members who are resident in the United Kingdom and who are also 16 years of age or under on the 1st. April , in which case a reduced fee of 50p shall be allowed.
4) The membership fee shall only be changed by resolution at an AGM.
5) Membership shall last from April 1st. until March 31st of the following year.
6) The Committee of the club shall consist of not more than 5 Officers, all of which are Honary appointments, plus not more than 10 other Committee members.
7) Any member of the ACC is eligible for election to the Committee, provided that he is proposed and seconded by 2 other ACC members.
8) Officers of the Committee must be 18 years of age or older.
9) The Committee members, including Officers, shall be re-elected each year at an AGM.
10) All of the activities of the club shall be controlled by the Committee.
11) All resolutions shall be carried by a simple majority of those present and voting. In the case of a tie the Chairman has the casting vote.
12) All general meetings shall be held within 10 miles of the centre of London.
13) Notice for any General Meeting shall be sent to members of the club not later than 2 weeks before the date of the meeting.

14) An extra-ordinary General Meeting may be called by 10 members provided that they give 2 month's notice to the Hon. Secretary and pay any costs incurred in informing all Club members of the proposed meeting, and also the costs of the meeting.

15) At any General Meeting a quorum shall consist of 10 members, including 3 members of the Committee, at least one of who shall be an Officer.

16) A resolution for the dissolution of the Club shall require a three-quarters majority of those present and voting. Any assets of the Club remaining on dissolution shall be distributed among the current members, pro-rata according to their subscription for that year.

MORE MEMBERS : AT 1/FEB/74

D.Aitken	33 Beverley Rd., Newlands, Glasgow G43 2RW
B.Allenby	11 New Cartergate, Grimsby, Lincs
D.Andrews	50 Bath Rd., Wells, Somerset BA5 3LQ
J.Baker	8 Shakespeare Rd., Temple Hill, Dartford, Kent DA1 5NW
J.Beard	13 Mayesford Rd., Chadwell Heath, Romford, Essex
M.Beg	114 Mount Pleasant, Alperton, Wembley
C.Bowman	4 Salisbury Way, Chichester, Sussex PO19 4DX
A.Burrows	59 Warde-Aldam Cresc., Wickersley, Rotherham, Yorks S66 0HN
P.Calvert	Dept. of Elec & Electronic Eng., The Queen's University of Belfast, Belfast BT7 1NN
K.Chaisuwan	Dept. of Botany, Manchester University, Manchester 13
M.Chapman	2 Thornton Close, Easingwood, York YO6 3JL
D.Charlesworth	West Side, Guilford Rd., West End, Woking, Surrey
J.Dawe	55 Summerway, Whipton, Exeter, Devon
A.Dearson	60 Old Farm Rd., Stetchford, Birmingham B33 9HJ
P.Deery	5 Knockwelan Park, Altnagelvin, Londonderry, N.Ireland
F.Deman	Ath-Plage, 7800 Ath, BELGIUM
G.Depre	V.Beauduinst 91, B3300 Tienen, BELGIUM
D.Downes	33 Wilson Ave., Summit, Heywood, Lancs
D.England	7 Partridge Ave., Tonypandy, Glamorgan
J.Estdale	The Vicarage, 702 Hitchin Rd., Stopsley, Luton, Beds
D.Esva	Avenue de Harpe 32, 1007 Lausanne, SWITZERLAND
J.Field	3 Berlay Mount, Susan Wood, Chislehurst, Kent BR7 5NG
F.Gallagher	5 Blacon Ave, Chester, Cheshire
M.Harding	16 West Ave., Heald Green, Cheadle, Cheshire
J.Heard	46 Redhall Crescent, Edinburgh EH14 2HU
R.Hutt	15 Priory St., Cheltenham, Glos GL52 6DR
M.John	34 Blakemere Rd., Welwyn Garden City, Hertfordshire
S.Kitson	11 St. Helens Rd., Thamesmead, Erith, Kent
T. Knauf	24 Lubeck, Hamburger Strasse 85, WEST GERMANY
F.Kwan	47 Cotswold Close, Braddell Heights, SINGAPORE 13
A.Lee	Greencroft, Stockton on the Forest, York YO3 9US
G.Leeder	8 Angorfa Close, Walsall Rd., Lichfield, Staffs WS13 8AG
A.Leong	483-F,BLK. 124, Lorong 1, Toa Payoh, SINGAPORE 12
N.Mackenzie	Keil School, Dunbarton G82 4AL
I.Maslen	47 Church Rd., Wheatley, Oxford OX9 1XY
J.McDonald	109 Livingstone Dr., East Kilbride, Glasgow G75 0EW
H.Mills	Dept. of Maths., St. John's College, Heworth Croft, York
C.Perrott	37A Park Mansions, Vivian Ave, Hendon, London NW4
C.Pfefferle	469 Harwicke Rd., Springfield, Penna. 19064 USA
B.Plummer	50 Runnymede Rd., Whitton, Twickenham, Middx
V.Sankey	29 Thomas St., Runcorn, Cheshire
J.Shaw	140 Newark Rd., North Hykeham, Lincoln LN6 8LZ
A.Steele	Saffron Walden County High School, Audley End Rd., Saffron Walden, Essex
H.Taylor	60 North Rd., Broadwell, Glos
L.Topham	610 Wokingham Rd, Earley, Berks RG6 2HR

D.Tsang	Flat A, 8th. floor, On Ning Building, 2-4 Kwei Chow Street, Kowloon, HONG KONG
R.Warburton	124 Oaklands Ave., Oxhey, Watford, Herts WD1 4LQ
E.Wennberg	M.Mjeldesvei 2, N-5031 Laksevag, NORWAY
B.Willis	Maths Dept., Cranborne Chase School, Wardour Castle, Tisbury, Salisbury, Wilts SP3 6RH
K.Wong	c/o Royal Observatory, Nathan Rd., Kowloon, HONG KONG
J.Wyatt	The Rook's Nest, Charlbury, Oxon OX7 3LR

M.Dreyfus sends details of the more interesting aspects of his machine;

-the program counter can be addressed as a regular register.
-all instructions may or may not be executed depending on 3 instruction bits which specify a condition which is tested. As a result of the test the instruction is either executed normally or treated as a 'NO-OP'.

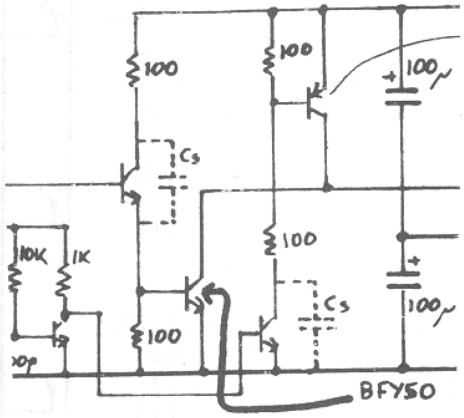
The detailed instruction format is;

5	3	3	3	2
code	cond	r1	r2	mode

r1 is the address of a register (0 to 7), 0 is the PC.
r2 is a second register or an index according to the mode;-
mode = 00, then the instruction is one word (reg to reg).
mode = 01, then the instruction is memory reference.
mode = 10, then the instruction is indirect memory reference.
mode = 11, the address is treated as a parameter (immediate mode)
In the last two cases the instruction is 2 words long, the second word being a memory address (16 bits) to which is added the content of an index register (1 to 7) as specified by the r2 bits when r2 is not zero.

GIGO

'Cores for Stores' part 1 (ACCN V1, Iss 2, p6) ; the wrong transistor was labelled BFY50. Correct version is shown below.



'Cores for Stores' part 3 (ACCN V1, Iss 4, p3) ; only some BC107 will work properly in this circuit - the others are too slow - 2N2369 or similar is to be preferred.

Computer Education Information Service,
c/o National Computing Centre,
Quay House, Quay Street,
MANCHESTER, M3 3HU
Publishes a newsletter called
Computer Education News.

IT WOULD REDUCE the work involved in producing the Newsletter if those contributors who can do so would type their contributions to the ACCN using a newish black ribbon and draw any diagrams with a black pen - not with a pencil.
Typing should be single spaced (as this). Large drawings can be reduced by up to 50% although this is a fairly expensive process.

THE ACTUAL WORKING (?) LIFE PROGRAM has had to be held over to the next issue of the ACCN because of lack of space.

THIS IS THE LAST issue of Vol. 1 of the Newsletter. An application form for membership & subscription to Vol. 2 of the Newsletter is included with this issue.
The first issue of Vol. 2 will be sent out in April, and the subsequent issues every other month.

THANKYOU to all who have contributed to Vol. 1 of the ACCN. We will, of course, welcome further articles for Vol. 2 , particularly on the various aspects of software.

CORES FOR STORES PART 4

X & Y DRIVE CIRCUITS

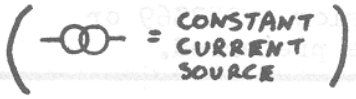
To recap; for each plane of a 4096 word memory we will have 64 X and 64 Y wires. Corresponding wires from each plane are connected in series so that the number of bits in a word (= the number of planes in the stack) does not affect the number of X & Y wire drivers.

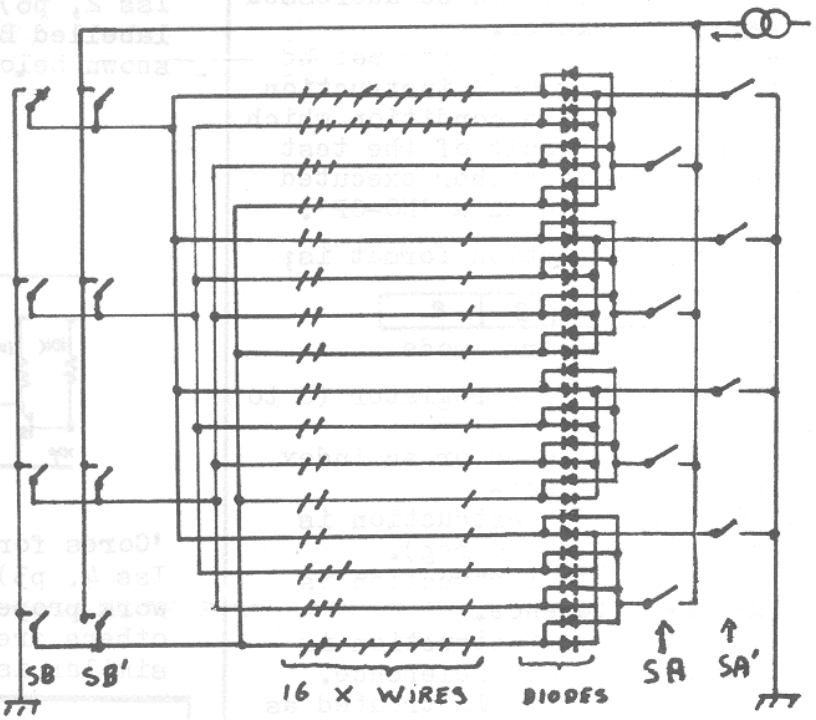
As they X and Y wire drive circuits are identical we only need consider one of them ; say the X wires;-

We want to be able to push a defined current through one selected wire; in one direction for a read, and the other direction for a write.

64 sets of bi-directional current drivers adds up to a lot of circuitry, but luckily we can reduce this by using a diode matrix. The diode matrix for a stack with 16 X wires is shown on the right.

If any one switch SA and any one switch SB are closed the current will flow in one wire, from right to left in the diagram. If the SA and SB are then opened and the corresponding SA' & SB' are closed, current will flow in the same wire but in the opposite direction.





4 sets of SA switches and 4 sets of SB switches give us 4x4 = 16 combinations, thus we can uniquely select any one of the 16 wires. For a stack with 64 X wires we would need 8 sets of SA and 8 sets of SB.

A suitable circuit for the SA and SB switches is shown below;