TIMEDATA MZ163

16/32K RAM

FOR ATOM / EUROCARD

INTRODUCTION

Timedata's range of MZ163 boards provide 16 or 32K bytes of RAM for use with the Acorn Atom or other 1MHz 6502/6800/6809 based computers. The various options available are;

MZ163A ; 16K, built & tested, to fit inside the Atom's case.
MZ163B ; 32K " " " " " " " " "
MZ163C ; 16K " " " , fitted with DIN41612 plug for rack mounting
MZ163D ; 32K " " " " " " " " " "
MZ163E ; Bare PCB, the basis for building any of the above.

Also available from Timedata is the MP100 DC/DC converter. This provides all the power rails required by any MZ163 board from an unstabilised 8V nominal unregulated DC source such as the Acorn Atom mains adaptor. It can be mounted 'piggy-back' fashion on any MZ163.

UNPACKING

Check that you have received the correct items. You should have this leaflet plus;

MZ163A ; Assembled PCB fitted with 21 IC's and a single row 32-way connector mounted on the reverse side of the board.
32 way plug (this may be supplied as several parts).
Length of tinned copper wire.

MZ163B ; As MZ163A but the board will be fitted with 29 IC's.

MZ163C ; Assembled PCB fitted with 21 IC's and a 32+32 way plug.
Length of tinned copper wire.

MZ163D ; As MZ163C but the board will be fitted with 29 IC's.

MZ163E ; Bare double sided plated through PCB.

INSTALLING THE MZ163A & B INSIDE AN ATOM

Remove the base moulding from your Atom to reveal the printed circuit board. At the top left-hand edge of the board you will see four long rows of holes, two rows being labelled 'PL6' and two rows being labelled 'PL7'. Each row will consist of 32 holes 0.1" apart.

To allow the MZ163 to connect to the Atom's board, a mating plug must be fitted in the third row of holes from the edge of the board. If this has not already been done then fit the connector(s) provided with the MZ163 as follows;

Remove the ATOM's PCB from the case.

Fit the connectors into the board so that the short end goes through the board, and the long end and the plastic moulding are on the component side of the Atom's board.

Check that the connectors are the right way round (see Fig 1), and that they are fitted in the third row of holes from the edge of the board.

Solder each of the 32 connection spills to the PCB, taking care that they are seated firmly with the long connector spills projecting at right-angles from the component side of the board.

Check your work carefully for solder splashes or dry joints.

Re-fit the Atom's PCB into the case, making sure that the keyboard does not foul the case.

Decide whether you are going to fit the bus buffers IC2,3,4,5 to the Atom. They are really only needed if you are going to connect external cards to the Atom bus, the MZ163 will work quite happily without them.

If fitted, they should be;

81LS95 or 81LS97 in IC2,3 positions
DP8304 or 8208 in IC4 position
74LS30 in IC5 position

If you do not fit these ICs, then you will need to fit tinned copper wire links in IC2,3,4 sockets, as shown in Fig. 2.

Carefully inspect the work you have done so far, and check that your Atom still runs as before.

Decide which address space your new memory is to occupy. There are three main possibilities;

a) 32K MZ163 occupying 0000 to 7FFF

In this case the Atom RAM ICs 10-19,51 and 52 will have to be removed, as will IC6. If the bus buffer IC4 is fitted, then bend pin 12 of IC5 so that it no longer connects with the socket.

b) 16K MZ163 occupying 2800 to 67FF

The Atom RAM ICs 10-19 should be removed, as should IC6.

c) 16K MZ163 occupying 3C00 to 7BFF

In this case the Atom RAM ICs 10-19 should all be fitted, to give a total text RAM space of 2800 - 7BFF.

Whichever address range is chosen, wire links must be fitted in SK2 of the MZ163 as detailed in Table 1.

Plug the MZ163 onto the Atom's PCB, making sure that the connectors mate properly on all pins.

The MZ163 requires power supplies of +5V at 150mA, +12V at 150mA (250mA for 32K) and -5V at 5mA. These are connected to the MZ163 via the six way socket at the corner of the board.

If you already have a power unit capable of providing these supplies, they can be connected as Fig. 3. Note that the memory ICs tend to self destruct if their -5V line is missing for any length of time, so make sure that this line is switched on at the same time as the +12V line. ~~If you have a 12V supply rather than 5V, then the MZ163 can be modified to accept this by fitting a 5.1V zener in the Z1 position, and a 1K resistor in place of the wire link in the R12 position.~~

Alternatively, the MP100 DC/DC converter can be used to derive the three supplies needed from an unregulated '8V' 0.5A DC source (any voltage in the range 7.5V to 11V will do). The MP100 simply mounts on top of the MZ163, plugging into the 6-way socket and supported by two screws. The '8V' supply to the MP100 is connected to the Atom as shown in Fig 4, so that it is provided by the Atom's mains adaptor. Depending on the actual current consumption of your MZ163, and also of the IC's on your particular Atom, the total current drawn from the external '8V' mains adaptor will be in the range 1.3A to 2A ; in most cases the later versions of the Atom mains adaptor (those marked '1.8A') will be capable of driving an Atom equipped with a 32K MZ163 and 6K graphics RAM. If you are unlucky, then a larger 8V supply will be needed, a suitable circuit is given in Fig 5.

Recheck all the connections and links, then re-fit the lower part of the Atom's case, then

Switch On

Your Atom should now be up and running with the added memory.

Entering; P.&718

should give; 29

showing that the text space starts at 2900 (hex).

The answer; 82

means that something is wrong so that the Atom can't see working RAM in the space starting at 2900.

If all is well, run the memory test program given in 'Atomic Theory and Practice' to check out your new memory thoroughly. But don't try to test the block zero RAM (0000 - 03FF) or the space occupied by the test program itself (2900 - 2BFF) !

THE MZ163C & D

These versions are equipped with a 32+32 way DIN41612 connector for use in a Eurocard rack system. The power requirements are +5V at 150mA, +12V at 150mA (250mA for 32K), and -5V at 5mA. The 'b' side of the connector is used to feed power to the board, the relevant pins being;

0V (GND)	b32	and a32
+5V	b1	and a1 (from hole 'f' on the MZ163 board)
+12V	b3	
-12V	b4	

~~A 12V supply may be used in place of 5V by fitting a 1K resistor in place of the link in the R12 position and by fitting a 5.1V zener diode in the Z1 position.~~

The Atom bus is prone to problems caused by noise coupling into the address lines on pins a24,a25 & a26. If you are extending the bus for any distance, then it is wise to connect 100pf capacitors from these three lines to ground near the MZ163 connector. Note also that some issues of the Atom PCB have the 'a' and 'b' sides of the external bus connector reversed

CONSTRUCTIONAL NOTES

If you are building a MZ163 from a bare board, then the following will be of help;

- Check both sides of the board thoroughly for faults in the etching such as bridges between tracks or broken tracks before starting to build.
- Sockets should be used for the RAM ICs (IC14-29) as this eases any fault finding required, and also reduces the chance of damage to the ICs. Whether or not sockets are used for IC's 1-13 is a matter of personal preference.
- If the board is to be fitted into the Atom case, then low profile sockets must be used, and the capacitors used must be small types which do not protude above the top of ICs 14-19.
- If a DIN41612 connector is to be fitted (for rack mounting use), then cut short all of the solder spills in row b except for pins 1,3,4, and 32. Also connect pin b1 to the hole 'f' to bring +5V to the board .
- For fitting inside the Atom's case, a row of 32 sockets will have to be fitted onto side B of the MZ163 PCB (the solder side) so that the finished MZ163 can plug onto the Atom PCB as illustrated in Fig 1. Also, if the MP100 is to be used, then a row of 6 sockets will have to be fitted to the component side of the MZ163 board to mate with the pins on the MP100. The leads of this socket should be cut short on side B of the board, and the cut ends covered with a small piece of insulating tape to prevent any chance of short-circuits to the pins of the 32-way plug. A 4" x 5" piece of card placed under the MZ163 will prevent short-circuits to the components on the Atom board.
- Be sure to check the completed board thoroughly for solder splashes or dry joints, and also make sure that all components are in the right positions and the right way round before applying power !
- Solder a wire link between holes 'j' and 'k'.

CIRCUIT DESCRIPTION

At the heart of the board are the memory ICs themselves , IC14-21 (and IC22-29 for the 32K versions). Each of these ICs can store 16K (16384) 'bits', so 8 ICs are used to hold 16K 8-bit bytes.

The data output and the data input pins of each chip (DO & DI) are combined and fed through an 8-bit bi-directional buffer IC13 to the computer data bus.

The 7 address inputs to each memory IC are all connected via the damping resistors to the multiplexers IC9,10,11,12 . The outputs of these multiplexers are derived from the computer address lines or from the outputs R0-R6 of the refresh counter IC1 according to the operation being performed (memory read, memory write, refresh, or idle) and also according to the timing signals generated on the board; see Fig 6 for details.

The 4-bit adder IC2, in conjunction with parts of IC3 and IC4 and the setting of the links in SK2, determines which addresses the MZ163 board responds to.

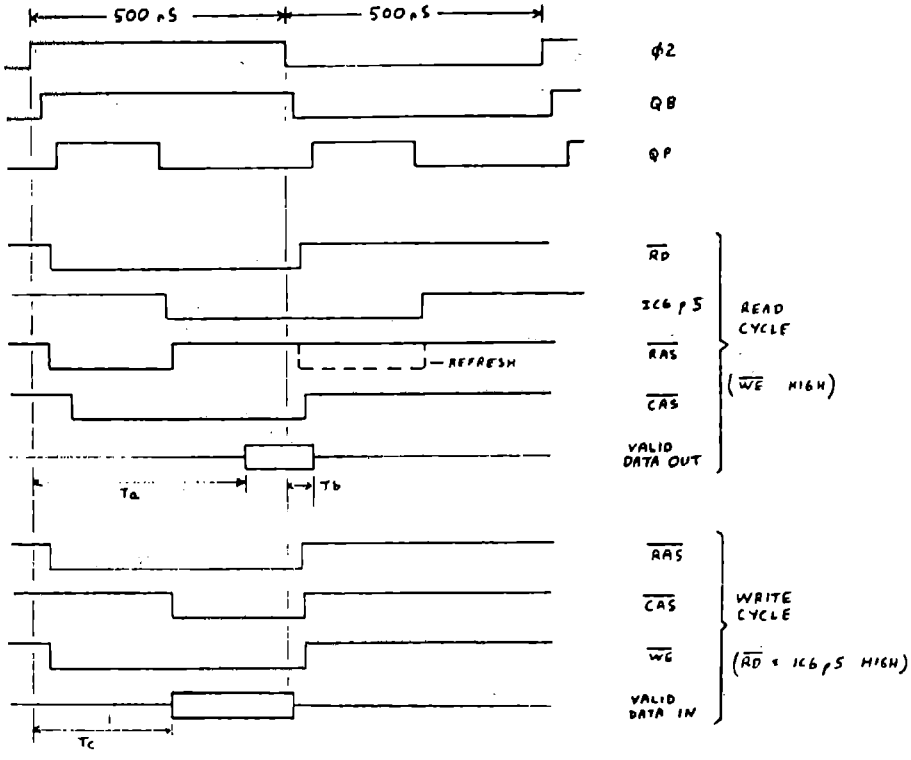


FIG 6

Notes;

Ta ; During a read cycle valid data is available at D0-D7 within 350nS of the positive going edge of Ø2

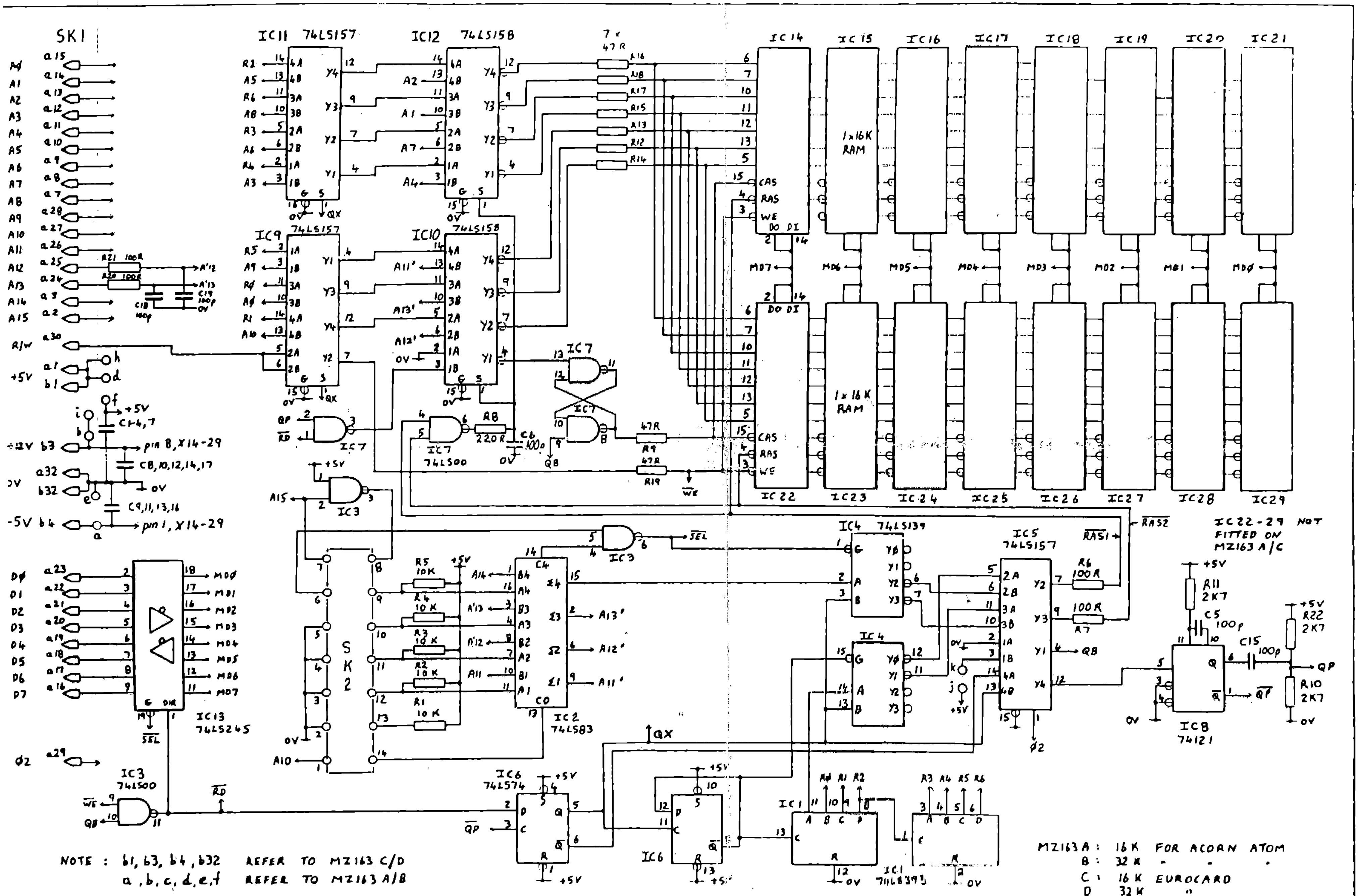
Tb ; During a read cycle valid data remains on D0-D7 for at least 10nS after the negative going edge of Ø2

Tc ; During a write cycle valid data must be present on D0-D7 no later than 200nS after the positive going edge of Ø2, and must remain valid until the negative going edge of Ø2

The address and R/W inputs must be valid at least 50nS before the positive going edge of Ø2, and must remain valid as long as Ø2 is high.

Refresh $\overline{RAS}$ pulses are generated during Ø2 low time as reouired, but never immediately after a write cycle.

R11 is adjusted as necessary so that the write $\overline{CAS}$ pulse width is between 150nS and 260nS,measured at +1.5V points.



ISS 2 20/9/81	ISS 3 24/12/82	ISS 4 10/4/82	16 / 32 K BYTE RAM BOARD	© TIMEDATA LTD. BASILDON, ESSEX	MZ 163 A/B/C/D SHT 1

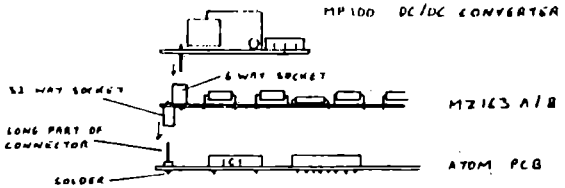


FIG 1

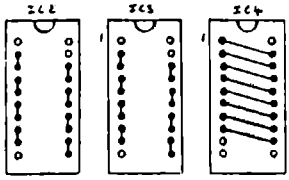


FIG 2

LINK SOCKET POSITIONS AS SHOWN : ●—●
WITH 24SWG BARE TINNED COPPER WIRE LINKS :

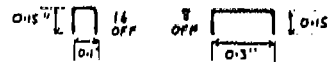
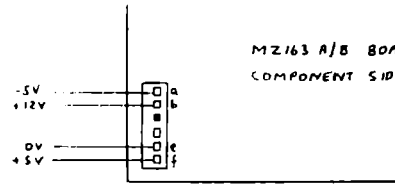


FIG 3

POWER CONNECTIONS TO MZ 163 A/B



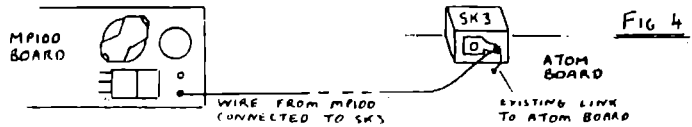


FIG 4

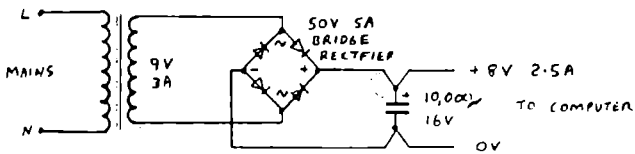
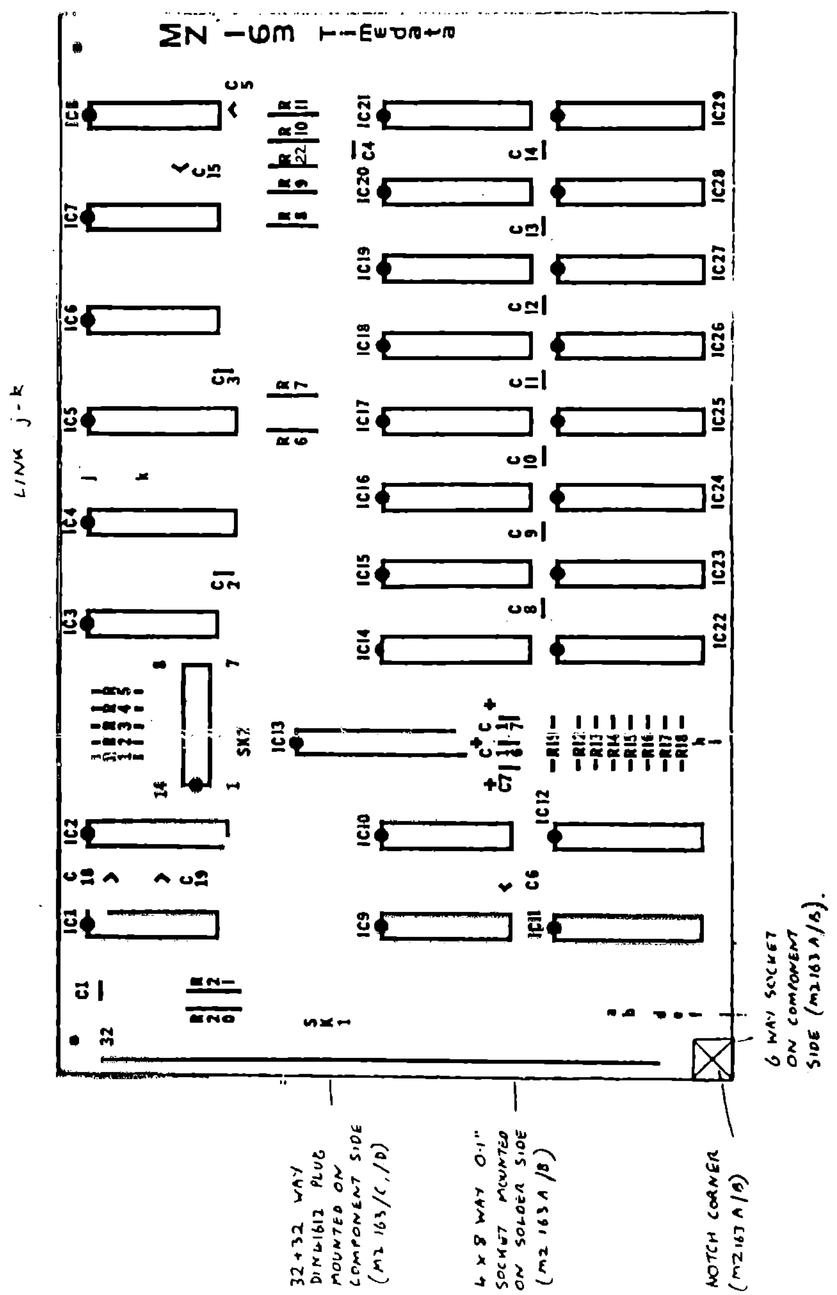


FIG 5

COMPONENTS

IC1	74LS393
IC2	74LS83
IC3,7	74LS00
IC4	74LS139
IC5,9,11	74LS157
IC6	74LS74
IC8	74121
IC10,12	74LS158
IC13	74LS245
IC14-29	4116 (200nS)
R1-5	10K ¼W 5%
R6,7,20,21	100R ¼W 5%
R8	220R ¼W 5%
R9,12-19	47R ¼W 5%
R10,11,14	2K7 ¼W 5%
C1-4,8-14	0.1uF min ceramic
C5,6,15,18, 19	100p min ceramic 5%
C7,16,17	2.2uF 16V tantalum bead

SK1	/A,/B ; 32 way socket, may be made from 4 off Maplin part YW296, R-S 467-677
	/C,/D ; 32+32 way DIN41612 plug,R-S 467-469
SK2	/A,/B only ; 6 way socket,Maplin YW296, R-S 467-677
	2 off 2.5mm x 10mm CH-HD screw (/C,/D only)
	2 off 2.5mm nut (/C,/D only)
	5 off plug Maplin YW13P, R-S 467-582, to mate with SK1,SK2 on /A & /B boards.



Iss		16/32 K RAM FOR ATOM / EUROCARD	© Timedata Ltd.
1	7/8/81		MZ 163 A/B/C/D
2	20/8/81		SHT 4
3	20/4/82		

TABLE 1 : ADDRESSING OPTIONS

RAM ADDRESS RANGE (hex)		LINK SK2 PINS ;				
		9	10	11	12	14
16K	32K	to	to	to	to	to
0000 - 3FFF	0000 - 7FFF	-	-	-	-	13
0400 - 43FF	0400 - 7FFF	-	-	-	-	1
0800 - 47FF	0800 - 7FFF	-	-	-	-	2
0C00 - 4BFF	0C00 - 7FFF	-	-	-	3	1
1000 - 4FFF	1000 - 7FFF	-	-	-	3	2
1400 - 53FF	1400 - 7FFF	-	-	4	-	1
1800 - 57FF	1800 - 7FFF	-	-	4	-	2
1C00 - 5BFF	1C00 - 7FFF	-	-	4	3	1
2000 - 5FFF	2000 - 7FFF	-	-	4	3	2
2400 - 63FF	2400 - 7FFF	-	5	-	-	1
2800 - 67FF	2800 - 7FFF	-	5	-	-	2
2C00 - 6BFF	2C00 - 7FFF	-	5	-	3	1
3000 - 6FFF	3000 - 7FFF	-	5	-	3	2
3400 - 73FF	3400 - 7FFF	-	5	4	-	1
3800 - 77FF	3800 - 7FFF	-	5	4	-	2
3C00 - 7BFF	3C00 - 7FFF	-	5	4	3	1
4000 - 7FFF		-	5	4	3	2
4400 - 7FFF		5	-	-	-	1
4800 - 7FFF		5	-	-	-	2
4C00 - 7FFF		5	-	-	3	1
5000 - 7FFF		5	-	-	3	2
5400 - 7FFF		5	-	4	-	1
5800 - 7FFF		5	-	4	-	2
5C00 - 7FFF		5	-	4	3	1
6000 - 7FFF		5	-	4	3	2
6400 - 7FFF		5	4	-	-	1
6800 - 7FFF		5	4	-	-	2
6C00 - 7FFF		5	4	-	3	1
7000 - 7FFF		5	4	-	3	2
7400 - 7FFF		5	4	3	-	1
7800 - 7FFF		5	4	3	-	2
7C00 - 7FFF		5	5	4	3	1

Also link SK2 pin 6 to SK2 pin 8.

If SK2 pin 6 is linked to SK2 pin 7 instead, then add 8000 hex to the addresses shown above.

16K boards are normally supplied linked for 3C00 - 7BFF.

32K boards are normally supplied linked for 0000 - 7FFF.