GM806AK

'SUPERMUM' Buffer Board

Construction and Functional Specification Documentation

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Introduction

'Supermum' has been designed to bolt "back to back" with a Nascom 1 and provide five Nasbus slots, and all the necessary buffer circuitry to buffer a Nascom 1. Additionally the board has been laid out so that the user may add his own power supply components to provide a 5A PSU for the Nascom, 'Supermum' and expansion boards. The notes are divided into two sections, a set of construction notes and a functional specification which outlines the design. A trouble-shooting section has been included in the functional specification section which should prove useful if your 'Supermum' fails to work or at some point in the future stops working.

Guarantee

The component parts of the Gemini G806 'Supermum' are guaranteed by the supplier (your Gemini dealer) for one year from the date of purchase. However, being a kit, the quality of the constructor's assembly falls outside the guarantee, and any faults attributable to the construction of the kit will be fully chargeable as to both parts and labour. The guarantee extends as far as the original hardware as supplied and no work on 'Supermums' modified in any way will be carried out.

Any queries regarding component shortages, faulty components, or general queries on the operation, or non-operation, of 'Supermum' should be directed at your Gemini dealer.

Component list

Note: Components in brackets are NOT supplied, but may be added in order to provide the on-board power supply.

No.	Qty.		Description	Circuit. Ref.	Check
INTEGRATED CIRCUITS					
01	1	74LS00	Quad Nand	IC 10	[ ]
02	1	74LS04	Hex inverting buffer	IC 2	[ ]
03	3	74LS74	Dual JK flip-flop	IC 1,3,9	[ ]
04	1	74LS221	Dual Monostable	IC 11	[ ]
05	3	74LS244	Octal schmit tri. buff	IC 5,6,8	[ ]
06	1	74LS245/645	Octal bi. tri. buff.	IC 4	[ ]
07	1	74LS257	Quad mux.	IC 7	[ ]
CAPACITORS					
(08	1	15000uF/16V	Electrolytic	C4	)
(09	1	3300uF/16V	Electrolytic	C7	)
(10	1	2200uF/25V	Electrolytic	C1	)
(11	1	1000uF/25V	Electrolytic	C10	)
12	3	68uF/10V	Tant. bead	C15,21,26	[ ]
13	1	10uF/10V	Tant. bead	C27	[ ]
14a	9	100nF	Ceramic disc	C13,14,18,19,20,22,23,24,25	[ ]
(14b	8	100nF	Ceramic disc	C2,3,5,6,8,9,11,12	)
15	1	47nF	Ceramic disc	C16	[ ]
16	1	10nF	Ceramic disc	C28	[ ]
17	2	33pF	Ceramic disc	C17,C29	[ ]
RESISTORS					
18	2	470R	1/4W 10% (Yellow/purple/brown)	R2,8	[ ]
19	2	820R	1/4W 10% (Grey/red/brown)	R4,5	[ ]
20	5	1k	1/4W 10% (Brown/black/red)	R1,16,17,18,19	[ ]
21	1	4k7	1/4W 10% (Yellow/purple/red)	R15	[ ]
22	9	10k	1/4W 10% (Brown/black/orange)	R3,6,7,9,10,11,12,13,14	[ ]
REGULATORS					
(23	1	78H05	5V at 5A	IC13	)
(24	1	7812	12V at 1A	IC12	)
(25	1	7905	-5V at 1A	IC14	)
(26	1	79M12 (or 7912)	-12 at 1/2A	IC15	)
DIODES					
27	1	1N4148	Signal diode	D1	[ ]
(28	1	1N4001	Power diode	D2	)
BRIDGE RECTIFIERS					
(29	3	N7011	4A/50V	BR1,3,4	)
(30	1	N9021	12A/50V	BR2	)

IC SOCKETS

31	5	14pin	0.3 DIL	IC1,2,3,9,10	[ ]
32	2	16pin	0.3 DIL	IC11,7	[ ]
33	4	20pin	0.3 DIL	IC4,5,6,8	[ ]

HEATSINKS

(34	1	3MB-1	Large	)
(35	3	TV21	Medium	)
(36	4	TV28	Small	)

WIRE

(37	30cm	Orange	)
(38	30cm	Grey	)
(39	30cm	White	)
(40	30cm	Yellow	)
41	10cm	Black	[ ]
42	10cm	Red	[ ]
43	10cm	Blue	[ ]
44	10cm	Pink	[ ]
45	10cm	Violet	[ ]
(46	3m	5A three core mains	)

HARDWARE

(47	18	4BA Nuts	)
(48	2	4BA Lockwashers	)
(49	19	4BA Insulating washers	)
(50	6	4BA X 10mm bolts	)
(51	5	4BA X 16mm bolts	)
(52	1	4BA X 25mm bolt	)
53	4	Spacers	[ ]
54	8	No 6 X 9.5mm self tap screws	[ ]

MISCELLANEOUS

55	1	16Mhz Crystal, series mode	[ ]
56	2	43 way edge connectors	[ ]
57	1	Vero board 43 way X 1.5 inch	[ ]
58a	24	Vero pins, 0.1 single sided	[ ]
(58b	8	Vero pins, 0.1 single sided	)
59	1	PCB	[ ]
(60	1	Transformer 14V at 0.9A 14V at 1.8A 8.5V at 9A 8.5V at 1.8A	)

Construction hints

1. Please do not begin construction now, carefully read through and comprehend all the documentation before starting in order to ensure that no fundamental and expensive errors are made.

2. Keep the box in which 'Supermum' was delivered in case it should have to be returned for repair.

3. Do not attempt to use too large a soldering iron. Use an earthed 15 to 25 watt soldering iron equipped with a suitably small bit. Use 22 Swg resin-cored solder.

4. Fit all components in the board on the same side as the printed information.

5. Be certain to fit all integrated circuits and tantalum bead capacitors in the correct locations and the correct way round.

6. Do not attempt to remove or plug in integrated circuits on the board, or perform any soldering while the power supply is switched on.

7. If any difficulty is experienced when pluging an IC into its socket do not use extreme force. If in doubt remove the IC; check that the pins are straight and parallel and start again. An IC insertion tool may be found useful. Note that all ICs are manufactured with the leads spread apart by a few degrees to suit mechanised handling equipment. They can be bent parallel with care using small pliers or one row at a time by pressing down sideways on a flat surface. There should be no bend in the leads and they should be at right angles to the body.

8. Before connecting on any power supplies, hold the board up against a powerful lamp and inspect both sides with a magnifying glass for solder splashes, unsoldered joints, incorrectly orientated components and bent IC pins. (To check for the latter look at all ICs end on). TAKE TIME OVER THIS. Solder flux residue can be removed by on of the proprietry flux removers or the use of meths, before using a flux remover the constuctor should ensure the chemical does not also remove the solder resist.

9. The following tools are needed:-

(a) Long nose pliers
(b) A powerful light source
(c) Side cutters
(d) 15 to 25 watt soldering iron
(e) Screwdriver (Pozidrive)

Suggested order of construction

Note that sections, or parts of sections, contained within square brackets '[ ]' are for fitting of the power supply components, should the user wish to supply these himself.

1. Carefully unpack the kit and in conjunction with the parts list check and identify all the parts. If any parts are damaged or missing please inform your dealer immediately. It is possible that from time to time substitutions in the supplied components will be made to ensure the continued supply of kits, if this occurs a note informing you of this will have been packed with your kit listing the substitutions. If a substitution is made it will first have been carefully checked to ensure that in no way will it degrade the performance of your 'Supermum'. Inspect the printed circuit board (PCB) for any signs of damage or manufacturing faults.

2. SOLDER PINS. These should be inserted/soldered in the following locations;
a) Three for D.C. power to/from the Nascom 1 in the P.S.U. area (+5V,+12V,0V).
b) Five for the power rails in the buffer circuitry section.
c) One for the reset switch.
d) Three for the speed selection. (2/4 MHz)
e) Eight for the selection of reset jump.
f) One for "NMI".
g) One for "NMI SW".
h) Two for the NMI link. (L1)
[Eight for the A.C. input on the L.H.S. of the board in the P.S.U. section.]

3. RESISTORS all the resistors should now be soldered in with reference to the resistor numbers in the parts list. Care should be taken to ensure that the leads are bent for the correct lead spacing and the resistors are positioned flat aginst the PCB.

4. IC SOCKETS. Check to see that all IC sockets do not have their pins bent or missing. During insertion take care not to bend any pins. When soldering the IC sockets, it may be a good idea to solder only two pins, one at each end of the socket on opposite rows to begin with. Then turn the board over again and check that the sockets are flat on the board, straight and also correctly orientated. Any necessary alterations may be carried out with ease, as only two pins have been soldered. Pin 1 is indicated by a corner cut-off on the IC socket and by a half moon on the board.

5. TANTALUM CAPACITORS. Insert and solder the four tantalum capacitors. These tantalum capacitors are polarised and, as such, must be correctly orientated.

6. CERAMIC CAPACITORS. Insert and solder the ceramic capacitors, it is suggested that the 100nF capacitors are soldered in last to prevent any confusion.

7. DIODES Insert and solder the diode D1 [and the diode D2. Please ensure they go into the appropriate locations as they are not interchangeable.]

8. 77 WAY EDGE CONNECTOR(S). 77 way edge connectors are not supplied with the kit as they are supplied with the expansion boards. If you wish to solder some in it should be done at this stage. Start with the slot nearest the buffer circuitry so as to preserve the daisy chains. Care should be taken when soldering in the edge connectors as it is relatively easy for them to short to one of the "Faraday screen" tracks. When you have soldered in all the edge connectors that are required, check with a multimeter that no inadvertant shorts to ground have occured. Please also ensure that you put the edge connectors in the correct way around (the keyway is at position 72).

[9. BRIDGE RECTIFIERS The four bridge rectifiers should be mounted in the following manner;

a) Bolt one of the small heatsinks to the bridge with a 25mm bolt for the large rectifier, 16mm bolt for the three small rectifiers (the bolt should "go" through from the heatsink).
b) Mount the bridge rectifier on the board.
c) Place an insulating washer on the end of the bolt.
d) Use a second nut to hold the assembly down. The sequence should be, top of bolt, heatsink, bridge rectifier, nut, PCB, insulating washer, second nut.
e) solder the connections.]

[10. REGULATORS The three TO220 regulators should be mounted as follows;
a) Carefully bend the leads so that they match the hole layout on the board.
b) Place an insulating washer on a 10mm bolt, then pass the bolt through the hole in the end of the regulator.
c) Mount the regulator on the heatsink (type TV 21).
d) Place a second 10mm bolt through the hole at the other end of heatsink.
e) Place an insulating washer on each bolt.
f) Now mount the entire assembly on the PCB.
g) Place an insulating washer on each bolt.
h) Now put a nut on each bolt.
i) Check the mechanical alignment of the assembly.
j) The sequence for the bolt through the regulator should be, top of bolt, insulating washer, regulator, heatsink, insulating washer, PCB, insulating washer, nut.
k) The sequence for the second bolt should be, top of bolt, heatsink, insulating washer, PCB, insulating washer, nut.
l) Solder the connections.

The 5V (TO3 can) regulator should be mounted as follows;
a) Bolt the regulator to the finned side of the large heatsink with 16mm bolts, ensure that neither of the regulator's leads are shorting to the heatsink.
b) Bolt the combination to the board with two more nuts along with two lockwashers, the space between the heatsink and the board will assist in heat dissipation.
c) The sequence should be, top of bolt, regulator, heatsink, nut, pcb, lockwasher, second nut.
d) Solder the connections.]

[11. ELECTROLYTIC CAPACITORS The four electrolytic capacitors should be soldered in with reference to the parts list. Please ensure that they are soldered in the correct way round, the positive terminal is indicated by a red dot or by a "+" mark on the body.]

12. CRYSTAL Care should be taken in handling the crystal as it is easily damaged by shock, mount it flat against the board and solder the leads in place. Save one of the spills, thread it through the two holes either side of the crystal, solder one side pull the lead tight and solder the other side, now carefully solder the lead to the crystal can.

13. INTEGRATED CIRCUITS Insert the ICs as outlined in the components List on page 1-2. When completed, check that all ICs are correctly orientated and in the right position. The end which is pin one is represented by a half moon shape on the PCB, on the IC pin one may be represented in various manners, however if the IC is viewed with the writing the correct way up, pin one is in the bottom lefthand corner.

14. LINKS The following links have to be made.

a) Reset jump, this determines which address the Z80 jumps to when a reset occurs, one of 16 locations is possible from 0000H to F000H. The address is programmed in by making the appropriate links. If all the links are made the Z80 will jump to 0H on reset, if none of the links are made the Z80 will jump to F000H. It should be noted that the first instruction (with the exception of 0H) should be an absolute unconditional jump. Please see appendix D and functional specification 2.2 for further details.

b) Speed, the speed link for initial commissioning of the system should be set to 2 MHz. A large number of Nascom 1s will run at 4MHz, but the system should first be made to work.

c) L1, this is for the NMI pulse and should not be connected at this stage.

15. Take a final look at the card and check that there are no unsoldered pins or solder bridges anywhere.

[16. When satisfied everything is correct, connect the power transformer to the system, before doing so however carefully examine the transformer and identify the windings so as to ensure that you do not connect the windings of the wrong current ratings to the correct voltage inputs. Use the orange wire for the 8.5V/9A connection, grey for the 8.5V/1.8A connection, white for the 14V/1.8A connection and yellow for the 14V/0.9A connection. Carefully check that you have it correct and power up the system, if a multimeter is available, check the power supply voltages.]

17. NASCOM 1 MODIFICATIONS The following modifications are required to enable the Nascom 1 to function with the 'Supermum'.

a) Clock. The clock signal to the Z80 will be provided by the 'Supermum'. To facilitate this carefully remove IC31 (a 7406) bend out pin 12 and reinsert so that the pin no longer makes contact with the socket (or anything else). Please note that the Nascom 1 clock is still used for the Video section of the Nascom 1.

b) Reset. The reset will be provided by the 'Supermum' (also note the section on reset jump), it will as a consequence be necessary to connect the reset switch to line 10 of Nasbus, and disconect it from the Nascom 1.

18. LINKING. The 'Supermum' and the Nascom can now be linked together. First screw the spacers to 'Supermum' using the number 6 / 9.5mm self tapping screws provided (constructors may find it useful to "start" the spacers by holding them in a vice or clamp and screwing the self tapping screw in a small way), screw the Nascom 1 to the four spacers with the same self tapping screws. The screws should not be tightened at this point. Put one of the 43 way edge connectors on the Nascom 1 and one on 'Supermum', place the piece of Veroboard supplied over the two edge connectors and solder the pins and tighten the screws.

a) Solder a resistor spill from the OV pin by IC12 (12V reg) to the OV pin on Nascom one, the soldering should take place on the backs of both boards, ensure you connect to the OV pin on Nascom 1 and not the Ext clock pin.

b) Link the -12V connections with a short piece of violet wire, the -12V pin on 'Supermum' is by C1, on Nascom 1 it is adjacent to the serial I/O socket.

c) Link the +5V with some red wire, use the pin by IC14 on 'Supermum' and connect to the +5V pin which is adjacent to the -12V pin on Nascom 1.

The next two connections are from the power pins in the buffer circuitry section of 'Supermum',

d) Link the +12V on 'Supermum' to the +12V on Nascom 1 with some of the pink wire.

e) Link the -5V rails with some of the blue wire, both pins are in the top corner of Nascom 1.

20. Your 'Supermum' / Nascom 1 combination is now complete.

[21. NOTES If the heatsinks are not mounted on the 'Supermum' itself, if for example the unit was mounted in an enclosed box and the user wishes to improve heat dissipation by mounting the heatsinks/regulators on the side of the box, 0.1 uF ceramic capacitors should be placed directly across the regulators, i.e. one from the input pin to ground and one from the output pin to ground, if this is not done the PSU will oscillate.]

'SUPERMUM' FUNCTIONAL SPECIFICATION

Contents

1.0 Introduction.

The 'Supermum' is to provide buffer circuitry, five Nasbus slots, and the facility for the user to fit a 5A PSU, all on one 8 x 12 card. The 'Supermum' is to be bolted "back to back" with the Nascom 1 and separated from it by spacers. Connection from the the Nascom 1 to 'Supermum' is via a "micromum" with two edge connectors.

2.0 Functional description.

The Nascom 1 has no on board buffering, the Z80 is only capable of driving the circuitry of the Nascom 1. If a bus is to be driven the signals from the Nascom 1 have to be buffered. The card is described in sections below.

2.1 Power supply.

If fitted by the user the power supply produces the following voltages;
    +12V at 1A, +5V at 5A, -5V at 1A, -12V at 0.5A
All the parts for the power supply apart from the transformer may be mounted on the 'Supermum' PCB.

2.2 Reset and reset jump.

System reset can come from one of two sources, on power up C21 will be discharged and on the application of power to the system it will charge up via R6, while the voltage at the junction of C21 and R6 is below the threshhold of the LS244 buffer the reset pin of the Z80 and the Nasbus reset line (14) is held low. The second source of a system reset is the grounding of Nasbus line 10, this shorts C15 to ground via R2 (inserted as a current limit resistor), C15 will then charge up via R3. When the input of the LS04 is held high the output is low, this causes the LS74's Q output to be low. When the LS04's output goes high the Q output of the LS74 will remain low until an M1 from the Z80 clocks the LS74. The LS221 is triggered by a L-H transition at which time it pulses the reset line.

The reset jump facility is provided so that the system can jump to any on of 16 locations on reset. This is achieved by inserting a multiplexer (IC7 LS257) in the four most significant address lines. The select input of the LS257 is driven from two LS74 type flip-flops, /M1 and /RESET is fed into the two flip-flops. In effect what happens is that a reset signal flips the LS257 over to the select inputs and the second M1 flips the LS257 back.

It should be noted that the Z80 thinks its "talking" to the first page of memory, so the first instuction must be an absolute unconditional jump instruction. The ROM BASIC for example has C3 03 E0 as its first instruction, if the 'Supermum' is set up to jump to E000 on reset and ROM BASIC is in the system, BASIC will come up in lieu of the monitor. The BASIC will do a cold start (poor thinking) which makes (in this case) the reset jump pointless. However if the user requires the ability to jump into BASIC on reset it is suggested that a short machine code routine be written and put in ROM at (for example) D000, the routine would decide by looking at (for example) 1000H and if C3 was found doing a warm start and if anything else was found doing a cold start.

2.3 Clock.
The clock is a 16Mhz crystal oscillator circuit divided down to either 2 or 4 Mhz with LS74 flip-flops. The Nasbus is driven via an LS244 and the clock of the Z80 is driven from the bus by a second LS244. This has been done to ensure that clock skew is kept to a minimum throughout a system, an LS244 will give about 20nS of delay. This means that if other cards in a system delay the clock by 20nS from the bus they will be "in time" with the Z80.

2.4 NMI pulse shaper.
Nasbus line 6 goes into an LS221 via an LS04 and back out on line 21 via a link. This is so that a switch can be used to create an NMI. There is no connection for NMI on the 43 way edge connector. Users requiring an NMI facility on their Nascom 1 should make appropriate arrangements.

2.5 Data bus.
The data bus is bidirectional, the direction in which the bus driver operates is determined by the Nasbus /DBDR line. This signal is provided by the Nasbus card which is providing the data, normally it is the same signal which enables the output buffer(s). /DBDR goes low to drive data to the Nascom 1. All data lines are tristated by the reset pulse and a /BUSAK.

2.6 Address bus.
The top four lines of the address bus are driven via the LS257 mux so that a reset jump may be implemented, the remaining 12 lines are buffered with LS244's. In common with the data bus the address bus is tristated by the reset pulse or a /BUSAK.

2.7 Control bus.
Some control signals are generated by the Nascom 1, some by the buffer circuitry and some by the peripheral cards. The control signals from the Nascom one will be dealt with first. /RD, /WR, /MREQ, /IORQ, /M1, /HALT and /RFSH are all generated by the Nascom 1 and are buffered on to the Nasbus by an LS244 which is tristated by the reset pulse and/or the /BUSAK signal. The /BUSAK signal is buffered onto the bus by a permanently enabled LS244. The buffer board circuitry generates the clock signal for the entire system (except for the Nascom 1 video), and "cleans up" the reset and NMI signals. The clock for the Nascom 1 is buffered from the Nasbus, as opposed to being buffered directly from the clock speed select link, as a consequence the Nasbus clock is 20nS ahead of the Z80. If a delay of 20nS is allowed between the bus and any peripheral chips (ie PIO, DMA, SIO ete), no clock "skew" should occur. The buffer cicuitry also provides pullup resistors on the following lines /INT, /NMI, /WAIT, /BUSREQ and IEO. The IEO line is for the interrupt daisy chain and is only pulled up in the buffer circuitry, it should be noted that the PIO on the Nascom 1 is not implemented in the daisy chain. The following control signals are provided by peripheral cards in the system, /NASCOM MEM, /NASCOM IO, /DBDR, /INT, /NMI, /WAIT and /BUSREQ. /DBDR is only used on the buffer board, /NMI is not implemented on the 43 way edge connector, users requiring /NMI will have to make their own arrangements.

APPENDICES

Appendix A - Nascom 1 edge connector pin allocations

PIN	SIGNAL	DESCRIPTION
1	D0	Z80 data
2	D1	Z80 data
3	D5	Z80 data
4	D2	Z80 data
5	D4	Z80 data
6	D3	Z80 data
7	D6	Z80 data
8	D7	Z80 data
9	A12	Z80 address
10	A13	Z80 address
11	A14	Z80 address
12	A9	Z80 address
13	A11	Z80 address
14	A10	Z80 address
15	A8	Z80 address
16	A7	Z80 address
17	A6	Z80 address
18	A5	Z80 address
19	A4	Z80 address
20	A15	Z80 address
21	A0	Z80 address
22	A3	Z80 address
23	A1	Z80 address
24	A2	Z80 address
25	/RD	Z80 read
26	/WR	Z80 write
27	/MREQ	Z80 memory access cycle
28	/M1	Z80 instruction fetch cycle
29	/IORQ	Z80 input/output cycle
30	/RFSH	Z80 refresh cycle
31	/HALT	Z80 halt signal
32	/WAIT	Z80 wait
33	/INT	Z80 interrupt
34	/RESET	Z80 reset
35	/BUSREQ	Z80 bus request
36	/BUSAK	Z80 bus acknowledge
37	keyway	
38	CLOCK	Z80 clock
39	/NASIO	Nascom I/O
40	/NASMEM	Nascom memory
41	+5V	Power
42	0V	Ground
43	0V	Ground

Appendix B - Nasbus pin allocation.

PIN		SIGNAL	DESCRIPTION
1		OV	Ground
2		OV	Ground
3		OV	Ground
4		OV	Ground
5		CLOCK	System clock
6	*	/NMI SW	Low on this line initiates a short pulse on line 21
7		RSFU	Reserved for future use
8		AUX CLOCK	2Mhz clock signal (optional)
9	*	/RAM DIS	Ram disable
10	*	/RESET SW	Reset switch
11	*	/NAS MEM	Memory decode to N1
12	*	/NAS IO	I/O decode to the Nascom
13	*	/DBDR	Data bus drive, used to change the direction of the data bus buffers in the buffer circuity.
14	*	/RESET	50uS reset pulse, resets entire system.
15		/HALT	Z80 halt signal
16		/BAI	DMA
17		/BAO	daisy chain
18		/BUSRQ	Z80 bus request
19		IEI	Interrupt
20		IEO	daisy chain
21	*	/NMI	Z80 NMI line, (not used by N1)
22	*	/INT	Z80 interrupt line
23	*	/WAIT	Z80 wait line
24		/RFSH	Z80 refresh signal
25		/M1	Z80 opcode fetch signal
26		/IORQ	Z80 input/output signal
27		/MREQ	Z80 memory signal
28		/WR	Z80 write signal
29		/RD	Z80 read signal
30		A0	
31		A1	
32		A2	
33		A3	
34		A4	
35		A5	
36		A6	
37		A7	
38		A8	Z80 16 bit
39		A9	address bus
40		A10	
41		A11	
42		A12	
43		A13	
44		A14	
45		A15	
46		A16	Optional implementation
47		A17	for extended
48		A18	addressing.
49		OV	Ground to seperate the data and address busses.

50	D0	
51	D1	
52	D2	
53	D3	Bidirectional data bus.
54	D4	
55	D5	
56	D6	
57	D7	
58	D8	Optional implementation
59	D9	for 16 bit systems.
60	D10	
61	D11	
62	D12	
63	D13	
64	D14	
65	D15	
66	NDEF	Not to be defined
67	GND	Ground to seperate power and signal lines.
68	-5V	
69	-5V	
70	-12V	
71	-12V	
72	keyway	
73	+12V	
74	+12V	
75	+5V	
76	+5V	
77	+5V	
78	+5V	

Notes.

1) * is an open collector line.
2) IEI to be linked to IEO on cards not using the interrupt daisy chain.
3) /BAI to be linked to /BAO on cards not using the DMA daisy chain.
4) AUX CLOCK (line 8) must be provided by any bus master not running at either 2 or 4Mhz.
5) Bus drivers must be able to drive 75/15 U.L.
6) Bus receivers must not load the bus past 1/0.25 U.L.
7) Bus master to pull up all open collector lines with 1k.
8) Bus master to pull up the following lines with 10k, /HALT, /MREQ, /IORQ, /RD, /WR, /M1, /RFSH.
9) System timing reference point is pin 6 of the Z80. All board timing must be referenced to the bus.
10) A16 to A18 to be tristated during /BUSAK.
11) NDEF is for user defined use must be provided with a jumper for disabling, TTL levels and no transition until 100nS after the previous transition, ie 5Mhz max.
12) All timing as per Zilog/Mostek, however bus clock to be 20nS (+/- 10nS) ahead of Z80 clock.
13) Control address and data signals should be buffered by buffers with a 20nS delay (+/- 20nS).
14) Cards which generate an /NASIO signal should assert it on detection of a Nascom I/O address, and not on the detection of the opposite condition.
15) The /RESET signal should be gated with /M1.
16) Cards using /BAI, /BAO, IEI & IEO should pull them up with 2k2.
17) Cards requiring wait states must generate them and not rely on the bus master.
18) Bus termination. Long buses may require termination, 220R on each line to 2.6 V should solve 99% of problems.
19) Grounding. The ground line to the PSU should be as short as possible and as thick as possible.

Appendix C - Troubleshooting

Problems come in many shapes and sizes, most can however be solved without undue difficulty. It is important to have some test equipment. Without doubt the most useful piece of equipment is a logic probe. A multimeter is also useful, however it need not be complicated or expensive, an oscilloscope can also be of help when dealing with serious problems, unfortunatly many of the cheap models have poor quality trigger circuits making them difficult to use. It will be assumed that the N1 being used was fully functional before it was modified and connected to the buffer circuitry (for Nascom 1 troubleshooting see the appropriate section of the Nascom manual).

1)The most common problem is the lack of reset. If this is your problem work through the following list.
a) Clock. Check that the clock is getting to the Z80 (pin 6).
b) Reset. Check that the CPU is getting a reset pulse.
c) Decode. Check that LK5 (MEM) is in the correct position, do not confuse this link with LK1 (I/O).
d) Work down the address lines on the Z80 (pins5-1 & 40-30), the top four will almost always be low when the monitor program is running, the remaining 12 should be switching, the top address lines can be persuaded to switch by loading the I register with FF.
e) Work down the data lines on the Z80 (pins 7-15 ex.11(Vcc)) and ensure that they are switching.
f) Control lines, /RD, /WR, /IORQ, /RFSH, /MREQ,/M1 should all be switching. /HALT, /WAIT, /BUSREQ, /INT, /NMI should all be high and staying that way.

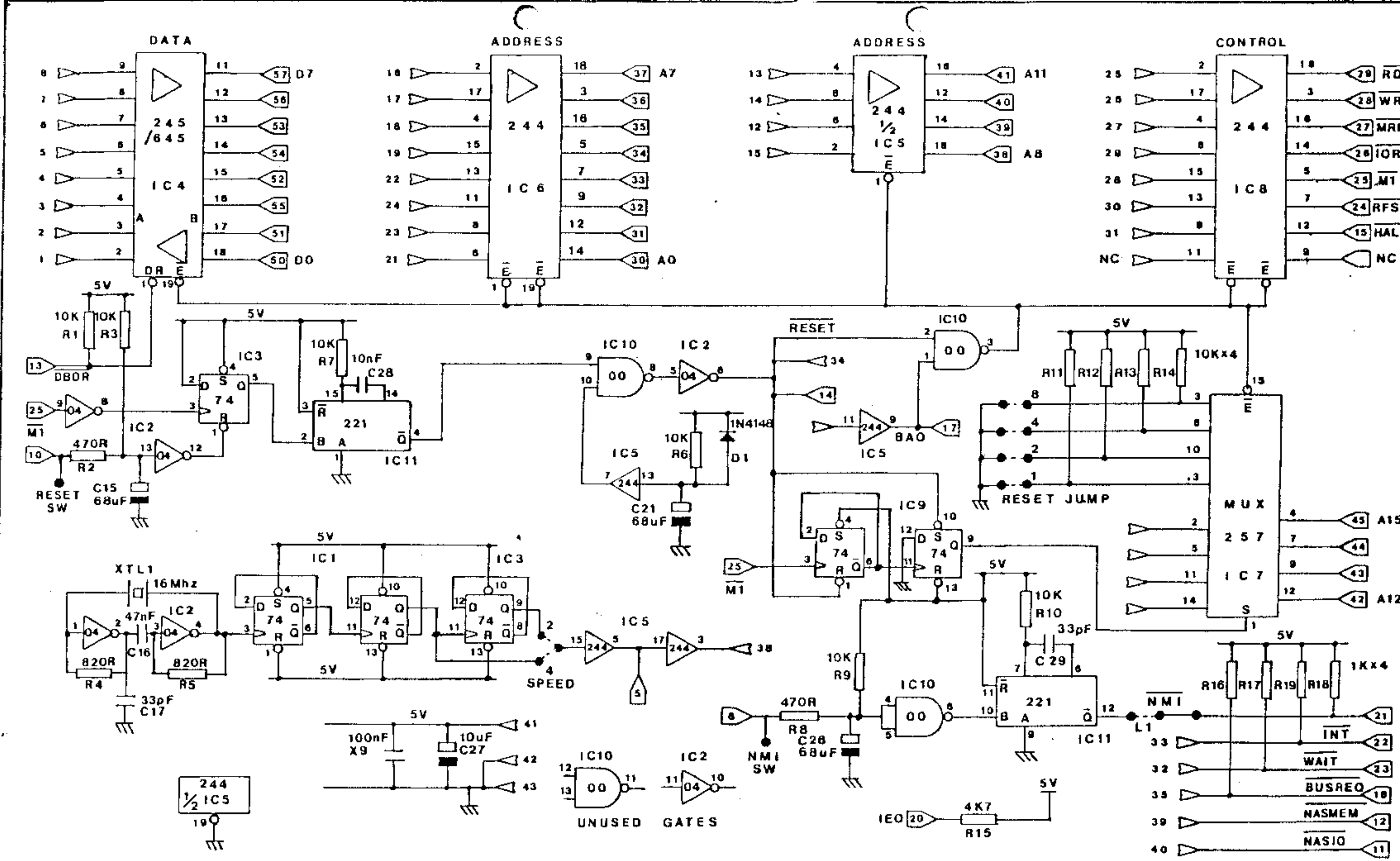
2) Unreliable system. This is generally caused by either a power supply problem or a noise problem, the PSU should be carefully checked, ensure that the correct windings on the transformer have been used. The wires connecting the transformer to 'Supermum' should be kept short to avoid voltage drops. Also check that the mains supply is at the correct voltage and relatively noise free. When the voltage regulators are fully loaded, the minimum voltage across them should be 3V, this has to be measured using a scope.

3) Unstable video. A problem which seems to afflict older Nascom 1s, the clock to the video is seperate from the clock which is used for the rest of the system. A fault here would be unlikely to affect the rest of the system. The problem is clock jitter, if this is the problem you will find that the crystal is sensitive to hand capacity. There are several cures, if you have a box of LS04's to hand work through until one "goes". The second solution is to put a capacitor from pin 12 of the LS04 to ground, a ceramic capacitor in the range of 10 to 33 pF should be suitable.

Appendix D - RESET JUMP LINKS

8	4	2	1	JUMP ADDRESS	8	4	2	1	JUMP ADDRESS
X	X	X	X	F000	X	X	X	I	E000
X	X	I	X	D000	X	X	I	I	C000
X	I	X	X	B000	X	I	X	I	A000
X	I	I	X	9000	X	I	I	I	8000
I	X	X	X	7000	I	X	X	I	6000
I	X	I	X	5000	I	X	I	I	4000
I	I	X	X	3000	I	I	X	I	2000
I	I	I	X	1000	I	I	I	I	0000

I = Link X = No link



G806 BUFFER CIRCUIT

ISSUE 1

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