HARDWARE DESCRIPTION MON/DOS65

Description for a build it yourself professional 6502 system.

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Introduction

To fulfil the use of the software of MON65 and DOS65 the hardware must meet to certain requirements. Some cards and a bus board previously published are needed together with a floppy disk controller (FDC) board. The cards published by Elektor need some modifications to remove a few errors. The memory-map is also changed. Here are the cards needed for a good working system.

- Power supply
- Bus board (Elektor Holland/U.K., Dec. '83)
- CPU card (Elektor Holland/U.K., Nov. '83)
- VDU card (Elektor Holland/U.K., Sep. '83)
- DYN. Ram card (Elektor Holland/U.K., Apr. '82)
- disk controller card (KIM Users Club '85)

The power supply

Concerning the power supply we want to be brief. You may be able to use the power supply from your old system. It is very easy to build a power supply. You need the following requirements:

+5 Volts at about 8 Amps. The power you need depends of the number of cards

+12 Volts at about 3 Amps. The power of this current depends of the number of disk-drives you are going to use. The system uses the +12 Volts only for the dynamic ram cards, the RS 232 interface and the FD 1793 FDC chip.

-5 Volts at about 0.5 Amps.

-12 Volts at about 0.5 Amps.

Another solution for the +5 Volts power suply is to make a power supply for about 10 Volts and to mount on every connector on the bus board a 5 Volts stabilizer. With this sytem the interference is at a minimum. But don't forget to mount a capacitor of 100 nF as close as possible to each stabilizer.

The bus board

The size of the bus board depends on the number and kind of cards you are use to connect. For example, you can take three 16K Byte ram cards or you can change one 16K card to 64K Byte ram. If you use the Elektor's Omnibus card (Elektor Holland/UK Dec. '83), you have enough for the near future. You can also join two of these cards; you are not advised to connect the cards with connectors, but to do it with wires to avoid problems with timing. If timing problems arise you can connect 1 K Ohm resistors to earth from the address signals, the data signals and the clock signals like R/W, RAM R/W, O1 and O2.

The CPU card

At the heart of the computer is an Elektor CPU card equipped with a 6502 or 65C02 microprocessor. The original article, which you will need to refer to, was published in Elektor in November 1983.

On the CPU card two errors have to be corrected and some small modifications made to allow the VIA IC 3 to be used as an external interface. The RAM (IC 5) is a 2 KByte type (6116) and the ROM (IC 6) is 8 KByte (2764). Appropriate address selections have to be made for these, the VIA's and the ACIA. Some simple circuits for debouncing the contacts of the RESET and NMI keys and for making a beep are necessary.

We suggest that each of interface IC's (the two VIA's and the ACIA) is connected to a 25 way D connector. We have given our wiring in the hope that others will copy it. If all users do the same it makes it easy to exchange equipment. It is a good idea to make a card front and attach the connectors to it.

Changes on the CPU card

The VIA IC 2, which we will refer to as VIA 1, is used for the communication protocol VIACOM and for the data signals of a centronics interface. VIA 2, the other VIA (IC 3) handles the paper out and select signals of the centronics interface and inputs from a parallel keyboard. The diodes D1 to D16 are no longer necessary and can be omitted.

The beeper is triggered on negative edges of CB2 of VIA 2. One way to do this is to use a dual NE555 timer, half of it as a one-shot to fix the length of the pulse and half to generate the beep. Another solution is to use an NE555 as a one-shot and a buzzer. Alternatively half of a 74LS123 monostable/flipflop can be used as it can switch a buzzer directly. The 3 possibilities are drawn in figures 1 to 3.

To prevent contact bounce of the RESET and NMI keys an extra circuit is needed. The circuit used is taken from the original JUNIOR computer (Elektor U.K. May 1980, Elektor Holland, March 1980). It is reproduced in figure 4.

Errors on the CPU card

In the schematic diagram and on the card you can find two errors. Both are related to the address-selection from the Rom or Ram. According to the diagram it is possible to select the Eprom during a write-cycle. That means, that the data of the procesbuffer (IC 14) is put on the slot together with the data of the Eprom. The solution is quite simple. Disconnect, on the card, pin 6 from IC 17. And connect pin 6 of IC 17 with pin 6 of IC 20. The result is that the Eprom will be selected only during READ-cycles. The second error is related to Ram IC 5. In the diagram happens something nasty. The chip enable that is made by N60 from the address-signals is low much earlier than the Read-Write line. The result is that the end of a write-cycle the data signals of the ram leave the tri-state. At that moment the procesbuffer and the ram are on the slot at the same time and that will give problems. You can solve this by by use of the early-write possibility of the ram. The Read-Write line must be low earlier than the chip-enable line. You can do this by disconnecting pin 6 of IC 16 on the card and connect it with pin 8 of IC 20.

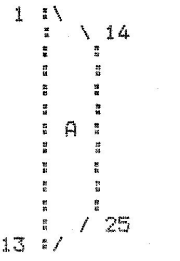
Jumpers on the CPU card

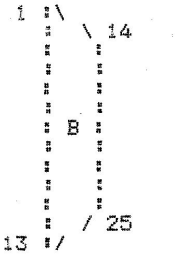
With the jumpers on the CPU card you can select the Eprom, Ram and the VIA's at the right addresses. There are also jumpers for the system clock etc. Here's the list of the jumpers and how to select them.

Eprom	$E000-$FFFF	PL11	1- 2 5- 6	PL12	1- 2 11-12 17-18
Ram	$C800-$CFFF	PL13	1- 2	PL9	1- 2 5- 6 11-12 15-16 17-18
		PL10	Open		
IC2	$C100-$C10F	A-A15	E-$\overline{A11}$	H-A8	
IC3	$C110-$C11F	B-A14	F-$\overline{A10}$	I-$\overline{A7}$	
IC4	$C130-$C13F	C-$\overline{A13}$	G-$\overline{A9}$	J-$\overline{A6}$	
		D-$\overline{A12}$			

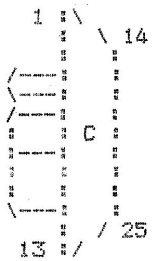
Sundries	PL1	Parallel Centronics output (printer)
	PL2	VIACOM
	PL3	Keyboard
	PL4	Open (not used)
	PL5	Printer/beeper
	PL6	Open (not used)
	PL7	RS232
	PL8	1- 2 (Busy-signal comes from ACIA)
	PL14	3- 4 (1 MHz)
	M-N	Open (internal clock)
	P-Q	Close (no interrupt)
	K-L	Close (no DMA)

D-connections on the CPU card





A = Keyboard
B = Printer
C = RS232



To let the RS232 work properly on the monitor software without hardware handshake make the following connections on connector C :
4 - 5
6 - 8 - 11

Pin 2 is the output!!
Pin 3 is the input!!

CONNECTOR A	CONNECTOR B	CONNECTOR C (ACIA)
1 - Via 2 CA1	1 - Via 1 CA 1	1 - n.c.
2 - Via 2 PA0	2 - Via 1 PA0	2 - TD
3 - Via 2 PA1	3 - Via 1 PA1	3 - RD
4 - Via 2 PA2	4 - Via 1 PA2	4 - RTS
5 - Via 2 PA3	5 - Via 1 PA3	5 - CTS
6 - Via 2 PA4	6 - Via 1 PA4	6 - DSR
7 - Via 2 PA5	7 - Via 1 PA5	7 - GND
8 - Via 2 PA6	8 - Via 1 PA6	8 - DCT
9 - Via 2 PA7	9 - Via 1 PA7	9 - n.c.
10 - Via 2 CA2	10 - Via 1 CA2	10 - N.C.
11 - + 10 Volt	11 - + 10 Volt	11 - + 10 Volt
12 - + 5 Volt	12 - + 5 Volt	12 - + 5 Volt
13 - GND	13 - GND	13 - GND
14 - Via 2 CB1	14 - Via 1 CB1	14 - n.c.
15 - Via 2 PB0	15 - Via 1 PB0	15 - n.c.
16 - Via 2 PB1	16 - Via 1 PB1	16 - n.c.
17 - Via 2 PB2	17 - Via 1 PB2	17 - n.c.
18 - Via 2 PB3	18 - Via 1 PB3	18 - n.c.
19 - Via 2 PB4	19 - Via 1 PB4	19 - n.c.
20 - Via 2 PB5	20 - Via 1 PB5	20 - DTR
21 - Via 2 PB6	21 - Via 1 PB6	21 - n.c.
22 - Via 2 PB7	22 - Via 1 PB7	22 - n.c.
23 - Via 2 CB2	23 - Via 1 CB2	23 - n.c.
24 - n.c.	24 - Via 2 PB4	24 - n.c.
25 - n.c.	25 - Via 2 PB5	25 - n.c.

General

It is also possible, of course, to connect other cards on this system. They should be, however, cards with the same address-structure mentioned above, i.e. the Eprommer or static ram cards. If you connect a keyboard on the VIA ensure that the strobe is active low, so if you don't use it, connect it to earth. The select-signal of the centronics interface is active high and should be wired to +5 Volts if unused.

This hardware may be look a little bit complicated but it is very simple to change an already existing OHIO-DOS system into a MON/DOS65 system. Many people have done so. For questions or problems you have you can always contact the club.

The VIA and ACIA connections

The software expects the peripherals to be connected according to the table below. We also suggest to use Sub-D connectors. There are several systems using Sub-D connectors so it looks useful to us to propose a standard. In this way keyboards, printers and modems could be exchanged.

VIA 1

PORT A (PL 2) Viacom		PORT B (PL 1) Centronic printer
CA1 - Handshake input		CB1 - Acknowledge
CA2 - Handshake output		CB2 - Strobe
PA0 - Databit 0		PB0 - Databit 0
PA1 - Databit 1		PB1 - Databit 1
PA2 - Databit 2		PB2 - Databit 2
PA3 - Databit 3		PB3 - Databit 3
PA4 - Databit 4		PB4 - Databit 4
PA5 - Databit 5		PB5 - Databit 5
PA6 - Databit 6		PB6 - Databit 6
PB7 - Databit 7		PB7 - Databit 7

VIA 2

PORT A Keyboard		PORT B (PL 5) Controlsignals
CA1 - Strobe	} PL 5	CB1 - n.c.
CA2 - n.c.	} PL 5	CB2 - beeper
PA0 - Databit 0	} PL 3	PB0 - n.c.
PA1 - Databit 1	} PL 3	PB1 - n.c.
PA2 - Databit 2	} PL 3	PB2 - n.c.
PA3 - Databit 3	} PL 3	PB3 - n.c.
PA4 - Databit 4	} PL 3	PB4 - Paper out (GND.)
PA5 - Databit 5	} PL 3	PB5 - Select (+5 Volts)
PA6 - Databit 6	} PL 3	PB6 - n.c.
PA7 - Databit 7	} PL 3	PB7 - n.c.

The VDU card

The Elektor's video card should have a 16 MHz crystal. You must also use the character generator made by The KIM Club, because it allows inverse characters. The area of the video ram is $D000-$D7FF. The CRTC is placed on the addresses $C140-$C147 (addressed 4 times, but only 2 are necessary. The jumpers for this address-selection must be set according to the table below.

A - A15	F - A15	K - $\overline{A10}$	P - $\overline{A5}$
B - A14	G - A14	L - $\overline{A9}$	Q - $\overline{A4}$
C - $\overline{A13}$	H - A13	M - A8	R - $\overline{A3}$
D - A12	I - $\overline{A12}$	N - $\overline{A7}$	
E - $\overline{A11}$	J - $\overline{A11}$	O - A6	

The dynamic ram card

The addresses from $0000 to $BFFF are occupied by RAM, some 48 K is total. It can be made up of three 16 K cards or one 16 K card connected to 64 K with only 48 K used. The last solution has some advantages. It saves two slots, and the power supply can be made smaller. The current from the +5 Volts, +12 Volts and the -5 Volts is less. How to change the card can be found in Elektor Holland/U.K., Sep. 1983. They give also attention to it in the Elektor's Computer Special (Holland and Germany). In the Special, however, the address-selection differs and ends at $DFFF.

There are some problems with the DRAM cards but you can solve them with a little change, to be found in DE 6502 KENNER, no. 28, Oct. 1983, page 6. Sometimes the changes used by Elektor are enough. You can find these in Elektor Holland, Dec. 1982., behind the article about OHIO FDC card, on page 79.

The FDC card

We can be brief about the floppy disk controller. To use the software it is necessary to have the FDC card of our club present. You can make this card yourself but the easiest way is to use the card developed by the KIM Users Club The Netherlands. It is a double-sided so called Eurocard, added with soldermask and text, developed on CAD/CAM. With the hardware description assembly is very easy. Refer to the manual from page 12 to find out how to build the card.

Errors on the CPU card

In the schematic diagram and on the card there are two errors. Both are related to the address-selection from the Rom or Ram. According to the diagram it is possible to select the Eprom during a write-cycle. That means, that the data of the databusbuffer (IC 14) is put on the bus together with the data of the Eprom. The solution is quite simple. Disconnect, on the card, pin 6 from IC 17, and connect pin 6 of IC 17 with pin 6 of IC 20. The result is that the Eprom will be selected only during READ-cycles. The second error is related to Ram IC 5. The chip enable that is made by N60 from the address-signals is low much earlier than the Read-Write line. The result is that the end of a write-cycle the data signals of the ram leave the tri-state. At that moment the busbuffer and the ram are on the bus at the same time and that will give problems. You can solve this by by use of the early-write possibility of the ram. The Read-Write line must be low earlier than the chip-enable line. You can achieve this by disconnecting pin 6 of IC 16 on the card and connecting it to pin 8 of IC 20.

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IC3	$C110-$C11F	B-A14	F-$\overline{A10}$	I-$\overline{A7}$	
IC4	$C130-$C13F	C-$\overline{A13}$	G-$\overline{A9}$	J-$\overline{A6}$	
		D-$\overline{A12}$			

Sundries	PL1	Parallel Centronics output (printer)
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	PL4	Open (not used)
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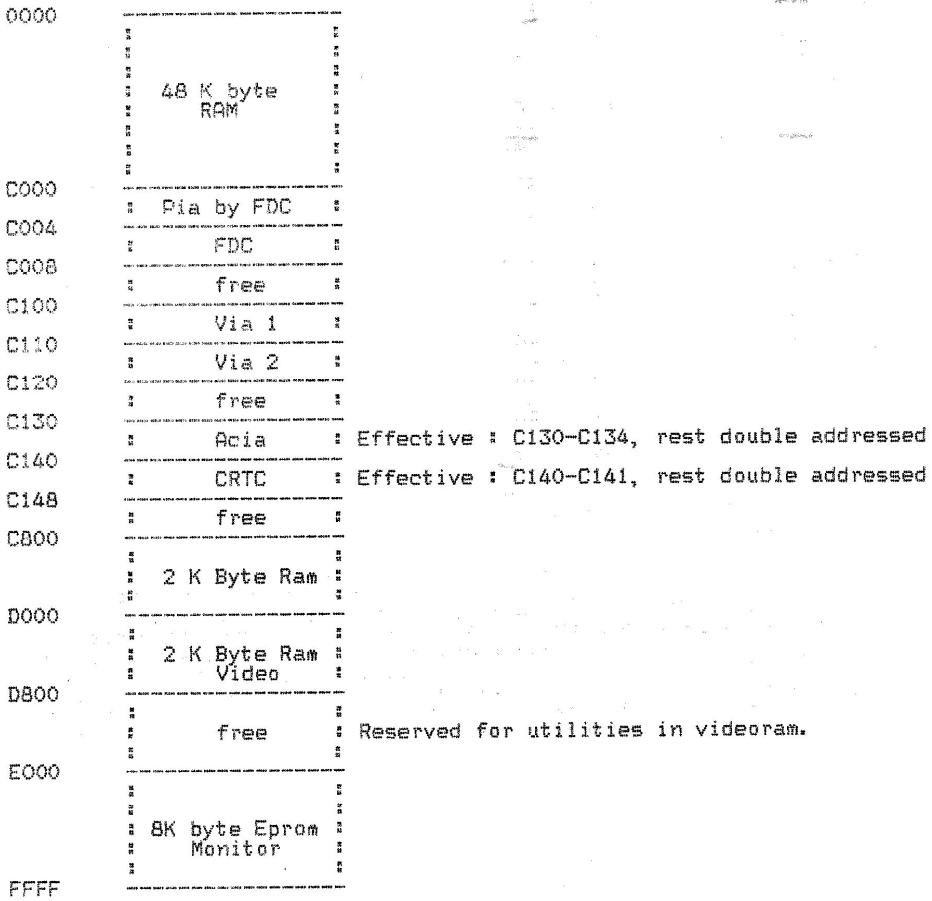
	PL14	3- 4 (1 MHz)
	M-N	Open (internal clock)
	P-Q	Close (no interrupt)
	K-L	Close (no DMA)

Memory map

To complete the documentation of the hardware a memory map will be given. Here you can find the entire memory map, written including via's, acia', crtc, etc.



Bus connections (Elektorbus)

1A - +5 Volt	1C - +5 Volt
2A - n.c.	2C - n.c.
3A - n.c.	3C - -12 Volt
4A - Ground	4C - Ground
5A - $\overline{\text{RES}}$	5C - RDY
6A - n.c.	6C - $\overline{\text{ML}}$
7A - D1	7C - D0
8A - D3	8C - D2
9A - D5	9C - D4
10A - D7	10C - D6
11A - n.c.	11C - $\overline{\text{BE}}$
12A - $\overline{\text{IRQ}}$	12C - $\overline{\text{NMI}}$
13A - n.c.	13C - OSC
14A - n.c.	14C - SO
15A - n.c.	15C - n.c.
16A - Ground	16C - Ground
17A - n.c.	17C - +12 Volt
18A - -5 Volt	18C - n.c.
19A - A15	19C - A14
20A - A13	20C - A12
21A - A11	21C - A10
22A - A9	22C - A8
23A - A7	23C - A6
24A - A5	24C - A4
25A - A3	25C - A2
26A - A1	26C - A0
27A - phase 2	27C - n.c.
28A - n.c.	28C - SYNC
29A - n.c.	29C - R/$\overline{\text{W}}$
30A - phase 1	30C - n.c.
31A - Ram R/$\overline{\text{W}}$	31C - n.c.
32A - Ground	32C - Ground

Some of the connections are not used. These are for future use. Think of battery backup, programming voltages for the Eprommer, etc.

Some of the signals will not be known by everyone. These are the signals are used by the 65C02. Because we don't want to close our eyes to this processor, we have named them already. They are connected to the CPU card too.

If there are other users wanting to build the system on their own, using this bus by means of wire-wrapping or whatever, there remains the possibility of exchange. If someone has problems with a card then it is often helpful to exchange it with others. New developments by the club will also be based on use of this bus.

HOW TO MODIFY THE ELEKTOR 64K MEMORY CARD FOR USE WITH DOS65

To make this card work with DOS65 v2.0 a few changes to the addressing are required. Proceed as follows:

1) Build the card out of TTL LS or TTL HC(T)MOS. I have built mine from TTL LS but do not envisage many problems with HCMOS versions provided it is remembered that only HCT devices can be driven from TTL LS. Seven 6264 rams are needed, the IC15 socket remains empty.

2) Reduce R27 (1K) to 390 ohms. Otherwise it will not function reliably with a 65C02 processor. On my card IC7 was a 7412, but I am not sure if this crucial. See the note about HCMOS cpu cards below.

3) Set all the dip switches off. The links are made as follows:

E - L
D - K
C - J

R .....
Q .....
P no connection
O .....
N no connection
M _____

4) Lift pin 8 of IC6 out of its socket then make the following connections when viewing the card with the writing the correct way up:

Connect a 1K resistor from IC6 pin 13 to +5 volts

Connect IC4 pin 3 to P left.

Connect IC6 socket pin 8 to N centre.

Connect IC6 pin 8 to N right.

Connect IC4 pin 12 to H.

Connect IC4 pin 14 to IC6 pin 9.

The card now occupies $0000 to $DFFF and will operate at 1 or 2 MHz. The effect of these changes is to connect A13, A14 and A15 to the inputs of N9 and place an inverter (N2) in its output.

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Note about HCMOS cpu cards: If you build your cpu card from HCMOS then leave IC9 as 74LS01, IC7 as 74LS04 and IC20 as 74LS06. IC7 can be 74HC04 provided R1 and R2 are increased to 1K5, but I found that it then worked unreliably with the 65C02.

Note about VDU cards: Everyone encounters screen flicker with these cards. It can be cured by replacing IC8 by a 74L30 when using an NMOS 6502. However the most effective solution is that suggested by Albert v.d. Beukel in De 6502 Kenner issue 46 page 17: Reconnect IC8 pin 1 to 02 (pin 27a of the 32 way connector). I built mine from HCMOS IC's with the exceptions of IC20 and IC21 which I could not obtain.

General

It is also possible, of course, to connect other cards on this system. It should be, however, cards with the same address-structure mentioned above, i.e. the Eprommer or static ram cards. If you connect a keyboard on the VIA you must consider that the strobe is active low, so if you don't use it, you should connect it with earth. The signal-select is also active high. If this signal is high, you should connect it with +5 Volts.

This hardware may be looks a little bit complicated but it is very simple to change an already existing OHIO-DOS system into a MON/DOS65 system. Many people did so. For questions or problems you have you may always contact the club.

The VIA and ACIA connections

The software expects the peripherals to be connected according to the table below. We also suggest to use Sub-D connectors. There are several systems using Sub-D connectors so it looks useful to us to propose to normalize. In this way keyboards, printers and modems could be exchanged.

VIA 1	
PORT A Viacom	PORT B Centronic printer
CA1 - Handshake input	CB1 - Acknowledge
CA2 - Handshake output	CB2 - Strobe
PA0 - Databit 0	PB0 - Databit 0
PA1 - Databit 1	PB1 - Databit 1
PA2 - Databit 2	PB2 - Databit 2
PA3 - Databit 3	PB3 - Databit 3
PA4 - Databit 4	PB4 - Databit 4
PA5 - Databit 5	PB5 - Databit 5
PA6 - Databit 6	PB6 - Databit 6
PB7 - Databit 7	PB7 - Databit 7

VIA 2	
PORT A Keyboard	PORT B Controlsignals
CA1 - Strobe	CB1 - n.c.
CA2 - n.c.	CB2 - beeper
PA0 - Databit 0	PB0 - n.c.
PA1 - Databit 1	PB1 - n.c.
PA2 - Databit 2	PB2 - n.c.
PA3 - Databit 3	PB3 - n.c.
PA4 - Databit 4	PB4 - Paper out (GND.)
PA5 - Databit 5	PB5 - Select (+5 Volts)
PA6 - Databit 6	PB6 - n.c.
PA 7 - Databit 7	PB7 - n.c.

Sub-D connections on the CPU card

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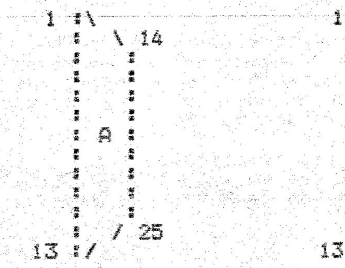
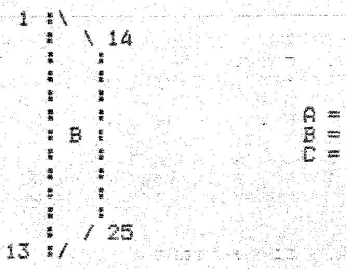
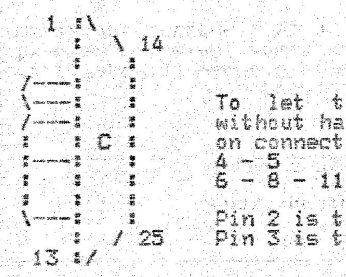




A = Keyboard
B = Printer
C = RS232



To let the RS232 work properly on the monitor software without hardware handshake the following connections should on connector C :

4 - 5

6 - 8 - 11

Pin 2 is the output!!
Pin 3 is the input!!

CONNECTOR A	CONNECTOR B	CONNECTOR C
1 - Via 2 CA1	1 - Via 1 CA 1	1 - n.c.
2 - Via 2 PA0	2 - Via 1 PA0	2 - TD
3 - Via 2 PA1	3 - Via 1 PA1	3 - RD
4 - Via 2 PA2	4 - Via 1 PA2	4 - RTS
5 - Via 2 PA3	5 - Via 1 PA3	5 - CTS
6 - Via 2 PA4	6 - Via 1 PA4	6 - DSR
7 - Via 2 PA5	7 - Via 1 PA5	7 - GND
8 - Via 2 PA6	8 - Via 1 PA6	8 - DCT
9 - Via 2 PA7	9 - Via 1 PA7	9 - n.c.
10 - Via 2 CA2	10 - Via 1 CA2	10 - N.C.
11 - + 10 Volt	11 - + 10 Volt	11 - + 10 Volt
12 - + 5 Volt	12 - + 5 Volt	12 - + 5 Volt
13 - GND	13 - GND	13 - GND
14 - Via 2 CB1	14 - Via 1 CB1	14 - n.c.
15 - Via 2 PB0	15 - Via 1 PB0	15 - n.c.
16 - Via 2 PB1	16 - Via 1 PB1	16 - n.c.
17 - Via 2 PB2	17 - Via 1 PB2	17 - n.c.
18 - Via 2 PB3	18 - Via 1 PB3	18 - n.c.
19 - Via 2 PB4	19 - Via 1 PB4	19 - n.c.
20 - Via 2 PB5	20 - Via 1 PB5	20 - DTR
21 - Via 2 PB6	21 - Via 1 PB6	21 - n.c.
22 - Via 2 PB7	22 - Via 1 PB7	22 - n.c.
23 - Via 2 CB2	23 - Via 1 CB2	23 - n.c.
24 - n.c.	24 - Via 2 PB4	24 - n.c.
25 - n.c.	25 - Via 2 PB5	25 - n.c.

Slots connections (Elektor's slots)

1A - +5 Volt	1C - +5 Volt
2A - n.c.	2C - n.c.
3A - n.c.	3C - -12 Volt
4A - Ground	4C - Ground
5A - $\overline{RES}$	5C - RDY
6A - n.c.	6C - $\overline{ML}$
7A - D1	7C - D0
8A - D3	8C - D2
9A - D5	9C - D4
10A - D7	10C - D6
11A - n.c.	11C - $\overline{BE}$
12A - $\overline{IRQ}$	12C - $\overline{NMI}$
13A - n.c.	13C - OSC
14A - n.c.	14C - SO
15A - n.c.	15C - n.c.
16A - Ground	16C - Ground
17A - n.c.	17C - +12 Volt
18A - -5 Volt	18C - n.c.
19A - A15	19C - A14
20A - A13	20C - A12
21A - A11	21C - A10
22A - A9	22C - A8
23A - A7	23C - A6
24A - A5	24C - A4
25A - A3	25C - A2
26A - A1	26C - A0
27A - phase 2	27C - n.c.
28A - n.c.	28C - SYNC
29A - n.c.	29C - R/$\overline{W}$
30A - phase 1	30C - n.c.
31A - Ram R/$\overline{W}$	31C - n.c.
32A - Ground	32C - Ground

Some of the connections are not used. These are for future use. Think of battery backup, programcurrents for the Eprommer, etc.

Some of the signals will not be known by everyone. This are the signals, however, used by the 65C02. Because we don't want to close our eyes for this processor, we give these signals a name already. They are connected to the CPU card too.

If there are other users wanting to build the system by their own, using this slots by means of wire-wrapping or whatsoever, the exchange-possibility of cards stays for them. It happens that somebody has problems with a card and then it is nice to exchange. New developments by the club will also be based on use of this slots.

Manual to build the floppy disk controller

If you have the floppy disk controller card 850328 it is easy to build. Of course, it is also possible to build it yourself with the schematic diagram and to use wire wraps or road runners. But we don't think it's worth the effort because the FDC card is not very expensive. This manual describes the use of card 850328.

We recommend you to put the IC's in good quality sockets, such as turned pin ones, and not to solder them to the card. After soldering the sockets you can mount the resistors and capacitors.
When you buy the parts ensure that they are not too big. The capacitors C2 and C01 to C016 have a pitch of 5 mm whereas it is 2.5 mm for C2 and C3. If the lead diameter of the electrolytic capacitor E1 exceed 0.8 mm they will not fit through the card. If this happens it is wisest to solder them to two smaller wires already soldered to the card.

The 34 way IDC connector is a right angle type so you can plug in a connector from the front. If you decide to make the cable between connector and drives yourself you must pay attention to the num-bering of the connections. The cable can be soldered to the card directly, but it is better to use IDC connectors, especially as most drives already have a ribbon cable with a female 34 way IDC connector when bought. The jumpers on the card are made with wire links or pins and straps. JP1 to JP8 address the card with JP8 the most significant bit. DOS65 and MON65 expect it to be addressed at $C000 to $C001.
The setting of the jumpers is given in the table below.

JP8 o-o o	JP8 - 1
o-o o	JP7 - 1
o o-o	JP6 - 0
o o-o JP5	JP5 - 0
JP4 o o-o	JP4 - 0
o o-o	JP3 - 0
o o-o	JP2 - 0
o o-o JP1	JP1 - 0

If the text near the jumper is upright, then a "1" is a connection between the pin in the middle and the pin left of it. A "0" is a connection between the pin in the middle and the pin right of it.

Avoid overheating the crystal when soldering. It's case is earthed by a bare wire wrapped round it and soldered to the card.

Jumper 9 is used to set the polarity of the READY signal from a floppy drive. In most drives it is active low and the connection is made between the pin in the middle and the pin right of it. If the READY signal is active high you should make the connection between the pin in the middle and the pin left of it. If the disk drive is as 8 inch, single density type the jumper JP10 is closed. When the common 5 inch drive is employed JP10 is left open.

When all the parts are mounted check the position of pin 1 of the capacitors E1 and C1. After that, and before IC's are placed in the sockets, check the power supply on every IC. Make sure there are no short circuits in the power supply. If everything is alright, put the IC's into the sockets. Don't forget to check pin 1 ! The card is now ready for use. No adjustment is needed!

Very important : If you want to use the cable of the OHIO-system between the card and the drive, you must turn one of the connectors around !! Because the OHIO-system uses the IDC connector in the wrong way; they call pin 1 number 34, pin 2 is called number 33, etc. Pin 1 is marked on the card. Here is the parts list for the floppy disk controller card.

Resistors:

R1	-	12 KOhm
R2	-	1 KOhm
R3	-	10 KOhm
R4,R5	-	1.5 KOhm
R6	-	1 KOhm
R7	-	4.7 KOhm
R8...R12	-	220 Ohm
R13,R14	-	10 KOhm

Capacitors:

C1	-	10 uF 2.5 mm pitch
C2	-	100 nF 5 mm pitch
C3	-	68 pF 2.5 mm pitch
E1	-	220 uF/15 Volt
C01...C08,	-	100 nF 5 mm pitch
C010..C016	-	100 nF 5 mm pitch

IC's:

IC1	-	74LS00
IC2	-	74LS02
IC3	-	7407
IC4	-	7406
IC5	-	74LS14
IC6	-	74LS04
IC7	-	74LS123
IC8	-	74LS245
IC9	-	FD1793 Western Digital
IC10	-	74LS138
IC11,IC12	-	74LS85
IC13	-	6821
IC14	-	74LS93
IC15	-	74LS153
IC16	-	74LS193

Other parts:

IC sockets: 7 * 14 pins
6 * 16 pins
1 * 20 pins
2 * 40 pins

1 * 64 pins connector male DIN 41612

1 * 34 way IDC connector, right angle, male

1 or 2 connectors for drives

34 way ribbon cable

Jumpers: 9 * 3 pins
1 * 2 pins

Crystal 8 MHz

DOS65 floppy disk controller card nr. 850328

Note : There is no capacitor C09, so a total of 16 100nF/5 mm pitch capacitors are required.

Jumper 9 is used to set the polarity of the READY signal from a floppy drive. The most drives are active low. In that case the connection is being made between the pin in the middle and the pin right of it. If the READY signal is high you should make the connection between the pin in the middle and the pin left of it. JP10 is used in case of a 8 inch single density drive. But we use most a 5 inch drive and then JP10 is not used.

When al the parts are mounted we check the position of pin 1 of the condensors E1 and C1. After that, and before IC's were placed in the sockets, we check the power supply on every IC. Be sure too there's no short-circuiting in the power supply. If everything is okay, put the IC's into the sockets. Don't forget checking pin 1 ! The card is now ready for use. No adjusting is needed !

Important : C01 up to and until C016 are only 15 condensors. So a total of 16 condensors with a pitch of 5 mm !!!!!

Very important : If you want to use the cable of the OHIO-system between the card and the drive, you must turn one of the connectors around !! Because the OHIO-system uses the Chiba connector in the wrong way; they call pin 1 number 34, pin 2 is called number 33, etc. Pin 1 is marked on the card. Here is the parts list for the floppy disk controller card.

Resistors:

R1	-	12 KOhm
R2	-	1 KOhm
R3	-	10 KOhm
R4,R5	-	1.5 KOhm
R6	-	1 KOhm
R7	-	4.7 KOhm
R8...R12	-	220 Ohm
R13,R14	-	10 KOhm

IC's:

IC1	-	74LS00
IC2	-	74LS02
IC3	-	7407
IC4	-	7406
IC5	-	74LS14
IC6	-	74LS04
IC7	-	74LS123
IC8	-	74LS245
IC9	-	FD1793 Western Digital
IC10	-	74LS138
IC11, IC12	-	74LS85
IC13	-	6821
IC14	-	74LS93
IC15	-	74LS153
IC16	-	74LS193

Condensors:

C1	-	10 uf 2.5 mm pitch
C2	-	100 nf 5 mm pitch
C3	-	68 pf 2.5 mm pitch
E1	-	220 uf/15 Volt
C01...C016	-	100 nf 5 mm pitch

Other parts:

IC sockets: 7 * 14 pins
6 * 16 pins
1 * 20 pins
2 * 40 pins

1 * 64 pins connector male DIN 41612

1 * 34 pins connector Chiba square, male

1 or 2 connectors for drives

Flatcable 34 cores

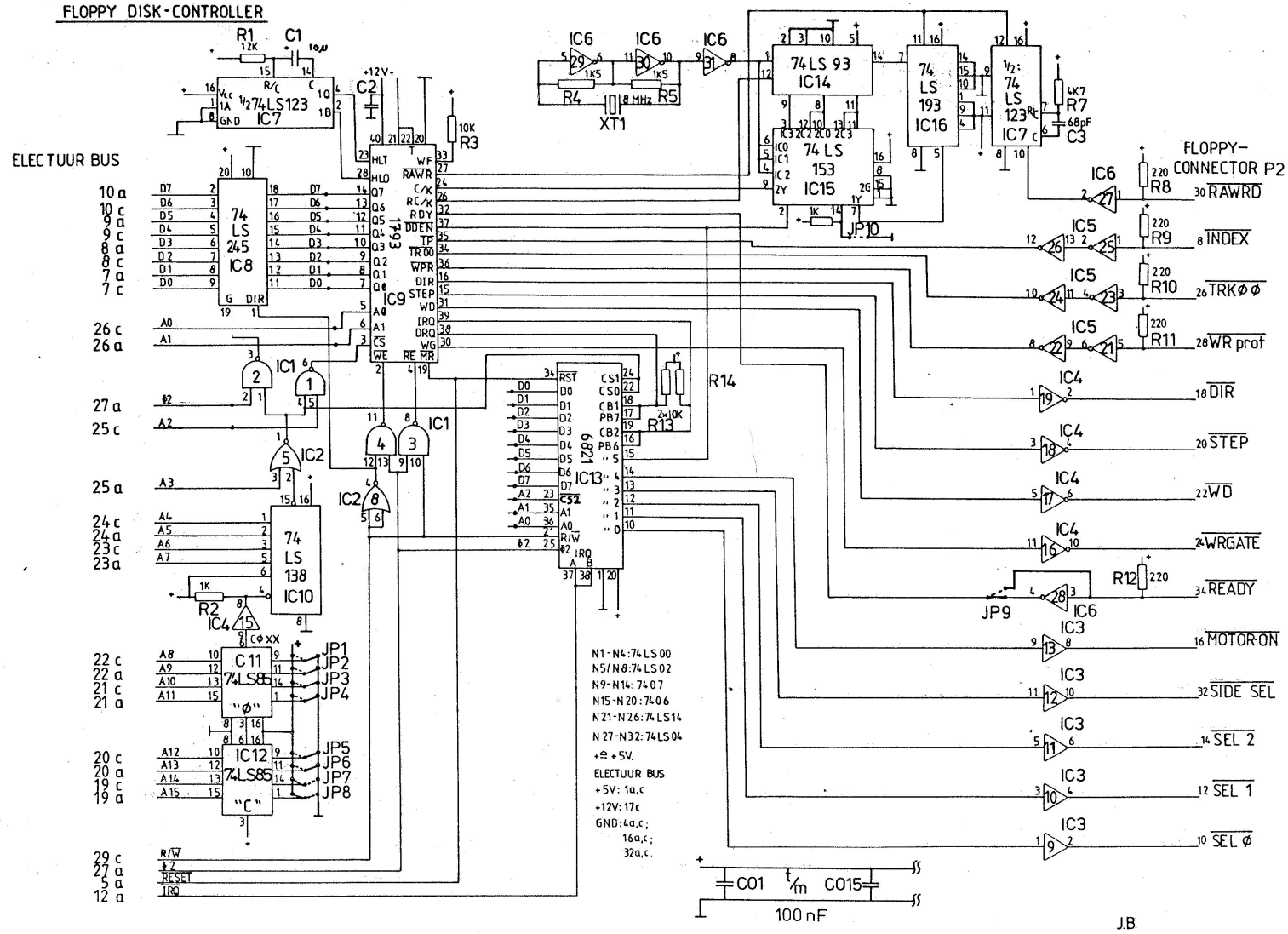
Jumpers: 9 * 3 pins
1 * 2 pins

Cristal 8 MHz

DD865 floppy disk controller card nr. 850328

Command list of MONITOR

@ xxxx	Modify address
B xxxx	Set breakpoint
B S	
B R	
C a1,a2,xx	Memory between a1 and a2 compared to xx
D xxxx	Dissasemble from xxxx
E xxxx	Execute address xxxx
F a1,a2,xx	Fill memory between a1 and a2 with xx
H a1,a2	Hex and ascii dump of memory between a1 and a2
M a1,a2,a3	Memory between a1 and a2 is copied starting at a3
L	List registers
P	Clears screen - purpose not known
Q	Quit
S a1,a2	Work out checksum of contents of addresses a1 to a2
V a1,a2,a3	Memory between a1 and a2 is compared to memory starting at a3
W a1,a2,xx..	Memory between a1 and a2 is searched for number or string xx
+ x,y	Performs 16 bit hex addition x+y
- x,y	Performs 16 bit hex subtraction x-y
$ xx	Converts decimal to hex
# xx	Converts hex to decimal
<	Continue execution from previous address
^S	
^Q	
^Y	Repeat previous command line


FLOPPY DISK-CONTROLLER
ELECTUUR BUS
FLOPPY-CONNECTOR P2
74 LS 245 IC8
74 LS 138 IC10
74 LS 93 IC14
74 LS 153 IC15
74 LS 193 IC16
74 LS 123 IC7
74LS123 IC7
74LS85 IC11
74LS85 IC12
6821 IC13
6843 IC9
XT1
8 MHz
R1 12K
C1 10µ
R2 1K
R3 10K
R4 1K5
R5 1K5
R7 4K7
C3 68pF
R8 220
R9 220
R10 220
R11 220
R12 220
R13 2×10K
R14
JP1
JP2
JP3
JP4
JP5
JP6
JP7
JP8
JP9
JP10
C01 t/m C015
100 nF
N1-N4: 74 LS 00
N5/N8: 74 LS 02
N9-N14: 7407
N15-N20: 7406
N21-N26: 74 LS 14
N27-N32: 74 LS 04
≙ +5V.
ELECTUUR BUS
+5V: 1a,c
+12V: 17c
GND: 4a,c;
16a,c;
32a,c.
J.B.