OEM MANUAL FOR THE JET-80 SINGLE BOARD COMPUTER.

1984-06-26.

WELCOME TO THE JET COMPUTER FAMILY

First of all:

Congratulations to Your purchase of the JET-80 SBC

Your new single board computer has been constructed and manufactured by

Jet Computer Corporation AB
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S-182 12 Danderyd
Sweden

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Telex: 11019

We in the Jet Computer Corporation, are very glad for your choice of computer and hope that You will enjoy it as much as we do. If You should encounter difficulties with the use or operation of Your computer, do not hesitate to contact us.

As with all JET products, we would appreciate any comments You may have regarding Your evaluation and application for this equipment. For Your convenience, we have enclosed a customer comment card at the end of this manual. Please send Your comment to us.

Along with the JET-80 single board computer You have received one original CP/M Plus license diskette and one Licensing Agreement Card from Digital Reaserch Inc. Please send this card back to us.

Good luck and best regards

Jet Computer Corporation AB, Danderyd, Sweden.

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Part 1: JET 80 SINGLE BOARD COMPUTER - SBC 80 Rev C0.

Contents:

(Network Serial Interface is described in the Jet Net manual.)

Short specification.

CPU Processor	: Z80A with 4 MHz clock and no wait states.
DMA	: Full DMA control of all I/O data transfer.
Memory	: 128 KBytes dynamic RAM with hidden refresh Provides with the DMA a full banked system.
Real time clock	: Supported by the operating system and CTC.
E-PROM	: Up to 64 KByte. Built in monitor 4 KBytes.
I/O Serial ports	: Supported by 2 SIOs and the CTC. Two full RS-232-C ports with software selectable baudrates. One RS-422 serial port for high speed local area network.
Parallel ports	: Intelligent winchesterinterface for SASI bus adaptable controllers. Full Centronics parallelinterface. ECB-bus interface. Interface for both 5.25" and 8" floppydrives.
Operating system	: CP/M Plus with bank switch.

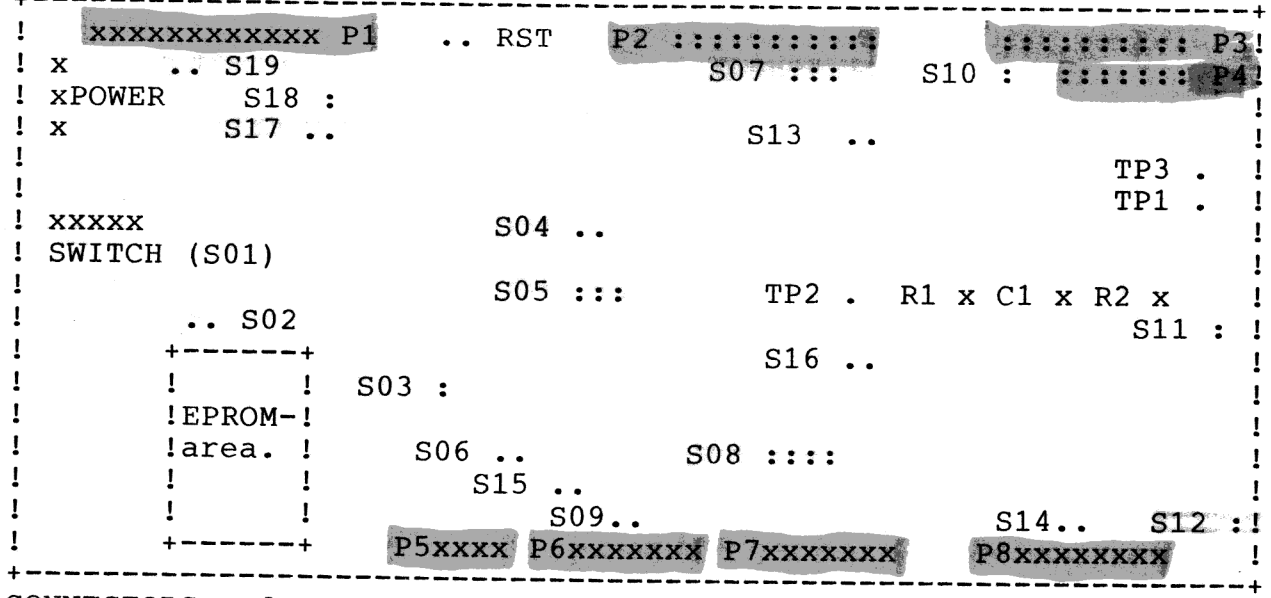
Physical considerations of the board.

The JET-80 single board computer (SBC) is packaged on a high quality double sided printed circuit board with silk screened component and connector identifiers and solder mask on both sides. The size of the board is 188 mm times 368 mm.
Centronics and serial ports have standard connectors on board.

Electrical considerations.

The JET-80 SBC requires +5 Volts with a power consumption of only 1.75 Amperes and +/- 12 Volts with a supply of 100 mA each.

The JET Computer Card. Revision C0. (picture 1):



CONNECTORS and JUMPERS:
(all jumpers have default strapping on solder side of the card)

RST: Reset

POWER:

1	+5 Volts	4	GND
2	+5 Volts	5	+12 Volts
3	GND	6	-12 Volts

SWITCH: 8 bits readable port. (S01)

EPROM-area: 4 EPROM-sockets 16, 32, 64 or 128 kBits.

P1	ECB-bus
P2	SASI-interface (PIN1 to the right)
P3	8"-FLOPPY (PIN1 to the left)
P4	5"-FLOPPY (PIN1 to the left)
P5	NETWORK SERIAL. RS422
P6	MODEM/PRINTER SERIAL. RS232C
P7	TERMINAL SERIAL. RS232C
P8	CENTRONICS PARALLEL PRINTER.
S02 S03	Jumpers for EPROM (1x3 pins).
S04	Jumper for EPROM (1x2 pins).
S05	Jumper for EPROM (2x6 pins).
S06 S15 S16	Jumpers for NETWORK OPTIONS (1x3 pins).
S07	Jumper for SASI-bus (2x8 pins).
S08	Jumper for RS-232-C-Modem/Printer (2x4 pins).
S09	Jumper for the RS-422-interface (1x3 pins).
S10	Jumper for 8"-floppy (1x3 pins).
S11	Trimpins for the floppycontroller (1x2 pins).
S13	Jumper for floppy-ready-signal (1x2 pins).
S12	Jumper for CENTRONICS (1x3 pins).
S14	Jumper for CENTRONICS (1x2 pins).
S17 S19	Jumpers for ECB BUS (1x3 pins).
S18	NMI connection (1x2 pins).
TP1 TP2 TP3	Testpins for the floppycontroller.
C1	Trimcapacitor for the floppycontroller.
R1 R2	Trimresistors for the floppycontroller.

The ECB-bus connector P1.

Connector for the Euro Card Bus is a Euro female connector DIN 41612-C-96/64.

1A:	+5 Volts	1C:	+5 Volts
2A:	Data 5	2C:	Data 0
3A:	Data 6	3C:	Data 7
4A:	Data 3	4C:	Data 2
5A:	Data 4	5C:	Address 0
6A:	Address 2	6C:	Address 3
7A:	Address 4	7C:	Address 1
8A:	Address 5	8C:	Address 8
9A:	Address 6	9C:	Address 7
10A:	*WAIT Wait	10C:	
11A:	*BUSRQ Busrequest	11C:	IEI Interrupt Enable In
12A:	BAI Buspriority ctrl in	12C:	
13A:	+12 Volts	13C:	+12 Volts
14A:		14C:	Data 1
15A:	Spare (-5 Volts)	15C:	-12 Volts
16A:		16C:	IEO Interrupt Enable Out
17A:	*BAO Buspriority ctrl out	17C:	Address 11
18A:	Address 14	18C:	Address 10
19A:	Spare (+15 Volts)	19C:	
20A:	*M1 Machine cycle	20C:	*NMI Non Maskable Interrupt
21A:	*RQI1 Request In 1	21C:	*INT Interrupt
22A:		22C:	*WR Write
23A:		23C:	*RQI2 Request In 2
24A:	Spare (+5 Volts)	24C:	*RD Read
25A:		25C:	*HLT Halt
26A:		26C:	*PWRCL Power On Clear
27A:	*IORQ IN/OUT Request	27C:	Address 12
28A:	*RFSH Refresh	28C:	Address 15
29A:	Address 13	29C:	FI Clock
30A:	Address 9	30C:	*MRQ Memory Request
31A:	*BUSAK Busacknowledge	31C:	*RESET Reset
32A:	GND Ground	32C:	GND Ground

Strap S17:

2 - 3: BAO active (17A) (default)
1 - 2: BAI active (12A)

Strap S19:

2 - 3: IEI active (11C) (default)
1 - 2: IEO active (16C)
(1 must be connected to 16C)

The SASI Winchester Interface. P2

The intelligent SASI Winchester Interface is connected to 4 logical ports on the card:

```
WNSEL   EQU     15H             ; WINCHESTER SELECT
WNWDAT  EQU     19H             ; WINCHESTER WRITE DATA
WNRDAT  EQU     1DH             ; WINCHESTER READ DATA
WNSTAT  EQU     1EH             ; WINCHESTER STATUS
                                ; BIT0 - I/O
                                ; BIT1 - C/D
                                ; BIT2 - *MSG
                                ; BIT3 - *BUSY
                                ; BIT4 - *REQ
```

For high speed data transfer to and from the SASI interface with the DMA You must use the BANK-DMA-MULTIPLEXER port:

```
BNKMUX  EQU     1BH             ; BANK-DMA-MULTIPLEXER
                                ; BIT0-2: DEVICES
DMWIN   EQU     00000011B       ; DMA-WINCHESTER
                                ; BIT3-4: MEMORY
DMBK11  EQU     00000000B       ; BANK1 --> BANK1
DMBK00  EQU     00001000B       ; BANK0 --> BANK0
```

DMWIN+DMBK00 to BNKMUX: SASI <--> BANK0 transfer
DMWIN+DMBK11 to BNKMUX: SASI <--> BANK1 transfer

The SASI Interface is a 50 pin connector, where all odd pins are ground:

```
 2: *Data0              36: *Busy
 4: *Data1              38: *Acknowledge
 6: *Data2              40: *Winchester Reset
 8: *Data3              42: *Message
10: *Data4              44: *Select
12: *Data5              46: Command/Data
14: *Data6              48: *Request
16: *Data7              50: Input/Output
```

18,...,34 Not connected.

The 8 data signals have no terminationresistors as default, but S07, located closed to P2, will give this option.

S07:

```
        16      9
         ::::::::
         1       8
```

```
Strap 1 - 16 : Data 7  terminated
  "   2 - 15 :   "  6      "
  "   3 - 14 :   "  5      "
  "   4 - 13 :   "  4      "
  "   5 - 12 :   "  3      "
  "   6 - 11 :   "  2      "
  "   7 - 10 :   "  1      "
  "   8 -  9 :   "  0      "
```


8"- and 5.25"-Floppy Interfaces. P3 and P4.

The floppy controller, Western Digital WD2797, handles all transfers through the two floppy interfaces. Each interface can address four disk units of each type - single/double sided and single/double density (selected via FLOPPY-EXTERNAL-SELECT). High speed data transfer with DMA is possible (selected via BNKMUX port).

```
FDXSEL  EQU     1AH             ; FLOPPY-EXTERNAL-SELECT
                                ; BIT0-1: UNIT SELECT
                                ; xxxxxx00 ...
                                ; xxxxxx11.
                                ; BIT2: 5"/8" SELECT
                                ; xxxxx0xx 5"
                                ; xxxxx1xx 8"
                                ; BIT3: 5"-MOTOR ON/OFF
                                ; xxxx1xxx ON
                                ; xxxx0xxx OFF
                                ; BIT4: 8"-MOTOR ON/OFF
                                ; xxx0xxxx ON
                                ; xxx1xxxx OFF
                                ; BIT5: DENSITY
                                ; xx0xxxxx DOUBLE
                                ; xx1xxxxx SINGLE
                                ; BIT6: 5"/8" VCO
                                ; x0xxxxxx 5"
                                ; x1xxxxxx 8"
                                ; BIT7: FREQUENCE
                                ; 0xxxxxxx 1 MHz
                                ; 1xxxxxxx 2 MHz

BNKMUX  EQU     1BH             ; BANK-DMA-MULTIPLEXER
                                ; BIT0-2: DEVICES
DMFDC   EQU     00000000B       ; DMA-FDC
                                ; BIT3-4: MEMORY
DMBK11  EQU     00000000B       ; BANK1 --> BANK1
DMBK00  EQU     00001000B       ; BANK0 --> BANK0

BNKMUX+DMBK00 to BNKMUX: FDC <--> BANK0 transfer
BNKMUX+DMBK11 to BNKMUX: FDC <--> BANK1 transfer

Floppy status is handled by the FLOPPY STATUS port.

FLSTAT  EQU     1EH             ; FLOPPY STATUS
                                ; BIT5 - SIDE1/0.
                                ; BIT6 - FLOPPY INT.REQ.
                                ; BIT7 - FLOPPY READY
```

If Your floppy have ready signal, strap jumper S13. Otherwise remove the jumper.

Adjusting the controller must take place in monitor mode. Here is a short summary of adjustment procedures of the controller and what to do on the JET card. If You want to have more information, consult the Western Digital manual.

Write precompensation:
1) Set *TEST (Pin22) to logical high - Remove strap S11.
2) Strobe *MR (Pin 19) - System reset.
3) Set *TEST (Pin22) to logical low - Strap S11.
4) Observe pulse width on WD (pin31) - TP3.
5) Adjust WPW (pin33) for desired pulse width (Precomp Value) - R1.
6) Set *TEST (pin22) to logical high - Remove strap S11.

Data separator:
1) Set *TEST (pin22) to a logical high - Remove strap S11.
2) Strobe *MR (pin19). Insure that 5/8, and *DDEN are set properly - In monitor Out D8H to port FDXSEL: O1A,D8
3) Set *TEST (pin22) to a logical low - Strap S11.
4) Observe Pulse Width on TG43 (pin29) - TP2.
5) Adjust RPW (pin18) for 1/8 of the read clock (250 ns for 8" DD, 500 ns 5.25" DD, etc.) - R2.
6) Observe Frequency on DIRC (pin19) - TP1.
7) Adjust variable capacitor on VCO (pin26), C1, for Data Rate (500 kHz for 8" DD, 250 kHz for 5.25" DD, etc.)
8) Set *TEST (pin22) to a logical high - Remove strap S11.

8"-Floppy Interface - 50 pin connector, where all odd pins are ground:

2: *LOWCUR	30: *SEL2
4: *MOTORON/OFF	32: *SEL3
10: SIDE2	34: *DIR
14: *SIDESELECT	36: *STEP
18: *HEADLOAD	38: *WRITEDATA
20: *INDEX	40: *WRITEENABLE
22: *READY	42: *TRACK0
26: *SEL0	44: *WRITEPROTECT
28: *SEL1	46: *READDATA

6, 8, 12, 16, 48 and 50 not connected.

5.25"-Floppy Interface - 34 pin connector, where all odd pins are ground:

2: *HEADLOAD	20: *STEP
6: *SEL3	22: *WRITEDATA
8: *INDEX	24: *WRITEENABLE
10: *SEL0	26: *TRACK0
12: *SEL1	28: *WRITEPROTECTION
14: *SEL2	30: *READDATA
16: *MOTORON	32: *SIDESELECT
18: *DIR	34: *READY
20: *STEP	

4 is not connected.

CENTRONICS PARALLEL PRINTER INTERFACE, P8.

The interface is handled by the PIO:

```
PIOAD   EQU     0CH             ; PIO A DATA - CENTRONICS DATA
PIOBD   EQU     PIOAD+2         ; PIO B DATA - CENTRONICS CTRL
                                ; BIT0 CEN. *BUSY
                                ; BIT1 CEN. *PAPER EMPTY
                                ; BIT2 CEN. *SELECT
                                ; BIT3 CEN. *FAULT
                                ; BIT4 CEN. *STROBE
                                ; BIT5 CEN. *ACK
                                ; BIT6 Must be '1'
                                ; BIT7 Must be '1'
```

Jumper S12 allows You to use the PIO strobe A or mask the strobe through PIO port B bit 5.

```
S12:    1 .
        2 .
        3 .
```

2-3: PIO strobe A.
1-2: strobe through PIO port B bit 4. (default)

Jumper S14 should be installed to connect CENTRONIC PIN14 to ground.

```
S14:    1  2
        .  .
```

The parallel printer interface follows the Centronics standard on a microribbon 36 pin connector:

```
 1: *STROBE              8: Data6
 2: Data0                9: Data7
 3: Data1               10: *Acknowledge
 4: Data2               11: *Busy
 5: Data3               12: *Paper empty
 6: Data4               13: *Select
 7: Data5               32: *Fault
```

16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 and 33 are ground.
14, 15, 17, 18, 31, 34, 35 and 36 are not connected.

Note: Port PIOBD bit 6 and 7 can be used to control the direction of the PIO buffers.
Bit 6 = '1' PIOA output else input.
Bit 7 = '1' PIOB (Bits 0-5) active as CENTRONICS control else reversed signal direction.

TERMINAL SERIAL PORT, RS-232-C, P7.

The interface is handled by the SIO1 device port B (data) and the CTC device (baudrate).

```
SIO1BD  EQU     2               ; RS232C,TERMINAL - DATA
SIO1BC  EQU     3               ; RS232C,TERMINAL - CONTROL/STATUS

                                ; CONNECTED TO 1,228,800 Hz
CTC1    EQU     9               ; - BAUDRATE SIO1B/TIMER
```

The terminal connector is a 25 pin D-don connector:

```
 2: Tx data
 3: Rx data
 4: RTS
 5: CTS
 7: GND signal ground.
```

MODEM/PRINTER SERIAL PORT, RS-232-C, P6.

The interface is handled by the SIO1 device port A (data), the CTC device (baudrate), the PIO device (modem) and optional jumper S08 (clock).

```
SIO1AD  EQU     0               ; MODEM/PRINTER - DATA
SIO1AC  EQU     SIO1AD+1        ; MODEM/PRINTER - CONTROL/STATUS
                                ; CONNECTED TO 1,228,800 Hz
CTC0    EQU     8               ; - BAUDRATE SIO1A/TIMER
```

The modem/printer connector is a 25 pin D-don connector:

```
 2: Tx data
 3: Rx data
 4: RTS
 5: CTS
 6: *DSR
 7: GND signal ground
 8: DCD
15: External Transmit Clock
17: External Recieve Clock
20: DTR
22: Ring Indicator
24: Baud Clock
```

The recieve/transmit clock can be strapped in different ways via S08:

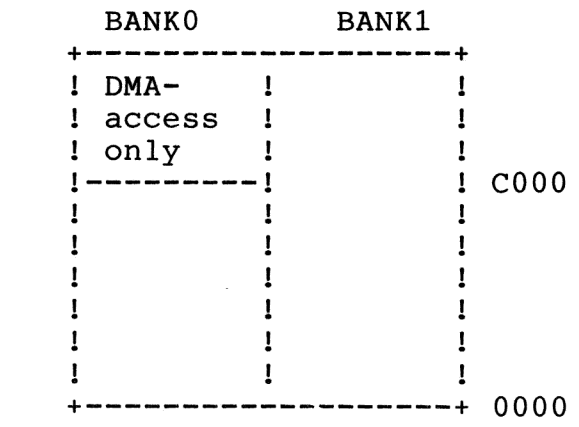
```
        4  1
        ::::
        5  8

 1-8: Internal Receive Clock       (default)
 2-7: External Receive Clock
 3-6: Internal Transmit Clock      (default)
 4-5: External Transmit Clock
```


BANK SELECT

The JET-80 SBC has two 64 kBytes RAM banks, which are addressable from the CPU and the DMA. The CPU can only address 48 kBytes in bank 0 and 64 kBytes in bank 1, but the DMA can address all 128 kBytes. To handle the select there is a write port, BANK-DMA-MULTIPLEXER, on the card called BNKMUX.

(picture 2: RAM banks):




```
BNKMUX  EQU     1BH             ; BANK-DMA-MULTIPLEXER
                                ; BIT0-2: DEVICES
DMFDC   EQU     00000000B       ; DMA-FDC
DMSI2A  EQU     00000001B       ; DMA-SIO2A
DMSI2B  EQU     00000010B       ; DMA-SIO2B
DMWIN   EQU     00000011B       ; DMA-WINCHESTER
DMSI1A  EQU     00000100B       ; DMA-SIO1A
DMSI1B  EQU     00000101B       ; DMA-SIO1B
DMEXT1  EQU     00000110B       ; DMA-EXTERN 1
DMEXT2  EQU     00000111B       ; DMA-EXTERN 2
                                ; BIT3-4: MEMORY
DMBK11  EQU     00000000B       ; BANK1 --> BANK1
DMBK00  EQU     00001000B       ; BANK0 --> BANK0
DMBK10  EQU     00010000B       ; BANK1 --> BANK0
DMBK01  EQU     00011000B       ; BANK0 --> BANK1
                                ; BIT5: CPU-BANK-SELECT
BANK1   EQU     00000000B       ; BANK1 (64K FOR CPU)
BANK0   EQU     00100000B       ; BANK0 (48K FOR CPU)
                                ; BIT6-7: NC
```

If CPU bank 0 is selected, and the address is between C000H and FFFFH, the CPU will read or write data in bank 1. This is a secure way of staying alive during a bankswitch session.

SOFTWARE READABLE 8 BIT SWITCH.

To make the JET-80 SBC as flexible as possible, one 8 Bit readable switch has been installed. The boot prom from Jet Computer Corporation takes great advantage from it. The switch has port address 1CH and does not support any other hardware on the card.

The 8 pins on the switch are used in three groups in the monitor program version 3.0:

Pin 1-3: Type of floppy to read.
Pin 4-6: Console type, baudrate and handshake.
Pin 7-8: How to boot the system.

1	2	3	4	5	6	7	8	Function
ON	ON	ON	x	x	x	x	x	5"-floppy 1x40x5x1024, 64 ent.
OFF	ON	ON	x	x	x	x	x	5"-floppy 2x40x5x1024, 128 ent.
ON	OFF	ON	x	x	x	x	x	5"-floppy 2x80x5x1024, 128 ent.
OFF	OFF	ON	x	x	x	x	x	5"-floppy 2x77x8x1024, 256 ent.
x	x	OFF	x	x	x	x	x	8"-floppy 2x77x8x1024, 256 ent.
x	x	x	ON	x	ON	x	x	Console baudrate 9600.
x	x	x	OFF	x	ON	x	x	Console baudrate 19200.
x	x	x	x	ON	ON	x	x	No console handshake.
x	x	x	x	OFF	ON	x	x	Console handshake.
x	x	x	x	x	OFF	x	x	Graphic terminal.
x	x	x	x	x	x	ON	ON	Boot in monitor
x	x	x	x	x	x	OFF	ON	Boot CP/M from floppy 1,2,3 are important.
x	x	x	x	x	x	ON	OFF	Boot CP/M from winchester.
x	x	x	x	x	x	OFF	OFF	Boot from network.

For more information, read the Monitor program manual.

EPROM-area.

The JET-80 SBC is prepared for 4 28 pin sockets for EPROM. On reset the CPU is able to read the EPROM area and write in RAM bank 1.
The EPROM bank is disabled by a read or a write to port 14H (PROM). The sockets can hold 16 kBits, 32 kBits, 64 kBits and 128 kBits EPROM. To have the correct pinconfiguration in the sockets and the correct address, You must strap S02,S03,S04 and S05. The EPROM chips are to be mounted with the GND in socket hole 14.
(picture 3: the JET-80 card)

	16 kBits	32 kBits	64 kBits	128 kBits
EPROM4	1FFFH	3FFFH	7FFFH	FFFFH
EPROM3	1800H	3000H	6000H	C000H
EPROM2	1000H	2000H	4000H	8000H
EPROM1	0800H	1000H	2000H	4000H
	0000H	0000H	0000H	0000H

S04: 12
..

1-2: One Wait State Rom (default)
cut: No Wait State Rom

	S05: 12 7	S02: ...	S03: 3.	
	::::::	321	2.	
	1 6		1.	
16 kBits:	1-11 2-10 3- 9 4- 8 5- 7	2-3	2-3	
32 kBits:	1-12 2-11 3-10 4- 9 5- 8 6- 7	2-3	1-2	(default)
64 kBits:	3-11 4-10 5- 9 6-7-8	1-2	1-2	
128 kBits:	4-11 5-10 6-7-8-9	1-2	1-2	

Part 2: JET-80 SBC MONITORPROGRAM Version 2.2

As a standard the card is shipped with a 4K monitor program in a 2732 EPROM. On reset the monitor program is lifted up from the EPROM-area start address 0000H to the RAM-area in BANK0 with start address D000H (look at picture 2 in part 1). After that the monitor switches off the EPROM-area and BANK0 and BANK1 are only available to the CPU. At this point it is very important how the pins on the SWITCH are installed. If both pin 7 and 8 are ON You will boot in the monitor, where You'll have some useful commands.

Note: the serial terminal port is initialized with 8 databits, 1 stopbit and no parity. Handshake and baudrate depend on the SWITCH.
Pin 6 is important for the terminal type.

COMMANDS:

B — Boot CP/M from floppy. Booting from diskette drive selected by the SWITCH. (The floppy must be physical select UNIT0).

D(f),(t) — Display memory. Shows the memory contents in active bank.
No argument: start at latest D-address.
Argument f only: start at address f.
Argument t only: start at address 0000 and stop at t.
Two arguments: start at address f and stop at t.
You can stop display by pressing any key and terminate by pressing <ENTER>.

Ff,t,w — Fill memory with w from address f to address t in active bank.

Gt — Goto address t. Start execute at address t. If the last instruction in the routine is C9H (RET), the monitor will take over after terminated execution.

H — Help. Shows the help menue.

Ip — read Inport p and shows it in binary notation.

Mf,t,ft(,x) — Move x bytes from address f in bank ft(MS BYTE) to address t in bank ft(LS BYTE).
Ex: MD000,8000,0001
Moves 128 bytes from address D000H in BANK00 to address 8000H in BANK01.
Ex: MC000,0000,0100,4000
Moves 4000H bytes from address C000H in BANK01 to address 0000H in BANK00.

N — boot Network.
The terminal ID is identified by strapping the SASI-data bus.

Op,x — byte x to Outport p. Sends one byte to a port.

Rs,t	Read sector s at track t. Note: You can only read UNIT0 selected by SWITCH.
S(t)	Set memory cell in active bank. One argument: Start at address t. No argument: Start at latest D-address. Only HEX-characters are permitted. <ENTER> in the first nibble: step one byte forward no memory change. - in the first nibble: step one byte back no memory change. Terminates at first non-hex-character.
Tf,t	Test memory from address f to address t in active bank. Be careful in BANK1 address D000-DFFF, where the monitor is located and FF00-FFFF, where the interrupt vectors are located.
X	eXchange banks. Alters the active bank.
W	boot CP/M from Winchester.

Part 3: CP/M Plus implementation on the JET-80 SCB.

INTRODUCTION

CP/M Plus is logically divided into several distinct parts:

- BIOS Basic I/O System (hardware dependent)
- BDOS Basic Disk Operating System
- CCP Console Command Processor
- TPA Transient Program Area

The BIOS provides the primitive operations necessary to access the disk drives and to interface standard peripherals (printer, modem, etc). The BDOS provides disk management by controlling one or more disk drives containing independent file directories. The BDOS implements disk allocation strategies which provide fully dynamic file contraction while minimizing head movement across the disk during access. Any particular file may contain any number of records, not exceeding the size of any single disk. The maximum capacity is filesize - 32 MBytes and disksize - 512 MBytes. The BDOS can handle up to 16 different disk drives (identified as A: through P:).
The CCP provides symbolic interface between the user's console and the remainder of the CP/M system. The CCP reads the console device and processes commands which include listing the file directory, printing the contents of files and controlling the operation of transient programs, such as Basic, word processing etc. The commands available in CP/M Plus are described in the HELP utility on the diskette.
The last segment of CP/M Plus is the area called the Transient Program Area - TPA. The TPA holds programs which are loaded from the disk under command of the CCP.

Booting the system takes place in four steps:
1) on reset the monitor program is loaded from EPROM area to bank 1 in RAM, where it executes.
2) the monitor loads the CP/M LOADER routine from the reserved tracks of the disk into RAM bank 0 with start address 100H.
3) the CP/M LOADER loads the CP/M Plus Disk Operating System into bank 0 and bank 1, where the operating system takes over the command in the cold boot routine.
4) the cold boot routine loads the Console Command Processor CCP into bank 0 and stores it starting at address 0000H. Then the warm boot routine copies it over to bank 1, start address 100H for execution. The command is turned over to the CCP.

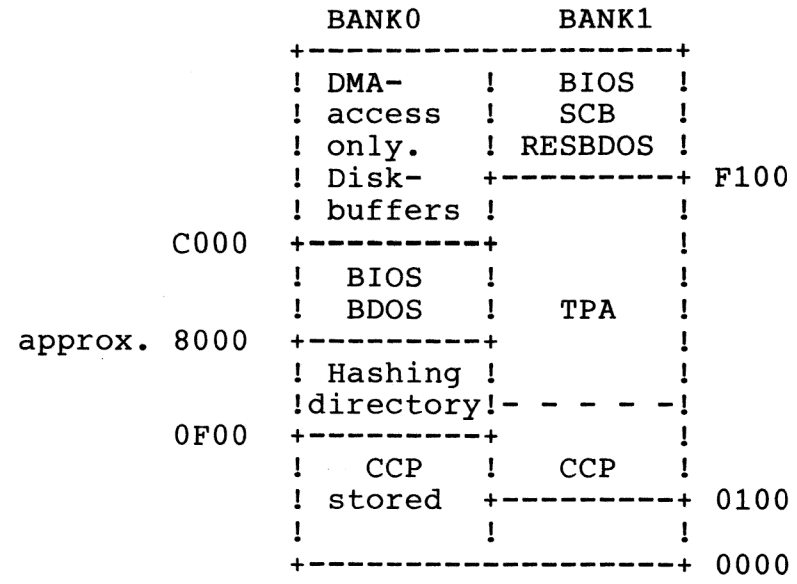
Upon initial start up, the CP/M Plus system is brought from disk A, and signs on for example:

```
CP/M Plus Version 3.0 - JET-80. 5"-floppy 2x800 kBytes.
BIOS Rev D. Copyright (C) 1984, Jet Computer Corporation AB.

A>
```

The prompt A> means that disk drive A is default and the CCP is active waiting for a command from the console.

After booting we have this memory image:

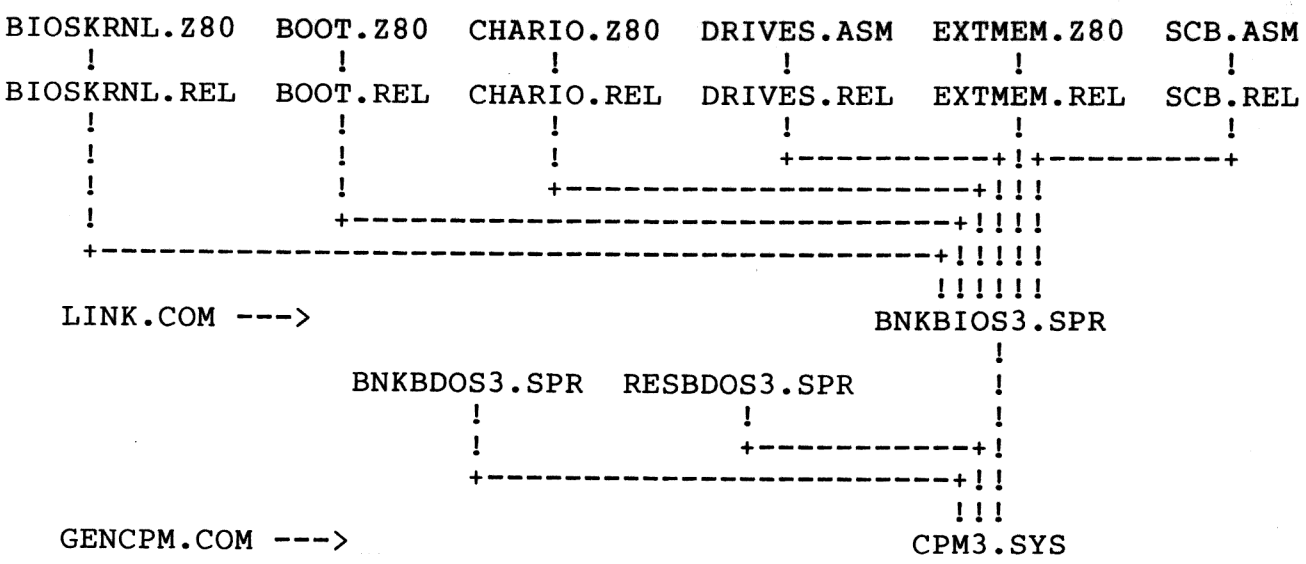


The hashing directory size in bank 0 differs with different numbers of directory entries in disk configurations.

CP/M Plus Disk Operating System supports two processors: Intel 8080 and Zilog Z80. Because the JET-80 has a Z80A processor on board most BIOS source is written i Z80 assembly language. The BIOS consists of six separate modules:

- BIOSKRNL.Z80
- BOOT.Z80
- CHARIO.Z80
- FDRIVES.ASM/WDRIVES.ASM
- EXTMEM.Z80
- SCB.ASM

All these modules are assembled and linked together in a file BNKBIOS3.SPR. The new SPR-file is linked together with RESBDOS3.SPR and BNKBDOS.SPR to CPM3.SPR by the utility GENCPM.COM.



Today the system has 8 basic configurations - 5 for floppy only and 3 for mixed floppy and winchester.
If You want to use other configurations, the two source files FDRIVES.ASM and WDRIVES.ASM are available on the license diskette.

Philosophy: all configurations must be able to read 8" single sided,single density (IBM-format) on logical unit D: Communication between the systems will be possible through logical unit C:

FLOPPY:

M8	A:	8" format 2x77x8x1024, 256 entries.	UNIT0	
	B:	8" format 2x77x8x1024, 256 entries.	UNIT1	
	C:	5" format 2x80x5x1024, 128 entries.	UNIT0	*
	D:	8" format 1x77x26x128, 64 entries.	UNIT1	
M5	A:	5" format 2x77x8x1024, 256 entries.	UNIT0	
	B:	5" format 2x77x8x1024, 256 entries.	UNIT1	
	C:	8" format 2x77x8x1024, 256 entries.	UNIT0	*
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*
M596D	A:	5" format 2x80x5x1024, 128 entries.	UNIT0	
	B:	5" format 2x80x5x1024, 128 entries.	UNIT1	
	C:	8" format 2x77x8x1024, 256 entries.	UNIT0	*
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*
M548D	A:	5" format 2x40x5x1024, 128 entries.	UNIT0	
	B:	5" format 2x40x5x1024, 128 entries.	UNIT1	
	C:	8" format 2x77x8x1024, 256 entries.	UNIT0	*
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*
M548S	A:	5" format 1x40x5x1024, 64 entries.	UNIT0	
	B:	5" format 1x40x5x1024, 64 entries.	UNIT1	
	C:	8" format 2x77x8x1024, 256 entries.	UNIT0	*
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*

(Format 2x80x5x1024 means: 2 sides, 80 tracks/side, 5 physical sectors/track and 1024 bytes/physical sector.)

* means that you will need one extra drive to be able to read and write on this format, because you normally work with two drives on logical units A: and B:

PIN 1, 2, 3, 7 and 8 on SWITCH are very important for the booting procedure in the monitor ver 3.0:

	1	2	3	7	8	
M8	x	x	OFF	OFF	ON	autostart in CP/M
M8	x	x	OFF	ON	ON	monitorstart
M5	OFF	OFF	ON	OFF	ON	autostart in CP/M
M5	OFF	OFF	ON	ON	ON	monitorstart
M596D	ON	OFF	ON	OFF	ON	autostart in CP/M
M596D	ON	OFF	ON	ON	ON	monitorstart
M548D	OFF	ON	ON	OFF	ON	autostart in CP/M
M548D	OFF	ON	ON	ON	ON	monitorstart
M548S	ON	ON	ON	OFF	ON	autostart in CP/M
M548S	ON	ON	ON	ON	ON	monitorstart

On monitorboot CP/M is loaded with the B command.

WINCHESTER

You must use the Xebec S1410 of firmware revision E or later or compatible controller to the winchester. The controller must be strapped: address jumper 0.
sector size 512.
The winchester must be connected as D0.

WIN8	A:	Winchester first half.		
	B:	Winchester second half.		
	C:	8" format 2x77x8x1024, 256 entries.	UNIT0	
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	
alt.	A:	8" format 2x77x8x1024, 256 entries.	UNIT0	
	B:	Winchester first half.		
	C:	Winchester second half.		
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	
WIN85	A:	Winchester first half.		
	B:	Winchester second half.		
	C:	5" format 2x77x8x1024, 256 entries.	UNIT0	
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*
alt.	A:	8" format 2x77x8x1024, 256 entries.	UNIT0	
	B:	Winchester first half.		
	C:	Winchester second half.		
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*
WIN5	A:	Winchester first half.		
	B:	Winchester second half.		
	C:	5" format 2x80x5x1024, 128 entries.	UNIT0	
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*
alt.	A:	5" format 2x80x5x1024, 128 entries.	UNIT0	
	B:	Winchester first half.		
	C:	Winchester second half.		
	D:	8" format 1x77x26x128, 64 entries.	UNIT0	*

The winchester formats are not described, because today You can combine up to 16 different drives from 5 MBytes to 40 Mbytes with the three WIN8, WIN85 and WIN5 formats.

Booting winchester can take place in many different ways and depending on how you do it, the system will boot as a normal configuration or an alternate configuration.
PIN 1, 2, 3, 7 and 8 on SWITCH are important.

	1	2	3	7	8	
WIN8	x	x	x	ON	OFF	autostart in CP/M
WIN8	x	x	x	ON	ON	monitorstart command W
WIN8 alt.	x	x	OFF	OFF	ON	autostart in CP/M
WIN8 alt.	x	x	OFF	ON	ON	monitorstart command B
WIN85	x	x	x	ON	OFF	autostart in CP/M
WIN85	x	x	x	ON	ON	monitorstart command W
WIN85 alt.	OFF	OFF	ON	OFF	ON	autostart in CP/M
WIN85 alt.	OFF	OFF	ON	ON	ON	monitorstart command B
WIN5	x	x	x	ON	OFF	autostart in CP/M
WIN5	x	x	x	ON	ON	monitorstart command W
WIN5 alt.	ON	OFF	ON	OFF	ON	autostart in CP/M
WIN5 alt.	ON	OFF	ON	ON	OFF	monitorstart command B

Alternate configuration must be used, when You start the system the very first time and are going to format it.

HOW TO CREATE A SPECIAL DISKETTE/WINCHESTER-CONFIGURATION

1/ Disketteconfiguration.
There is a file FDRIVES.ASM on the license diskette. In this file You can find the five diskette formats.
Use Your editor and set the following parameters:

```
VERIFY    EQU    TRUE/FALSE   TRUE=verify after write.
```

One of the following parameters must be TRUE the other three must be FALSE:

```
M8
M5
M596D
M548D
M548S
```

After that use Your assembler. RMAC will be good.
If no errors give the command SUBMIT GENFBIOS
after that the command GENCPM AUTO DISPLAY.

Be careful that the floppy You place CPM3.SYS (the OS) on has the same format as logical unit A: in the new OS.

2/ Diskette/Winchesterconfiguration.
There is a file WDRIVES.ASM on the license diskette. In this file You can find the two floppy formats and one winchester format.
Set the floppy parameters TRUE or FALSE.
Set four winchester parameters:

```
Winchesterchoice:   one TRUE the others FALSE.
To the controller:  LEAV    (sector interleaving. Should be 7)
                    RESTEP  (retrys and buffered step option.
                             Consult Your Xebec-manual)
To the OS:          ENT     (number of entries 512 or 1024)
                    REDUCE  (reduce factor)
```

After that use Your assembler.
give the command SUBMIT GENWBIOS
and the command GENCPM
Answer all questions with <ENTER> except the four last ones, because now You must consider that You are configuring an alternate configuration. That means that A: and D: are floppies and their directory spaces should be as small as possible. Set A: to #4 and D: to #0 shared with A:. B: and C: must be as big as possible.

UTILITY PROGRAMS

COPYSYS

Syntax: COPYSYS
        COPYSYS FILE
Explanation:
COPYSYS copies the system loader from the reserved tracks or from a file on one disk to the reserved tracks on another disk.

ERRORS

Syntax: ERRORS
Explanation:
This utility shows how many disk errors that have occured since cold boot.

FASTCOPY

Syntax: FASTCOPY
Explanation:
This utility makes a complete copy of a diskett. During the execution the utility program formats, copies and verifies. The destination drive must have the same capacity as the source drive.

FORMATER

Syntax: FORMATER
Explanation:
You use this program to format diskettes and winchester drives.
The first question to answer in the program is:
Enter drive to format?
Answer with the desired logical unit followed by a colon.
For example: C:
Just <ENTER> will terminate.
The program displays all the characteristics for the drive and prompts another message:
Confirm formatting of this diskette with YES ! (if floppy)
Confirm formatting of this winchester with YES ! (if winchester)
Answer YES and the formatting procedure will start. Any other answer will return to the first question.
When You format a winchester drive, You must select it with the first logical unit (but the whole drive will be formatted).
Because this utility displays the characteristics of the different drives in the system, it can be very useful, if You're only interested in these details.

PRIMO

Syntax: PRIMO
        PRIMO I
Explanation:
PRIMO initializes the PRINTER/MODEM port with optional baudrate, parity, handshaking, and number of databits and stopbits.
Note: use PRIMO after DEVICE.

Part 4: SOURCE FILE IOS.Z80

```
;*********************************************************
;*      THIS MODULE DOES ONLY CONTAIN THE ADDRESSES      *
;*      TO THE PHYSICAL PORTS ON THE JET CARD.           *
;*********************************************************

; LATEST CHANGE: 1984-06-21. PSW.

SIO1AD  EQU     0               ; RS232C-MODEM/PRINTER - DATA
SIO1AC  EQU     SIO1AD+1        ; RS232C-MODEM/PRINTER - CONTROL/STATUS
SIO1BD  EQU     SIO1AD+2        ; RS232C-TERMINAL - DATA
SIO1BC  EQU     SIO1AD+3        ; RS232C-TERMINAL - CONTROL/STATUS

SIO2AD  EQU     4               ; RS422-NETWORK - DATA
SIO2AC  EQU     SIO2AD+1        ; RS422/NETWORK - CONTROL/STATUS
SIO2BD  EQU     SIO2AD+2        ;
SIO2BC  EQU     SIO2AD+3        ;

                                ; SUPPORTED WITH 1,228,800 Hz
CTC0    EQU     8               ; CTC CHANNEL 0 - BAUDRATE SIO1A/TIMER
CTC1    EQU     CTC0+1          ; CTC CHANNEL 1 - BAUDRATE SIO1B/TIMER
CTC2    EQU     CTC0+2          ; CTC CHANNEL 2 - TIMER TO CTC3
                                ; DIVIDED BY TO 2 TO CHANNEL 3.
CTC3    EQU     CTC0+3          ; CTC CHANNEL 3 - REALTIMECLOCK/COUNTER
                                ; GENERATES 10 Hz.

PIOAD   EQU     0CH             ; PIO A DATA - CENTRONICS DATA
PIOAC   EQU     PIOAD+1         ; PIO A CONTROL (WRITE ONLY)
PIOBD   EQU     PIOAD+2         ; PIO B DATA - CENTRONICS CTRL
                                ;              + MODEM CTRL
                                ; BIT0 CEN. *BUSY
                                ; BIT1 CEN. *PAPER EMPTY
                                ; BIT2 CEN. *SELECT
                                ; BIT3 CEN. *FAULT
                                ; BIT4 CEN. *STROBE
                                ; BIT5 CEN. *ACK.
                                ; BIT6 PIO BUFFER DIRECTION CH. B
                                ; BIT7 PIO BUFFER DIRECTION CH. A
PIOBC   EQU     PIOAD+3         ; PIO B CONTROL (WRITE ONLY)

                                ; FLOPPY DISK CONTROLLER WD2797
FDCCMD  EQU     10H             ; COMMAND REGISTERS.
FDCSTA  EQU     10H             ; STATUS REGISTER
FDTRK   EQU     11H             ; TRACK REGISTER
FDSEC   EQU     12H             ; SECTOR REGISTER
FDDATA  EQU     13H             ; DATA REGISTER

PROM    EQU     14H             ; DISABLE BOOTPROM

WNSEL   EQU     15H             ; WINCHESTER SELECT

DMA     EQU     18H             ; DMA.

WNWDAT  EQU     19H             ; WINCHESTER WRITE DATA
```

```
FDXSEL  EQU     1AH             ; FLOPPY EXTERNEL SELECT
                                ; BIT0-1: UNIT SELECT
                                ; xxxxxx00 ...
                                ; xxxxxx11.
                                ; BIT2: 5"/8" PHYSICAL SELECT
                                ; xxxxx0xx 5"
                                ; xxxxx1xx 8"
                                ; BIT3: 5"-MOTOR ON/OFF
                                ; xxxx1xxx ON
                                ; xxxx0xxx OFF
                                ; BIT4: 8"-MOTOR ON/OFF
                                ; xxx0xxxx ON
                                ; xxx1xxxx OFF
                                ; BIT5: DENSITY
                                ; xx0xxxxx DOUBLE
                                ; xx1xxxxx SINGLE
                                ; BIT6: SELECT 5"/8" VCO
                                ; x0xxxxxx 5"
                                ; x1xxxxxx 8"
                                ; BIT7: FREQUENCE
                                ; 0xxxxxxx 1 MHz
                                ; 1xxxxxxx 2 MHz

BNKMUX  EQU     1BH             ; BANK DMA MULTIPLEXER
                                ; BIT0-2: DEVICES
DMFDC   EQU     00000000B       ; DMA-FDC TRANSFER
DMSI2A  EQU     00000001B       ; DMA-SIO2A TRANSFER
DMSI2B  EQU     00000010B       ; DMA-SIO2B TRANSFER
DMWIN   EQU     00000011B       ; DMA-WINCHESTER TRANSFER
DMSI1A  EQU     00000100B       ; DMA-SIO1A TRANSFER
DMSI1B  EQU     00000101B       ; DMA-SIO1B TRANSFER
DMEXT1  EQU     00000110B       ; DMA-EXTERN 1 TRANSFER
DMEXT2  EQU     00000111B       ; DMA-EXTERN 2 TRANSFER
                                ; BIT3-4: MEMORY
DMBK11  EQU     00000000B       ; BANK1 --> BANK1 TRANSFER
DMBK00  EQU     00001000B       ; BANK0 --> BANK0 TRANSFER
DMBK10  EQU     00010000B       ; BANK1 --> BANK0 TRANSFER
DMBK01  EQU     00011000B       ; BANK0 --> BANK1 TRANSFER
                                ; BIT5: CPU-BANK-SELECT
BANK1   EQU     00000000B       ; BANK1 (64K FOR CPU)
BANK0   EQU     00100000B       ; BANK0 (48K FOR CPU)
                                ; BIT6-7: NC
```

```
SWITCH  EQU     1CH             ; READABLE SWITCH (FOR MONITOR PROM 3.0)
                                ; 1=OFF , 0=ON
                                ; BIT0-2: FLOPPYTYPE
                                ; xxxxx000 5" SS 48-TPI (200 kBytes)
                                ; xxxxx001 5" DS 48-TPI (400 kBytes)
                                ; xxxxx010 5" DS 96-TPI (800 kBytes)
                                ; xxxxx011 5" DS 96-TPI (1232 kBytes)
                                ; xxxxx1xx 8" DS (1232 kBytes)
                                ; BIT3: CONSOLE BAUDRATE
                                ; xxxx0xxx  9600 BAUD
                                ; xxxx1xxx 19200 BAUD
                                ; BIT4: CONSOLE HANSHAKE
                                ; xxx0xxxx NO HANDSHAKE
                                ; xxx1xxxx HANDSHAKE
                                ; BIT5: TERMINAL TYPE
                                ; xx0xxxxx SERIAL
                                ; xx1xxxxx GRAPHIC
                                ; BIT6-7: BOOTNING
                                ; 00xxxxxx MONITOR
                                ; 01xxxxxx FLOPPY
                                ; 10xxxxxx WINCHESTER
                                ; 11xxxxxx NETWORK

WNRDAT  EQU     1DH             ; WINCHESTER READ DATA

WNSTAT  EQU     1EH             ; WINCHESTER STATUS
                                ; BIT0 - I/O
                                ; BIT1 - C/D
                                ; BIT2 - MSG
                                ; BIT3 - BUSY
                                ; BIT4 - REQ

FLSTAT  EQU     WNSTAT          ; FLOPPY STATUS
                                ; BIT5 - SIDE1/0.
                                ; BIT6 - FLOPPY INT.REQ.
                                ; BIT7 - FLOPPY READY

                                ; OPTIONAL GRAPHIC TERMINAL WITH
                                ; WITH INTERRPUT DRIVEN HANDSHAKE
PIOGAD  EQU     20H             ; PIO A GRAPHIC PORT DATA OUT (DISPLAY)
PIOGAC  EQU     PIOGAD+1        ; PIO A GRAPHIC PORT CONTROL (WRITE ONLY)
PIOGBD  EQU     PIOGAD+2        ; PIO B GRAPHIC PORT DATA IN (KBD)
PIOGBC  EQU     PIOGAD+3        ; PIO B GRAPHIC PORT CONTROL (WRITE ONLY)
        END
```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