Tulip at *compact 3*

Technical Training

Tulip computers

Tulip at _compact 3_
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TECHNICAL TRAINING TULIP AT COMPACT 3

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CONTENTS:

1 INTRODUCTION:

This manual describes the Tulip AT compact 3.

The Tulip AT compact 3 is built around the 80286 processor. There are five expansion slots available for the installation of expansion cards. Furthermore, the computer offers 1 Mb internal memory which is expandable to 3 Mb on-board. When using 1 M bit chips in both memory banks, the total amount of memory will be 4 Mb.

In addition, at the back of the top cover of the system unit there is a hole (with cap). Like other Tulip compact models, the system can be locked to prevent it from being opened.

The system unit can be placed vertically. For this purpose you should attach the magnetic strips located underneath the system unit to the left side of the system. The floppy disk drive will then be located at the top of the system unit.

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2 MAIN SYSTEM BOARD

Overview:
The TC-16 system board is a fully ISA compatible board with extra features implemented. The layout of the system board of the Tulip AT compact 3 is printed below.

FIGURE 1: MAIN SYSTEM BOARD.

In bank 1 alleen 1Mbit chips

Due to usage of semi-custom VLSI 's, board space used by conventional components could be reduced and used for implementation of new features. The major components will be discussed in the following chapters.

FIGURE 2: LOGICAL SCHEME OF THE AT COMPACT 3.
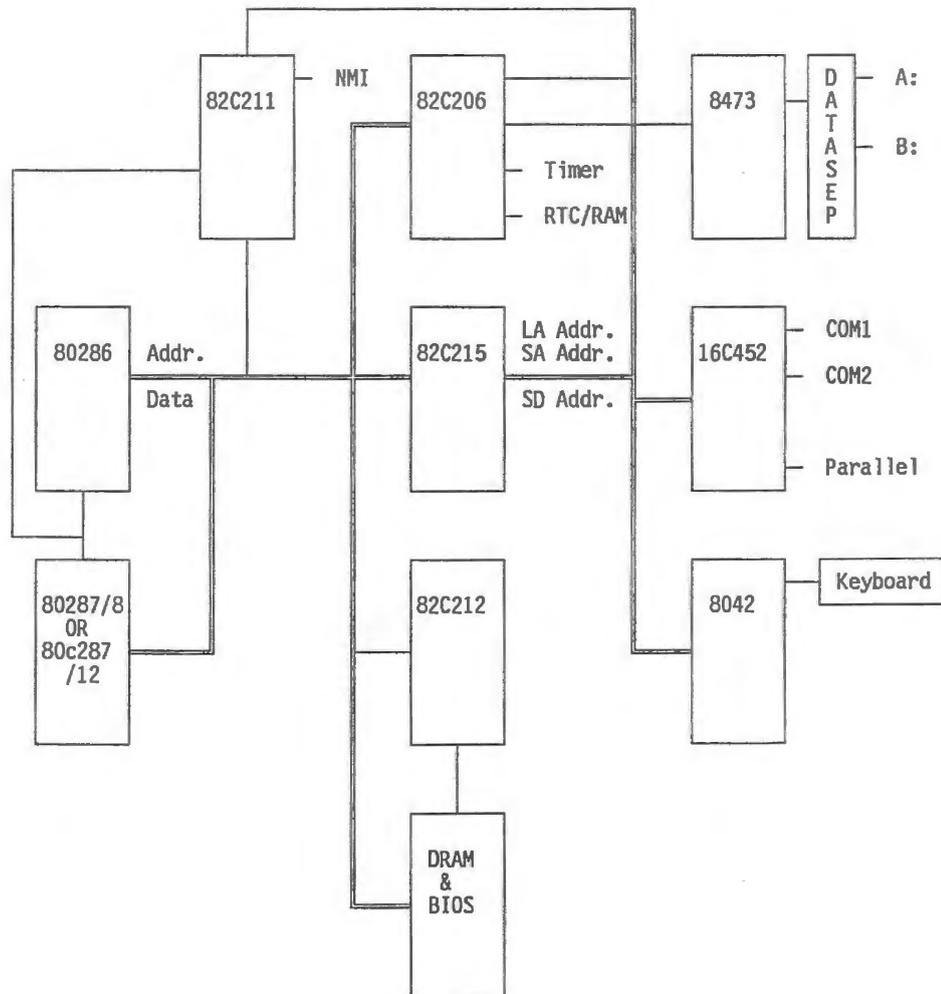
3 MAIN PROCESSOR

The heart of the system is the AMD 80286 microprocessor, which is placed on the Tulip TC 16 board. This processor has a 24-bit address and a 16-bit data bus, and is object code compatible with the 8088 and 8086. The processor runs at 12.5 / 7.15 Mhz. The clock frequency is derived from a 25 Mhz crystal. The processor clock runs independent from the bus clock. He can operate in two modes: the real and protected mode. At power up the processor operates in real mode. It acts as a high performance 8086, using only the lower 20 address-lines. Programs written for the 8086 can be executed in this mode without any modification.

3.1 The REAL-mode

In this mode, the 20 bit address is generated by a 32 bit pointer containing 2 components:
- a 16 bit segment selector that determines the start-address of the segment, and
- a 16 bit effective address offset that determines the displacement of a location within a segment.
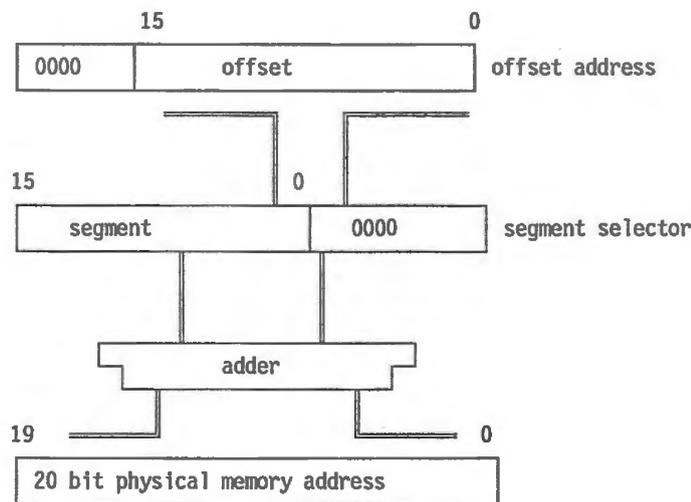
FIGURE 3: REAL-mode memory addressing

The lower 4 bits of the 20 bit segment selector are always 0. Therefore, segment addresses always start at 16 byte boundaries. Segments are 64 Kb in length, they may contain data, code or stack. No limit or access checks are performed in this mode.

Two fixed areas are reserved:

- FFFF0....FFFFF system initialization area.
- 00000....003FF interrupt vectors.

Example:

FFE4:002E means:

$$
\begin{array}{rl}
\text{segment starts at} & \text{FFE40} \\
\text{byte offset 2E} & \text{0002E} \\
\hline
\text{Real memory address} & \text{FFE6E}
\end{array}
+
$$

Attention: 0000:0030 and 0001:0020 and 0002:0010 are identical addresses!

3.2 Protected virtual address mode

In this mode, the 80286 provides an efficient on-chip memory management architecture. This means that the 80286 supports the implementation of virtual memory systems. These systems swap data and/or code between real memory and secondary storage devices (e.g. hard-disks), transparent to the executing application programs. A program may refer to a location which is not currently present in real memory. Protected mode provides a maximum of 1 Gigabyte virtual address space mapped into a 16 Mb physical address space defined by the address pins A0 to A23. A memory management scheme interposes a mapping operation between logical addresses (as they are viewed by programs) and physical addresses (being in real memory). Since the logical address spaces are independent of physical memory, the mapping is transparent to software.

The 80286 enters the protected mode by setting the Protection Enable bit (PE-bit) with the Load Machine Status Word (LMSW) instruction. The protected mode uses 32 bit pointers consisting of:

- a 16 bit effective address offset that determines the displacement of a location within a segment.
- a 16 bits segment selector that references to a particular segment.
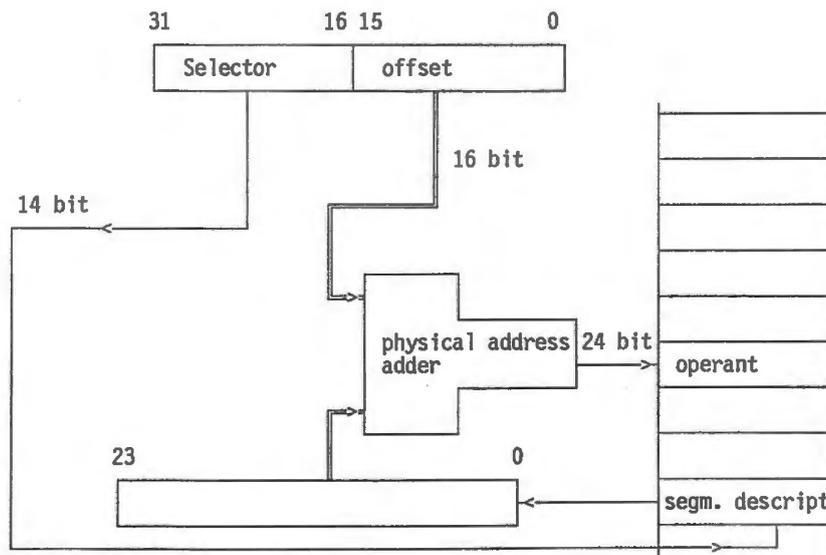
FIGURE 4: Protected virtual address mode

The segment selector specifies an index to memory resident table. Two of the selector-bits are not involved in the selection, they are used for the Requested Privilege Level. The remaining 14 bits designate a particular segment. The virtual address space therefore encompasses one Gigabyte addressable byte locations $(2^{\wedge}(14+16))$.

The 24 bit base address is obtained from the tables in memory.

The 16 bit offset is added to the 24 bit segment base address to form the 24 bit physical address. The microprocessor automatically refers to the tables whenever a segment register is loaded with a selector. All instructions that load a segment register will refer to the memory tables. There are several descriptor tables resident in memory.

One of them is the global descriptor table, providing a complete description for the global address space. It is used for system wide data and procedures including operating system software, library routines, runtime language support and other commonly shared system services. In addition, there may be one or more local description tables, each describing the local address space of one or more tasks.

A descriptor table may contain 1 to 8192 entries.

4 THE NUMERIC COPROCESSOR

The TC-16 board can be equipped with a numeric coprocessor to improve system performance when heavy arithmetic calculation has to be done. The Intel 80287 numeric coprocessor running at 8 MHz or an Intel 80c287A numeric coprocessor running at 12.5 MHz can be installed.

The 80287 coprocessor works in parallel with the microprocessor. This parallel operation decreases operating time by allowing the coprocessor to do mathematical operations while the microprocessor continues to do other functions. It effectively extends the register and instruction set of the system and adds several new data types as well.

4.1 How to install the numeric coprocessor

The Tulip AT compact 3 allows the installation of a numeric coprocessor. Installation is done as follows:

1 Open the system unit.

2 Install the coprocessor carefully into the appropriate socket and make sure that the mark (dot) is in the indicated position (see figure 1).

3 Run the Diagnostics program to inform your system that a numeric coprocessor has been installed. Refer to the paragraph "How to run Diagnostics" for more information on this subject.

The installation of the numeric coprocessor has now been completed.

5 SYSTEM BIOS

The Basic Input Output system of the AT compact 3 is an IBM PC/AT 3 compatible BIOS with extra features for support of all non-standard functions. These extra features will not affect compatibility in any way.

The BIOS is stored into two EPROM's mounted on the system board. One EPROM for the odd bytes; the other for the even bytes. Two types of Eproms can be used, selection of these types can be made by setting jumper J11. The possibilities are:

$$2 * 27128 \quad (150 \text{ ns})$$
$$2 * 27256 \quad (150 \text{ ns})$$

J11: ROM SELECT:

Jumper on pin 1-2: ROM size 2 x 32 Kb (27256)
1 2 3

Jumper on pin 2-3: ROM size 2 x 16 Kb (27128)
1 2 3

Because of the RAM shadowed BIOS feature we can reduce the BIOS wait states when the BIOS is copied to shadowed RAM. This feature is possible in all memory configurations.

The extra features with regard to a standard AT BIOS are:

1- BIOS identification
2- NEAT chipset support
3- Automatic FDC configuration
4- Serial and parallel port conflict detection
5- Disk controller detection
6- Continued boot
7- Boot sequence
8- Speed switch

These extra features will be explained on the next pages.

5.1 Bios identification

The BIOS contains a Tulip specific BIOS identification sign which can be used by Tulip system dependent software to identify the system board. The specification of the system board identification sign is as follows:

FIGURE 6: BIOS identification

Address	Contents	Remarks
F000:FF76	54h	Ascii "T"
F000:FF77	40h	Board + level number.

The board and level number are constructed as follows:

```
Bitnr.        7   6   5   4   3   2   1   0

F000:FF77   | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
```

Rev. nr.

Board nr.
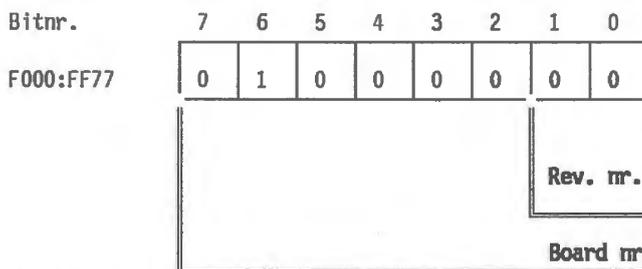
In this example we are dealing with a TC16 board, and the revision level is 0 (bits 0 and 1 are both zero).

5.2 NEAT chipset support

Initiation needed by the NEAT chipset for the selection of wait states, command delays etc. is implemented in the AT compact 3 BIOS.

5.3 Automatic Floppy disk controller configuration

When the BIOS detects that a floppy disk controller is installed in the I/O slots, the on board floppy disk controller is disabled.

5.4 Serial and parallel port conflict detection

If a conflict is detected between an on board serial or parallel port this is signalled to the user, at power up time. Run the diagnostic program to enable or disable ports.

5.5 Hard Disk controller detection

If a hard disk controller is inserted in the I/O slots, this is detected by the BIOS (if the 40 pin flatcable has been removed from the embedded hard disk). Run The diagnostic program to disable the on-board embedded disk controller.

5.6 Continued boot

A conventional BIOS does not continue booting after the 'Power On Self Test' when the keyboard is locked. The AT compact 3 BIOS will allow a boot from hard disk when the keyboard is locked. No attempt will be made to boot from a floppy disk in case of a locked keyboard. This feature can be useful for stand alone remote controlled stations like bulletin board hosts and network servers.

5.7 Bootsequence

By means of diagnostics it is possible to select the sequence of booting. Usually the bootsequence of a PC is, first try to boot from floppy, and then try to boot from hard disk. On the AT compact 3 it is possible to change this sequence the other way around. First the BIOS tries to boot from hard disk, if this fails the BIOS boots from floppy disk.

5.8 Speedswitching

By means of a key sequence it is possible to change the processor speed in 7.15 Mhz or 12.5 Mhz. See chapter 17.7 for detailed information.

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6 NEAT CHIPSET CS 8221

The Tulip AT compact 3 is controlled by the CS 8221 New Enhanced AT Chipset. This high performance 4 chip VLSI implementation provides the control logic for an AT compatible computer. Beside, new functions have been added to improve system performance. The chipset consists of:

1- 82C211 bus controller
2- 82C212 page/interleave EMS memory controller
3- 82C215 data/address buffer
4- 82C206 integrated peripherals controller.

6.1 82C211 bus controller

The bus controller provides the synchronization and control signals for the CPU local bus, the system memory bus, the I/O channel bus and the peripheral bus. It also provides clock generation with software speed selection, programmable command delays and wait state generation. On top of this the bus controller contains the NMI generation logic and the control logic to interface the 80287 coprocessor and the 80286 microprocessor.

6.2 82C212 page/interleave and EMS memory controller

The memory controller contains all logic to control the memory on the TC16 board. It provides the following features:
- Page / interleave operation
- Memory remapping
- Shadow RAM
- LIM-EMS address translation logic.

Whenever both memory banks contain 1024 K by 1 bit DRAM's (4 Mb memory), the page interleave feature is enabled. This results in an average of less than 0.7 wait states, inserted on accesses to the memory. The memory remapping feature provides the possibility to remap the RAM that overlaps the BIOS EPROM area (640k-1M) above the 1 Mb area (1 Mb- 1.384 Mb). This feature can not be used when the amount of memory is more than 1 Mb and when the shadow RAM feature is enabled.

```
                                      Mapping
                                      ┌──────────┐ 15FFFFh
                                      │ 384 Kb   │
                                      │ RAM      │
         System RAM      ┌─────────   │          │
        ┌─────────┐ 1 Mb │        ┌──▶│          │
        │         │      │        │   ├──────────┤ 100000h
        │         │      │        │   │ ROM      │ 0FFFFFh
        │         │◀─────┘        └── │          │
        ├─────────┤ 640 Kb            ├──────────┤ 0A0000h
        │         │                   │          │ 09FFFFh
        │         │                   │          │
        │         │                   │ 640 K    │
        │         │        ◀────────▶ │ RAM      │
        │         │                   │          │
        │         │                   │          │
        └─────────┘ 0 Kb              └──────────┘ 000000h
```
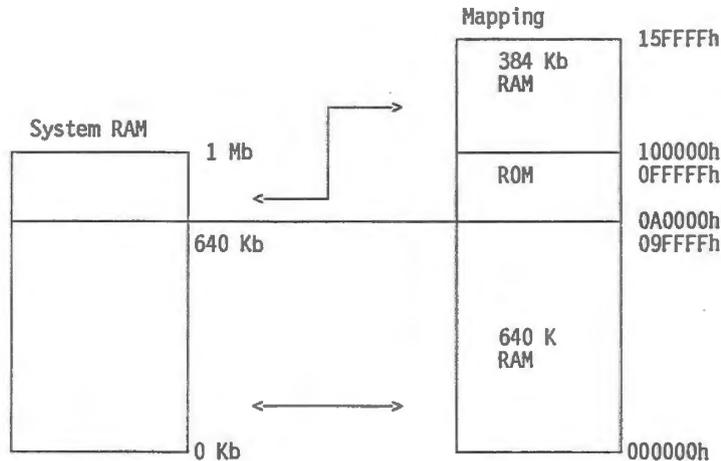
FIGURE 7: Memory mapping

The shadow RAM feature provides the possibility to use the RAM that overlaps the BIOS EPROM area for shadowing the BIOS EPROMS. This feature allows BIOS code to be executed from fast RAM instead of the slow EPROMS. The BIOS copies the code into RAM before this feature is enabled. Note that when the memory remapping feature is enabled, the shadow RAM feature can not be used.

The memory controller also contains EMS translation logic to map the 0 to 4 Mb system RAM into a 64 K block which is unused so far. With the help of the diagnose program this 64 Kb block can be located in the address space of 0C000h trough 0EFFFFh, starting at a 4000h boundary.

6.3 82C215 data / address buffer

The 82C215 data/address buffer provides the buffering and latching between the local CPU address bus and the peripheral address bus. It also provides buffering between the local CPU data bus and the system memory databus. Databus conversion is performed when the CPU issues 16 bit reads or writes to 8 bit memory or I/O devices.

6.4 82C206 integrated peripherals controller

The 82C206 integrates the standard peripherals normally found on the AT system board, except the keyboard controller. It contains a 7 level DMA system, a 16 level interrupt system, a counter timer system, a real time clock, a DMA clock devider, a programmable wait state generator and 114 bytes of CMOS RAM.

7 MEMORY

The AT compact 3 will standard be equipped with 1 Mb memory. This 1 Mb can be configured in different ways: several types of chips can be used.

7.1 How to install memory expansion

Most AT-compatible computers offer 640 Kb standard on-board memory. As the Tulip AT compact 3 will especially be used to run high-end applications, such as Desktop Publishing software and CAD software, the machine offers standard 1 Mb internal memory, which is expandable to 4 Mb on-board. This means that no expansion cards are needed, thus still having connectors available for other expansion cards. Besides, memory on-board can be accessed faster than memory which has been extended by means of expansion cards.

On the main board there are special sockets reserved for the installation of conventional DRAM chips to obtain memory expansion. While installing the DRAM chips, you may consult figure 1 showing the exact location of the sockets on the main board. When upgrading to 4 Mb both banks must have 1 Mbit chips installed.

After installing memory expansion and -if necessary- setting the corresponding jumpers you should run the Diagnostics program to inform the system about the new configuration. Refer to "Memory expansion in Diagnostics" for the values to be entered when running the Diagnostics program.

7.2 Memory settings with the diagnostic program

When you are running Diagnostics, you are asked to enter the total amount of memory of your computer and your are asked to specify how you want to use it.
Some of the terms included in that part of Diagnostics will be explained in detail below.
The amount of extra memory on the main board is the total amount of memory on the main board minus the standard memory (640 Kb) and - if used - minus the amount of Shadow (video and) system BIOS (384 Kb).
Shadow system BIOS (Shadow RAM) contains a copy of the BIOS. Shadow system BIOS increases BIOS performance with approximately 300 to 400 %.
The amount of extra memory on the main board can be used as extended memory or as expanded memory. Which possibility to choose depends on the application program you want to use.

The memory above 1 Mb is referred to as extended memory. Extended memory has been developed especially for 80286 and 80386 computers. It is, for example, directly accessible for Tulip MS-OS/2, Xenix and Windows/386. If your are using MS-DOS, the extended memory can be used as DOS memory disk. For this purpose you should install a driver (e.g. ramdrive). For more information on this subject refer to the MS-DOS Reference Guide that was shipped with your computer.

Expanded memory (EMS) is memory that can be used when running application programs especially developed for 8088 computers. Expanded memory, for example, can be very useful when running spreadsheet programs and DTP software. In the manuals delivered with these software packages you will find information on how to use expanded memory.

EMS memory may not exceed the total amount of extra ("expansion") memory on the main board (which means not more than 2 Mb). This means that the amount of memory on expansion cards can not be used as expanded memory.

To allow the system to use EMS, you will first have to install a device driver. More information on the device driver you will find in the paragraph "Emm.sys".

If you use both extended and expanded memory, you must make sure that EMS memory size plus extended memory size equals the total amount of extra ("expansion") memory in the system (i.e. on-board as well as on memory expansion cards).

The table below contains some examples to elucidate the information above.

Memory wanted (%)		Extra memory (Kb)		Setting in Diagnostics	
Extended Mem.size	EMS mem.size	On main-board	On expansion cards	Extended mem.size	EMS size (1)
100%	-	384 (2)	-	384	-
-	100%	384 (2)	-	0	0-1
100%	-	2048 (3)	-	2048	-
-	100%	2048 (3)	-	0	2
50%	50%	2048 (3)	-	1024	1
100%	-	2048 (4)	1024	3072	-
-	100%	2048 (4)	1024	0	2 (5)
67%	33&	2048 (4)	1024	2048	1

FIGURE 8: Memory expansion and the diagnostic program

1 = EMS memory size in Mb (1 Mb equals 1024 Kb)
2 = Default configuration (1 Mb memory)
3 = Default configuration with memory expansion of 2 Mb on main board
4 = Default configuration with memory expansion on main board and on expansion cards
5 = Memory on memory expansion cards can not be used for EMS, so you will not be able to use it.

7.3 EMM.SYS

On one of the diskettes shipped with the Tulip AT compact 3 you will find the emm.sys program.

The emm.sys program allows you to use expanded memory. The EMS (Expanded Memory Specification) Version 4.0 device driver is a standard MS-DOS device driver that gets loaded at boot time by the config.sys file. The config.sys file should include the following command line:

device = [drive:] [path] emm.sys

When the EMS driver is first executed, the title and copyright notice will appear on the screen :

"EMS Expanded Memory Device Driver Ver. 4.0"
"Copyright (c) Chips and Technologies inc., 1987"

If the EMS detects that a previous EMS driver has been loaded, it will display the following message on the screen:

"An Expanded Memory Manager has already been installed."

Consequently, the EMS driver will not get loaded into the system.

When the EMS device driver is being loaded by MS-DOS, an internal test on the EMS hardware configuration is done. If any conflicts are detected that would cause EMS not to function properly, the message:

"The EMS setup has been incorrectly specified. No EMS is available."

will appear on the screen after the EMS copyright notice, and EMS will be disabled.

Now that the installation of the device driver has been completed, the system can be used to support Lotus/Intel/Microsoft EMS 4.0. The EMS device driver shipped with your computer used in conjunction with the EMS support integrated functions similar to the EMS device driver used in conjunction with an EMS expansion card.

Note
This device driver can only be used in a Tulip AT compact 3, a Tulip sx computer (Tulip sx compact 2, Tulip at 386sx and Tulip tr 386sx) or in a Tulip lt 286.

main board t.b.v. ob 2a RAM
sporadisch
gereproduceerd
(chip formaat afwijkend)

DRAM:

Bank 0	Bank 1	J3	J4	J5	J6
256k*4	-	1-2, 4-5	1-2, 4-5	1-2, 4-5	5-6
256k*4	1M * 1	1-2, 4-5	1-2, 4-5	1-2, 4-5	5-6
512k B	-	1-2, 3-4	1-2, 3-4	1-2, 3-4	2-3
512k B	1M * 1	1-2, 3-4	1-2, 3-4	1-2, 3-4	2-3
512k T	-	1-2, 3-4	1-2, 3-4	1-2, 3-4	1-2
512k T	1M * 1	1-2, 3-4	1-2, 3-4	1-2, 3-4	1-2
1M * 1	-	2-3, 4-5	2-3, 4-5	2-3, 4-5	4-5
1M * 1	1M * 1	2-3, 4-5	2-3, 4-5	2-3, 4-5	4-5

FIGURE 9: Jumper settings on mainboard for memory configurations

REMARK: In the table above the characteristics of the chips are mentioned. **Example: 512k B bank 0 means: bank 0 consists of 16 chips of 512 k bit per chip. So total 1Mb.**

When using 256K * 4 chips other sockets have to be used! Only 8 chips are needed in that case.

FIGURE 10: Some examples of jumper settings

Ram in standard configuration with 1 Mb memory

Bank 0: 512 Kb DRAM type T
Bank 1: not used
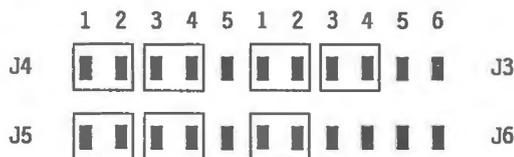
Bank 0: 512 Kb DRAM type B
Bank 1: not used
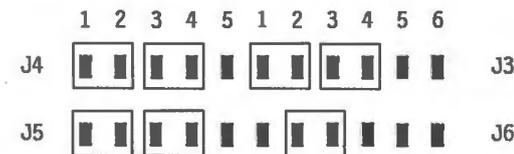
RAM in standard configuration with 2 Mb memory

Bank 0: 1 Mb DRAM
Bank 1: not used

```
         1  2  3  4  5  1  2  3  4  5  6
J4    ▮ ▮▮ ▮▮ ▮ ▮▮ ▮▮ ▮    J3
J5    ▮ ▮▮ ▮▮ ▮ ▮ ▮ ▮▮ ▮    J6
```
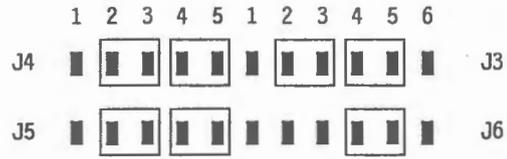
8 FLOPPY CONTROLLER

The floppy disk interface contains the circuitry and control functions for interfacing the system to up to two floppy disk drives. The AT compact 3 can be supplied with four types of floppy disks:

- 5¼ " 360 Kb disk drive
- 5¼ " 1.2 Mb disk drive
- 3½ " 720 Kb disk drive
- 3½ " 1.44 Mb disk drive

All these types are supported by the 8473 Floppy Disk Controller. The AT compact 3 has an analog data separator, which provides a better performance. The floppy disk interface on the mainboard will automatically be disabled if an other floppy disk controller is inserted in the I/O slots.

The interface is developed for both single and double sided, double and high density floppy disks. It uses modified frequency modulation (MFM) to read and write data.

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9 I/O INTERFACES

I/O interfacing is realized by using the UM82C452 or VL16C452 Parallel / Asynchronous Communication Element. The chip is housed in a 68 terminal plastic leaded chip carrier.

The device services two serial input / output interfaces simultaneously and a fully bidirectional parallel data port. Each serial channel performs serial-to-parallel conversion on data characters received from peripheral devices or modems, and parallel-to-serial conversion on data characters transmitted by the CPU. The complete status of each channel can be read at any time during functional operation by the CPU.

The parallel data port fully supports the Centronics type printer interface. The port allows data transmitted by the CPU to be printed.

The parallel port, together with the two serial ports, provide AT compatible computers with a single device to serve the I/O functions.

A programmable baudrate generator is included and can divide the timing reference clock by a certain devisor.
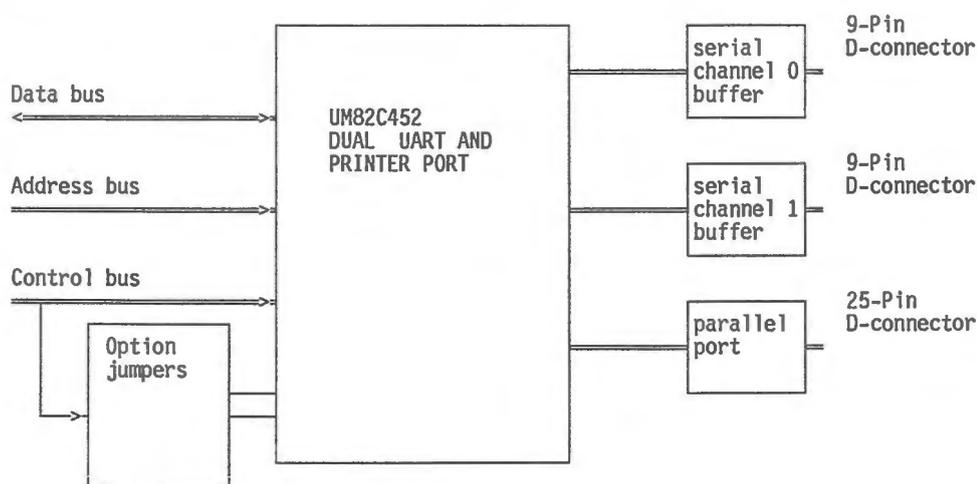
10 MOUSE

In the AT compact 3 there is no support for a bus mouse. A serial mouse can be used, connected to one of the serial ports. To be able to work with a serial mouse it is necessary to add the software driver MOUSE.SYS. Normally the mouse will be connected to COM1 and typing MOUSE/C1 will install the mouse driver for serial port COM1.

11 EXPANSION SLOTS

The TC16 board contains four 16 bit slots and one 8 bit slot. The 8 bit slot is located at the right most position next to the power supply. This is done for optimum use of system board space. The 8 bit expansion slot is needed because several expansion boards do not fit into a 16 bit slot. One of these dedicated 8 bit slot expansion boards is the Tulip ISOLAN PC controller card (old version).
One expansion slot is occupied by the video adapter.

12 KEYBOARD / KEYBOARD CONTROLLER

The keyboard provided with the AT compact 3 is a standard Tulip 101/102 key keyboard (Country dependent key layout).   The keyboard controller provides the standard interface to the keyboard. On top of this it provides a number of extra functions, not found in a standard keyboard controller. These extra functions are used for the system password protection (SPP) and provides user friendly system operation and system security.
The keyboard controller is realized by the **80742 single chip** micro controller. It communicates with the master processor trough the lower 8 bits of the data bus. A status register, an output buffer and an input buffer connect to the bus. Internally an 8 bit processor executes the commands and controls the data flow. Besides the register and buffer the processor addresses 2Kb of ROM ,128 bytes of RAM and two 8-bit I/O ports. These ports provide system information, an interrupt request and master processor reset line and the serial interface lines to the keyboard.

12.1 Keyboard connection

On this page you will find a description of the connection of the keyboard.

Check the position of the switch(es) underneath the keyboard. The number of switches depends on the type of keyboard you have:
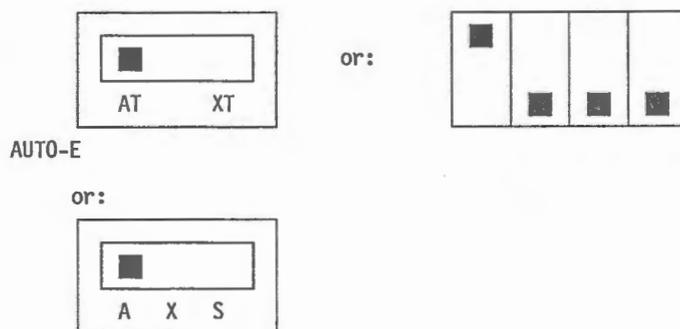
FIGURE 11: Keyboard dipswitches underneath the keyboard

13 SYSTEM PASSWORD PROTECTION

In order to obtain system security the Tulip AT compact 3 offers password protection for the startup procedure and for two additional system functions: the Keylock function and the Hard reset function (more about these functions you will find in the part "Additional system functions" in this paragraph).

13.1 How to install the password

For the installation of a password you should run Diagnostics. After selecting the "Security" option in the Setup procedure a drop-down menu will appear:

> **Password**
> **Startup password**
> **Hot key**

If the "**Password**" option is disabled you will not be prompted for one, neither during the startup procedure nor during the Keylock and the Hard reset procedure; you can install a password by choosing "Change password" within the "Password" option.
If you do not want to be prompted for a password during the startup procedure, choose "**Startup password**" and select "No". Be aware that the password should have a minimum length of four and a maximum length of eight characters.
Select the "**Hot key**" option if you want to select a key sequence for activating the system functions mentioned above.

13.2 Additional system functions

As already mentioned in the previous part the Tulip AT compact 3 offers two additional system functions which can be activated from the keyboard and which can be protected by means of password installation.

    1   Keylock. This feature enables the user to lock the keyboard in order to prevent unwanted input, when leaving the computer for a while.

    2   Hard reset. The Hard reset feature should be used if a normal reset by pressing ctrl + alt + del fails to work.

Below you will find information on how to activate the Keylock and Hard reset function.
First you should press the "Hot key". If the "Hot key" is pressed, the system will beep two times and the num lock LED starts blinking which means enter function.

System Function	Function key:
Keylock	f3
Hard reset	f4

Note

To remind you which function key corresponds to which system function, two adhesive overlays ("System Password Protection") are shipped with the Tulip AT compact 3. The overlay should be placed on the num lock, caps lock and scroll lock LED.

You can exit the ENTER FUNCTION mode with the esc key. When the function key is chosen, the caps lock LED starts blinking (num lock stops blinking) which means ENTER PASSWORD. After typing the correct password (the password you entered in Diagnostics) and pressing the enter key the selected function is executed. Entering an incorrect password results in returning to the enter function mode. Exit the ENTER password mode (=returning to enter function mode) with esc.
Note that if no password has been installed in Diagnostics the selected function is executed immediately after pressing the corresponding function key.

14 STORAGE DEVICES

14.1 Floppy disk

For the Tulip AT compact 3 a 3.5" floppy disk is used. It is a CANNON MD3611 series which is 1" high, has a low power consumption and uses only one +5V DC power connection The drive supports both double density (720 Kb) and high density (1.44 Mb) capacities. Other marks are also possible.

14.2 Hard disk

The AT compact 3 systems will be shipped with 3.5" half height embedded AT hard disks. Available capacities are 20 Mb (Seagate ST 125 A) and 40 Mb (Miniscribe 8051 A). An AT embedded disk is in fact a disk like the older ST506 drives. The difference is, that an AT embedded drive has his controller integrated on the disk, while a ST506 drive needed a disk controller in an I/O slot.

During low level formatting, the sector numbers are written in the headings of the sectors. So the interleave is defined during low level formatting. The same happens with the bad spots, they are marked as bad during low level formatting.

The bad sectors can be entered by hand.

High level format is depending on the operating system which you use. If you use MSDOS, then the high level format program checks the disk for bad sectors, and creates a File Allocation Table on the disk. The bad sectors are marked as bad.

With an AT embedded disk, the low level formatting is done by the vendor of the disk. This information is fixed on the disk. The advantages of putting the disk controller fixed on the disk are:

- The timing between disk and disk controller can be optimized because it won't be changed.
- The drive can be made more intelligent, for instance a drive which is known to the system as a 17 sector per track drive (to keep compatible with MSDOS tables), can physically can have 32 sectors per track.
- Bad spots can be mapped out during low level format and the disk can use his reserved tracks instead, so to the outside world it looks as if the disk has no bad spots.
- Look ahead cache, to provide higher transfer rates on small records.

Because of the internal bad spot remapping, it is recommended not to perform low level formatting of embedded hard disks: it looks as if these disks don't have bad spots, but they do!

Most vendors have changed the implementation of the low level format command: the drive won't format if you give the command, the interleave is also not changeable.

Specifications of both hard- and floppy disks can be found in the appendix "Disk specifications".

14.3 Embedded hard disk adapter:

The embedded hard disk interface, which resides on the AT compact 3 mainboard, is specially designed to interface the system to an intelligent, ST506 compatible hard disk drive. These drives are called embedded AT drives. The controller logic is integrated on these disks. The interface contains no drive control logic, it only provides the buffering of the databus and the signals to and from the drive. It also provides address decoding of the system address bus. Up to two disks can be connected to this interface. On the mainboard exists:

- J25: a 40-pin connector for connecting the hard disk(s).
- J20: a jumperblock for the connector configuration.

The reason that this jumperblock is available is due to the history of the development of the embedded AT interface. In the definition phase of this interface the standard was not 100% stable, and sometimes it was needed to change some signals from the hard disk to the interface. Nowadays the situation is completely stable and you simply have to place the jumper(s).

The signals that we are talking about are:

- IOCHRDY (I): A signal which is used to lengthen bus cycles, the system inserts waitstates when the drive requests this.

- HBALE (O): The Buffered Latch Enable Signal from the host CPU.

To connect these signals in a proper way, you have to connect pins 7-8 (IOCHRDY) of J20 by means of a jumper. Pins 11-12 (HBALE) are already hard-wired on the mother board, so a jumper does not have to be inserted.

```
        14  ┌ .   . ┐  13
            │ .   . │
    J20     │ .   . │
            │ .__. │
            │ .   . │
            │ .   . │
         2  └ .   . ┘  1
```
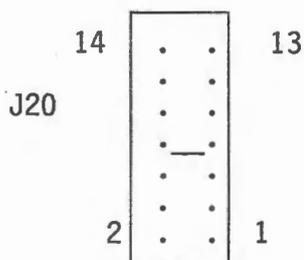
15 VIDEO

The video adapters shipped with the AT compact 3 are alike the types that are used in other Tulip systems. The following video configurations are available :

VIDEO ADAPTOR	MONITOR
DGA DGA DGA DGA	WHITE MONOCHROME TTL 12" GREEN MONOCHROME TTL 12" GREEN MONOCHROME TTL 14" COLOR TTL 14"
TEVA	COLOR TTL 14"
VGA/16 VGA/16	VGA MONOCHROME 14" VGA COLOR 14"

FIGURE 12: Video adapters and monitors

Jumper setting:

J15   VIDEO

```
1   2   3
```

Jumper on pin 1-2: monochrome card installed.

```
1   2   3
```

Jumper on pin 2-3: Color (CGA card or TEVA-2 card) installed.

```
1   2   3
```

DGA card: connect DGA cable to pin 2-3: (red to pin 3, black to pin 2).

The jumper setting does not apply if a VGA card has been installed.

15.1 Video memory map:

The video is addressed in the system memory address space according to the next table:

Address		Function
Decimal	**Hex**	
640 K	A0000	
704 K	B0000	4K mono-chrome
	B0FFF	
		128K EGA/VGA
736 K	B8000	32K or 64K Hercules
752 K	BC000	16K or 32K Color Graphics
	BFFFF	

FIGURE 13: Video memory map

C0000 } VGA - Bios
C7FFF }

16 INSTALLATIONS

The system unit should be opened as follows:

1: Turn off the computer and disconnect the AC power cable. Also switch off the peripherals (e.g. monitor and printer).

2: Remove the two screws on each side of the system unit. You can now lift the cover from the system unit.

3: Remove the two screws of the hard disk and disconnect the flat cable(s) from the hard disk controller or from the main board.

4: If you want to reach the main board, e.g. for changing the jumper settings or installing memory expansion, you should slightly lift up the mounting plate with power supply, floppy disk drive and front panel, and put it aside. Pay attention to the length of the flat cables; they are usually just long enough to have access to the entire main board. If any cables should be disconnected, make sure that they are properly reconnected again, and run the diagnostic program.

16.1 How to replace the batteries

The batteries are used to make sure that the configuration and the correct time and date set will not be lost when the computer is powered off. Pay attention to the polarity (+ and -) when installing new batteries.

After having replaced the batteries you should run Diagnostics to indicate the correct time, date and configuration to the system. More information on Diagnostics you will find later in this manual.

16.2 How to change the fan speed

The fan speed can have two different setting. If you have installed cards with a high power consumption, the temperature in your machine may rise considerably. You are therefore well-advised to modify the fan to run at a higher speed. The fan can be set at high and low speed by setting the jumper inside the power supply. The appropriate jumper setting is shown below:

jumper

 Low speed

    High speed

LO HI

16.3 Closing the cabinet

Check whether the cable connections are reinstalled correctly and not jammed between the mounting plate. You should remember to connect the flat cable(s) again and to secure the hard disk by tightening the two screws.
Replace the top cover to the system unit. Make sure that the cards are locked firmly into the card guides.
Secure the top cover by using the two screws on each side of the system unit.
Reconnect the AC power cable to an earthed AC mains outlet.
If you have made changes to the hardware of your computer, such as installing a numeric coprocessor or replacing or adding expansion cards, you should run Diagnostics to inform the system about these changes. More about Diagnostics you will find in the paragraph "How to run Diagnostics" later in this manual.

Make sure that when reinstalling the flat cable, the red wire of the cable is located at the side of the floppy disk drive.

17 DIAGNOSTICS

Diagnostics is a program which can be used in a wide range of situations. A large number of Help screens and drop-down menus enable you to communicate with your computer and run the program.
The program is very easy to handle, but still there may be some unexpected conditions where we have to deal with. Therefore some examples of diagnostics are given in this chapter. The Diagnostics program should be used:

- when you have to set up your system before using it for the first time.
- when the message "run DIAGNOSTICS" appears on your screen during the starting procedure ("booting") of the computer.
- when you have a problem with your computer and you want to find out what might have caused it. For this purpose a test menu with several test options are available. (If the configuration is correct).
- when the date or the time are not set correctly. (Not DOS 3.30)
- when you have installed additional hardware, e.g. another display adapter, memory expansion or a floppy disk drive.
- when batteries have been replaced, or the cable has been disconnected.
- when you plan to transport your computer. You should run Diagnostics in order to secure the damageable parts of the hard disk.

- when you want to install a password for the first time or when you want to disable or change your password.
- when you want to select the "Hot key" for the Keylock function and the Hard reset function.

17.1 Starting diagnostics

You can start Diagnostics in two ways:
when the message "run DIAGNOSTICS" is displayed on your screen, you should insert the Diagnostics diskette **version 2.04 (or higher)** in drive A and press a key. when the screen does not display any message, but you still want to run Diagnostics, you can start the Diagnostics program directly from DOS by typing the command Diagnose at the DOS prompt. (Make sure that you start Diagnostics from the drive and the directory holding all Diagnostics files. This means that, if the Diagnostics program has been installed on your hard disk, you should first go to the appropriate directory and type Diagnose. If Diagnostics is on a diskette, you should first go to the drive in which the diskette has been inserted (e.g. by typing a:) and then type Diagnose).

17.2 Using the diagnostic program

After starting Diagnostics, the message "This is a Tulip AT compact 3" will be displayed on the screen. Immediately after that the Diagnostics window with four menus will appear on the screen.

You can use the direction keys to select a menu and move the cursor within a menu.

http://www.computer-museum.net

```
┌─────────────────────────────────────────────────────────────────────┐
│ Diagnostics  V2.04              Wednesday  November 1, 1989  12:05 pm │
└─────────────────────────────────────────────────────────────────────┘
```

```
                    ┌──────────────────────────────┐
                    │          DIAGNOSTICS          │
                    ├──────────────────────────────┤
                    │  This is a Tulip AT compact 3. │
                    └──────────────────────────────┘
```
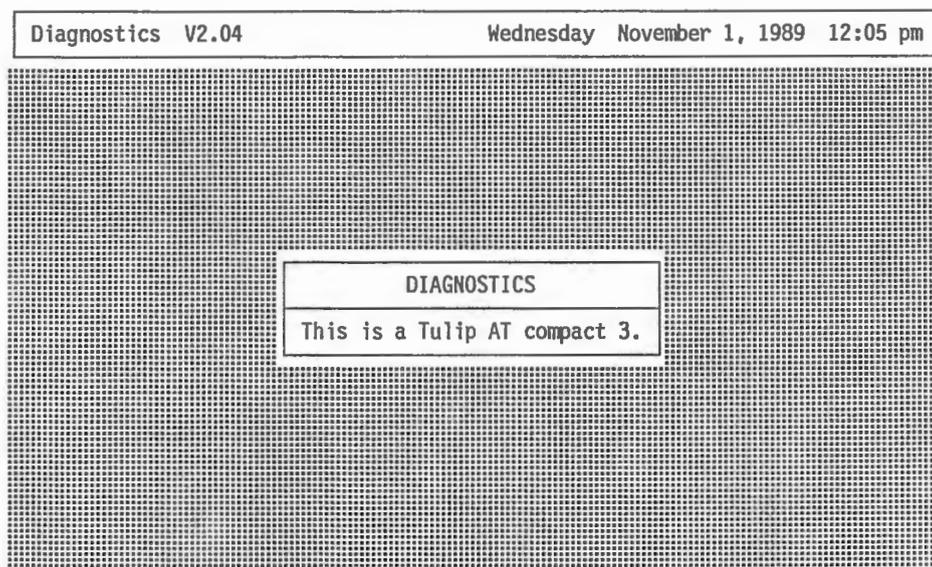
FIGURE 14: Diagnostics 2.04 should recognize your AT compact 3

```
┌─────────────────────────────────────────────────────────────────────┐
│ Diagnostics  V2.04              Wednesday  November 1, 1989  12:08 pm │
└─────────────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────────────┐
│  Setup    Test    Transport    System_Info                           │
└─────────────────────────────────────────────────────────────────────┘
                    │System information│
```

```
              ┌──────────────────────────────────────┐
              │          System information           │
              ├──────────────────────────────────────┤
              │ System ID:  16, Rev: 0                │
              │ System BIOS date:  10/06/89           │
              │ BIOS configuration word:  F9E6        │
              │ Processor:  80286                     │
              │ Coprocessor:  None                    │
              │ Serial Ports:  2                      │
              │ Parallel Ports:  2                    │
              │ Network:  Disable                     │
              └──────────────────────────────────────┘
```

```
                        <F1> Help, <Esc> Exit
```
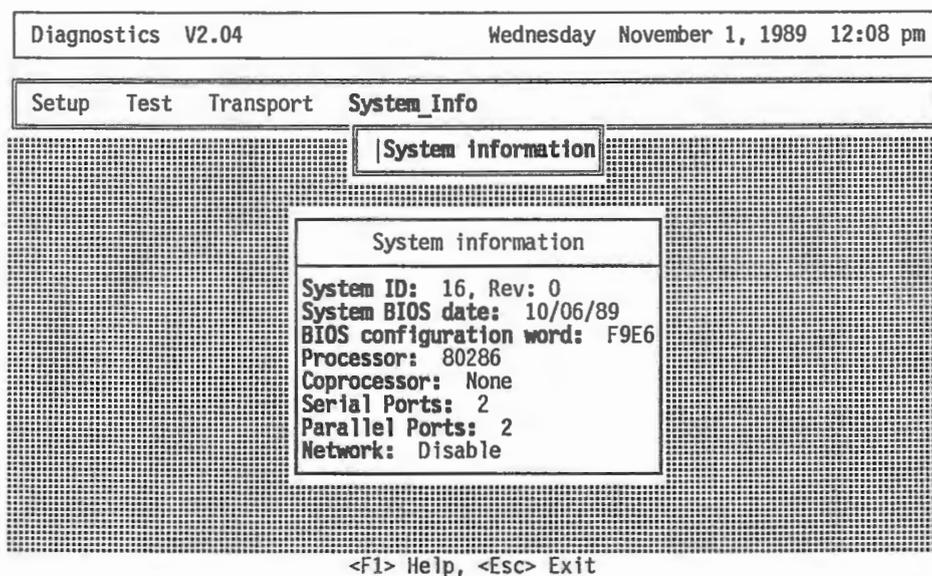
FIGURE 15: Looking for system information

You can use the enter key to select a command within a menu.

The first menu, "Setup", enables you to enter or change the configuration of your system. After pressing the enter key, a drop-down menu appears.

The second menu, "Test", should be used to test some (or all) of your system components and to detect the cause(s) of any problems arising.

You can use the third menu, "Transport", to secure all damageable parts of the hard disk of your computer before transport.

The fourth menu, "System_Info", provides technical information on the Tulip AT compact 3. It is not possible to alter any of this information.

You can use the direction keys (up, down, right, left) to move across the menu bar and up and down the menus. You can select a menu by pressing the enter key. During the execution of Setup you can type information or, if a new box appears, choose from a list of options.

Help screens

When you are running the Setup program or planning to run one of the test programs and you need help for the operation you are going to perform, you can press f1. Diagnostics will respond by displaying a screen with help information on the topic you are working on. If you press the f1 key for the second time, a screen will appear which lists all keys you can use to run Diagnostics.

Pressing f1 twice displays a Help screen with (the function of) all keys you can use to run Diagnostics.

Canceling a command

Once you have entered incorrect information which you want to change, you can cancel the command by pressing the esc key. (As long as you do not press the enter key the command will not be executed. You can cancel the command by pressing the esc key). Each time you press esc, Diagnostics will return to the previous screen or box.

Warnings and errors:

When you are running the Setup program, two types of messages can appear on your screen:

Warnings:

Warnings appear, when you choose an option which does not correspond to the current configuration of your machine. After running Setup you can still change the configuration (e.g. add or replace a video card), so that the option you have set, is correct.

Errors:

Errors appear, when you choose a setting which would make the system crash, if it were installed. You can only continue running the Setup program, if you find an appropriate solution to the problem, i.e. choose another setting.

Things to pay attention to:

When you are running the Setup procedure in Diagnostics, you will be asked to specify the type of hard disk your machine contains. You will find a specification of the hard disk type at the back of the machine, or, if you have a retrofit set hard disk, at the hard disk itself. Checking the type specification before you install your hard disk will save you a lot of trouble.

Ending Diagnostics:

You can end the Diagnostics program by pressing esc. Then a box will appear with the question "Exit Diagnostics" and the options "Yes" and "No". Choose option "Yes" to end Diagnostics.

If you have changed the system's configuration the system will be restarted.

If you have not made any changes there are two possible situations:

When you have started the system with the Diagnostics diskette in drive A, the system will now be restarted. Remove the Diagnostics diskette to prevent the Diagnostics program from starting again.

When you have started Diagnostics directly from DOS, the DOS prompt will now be displayed again.

When you choose the option "No", you can continue running the Diagnostics program.

http://www.computer-museum.net

17.3 System configurations in Diagnostics

In order to enter or change the configuration of the Tulip AT compact 3 you will have to run the Setup procedure of the Diagnostics program. Below you will find information on some important system configurations provided by the Setup procedure.

17.4 Enable/disable system hard disk controller

The "Disk drives" option provides the possibility to enable or disable the hard disk controller installed.

```
┌──────────────────────────────────────────────────────────────────────┐
│ Diagnostics  V2.04                    Wednesday  November 1, 1989  12:24 pm │
└──────────────────────────────────────────────────────────────────────┘
┌──────────────────────────────────────────────────────────────────────┐
│ Setup    Test    Transport    System_Info                              │
└──────────────────────────────────────────────────────────────────────┘
   ┌──────────────────┐
   │Real Time Clock   │
   │Disk Drives       │
   │Memory            │
   │Clock frequencies │
   │Configuration     │
   │Security          │
   └──────────────────┘
      ┌───────────────────────────────────────────────────────────┐
      │                       Disk Drives                          │
      ├───────────────────────────────────────────────────────────┤
      │ Floppy disk drive A:        1.44 Mb DS/HD unit (3.5")       │
      │ Floppy disk drive B:        None                           │
      │                                                            │
      │ Hard disk drive C:          17 ...                         │
      │ Hard disk drive D:           0 ...                         │
      │ System Hard Disk Controller: Enable                        │
      │ First boot from:            Floppy Disk Unit               │
      └───────────────────────────────────────────────────────────┘
```

<Ctrl PgUp> Previous, <Ctrl PgDn> Next, <Enter> Select, <F1> Help, <Esc> Exit
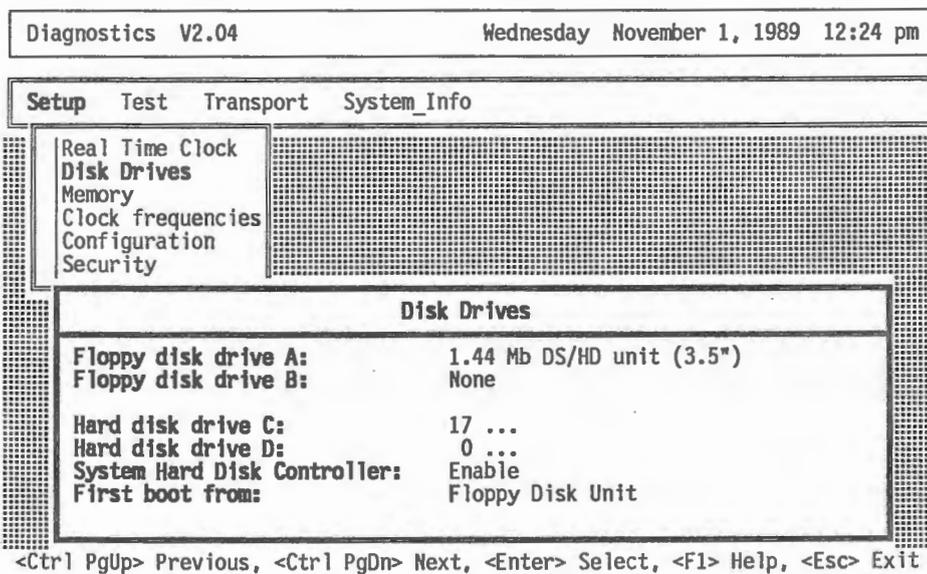
FIGURE 16: Enabling / disabling the embedded hard disk controller

As the Tulip AT compact 3 will be delivered standard with an embedded hard disk controller, the "System hard disk controller" item is enabled. In case you want to use another hard disk controller, you will have to disable the hard disk controller installed on the main board to prevent conflict.

Note that disabling of the system floppy disk controller, which is standard enabled, is automatically executed by the system. The system floppy disk controller will be disabled if a floppy disk controller on an expansion card has been installed in the Tulip AT compact 3.

17.5 Enable/disable system ports

The "Configuration" option allows to enable or disable the system ports (serial port 1 and 2, parallel port).

```
┌──────────────────────────────────────────────────────────────────┐
│ Diagnostics  V2.04              Wednesday  November 1, 1989  1:56 pm │
└──────────────────────────────────────────────────────────────────┘

┌──────────────────────────────────────────────────────────────────┐
│ Setup   Test   Transport   System_Info                             │
├──────────────────────────────────────────────────────────────────┤
│ Real Time Clock                                                    │
│ Disk Drives                                                        │
│ Memory                                                             │
│ Clock frequencies                                                  │
│ Configuration                                                      │
│ Security                                                           │
│                          ┌─────────┐                               │
│                          │  Port   │                               │
│              System      │ Enable  │ guration                      │
│ Vi                       │ Disable │                               │
│ No  System serial port 1:└─────────┘         Enable                │
│ Ar  System serial port 2:                    Enable                │
│ Pr  System Parallel Port:                    Enable                │
│     Parallel port address:                   378h                  │
└──────────────────────────────────────────────────────────────────┘
```
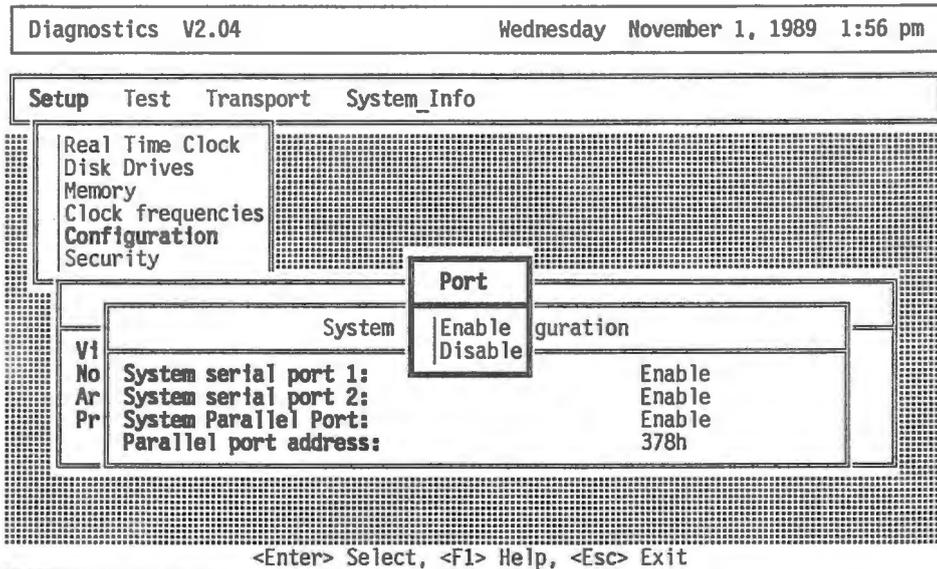
<Enter> Select, <F1> Help, <Esc> Exit
FIGURE 17: Port enable / disable

A system port should be disabled in the following situations:
If a port on an expansion card uses the same address.
If an expansion card (e.g. network card) uses the same address or interrupt.

The table below shows the correct address and interrupt settings for both serial ports and the parallel port of the Tulip AT compact 3.

Port	Address	Interrupt
Serial port 1	3F8h	4
Serial port 2	2F8h	3
Parallel port	378h/278h (1)	7/5 (1)

1)software selectable
FIGURE 18: Port interrupts and addresses

17.6 Clock frequencies

The "Clock frequencies" option allows to (permanently) set the processor speed (CPU clock), bus speed and coprocessor speed. The following settings are possible:

CPU clock	Bus clock	Coprocessor clock
Slow (7.15 MHz)	Slow **	Slow (8 MHz)
Normal (12.5 MHz) *	Fast */**	Fast (12.5 MHz) *

FIGURE 19: Possible clock speeds

*)Default setting
**)Is only available when processor speed is set to "Normal".

```
Diagnostics  V2.04                    Wednesday  November 1, 1989  1:53 pm

 Setup    Test   Transport   System_Info
       Real Time Clock
       Disk Drives
       Memory
       Clock frequencies
       Configuration
       Security
                           Clock frequencies
        CPU clock:              Normal

        Bus clock:              Fast



<Ctrl PgUp> Previous, <Ctrl PgDn> Next, <Enter> Select, <F1> Help, <Esc> Exit
```

FIGURE 20: Setting clock speeds in the diagnostic program

17.7 Changing the processor speed by keyboard

Special software has been implemented in the Tulip AT compact 3 which allows you to temporarily change the processor speed. Two possible options can be chosen: 12.5 MHz and 7.15 MHz. (When you power off the system, the setting of the processor speed will be lost.)

The processor speed can be selected by pressing the ctrl and alt keys and one of the number keys on the numeric keypad (at the right on your keyboard) simultaneously. Each time the processor speed is changed, the system will generate a beep. If you choose the processor speed which is currently set, the system will not generate a beep.

The following table lists the possible processor speed selections and the key sequences to be pressed.

Processor speed	Key sequence
7.15 MHz	ctrl+alt+1
12.5 MHz	ctrl+alt+2

FIGURE 21: Speed switching with the keyboard

Note:

It is not possible to change the processor speed if "CPU clock" and "Bus clock" in Diagnostics are set to "Normal" and "Slow" respectively.

17.8 Memory configuration

```
┌──────────────────────────────────────────────────────────────────┐
│ Diagnostics  V2.04                   Wednesday  November 1, 1989  12:26 pm │
└──────────────────────────────────────────────────────────────────┘
┌──────────────────────────────────────────────────────────────────┐
│ Setup   Test   Transport   System_Info                             │
├───────────────────────┐                                            │
│ Real Time Clock        │                                           │
│ Disk Drives            │                                           │
│ Memory                 │                                           │
│ Clock frequencies      │                                           │
│ Configuration          │                                           │
│ Security               │                                           │
└────────────────────────────────────────────────────────────┐       │
│                           Memory                             │       │
├──────────────────────────────────────────────────────────────┤     │
│ Memory in bank 0:              512 Kbit DRAM                  │       │
│ Memory in bank 1:              None                          │       │
│ Mapping of 384 Kb:             Not used                      │       │
│ Extended memory (Kb):          0                             │       │
└──────────────────────────────────────────────────────────────┘     │
└──────────────────────────────────────────────────────────────────┘
<Ctrl PgUp> Previous, <Ctrl PgDn> Next, <Enter> Select, <F1> Help, <Esc> Exit
```
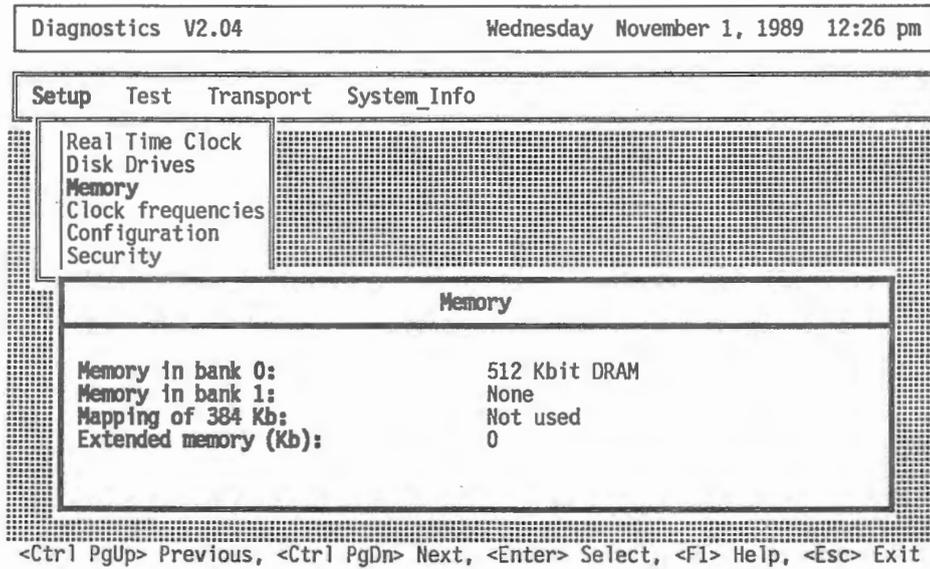
FIGURE 22: Configuring the memory

If the memory has to be configured the above screen is produced by the diagnostic program. Refer to the chapter "memory" for detailed information about the different possibilities.

Remark: 512 Kbit DRAM in bank 0 means: there are 16 chips of 512K * 1 bit installed, so total = 1 Mb!

18 ERROR MESSAGES

During power on procedure, a number of error messages might appear on your screen. These messages are listed below with a short description of their (possible) causes and of the procedures used to correct them.

Configuration not set (run DIAGNOSTICS)
The configuration indicated by you is not correct (memory size, display adapter, diskette drives, etc.).
Run Diagnostics again with the correct input.

Diskette drive 0/1 seek failure
Drive is not available or not correctly connected.
Run Diagnostics and make sure that the settings of the floppy drive are correct. If the same message appears again, check whether the cables have been correctly connected to the floppy disk controller.

Diskette read failure. Hit any key to retry boot
The diskette is either not formatted or defective.
Replace the diskette with a system diskette and retry boot. If the same message appears again, check whether the disk drive has been correctly connected.

Display adapter failed; using alternate
The color/monochrome switch on the DGA card is set wrong.
Change the switch to the correct setting.
The primary video adapter failed.
Check the primary video adapter.

Hard disk controller disabled
Hard disk controller is disabled by BIOS
Run Diagnostics and make sure the "System Hard Disk Controller" item within the "Configuration" option is disabled to avoid future conflicts.

Hard disk 0/1 error
The hard disk is not formatted.
Check if you have entered an incorrect type of the hard disk installed during the Diagnostics program and if the batteries are empty. If none of these two situations applies, you should contact your local dealer.

Hard disk 0/1 failure
The hard disk is not connected correctly.
Make sure the cable of the hard disk is correctly connected.

Keyboard stuck key failure
A key is (or more keys are) jammed or you have pressed a key during the starting procedure.
Restart your system. If the same problem should occur again, check which key(s) is (are) jammed.

No boot device available - hit any key to retry boot
Either diskette drive A, the hard disk, or the diskette itself is defective.
Retry boot. If that does not work, replace the floppy diskette and make sure that the hard disk is formatted.

No boot sector on hard disk - hit any key to retry boot
The C: drive is not formatted or is not bootable.
Make sure that the hard disk contains the MS-DOS system files.

Not a boot diskette - hit any key to retry boot
The diskette in drive A is not formatted as a system diskette.
Replace the diskette by a system diskette and retry boot.

Parallel ports conflict - Port 378h disabled.
Parallel port is disabled by BIOS
Run Diagnostics and make sure that the system parallel port is set to address 278h (in case this address is not used) or is disabled.

Serial ports conflict - COM 1/COM 2 disabled
System Serial port 1/2 is disabled by BIOS
Run Diagnostics and make sure that system serial port 1/2 is disabled to avoid future conflicts.

Time-of-day not set (run DIAGNOSTICS)
The Real Time Clock is not running. Probably the batteries are empty.
Check the batteries. After replacing batteries you must run Diagnostics to set the new date, time and configuration. You will find more information on this topic in the paragraph "How to run Diagnostics", earlier in this manual.

19 CONNECTOR PINOUTS TULIP AT COMPACT 3

J27/J29   SERIAL PORTS A+B (9 PIN)

PIN	SIGNAL
1	CARRIER DETECT
2	RECEIVE DATA
3	TRANSMTT DATA
4	DATA TERMINAL READY
5	GROUND
6	DATA SET READY
7	REQUEST TO SEND
8	CLEAR TO SEND
9	RING INDICATOR

J30 PARALLEL PORT:

PIN	SIGNAL	PIN	SIGNAL
1	-STROBE	10	-ACK
2	DB0	11	BSY
3	DB1	12	PE
4	DB2	13	SLCT
5	DB3	14	-AUTO FD
6	DB4	15	-ERROR
7	DB5	16	-INIT
8	DB6	17	-SLCT IN
9	DB7	26	NOT USED

Pins 18 to 25 grounded.

J17 KEYBOARD:

PIN	SIGNAL
1	CLOCK
2	DATA
3	NOT CONNECTED
4	GROUND
5	+5V

J18 FLOPPY DISK INTERFACE:

Pin	Signal	Pin	Signal
2	-LOW DENS	20	-STEP
4	NOT CONNECTED	22	-WDATA
6	NOT CONNECTED	24	-WGATE
8	-INDEX	26	-TRKO
10	-DRSELO	28	-WRPROT
12	-DRSEL1	30	-RDDATA
14	NOT CONNECTED	32	-SIDE
16	-MOTOR ON	34	-DISK CHANGE
18	-DIR		

All odd pins grounded.

Tulip FDC can differ from IBM with regard to motor on and drive select signals

MONITOR CONNECTOR (ON DGA BOARD):

PIN	SIGNAL
1	HORIZONTAL SYNC.
2	VERTICAL SYNC.
3	SIGNAL GROUND
4	INTENSITY
5	VIDEO
6	GROUND

MONITOR:

PIN	SIGNAL
1	GROUND
2	GROUND
3	RED
4	GREEN
5	BLUE
6	INTENSITY
7	COMPOSITE/MONO VIDEO
8	HORIZONTAL SYNC.
9	VERTICAL SYNC.

POWER CONNECTOR J31 + J32:

PIN	SIGNAL
J31/1	NOT USED
2	+5V
3	+12V
4	-12V
5	GND
6	GND
J32/1	GND
2	GND
3	-5V
4	+5V
5	+5V
6	+5V

Remark: The - 5V is made on the mainboard itself by a 7905 chip.
The power supply does not need a -5 V terminal, unless the 7905
is removed.

FRONT ASSY CONNECTOR J12:

PIN	SIGNAL
1	+BAT
2	HDLED
3	-KBLOCK
4	GND
5	GND
6	GND
7	HSPEED
8	PWR LED
9	-SPEAKER
10	+5V

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20 SPECIFICATIONS

Microprocessor (CPU)   Intel 80286
 12.5 MHz
Processor speed   7.15 or 12.5 MHz
 (keyboard and software
 selectable)
Internal memory   1 Mb
 Expandable to 3 Mb on-board
 1 Wait State
Keyboard connector   5-pin DIN connector
Clock/calendar   Battery run CMOS memory
Floppy disk controller   For 5.25 inch and 3.5 inch floppy disk drives
Hard disk controller   Integrated on main board
Parallel port   25-pin connector
 (Centronics compatible)
Serial ports   9-pin connectors
 (RS-232C compatible)
Expansion slots   5 slots
 -one 8-bit slot
   (XT-compatible)
 -four 16-bit slots
   (AT-compatible)
All slots accept cards of full length (and with XT-height)
Keyboard   101/102 keys
 (AT-compatible)
Tulip MS-OS/2 support
LIM EMS 4.0 support
Shadow RAM function

21 OPTIONAL

Tulip Serial Mouse	Microsoft compatible
Numeric coprocessor	Intel 80c287A 12.5 MHz
VGA card and VGA monitor	
TEVA card and CGA/EGA monitor	
Memory expansion	2 Mb
Hard disk	Hard disks of different capacities
Tulip Tape Streamer*	60 Mb, 1.25 Mb/min.
DOS and Novell support	
Tulip MS-OS/2	
Isolan AT controller	

APPENDIX A: DISK SPECIFICATIONS:

EMBEDDED HARD DISK 40 Mb

General:

Product name	Embedded hard disk Miniscribe 40 Mb
Type	8051A
Drive type	17
Actuator type	Rotary voice coil
Number of disks:	2
Data surfaces	4
Read/write heads	4
Servo	embedded
Tracks per surface	768
Track density	1109 tpi
Track capacity	Formatted: 14.336 bytes
Bytes per block	512
Blocks per track	28
Blocks per drive	86016

Performance:

Seek time		Track to track 8 ms
		Average 28 ms
		Maximum 60 ms
Average latency		8.61 ms
Rotation speed		3484 rpm
Controller overhead		1 ms
Data transfer rate		1 Mbyte/second (to/from media)
Data transfer rate		4 Mbyte/second (to from buffer)
Start time	(typ)	10 sec
	(max)	20 sec
Stop time	(typ)	10 sec
	(max)	20 sec
Interleave		1:1
Buffer size		8 Kb

Physical dimensions:

Height	1.625" (4.13 cm)
Length	5.75" (14.61 cm)
Width	4.00" (10.16 cm)
Weight	1.43 lbs (0.65 kg)

Operating environment:

Ambient temperature	5 °C to 50 °C
Relative humidity	8% to 80 %
Maximum wet bulb	26 °C

Power requirements:

DC power	12V DC (± 5%)
	5V DC (± 5%)
Dissipation	8 Watts avg

Reliability:

MTBF	30.000 hours
MTTR	10 minutes typical
Component life	5 years
Data reliability	< 1 non recoverable error in $10\,^\wedge\,12$ bits read

EMBEDDED HARD DISK 20 Mb

General:

Product name	Embedded hard disk Seagate 20 Mb
Type	ST 125A
Drive type	2
Actuator type	Rotary voice coil
Number of disks:	2
Data surfaces	4
Read/write heads	4
Servo	embedded
Tracks per surface	615
Track per inch	824
Bytes per sector	512
sectors per track	17

Performance:

Seek time	Track to track 8 ms
	Average 28 ms
	Maximum 70 ms
Average latency	8.33 ms
Rotation speed	3600 rpm
Data transfer rate	7.5 Mbits/second (to/from media)
Data transfer rate	4 Mbyte/second (to from buffer)
Interleave	1:1

Physical dimensions:

Height	1.625" (4.13 cm)
Length	5.77" (14.66 cm)
Width	4.02" (10.21 cm)
Weight	1.6 lbs (0.73 kg)

Operating environment:

Ambient temperature	10 °C to 45 °C
Relative humidity	8% to 80 %
Maximum wet bulb	26 °C

Power requirements:

DC power	+12V DC (± 5%)
	+5V DC (± 5%)
Dissipation	9 Watts avg

Reliability:

MTBF	50.000 hours
MTTR	30 minutes typical
Component life	5 years
Data reliability	< 1 non recoverable error in $10 \wedge 12$ bits read

FLOPPY DISK 3.5"

General:

Type	Cannon MD 3611
Encoding method	MFM
Track density	135 tpi
Data transfer rate	500 / 250 Kbits / second
Media rotation speed	300 rpm
Latency time	100 ms
Motor start time	500 ms

Capacity:

Unformatted	2Mb / Mb per disk
	12.5 Kb / 6.25 Kb per track
Formatted	1474.6 Kb / 737.3 Kb per disk
Number of tracks	160
Sectors per track	18 / 9
bytes per sector	512

Performance:

Track to track	3 ms
Seek settling time	15 ms
Average access time	94 ms

Power requirements:

DC power	5V ±5%
Consumption	1.0 Watt (operating)
	.02 Watt (stand by)

Operating environment:

Ambient temperature	5 °C - 45 °C
Relative humidity	20 - 80%
Wet bulb temperature	29 °C

Dimensions:

Length	149.5 mm
Width	101.6 mm
Height	25.4 mm
Weight	.43 kg

Reliability:

MTBF	10.000
MTTR	30 minutes

APPENDIX B: JUMPER SETTINGS:

In this appendix al the jumper settings of the mainboard are summarized:

**J20: Embedded hard disk interface
definition: factory set, do not
          change. Refer to page 29.**

```
14  . .  13
    . .
    . .
    .▬.
    . .
    . .
2   . .  1
```
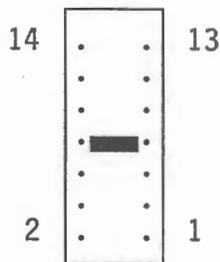
J11: BIOS ROM select. Refer to page 12.

```
. .  .   2x32 Kb (27256)
1 2 3
. . .   2x16Kb  (27128)
```
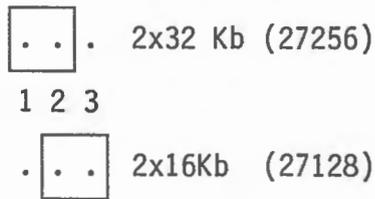
J3,4,5,6: Memory size select. Refer to page 20.

```
   1 2 3 4 5 1 2 3 4 5 6
J4 . . . . . . . . . . .  J3
J5 . . . . . . . . . . .  J6
```
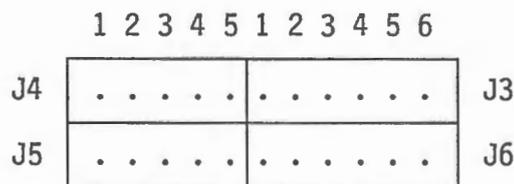
Keyboard dipswitches. Refer also to page 25.

```
 .
   . . .
```
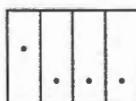
Fan speed: this jumper is in the power supply. Refer to page 31.

Low speed.

High speed.

J8:
   out: 4 normal (alkaline) bateries.
    in: 3 normal bateries.

J15: VIDEO. See also page 30.

pin 1-2: Monochrome card installed.

1 2 3

pin 2-3: CGA or TEVA-2 card installed.

When a DGA card is installed, the DGA cable should be connected to pin 2-3: red to pin 3, black to pin 2.
When a VGA card has been installed, the jumper setting does not apply.