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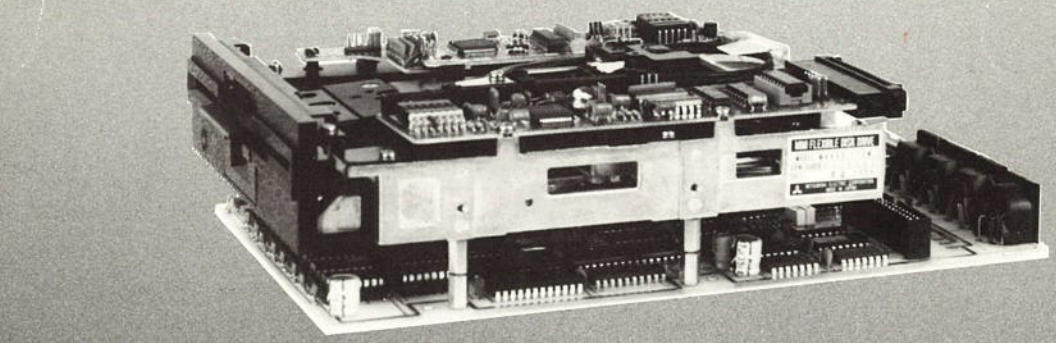
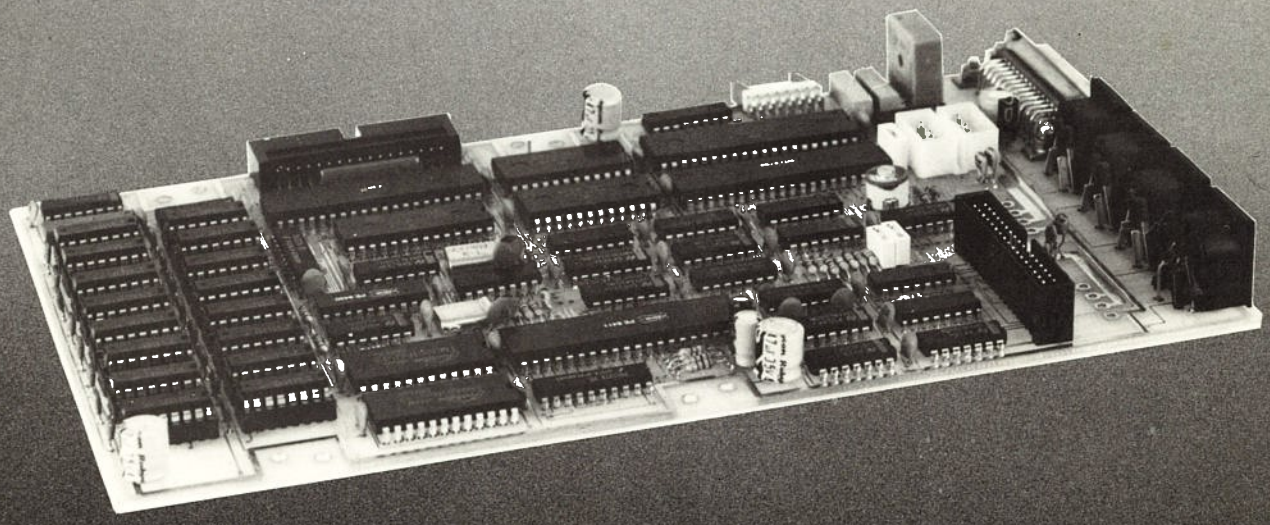
PROTON

# COMPACTBOARD 80

HARDWARE





# COMPACTBOARD-80 tm

## USER MANUAL

<< For revision level 1 board >>

(IBM keyboard
- 250/500 kbyte FDD rate)

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The NETHERLANDS

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CONTENTS

# CHAPTER 1 INTRODUCTION

The Proton compactboard 80 is a complete computersystem integrated on a single printed circuit board. The board fits under a 5.25 inch floppy-disk drive and is provided with on-board connectors for all interfaces.

## 1.1 Specifications

### 1.1.1 Functional specification

The main buildingblocks of the compactboard 80 are:

* Fast Z80 CPU (8 Mhz)
* 64/128 K RAM
* Video-screen controller 80x24 and 40x24
* Keyboard interface
* Floppydisk controller (1-4 drives SD/DD 40/80 tracks)
* Parallel printer interface
* 1 RS232 Input & 2 RS232 outputs

### 1.1.2 Performance

| | | |
|---|---|---|
| * Processor clock | 8 | Mhz |
| * Video bit-rate | 12 | Mhz |
| * Floppydisk bit-rate (Single Dens.) | 125 / 250 | Kbit/s FM |
| (Double Dens.) | 250 / 500 | Kbit/s MFM |
| * RS232 (main) baudrates | 19200, 9600 | Baud |
| | 4800, 1200 | |
| | 300, 75 | |
| * RS232 (aux) output | 9600, 75 | Baud |
| * Keyboard input | 1200 | Baud |
| * Parallel printer port strobe | 4 | uS (min) |

### 1.1.3 Physical

| | | |
|---|---|---|
| * DC Power requirements (without diskdrives) | 4.5 | Watt |
| DC current on +5V | 0.90 | Amp (typ.) |
| DC current on +12V and -12V | 0.02 | Amp (typ.) |

Note: To calculate the total system energy requirement, add the current of the diskdrives used in the application to these values.

| | | |
|---|---|---|
| * Operational environmental conditions | | |
| Ambient temperature (min) | 5 | degree Celcius |
| Ambient temperature (max) | 50 | |
| Relative humidity | 20 - 80 % | non-condensing |
| * Non-operational environmental conditions | | |
| Ambient temperature (min) | -15 | degree Celcius |
| Ambient temperature (max) | 80 | |
| Relative humidity | 5 - 95 % | |

### 1.1.4 Reliability

| | | |
|---|---|---|
| MTBF (Mean time between failure) | > 10000 | Power-on hour |
| MTTR (Mean time to repair) | 20 | minutes |
| Unit life | 30000 | Power-on hours |

# CHAPTER 2 Operation of major components

## 2.1 Power-on sequence

The on-board PROM of the Compactboard 80 contains a set of monitor functions which support operation on normal video and keyboard as well as operation on the main RS232 channel. After Power-on the buzzer will sound. When the keyboard input or the RS232 input receives a character the machine language monitor is invoked. When after 2 seconds no character is received, the program will start the bootstrap procedure.
The bootstrap loader will load sector 1 of track 0 and place it at address FA00 (hex). If the **exclusive or** of the 4th and 5th byte of the sector results in FF (hex) the loader will jump to this location to let this program take over.
The sector size can be any standard size from 128 to 1024 bytes. The format pattern on disk must be readable by the 2793 floppy-controller, double density (IBM 34).
When the boot diskette is incorrect, an error message will be shown and the monitor will be entered. Messages are:

| | |
|---|---|
| Seek error | The drive read a wrong track or sector. |
| Read error | The drive read a bad sector. |
| No system on this disk | The diskette is not for this computer or no system was written on the disk after format. |

The monitor prom may be patched for own installation on the following locations:

| | | |
|---|---|---|
| 0080 | 00 | disk number for automatic boot |
| 0081 | 00 | ASCII (FF) or IBM (00) keyboard flag |
| 0082 | 95 | Initial IObyte value on boot. |
| 0083 | FF | Double density mode on boot. (00 = Single Dens.) |

## 2.2 Video functions

The video-routines in the PROM supports most functions of the televideo TVI 950. For program installation this terminal can be used as a standard. Note: Because the video functions are processor-controlled all delays for terminalfunctions may be zeroed.

| function | command |
|---|---|
| **CURSOR control** | |
| Home | ^^ |
| New line | ^ |
| Carriage return | ^M |
| Linefeed/down | ^J, ^V, ESC B |
| Up | ^K, ESC A |
| Backspace/left | ^H, ESC D |
| Right | ^L, ESC C |
| **EDIT control** | |
| Erase to end of line | ESC T |
| Erase to end of screen | ESC Y |
| Clear screen | ESC *, ESC +, ^Z |
| Char insert | ESC Q |
| Char delete | ESC W |
| Line insert | ESC E |
| Line delete | ESC R |

## PROGRAM control

| | |
|---|---|
| Load cursor location r/c | ESC = RC |
| Read cursor location r/c | ESC ? |
| Read cursor contents | ESC @ |
| Bell | ^G |
| Load status-line | ESC f <text> ^M (CR)<br>[cursor position will be lost] |
| Turn status line on | ESC g |
| Turn status line off | ESC h |

## VIDEO control

| | |
|---|---|
| Normal | ESC G 0, ESC m |
| Blank (normal) | ESC G 1 |
| Blink | ESC G 2 |
| Blank (blink) | ESC G 3 |
| Inverse | ESC G 4, ESC 1 |
| Blank inverse | ESC G 5 |
| Inverse (blink) | ESC G 6 |
| Blank (inverse blink) | ESC G 7 |
| Underline | ESC G 8 |
| Blank underline | ESC G 9 |
| Underline blink | ESC G : |
| Blank (underline blink) | ESC G ; |
| Inverse underline | ESC G < |
| Blank (inverse underline) | ESC G = |
| Inverse blink underline | ESC G > |
| Blank (inverse blink underline) | ESC G ? |
| Half intensity on | ESC ) |
| Half intensity off | ESC ( |
| Semigrafic mode on | ESC $ |
| Semigrafic mode off | ESC % |

## COLOR/INTENSITY setting and test

| | |
|---|---|
| Foreground (n = 0,1,2,3,4,5,6,7) | ESC _ n |
| Halftone (n = @,A,B,C,D,E,F,G) | ESC _ n |
| Background (n = P,Q,R,S,T,U,V,W) | ESC _ n |
| Show all characters | ESC _ % |

## CURSOR Style

| | |
|---|---|
| No displayed cursor | ESC . 0 |
| Blinking block cursor | ESC . 1 |
| Steady block cursor | ESC . 2 |
| Blinking underline cursor | ESC . 3 |
| Steady underline cursor | ESC . 4 |

### 2.2.1 Functional description of the video functions

CURSOR control.
The cursor can be moved across the screen using the codes for cursor control. When the cursor is on the bottom line and moved down, the screen will scroll up automatically. All rows are shifted up one position, the top row will be removed from the screen.
The status line is not scrolled.

EDIT control
All functions designated with ´erase´, will not operate on the full screen but only from (and including) the cursor location. Functions designated with ´clear´ operate on the full screen.

PROGRAM control
The cursor location is addressed by row and collumn. The row/collumn code are given as a character. The space represents a one (1), the ! a two (2) and so on. To address the 5th character position on the top row use a space for the row code and the $ for the collomn code. The cursor read back funcktion uses the same codes.

VIDEO control
The video attributes are selected on a character by character bases (non-embedded attributes) and are active only on characters written after the selection. Standard attributes are:

| | |
|---|---|
| Inverse | reverses the foreground/background color. |
| Underline | activates the underline of a character. |
| Blink | will flash the character on and off. |
| Blank | will write a space character for each character send to the screen. |

The normal alphanumeric characterset is given in table 2.1. Empty places in the table will give no reaction on the screen. The semigrafic character set displays the characters space (20h) till underscore (5Fh) conform the EPSON MX-80 semigrafic set (See table 2.2). Control functions will operate normally, video control functions will override the grafic mode.

All attributes are cleared by a clear screen function.

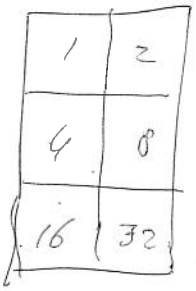
The video functions of the Compactboard are extended with a number of codes which allow compatibility with software of some other computers. When installing programs, use the video functions which are standard on a Televideo terminal 950.

table 2.1 Alphanumeric character set

| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 |
| 0 | 0000 | | | SP | 0 | @ | P | ` | p |
| 1 | 0001 | | | ! | 1 | A | Q | a | q |
| 2 | 0010 | | | " | 2 | B | R | b | r |
| 3 | 0011 | | | # | 3 | C | S | c | s |
| 4 | 0100 | | | $ | 4 | D | T | d | t |
| 5 | 0101 | | | % | 5 | E | U | e | u |
| 6 | 0110 | | | & | 6 | F | V | f | v |
| 7 | 0111 | BEL | | ' | 7 | G | W | g | w |
| 8 | 1000 | BS | | ( | 8 | H | X | h | x |
| 9 | 1001 | | | ) | 9 | I | Y | i | y |
| A | 1010 | LF | CLS | * | : | J | Z | j | z |
| B | 1011 | VT | | + | ; | K | [ | k | → |
| C | 1100 | FF | | , | < | L | \ | l | \| |
| D | 1101 | CR | | - | = | M | ] | m | ← |
| E | 1110 | | HOME | . | > | N | ^ | n | ° |
| F | 1111 | | NEW LINE | / | ? | O | _ | o | ▮ |

table 2.2 Semigrafic character set

| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 |
| 0 | 0000 | | | | | | | | |
| 1 | 0001 | | | | | | | | |
| 2 | 0010 | | | | | | | | |
| 3 | 0011 | | | | | | | | |
| 4 | 0100 | | | | | | | | |
| 5 | 0101 | | | | | | | | |
| 6 | 0110 | | | | | | | | |
| 7 | 0111 | BEL | | | | | | | |
| 8 | 1000 | BS | | | | | | | |
| 9 | 1001 | | | | | | | | |
| A | 1010 | LF | CLS | | | | | | |
| B | 1011 | VT | | | | | | | |
| C | 1100 | FF | | | | | | | |
| D | 1101 | CR | | | | | | | |
| E | 1110 | | HOME | | | | | | |
| F | 1111 | | NEW LINE | | | | | | |



## CHAPTER 3 Jumper selections

The compactboard 80 has only a few features that are hardware selected by means of a jumper. Other features are software selected.

### 3.1 Main RS232 baudrate

The baudrate of the Main RS232 channel is selected by pins 3 thru 8 of jumper J1 (See J1-table).

### 3.2 Aux. RS232 baudrate

The baudrate of the ~~Main~~ Aux RS232 channel is selected by pins 1 or 2 jumper J1 (See J1-table).

| J1 nr | | Baudrate (ascii kb) | Baudrate (IBM -keyb) |
|---|---|---|---|
| Aux | 1 | 9600 | NVT |
| | 2 | 75 | 1200 |
| Main | 3 | 19200 | 19200 |
| | 4 | 9600 | 9600 |
| | 5 | 4800 | 4800 |
| | 6 | 1200 | 1200 |
| | 7 | 300 | 300 |
| | 8 | 75 | 75 |

Note the position of pin 1 of the jumper block is close to IC33.

The format of the serial data is default 1 start bit, 8 data bits, no parity, 2 stopbits.

### 3.3 Processor clock-speed

The clock-speed of the Z80 can be chosen from two internal sources (6 and 8 Mhz). The 6 Mhz frequency is derived from the 12 Mhz videoclock. The 8 Mhz frequency is generated by a 16 Mhz oscillator. This is the standard configuration in which the compactboard 80 is shipped. The choice of operating frequency is made by jumper J2 which is already strapped for 8 Mhz operation on the printed circuit board. For 6 Mhz operation a jumper is installed on J2 pin 2-3 (Note that the connection between pin 1-2 must be cut).
On both clock speeds, 1 WAIT state is inserted on every memory and I/O cycle yielding an effective processor speed of approximately 6.8 Mhz.

### 3.4 External video synchronisation

The videocontroller of the compactboard 80 can operate as a 'slave'-unit. It can be synchronized to an external videosignal. The pins 1-2 of J3 are normally connected (internal video generation). Disconection allows external synchronisation of the videosignal. Detailed description for external synchronisation is found in the Compactboard-80 Service Manual (purchased separately).

### 3.5 IBM type vs ASCII serial keyboard

The Compactbvoard-80 allows the interface to an IBM type keyboard (standard setting) or an ASCII serial keyboard. To change the board for ASCII input, jumpers J4 and J5 must be changed and the monitor prom must be changed and re-programmed (see section 2.1).
The serial keyboard must have a data format of 8 databits, no parity and 2 stopbits at 1200 baud.

| | IBM type | ASCII serial | ASCII via Aux port |
|---|---|---|---|
| J4 | 1-2 | 1-2 | 2-3 |
| J5 | 1-2 | 2-3 | 2-3 |

## CHAPTER 4 Electrical interface

The Compactboard 80 has a number of external interfaces. All connections of these interfaces will be outlined:

- Floppy-disk (signal and power)
- Keyboard (signal and power)
- Video monitor
- Power supply
- Main RS232
- Auxiliary RS232
- Parallel printer
- Bus expansion

### 4.1 FLOPPY-DISK interface

The interface to the floppydisk is Shugart compatible and uses a 34 wire flat-cable connector. The board can address up to four drives. The drives must be strapped to load the head on ´drive-select´, start the motor on ´motor-select´.
Standard layout of the board is for drives with a ´ready´ signal (J6 = 1-2). For drives without a ready signal, cut the J6 1-2 trace and connect J6 2-3, then the Compactboard-80 generates a ready signal after 800 mS. The motor is assumed to be at the correct speed in that time. The motor will stop running when no drive is selected for more than approximately 10 sec.

Connector pin arrangement K9

| signal | Pin | return |
|---|---|---|
| Not connected | 2 | 1 |
| Not connected | 4 | 3 |
| Drive select 3 | 6 | 5 |
| Index | 8 | 7 |
| Drive select 0 | 10 | 9 |
| Drive select 1 | 12 | 11 |
| Drive select 2 | 14 | 13 |
| Motor on | 16 | 15 |
| Direction select | 18 | 17 |
| Step | 20 | 19 |
| Write data | 22 | 21 |
| Write gate | 24 | 23 |
| Track 00 | 26 | 25 |
| Write protect | 28 | 27 |
| Read data | 30 | 29 |
| Side Select | 32 | 31 |
| Drive Ready | 34 | 33 |

Pins K2, K3

AMP 350543-1

| signal | pin |
|---|---|
| +12 V | 1 |
| GND | 2 |
| GND | 3 |
| +5V | 4 |

## 4.2 The Keyboard interface

The keyboard for the Compactboard 80 revision 1 must be an IBM compatible keyboard.
The bit level data format is 1 startbit, 8 databits, no parity bit. The keyboard must send 'scan-codes' with the 8-th bit low for key contact make and the 8-th bit high for break. It is not allowed for the keyboard to send pulses on the dataline which have no meaning as data.The keyboard can use the powersupply of the compactboard. A recommended keyboard is the K7M from Montary.

Pin-layout of the keyboard connector K4

Connectorlay-out of K4

| signal | | pin | |
|---|---|---|---|
| Clock | (RS232) | 1 | ye |
| Data | DATA | 2 | bk |
| Reset | | 3 | bl |
| Ground | GND | 4 | gn |
| +5V | | 5 | rd |

The Transmit data can be used as an extra printer-output or as transmit-data in a Teletex/Viewdata system. This serial output can be used with 2 baudrates: 9600 and 1200 baud (Jumpers 1 resp. 2 of J1).

## 4.3 The RS232 interface

Connector K6 is the Main RS 232 interface.

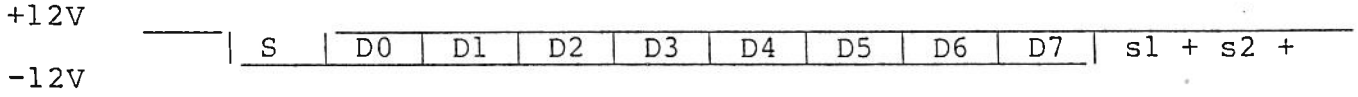
The auxiliary RS 232 connector (K7) is usefull for connecting a serial printer.

Connectorlay-out of K6 and K7
(Main and Aux. RS232)

DEFAULT FORMAT:
8/N/2

| signal | pin | |
|---|---|---|
| Receive Data | 1 | (input) |
| Ground | 2 | |
| Req. to Send | 3 | (output) |
| Clr to send | 4 | (input) |
| Transmit Data | 5 | (output) |

Timing diagram of the serial data (input or output).



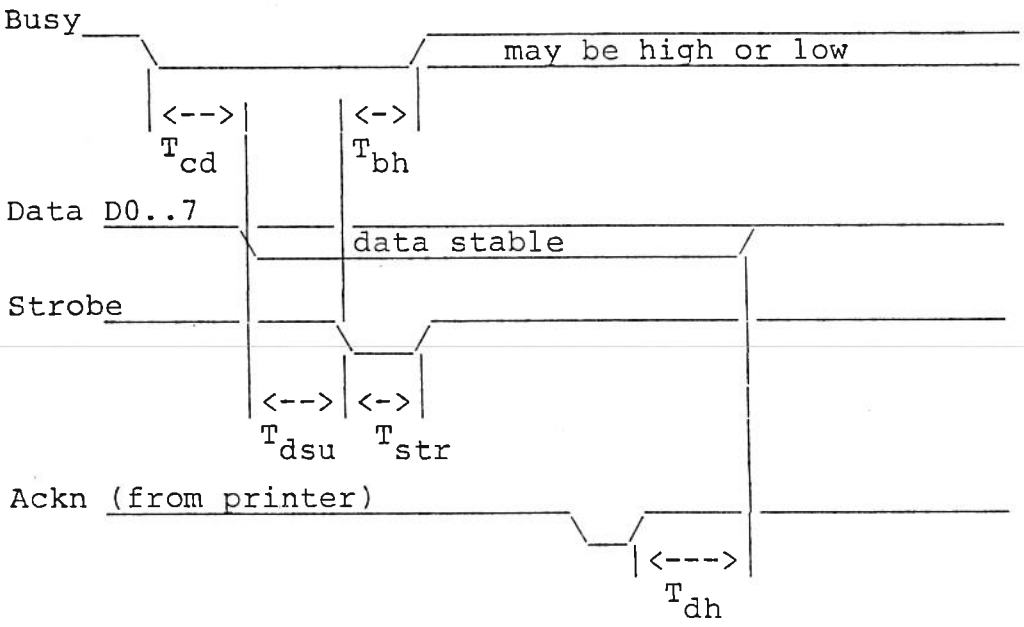

S is Startbit, D0..7 are the DATA bits and s1 and s2 are stopbits.

## 4.4 The printer interface

The printer interface is a Centronics-type interface, compatible with all parallel printers. The layout of the connector K8 is:

| signal | pin | | |
|---|---|---|---|
| -Strobe | 1 | (output) | All outputs of the printer-interface are open-collector buffers which can sinc up to 30 mA. The outputs may be provided with 'on-board' pull-up resistors by adding network RD5 (470 E). |
| Data 1 | 2 | (output) | |
| Data 2 | 3 | (output) | |
| Data 3 | 4 | (output) | |
| Data 4 | 5 | (output) | |
| Data 5 | 6 | (output) | |
| Data 6 | 7 | (output) | |
| Data 7 | 8 | (output) | |
| Data 8 | 9 | (output) | |
| -Ackn | 10 | (input) | |
| Busy | 11 | (input) | |
| Ground | 14 ~~18~~..25 | | |

Timing diagram




| | | |
|---|---|---|
| $T_{dsu}$ | Data setup time | 3 uS (min.) |
| $T_{str}$ | Strobe duration | 5 uS (min.) |
| $T_{dh}$ | Data hold time | 4 uS (min.) |
| $T_{cd}$ | cycle delay | 10 uS |
| $T_{bh}$ | Busy hold | 0 uS |

Note: When the acknowledge from the printer is received, data signals must not be assumed stable after $T_{dh}$.
As long as the BUSY is high a new cycle is suspended.

## 4.5 Video monitor connector

The Video monitor is connector to K5 (6 pol DIN). This connector contains 2 signal types:

1. Composite video Black/White (1 Vtt)
2. R-G-B and Sync. (positive TTL-levels)

The connector layout of K5 is:

| pin | function |
|---|---|
| 1 | Red |
| 2 | Green |
| 3 | Blue |
| 4 | Sync (H & V) |
| 5 | Ground |
| 6 | Comp. Video B/W |

The video signal is 312 lines (non interlace), 50 Hz. The vertical sync has seration pulses to allow proper H-sync during vertical retrace.

## 4.6 Main Power connector

The powersupply for the compactboard 80 is connected to K1. The connector number of K1 is AMP 1-380999-0. The connector pinlayout is given:

| signal | pin |
|---|---|
| GND | 1 |
| GND | 2 |
| +5V | 3 |
| +12V | 4 |
| -12V | 5 |
| not connected | 6 |

## 4.7 Bus expansion connector

The expansion connector K11 is a 40-pole flat-cable connector. The expansion connector has all unbufferd CPU signals, therefore the wiring should be kept as short as possible to prevent bus overloading. When using DMA, don't hold the processor too long, since the ram-refresh will be stopped. (Don't DMA during Disk R/W)
For explanation of the bus-signals see schematic diagrams (Service Manual) and the Z80 data sheets.

Pin arrangement of K11 (Bus expansion)

| signal | pin | type | signal | pin | type |
|---|---|---|---|---|---|
| Ground | 1 | | -INT | 2 | input |
| -NMI | 3 | input | Ground | 4 | |
| -M1 | 5 | output | CLK | 6 | output |
| -MREQ | 7 | output | -IOREQ | 8 | " |
| -RD | 9 | output | -WR | 10 | " |
| -BREQ | 11 | input | -BACK | 12 | " |
| A0 | 13 | in/out | A1 | 14 | |
| A2 | 15 | in/out | A3 | 16 | |
| A4 | 17 | in/out | A5 | 18 | |
| A6 | 19 | in/out | A7 | 20 | |
| A8 | 21 | in/out | A9 | 22 | |
| A10 | 23 | in/out | A11 | 24 | |
| A12 | 25 | in/out | A13 | 26 | |
| A14 | 27 | in/out | A15 | 28 | |
| D0 | 29 | in/out | D1 | 30 | |
| D2 | 31 | in/out | D3 | 32 | |
| D4 | 33 | in/out | D5 | 34 | |
| D6 | 35 | in/out | D7 | 36 | |
| -WAIT | 37 | input | -RESET | 38 | |
| +5V | 39 | | +5V | 40 | |

Note: If a name is preceded by a '-', the signal is active-low.

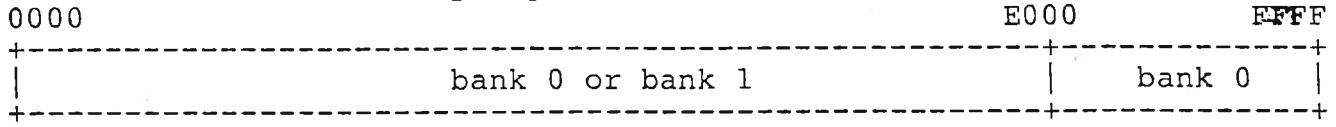
# CHAPTER 5 Memory and I/O addresses

## 5.1 Memory map and Soft switching

### 5.1.1 RAM addresses

The Compactboard 80 has a full 64K (from 0000-FFFF) address space available for transient programs (RAM). For 128K models a bankswitching is provided. This mechanism replaces the Bank 0 ram addresses 0000-DFFF by the ram of Bank 1. This method provides a ´common´ area of ram (E000-FFFF) which is NOT affected by the bankswitch logic.

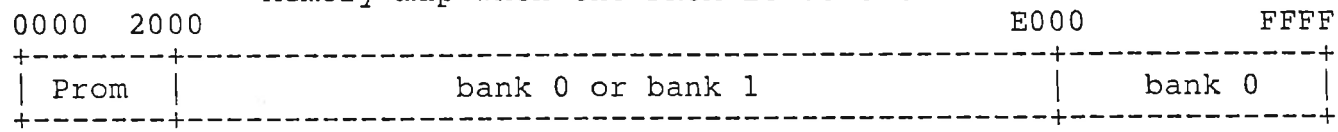
Memory map of the RAM




### 5.1.2 PROM addresses

To provide for a ´power-on´ program (normally a bootstrap loader) an (E)prom (2732 or 2764) is active from address 0000-1FFF. The prom can be deactivated to supply the full 64 K for RAM use.
See for bankswitching BIOS functions (chapter 7).

Memory map when the PROM is selected



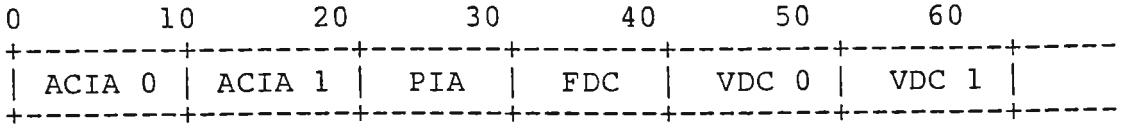

Use bits 6 and 7 for bank and prom switching (see 5.3).

## 5.2 I/O map

All I/O-devices have registers for read and write, thus the address map of the input-ports and the address map of the output ports are exactly the same. The following I/O-address table gives the portnumbers of the devices:

| device | Output register | Input register | port address (hex) |
|---|---|---|---|
| ACIA 0 | Control | Status | 00 |
| | Transmit Data | Receive Data | 01 |
| ACIA 1 | Control | Status | 10 |
| | Transmit Data | Receive Data | 11 |
| PIA | Data A | Data A | 20 |
| | Control A | Control A | 21 |
| | Data B | Data B | 22 |
| | Control B | Control B | 23 |
| FDC | Commands | Status | 30 |
| | Track number | Track number | 31 |
| | Sector number | Sector number | 32 |
| | Data | Data | 34 |
| VDC 0 | Reg0 | Reg | 40 |
| VDC 1 | Reg1 | Data | 50 |

I/O-map:



## 5.3 Soft switches

The Compactboard 80 has a number of hardware features that can be controlled by software. The functions are Bank select, Prom enable and floppy disk control.

The functions are controlled by the PIA A-port. The following table shows the bit number and its function.

PIA port A (address 20 hex)

| | |
|---|---|
| bit 0 | Drive select $2^0$ |
| bit 1 | Drive select $2^1$ |
| bit 2 | Drive Side select |
| bit 3 | Enable write precompensation |
| bit 4 | Enable Single density / Buzzer drive |
| bit 5 | Printer BUSY input |
| bit 6 | Memory bank 0 enable |
| bit 7 | Prom enable |
| | |
| CA2 | Enable 8" drives |
| CA1 | 75 Hz input for realtime clock |

All signal names are given in active high logic.

The compactboard offers a 75 Hz square wave at the 6821 on pin CA1. This can be used to support a realtime clock in an interrupt routine.

Bits 0,1,2,3,4 and CA2 are used by the system software within the Combidos BIOS.

## CHAPTER 6 Adjustment

The Compactboard 80 is an almost 'all-digital' board, which results in very few adjustment-points. The only adjustment needed is the analog part of the floppydisk data-separator. This data-separator is incorporated in the 2793 floppydisk controller. Connector K10 is provided for easy accessibility of all test-points. The test-pin connector must have a connection between pin 3 and 5 (test-mode ON).

**Sequence to enter the TEST-MODE**

Adjustments must be made after RESET and entering the machine-code monitor (-DDEN=0, -5/8=1). At this time the 'TEST'-pin (pin 3 of K10) must be grounded to pin 5.
Do NOT insert a floppydisk in the drive.

### 6.1 Floppy VCO

Install the testconnector to K10. Connect a oscilloscope to pin 1, enter the test-mode and set the time-base to 1 **usec/div.** and input-sensitivity to 2 **V/div.** Adjust the period-time to the tablevalue of VCO using capacitor trimmer C3.

### 6.2 Read-data Pulse Width

Install the testconnector to K10. Connect a oscilloscope to pin 2, enter the test-mode and set the time-base to **0.5 usec/div.** and input-sensitivity to **2 V/div.** Adjust the positive pulswidth to the tablevalue of RPW using trimmer **P1.**

Floppy controller adjustment values

| | | |
|---|---|---|
| Data-rate | FM | 125 Kb/s |
| | MFM | 250 Kb/s |
| VCO | | 4.0 uS |
| RPW | | 500 nS |

Note: For systems that must operate at 250/500 Kb/s, the -5/8 signal must be made high. And Capacitor C2 must be made 0.1 uF. For this, it is not possible to use a mix of drives with different data-rates on a system simultaneously. Future revisions may solve this problem.

### 6.3 Write Precompensation time

Install the test-pin connector to K10. Connect a oscilloscope to pin 4 and the ground (pin 5) and set the time-base to **0.5 usec/div.** and input-sensitivity to 2 **V/div.** Adjust the positive pulswidth to the value most suitable for the floppy-drive used. Trimmer **P2** must be used for this adjustment. The value will normally be in the range of 200 - 300 nS (nano seconds). Factory adjustment is 200 nS.
Most modern floppy disk drives do not need the write pre-compensation. The use of write precompensation is software controlled by ENP (PA3 of the 6821).

## CHAPTER 7 Warranty and Service

PROTON Electronics warrants its products to be free from defects in material and workmanship for a period of 6 months from the date of shipment from the factory. If you receive a compactboard that has been damaged in shipment, contact your carrier and process a claim.

### 7.1 Service under warranty

If it is necessary to return the compactboard 80 to PROTON, your distributor will give you a RMN (Return Material Number). All communication regarding the compactboard should reference this number.
The compactboard is to be shipped to PROTON at your expense. PROTON will repair the board at no cost to you and pay for shipping it back via mailservice.

### 7.2 Service out of warranty

If your compactboard is out of warranty when it needs service, you should follow the same procedure to receive a RMN. You will be responsible for all shipping, service and repair costs.

### 7.3 Serial number

The serialnumber of your compactboard 80 is printed in a corner. This will be your reference number for communication with your distributor or our service department.

For service and (re-)installation you can enter the serialnumber, date received and jumper-settings in the table below.

Serial number _____ Date received _____

Jumper-settings

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| J1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| J2 | 1-2 | 2-3 | | | | | | |
| J3 | open/closed | | | | | | | |

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# Printed circuit board layout