

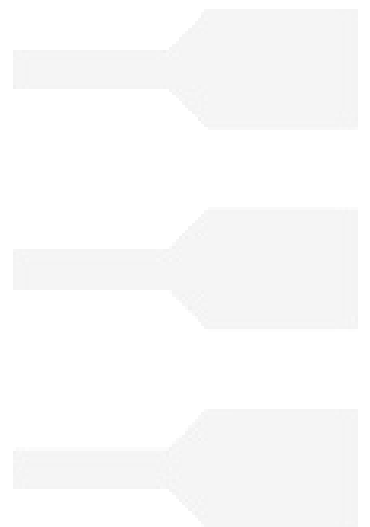


CPU-1454/64

User Manual

MNL-0547-01
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Before proceeding further, please carefully read the following paragraphs:

Safety Notices and warnings

FCC information and compliance

This device has been designed to comply with the limits of a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference. The device generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications or to devices that are not appropriately shielded.

Parvus is not responsible for any radio or device, which may be affected by harmful interference. Appropriate shielding of susceptible devices is not the responsibility of Parvus. Further, Parvus is not responsible for unauthorized modifications of Parvus equipment including the substitution or attachment of cables and/or other unauthorized equipment. If electrical interference is harmfully affecting a device, it is the responsibility of the user to correct this interference.

In order to minimize the affects of electrical interference, use only shielded data cables with the system. In accordance with FCC 15.21, changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Emissions information for Canada

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

CE Marking



This equipment complies with the requirements for CE marking when used in a residential, commercial, vehicular or light industrial environment.

RAEE

The information below is issued in compliance with the regulations as set out by the 2002/96/CE directive, subsequently superseded by 2003/108/CE, and refers electrical and electronic equipment and the management of their waste (WEEE). When disposing of a device, including all of its components, subassemblies and materials that are an integral part of the product, you should take the WEEE directive into consideration.



This symbol has been attached to the equipment or, in the case that this is not possible, on the packaging, instruction literature and/or the guarantee sheet. By using this symbol it states that the device has been marketed after August 13th 2005, and implies that you must separate all of its components when possible, and dispose of them in accordance with local waste disposal legislations.

- Because of the substances present in the equipment, an improper use or disposal of the refuse can cause damage to human health and to the environment.
- With reference to RAEE, it is compulsory to not dispose of the equipment with normal urban refuse, arrangements should be instigated for separate collection and disposal.
- For more detailed information about recycling of RAEE, please contact your local waste collection body.
- In case of illicit disposal, sanctions will be levied on transgressors.

RoHS

This device, including all its components, subassemblies and the consumable materials that are an integral part of the product, has been manufactured in compliance with the European directive 2002/95/EC known as the RoHS directive (Restrictions on the use of certain Hazardous Substances), this directive targets the reduction of certain hazardous substances previously used in electrical and electronic equipment (EEE).

Anti-static precautions



Always use appropriate antistatic precautions when handling any board. This is to avoid damage caused by ESD (Electro Static Discharge).

Conventions

The following table lists the conventions that are used throughout this manual.

Icon	Notice Type	Description
	Information note	Important features or instructions
	Warning	Information to alert you to potential damage to a program, system or device or potential personal injury

The “Mode” of the register:

R/W Read and write register.
RO Read only register.
W Meaning of the register when written.
R Meaning of the register when read.

Hexadecimal numbers:

Hexadecimal numbers are indicated with an “h” suffix (for example: 11Ch).

Other:

NC Not internally connected
Reserved Use reserved to Factory

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Chapter 1 Product Overview

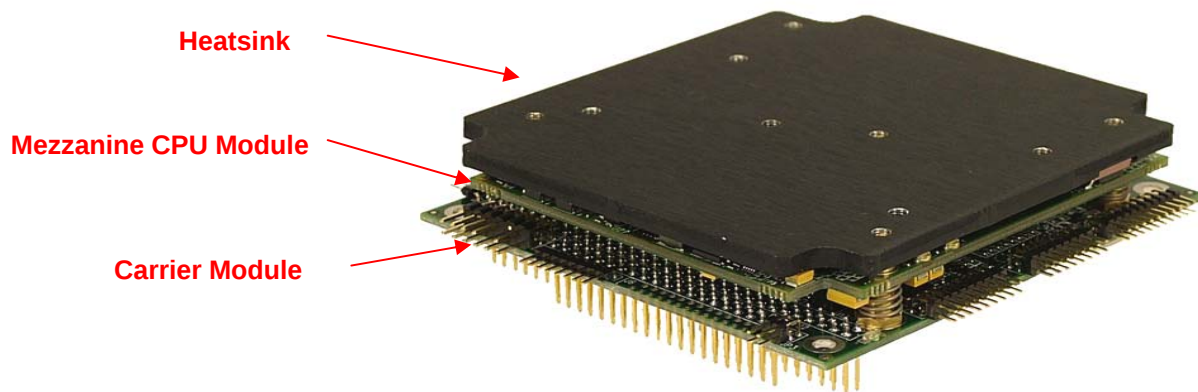
The CPU-1454 and CPU-1464 are two embedded RoHS compliant boards based on a mezzanine CPU module combined with a PC/104-Plus form factor carrier.

In the CPU-1454 the mezzanine CPU module features the Intel® Celeron® 400MHz processor

In the CPU-1464 the mezzanine CPU module features the Intel® Pentium III® 800MHz processor.

Both the CPU-1454 and CPU-1464 feature an Intel® 815E chipset and come with 256MB SDRAM soldered onboard.

The carrier has all the connections to the external world, except for the LCD connector that is available on the mezzanine CPU module.



Related Products Available:

- RJ45 10/100 Ethernet adapter
- RJ45 Gigabit Ethernet adapter
- AC97 adapter
- USB adapters
- 2mm to 2.54mm IDE cable
- Cable Set Kit
- Development Kit

For a complete list of our products visit our website: www.parvus.com

In the following paragraphs, you will find a brief description of the CPU-1454/64 characteristics.

Product Definition

Architecture:

PC/104-Plus compliant

Processor:

Intel® Celeron® 400MHz, 256KB L2 cache, 100MHz FSB in the CPU-1454

Intel® Pentium III® 800MHz, 512KB L2 cache, 133MHz FSB in the CPU-1464

Chipset:

Intel® 815E

Memory:

256MB SDRAM soldered onboard

Supported Operating Systems:

Windows CE®, Windows XPE® and Linux®

BIOS Flash:

1MB Flash EPROM

Interfaces:

- IDE Controller, Ultra ATA
- Serial ports:
 - 1x RS-232
 - 1x RS-232, RS422 or RS485, software configurable
- 4x USB 1.1 ports
- Gigabit Ethernet (1000 Mbps)
- Ethernet (10/100 Mbps)
- Video Controllers:
 - Analog VGA output
 - Digital LVDS output
- Auxiliary Power
- AC97
- Keyboard and Mouse

Bus:

- PC/104-Plus (PCI)
- PC/104 (ISA)

Watchdog:

2-255 seconds / minutes

Power Supply:

Single +5V DC

Chapter 2 Module Layout

This chapter provides a brief description of the layout of the CPU-1454/64 Module.

Connectors are shown as **J** followed by its designated number: a red pad indicates pin 1.

Jumpers are shown as **JP** followed by its designated number

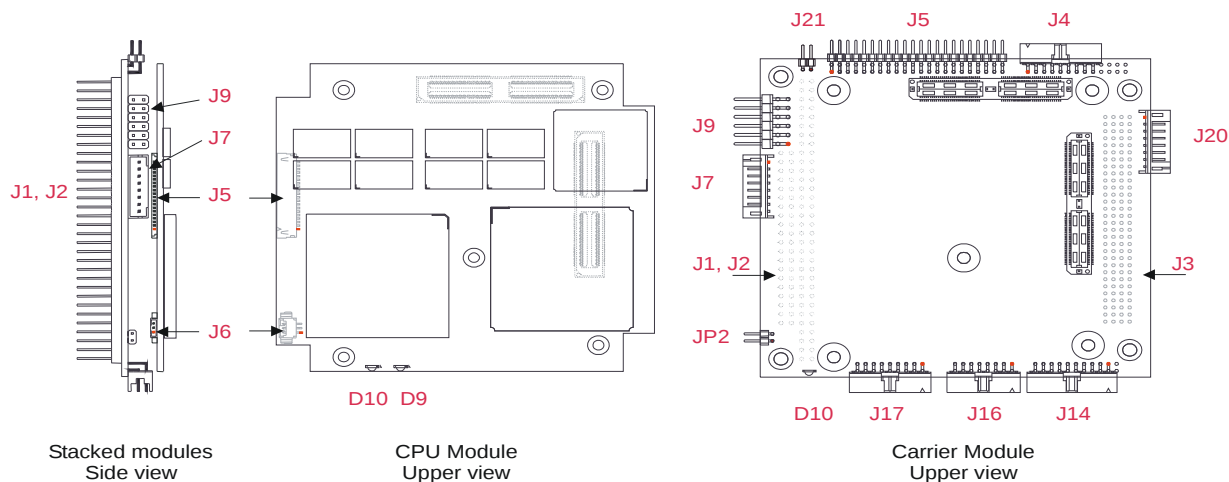


Figure 1. Connector and Jumper layout

CPU Module

Connector #	Function	Qty of pins	Format	Pitch (mm)
J5	Digital LVDS video output	44	SIL 20	1.00
J6	LCD backlight to wire interface	8	SIL 3	1.25

LEDs	Function	Qty of pins	Format	Pitch (mm)
D9	Vdd +5V present	-	Green LED	-
D10	Vcc +3.3V present	-	Green LED	-

Carrier Module

Connector #	Function	Qty of pins	Format	Pitch (mm)
J1	ISA Bus. Location: bottom side only	64	PC104: 32x2	2.54
J2	ISA Bus. Location: bottom side only	40	PC104: 20x2	2.54
J3	PCI Bus. Location: bottom side only	120	PC104PLUS: 30x4	2.00
J4	Multifunction, VGA	18	Minitex 9x2	2.00
J5	IDE/DOM	44	Pin strip 22x2	2.00
J7	USB (Ports 2 and 3)	8	Pin strip 8x1	2.00
J9	Aux. power	12	Pin strip 6x2	2.54
J14	USB 1.1 (Ports 0 and 1), AUDIO	20	Minitex 10x2	2.00
J16	Gigabit Ethernet (1000Mbps)	16	Minitex 8x2	2.00
J17	Serial Ports 1 and 2	18	Minitex 9x2	2.00
J20	Fast Ethernet (10/100Mbps)	8	Pin strip 8x1	2.00
J21	IDE LED	2	Pin strip 2x1	2.00

Jumper #	Function	Qty of pins	Format	Pitch (mm)
JP2	Reserved. Default: Open	2	Pin strip 2x1	2.00

LEDs	Function	Qty of pins	Format	Pitch (mm)
D10	V3s +3.3V stand-by power present	-	Green LED	-

Table 1. Connector and Jumper Functions

How to connect the CPU Module to other PC/104 & PC/104-Plus devices: the stack assembly

The ISA and PCI Bus connectors of the CPU Module are located on the bottom side of the module only, and are designed to allow the connection on the top position of the stack formed by other PC/104 and/or PC/104-Plus devices.

We recommend you to follow the procedure below ensuring that stacking of the modules does not damage connectors or electronics parts.



Always use appropriate antistatic precautions when handling boards

1. Turn off all power to the PC/104 computer and its peripheral devices.
2. Select and install standoffs to properly position the module on the PC/104 stack.
3. Remove the module from its antistatic bag.
4. Check that keying pins in the bus connector are properly positioned.
5. Check the stacking order; make sure an XT bus card are not placed between two AT bus cards as this will interrupt the AT bus signals.
6. Hold the module by its edges and orient it so that the bus connector pins line up with the matching connector on the stack.
7. Using even pressure press the module onto the PC/104 stack.

The figure below shows a module stack with the CPU-1454/64 on the top of two PC/104-Plus modules.

If standard PC/104 modules are used in the stack, they must be the lowest modules because they will normally not include the PCI bus. An adapter module must be used.

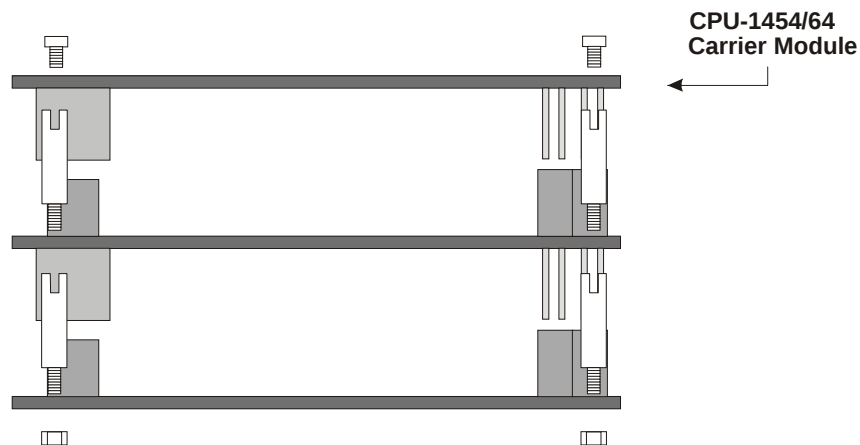


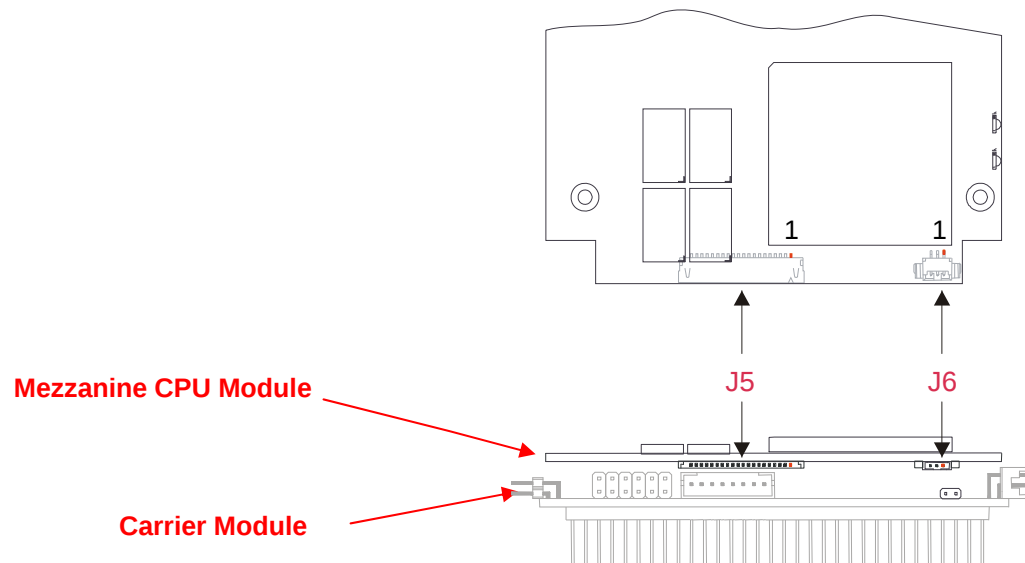
Figure 2. The Module Stack



Do not force the module onto the stack! Wiggling the module or applying too much pressure may damage it. If the module does not readily press into place, remove it, check for bent pins or out-of-place keying pins, and try again.

Chapter 3 Mezzanine CPU Module Connectors

The mezzanine CPU module features two connectors, J5 and J6, for interfacing TFT-LCD displays. They are located on the bottom side.



J5: LVDS video output for TFT-LCD displays

Pin #	Signal	Function
1	Vcc +3.3V	Power supply
2	Vcc +3.3V	Power supply
3	GND	Ground
4	GND	Ground
5	RXIN0-	Receiver signal (-)
6	RXIN0+	Receiver signal (+)
7	GND	Ground
8	RXIN1-	Receiver signal (-)
9	RXIN1+	Receiver signal (+)
10	GND	Ground
11	RXIN2-	Receiver signal (-)
12	RXIN2+	Receiver signal (+)
13	GND	Ground
14	RXCKIN-	Clock signal (-)
15	RXCKIN+	Clock signal (+)
16	GND	Ground
17	RXIN3-	Receiver signal (-)
18	RXIN3+	Receiver signal (+)
19	GND	Ground
20	LVDS_SET	LVDS SET

Table 2. LVDS connector pinout

J6: TFT-LCD backlight to wire interface

Pin #	Signal	Function
1	SCLK_CONN	Clock
2	SDAT_CONN	Data
3	GND	Ground
4	Not Connected	-
5	GND	Ground

Table 3. TFT-LCD display connector pinout

Flat Panel Modes Supported

The CPU-1454/64 supports a variety of flat panel display modes up to a resolution of 1024x768 at 60 Hz, 24 bits per pixel

Chapter 4 Carrier Module Connectors

J1, J2 and J3: buses for PC/104-Plus connectivity

The ISA Bus (J1 and J2) and the PCI Bus (J3) connectors of the CPU-1454/64 are located on the bottom side of the carrier module only, and are designed to allow the connection on the top position of a stack formed by other PC/104 and/or PC/104-Plus devices.

J4: Multifunction and VGA

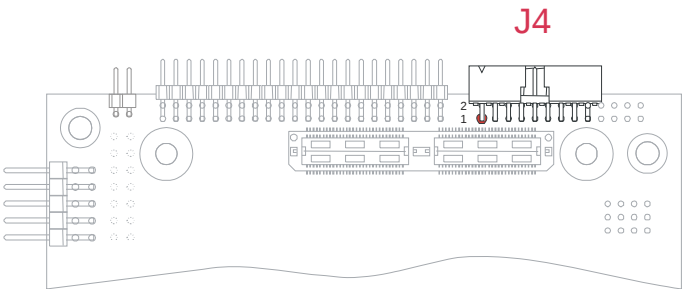


Figure 3. J4 Connector Layout

Pin #	Signal	Function	Pin #	Signal	Function
1	GND_SRV	Multifunction	2	VDD_SRV (+5V)	Multifunction
3	KBDAT	Multifunction	4	KBCLK	Multifunction
5	MSDAT	Multifunction	6	MSCLK	Multifunction
7	BAT_IN	Multifunction	8	SPKR	Multifunction
9	RES_PB_IN	Multifunction	10	GND_VGA	VGA
11	HSYNC	VGA	12	VSYNC	VGA
13	RED_VGA	VGA	14	GREEN_VGA	VGA
15	DDC1_SCL	VGA	16	DDC0_SDA	VGA
17	GNDA_VGA	VGA	18	BLUE_VGA	VGA

Table 4. J4 connector pinout

Multifunction Section

This section of the connector implements the following functions:

- **Keyboard**

An AT compatible keyboard can be connected to the module through connector J4. Table 5 lists the pin-out of connector J4.

Pin #	Signal	Function
1	GND	Ground signal
2	+5V	Power supply
3	KBDAT	Keyboard data
4	KBCLK	Keyboard clock

Table 5. Keyboard connector table

- **Mouse**

A PS/2 compatible mouse can be connected to the J4 connector. Table 5 shows the pin-out for the mouse

Pin #	Signal	Function
1	GND	Ground signal
2	+5V	Power supply
5	MSDAT	Mouse data
6	MSCLK	Mouse clock

Table 6. J4 for Mouse connector

- **System reset**

The connection of the multifunction connector pin 9 to ground performs a hardware reset of the module. It is possible to use an external push-button (normally open) to manually reset the system. The reset signal is “de-bounced” on the board.

- **External Battery**

Pin 7 of the multifunction connector allows the connection of an external backup battery. If you connect a battery, then the voltage must be between 3.0V and 3.9V. This battery is used when the system is powered down to preserve the Real Time Clock data. The typical battery consumption with the module off is 7uA.

- **Speaker**

A transistor that supplies 0.1W to an external speaker controls these outputs. A transistor amplifier buffers the speaker signal. Use a small general-purpose 2” or 3” permanent magnet speaker with an 8-Ohm voice coil. The audio output is based on two signals: one come from the output of Timer 2, and the other come from I/O port 61h compliant with the AT Standard.

The Parvus/Eurotech Multifunction Adapter

The Parvus/Eurotech Multifunction Adapter simplifies the connection of the Multifunction Connector of the CPU module. Please refer to the Application Note An0067 for further information.

VGA Section

Resolution	Bits Per Pixel (frequency in Hz)		
	8-bit Indexed	16-bit	24-bit
320x200	70	70	70
320x240	70	70	70
352x480	70	70	70
352x576	70	70	70
400x300	70	70	70
512x384	70	70	70
640x400	70	70	70
640x480	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 70, 72, 75, 85
720x480	75, 85	75, 85	75, 85
720x576	60, 75, 85	60, 75, 85	60, 75, 85
800x600	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 70, 72, 75, 85
1024x768	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 70, 72, 75, 85
1152x864	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 70, 72, 75, 85
1280x720	60, 75, 85	60, 75, 85	60, 75, 85
1280x960	60, 75, 85	60, 75, 85	60, 75, 85
1280x1024	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 70, 75, 85

Table 7. Partial list of Display Modes Supported

J5 IDE

The CPU-1454/64 module provides an interface for up to two Integrated Device Electronics (IDE) hard disk drives on connector J5.

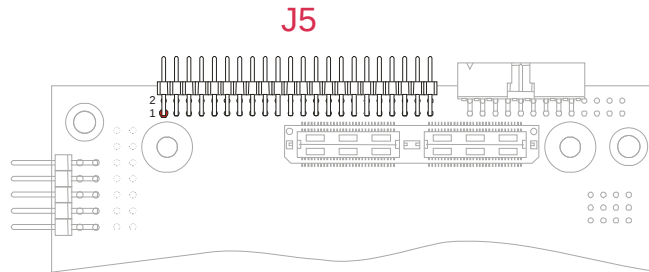


Figure 4. J5 Connector layout

To install the hard disk, perform the following operations:

➤ *Hardware installation*

Connect the hard disk to the module using a data cable, and then connect the hard disk to the power supply according to the device's specifications. Make sure that pin 1 of connector J5 and pin 1 of the drive or drives are correctly connected. Pin 1 of the interface cable is usually indicated by a stripe along the edge of the cable. If two hard disks need to be connected, they must be configured for common operation (i.e. master/slave or cable select connection).

➤ *IDE BIOS Setup*

The hard disk parameters can be configured using the Setup program. If the hard disk is connected to the module without the correct setup configuration (BIOS or Hardware), a time-out of a few minutes may occur.

➤ *Software initialization for specific operating systems*

Refer to the OS documentation.

J7: USB 1.1 (Ports 2 and 3)

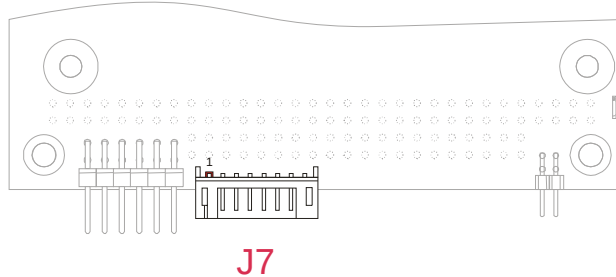


Figure 5. J7 Connector Layout

Pin #	Signal	Function
1	VDD_USB2	USB 2
2	USB2-	USB 2
3	USB2+	USB 2
4	GND_USB_2	USB 2
5	VDD_USB_3	USB 3
6	USB3-	USB 3
7	USB3+	USB 3
8	GND_USB_3	USB 3

Table 8. J7 Connector pin out



WARNING:

USB Ports 2 and 3 have 2A current limiters. It should be noted that the maximum combined power should be kept below 2A.

USB Ports 0 and 1 have no current limit, however the end user should manually limit the power usage of these ports; also the available power is dependent on the Power Supply module that the customer is using.

J9: Auxiliary Power

J9 is an auxiliary power connector and can be used to power the module as an alternative to the PC/104-Plus bus.

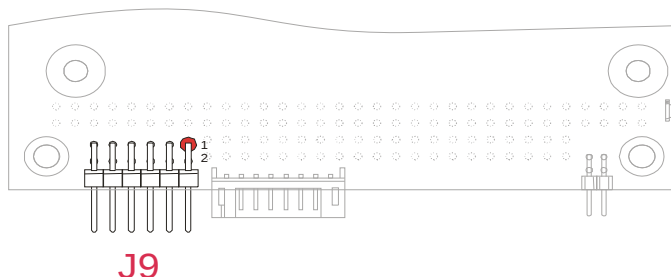


Figure 6. J9 Connector layout

Pin #	Signal	Pin #	Signal
1	GND	2	VDD
3	N.C.	4	+12v
5	-5V	6	-12V
7	GND	8	VDD
9	N.C.	10	PWRBTN#
11	+5VSB ⁽¹⁾	12	PSON# ⁽²⁾

⁽¹⁾ +5VSB: +5 Volts-Always from the ATX Power supply

⁽²⁾ PSON#: Power-On command to ATX Power supply

Table 9. J9 Auxiliary Power Connector

Power button (input)

If the soft power management is enabled, a low signal in this pin turns the system on or off.



Note. The VSB (Volt Stand-By) voltage is useful for Power management applications only.



Note. The +12VDC and -5VDC voltages are neither used nor generated by the CPU-1454/64 module: they are only conveyed on the PC/104-Plus bus (connector J1) and can be used by other devices or modules that are stacked onto the CPU module.



WARNING! IMPROPER CONNECTION OF THE POWER SUPPLY WILL RESULT IN SERIOUS DAMAGE TO THE MODULE.

J14 for USB 1.1 (Ports 0 and 1) and Audio-CODEC

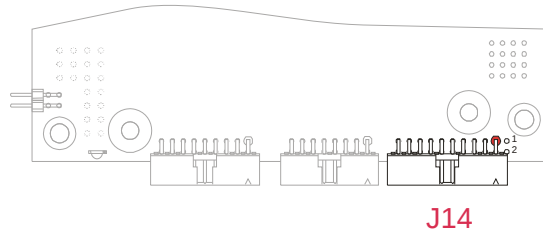


Figure 7. J14 Connector Layout

Pin #	Signal	Function	Pin #	Signal	Function
1	SPKR	Audio Codec	2	SDIN1	Audio Codec
3	SDOUT	Audio Codec	4	CDC_EN#	Audio Codec
5	GND	Ground signal	6	GND	Ground signal
7	SDIN0	Audio Codec	8	BITCLK	Audio Codec
9	RST	Audio Codec	10	SYNC	Audio Codec
11	GND	Ground signal	12	USB Over Current#	USB 0 & 1
13	USB0-	USB 0	14	USB1-	USB 1
15	USB0+	USB 0	16	USB1+	USB 1
17	GND	Ground signal	18	VDD	Power supply
19	GND	Ground signal	20	VDD	Power supply

Table 10. J14 Connector pin out



WARNING:

USB Ports 2 and 3 have 2A current limiters. It should be noted that the maximum combined power should be kept below 2A.

USB Ports 0 and 1 have no current limit, however the end user should manually limit the power usage of these ports; also the available power is dependent on the Power Supply module that the customer is using.

The Parvus/Eurotech USB & AC97-Audio Codec Adapter

Before using a USB and/or an Audio Device, the Parvus/Eurotech Adapters can be connected to the CPU board. The connection between the Parvus/Eurotech adapter and the CPU board is established by a cable set provided with the adapter.

Please refer to the Application Note MNL-0548A-01 for further information.

J16: Gigabit Ethernet

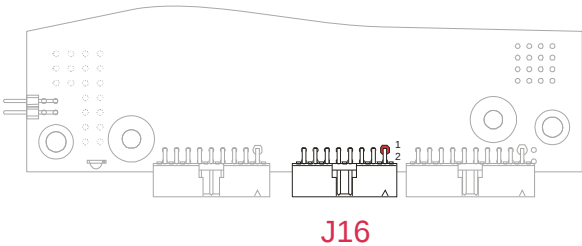


Figure 8. J16 Connector Layout

Pin #	Signal	Pin #	Signal
1	MX-1	2	MX+1
3	MX-2	4	MX+2
5	MX-3	6	MX+3
7	MX-4	8	MX+4
9	-	10	-
11	GND	12	+3.3V
13	LINK LED	14	ACTIVITY LED
15	LINK 100 LED	16	LINK 1000 LED

Table 11. J16 Connector pinout

The Parvus/Eurotech Gigabit Ethernet Adapter

Parvus/Eurotech supplies an adapter that can be placed between the network connector of the CPU board and the network cable for establishing a Gigabit Ethernet connection.

Please refer to the Application Note MNL-0548A-01 and MNL-0549A-01 for further information.

 **Note.** To make a Gigabit Ethernet connection use only Category 6 (or superior quality) cables.

J17: SERIAL1 and SERIAL2

Serial 1 is RS232 only

Serial 2 is RS232, RS422 or RS485, software selectable from BIOS

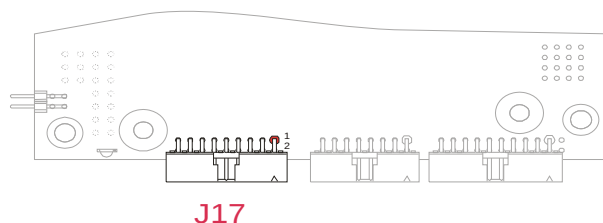


Figure 9. J17 connector layout

Pin #	Signal	Function	Pin #	Signal	Function
1	DCD1	Serial 1	2	DSR1	Serial 1
3	RX1	Serial 1	4	RTS1	Serial 1
5	TX1	Serial 1	6	CTS1	Serial 1
7	DTR1	Serial 1	8	RI1	Serial 1
9	GND	Ground signal	10	DCD2	Serial 2
11	DSR2	Serial 2	12	RX2	Serial 2
13	RTS2	Serial 2	14	TX2	Serial 2
15	CTS2	Serial 2	16	DTR2	Serial 2
17	RI2	Serial 2	18	GND	Ground signal

Table 12. J17 connector pinout (RS232 mode)

RS422				RS485			
Pin #	Signal	Function	In/out	Signal	Function	In/out	Pin #
10	-TX	Transmit data	Out	-TX/-RX	Transmit/Receive data	In / Out	10
11	--	Not connected	--	--	Not connected	--	11
12	+TX	Transmit Data	Out	+TX/+RX	Transmit/Receive data	In / Out	12
13	--	Not connected	--	--	Not connected	--	13
14	-RX	Receive Data	In	--	Not connected	--	14
15	--	Not connected	--	--	Not connected	--	15
16	+RX	Receive Data	In	--	Not connected	--	16
17	--	Not connected	--	--	Not connected	--	17
18	Ground	Signal ground	--	Ground	Signal ground	--	18

Table 13. Serial Port 2 of the J17 connector in RS422-RS485 modes



Note. If the Serial port is used in RS485 mode, the bi-directional line must be controlled via software, using the Data Terminal Ready (DTR) signal of the serial controller.

This signal is defined by bit 0 of the UART Modem Control Register (MCR) and the bi-directional line is controlled as follows:

- Bit 0 of the MCR register = 0 means RS485 line receiving
- Bit 0 of the MCR register = 1 means RS485 line transmitting

The I/O address of the MCR is "Serial port Base address"+4H.

J20: Fast Ethernet

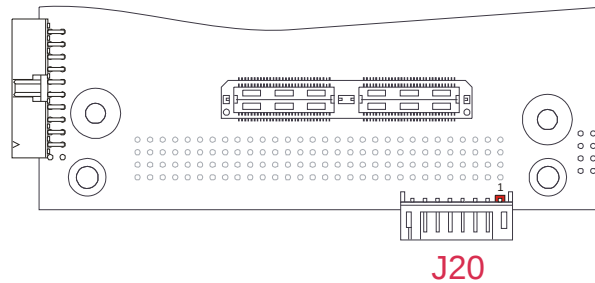


Figure 10. J20 connector payout

Pin #	Signal
1	TX-
2	TX+
3	GND
4	LINK LED
5	RX-
6	RX+
7	ACTIVITY LED
8	+3.3V

Table 14. J20 connector pinout

The Parvus/Eurotech Ethernet Transceiver

To establish an Ethernet connection an Ethernet Transceiver must be used. Parvus/Eurotech supply a Transceiver that can be placed between the J20 CPU board connector and the network cable.

Please refer to the Application Note An0066 and An0067 for further information.

J21: IDE LED

J21 makes available to connect a LED for signalling activity on the IDE BUS

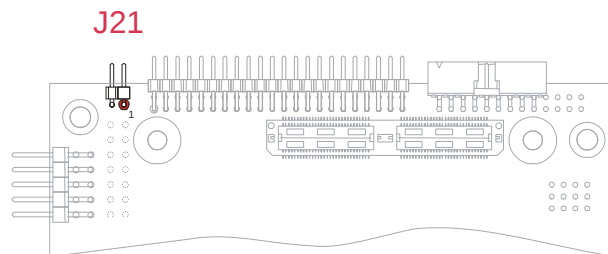


Figure 11. J21 connector layout

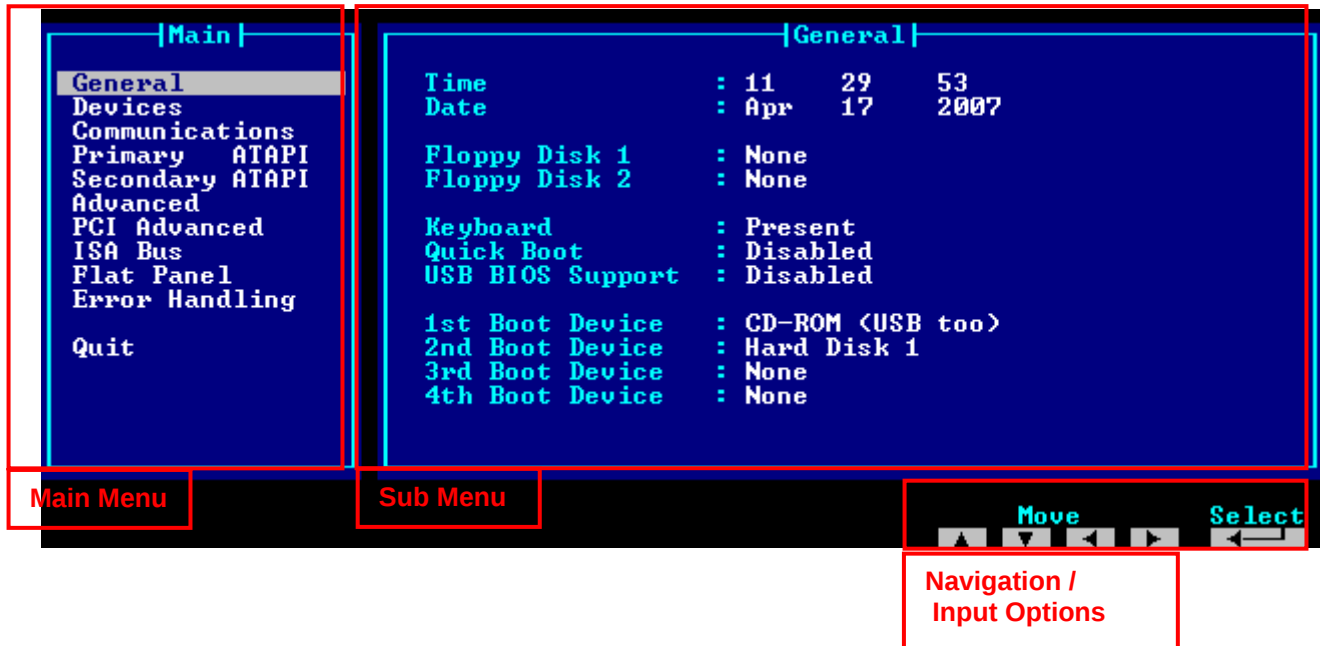
Pin	Signal	Function
1	IDE LED -	IDE LED anode (-)
2	IDE LED +	IDE LED cathode (+)

Table 15. J21 connector pinout

Chapter 5 The Setup Program

Notes:

- This Section refers to the BIOS revision 4_57_03. Other version may differ.
- Some sub menus may not be visible; this is due to the BIOS automatically detecting the model number of CPU installed and only showing relevant pages.



As you can see from the diagram above the display is separated into 3 zones:

Main menu

To the left is the Main menu; this shows a list of possible *Sub menus* that can be selected.

Sub menu

The right hand panel will change depending on the selected Tab in the *Main menu*.

Navigation / Input options

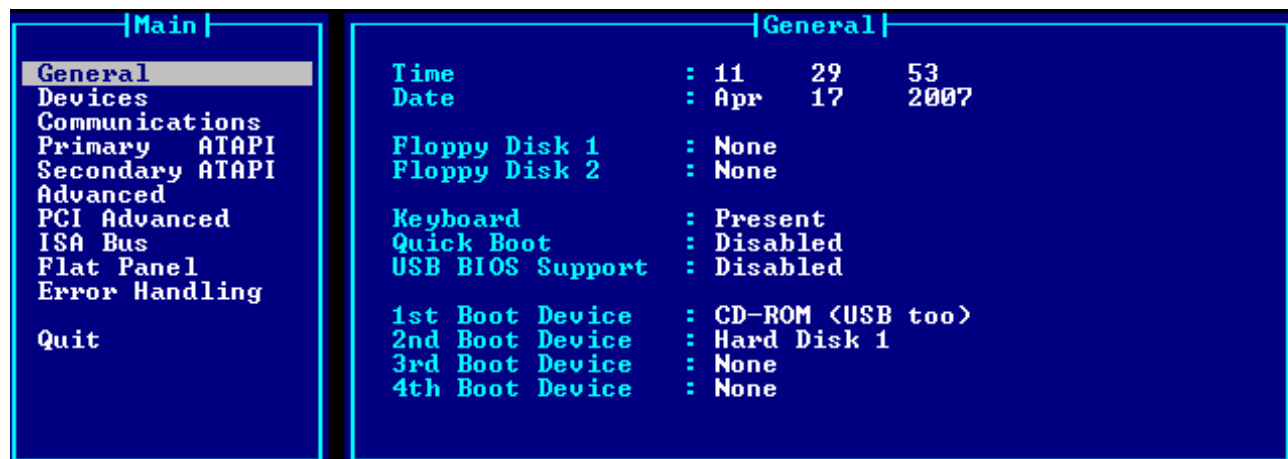
In the Lower right hand corner icons are displayed that show all the possible actions that you can perform with the selected Parameter or Tab.

Navigation Keys:

In the lower right hand corner of the BIOS Setup screen, you will notice a selection of icons, these show what keys can be used with the currently selected item, and they are as follows:

Icon	Keys	Use
	Up Arrow	Go to the next field above
	Down Arrow	Go to the next field below
	Left Arrow	Go to the next field to the right
	Right Arrow	Go to the next field to the Left
	- Enter - Return	- Select field to modify - Select an option i.e. "Detect Now" - Accept a value you have entered
Esc	Escape	- Cancel a value you are entering - Go back to the Main menu
PgDn/+	- Page Down +	Select next option in a list
PgUp/-	- Page Up -	Select previous option from a list
0..9	Numbers 0 ~ 9	Enter a numerical number using 0 to 9
BackSpace	Backspace	Erase last character entered
A..Z,0..9	- Numbers 0 ~ 9 - Letters A ~ Z	Enter a sentence containing both numeric and Alphanumeric values, for example "C:\example\example.dat"
0..9,A..F	- Numbers 0 ~ 9 - Letters A ~ F	Enter a Hexadecimal Value

General:



Option	Sub Option	Possible selections
Time	Hours	• 00 ~ 23
	Minutes	• 00 ~ 59
	Seconds	• 00 ~ 59
Date	Month	• Jan ~ Dec
	Day	• 01 ~ 31
	Year	• 2003 ~ 2999
Floppy Disc 1 Floppy Disc 2		• None • 360 KB • 1.2 MB • 720 KB • 1.44 MB • Integrated SSD • USB
Keyboard		• Not Present • Present
Quick Boot		• Disabled • Enabled
USB BIOS Support		• Disabled • Enabled
1st Boot Device 2nd Boot Device 3rd Boot Device 4th Boot Device		• None • Floppy Disk 1 (SSD and USB too) • Hard Disk 1 • CD-ROM (USB too) • Network • 1st USB other than Floppy and CD

Notes:

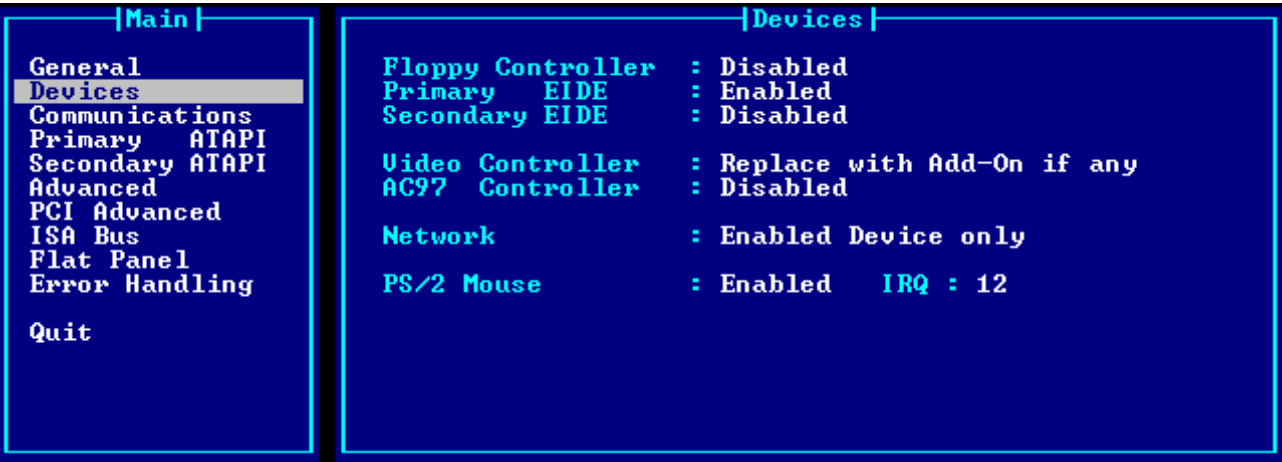
Floppy Disc X:

- Drive letters are assigned consecutively starting from A:
- We suggest that it is good practice to use each Floppy Disc 1 before using Floppy Disc 2.
- The Integrated SSD is a read only device.

Quick Boot:

- Quick Boot will take less than 5 Seconds, this is done by skipping the following tests:
 - o System memory pattern test
 - o Keyboard detection
 - o Floppy disk presence (seek test)
 - o RTC time test

Devices:



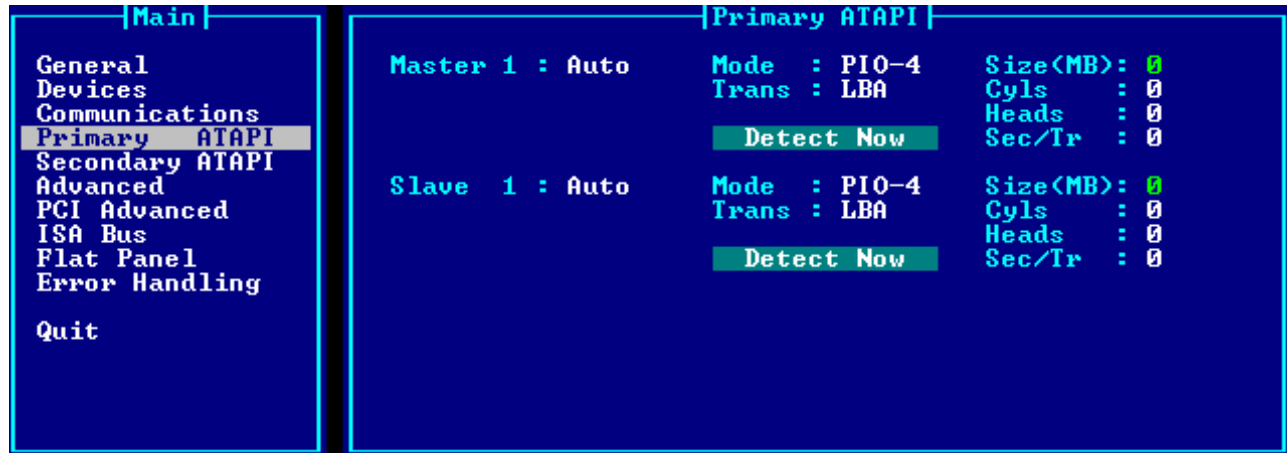
Option		Possible selections
Floppy Controller		- Disabled - Enabled
Primary EIDE Secondary EIDE		- Disabled - Enabled
Video Controller		- Replace with Add-On if any - Always use Integrated
AC97 Controller		- Disabled - Enabled
Network		- Disabled - Enabled device only - Enabled device and Firmware
PS/2 Mouse	Enable	- Disabled - Enabled
	IRQ	List of available IRQ numbers

Communications:

Main	Communications
General	Serial Port 1 : 3F8h IRQ <Share 1> : 4
Devices	Mode : RS232
Communications	VP2000 and VT100 : Enabled
Primary ATAPI	Serial Port 2 : 2F8h IRQ <Share 1> : 3
Secondary ATAPI	Mode : RS232
Advanced	VP2000 and VT100 : Enabled
PCI Advanced	Parallel Port : 0378h IRQ : 7 DMA : None
ISA Bus	Mode : Printer
Flat Panel	VP2000 : Enabled
Error Handling	
Quit	

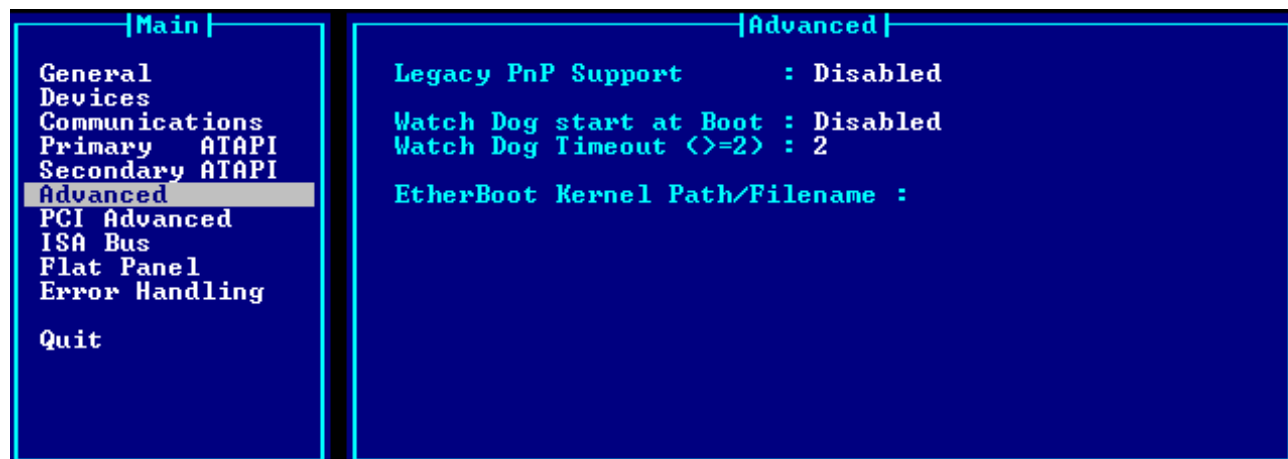
Option	Sub Option	Possible selections
Serial Port 1 Serial Port 2	Address	- Disabled 3F8h 2F8h 3E8h 2E8h
	Mode	- RS232 - RS422 (Only available on Port 2) - RS485 (Only available on Port 2)
	VP2000 and VT100	- Enabled - Disabled
	IRQ (Share 1)	- None - List of available IRQ numbers
Parallel Port	Address	- Disabled 0378h 0278h
	Mode	- Printer - Bidirectional - PP FIFO - ECP - EPP
	VP2000	- Enabled - Disabled
	IRQ	- None - List of available IRQ numbers
	DMA	- None - List of available DMA channels

Primary & Secondary ATAPI:



Option	Sub Option	Possible selections	Notes
Master 1 Slave 1 Master 2 Slave 2		• None • Auto • LBA • CHS • CD-ROM • Other	
	Mode	• PIO-0 • PIO-1 • PIO-2 • PIO-3 • PIO-4	• 3.3 MBps Transfer Rate • 5.2 MBps Transfer Rate • 8.3 MBps Transfer Rate • 11.1 MBps Transfer Rate • 16.6 MBps Transfer Rate
	Trans.	• LBA • ECHS	• LBA Translation • Extended CHS translation
	Size (MB)	• Automatically calculated using Cyls, Heads & Sec/Tr	
	Cyls	• 0 ~ 65536	• Cylinders
	Heads	• 0 ~ 64	• Heads
	Sec/Tr	• 0 ~ 255	• Sectors per track
	Detect Now	• Selection will attempt to Auto-detect any devices connected.	

Advanced:



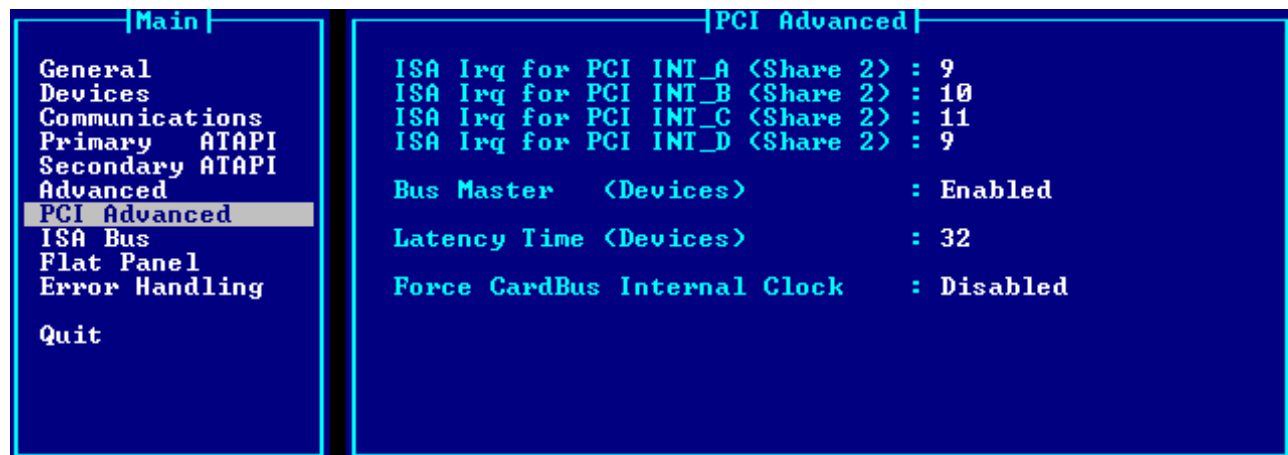
Option	Possible selections
Legacy PnP Support	• Disabled • Enabled
Watch Dog start at boot	• Disabled • Seconds • Minutes
Watch Dog Timeout (>=2)	• 2 ~ 255
Etherboot Kernel Path/Filename	• Pathname for Etherboot

Note:

Watch Dog Timeout can be set to between 2 & 255 seconds or 2 & 255 minutes, as defined by **Watch Dog start at boot** parameter.

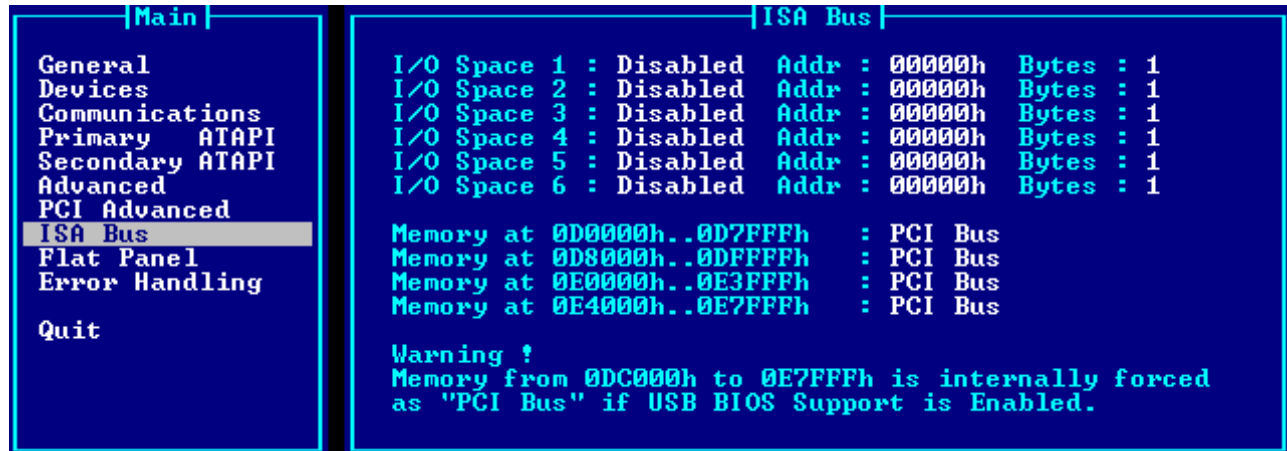


PCI Advanced



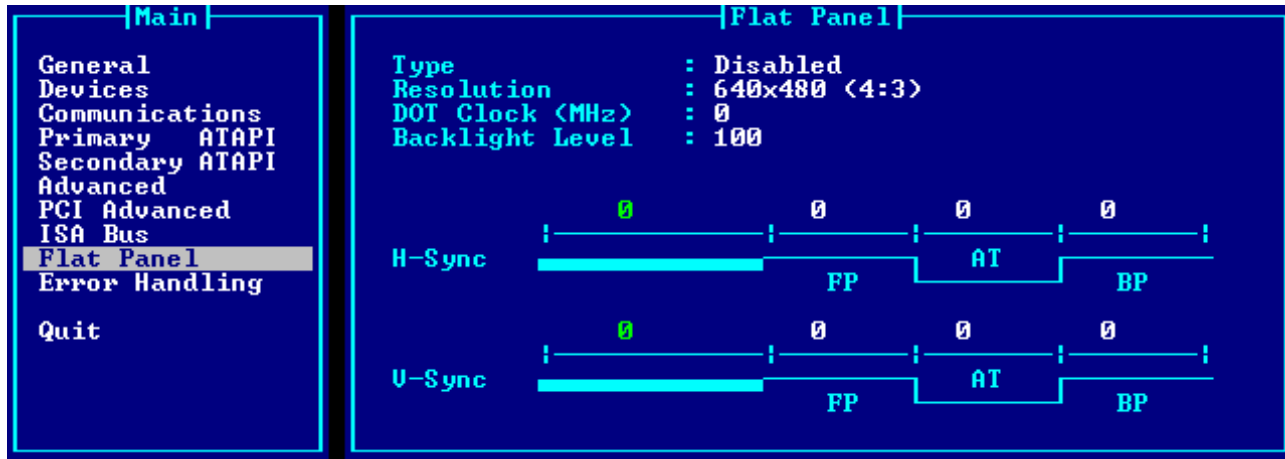
Option	Possible selections
ISA Irq for PCI INT_A (Share 2) ISA Irq for PCI INT_B (Share 2) ISA Irq for PCI INT_C (Share 2) ISA Irq for PCI INT_D (Share 2)	List of available IRQ numbers
Bus Mater (Devices)	- Disabled - Enabled
Latency Time (Devices)	0 ~ 255
Force CardBus Internal Clock	- Disabled - Enabled

ISA Bus:



Option	Possible selections
I/O Space 1	- Disabled - Enabled
I/O Space 2	
I/O Space 3	
I/O Space 4	
I/O Space 5	
I/O Space 6	
Addr	00000h ~ 0FFFFh
Bytes	1, 2, 4, 8, 16, 32, 64 or 128
Memory at 0D0000h. 0D7FFFh	- PCI Bus - ISA Bus
Memory at 0D8000h. 0DFFFFh	
Memory at 0E0000h. 0E3FFFh	
Memory at 0E4000h. 0E7FFFh	

Flat Panel:



Option	Possible selections
Type	- Disabled - Custom - Hitachi 800x600 (38 MHz) - LG 800x600 (38 MHz) - NEC 800x600 (38 MHz) - Sharp 800x600 (40 MHz)
Resolution	640x480 (4:3) 800x600 (4:3) 1024x768 (4:3) 1152x864 (4:3) 1280x960 (4:3) 1400x1050 (4:3) 1600x1200 (4x3) 848x480 (16:9) 1024x576 (16:9) 1280x720 (16:9) 1280x768 (16:9) 1600x900 (16:9)
Dot Clock (MHz)	0 ~ 255
Backlight Level	0 ~ 100 (in steps of 10)
H-Sync FP, PW, BP	0 ~ 255 Note: Number is multiplied by 8
V-Sync FP, PW, BP	0 ~ 255

Notes:

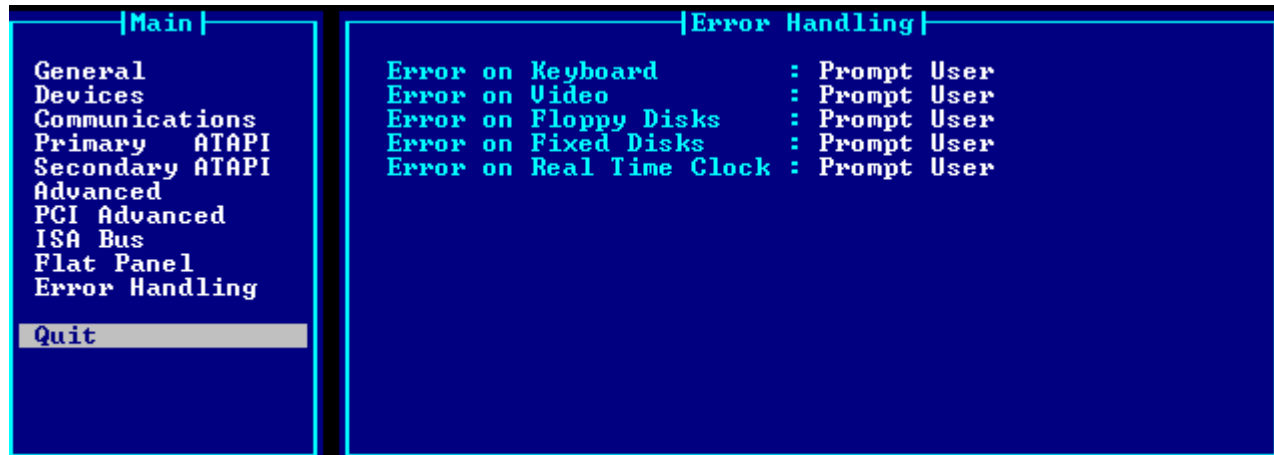
FP = Front Porch
PW = Pulse Width
BP = Back Porch

Error Handling:

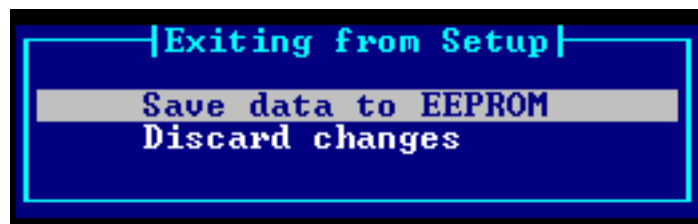


Option	Possible selections
Error on Keyboard	- Ignore - Prompt User
Error on Video	
Error on Floppy Disc	
Error on Fixed Disc	
Error on Real Time Clock	

Quit:



Pressing the *Enter* or *Return* keys when *Quit* is selected the following will be displayed:



Option	Notes
Save data to EEPROM	The configuration data will be saved to the EEPROM The Module will then reboot
Discard Changes	Changes made will be discarded The Module will reboot with the original settings

Note: When quit has been selected, it is not possible to return to the configuration pages, you must reboot the system and re-enter the BIOS using F2 during the initial boot sequence.

Chapter 6 BTOOL Program and Solid State Disk

This chapter explains how to use the BTOOL Program and gives information about the Integrated Solid State Disk.



Warning: The BTOOL Program can be different for each CPU and each BIOS version. For the latest versions visit the site: www.parvus.com

When you download a new BIOS revision you should also find the latest copy of BTOOL enclosed in the package, this will be the correct version to use with the BIOS, it should not be used with other revisions (older or newer).

The BTOOL program

BTOOL is a utility used to update the BIOS Flash EPROM; it can be used for the following tasks:

- Upgrading the BIOS
- Installation of a MiniDOS compatible program into the Flash (Integrated SSD)
- Installing a BIOS Extension onto the flash device



PLEASE NOTE:

The BTOOL program should only be run in the MS-DOS environment, **not a DOS WINDOW**, we advise the creation of a bootable MS-DOS floppy disc.

The following precautions should be taken into consideration:

- Power assured during all the program executions.
- AUTOEXEC.BAT and CONFIG.SYS should not have any parameters
- No memory manager should be loaded.
- HIMEM or EMM386 will cause errors with BTOOL

The program is run at the command line by typing **BTOOL** (or **BTOOL.EXE**) followed by an appropriate argument, as described in the following pages.

If no arguments are used the following on-line help page will be displayed:

```

Use : BTOOL options

/S      -> Run Setup Program
/L      -> Lock Integrated Setup
/U      -> Unlock Integrated Setup
/G FILENAME -> Get Setup Data from system and save to file
/P FILENAME -> Read Setup Data from file and put to system
/B FILENAME -> Update BIOS Firmware
/E FILENAME -> Update Emergency BIOS Firmware
/DA     -> Build Integrated SSD from Disk "A:"
/DB     -> Build Integrated SSD from Disk "B:"
/IP     -> Build Integrated SSD from Image
/IA     -> Build Image from Disk "A:"
/IB     -> Build Image from Disk "B:"

```

Argument	Definition	Notes
/S	Run the Setup program without needing to reboot the system.	
/L	Lock the Setup Program.	
/U	Unlock the Setup Program.	
/G [Filename]	Gets the Setup Data from the system and save it in a file with the name [FILENAME.BIN].	
/P [Filename]	This option takes Setup data from the file [FILENAME.BIN] and stores it to the Flash EPROM.	
/B [Filename]	This option updates the entire BIOS firmware with the version stored in the file named [FILENAME.BIN]	
/V [Filename]	This option updates only the video BIOS firmware with the new version stored in the file named [FILENAME.BIN]	
/E [Filename]	This option updates the Emergency BIOS Firmware with the new version stored in the file [FILENAME.BIN] (this option is)	Not available with the CPU-1212
/DA	This option creates the image of the Floppy "A:" on the Integrated SSD	
/DB	This option creates the image of the Floppy "B:" on the Integrated SSD	

Notes:

1. All files are stored in a binary format (.BIN)
2. The BTOOL program should always be followed by a hardware reset
Pressing CTRL+ALT+DEL is not sufficient
It is necessary to cycle the power on the module to complete the operations.

EXAMPLE 1: Updating the BIOS

Following is an example of how to update the BIOS on your CPU module:

1. Visit the Parvus website (www.parvus.com) and download the latest BIOS revision:
2. Unzip and store the BIOS and BTOOL files to your bootable DOS floppy disc
3. Insert the floppy disc into the floppy disc drive attached to your CPU module
4. Boot the system to the DOS prompt
5. Type the following command at the DOS prompt (BIOS.BIN is only an example file name, check the name of the file that came with the download).
 - `BTOOL /B BIOS.BIN ↵`
6. The program will store the new BIOS version to the CPU EPROM
7. Follow all the instructions the BTOOL may give you: the program will proceed by erasing the Flash device blocks and then writing and verifying them with the data present in the Binary file.
8. BTOOL will inform you about the result of the operation
9. Once completed cycle the power to finalise the operation.

Note:

You may need to enter the Setup programme using F2 during the boot sequence to configure the system as required.

The Integrated Solid State Disk

A portion of the Flash EPROM can be used as an Integrated Solid State Disc (SSD). This Integrated SSD is like a write-protected floppy disk.

Depending on the CPU module used the size of this disc may vary (refer to Table 16), before use data needs to be written to it using the **BTOOL** program.

CPU Module	SSD Size
CPU-1454/64	768 KB

Table 16. SSD Size

EXAMPLE 2: Creating an image of a floppy disk into the Integrated SSD

1. Create the “image disk”, copy any files and directories that you require.
2. During this copying process take care not to delete any files or data from the floppy disc, doing so will create empty sectors and these will be mirrored onto the SSD, wasting space.
3. Take care not to exceed the SSD Size (refer to Table 16)
4. Type the following command at the DOS prompt (BIOS.BIN is only an example filename, check the name of the file that came with the download).
 - `BTOOL /DA BIOS.BIN ↵`
5. The program will ask you to insert the “image disk” into drive A.
6. Follow all the instructions the BTOOL gives you: the program will proceed by erasing the Flash device blocks and then writing and verifying them with the data present on the “image disk”.
7. BTOOL will inform you about the result of the operation.
8. Once completed cycle the power to finalise the operation.

Note:

You may need to enter the Setup programme using F2 during the boot sequence to configure the system as required (for example setting up the SSD as a boot device).

Chapter 7 Virtual Peripheral

Parvus/Eurotech CPU Modules are designed for use in stand-alone mode i.e. without keyboard, mouse, video or other I/O peripherals connected.

Therefore to simplify maintenance operations, users can easily make I/O peripherals available by using "Virtual Peripheral" mode, by doing this the CPU Module inherits the I/O peripherals from another compatible computer (called the *Host computer*) connected through a serial cable. To make this possible, the *VP2000* DOS program must be running on the *Host computer*.

How "Virtual Peripheral" works

The "*Virtual Peripheral*" is a software solution implemented at BIOS level. BIOS service functions called to handle the keyboard, video and floppy disk devices, are converted into messages forwarded to the *Host computer* through the communication channel using a proprietary packet protocol.

When the Operating System or the user's program deals with the keyboard, video or floppy disk drive, it actually deals with *host computer's* devices. There are no hardware traps to intercept accesses to these devices, so *Virtual Peripheral* works only if operating system and application programs use BIOS calls to work on them without directly accessing the relative I/O ports and memory areas.

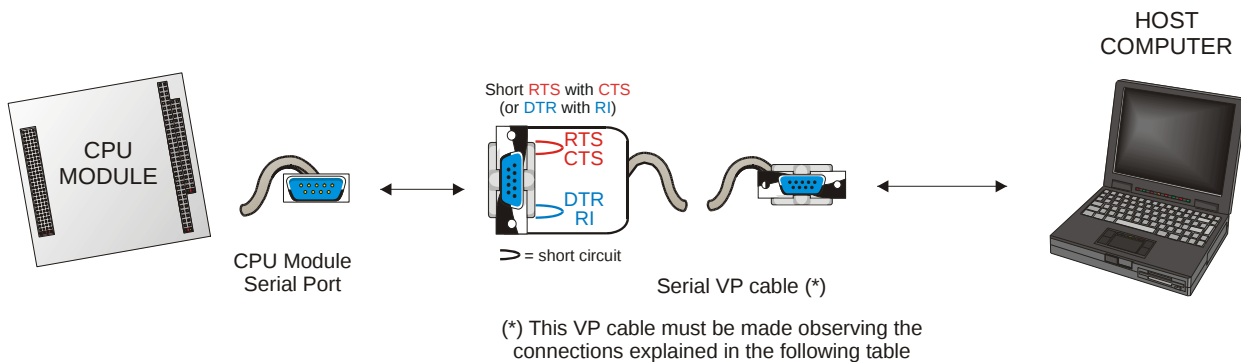
Choosing the *Virtual Peripheral* connection type

On CPU-1454/64 the *Virtual Peripheral* session can be only performed via a Serial connection

Serial Connection:

- Requires a RS232 RX/TX cable (with special wiring on CPU end of the cable)
- Connection is made at 112000 bits/sec.
- Connection works on any CPU serial port that is configured for RS232 mode.
- In case of bad configuration data, or if the invalid set-up is running, VP connection works only on the port that only supports RS232 (this avoids troubles if RS422/RS485 devices are connected).

The following illustration shows how to make a Serial VP cable connection:



The following table shows the connections required for the cable, we assume that the user is using DB9 cables:

Table 1. Serial *Virtual Peripheral* cable signals

Connector	Pin #	Signal	Description	DB9 Host Computer	Note
J17	3	RX	Receive Data	2	
J17	5	TX	Transmit Data	3	
J17	4	RTS ↓	Request to Send	Not Connected	To J17 Pin #6
J17	6	CTS ↑	Clear To Send	Not Connected	To J17 Pin #4
J17	7	DTR ↓	Data Terminal Ready	Not Connected	To J17 Pin #8
J17	8	RI ↑	Ring Indicator	Not Connected	To J17 Pin #7
J17	9	GND	Ground	5	

The VP2000.EXE program

The VP2000 can be downloaded from the Parvus website (www.parvus.com)

The program only works in the DOS operating environment (it functions better without any keyboard or memory management device drivers loaded).

Select the following options based on which Host computer devices you want to redirect and which port you will be using.

Execute the command:

VP2000 /TYPE=N [/v] [/k] [/d] [/c] [/a]

Option	Function
/TYPE	/COM: Use serial port cable /LPT: Use Parallel port cable
N	When using /COM 1: Use Serial port at 3F8h (no IRQ) 2: Use Serial port at 2F8h (no IRQ) 3: Use Serial port at 3E8h (no IRQ) 4: Use Serial port at 2E8h (no IRQ)
/v	Re-direct Video
/k	Re-direct Keyboard
/d	Re-direct Floppy disc A
/c	Re-direct Console (Video & Keyboard)
/a	Re-direct All (Video + Keyboard + Floppy Disk A:)

How to perform a Virtual Peripheral session

To perform a Virtual Peripheral session you need:

- A free Serial Port configured as RS232 on the CPU module.
- If invalid configuration or the invalid set-up jumper is installed, you must use only one of the Serial Ports that are RS232 fixed (not RS232/422/485 selectable).
- The appropriate Serial VP cable
- A PC compatible computer to be used as host, this computer must have a free RS232 Serial Port
- The Host Computer must be running DOS Operating System. If not available on its hard disk, you must create a DOS floppy disk and then boot from it. Do not put any memory manager or keyboard driver on that floppy.
- The Parvus/Eurotech VP2000 program, Save it on the hard disk or on the just created floppy disk.

Follow these steps to perform a Virtual Peripheral session:

- Make sure the CPU Module and the host computer are switched off.
- Connect the CPU Module and the host computer together using the VP cable.
- Turn the host computer on and boot DOS.
- At the DOS prompt start the VP2000.exe program using the command line options as listed above in order to choose the Serial Port you want to use and the peripherals you want to connect to the CPU.
- Turn on the CPU Module. Note that when you turn on the CPU Module, the VP2000 program must be already running on the host computer. If you start running the VP2000 program later, the Virtual Peripheral connection will not work.
- If you have chosen to redirect the Video, then CPU Module's video output will be redirected to host computer screen where you will see the CPU BIOS Banner and POST information.
- If you have chosen to redirect the Keyboard, then you must use the host computer's keyboard to enter set-up pressing 'F2' or to continue boot pressing 'F1'.
- If you have chosen to redirect the Floppy Disk, then CPU Module will see host computer Floppy Disk as its own Floppy Disk 'A:.' If you have a diskette inserted into host computer drive, the CPU Module will try to boot from it!
- To exit VP2000 program press the 'Print-screen' key.
- You can hardware reset the CPU Module or recycle its power without exiting and restarting VP2000.



During a Virtual Peripheral session:

- **Do not press the 'Ctrl + Alt + Del' key combination on the host computer keyboard: the result will be a reboot of the host computer, not of CPU!**
- **Do not use the DOS "format" command under Virtual Peripheral mode: it will not work.**
- **Do not disconnect (and then reconnect) the communication cable: the hardware might be seriously damaged!**
- **Remember that Virtual Peripheral is only intended for maintenance and upgrade operations: if you need a remote operative console, Virtual Peripheral is not a good solution.**

Chapter 8 Watchdog Timer

This chapter describes the configuration of the Watchdog Timer with some examples.



The watch dog is a part of the on-board SUPER I/O device PC87364

The Super I/O watchdog allows managing time-outs in order to seconds or minutes (depending on the Super I/O programming).

Watchdog modes

The watchdog function resets the board at the end of the countdown. There are two ways to program the watchdog:

- Using *BIOS INT 52h*
- Using direct *Super I/O registers programming*

BIOS INT 52h - functions 0Ch, 0Dh, 0Eh

This method can be used under DOS or under Operating Systems using the board BIOS (i.e. not under Linux which erases the BIOS after the boot and autonomously manage the module hardware).

The functions implemented from the BIOS are:

INT 52h, function 0Ch: watchdog enabling with a fixed time of 2 seconds. This function programs and starts immediately the watchdog counter.

INT 52h, function 0Dh: watchdog erasing. Counting is interrupted and watchdog disabled.

INT 52h, function 0Eh: watchdog refresh. Every call to this function restarts the counting from the initial value.

When the watchdog is activated, the countdown starts immediately. If no refresh occurs, when the default timeout expires, the board reset is executed. Therefore, the watchdog must be enabled and continuously refreshed, avoiding in this way the board reset.

Example:

```
...  
MOV    AH, 0Ch  
INT     52h      Enable the watchdog (fixed timeout = 2 seconds)  
...
```

Super I/O registers programming

This method must be used when the OS doesn't manage the BIOS (i.e. Linux) or when a personalized watchdog programming is required.

The following example shows how to change the Super I/O (SPIO) FDC 37B782 watchdog registers:

```
MOV    DX, 03F0h    ; SPIO: enter in configuration mode
MOV    AL, 55h      ; SPIO Index Port
OUT    DX, AL       ; SPIO Configuration Mode Enable Key
OUT    DX, AL       ; Enter in configuration mode

MOV    DX, 3F0h     ; Select Logical Device 8 (watch dog)
MOV    AL, 07h      ; SPIO Index Port
OUT    DX, AL       ; Logical Device selector is the register 7
INC    DX           ; Point to Logical Device selector
INC    DX           ; SPIO Data Port
MOV    AL, 08h      ; Logical Device number 8
OUT    DX, AL       ; Select the Logical Device 8

MOV    DX, 3F0h     ; Select the time base (seconds or minutes)
MOV    AL, F1h      ; SPIO Index Port
OUT    DX, AL       ; Watchdog timer units register (WDT_UNITS)
INC    DX           ; Point to register WDT_UNITS
INC    DX           ; SPIO Data Port
IN     AL, DX       ; Read WDT_UNITS
OR     AL, 01h      ; Mask reserved bits and set time in seconds
AND    AL, FEh      ; Mask reserved bits and set time in minutes
MOV    BL, AL       ; Save new WDT_UNITS value
MOV    DX, 3F0h     ; SPIO Index Port
MOV    AL, F1h      ; Watchdog timer units register (WDT_UNITS)
OUT    DX, AL       ; Point to register WDT_UNITS
INC    DX           ; SPIO Data Port
MOV    AL, BL       ; WDT_UNITS value
OUT    DX, AL       ; Write the new WDT_UNITS value

MOV    DX, 3F0h     ; Select the watchdog timer timeout value
MOV    AL, F2h      ; SPIO Index Port
OUT    DX, AL       ; Watchdog timeout value (WDT_VAL)
INC    DX           ; Point to register WDT_VAL
INC    DX           ; SPIO Data Port
MOV    AX, 37       ; New WDT_VAL value (from 0 to 255 - seconds in this case)
OUT    DX, AL       ; Write the new WDT_VAL value

MOV    DX, 3F0h     ; SPIO: exit from configuration mode
MOV    AL, 0AAh     ; SPIO Index Port
OUT    DX, AL       ; SPIO Configuration Mode Disable Key
OUT    DX, AL       ; Exit from configuration mode
```

- **Note:** for further information about the watchdog programming, refer to “FDC 37B78x Advance Information” manual from SMSC.

Watchdog time-out pin

For external control purposes, the status of the watchdog time-out event is provided to connector J11 pin 9. This signal goes high when the watchdog resets the system. The software can reset this signal by setting and resetting bit 2 of the I/O port 110h. This signal is also initialised by hardware at power-on.

The following example shows how to reset the watchdog time-out pin:

MOV	DX, 110h	; Control Port
IN	AL, DX	; Read actual value
OR	AL, 04h	; Mask reserved bits and set bit 2
OUT	DX, AL	; Write new value
AND	AL, FBh	; Mask reserved bits and reset bit 2
OUT	DX, AL	; Write new value

Chapter 9 Troubleshooting

Technical/Sales Assistance

If you have a technical question or if you cannot isolate a problem with your PC/104 system, please call or e-mail the Parvus Technical Support:

- Email: tsupport@parvus.com
- Phone: +1 (801) 483-1533
- Fax: +1 (801) 493-1523

If you have a sales-related question, please contact your local Sales Representative.

Returning For Service

Before returning any Parvus product, you must contact Parvus to obtain a Returned Material Authorization (RMA) number.



Note. You must have the RMA number in order to return any product for any reason!

Pack the module in an anti-static material and ship it in a sturdy cardboard box with enough packing material to adequately cushion it.



Warning! Any product returned to Parvus improperly packed will immediately void the warranty for that particular product!

Chapter 10 Appendix

A.1 Electrical and Environmental Specifications

The following section provides tables and illustrations showing the electrical, mechanical and environmental specifications.

You will find:

- Operating Characteristics
 - Electrical operating characteristics
 - Backup Battery characteristics
 - Operating temperature Range
 - Absolute maximum ratings
 - MTBF

Operating Characteristics

Electrical Operating Characteristics

Recommended power supply: VDD= +5V (with tolerance +/-5%)
Power consumption: 8.0 W typical (CPU-1452 w/ Celeron 400MHz and 256MB SDRAM)
13.0 W typical (CPU-1462 w/ Pentium III 800MHz and 256MB SDRAM)

Battery current draw (board off without any device on the SSD): 7 μ A.



Note. This module is not warranted against damage caused by overheating due to improper or insufficient cooling or airflow.

Backup Battery Characteristics

There is no configuration data saved by the BIOS into the CMOS Real Time Clock. Therefore, the CPU module does not need a battery, except in the case of applications needing to retrain the date and time at power-off.

Battery Voltage: VBAT= 3.6V (range = 3V to 3.9V)



Note. Setup data is stored into the BIOS Flash EPROM; it is therefore impossible to lose the setup data due to a lack of backup-battery supply.

Operating Temperature Range

For proper operation of the module, the ambient air temperature must remain inside this range:
0°C to +50°C (+32°F to +122°F).

The +50°C test was made at a constant temperature in a climatic chamber.

Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Supply Voltage:	Vcc: 0.00 to 7.00V
Storage Temperature Range:	-50°C to +85°C (-58°F to +185°F)
Non-Condensing Relative Humidity:	<95% at 40°C (+104°F)

This module is available also in Extended Temperature Ranges.



Warning! Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. These are stress ratings only. Operation beyond the “Operating Conditions” is not recommended. Extended exposure beyond the “Operating Conditions” may affect device reliability.

MTBF (Mean Time Between Failures)

Hours: 555,000

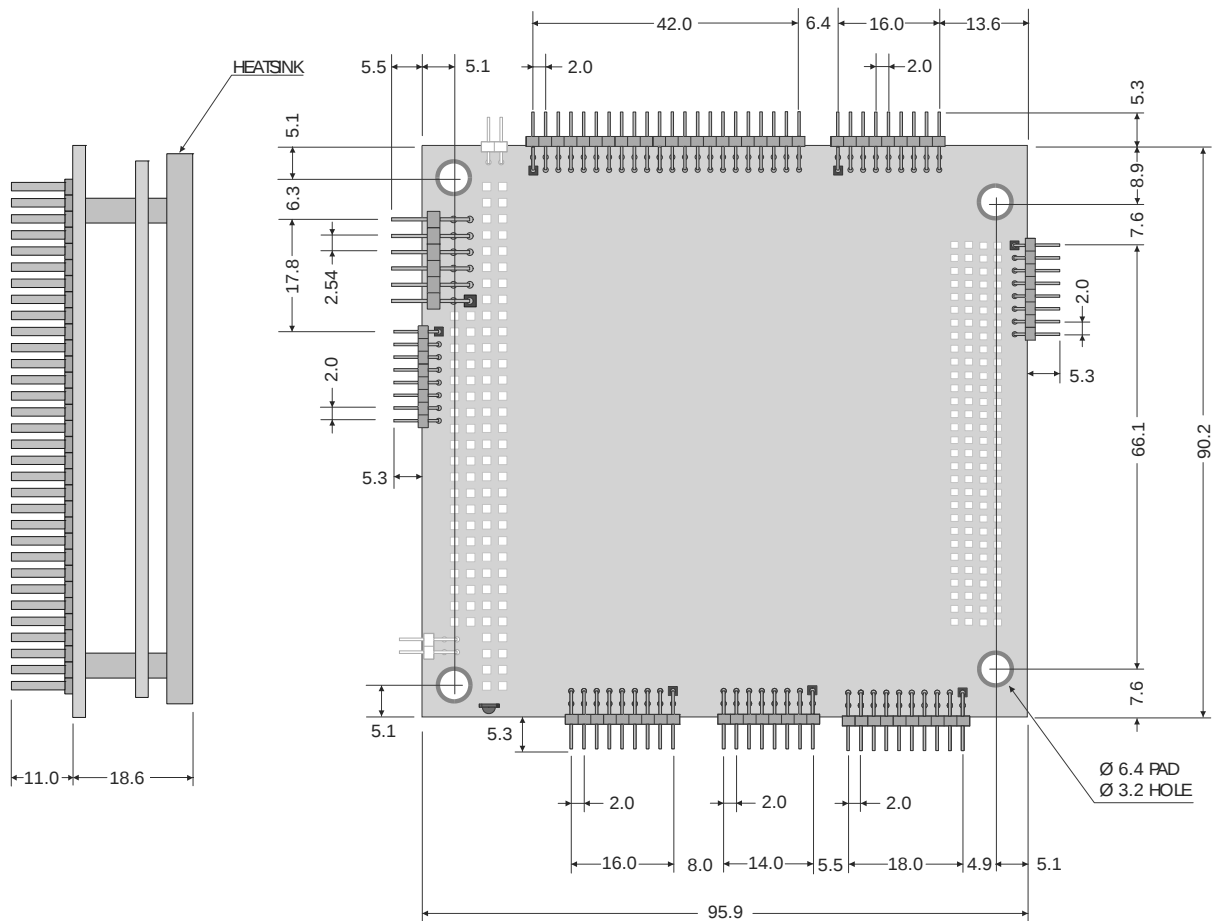
Condition: MIL-HDBK-217F@25C Ground Benign

A.2 Mechanical Dimensions

CPU Dimensions

The Carrier mechanical dimensions are shown in the following picture:

- Dimensions: 90 X 96 mm (3.6"X3.8"), height: 15 mm (0.6")



Dimensions are in millimetres

Figure 12. CPU-1454/64 Board dimensions



Note: For further information about the mechanical dimensions of ISA and PCI buses please refer to the pc104 consortium site (www.pc104.org)

For more information about this or other products in the Parvus line of embedded systems solutions, call (801) 483-1533 from 8:00AM to 5:00PM Mountain Time, E-mail us at sales@parvus.com or visit our web-site at: <http://www.parvus.com>

LIMITED WARRANTY

Parvus Corporation warrants this product to be free of defects in materials and workmanship, and that the product meets or exceeds the current specifications published by Parvus. This Warranty is valid for a period of one (1) year from the date of purchase. Parvus reserves the right to repair or replace any Warranted products at its sole discretion. Any product returned to Parvus for repair or replacement under the provisions of this warranty must be accompanied by a valid Return Material Authorization (RMA) number issued by the Parvus Customer Service Department.

Parvus Corporation makes no warranty not expressly set forth in this document. Parvus disclaims and excludes all implied warranties of merchantability and fitness for a particular purpose. The aggregate liability of Parvus arising from or relating to (regardless of the form of action or claim) is limited to the total of all payments made to purchase the product. Parvus shall not in any case be liable for any special, incidental, consequential, indirect or punitive damages, even if Parvus has been advised of the possibility of such damages. Parvus is not responsible for lost profits or revenue, loss of the use of software, loss of data, costs of recreating lost data, or the cost of any substitute equipment or program.

This Warranty shall be governed by the laws of the United States of America and the State of Utah, and any claim brought under this Warranty may only be brought in state or federal court located in Salt Lake County, State of Utah, and purchaser hereby consents to personal jurisdiction in such courts.

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