MAGNUM

Biscuit format Single Board PC

User Manual

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Blue Chip Technology Ltd.
Chowley Oak
Tattenhall
Chester
CH3 9EX
U.K.

Telephone: +44 (0)1829 772000
Facsimile: +44 (0)1829 772001

www.bluechiptechnology.co.uk

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INTRODUCTION

COMPANY PROFILE

Blue Chip Technology is a leading specialist PC product manufacturer in Europe, providing innovation with quality design and manufacturing from a single source.

Based in the North West of England, our purpose built complex contains both advanced research and development facilities, and manufacturing facilities.

Specialising in the provision of industrial computing and electronic solutions for a wide range of UK and European organisations, Blue Chip Technology has one of the UK's largest portfolios of industrial PCs, peripherals and data acquisition cards. This extensive range of products, coupled with our experience and expertise, enables Blue Chip Technology to offer an industrial processing solution for any application. This is one of the products from our portfolio, providing you with a cost effective product development and volume production tool.

A unique customisation and specialised system integration service is also available, delivering innovative solutions to customers problems. The company's success and reputation in this area has led to a number of large design and manufacturing projects for major companies.

British Standards Institute approval (BS EN 9001) means that all of Blue Chip Technology's design and manufacturing procedures are strictly controlled, ensuring the highest levels of quality, reliability and performance.

Blue Chip Technology are committed to the single European market, and continue to invest in the latest technology and skills to provide high performance computer and electronic solutions for a world-wide customer base.

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RELATED PUBLICATIONS

The following publications will provide useful information related to the Standard Personal Computer and can be used in conjunction with this manual.

- IBM Personal Computer AT Technical Reference, 1502494, IBM, 1984.
- IBM Personal System/2 and Personal Computer BIOS Interface Technical Reference, 15F0306, IBM, 1987.
- The Programmers PC Sourcebook, Microsoft
- The Winn L. Rosch Hardware Bible, Brady

TRADEMARKS

PRECAUTIONS

Certain precautions are necessary when designing with, handling, and using circuit boards. ***It is imperative that precautions are taken at all stages to avoid electro-static discharges, which will damage boards. Those boards fitted with an on-board lithium battery must be handled carefully to avoid maltreatment of the battery that could create a hazard.***

ELECTRO-STATIC DISCHARGES

The devices on this card can be totally destroyed by static electricity. Also bear in mind that the damage caused by static electricity may be partial and not immediately obvious. This could have an effect on your product's reliability and warranty. Ensure that you take necessary static precautions, ideally you should wear an approved wrist strap or if that is not possible, touch a suitable ground to discharge any static build up. This should be repeated if the handling is for any length of time.

When carrying the board around, please place it into the anti-static bag in which it came. This will prevent any static electricity build up. Do not use black anti-static bags because these tend to be conductive and will discharge any on-board battery.

ON-BOARD BATTERY

This applies to boards fitted with a Lithium battery (most single board computer boards). If the battery is mistreated in any way there is a very real possibility of fire, explosion, and harm. Great care should be taken with this type of battery. Under NO circumstances should it be:

- short-circuited
- exposed to temperatures in excess of 100 ºC or burnt
- immersed in water
- unsoldered
- recharged
- disassembled

Expired batteries remain hazardous and must be disposed of in a safe manner.

BIOS & CMOS RAM

Please be aware that on single board computer products, it is possible to create configurations within the CMOS RAM that make booting impossible. If this should happen, clear the CMOS settings, (see the description of the Jumper Settings for details).

ELECTROMAGNETIC COMPATIBILITY

This product meets the requirements of the European EMC Directive (89/336/EEC) and is eligible to bear the CE mark.

It has been assessed operating in a Blue Chip Technology housing. However, because the board can be installed in a wide variety of chassis, certain conditions have to be applied to ensure that the compatibility is maintained. Subject to those conditions, it meets the requirements for an industrial environment (ITE Class A product).

- The board must be installed in a computer system chassis that provides screening suitable for an industrial environment.
- Any recommendations made by the computer system manufacturer/supplier must be complied with regarding earthing and the installation of boards.
- Any metal back plate must be securely screwed to the chassis of the computer to ensure good metal-to-metal (i.e. earth) contact.
- Connector bodies must be securely connected to the enclosure.
- The external cabling to boards causes most EMC problems. It is imperative that any external cabling to the board is totally screened, and that the screen of the cable connects to the metal end bracket of the board or the enclosure and hence to earth. It is recommended that round, screened cables with a braided wire screen are used in preference to those with a foil screen and drain wire. Use metal connector shells that connect around the full circumference of the cable screen: they are far superior to those that earth the screen by a simple "pig-tail".
- The keyboard and mouse will play an important part in the compatibility of the processor card since they are ports into the board. Similarly, they will affect the compatibility of the complete system. Fully compatible peripherals must be used otherwise the complete system could be degraded. They may radiate or behave as if keys/buttons are pressed when subject to interference. Under these circumstances it may be beneficial to add a ferrite clamp on the leads as close as possible to the connector. A suitable type is the Chomerics type H8FE-1004-AS.
- USB cables should be high quality screened types.
- Ensure that the screens of any external cables are bonded to a good RF earth at the remote end of the cable.

Failure to observe these recommendations may invalidate the EMC compliance.

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

USER GUIDE

MANUAL ORGANISATION

This manual describes in detail the Blue Chip Technology MAGNUM Single Board processor card.

We have tried to include as much information as possible but we have not duplicated information that is provided in the standard IBM Technical References, unless it proved to be necessary to aid in the understanding of the MAGNUM.

The manual is sectioned as follows:

Overview, listing the board's features and specification;
Layout, showing where the various items are located;
Installation, and associated issues;
Using the board, including the peripherals;
Troubleshooting guide;
Connector Pin-Out details.

We strongly recommend that you study this manual carefully before attempting to interface with MAGNUM or change the standard configurations. Whilst all the necessary information is available in this manual we would recommend that unless you are confident, you contact your supplier for guidance. ***IT IS PARTICULARLY IMPORTANT THAT YOU READ THE SECTION 'PRECAUTIONS' BEFORE HANDLING THE BOARD.***

If you have any suggestions or find any errors concerning this manual and want to inform us of these, please contact our Technical Services department with the relevant details.

OVERVIEW

The Blue Chip Technology MAGNUM Single Board PC integrates the latest advances in low power processor, memory, and I/O technologies to provide an ideal platform for embedded applications. The MAGNUM complies with the PC/104*Plus* standard providing a PCI bus interface on a single card.

The board is available with CPU build options of an Ultra Low Power Celeron 300MHz and Low Power PIII 700MHz. The memory interface supports up to 512MB of 3.3V PC133 SDRAM, in a standard 168-pin DIMM socket.

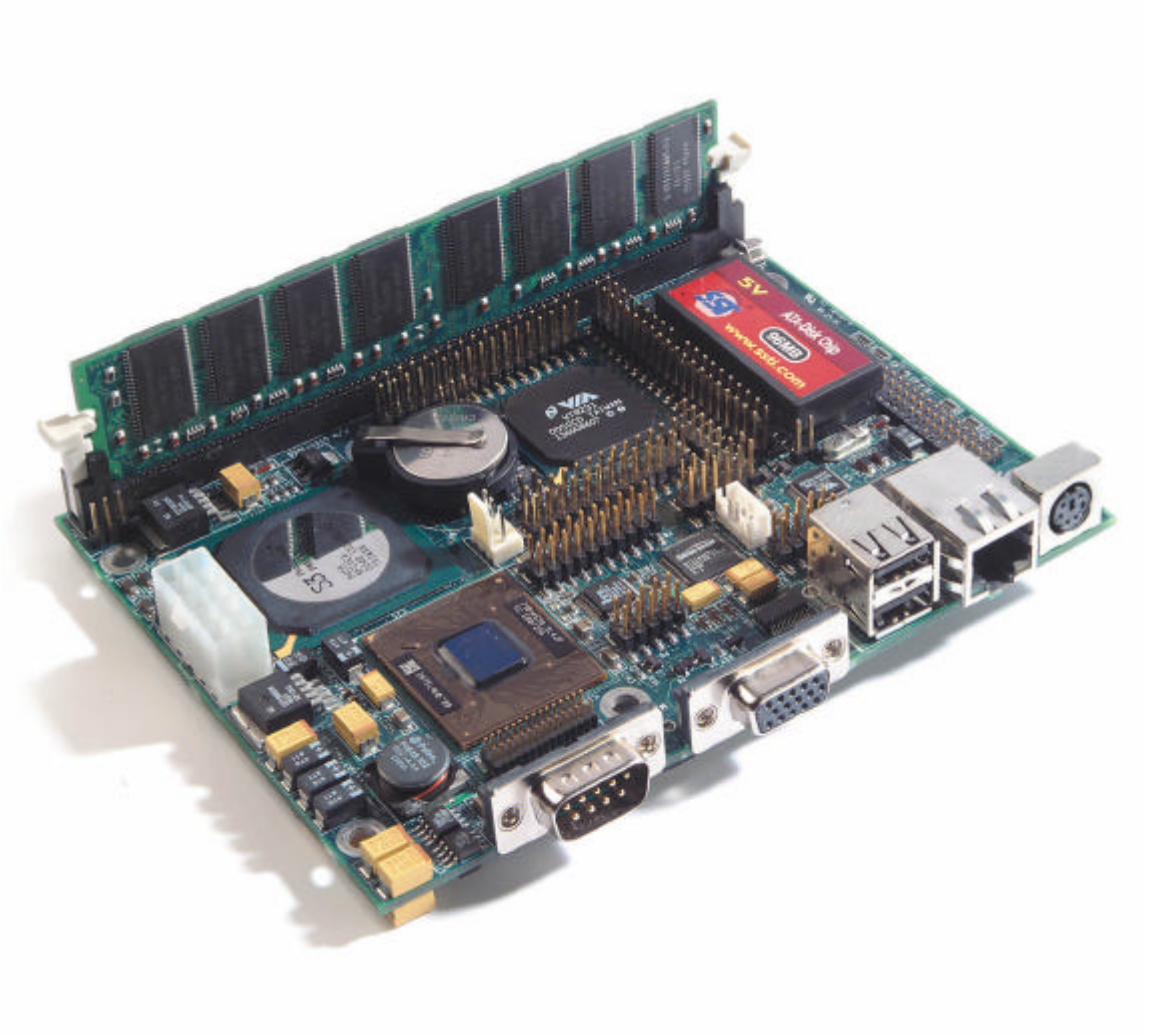
The MAGNUM utilises VIA's PN133T chipset to integrate many peripherals. These include: VGA and LCD, ATA-100 IDE interface, ATA solid state disk, 10/100 Fast Ethernet controller, floppy disk interface, dual USB ports, dual serial ports, parallel port, real-time clock, keyboard and mouse (PS/2) controller. Sixteen general purpose input-output pins (GPIO) are available, and a serial AC'97 audio interface. Connection to most of these functions is made through on board connectors, eliminating and/or reducing the number of off-board connectors. Cable sets are available for those functions not supported through on-board connectors.

An optional cable is also available to provide the serial ports, parallel port and standard utilities (Reset, Power switches, HD LED, speaker and External SMI) at standard format connectors.

The MAGNUM will also drive up to four external PC/104*Plus* expansion modules, three of which can perform Bus Mastering.

A full set of software drivers and utilities are available to allow advanced operating systems such as Windows™ 9x, ME, NT, and 2000 to take full advantage of all the hardware capabilities.

MAGNUM PROCESSOR BOARD PHOTO



Board Level Features

- 300MHz Celeron/700 MHz PIII CPU operation
- Integrated L2 Cache (128K Celeron, 256K PIII)
- 100MHz FSB
- VIA PN133T chipset:
  - VT8606 North Bridge with
  - VT8231 South Bridge
- One 168 pin DIMM socket for up to 512MByte of PC133 SDRAM
- Integrated S3 ProSavage x4 AGP graphics controller with CRT/LCD
- PCI expansion bus via PC/104*Plus* connector
- Dual floppy interface.
- ATA-100 EIDE interface for two devices.
- EPP/ECP bi-directional parallel interface.
- PCI 100/10 base-T Ethernet LAN controller.
- Quad USB ports.
- Stereo sound (SoundBlaster™ compatible) Line In, Out and mic.
- Dual RS232 serial ports.
- Real-time clock with on-board battery
- PS/2 mouse and keyboard controller
- Plug-in ATA Flash module.
- Drive for 4 PCI modules
- Sixteen General Purpose I/O signals.
- System Hardware Monitor for voltage, temperature and fan monitoring.
- Watchdog facility.

CPU

The MAGNUM single board PC comes with Celeron or PIII Processors running at 1.1V or 1.35Volts. On-board voltage regulator circuits provide the required voltages for the processor from the incoming 5 volt power supply. The Celeron version of MAGNUM is targeted at lower cost, power conscious, performance driven applications. The PIII build offers a higher performance solution for applications where reduced power is less of a requirement.

The processor maintains full backward compatibility with the 8086, 80286, i386™ and Intel486™ processors. It supports both read and write burst mode bus cycles, and includes separate on-chip code and data caches which employ a write-back policy. L2 cache is integrated within the CPU and operates at the full CPU frequency giving excellent performance. L2 cache size is 128K for Celeron and 256K for PIII. Also integrated into the processor is an advanced numeric co-processor which significantly increases the speed of floating point operations, whilst maintaining backward compatibility with Intel486™ math co-processor and complying with ANSI/IEEE standard 754-1985.

CHIP SET

The MAGNUM board uses the VIA PN133T chipset (comprising the VT8606 and the VT8231 ICs). This is well known and widely used in the general purpose PC marketplace. It offers outstanding performance with a high level of integration of standard functions, and with the latest iteration, PC133 SDRAM, AGP x4, UDMA-100 to give a high performance solution.

SYSTEM MEMORY

The MAGNUM single board PC is fitted with one 168-pin 3.3V SDRAM SO-DIMM memory socket. This supports DIMM SDRAM modules up to 512 MB in size. The Front-Side Bus, which is fixed at 100MHz requires PC100 speed memory, or faster. There are no jumper settings required for the memory size, this is automatically detected by the system BIOS through the SPD/SMBus. Although the 100MHz Host FSB is fixed, the SDRAM interface can operate at either 66,100,133MHz

ECC memory not is supported.

BUS EXPANSION FACILITIES

The MAGNUM is designed for use in an embedded application and provides for expansion cards with PC/104*Plus* stacked connectors. This board has to be mounted at the 'top' of a stack. This is to allow cable access and because the PC/104*Plus* connector is not available on the upper side.

USER EEPROM

The EEPROM on the MAGNUM unit is a NM93C46 serially programmed device. It comprises 128 bytes of user programmable memory, organised as 64 x 16 bit words. The EEPROM does not have to be completely erased before writing to a single location. Software functions are provided to use the facility.

WATCHDOG FACILITY

MAGNUM includes a watchdog timer circuit, which may be used to monitor software or processor hardware failure. The time-out period of the watchdog is fixed and the timer is enabled or disabled by using a software interrupt (INT50).

GENERAL PURPOSE DIGITAL INPUT/OUTPUT

MAGNUM provides sixteen 5V TTL-compatible programmable digital input/output lines. BIOS functions are available to control this facility, which must be enabled in the BIOS setup. The sixteen bits are accessible in IO space as two consecutive addresses from the IO Base address selected from within the BIOS. Each of the 16 bits can be individually configured as inputs or outputs. When configured as inputs each it can be programmed to generate an interrupt on either a falling or rising edge. Four inputs are available with a configurable de-bounce function for monitoring switch type inputs or signals with slow rising/falling edges.

SPECIFICATION

MAGNUM Power Requirement	+5 V ± 5%	Required for processor and IO operation.
	+12 V ± 5%	Required for RS232 and audio operation.
	-12 V ± 5%	Required for RS232 operation.
	+3.3 V ± 5%	Required for board operation.
	$+5V_{STBY}$	Required for board operation – may be linked from +5V

5-Volt Power Consumption	1.2 A typical, 1.5 A peak	300 MHz Celeron CPU, 64 MB SDRAM
	1.2 A typical, 1.5 A peak	300 MHz Celeron CPU, 512 MB SDRAM
	2.2 A typical, 3 A peak	700 MHz PIII CPU, 64 MB SDRAM
	2.2 A typical, 3 A peak	700 MHz PIII CPU, 512 MB SDRAM

3-Volt Power Consumption	2 A typical, 2.5 A peak	300 MHz Celeron CPU, 512 MB SDRAM
	1.8 A typical, 2.3 A peak	300 MHz Celeron CPU, 64 MB SDRAM

Temperature	Non-Operating	-40 ºC to +70 ºC
	Operating	+0 ºC to +55 ºC

(Heatsinks and airflow will be required for the higher limits)

EMC	Emissions	EN 55022 (A)
	Immunity	EN 55024

MTBF	Calculated	>100,000 Hrs

Dimensions	Board only	110 x 45mm {large memory modules, overhanging connectors and a large heatsink may increase these dimensions.}

Power Consumption figures given are for typical configurations.

This information is provided only as a guide to calculating approximate total system power. Power usage will increase when additional resources are added.

BOARD LAYOUT

TOP SURFACE OF THE PCB

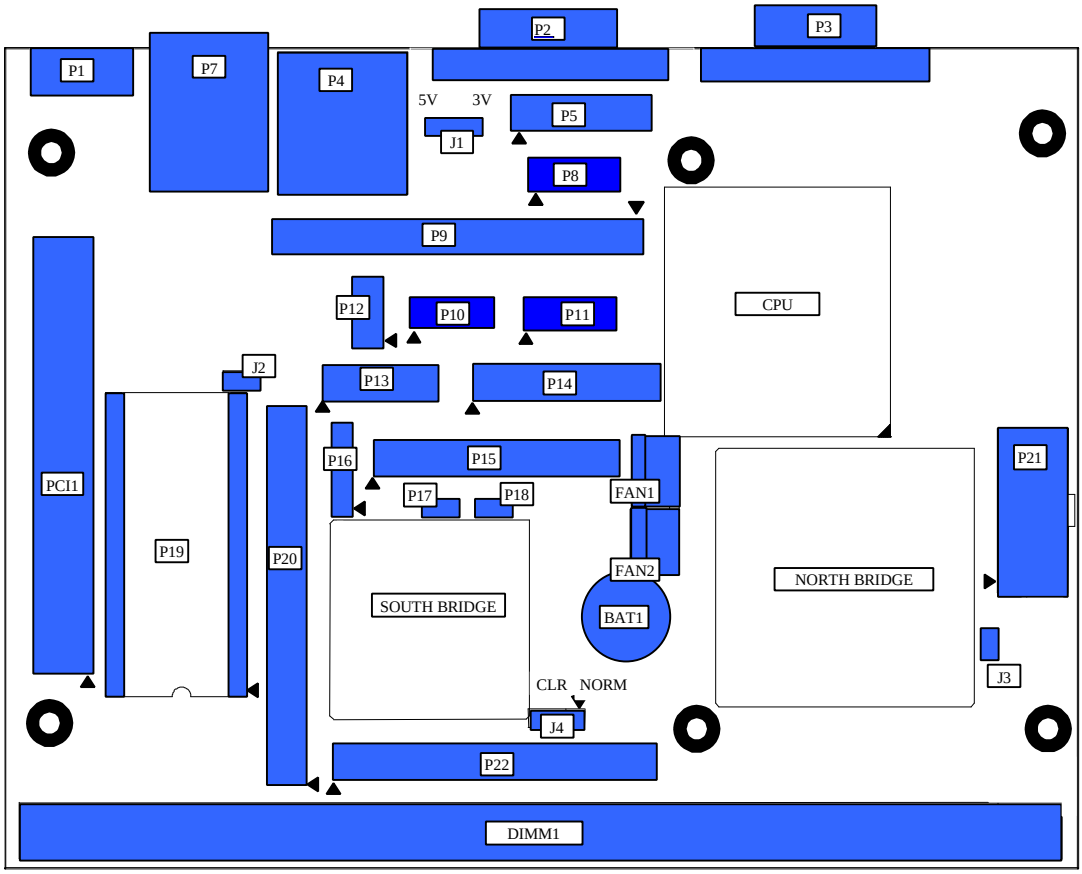


Figure 1. MAGNUM PCB - Top View Showing Connector Positions.
Pin 1 of each connector is indicated by an arrow.

Ident	Description	Ident	Description
DIMM1	DIMM connector	P12	Audio CD in
J1	LCD Supply select (5V or 3V3)	P13	Utilities header
J2	ATA Disk write protect jumper	P14	GPIO header
J3	ATX enable (Auto on) jumper	P15	LPT1 header
J4	CMOS/RTC clear jumper	P16	Reserved for Future Upgrade
P1	Keyboard /Mouse connector	P17	External SMI input header
P2	VGA connector	P18	Remote 10K Thermistor header
P3	COM1 connector	P19	Socket for ATA Disk (Flash)
P4	Dual USB connector	P20	ATA 66-100 EIDE header
P5	TFT/DSTN LCD header (24-35)	P21	Power supply connector
P7	10/100 UTP Ethernet connector	P22	Floppy Disk header
P8	Dual USB Header (ports 3+4)	FAN1	12V sensed fan connector
P9	TFT/DSTN LCD header(0–23)	FAN2	5V sensed fan connector
P10	Audio header	PCI1	PC/104*Plus* connector (below PCB)
P11	COM2 header connector	BAT1	12mm Battery holder for RTC

See the section "Magnum Connectors " for details of individual signals on the connectors.

INSTALLATION

MOUNTING

The MAGNUM board has 6 mounting holes of 4.5mm diameter. Care should be taken on the underside of the board to not cause any mechanical damage to the components adjacent to the mounting holes.

The MAGNUM CPU has to be installed at the top of a PC/104*Plus* stack because of its' interconnect restrictions. It is also difficult to mount any PC/104 boards on top of MAGNUM because of the potential height variations of the DIMM installed into the socket.

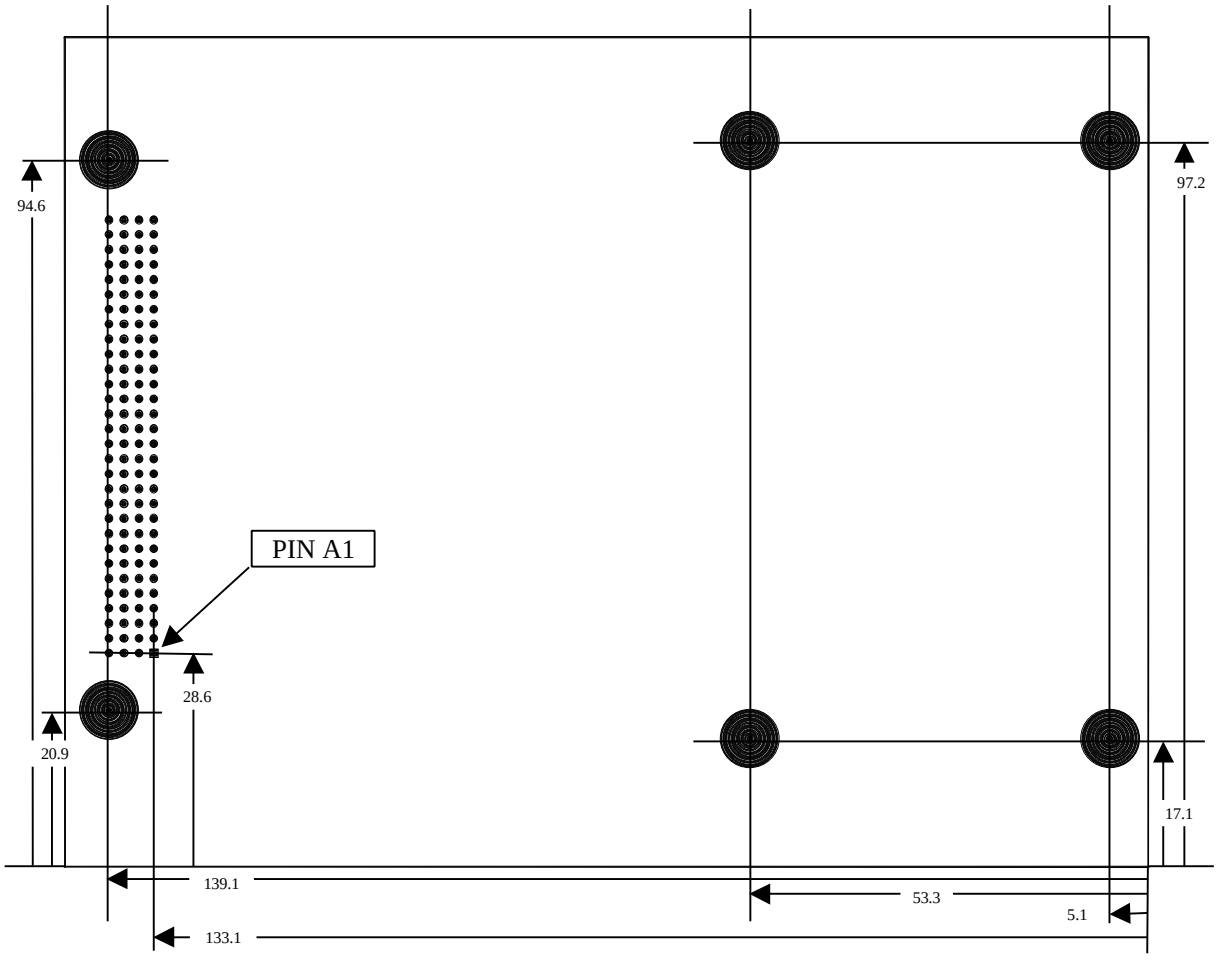


Figure 2. MAGNUM PCB - Top View Showing Mounting Hole Positions.
All Dimensions in millimetres

COOLING

Efficient cooling is essential for long and reliable operation of any electronic equipment. The CPU and the Via VT8606 IC (commonly termed the 'North Bridge') do get hot in normal operation, and in an elevated ambient temperature will require additional cooling. Cooling requirements will vary with application, desired operating temperature, CPU load, memory size and board orientation.

Mounting the PCB vertically will aid natural convection and create a chimney effect. Passive heatsinks are available for the CPU and the VT8606 IC. In addition, a 5V or 12-Volt fan connector is provided on the board edge. A fan, whilst not always desirable, will provide a high degree of cooling even for a relatively slow airflow.

Further options that may be considered are sinking heat to the chassis or enclosure, and in extreme situations the use of a heatpipe.

The CPU is equipped with an onboard thermal diode for thermal monitoring. This diode is connected to a system monitor within the South bridge. The South bridge is fitted with a thermal monitoring device can also monitor its own temperature. A thermistor is available to monitor the temperature of critcal and potential hot-spots on the board. A connector (P16) is provided for the user to connect the thermistor for remote temperature sensing. The thermistor should be a Negative Temperature Coefficient type of nominally 10K resistance at 25ºC, with a ß=3988. Software to monitor the diodes and thermistor is available for download on the Via website (see the section Loading Operating Systems and Drivers). If you require further assistance please contact the Blue Chip Technology Technical Support team.

When designing an enclosure, bear in mind that the greater the volume of air that can flow through the enclosure, the greater the cooling effect and the lower the temperature rise above the ambient air temperature. However, the volume produced by any fan will vary with the pressure against which it has to work. The resistance to airflow (the back-pressure on the fan) will depend upon the enclosure, the mounting and restrictions. Therefore, when mounting and cabling the board, it is essential that the free circulation of the cooling airflow is not impeded.

The calculation of airflow through an enclosure is not straightforward, and depends on many factors. The method of meeting the cooling requirements will be specific for each system. Consequently, the system builder is responsible for ensuring adequate cooling. However, interpreting airflow volumes is not intuitive. As an aid to selecting suitable cooling, the following example is offered. A 60 mm axial fan (such as a Papst type 612NGH) blowing over the board can supply up to 46 m^3/hour when unrestricted. Restrictions to the airflow will reduce this volume.

CABLING

Careless routing of connecting cables can affect the cooling dramatically. It will also have a bearing on EMC. Lengths should be limited to the necessary minimum.

Connections may be made to the MAGNUM board directly, using custom cables to suit the application. Cables are available to connect the MAGNUM to standard connectors, UDMA disks and floppy disks. The actual cabling required will vary for each application, with some functions not being required.

Please note that to achieve higher IDE throughput than UDMA33 requires the use of a special 80-conductor IDE cable. Using a standard 40-conductor IDE cable will force the interface to work at a lower speed.

All applications will require a power connection. The MAGNUM board requires a 5V, 3V3, and ±12V supply for stand-alone operation. The power connection to MAGNUM is made through a 10-way ATX style connector. The mating connector and details of the associated crimps can be found in the Magnum Connectors section of the manual.

Power wiring should be of an adequate gauge to ensure that the voltage does not fall below the watchdog trip point (nominally 4.75V at the watchdog). Note that each terminal is rated at 7 Amps when using the standard crimps. There are three ground, one 3V3, two 5V and one $5V_{STBY}$ connections. All these must be connected for correct and reliable operation. An ATX power supply may be used, in which case a 5V standby supply line would be available. This should be connected to $5V_{STBY}$ terminal. The ATX PSU may be switched on and off by the power switch on the Utilities connector controlling the PSU PSON# line.

If a 5V standby supply is not available, the terminal should be linked to +5V supply. The Ethernet controller and much of the power-sequencing blocks in the chipset are powered from this terminal. If ATX PSU PSON# operation is not required, jumper J1 should be fitted. Fitting this jumper ensures that the PSU will switch on as soon as the input power is applied to the PSU.

Take care to identify cables, and be aware that some connectors could be transposed.

EMC ISSUES

The enclosure in which the board is mounted will have a significant effect on the electro-magnetic compatibility of the final system. For best effect it should be electrically conducting and provide a complete screen around the electronics. Apertures should be kept to a minimum and as small as possible. For ventilation purposes, many small holes are far more preferable to a few large holes.

It is the maximum dimension of an aperture that governs the lowest frequency that can pass through the enclosure (either in or out). This is irrespective of the width of the aperture. Even a narrow gap between two sections of an enclosure can leak radio interference. Large apertures will significantly reduce the electro-magnetic compatibility of the system.

The major contributor to EMC problems will be cables entering and leaving the enclosure. To minimise these effects ensure that any external cables are fully screened, and that the screen is electrically connected to the chassis. Full wire-screened cables are much more effective than those with a foil screen and drain wire. Use metal connector shells/covers, and do not allow the external screen to pass into the enclosure.

USING THE BOARD

BIOS SETTINGS

The board contains a custom implementation of the Phoenix BIOS 4, Revision 6.1 to suit the specific hardware features.

Certain combinations of BIOS settings may prevent the MAGNUM from working correctly. If problems or lock-ups are experienced on boot-up, clear the CMOS memory and restart. The default settings will usually work in most instances. The CMOS memory is cleared using the jumper block J4. To clear the CMOS, switch off the power to the board, then move the jumper at J4 to the "CLR" position for a few seconds, and then return it to its original position. The power may then be restored.

Press the keyboard <F2> key during the boot-up operation to enter the BIOS set-up screen. Various information is available on the set-up and interpretation of the BIOS in the following files:

Bios-Set

Bios-POS

JUMPERS

Four jumper blocks are used on the board: one to clear the CMOS memory (J4), one to force an ATX PSU on (J3), one to write protect the onboard solid state ATA Disk Chip (J1) and one for selecting between 5V and 3V3 for LCD panel power. No other jumpers are available, all other features are controlled from the BIOS setup or operating system options.

Please bear in mind that the board will not function if the CMOS clearing link is left in the "Clear" position.

LOADING OPERATING SYSTEMS & DRIVERS

Some operating systems provide in-built support for the chipset used on this board. It is variously known as VIA PN133, VIA Pro-Savage, VIA Technologies VT8606/VT8231 with Intel Mobile Celeron or Intel mobile PIII CPU.

A CD-ROM is supplied with each board, containing most common operating system drivers. Bear in mind that suppliers continually update their drivers, so it is always a good idea to check on the Internet for later ones. The following websites are good starting points:

www.via.com.tw
www.viatech.com
www.intel.com

PROGRAMMING THE BOARD

The board includes an EEPROM, a Watchdog and General Purpose I/O, all of which are accessible by using a special BIOS function.

The EEPROM and the General Purpose I/O are not available together. One or the other is first enabled in the BIOS set-up program, and then controlled by software using the software interrupt INT 50h.

USER EEPROM

The EEPROM on the MAGNUM unit is a NM93C46 serially programmed device. It comprises 128 bytes of user programmable memory, organised as 64 x 16 bit words. The EEPROM does not have to be completely erased before writing to a single location.

Before it can be used, the EEPROM must be enabled within the BIOS. The BIOS provides two functions to simplify user access to the EEPROM memory, available through a software interrupt (INT 50h):

Write to Single EEPROM Location

Calling Registers:	AH = 03 BL = Location (0 – 63) DX = Write data (16-bit value)
Perform INT 50h	
Return Registers:	AH = 00, and Carry flag is clear if successful AH = 02, and Carry flag is set if function valid but disabled AH = FF, and Carry flag set if function failed

READ Single EEPROM Location

Calling Registers:	AH = 04 BL = Location (0 – 63)
Perform INT 50h	
Return Registers:	DX = EEPROM Data AH = 00, and Carry flag is clear if successful AH = 02, and Carry flag is set if function valid but disabled AH = FF, and Carry flag set if function failed

Please note that the pins driving this device are shared with the general-purpose I/O lines. It is therefore not possible to use the EEPROM and GPIO lines simultaneously.

WATCHDOG FACILITY

MAGNUM includes a watchdog timer circuit, which may be used to monitor software or processor hardware failure. The time-out period of the watchdog is fixed at 1200 milliseconds. The timer is enabled or disabled by using the software interrupt at INT 50h.

The following code demonstrates the control of the watchdog timer.

Enable/Disable Watchdog

Calling Registers:	AH = 05 AL = 01 to enable, 00 to disable
Perform INT 50h.	

Return Registers: AH = 00, and Carry flag is clear if successful
AH = 02, and Carry flag is set if function valid but disabled
AH = FF, and Carry flag set if function failed

Refresh Watchdog

Calling Registers: AH = 06

Perform INT 50h

Return Registers: Carry flag clear

GENERAL PURPOSE I/O LINES

MAGNUM provides sixteen TTL-compatible programmable digital input/output lines. Before the lines can be used, the GPIO function has to be enabled within the BIOS Set-up program. Once enabled, BIOS functions are available to control this facility.

As inputs, the lines are non-inverting, and are pulled high by on-board resistors. The default settings for all lines are as inputs. The direction control and data may be handled using the software interrupt function (INT 50h):-

Set User IO Line Control

Calling Registers: AH = 17 (hex)
DL (bits 2-0) = IO Line Mask (0=input, 1=output)

Perform INT 50h

Return Registers: Carry Flag is clear, and AH=00 if successful
Carry flag is set, and AH=02 if not enabled in BIOS setup.

Write User IO Lines

Calling Registers: AH = 16 (hex)
DL (bits 2-0) = IO Line data

Perform INT 50h

Return Registers: Carry Flag is clear, and AH=00 if successful
Carry flag is set, and AH=02 if not enabled in BIOS setup.

Read User IO Lines

Calling Registers: AH = 15 (hex)

Perform INT 50h

Return Registers: DL (bits 2-0) = IO Line data (bits 7-3 = 0)
Carry Flag is clear, and AH=00 if successful
Carry flag is set, and AH=02 if not enabled in BIOS setup.

Please note that the pins driving the User EEPROM are shared with the general-purpose I/O lines. It is therefore not possible to use both functions simultaneously.

ACCESSING SOFTWARE 'INT 50H' FUNCTIONS

Most high level languages allow access to software interrupts through a particular function call. The user loads a particular function code into the AH register followed by a specific set of parameters in the other registers before executing the interrupt.

For example, in C :-

```
#include <stdio.h>
#include <dos.h>

#define MAGNUM 0x50

void main(void)
{
    union REGS regs;
    regs.x.ax = 0x0400;                 /* read eeprom data */
    regs.x.bx = 0x31;                   /* from address 0x31 */
    int86(MAGNUM, &regs, &regs);
    printf("EEPROM Address 0x31 contains %x\n",regs.x.dx);
}
```

and similarly in Quick Basic

```
'Read EEPROM Data via interrupt 50 call
$include:'QB.BI'

DIM INARY%(7), OUTARY%(7)
CONST AX=0,BX=1,CX=2,DX=3,BP=4,SI=5,DI=6,FL=7

INARY%(AX) = &H0400                     ' Read e2 data
INARY%(BX) = &H31                       ' address &H31
CALL INT86OLD(&H50,INARY%(),OUTARY%())  ' Call the Int50h service
PRINT "EEPROM ADDRESS &H31 CONTAINS: ";OUTARY%(DX)
```

Note that only the functions listed in the sections above are valid. On return, the contents of register AH may contain a value indicating the status:

AH = 00h	-	Function successful, Carry flag cleared
AH = 01h	-	Function invalid, Carry flag set
AH = 02h	-	Function valid but disabled, Carry flag set
AH = 03h	-	Function failed, Carry flag set

MAINTENANCE

The only regular maintenance required is to ensure that the cooling airflow remains unrestricted. Generally the enclosure design and the wiring layout will ensure that the cooling is stable. However, bear in mind that any air filters may become clogged thereby reducing the cooling.

After a period of time, it may be necessary to replace the on-board battery, if it cannot maintain the CMOS memory.

REPLACING THE ON-BOARD BATTERY

Before attempting to replace the battery, please read the precautions detailed in the introductory section. Remember that even discharged batteries can present a real personnel hazard if mistreated.

The battery is held in place by the spring-clip on the top of the plastic carrier. To remove the battery, insert a non-conductive tool, or fingernail under the battery to lift it above the lip of the holder against the retaining spring. Then slide the battery out.

Replacing the battery is the reverse procedure, ensuring that the new battery is placed with the positive face up (visible).

TROUBLESHOOTING GUIDE

This is not intended as an extensive faultfinding procedure, rather it is intended to indicate the more likely causes of failure with this product. Ensure that the power is switched off before making any hardware changes. Bear in mind that it is possible to set combinations of parameters within the BIOS that will prevent proper operation of the board. See the BIOS section for details. If in doubt, set default values or clear the CMOS memory and start again. Default values will generally provide a working but limited system.

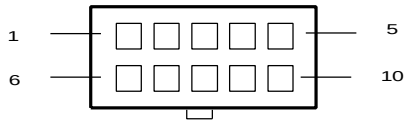
SYMPTOM	**Fail to boot**
Possible Cause	Power supply incorrect
Action	Check all supply rails 5V, 3V3, $5V_{STBY}$
Possible Cause	Check that the 5Vstandby terminal is connected
Action	Link to +5V if not powered from an ATX 5Vstandby supply
Possible Cause	CMOS memory corrupt/invalid
Action	Power off, set CMOS clear jumper to 'Clear', then return jumper to operational position
Possible Cause	CMOS Clear jumper in wrong position
Action	Set to operational position, NOT 'Clear'
Possible Cause	Extended System Configuration Data (ESCD) memory corrupt/invalid
Action	Use BIOS Setup to clear and re-write the ESCD memory
Possible Cause	Memory not fully seated in socket
Action	Remove and refit memory
Possible Cause	Add-in board requires other voltage rails (MAGNUM does not provide –5V)
Action	Check power requirements of expansion board, and power supplies
SYMPTOM	**Time and Date incorrect, loss of CMOS memory contents**
Possible Cause	Discharged / displaced battery, Clear CMOS link not fitted.
Action	Power off, replace battery (ensure correct orientation), reset CMOS values or fit link
SYMPTOM	**No display on monitor**
Possible Cause	Incorrect BIOS setting, LCD display selected rather than Monitor or Both
Action	Clear CMOS memory, reset correct values
SYMPTOM	**User EEPROM contents corrupt or inaccessible**
Possible Cause	EEPROM not enabled within BIOS Set-up
Action	Enable EEPROM within BIOS
SYMPTOM	**Incorrect operation of GPIO or inaccessible**
Possible Cause	GPIO not enabled within BIOS Set-up
Action	Enable GPIO in BIOS
SYMPTOM	**System crashes during intensive operation or after prolonged use**
Possible Cause	Inadequate cooling allowing CPU/chipset to overheat
Action	Improve heatsink and / or cooling airflow
SYMPTOM	**Solid-state Disk Unreliable**
Possible Cause	Solid-state Disk chip not fully seated, or pin damaged.
Action	Check alignment and seating of chip

MAGNUM CONNECTORS

POWER CONNECTIONS

POWER SUPPLY INPUT CONNECTOR

P21: 10 Way MOLEX Mini-Fit Jr Header
Mating Connector: 10 Way MOLEX Mini-Fit Jr Receptacle
Molex Number 39-01-2105
Molex Crimp: Molex Number 39-00-0078



Pin	Description	Pin	Description
1	+5V	6	+5V
2	0V	7	0V
3	3V3	8	0V
4	PSON#	9	$+5V_{STBY}$
5	-12V	10	+12V

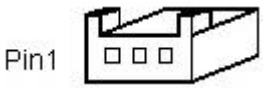
Note: The terminal $5V_{STBY}$ must be connected to a +5V supply. Link to +5V if no Standby power available.

NOTE: PLEASE PAY CAREFUL ATTENTION TO THE WIRING OF THIS CONNCTOR. AN INCORRECTLY WIRED CONNECTOR WILL DESTROY THE MAGNUM BOARD AND MAY DAMAGE THE POWER SUPPLY.

12V OUTPUT CONNECTOR TO FAN1

FAN1 - Connector: Molex 0.1" KK 3-way pin header
Mating Connector: Molex 0.1" KK 3-way plug

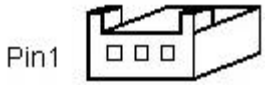
Pin	Function
1	0V
2	+12V Output
3	Tacho Sense Input



5V OUTPUT CONNECTOR TO FAN2

FAN2 - Connector: Molex 0.1" KK 3-way pin header
Mating Connector: Molex 0.1" KK 3-way plug

Pin	Function
1	0V
2	+5V Output
3	Tacho Sense Input



BATTERY HOLDER

Battery type CR1220 (35mAh standard).

Fit battery with the positive terminal visible on top.

JUMPERS

ATA DISK CHIP WRITE PROTECT

J2 Jumper

Link	Operation
Fitted	Write protect enabled
Not Fitted	Write protect disabled

LCD VOLTAGE SELECTION

J1 Jumper

Link	Operation
1-2	5Volt operation
2-3	3V3 operation

ATX PSU OPERATION

J3 Jumper

Link	Operation
Fitted	Force ATX PSU on
Not Fitted	Depends on external switch on Utilities (P13)

CMOS CLEARING LINK

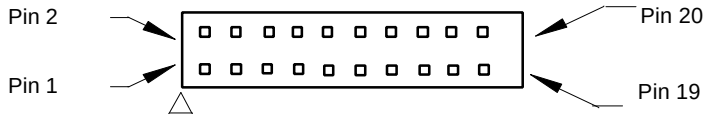
J4 Jumper

Link	Operation
1-2	Normal operation
2-3	Clear CMOS memory

INPUT/OUTPUT CONNECTORS

GPIO PORT

P14 - Connector: 20-way 0.1" pitch pin header
Mating Connector: 20-way 0.1" pitch IDC socket



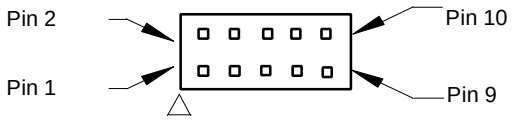
View on Connecting Pins

Signal	Pin	Pin	Signal
+5V	1	2	+5V
GPIO10	3	4	GPIO20
GPIO11	5	6	GPIO21
GPIO12	7	8	GPIO22
GPIO13	9	10	GPIO23
GPIO14	11	12	GPIO24
GPIO15	13	14	GPIO25
GPIO16	15	16	GPIO26
GPIO17	17	18	GPIO27
0V	19	20	0V

Resetable thermal fuses protect both 5V supplies. These have a nominal current carrying capability of 1.1 Amps and a trip rating of 2.2 Amps at 20 °C.

UTILITIES CONNECTOR

P13 - Connector: 10-way 0.1" pitch pin header
Mating Connector: 10-way 0.1" pitch IDC or crimp socket

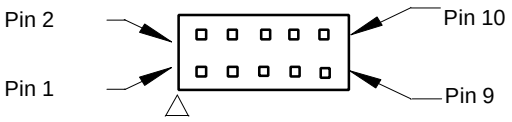


View on Connecting Pins

Signal	Pin	Pin	Signal
Speaker +	1	2	Speaker -
Reset Switch	3	4	Ground
Power Switch	5	6	Ground
HD Activity LED Cathode	7	8	HD Activity LED Anode
External Battery +3V	9	10	Ground

AUDIO CONNECTOR

P10 - Connector: 10-way 0.1” pitch pin header
Mating Connector: 10-way 0.1” pitch IDC or crimp socket



View on Connecting Pins

Signal	Pin	Pin	Signal
Line In Left	1	2	Line In Right
Ground	3	4	Ground
Microphone In	5	6	Microphone Bias
Ground	7	8	Ground
Line Out Left	9	10	Line Out Right

FLOPPY DISK HEADER

P22 - Connector: 34-way 0.1" pitch header
Mating Connector: 34-way 0.1" pitch IDC socket
Standard Pin Out

PRIMARY IDE HEADER

P20 - Connector: 40-way 0.1" pitch header
Mating Connector: 40-way 0.1" pitch IDC socket
Standard Pin Out.

ATA FLASH DISK SOCKET

P19 - Connector: 32-pin 0.1" x 0.6" DIL socket
Mating Connector: ATA Flash Disk IC
Standard Pin Out.

REMOTE THERMISTOR FOR TEMPERATURE SENSE

P18 - Connector: 2-way 0.1” pin header
Mating Connector: 2-way 0.1” socket

An external NTC thermistor (10 Kohm at 25ºC, ß= 3988) may be connected here. (Pin 2 is GND)

EXTERNAL SMI

P17 - Connector: 2-way 0.1” pin header
Mating Connector: 2-way 0.1” socket

External SMI: External Systems Management Interrupt. Pull to ground to interrupt. (Pin 2 is GND)

DIMM SOCKET

DIMM1 - Connector: JEDEC standard
Standard Pin Out.

PC/104 PLUS *CONNECTOR*

PCI1 - Connector: 120-pin PC/104*Plus* standard plug
Standard Pin Out.

COM2 RS232

P11 - Connector: 5x2-way 0.1" pitch pin header
Standard Pin Out.

PARALLEL

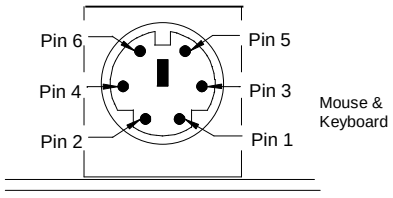
P15 Connector: 2x13-way 0.1" pitch pin header
Standard Pin Out.

KEYBOARD & MOUSE

P1 - Connector: PS/2 6-pin mini-DIN socket.
Mating Connector: PS/2 keyboard and mouse connector.

Note that whilst the socket includes both mouse and keyboard signals, the signal pin-out is compatible with a standard PS/2 keyboard. A keyboard may be plugged directly into P1. Alternatively, a splitter cable is available to provide both mouse and keyboard connections.

Pin	Lower
1	Keyboard Data
2	Mouse Data
3	Ground
4	+5V
5	Keyboard Clock
6	Mouse Clock

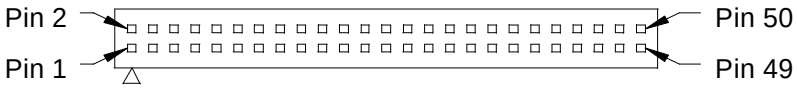


View on Connecting Sockets

LCD PANEL CONNECTORS

There are two LCD connectors:-

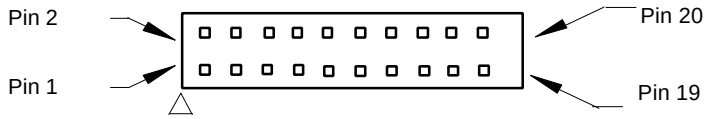
P9 - Connector: 50-way 2mm pitch pin header
Mating Connector: 50-way 2mm pitch IDC or crimp socket



View on Connecting Pins

Signal	Pin	Pin	Signal
Panel Supply – see J1	1	2	Flat Panel Detect
+12V	3	4	Ground
VEE enable switch(3V CMOS level)	5	6	Flat Panel GPIO
Panel Supply – see J1	7	8	Ground
Panel Supply – see J1	9	10	VCC enable switch(3V CMOS level)
Shift Clock	11	12	Ground
Line Pulse	13	14	Flat Panel Power Down
Display Enable	15	16	Ground
First Line Marker	17	18	Ground
Data D0	19	20	Ground
Data D1	21	22	Data D23
Data D2	23	24	Ground
Data D3	25	26	Data D22
Data D4	27	28	Ground
Data D5	29	30	Data D21
Data D6	31	32	Ground
Data D7	33	34	Data D20
Data D8	35	36	Ground
Data D9	37	38	Data D19
Data D10	39	40	Ground
Data D11	41	42	Data D18
Data D12	43	44	Ground
Data D13	45	46	Data D17
Data D14	47	48	Ground
Data D15	49	50	Data D16

P5 - Connector: 20-way 2mm pitch pin header
Mating Connector: 20-way 2mm pitch IDC socket

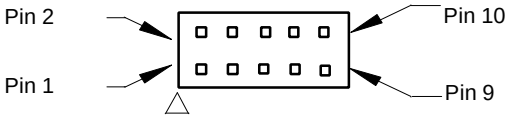


View on Connecting Pins

Signal	Pin	Pin	Signal
Ground	1	2	Data D35
Data D24	3	4	Ground
Data D25	5	6	Data D34
Ground	7	8	Data D33
Data D26	9	10	Ground
Data D27	11	12	Data D32
Ground	13	14	Data D31
Data D28	15	16	Ground
Data D29	17	18	Data D30
Ground	19	20	Ground

USB HEADER CONNECTOR

P8 - Connector: 10-way 0.1” pitch pin header
Mating Connector: 10-way 0.1” pitch IDC or crimp socket



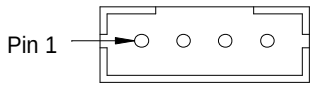
View on Connecting Pins

Signal	Pin	Pin	Signal
+5V	1	2	Ground (Screen)
USB 3 Data-	3	4	Signal Ground
USB 3 Data+	5	6	USB 4 Data+
Signal Ground	7	8	USB 4 Data-
Ground (Screen)	9	10	+5V

CD-ROM AUDIO INPUT

P12 - Connector: JST 2mm 4-way boxed pin header B 4B-PH-K/Tactpro WD.03/2
Mating Connector: JST PHR4 & SPH crimps

Pin	Signal
1	CD Right Channel
2	CD Ground
3	CD Left Channel
4	CD Ground



View on Connecting Pins

ETHERNET CONNECTOR

P7 - Connector: RJ-45 8-pin socket.
Mating Connector: RJ-45 8-pin plug.
Standard Pin Out.

COM1 CONNECTOR

P3 - Connector: Nicomatic 7902-09-MCD.
Mating Connector: Standard 9 way female D type
Standard Pin Out.

VGA CONNECTOR

P2 - Connector: Nicomatic 7912-15-FCD.
Mating Connector: Standard High density 15 way male D type
Standard Pin Out.

DUAL USB CONNECTOR

P4 - Connector: TACT 402-008-001-102
Mating Connectors: Series A USB connector
Standard Pin out.

STANDARD CONNECTORS

The attached guide is a general reference point for the following standard pin-outs.

Standard Pin Out

AMENDMENT HISTORY

Issue Level	Issue Date	Author	Amendment Details
0.1	06/11/01	PMD	First Draft Issue
1.0	09/07/02	PMD	First Release Issue 1.0 boards
2.0	22/11/02	PMD	Updated for Issue 2.0 boards
2.1	06/12/02	TMCK	Minor Corrections
2.2	06/03/03	SO	Minor Corrections