



BCT100

PICMG v1.3 Single Board Computer

User Guide

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Regulatory Statements

CE

This product meets the essential protection requirements of the European EMC Directive (2004/108/EC) and the Low Voltage Directive (2006/95/EC), and is eligible to bear the CE mark.

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.

FCC

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING:

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Safety Warning for North America

If the power lead (cord) is not supplied with the computer, select a power lead according to your local electrical regulations. In the USA use a 'UL listed' lead. In Canada use a CSA approved or 'cUL listed' lead.

Si le cordon secteur n'est pas livré avec l'ordinateur, utiliser un cordon secteur en accord avec votre code électrique nationale. En l'Etat Unis utiliser un cordon secteur 'UL listed'. En Canada utiliser un cordon secteur certifié CSA, ou 'cUL listed'.

Manual Organisation

This manual describes in detail the BCT100 Industrial SBC.

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 product.

The manual is sectioned as follows:

Introduction

Overview, listing the unit's features and specification

Installation, including what software to install

Layout, showing where the various connectors are located, and their pin-out details

How to upgrade the system

Bios Setup

Maintenance details

We strongly recommend that you study this manual carefully before attempting to interface with the BCT100 SBC 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 ANY COMPONENTS INSIDE THE UNIT.***

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.

Introduction

The Blue Chip Technology PICMG BCT100 complies with the PICMG 1.3 form factor providing PCI and PCI Express bus interfaces on a single plug-in card. The PICMG single board PC is an ideal platform for the increasing requirements of today and tomorrow's embedded applications.

This Full-length PICMG design is optimized for LGA775 Intel® Core™ 2 Quad, Core™ Duo and Celeron® processors supporting 800/1066/1333 MHz Front Side Bus. The memory sub-system is designed to support up to 4 GB dual channel DDR2 667/800 SDRAM memory.

The PICMG BCT100 single board PC uses the Intel® Q35 +ICH9 chipset with integrated GMA 3100 graphics to provide outstanding graphics performance and increased integration over previous single board PC designs.

The PICMG BCT100 Super I/O Controller Hub along with the ICH9 allows support for two serial ports, one parallel port, four Hi-speed USB 2.0 ports, one SATA to PATA IDE interface and four S-ATA high speed ports transferring at up to 3 GB/s. A Compact Flash socket is also provided for convenient access to solid state data.

Dual Realtek RTL8111B Gigabit Ethernet as standard offer 10/100/1000 Mbps Base-TX Ethernet support. This device can auto-negotiate network speeds and comes complete with drivers for most network environments, as well as PXE support

PS/2 keyboard and mouse support is provided via a splitter cable.

Specification

CPU:	LGA775 Intel® Core™ 2 Duo Desktop/Pentium® D/ Pentium® 4 / Celeron® D processor Supports 533/800/1066 FSB
Chipsets:	Intel® 82945G and 82801GR(ICH7)
Graphics Controller:	Integrated Maximum Resolution 2048 x 1536 @75Hz VGA
BIOS:	Phoenix Award
Memory:	Dual Channel Memory Architecture 2 x 240-pin DIMM sockets supporting up to 4Gb Of unbuffered non-ECC 400/533/667 Mhz DDR2 memory modules
LAN:	Dual Intel 82573E/V PCI Express Gigabit Ethernet controller IEEE 802.3 10BASE-T/100BASE-TX/1000BASE-T
System Management:	CPU and System temperature Monitoring CPU and System Voltage detection CPU and secondary fan speed detection
SATA Storage	Four S-ATA ports Supports data transfer rates up to 300MB/s
IDE Interface:	Single Port supporting up to 2 devices
External I/O Interface:	Standard VGA connector Two RJ-45 10/100/1Gb Base-T Ethernet LAN connectors 1 9 way Serial connector (RS232/422/485) via cable 1 9-way Serial connectors (RS232) via cable 1 Parallel Port connector via cable PS/2 Keyboard/Mouse via splitter cable 4 x USB 2.0 Connectors via cable 4 x USB 2.0 Connectors via cable
Watchdog:	Reset: 1 sec-255min. with 1 sec or 1min. step
Environmental Conditions:	Operating temperature range 0°C to +60°C Storage Temperature range -20°C to +80°C Relative Humidity 10-90% non-condensing
Dimensions	338mm x 126mm

General Precautions

Your Single Board Computer is susceptible to damage by electrostatic discharges. In order to avoid damage, you should work at an anti-static bench and observe normal anti-static precautions. Wear an anti-static wrist strap connected to an earth point *before* opening any packaging.

Where a wrist strap is not available, discharge any static charge you may have built-up by touching an earth point. Avoid any further movement that could build up another static charge. Touch an earth point from time to time to avoid further build-up, and remove the items from their anti-static bags only when required

PS/2 Devices

It is important that PS/2 devices (mouse and keyboard) are not connected or disconnected with the unit powered on. Damage or data corruption may occur if this precaution is not observed.

Electro-Static Discharges

If you are going to open up the unit, it is important to realise that the devices on the cards within this unit can be damaged by static electricity. Bear in mind that the damage caused by static electricity may vary from total destruction to partial damage, which may not be immediately obvious. This could have an effect on the product's reliability and warranty. Before opening the chassis, ensure that you take necessary static precautions. Ideally you should work at an anti-static bench and wear an approved wrist strap or if that is not possible, touch a suitable ground to discharge any static build up before touching the electronics. This should be repeated if the handling continues for any length of time.

If it is necessary to remove a board or electronic assembly, place it into an anti-static bag. This will prevent any static electricity build up damaging the board. Metallised bags are preferred. Do not use black anti-static bags for any item containing a battery because these tend to be conductive and will discharge the battery.

On-Board Battery

The processor board is fitted with a Lithium battery. Great care should be taken with this type of battery. If the battery is mistreated in any way there is a very real possibility of fire, explosion, and personal harm. Under NO circumstances should it be short-circuited, exposed to temperatures in excess of 100 °C or burnt, immersed in water, recharged or disassembled.

Expired batteries remain hazardous and must be disposed of in a safe manner, according to local regulations.

Le panneau de processeur est équipé d'une batterie de lithium. Le grand soin devrait être pris avec ce type de batterie. Si la batterie est mistreated il y a de dans de toute façon un possibility très vrai du feu, d'explosion et de mal personnel. Dans au cunes circonstances il est sous peu circuité, exposé aux températures au dessus de 100 degrés de centigrade ou brûlé, immergé dans l'eau, rechargée ou dissassembled.

Les batteries expirées restent dazaedous et doivent être reejetées d'une façon sûre, selon des règlements locaux.

BIOS & CMOS Memory

Please be aware that with personal computer products, it is possible to create configurations within the CMOS memory 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 has been assessed operating in representative, standard configurations. As with any PC product, however, final installation & configuration can vary significantly, and so the following guidelines are offered to help ensure that compatibility is maintained.

- All components added to a system should either carry appropriate equivalent levels of compliance, or be tested for compliance as part of the final system, and should be installed in accordance with supplier recommendations.
- The external enclosure should be securely fastened (with standard lids and covers in place) to ensure good metal-to-metal contact around the internal electronics
- Any metal back plate must be securely screwed to the chassis of the computer to ensure good metal-to-metal (i.e. earth) contact.
- Metal, screened, connector bodies should be securely connected to the enclosure.
- The external cabling to boards causes most EMC problems. It is recommended that any external cabling to the board be 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. Round, screened cables with a braided wire screen are used in preference to those with a foil screen and drain wire. Wherever possible, 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.

Quick Start

The following sections explain how to install the BCT100 Single Board Computer in your System Unit.

First ensure that you are familiar with the contents of the section "Precautions". It contains important information to avoid damage to the board.

Next, read the appropriate documentation from your System Unit supplier on how to install or upgrade a processor board into the intended system unit.

If choosing your own cooling solution for the CPU, check the application notes for the particular CPU from the Intel website to ensure that your solution is capable of cooling the processor throughout the desired operating temperature range. Note that the upper operating limit of 60°C is for the boards operation in free air, which would equate to the air temperature inside the System Unit with the lid closed. It is important to ensure that the operating temperature inside the system unit in the vicinity of the processor board does not exceed the 60°C limit.

If a PC/2 mouse and keyboard are to be removed for normal operation, shut down the computer and switch off the power before removing them.

Installation

Connector Locations

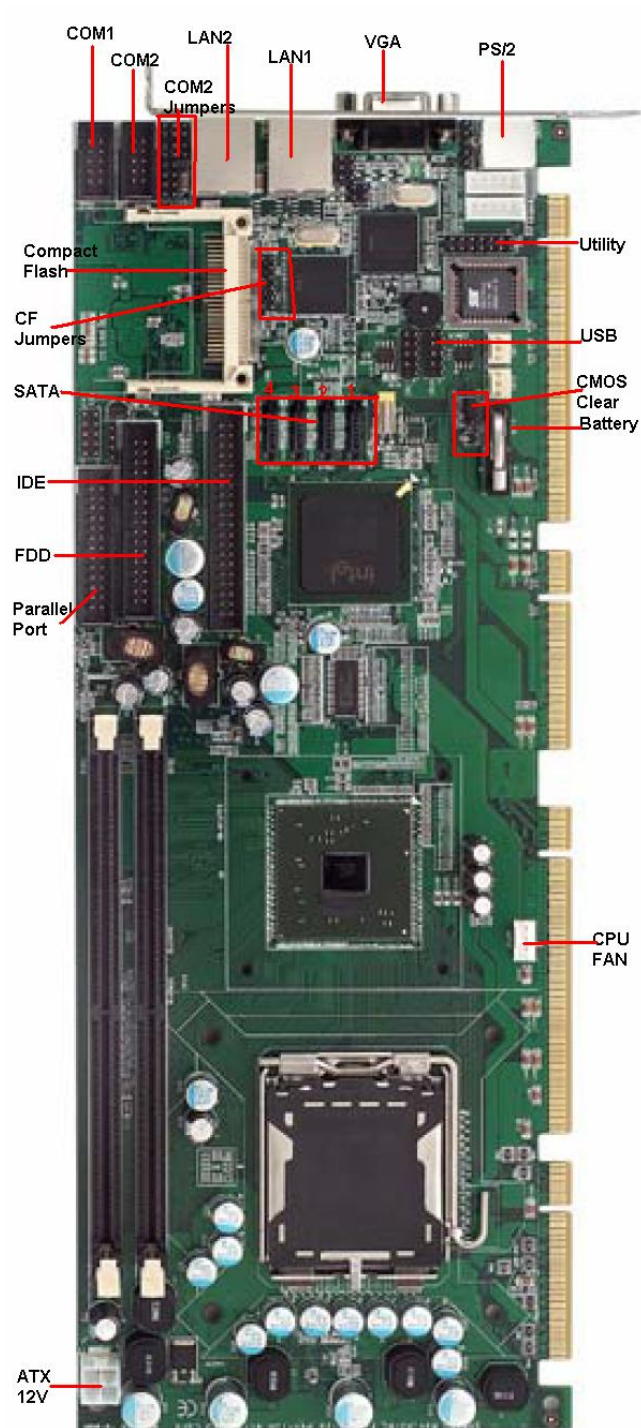


Figure 1: Connector Locations

CPU Installation

The PICMG BCT100 board supports a single Intel® Core™ 2 Duo Desktop/Pentium® D/ Pentium® 4 / Celeron® D processor.

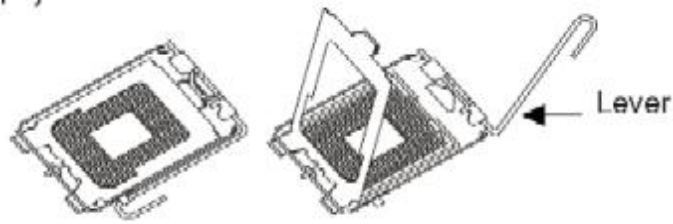


Figure 2: CPU LGA 775 Socket

Before installing the processor, raise the lever on the side of socket 775, perpendicular to the board, and flip up the cover. Place the CPU onto the socket in the correct orientation. **AVOID TOUCHING BOTH THE UNDERSIDE OF THE CPU AND THE PINS ON THE CONNECTOR AS THIS MAY CAUSE DAMAGE.** Lower the cover over the CPU, and lower the lever to lock the cover in place. Apply heatsink Thermal compound to the top of the CPU ensuring an even distribution.

The PICMG BCT100 is usually supplied without any CPU cooling method. This allows the user to select the appropriate cooling method for their particular application.

Caution: Insufficient contact, incorrect types of Fans, heatsink or Thermal Compound used, or improper amounts of Thermal compound applied, can cause the processor to overheat and may result in the System crashing.

Memory Installation

The PICMG BCT100 board supports two 240 pin DDR2 memory Modules. Figure A2 shows a DDR2 module and how the notch on the module aligns with the notch on the Socket. If the notches do not align, DO NOT FORCE the module into the socket as this will cause damage.

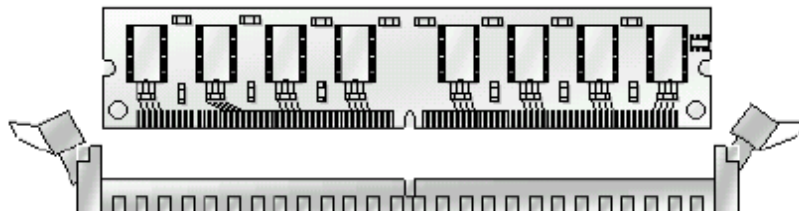


Figure 2A: DIMM Socket and notches

When fitting more than one DDR2 module, ensure that both modules are of identical capacity and manufacture. Failure to do so may result in poor performance and data corruption.

CPU Heatsink

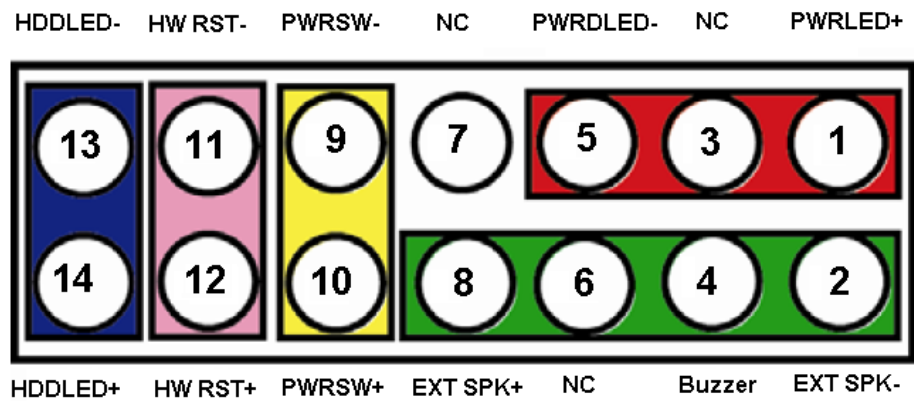
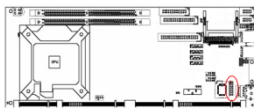
When Selecting a suitable CPU heatsink, you must take into account the both the anticipated operating environment as well as any height restrictions that may apply.

When attaching your heatsink, follow the recommended guidelines from the heatsink manufacturer to ensure correct attachment.

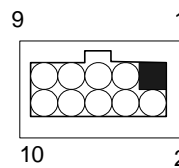
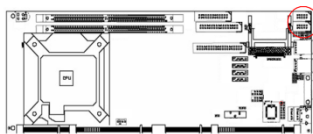
CAUTION

If the heatsink is incorrectly attached, this may result in the CPU overheating and eventual failure

System Front Panel Utility Connector

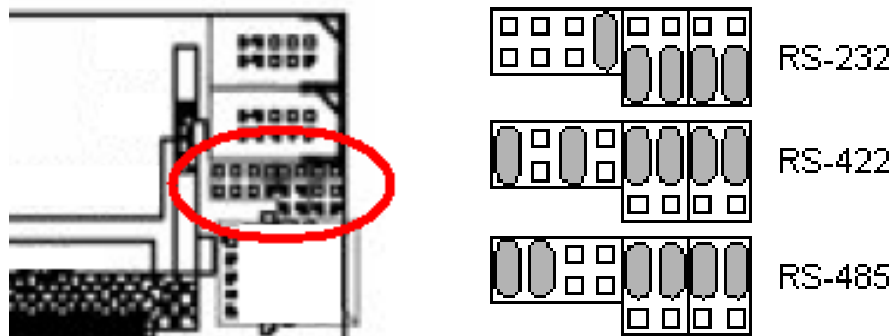


COM Ports: COM1-RS232; COM2- RS232/RS422/RS485

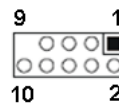
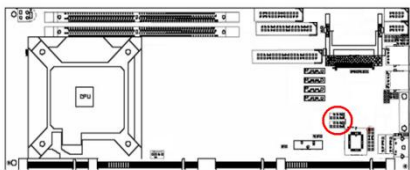


Pin#	Assignment			Pin#	Assignment		
	RS232	RS422	RS485		RS232	RS422	RS485
1	DCD	TX-	Data-	2	DSR	NC	NC
3	RXD	TX+	Data+	4	RTS	NC	NC
5	TXD	RX+	NC	6	CTS	NC	NC
7	DTR	RX-	NC	8	RI	NC	NC
9	GND	GND	GND	10		NC	

COM2 can be configured using Jumpers JP2, JP3 and JP4 as follows

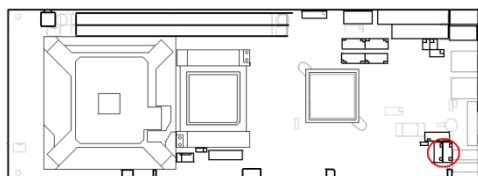


USB Header



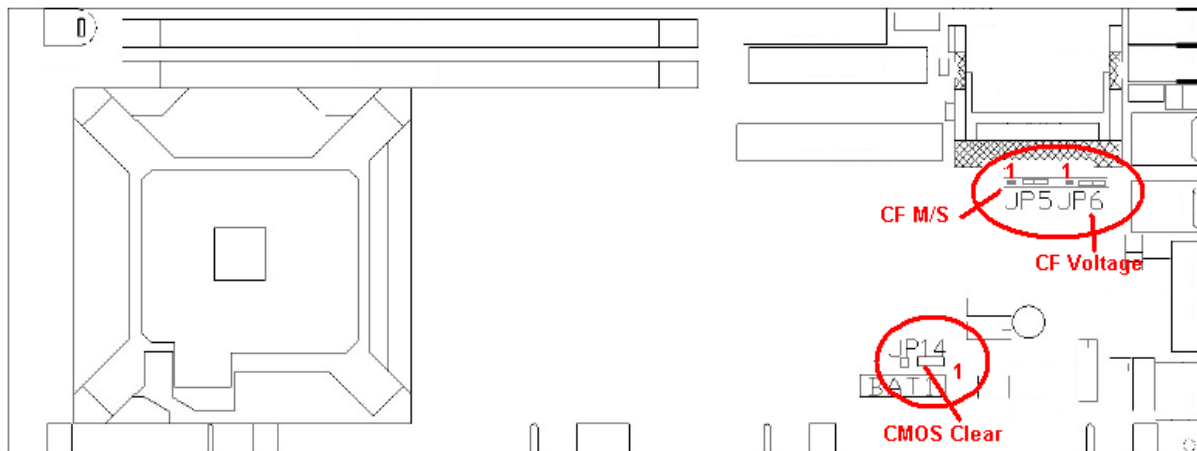
Pin #	Assignment	Pin #	Assignment
1	VCC	2	VCC
3	USB2- / USB4-	4	USB3- / USB5-
5	USB2+ / USB4+	6	USB3+ / USB5+
7	Ground	8	Ground
9	----	10	N/C

Keyboard / Mouse headers



Keyboard		Mouse	
Pin #	Assignment	Pin #	Assignment
1	PS2_KBCLK	1	PS2_MSCLK
2	PS2_KBDATA	2	PS2_MSDATA
3	NC	3	NC
4	Ground	4	Ground
5	5VSB	5	5VSB

Jumper Settings



Pin #	Description
CMOS Clear	
1 - 2	Normal operation
2 - 3	Clear CMOS
JP5 CF Setting	
1 - 2	Slave
2 - 3	Master
JP6 CF Voltage	
1 - 2	3.3V
2 - 3	5V

Software Configuration

Installing Operating Systems

The necessary operating system drivers can be found on the Blue Chip Support CD which should have been supplied with your PICMG BCT100 Single Board Computer. The necessary files can also be downloaded from the Blue Chip Technology website at www.bluechiptechnology.co.uk

The manner in which any drivers are loaded will vary depending upon the actual operating system used. Details follow for Microsoft XP.

Microsoft XP

Install the drivers for Windows XP from the Support CD/DVD supplied with board in the order as follows

The drivers can be found in the Drivers\SBPC\BCT100\ directory on the DVD

- Chip set INF driver
 - run 1_inf_autol.exe
- VGA driver
 - run 2_xp_video.exe
- Gigabit Ethernet driver
 - Run Device Manager and select the unknown Network device and Update driver pointing it to Drivers\SBC\BCT100\3_lan
- Storage Driver
 - Refer to readme file in Drivers\SBPC\BCT100\4_Storage
 - Note if setting a Raid configuration, then create the floppy from the folder and use as part of Windows Install

Watchdog Timer Programming

The Watchdog Timer (WDT) is a special hardware device that monitors the computer system during normal operation. The WDT has a clock circuit that counts down from a set number to zero. If a monitored item occurs before that timer reaches zero, the WDT resets and counts down again. If for some reason the monitored item doesn't occur before the timer reaches zero, the WDT performs an action, such as a diagnostic operation (rebooting the computer) or generate an NMI.

Watchdog Configuration		
Address Port: 2Eh	Data Port: 2Fh	Description
87h		Unlock Super IO
87h		Unlock Super IO
07h	08h	Select Logic Device
F5h	00h	00h: select second mode, 01h: select minute mode
F6h	xxh	Time out occurs after 0-255 second/minute, xx=00,01,02..FF
30h	01h	Activate Timer
F6h	xxh	Time out occurs after 0-255 second/minute, xx=00,01,02..FF
Repeat step to prevent timeout		
30h	01h	To disable timer

Example (C):

The following example sets up the watchdog time to 5 minutes.

```
1. outportb(0x2e,0x87);
2. outportb(0x2e,0x87);
3. outportb(0x2e,0x07);
4. outportb(0x2f,0x08);
5. outportb(0x2e,0x30);
6. outportb(0x2f,0x01);
7. outportb(0x2e,0xF5);
8. outportb(0x2f,0x01);
9. outportb(0x2e,0xF6);
10. outportb(0x2f,0x05);
.....
xx. outportb(0x2e,0x30);
yy. outportb(0x2f,0x01);
```

BIOS SETUP

The PICMG BCT100 Single Board Computer uses AwardBIOS™ from Phoenix Technologies®. The AwardBIOS™ provides a built-in Setup program which allows the user to modify the basic system configuration and hardware parameters. The modified data is stored in a battery-backed CMOS, so that data is retained even when the power is turned off.

It is possible for the CMOS battery to fail, and in such an instance the BIOS settings will revert to default and the user will require to reset them once the CMOS battery has been replaced.

The AwardBIOS™ is immediately activated when you first power on the computer. The BIOS reads the system information contained in the CMOS and begins the process of checking out the system and configuring it. When it finishes, the BIOS will seek an operating system on one of the disks and then launch and turn over control to the operating system.

While the BIOS is in control the Setup program can be activated in one of two ways:

1. By pressing immediately after the <NUM>,<Caps>,<Scroll> lock keys flash after switching on

Note: On some slower CRT displays, the unit can boot up quickly and complete POST before there is anything shown on the Display. On most systems, a Splash screen is displayed during POST

If the message disappears before you respond, then you will have to restart the system again by either turning the power OFF and then ON again, pressing the “RESET” button on the system case if there is one, or by simultaneously pressing the <Ctrl>, <Alt> and keys

Caution: Setting the wrong value can lead to an unstable system and should only be attempted by experienced personnel

The following pages provide a starting point to locate items that may be useful. They do not provide full in depth descriptions of each item

For example; Configuring Serial Ports can be found under the SuperIO Configuration Sub menu on the Integrated Peripherals page, and to have the system start automatically when power is applied, then the “PWRON After PWR-Fail” setting can be found in the same sub-menu (set this to Power ON)

Common User configurable options will be identified as appropriate

Main Menu

Once you enter the Setup program, the main Menu appears as shown in Figure B1 below. The menu allows you to select different Setup functions and has two exit options. Navigation through the menu's is by the arrow keys and by using the <enter> key to select the appropriate sub-menu.

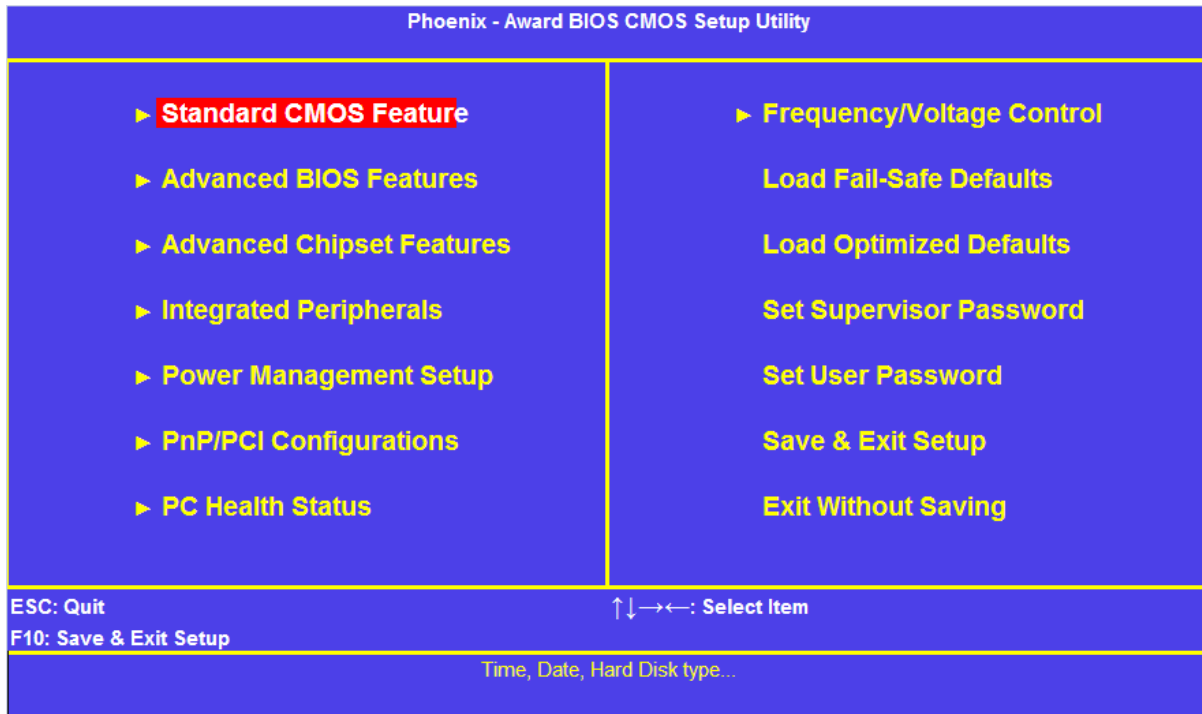


Figure B1

Standard CMOS Setting

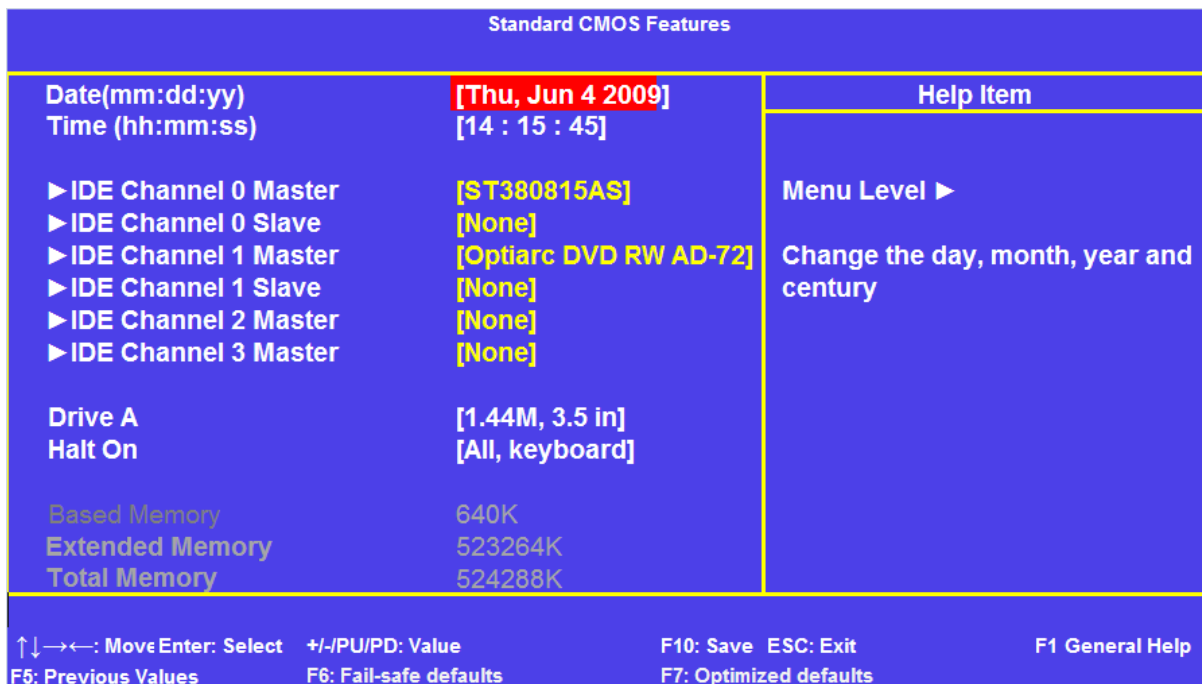


Figure B2

There are 10 User configurable categories within this section, with each category having one or more than one setup item. Use the arrow keys to highlight the item and then the <PgUp> or <PgDn> keys to select the value you want.

Date: options are Month/DD/YYYY

Time: options are HH:MM:SS

Drive A: Options are None, 360K, 5.25 in/1.2M, 5.25 in/720K, 3.5 in/1.44M, 3.5 in/2.88M

Halt On: options are “All Errors” “No Errors” “All, But Keyboard” “All, But Diskette” “All, but Disk”

this selects the situation in which you want the BIOS to stop during POST

Base Memory: displays the amount of conventional memory detected during POST

Extended Memory: displays the amount of extended memory detected

Total Memory: Displays the total memory available in the system

IDE Channel 0/1/2/3 Master /Slave: Press enter to see the sub-menus

Advanced BIOS Features

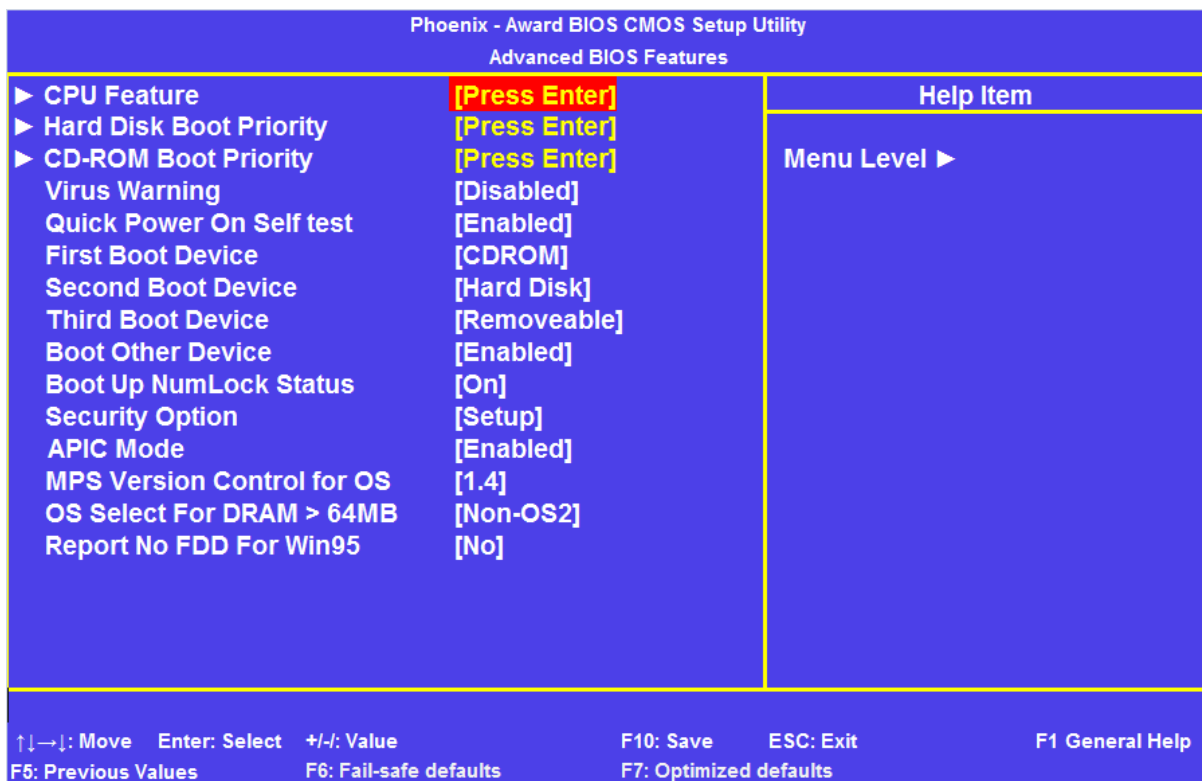


Figure B3

The main features within this menu area are indicated below

Boot Priority

Boot Priority is controlled at two levels

Initially, set the boot order for particular device families, as shown in the example above. First Boot Device: CDROM, Second Boot Device: Hard Disk etc

Next, boot order for family types can be set using the relevant menu, for example for Hard Disk

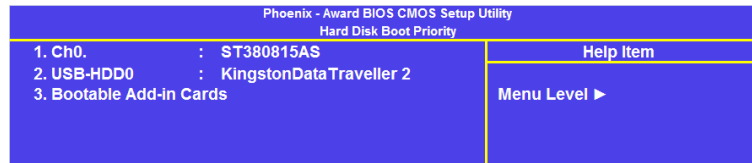


Figure B3.1

Note: Some USB Flash drives are recognised as HDD's and some are recognised as FDD. In this example a USB Flash drive is recognised as a HDD media, and so appears in this list. To boot to this device first, move it up the list so that it appears before the physical HDD (ST380815AS in this example)

Advanced Chipset Features

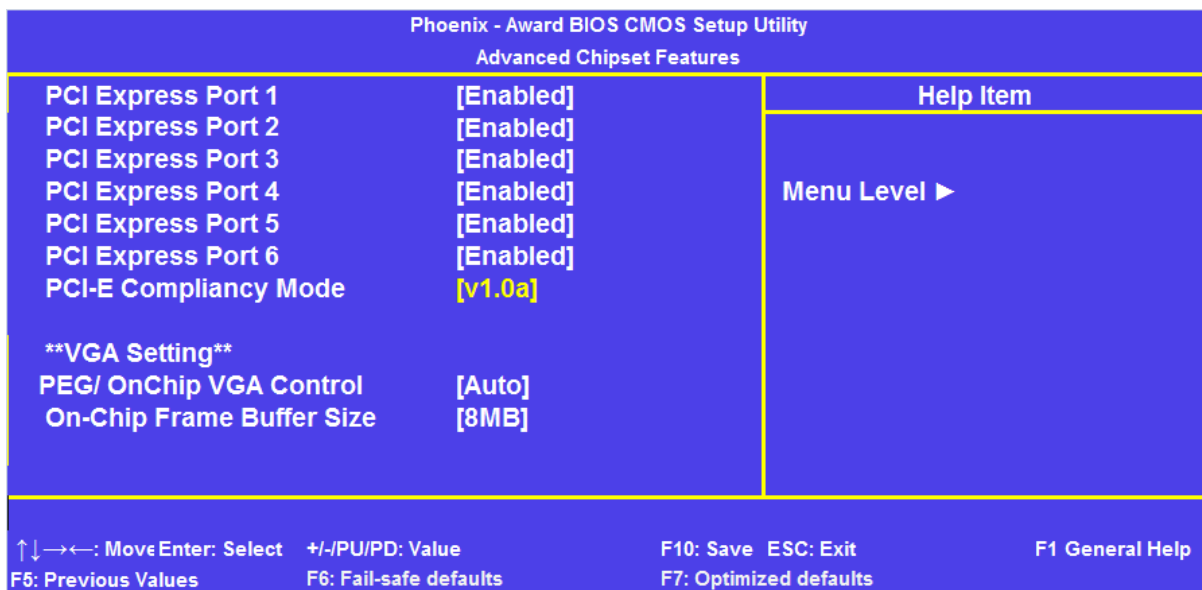


Figure B4:

This Menu Screen allows configuration of the PCI-Express capability, including integrated PCI-Express graphics.

Integrated Peripherals

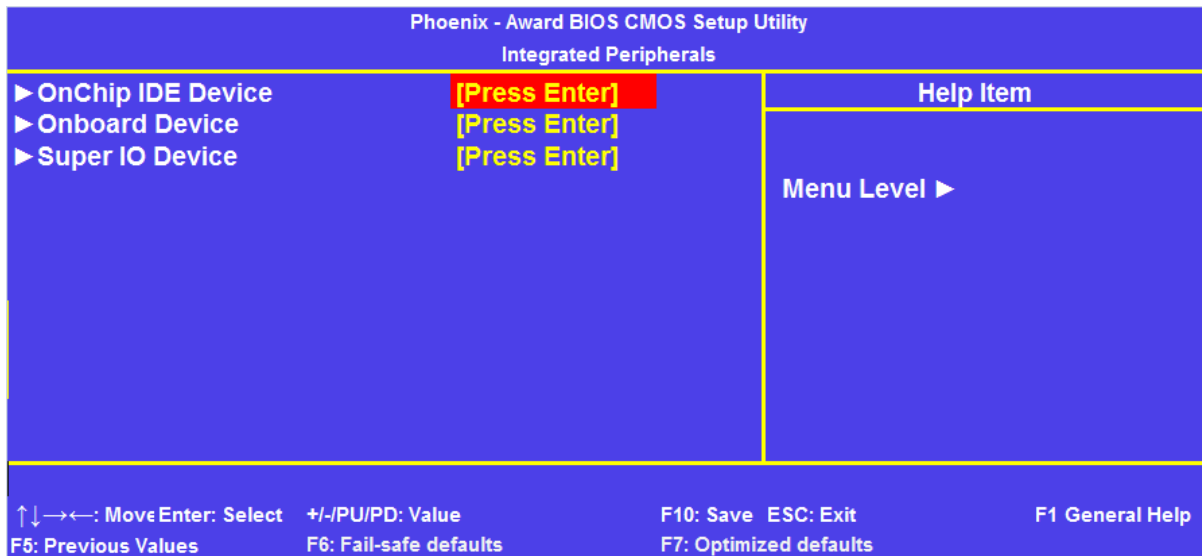


Figure B5:

This menu allows for configuration of standard I/O features

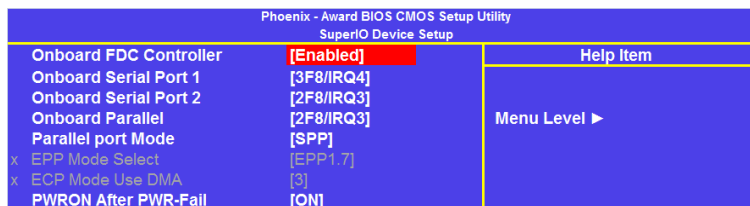


Figure B5.1:

Onboard Serial and Parallel Ports can be configured within the SuperIO sub menu. Also in this menu is the ability to determine what happens to the PC in the event of the power loss.

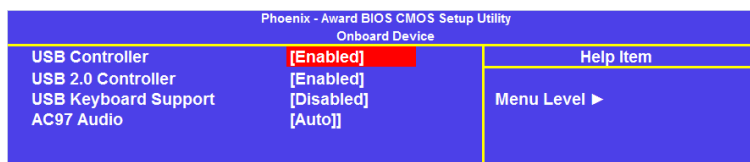


Figure B5.2:

The Onboard Devices sub menu allows configuration of the USB features. The main item to set is the USB Operation mode. In Full Speed mode, USB data will be transferred at only USB 1 rates. For USB 2 data rates, this must be set to High Speed.

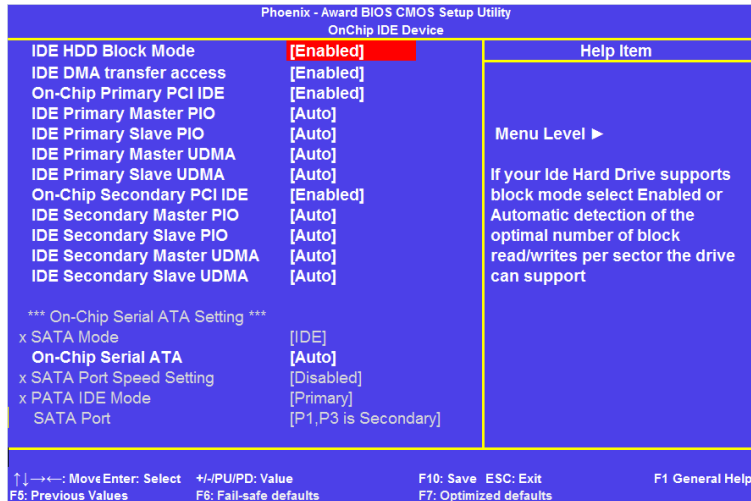


Figure B5.3

The OnChip IDE sub menu allows setting how SATA and IDE drives are recognised

Power Management Setup

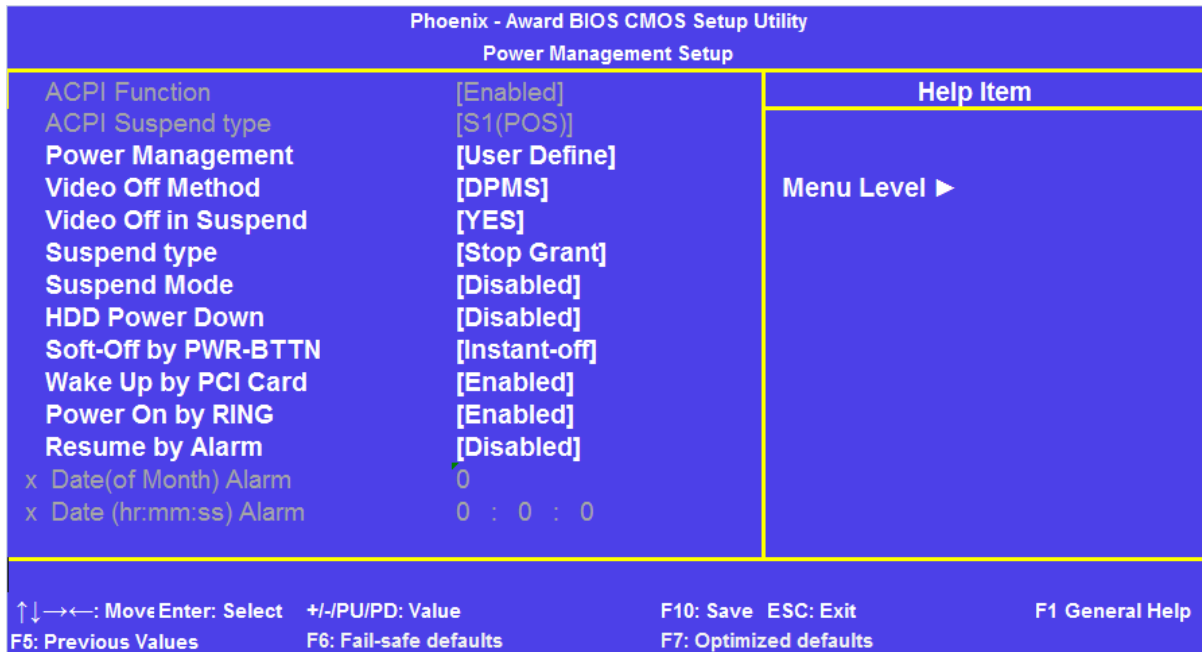


Figure 6:

In Industrial Applications, Power Management features are usually not required, however if they are, they can be set via this menu page

PnP/PCI Configurations



Figure 7:

If the BCT100 Processor board is being used with hardware which requires specific IRQ, then change the setting from Auto to Manual and manually reserve the resources required.

Any time additional hardware is inserted or removed from a IPC containing the BCT100, set the “Reset Configuration Data” option to enabled, to allow the BIOS to perform a full rescan of system resources. This will prevent resources from being reserved unnecessarily

PC Health Status

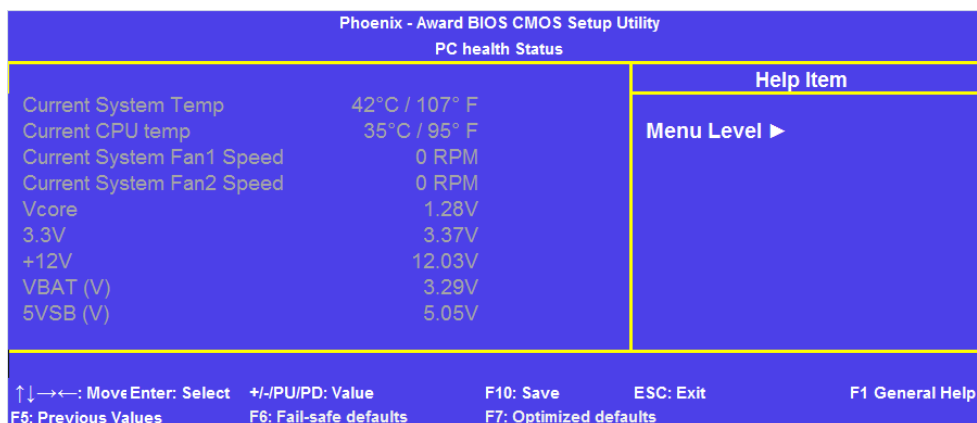


Figure 8:

The PC Health Status page is not configurable however it is very important when building and configuring the BCT100 into your chassis, or if your system is unstable.

Instability can occur if Voltages are out of spec (check Vcore against the rating for the CPU in use as this will vary).

Other causes of instability can be overheating, particularly CPU. Actual temperatures measured will vary depending on CPU heatsink, and CPU and System Fans, as well as airflow through the chassis.

Frequency/Voltage Control

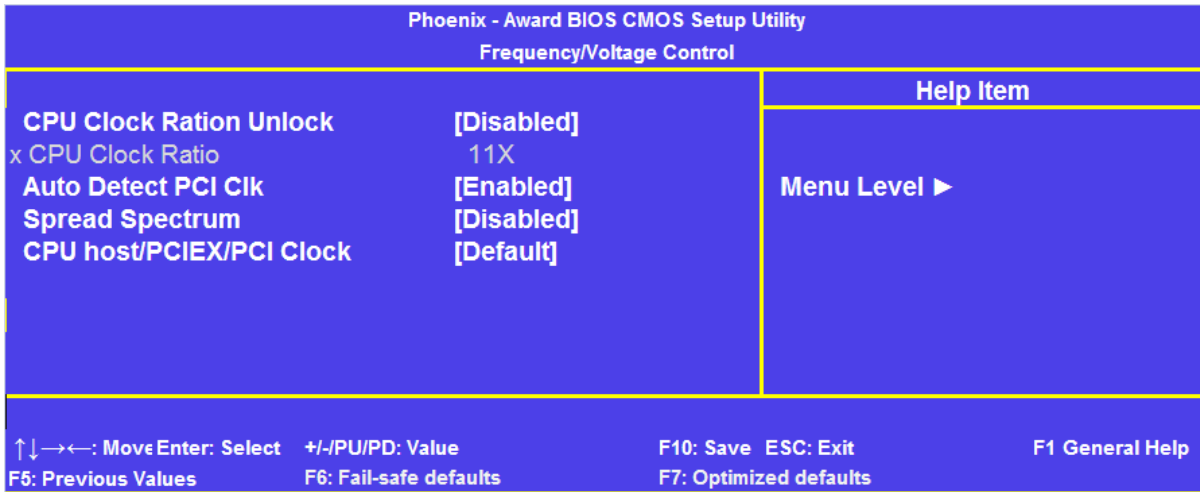


Figure 9:

Users should be careful with changing these settings, as changing clocks and clock ratios may permanently damage hardware

Fail-Safe / Optimised Defaults



Figure 10:

In the event of any instability of or unaccountable behaviour, as a first course of action, resetting the BIOS to either Fail-Safe or Optimised Defaults should be tried

Maintenance

The BCT100 Single Board Computer should not require any regular maintenance. After a period of several years, it may be necessary to replace the battery on the processor board, if it cannot maintain the CMOS memory whilst the AC power is disconnected.

On a regular basis the inside of the System Unit which houses the BCT100 Single Board Computer should be cleaned out to prevent dust build up which could eventually clog the fans and prevent efficient operation.

For general maintenance of the System unit, follow the recommended maintenance schedule set out by the manufacturer of the System Unit.

Replacing the Processor Battery

The processor board includes a small 3V lithium battery (type CR-2032) to retain the BIOS settings in the CMOS memory. 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.

CAUTION

Danger of explosion if battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer.

Dispose of used batteries according to the manufacturer's instruction.

ATTENTION

Il y a danger d'explosion s'il y a remplacement incorrect de la batterie.
Remplacer uniquement avec une batterie du même type ou d'un type
recommandé par le constructeur.

Mettre au rebut les batteries usagées conformément aux instructions du fabricant.

Do NOT under any circumstances try to remove the battery with metallic tools (pliers, tweezers etc.). They will short out the battery with possible disastrous results.

Replace the battery by one of the same type, ensuring that it is fitted with the positive terminal facing the CPU, and that the clip is fully engaged. When the battery has been replaced, the BIOS settings will revert to their default settings. Reset them as necessary to suit your application.

Fuses

There are no user-serviceable or replaceable fuses on the Computer Board.

Amendment History

Issue Level	Issue Date	Author	Amendment Details
1.0	30-06-09	T Mck	First Release

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